Stáisiún Uí Chonghaile, Baile Átha Cliath 1, D01 V6V6
Connolly Station, Dublin 1, D01 V6V6
T 01 703 4293 E foi@irishrail.ie W www.irishrail.ie

Iarnród Éireann
Irish Rail

27th August 2021

[redacted]

[redacted]

Re: FOI request IE_FOI_498

Dear [redacted]

I refer to your request dated 16th July 2021 made under the Freedom of Information Act 2014, which was received on by my office on the 19th July 2021, for records held by Iarnród Éireann.

Request:

- copy of any risk analysis, report, briefing, or other such review/discussion document prepared by Irish Rail with regard to the issue outlined in the following newspaper article: https://www.irishtimes.com/news/consumer/passengers-warn-over-faulty-dart-announcement-systems-1.4617372

The decision maker handling your request is [redacted].

Response:

I, Ms. Emma Cuddy, Decision Maker have now made a final decision to part grant your request on 27th August 2021.

Please find response documents and schedule of records attached.

Rights of appeal

In the event that you are not happy with this decision you can make an appeal in relation to this matter, you can do so by writing to the FOI Unit, Corporate Communications, Iarnród Éireann Irish Rail, Connolly Station, Amiens St, Dublin 1 or by e-mail to foi@irishrail.ie. You should make your appeal within 4 weeks (20 working days) from the date of this notification, where a day is defined as a working day excluding, the weekend and public holidays, however, the making of a late appeal may be permitted in appropriate circumstances.
The appeal will involve a complete reconsideration of the matter by a more senior member of the staff of this body.

Should you have any questions or concerns regarding the above, please contact the FOI Officer on [redacted] or by email at foi@irishrail.ie

Yours sincerely,

[redacted]

[redacted], **FOI Decision Maker, CME Dept, Iarnród Éireann**

Cathaoirleach Chairman - P Gaffney(UK), **Stiúrthóirí** Directors: F Allen, C Griffiths (UK), T McGee(UK), M McGreevy (UK), J Moloney; F O'Mahony, T Wynne; **Príomh Fheidhmeannach** Chief Executive: D Franks
Iarnród Éireann – Irish Rail, cuideachta ghníomhaíochta ainmnithe, faoi theorainn scaireanna, cláraithe in Éirinn ag Stáisiún Uí Chonghaile, Baile Átha Cliath 1, Ur. 119571 Ur. CBL IE 4812851 O
Iarnród Éireann – Irish Rail, a designated activity company, limited by shares, registered in Ireland at Connolly Station, Dublin 1, No. 119571 VAT No. IE 4812851 O

Freedom of Information Request:
Schedule of Records for IE_FOI_498 : Summary for Decision Making

Record No.	Date of Record	Brief Description	No. of Pages	Decision: Grant/Part Grant/Refuse	Section of Act if applicable	Record Edited/Identify Deletions
1	24.08.2021	700-PS-FOI-498 - DART Passenger Information System	1	Grant	~	~
2	~	2011 june works report	2	Grant	~	~
3	~	2011 may works report	7	Grant	~	~
4	Oct-20	7317_Award_PIS_DART_IE_Board_Draft_V1_jd	7	Part Grant	S36 (c)	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates
5	~	8500 progress report	1	Grant	~	~
6	15.05.2017	8500 Vernisa	3	Part Grant	S37	Personal Information of Others
7	19.02.2014	Award_Passenger Information System Feb 2014 V5 05 02 14(PS)	5	Part Grant	S36 (c)	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates
8	~	Cap_exp PIS Replacement for GDA fleets_version 2	4	Part Grant	S36 (c)	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates

9	20.10.2020	Capex_DART PIS replacement_version 1 - submitted	3	Part Grant	S36 (c) S37	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates Personal Information of Others
10	20.10.2020	Capex_DART PIS replacement_version 2	3	Part Grant	S36 (c) S37	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates Personal Information of Others
11	29.05.2017	D6921_PIS_Health_Checks		Part Grant	S36 S37	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates Personal Information of Others
12	12.05.2010	Dart fleet PIS	1	Part Grant	S35	Personal Information of Others
13	01.10.2019	Dart passenger information system	1	Part Grant	S37	Personal Information of Others
14	04.11.2019	DART PIS	1	Part Grant	S37	Personal Information of Others

15	21.03.2017	Dart PIS1	2	Part Grant	S37	Personal Information of Others
16	29.01.2019	DART PIS2	1	Part Grant	S37	Personal Information of Others
17	14.06.2019	Dart PIS3	1	Part Grant	S37	Personal Information of Others
18	02.12.2020	DM_Approval to Award_PIS Upgrade-DART_021220	1	Part Grant	S37	Personal Information of Others
19	11/06.2019	DTTAS - Joint Oireachtas Committee Accessibility Report Update - 11.06.19	4	Part Grant	S36 (c)	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates
20	~	EMU PIS repair quotation request	2	Part Grant	S36 (c)	information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates
21	04.07.2019	FINAL VERSION DTTAS - Joint Oireachtas Committee Accessibility Report Update	5	Part Grant	S36 (c)	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates
22	04.11.2015	FW 8500 PIS	14	Part Grant	S37	Personal Information of Others

23	30.05.2017	FW 8500 Vemisa	4	Part Grant Part Grant	S36 (c) S37	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates Personal Information of Others
24	11.01.2010	FW WEMISA's proposal	16	Part Grant	S36 (c) S37	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates Personal Information of Others
25	04.11.2019	IE.19.0009 - NTA acknowledgement letter - 04.11.19	1	Part Grant	S36 (c) S37	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates Personal Information of Others

26	~	Infotainment report TLR-T22414-001	41	Part Grant	S36 (c)	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates
27	09.09.2010	Interfleet Report	3	Part Grant	S37	Personal Information of Others
28	24.08.2010	Jul10 - PIS Replacement	6	Part Grant	S36 (c)	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates
29	~	JUN09_report	13	~	~	~
30	~	June_10 Report	8	~	~	~
31	~	March_10 Report	6	~	~	~
32	~	NTA Grant application - Nov 2019	8			
33	05.11.2018	On Board PIS funding	1	Part Grant	S37	Personal Information of Others
34	~	Passenger Information Systems	1	Part Grant	S36 (c)	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates
35	19.09.2014	PIS_PA fleet check	1	Part Grant	S37	Personal Information of Others

36	06.10.2014	PIS	1	Part Grant	S37	Personal Information of Others
37	17.05.2017	Project Funding Proposal - DART PIS Version 1 17.05.17	1	Part Grant	S36 (c)	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates
38	13.05.2021	Project Initiation Documentation (DART PIS)_live_v2	24	Part Grant	S36 (c)	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates
39	~	project progress report	2	~	S37 ~	Personal Information of Others ~
40		RE announcements on DART services	1	Part Grant	S37	Personal Information of Others
41	17.06.2021	RE DAIL Question No.232	2	Part Grant	S37	Personal Information of Others
42		Re Dart passenger information system	2	Part Grant	S36 (c) S37	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates Personal Information of Others

43	03.11.2015	RE Maintenance proposal	2	Part Grant	S37	Personal Information of Others
44	28.06.2021	RE PQ Referred_30746_21, for answer 15_06_2021	3	Part Grant	S36 (c) S37	Information whose disclosure could prejudice the conduct or outcome of contractual or other negotiations of the person to whom the information relates Personal Information of Others
45	21.03.2017	Re Vemisa	2	Part Grant	S37	Personal Information of Others
46	~	Renewal_Proposal	9	~	~	~
47	25.06.2012	Repairs Report	1	~	~	~
48	11.08.2009	Replacement Passenger Information Systems on Fleet IE Draft 1 2(11-08-09)	127	~	~	~
49	02.03.2017	Response Letter to Mr Fitzgerald re DART PIS	2	Part Grant	S37	Personal Information of Others
50	15.12.2011	Techinical Specification - Replacement PIS - issue 14	134	Part Grant	S37	Personal Information of Others
51	08.07.2020	Techinical Specification for DART PIS Upgrade_FINAL_Version.2	11	Part Grant	S37	Personal Information of Others
52	04.10.2010	Vemisa_IO letter	1	~	~	~

Signed:

Freedom of Information / Data Protection Executive

Chief Mechanical Engineer's Department, Inchicore, Dublin 8
Roinn na bPríomhinnealtóirí Meicniúla, Inse Chór, Baile Átha Cliath 8
T 01 703 3725 **F** 01 453 7329 **E** peter.smyth@irishrail.ie **W** www.irishrail.ie

Iarnród Éireann Irish Rail

24th August 2021

REFERENCE PS/ FOI 498 /700

Re: FOI 498 DART Passenger Information System

Background

The Irish Times Article dated 12th July 2021 refers to the DART Passenger Information System and the inability to maintain the system due to obsolescence on 68 carriages of the 144-carriage fleet of DART trains. This specifically relates to the system of digital scrolling information displays and automated announcements within the carriages. Note that the system for the driver or train crew to make manual public address announcements throughout the train (PA) is completely separate as is the system for making emergency communications with the driver. Both of these systems are regarded as safety critical and are maintained and are fully functional on the DART fleet.

Request

The request seeks copies of any risk analysis, reports, briefing or other such review / document with regard to the issue outlined in the newspaper.

History and current status

There is considerable history on this issue especially since 2010. By way of background, I can advise that the 68 carriages were supplied by Tokyu Car / Mitsui of Japan in 3 x batches between 2000 and 2004 and are known as the Class 8500, 8510 and 8520 of trains. The trains are very similar however the passenger Information Systems were from different suppliers. The equipment suppliers for the PIS systems on these trains were Eurunion (later acquired by Vemisa) and Ikusi.

In 2007 as a separate project Irish Rail retrofitted a new system from Televic to the original 1984 DART trains (76 carriages) and this has performed very well to date. Irish Rail has expended considerable time and money in trying to get the system to function reliably on the 68 carriages through in house programmes of repairs and upgrades. We have contracted with suppliers to support the equipment and in the meantime, we have undertaken a number of tender processes to completely replace the system. The most recent tender which was awarded at a value of €3.5m was awarded in 2020 and equipment fitting will commence towards the end of this year. The capital project is funded by the National Transport Authority.

Cathaoirleach Chairman - F Allen, **Stiúrthóirí** Directors: S Byrne, C Griffiths (UK), D Guinan, V Little, M McGreevy (UK), Dr P Mulholland, S Roarty, T Wynne; **Príomh Fheidhmeannach** Chief Executive: J Meade
Iarnród Éireann – Irish Rail, cuideachta ghníomhaíochta ainmnithe, faoi theorainn scaireanna, cláraithe in Éirinn ag Stáisiún Uí Chonghaile, Baile Átha Cliath 1, Ur. 119571 Ur. CBL: IE 4812851 O
Iarnród Éireann – Irish Rail, a designated activity company, limited by shares, registered in Ireland at Connolly Station, Dublin 1, No 119571 VAT No IE 4812851 O

V.E.M.I.S.A.

June, 27th, 2011

DETAILED REPORT OF WORKS IN 8200 SERIES UNITS JUNE 20th -24th

WORKS BY DATES.

TUESDAY 21st.

- Solving ground problem: a 10900 wire used for former MMI as a ground just for MMI (following ALSTOM schematics) was removed and given a different function. As this wire was not only for former MMI, was returned to be ground and the problem with the TELOC was solved.
- Charging software in 8201 cabin.
- Function tests.
- Problems detected in RS485 line.

WEDNESDAY 22nd.

- Solving the RS485 line problems.
- Final tests. 8201-8401 finished.

THURSDAY 23rd.

- Wiring in 8203-8405.
- Software charge an test: screens damaged and 2 passenger alarm intercom damaged.

FRIDAY 24th.

- Solving some screen problems. Remains damages in intermediate inside screens and one frontal missing.
- Function tests.

For next trip adjusting 8203-8405 will be finished and track tests will be made wit IE personnel. Broken materials should be sent to Spain to repair, in order to have spare parts in Fairview.

V.E.M.I.S.A.

May, 31st, 2011

DETAILED REPORT OF WORKS IN 8200 SERIES UNITS MAY 23rd -27th

1.- WORKS BY DATES.

TUESDAY 24rd (train inside depot).

- Installing repaired parts in 8201-8401: 1 frontal display, 2 dc/dc for internal displays, 1 internal display and 1 alarm handset (passenger unit).
- 8201 and 8401 cabins re-wiring: installing a VGA cable and 3 new wires (doors and tacho signalling) from former MMI position to new computer position:

Former MMI position in 8401 with new touch screen.

New computer location

WEDNESDAY 25th (train outside the depot and moved along the track from 8201 cabin – south end).

- Radio moving in 8201 and 8401 cabins.
- Computer and bracket fitting in both cabins.
- Connections between tocuchscreen, computer and 85X1 connection panel in 8401 cabin.
- Software charge and configuration.
- System power tests.
- System signalling tests.
- Touchscreen fitting in 8401.
- 8401 cabin finished with new PIS system.

V.E.M.I.S.A.

THURSDAY 26th (train outside the depot – north end).

- 8203-8405 repaired parts re-fitment: 1 inside display, 1 H3 driver's alarm handset, 1 power supply and 1 alarm handset (passenger unit).
- 8201 cabin connections between touchscreen, computer and 85X1 connection panel.
- Touchscreen fitting in 8201.
- 8201 cabin finished (no system tests).

FRIDAY 27th (same train location).

- Unable to power PIS and PAS. No 110Vcc input.
- Unable to test tacho with movement.
- Explaining IE personnel wire modificacions.

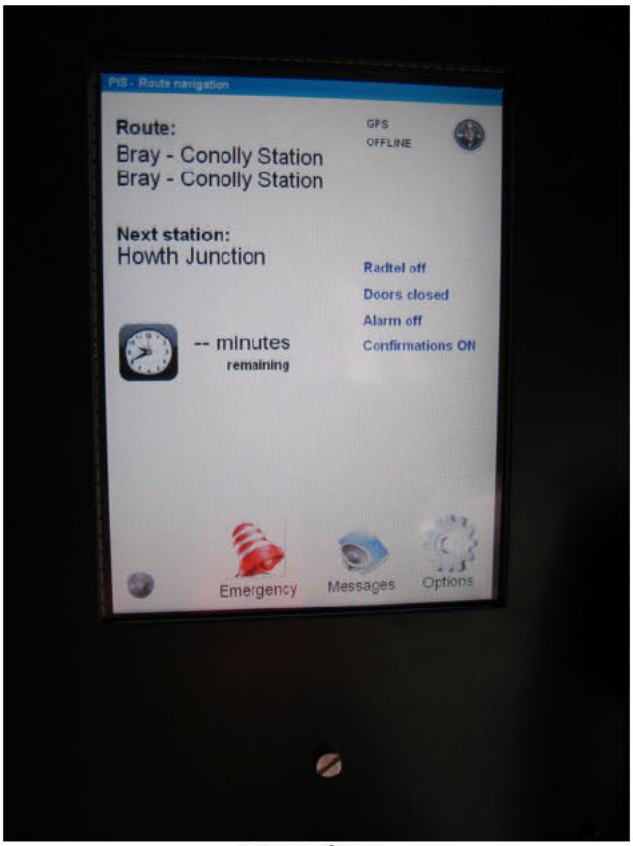
2.- IMAGES FROM FINISHED SYSTEM.

New computer

V.E.M.I.S.A.

New touchscreen

V.E.M.I.S.A.



New software

V.E.M.I.S.A.

3.- WIRING DETAILS.

WIRE NUM.	PANEL	POSITION	FUNCTION	NEW FUNCTION
44500	Former MMI	Former MMI	+110Vcc Doors	Continued from MMI to computer. Same function
62524	Former MMI	Former MMI	+Tacho	Continued from MMI to computer. Same function.
62525	Former MMI	Former MMI	-Tacho	Continued from MMI to computer. Same function.
43512	Former MMI	Former MMI	+110Vcc Alarm activation (H3)	Continued from MMI to computer using 43509 – POS10 taken out of 85X1
43513	Former MMI	Former MMI	-110Vcc Alarm activation (H3)	Continued from MMI to computer using 43507 – POS7 taken out of 85X1
43504	85X1	4	+24Vcc RadTel	Used as –V TFT to power touchscreen once taken out. Connection to computer from POS4.
43505	85X1	5	-24Vcc RadTel	Used as +V TFT to power touchscreen once taken out. Connection to computer from POS5.
43509	85X1	10	PAS Active	To computer.

43508	85X1	8	-15Vcc	To computer.
43510	85X1	23	+ PAS	- Driver Loudspeaker. To computer mini-jack.
43511	85X1	18	-PAS	To computer mini-jack.
10900	85X1	27	-110Vcc	To computer mini-jack, once taken out of 85X1. Train connection to computer.
43521	85X1	12	+17Vcc	To computer and tft using 43505.
81580	81X1	80,81	-RS485 from former MMI	2 pin in RS232 connection computer-tft. From computer to displays.
81581	81X1	82,83	+RS485 former MMI	3 pin in RS232 connection computer-tft. From computer to displays.
85582	81X1	84,85	GND RS485 former MMI	5 pin in RS232 connection computer-tft. From computer to displays.

EXPLANATION:

- 44500 (+110Vcc doors): former MMI, continued with a new wire from former MMI location to new computer location.
- 62524 (+TACHO): former MMI, continued with a new wire from former MMI location to new computer location.
- 62525 (+TACHO): former MMI, continued with a new wire from former MMI location to new computer location.
- 43512 (+110Vcc ALARM ACTIVATION): former MMI, continued using 43509 wire taken out from position 10 in 85X1 from former MMI to 85X1.
- 43513 (+110Vcc ALARM ACTIVATION): former MMI, continued using 43507 wire taken out from position 7 in 85X1 from former MMI to 85X1.
- 43504 (+24Vcc RadTel): 85X1, position 4, taken out from 85X1 to use it as –V tft and computer connected to 85X1 position 4 to read the signal.
- 43505 (-24Vcc RadTel): 85X1, position 5, taken out from 85X1 to use it as +V tft and computer connected to 85X1 position 5 to read the signal.
- 43509 (PAS Activation): 85X1, position 10, connected to computer.

V.E.M.I.S.A.

- 43508 (-15Vcc): 85X1, position 8, connected to computer.
- 43510 (+PAS audio): 85X1, position 23, once taken out from connection panel, used as –Driver loudspeaker signal. 23 position connected to computer mini-jack as + PAS audio.
- 43511 (-PAS audio): 85X1, position 18, connected to computer mini-jack.
- 10900 (-110Vcc): 85X1, position 27, used as + Driver loudspeaker once taken out from 18 position. Position 18 connected to computer as -110Vcc.
- 43521 (+17Vcc): 85X1, position 17, connected to computer and tft using 43505.
- 81580 (-RS485): 81X1, positions 80, 81, taken out from position and used as RS232 pin2. Position connected to computer as –RS485 for displays.
- 81581 (+RS485): 81X1, positions 82, 83, taken out from position and used as RS232 pin3. Position connected to computer as +RS485 for displays.
- 81582 (-RS485): 81X1, positions 84, 85, taken out from position and used as RS232 pin5. Position connected to computer as GND RS485 for displays.

IMPORTANT NOTICE: **all wires removed from the 85X1 and 81X1 connection panels are connections between the connection panel and the former MMI. These wires are being re-used for the new functions, and the signals in the connection panels connected to the computer, in the same cabinet. This means the connection panels 85X1 and 81X1 maintain exactly the same functions as before VEMISA modifications. Disconnecting the wires between 81X1 and 85X1 and former MMI meant to isolate MMI from the train: no other device is affected.**

VEMISA personnel has tested 8401 cabin and all signals are read by the new MMI (except tacho, not tested), and the system is correctly powered. This means the signals, correctly read, remain in the panels, because the computer DIO card is connected to these panels.

Cut and open wires were left as they were (noticed 2 disconnected wires in 8201 cabin 85X1 connection board).

Author: Procurement Category Buyer – Rolling Stock	**Passenger Information System Upgrade Dart EMU Class 85xx~~00~~ Fleet Contract Award**	Reviewed by: Chief Mechanical Engineer
Submitted by: Chief Procurement Officer		Approved by: Exec Group

1. DECISION SOUGHT

The approval of the Board of Iarnród Éireann is sought to award a contract to Company A for the provision of a Passenger Information System Upgrade for the Dart EMU Class 85xx~~00~~ Fleet, with the system to be fully upgraded in 2021.

The estimated contract cost of this contract is [redacted] (excl. VAT). The estimated non-recoverable VAT is [redacted] (excl. VAT)

The external funding source for this contract will be the National Transport Authority (NTA) 2020 Capital Funding Programme.

2. BACKGROUND

Iarnród Éireann (IÉ) is upgrading the Passenger Information System on the 8500, 8510 & 8520 EMU Fleets, as the system~~s~~ is unreliable and most of their components ~~are now~~ are obsolescent. It is proposed to replace the equipment with modern, reliable and best in class systems, which will provide consistent, reliable, accurate and timely information, with improved visual displays and audio functionality. The new PIS equipment will be a standalone system, which can be fitted into the existing fleet with minimal modifications required and minimum interface to the other on-board equipment.

3. PROCUREMENT APPROVALS

3.1 Selection and Award Criteria

The selection criteria as set out in Appendix 1 were approved in accordance with the threshold levels set out in the Group Procurement Policy and Procedures. The award criteria set out in Appendix 2 were approved by the IÉ Board in June 2020.

3.2 Procurement Evaluation Panel

The tender evaluation panel comprised of the CME On-Board Technology Manager, CME On-Board Technology Executive and a Rolling Stock Category Buyer who chaired the tender evaluation process.

4. TENDER PROCESS

The requirement was advertised in the Official Journal of the European Union (OJEU) in March 2020. Fourteen expressions of interest with completed pre-qualification questionnaires were received by the closing date in April. Following evaluation of the Pre-Qualification Questionnaires, a shortlist of 5 applicants was selected and were invited to tender in July 2020.

One company withdrew from the process, citing internal resource limitations, and that despite the extension granted by IÉ in respect of the tender closing date, they still would not be in a position to respond by the required date.

Tender submissions were received in August 2020.

5. TENDER EVALUATION

Tenders were evaluated with reference to the award criteria set out in Appendix 2. One company failed to meet the minimum required score on numerous criteria and was deemed to be non-compliant.

The following table sets out the initial tender cost and the Best and Final Offer for the three compliant bids:

Company	Tender Form Total Cost (Excl. VAT)	Final BAFO Cost (Excl. VAT)
Company A	[redacted]	[redacted]
Company B	[redacted]	[redacted]
Company C	[redacted]	[redacted]
Company D	[redacted]	[redacted]

The table below outlines the scores achieved by Company A with reference to the award criteria in Appendix 2:

No.	Criterion	Maximum Available Marks	Company A	Company B	Company C	Company D
1	Conformance to IÉ Technical Specification	**Pass/Fail**	**Pass**	**Pass**	**Pass**	**Pass**
2	Cost	5,000	[redacted]	[redacted]	[redacted]	[redacted]
3	Conformance to IÉ Specification					
3.1	PIS Distance Measuring System	400	[redacted]	[redacted]	[redacted]	[redacted]
3.2	Carriage Loading Information System	400	[redacted]	[redacted]	[redacted]	[redacted]
3.3	Audio and PA System	400	[redacted]	[redacted]	[redacted]	[redacted]
3.4	Visual Displays	400	[redacted]	[redacted]	[redacted]	[redacted]
3.5	Timetable	200	[redacted]	[redacted]	[redacted]	[redacted]
3.6	Software	200	[redacted]	[redacted]	[redacted]	[redacted]
3.7	Driver Interface	200	[redacted]	[redacted]	[redacted]	[redacted]
4	Reliability	1,000	[redacted]	[redacted]	[redacted]	[redacted]
4	Methodology for Contract Delivery	800	[redacted]	[redacted]	[redacted]	[redacted]

4	Usability and Staff Interface	500	[redacted]	[redacted]	[redacted]	[redacted]
7	Project Plan	200	[redacted]	[redacted]	[redacted]	[redacted]
8	Lead Time	300	[redacted]	[redacted]	[redacted]	[redacted]
Total		**10000**	[redacted]	[redacted]	[redacted]	[redacted]

Company D failed to provide any detail in the tender response to demonstrate compliance with some of the qualitative criteria and was therefore deemed to be non-compliant.

6. PRINCIPAL TERMS

Pricing will be fixed for the term of the contract.

7. BUDGET IMPACT

The proposed rates are reflective of the design standards and technology specifications required by IÉ in order to meet it's passenger information system upgrade requirements. The proposed contract value in Section 1 consists of the core services with a contingency for a small amount of identified capital spare parts. Two?? Other optional requirements were included in the pricing document, both will which will be included in the award.

Tenderers were invited to provide a BAFO, during which [redacted] resulting in a [redacted] discount on their original tendered cost.

8. SIGNIFICANT RISKS

A Contract Award recommendation has been prepared which incorporates confirmation that technical, financial, procurement and legal risks arising in the process to date have been considered and are being managed.

9. TERMINATION PROVISIONS

The Contract contains provisions for termination in the event that the contractor fails to deliver the goods in accordance with the specification, sub contracts without permission, abandons, commits a material breach of the contract, is bankrupt or undergoes a change of control without notifying Iarnród Éireann. The Contract also includes provision for termination at will by IÉ.

10. NEXT STEPS

Subject to approval, IE will enter into a contract with [redacted] A managed SAP agreement will be put in place to monitor and manage the expenditure to ensure that the approved contract value is not exceeded.

11. CONTRACT DOCUMENTATION

The documentation for this contract has been prepared by CIÉ Group Solicitors reflecting the instructions of the project team.

Chief Procurement Officer,
Inchicore.

Appendix 1 Selection Criteria

Annual Turnover	Applicants will be required to demonstrate that they have had a turnover in excess of the €2M per annum for the last three years. Applicants must provide acceptable unqualified Audit opinions for the Financial Statements for these years.

Further Short-Listing Criteria A minimum score of 40% of the points available must be achieved in respect of each criterion below.	
Criterion	**Weighting**
Relevant Experience Experience in the supply and installation of highly reliable passenger information systems retrofitted into existing rolling stock fleets. Experience to be demonstrated by way of 3 detailed case studies to contain the following information at a minimum; i. Contract Description ii. Name of Awarding Entity iii. Description of Contract Obligations iv. Detailed Scope of Contract to include sourcing of components, engineering design, installation work (electrical, mechanical and body), external technical approvals and commissioning, v. Detailed design of the PIS solution provided, carriage loading information, remote access and control of PIS system vi. Lead time on components and software changes vii. Conformance to relevant railway standards, including TSI-PRM viii. Contract Value (at signing); and Contract Value (upon completion) ix. Contract dates (commencement date and completion date) x. Contract scale (quantity and type of vehicles) xi. Location of Works xii. Name and Contact Details of Referee from Awarding Entity	**60%**
Company Capacity Demonstration that the applicant has the available capacity to deliver the IÉ requirements commencing in 2020 and delivered in 2021.	**15%**
Company Resources Demonstration that the applicant has the required technical resources available to deliver the IÉ requirements.	**10%**
Quality Management Systems [QMS] Demonstration that the applicant has in place a suitable quality management system to ISO:9001 standard (or equivalent). i. Quality Management System – 5% ii. Production Management System – 5% iii. Technical Control System – 5%	**15%**
Total	**100%**

Appendix 2 Award Criteria

Minimum Technical Criteria

Mandatory Criteria (Pass/Fail)	
Criterion	**Conformance with IÉ's Technical Specification** Tenderers must complete a detailed clause by clause matrix to verify compliance against the minimum requirements of the IÉ specification.

Upon satisfying the pass/fail criteria, the following further criteria applied:

Criterion	**Weighting %**
Total Cost Cost to be calculated on the basis of capital cost for the supply of the system and the cost of all mandatory replacement spare parts required for the first 5 years of the system life.	**50%**
A minimum score of 40% of the points available must be achieved in respect of each the criterion below.	
Conformance to IÉ Technical Specification	**22%**
• PIS Distance Measuring System	4%
• Carriage Loading Information System	4%
• Audio and PA System	4%
• Visual Displays	4%
• Timetable	2%
• Software	2%
• Driver Interface	2%
Reliability Tenderers must submit a methodology document which deals with the 'Reliability of the Passenger Information System'. The methodology should include at a minimum, information relating to the proposed warranty, spare parts and accessibility to spare parts, repair process, access to technical documentation, technical support and reliability figures.	**10%**
Methodology for Contract Delivery Tenderers will be required to submit a detailed written methodology document outlining their proposed project delivery programme, which identifies the critical tasks and project milestones and their proposed approach to addressing each of these in their delivery of the project.	**8%**
Usability and Staff Interface Tenderers must submit a detailed document outlining the level of staff interaction required with their proposed system. The proposal should detail at a minimum, the level of system maintenance required, details on the user interface (touchscreens), system navigation, system diagnostics, fault reporting, remote management and distribution.	**5%**
Project Plan Tenderers are required to submit a detailed project plan outlining the process from contract award to the end of the warranty period. Details to include the timelines for all stages of the process, from system design, engineering approval, manufacture, delivery, installation/integration, testing, commissioning, training etc.	**2%**
Lead Time The lead time to be based from the date of order placement by Iarnród Éireann to project completion. The company submitting the lowest lead time will be awarded full marks and all other companies will receive a score, pro-rata based on their proposed lead time.	**3%**
Total	**100%**

V.E.M.I.S.A.

Monday, April the 2nd.

DETAIL OF WORKS IN SETS 01-02, 03-04 AND 05-06 FROM 8500 FLEET

In this document we detail works done in sets already upgraded from the 8500 fleet, noticing the situation in 2009-2010 (evaluation) and real situation in November, 2011 (set 012-02 installation) and March, 2012 (sets 03-04 and 05-06 installation):

	EVALUATION	***REAL***
8601	Nothing broken	H3, PA Central
8501	Noisy Alarms	Booster, 1 power supply
8502	Noisy Alarms	1 power supply
8602	Nothing broken	PA Central
8603	1 power supply	1 power supplies
8503	1 power supply, 2 inside screens	2 power supplies, 1 inside screen
8504	1 inside screen	1 inside screen
8604	1 power supply, 1 inside screen	2 inside screens (cabin side from 8200)
8605	2 power supplies	PA Central, 1 power supply (8505 side, from 8200)
8505	1 power supply	1 power supply (8605 side, from 8200)
8506	1 power supply	-- No spare parts to complete --
8606	2 power supplies	PA Central, 1 power supply (8506 side, from 8200)

Set 05-06 could not be finished (3 power supplies broken) because there were not spare parts enough.

Parts marked “from 8200” means these parts have been taken from 8200 fleet.

From: [redacted]
[redacted]
Subject: 8500 Vemisa
Date: Monday 15 May 2017 13:51:00
Attachments: EMU_PIS_Repair_Quotation_Request.docx
image003.png

[redacted]

I have cleared the way for Quaestor to work on 8500/8510 Vemisa equipped units. Can you review the attached document and make a proposal based on this

Thanks

[redacted]
Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin
D08 K6Y3
[redacted]

IARNRÓD ÉIREANN QUOTATION REQUEST

DART 8500 AND 8510 PASSENGER INFORMATION SYSTEMS – HEALTH CHECKS

Introduction

Iarnród Éireann (IÉ) have experienced numerous reliability issues on the Passenger Information Systems (PIS) installed in the 8500 and 8510 fleets of Electrical Multiple Unit (EMU).

The PIS were originally supplied by VEMISA.

IÉ have an immediate requirement to address these reliability issues with a view to (a) understanding the root cause of the reliability issues; (b) quantifying the required material and labour costs associated with returning the systems to full working order; (c) making a decision on undertaking the required remedial actions; and (d) agreeing a maintenance regime which will maintain the systems in full working order in line with VEMISA expected operational parameters of reliability.

Accordingly, IÉ are seeking a commercial offer from Quaestor Analytic Ltd. For the following sequence of works;

a. **Root Cause Failure Analysis**
   a1: Provide a fixed price per 4 car set for undertaking the required health and status checks.
   a2: Prepare a technical report on the findings from the health and status checks providing insights into the root cause of the reliability issues being experienced.
   a3. Prepare a technical report, making recommendations on how best to manage and remedy the current technical difficulties.
b. **Costed Proposal for Repairs**[1]
   b1. Provide a costed option for repairing each 4 car set to include all labour and material costs[2].
   b2. Propose a line unit replacement (LRU) repair cost for each identifiable piece of defective equipment.
   b3. Provide a fixed price for all main LRU for instances where equipment is life expired, obsolete or beyond economic repair.
c. **Project Planning and Lead Times**
   c1. Provide a project plan outlining the timescales for achieving the recommendations in b1 and b2.
   c2. List all lead times for supply of new equipment, repair of existing equipment and timeframes required to undertake repairs to each 4 car set (i.e. vehicle downtime).

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[1] In relation to items b1, b2 and b3, you are requested to provide a full breakdown of costs for all repair types, specifically with reference to (a) costs for repairing items of equipment by Quaestor in-house; and (b) costs for sending equipment back to VEMISA for repair and the associated Quaestor handling charges for same. VEMISA repairs and VEMISA new equipment supply shall be managed only at an agreed Quaestor handling charge and should be fully transparent in your commercial offer.

[2] You are required to prepare all materials costs taking cognisance of existing spare equipment held currently by IÉ.

d. **On-Going Maintenance**
   d1. Provide a technical report outlining the preferred maintenance activities prescribed to maintain the VEMISA expected operational parameters of reliability post vehicle repair.

Commercial Offer

You are required to submit your commercial offer in the following format;

	Cost	**Units**	**Total**
a1	€0.00	7	
a2	€0.00	1	
a3	€0.00	1	
b1	€0.00	1	
b2	€0.00	1	
c1	€0.00	1	
c2	€0.00	1	
d1	€0.00	1	
Additional Technical Labour (Per Hour) outside of section a, b, c or d	€0.00		

Please note that IÉ will make a final decision on proceeding with repairs upon receipt of the costed options. IÉ may decide not to proceed with the repairs at this stage.

Any agreement will be made subject to IÉ's standard terms and conditions which are available on request.

Quotation to remain valid for consideration for 3 months from submittal date.

Author:	CONTRACT AWARD	Reviewed by:
Submitted by:	Design, Supply, Install & commission on board Passenger information system	Approved by:

1 DECISION SOUGHT

1.1 The approval of the Board is sought to conclude negotiations and award a contract to Contractor D for the design, supply, installation and commissioning of a replacement On Board Passenger Information System for the 8500, 8510 and 8520 fleets with a value of [redacted] (exclusive of VAT). The non-recoverable VAT arising is estimated at [redacted]] giving a total contract award figure o[redacted]] (see Note 1).

1.2 The contract award value, and any associated non recoverable VAT, is fully provided for within DTTAS budget, Transport Projects 2014 at a sum of [redacted] and additional funding of [redacted] in 2015.

Note 1: Approximate figure; final value to be confirmed during negotiation as the impact of additional performance security may impact on final cost

2 BACKGROUND

2.1 General Background

The seamless operation and performance of the onboard Passenger Information System (PIS) on the DART fleet is particularly important on a city metro style operation. In 2007 the Class 8100 fleet (54% of operational vehicles) was refurbished to a high standard with a modern and reliable system installed across the fleet. As advised to the IE Board in 2010 the remaining DART fleet of 67 vehicles feature a system that is not maintainable and has a very poor performance (typically 50% operational) and is the source of frequent complaints and representations from passengers, tourist bodies, government bodies, public representatives and user groups such as those representing passengers of reduced mobility or partially sighted.

The IE Board agreed a strategy in 2010 to seek funding from the DTTAS for replacement of the remaining DART system with a modern functional and reliable system. The DTTAS has provided capital funding in 2014 and 2015 to facilitate this to a total value [redacted].

The reliability and performance of the current PIS systems are poor due to five main causes:

- Poor design, poor reliability, poor diagnostics – system and software failures, unpredictable operation, system "freeze" incidents, lack of diagnostic tools.
- Obsolescent and aged technology – obsolete hardware, expensive material & repair costs, very long lead times.
- Poor product support – suppliers have disappeared, technical advice unavailable, no ability to adjust or upgrade (e.g. Irish language character sets).
- Lack of compatibility – incompatible between systems, multiple systems requires multiple spares.

- Very poor configuration tools – database management tools to change the PPIS not well developed, remote centralised downloads poor or non-existent.

~~[Iarnród Éireann – Irish Rail is looking to replace the existing Passenger Information Systems on its 8500, 8510 and 8520 fleets. The existing system has proven to be unreliable and difficult to maintain.] – CME to confirm appropriate wording.~~

3 PROCUREMENT PROCESS

3.1 Advertisement

The requirement was advertised in the Official Journal of the European Communities (OJEU) under the contract reference number 2010/S 113-171682 dated 12th June 2010.

3.2 Expressions of Interest

Sixty two expressions of interest were received on the closing date of 2nd July 2010.

3.3 Selection Criteria

The selection criteria for all contracts with an estimated value of €1m- €5m was proposed by Engineering procurement and approved by the CME in advance of the invitation to tender. (See Note 2)

The approved selection criteria are:

ITEM	CRITERION	WEIGHTING
1.	Relative Financial Strength	30%
2.	Technical Capacity and Capability	70%

3.4 Award Criteria

The award criteria for all contracts with an estimated value of €1m- €5m was proposed by Engineering procurement and approved by the CME in advance of the invitation to tender. (See Note 2)

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The approved award criteria are:-

Criterion	Weighting

Cost	40%
Proposed Methodology for the Performance of the Services	10%
Technical Solution Offered	30%
Lead time for the performance of the services	10%
Continuity of supply of goods and services	5%
Compliance with the terms and conditions of the framework agreement	5%

3.5 Procurement Evaluation Panel

The tender evaluation panel comprised of the CME, CME Project Manager and an Engineering Procurement executive who facilitated the tender evaluation.

Note 2: The thresholds for Selection or Award Criteria which applied at the time this procurement process commenced (2010) did not require board approval for procurements less than €10m. (Ref. CIE Group Procurement Policies and Procedures September 2006 - subsequently amended March 2011).

4 PROCUREMENT PROCESS

Twenty candidates, who expressed an interest, completed and returned a Pre-Qualification Questionnaire (PQQ). Ten candidates were assessed to have met the standards to be pre-qualified and consequently they were invited to tender.

5 TENDER SUBMISSION

An invitation to tender was issued to ten companies on the 21st December 2011. Four tender submissions were opened on the 14th March 2012

The processes was suspended and following a clarification of the requirements, revised tenders were issued in 5th September 2012 and again following further adjustments to requirements on the 12th March 2013. Refreshed quotes were requested on the 11th October 2013. These tenders were opened on the 28th September 2012, 2nd April 2013 and 31st October 2013 respectively.

Following tender negotiations the final tender submission was evaluated. The following table sets out the cost of the submission:

Tender	**Tender Cost**	**Final Tender Cost (post negotiation)**
Contractor A	[redacted]	-

Contractor B	[redacted]	-
Contractor C	[redacted]	-
Contractor D	[redacted]	-

Note 3: These are the latest tendered prices a review is in hand to validate these prices.

6 TENDER EVALUATION

The following table sets out the results of the tender evaluation:

Name	Maximum Score	Contractor A	Contractor B	Contractor C	Contractor D
Cost	4000	[redacted]	[redacted]	[redacted]	[redacted]
Proposed Methodology for the Performance of the Services	1000	[redacted]	[redacted]	[redacted]	[redacted]
Technical Solution Offered	3000	[redacted]	[redacted]	[redacted]	[redacted]
Lead time for the performance of the services	1000	[redacted]	[redacted]	[redacted]	[redacted]
Continuity of supply of goods and services	500	[redacted]	[redacted]	[redacted]	[redacted]
Compliance with the terms and conditions of the framework agreement	500	[redacted]	[redacted]	[redacted]	[redacted]
Total	**10,000**	[redacted]	[redacted]	[redacted]	[redacted]

Note 4: [redacted].

7 PRINCIPAL TERMS

The Principal terms of the proposed contract includes:

- Liquidated damages for Failure of system in service, failure to respond to a failed system, late acceptance of system into service and late delivery of spare parts.
- Source code escrow agreement
- Suspension
- Advance payment guarantee
- Performance bond
- Retention of payment
- Parent company guarantee

8 BUDGET IMPACT

The contract is capital funded by the DTTAS budget, Transport Projects 2014 at a sum of [redacted] and a further [redacted] in 2015..

9 SIGNIFICANT RISKS

IE has a number of concerns regarding the financial status and technical capability of Contractor [redacted] to deliver the project to plan and specification and will be seeking the introduction of additional performance security in the contract as outlined in the principal terms:

10 TERMINATION PROVISIONS

The contract allows for termination based on default of the contractor with charges permissible only for the services properly completed at the time of termination, furthermore the contract permits termination for convenience on the basis that charges owing would be allowable.

11 NEXT STEPS

Following successful conclusion of the negotiations a letter will be issued to the preferred bidder. Amendments to the contract as issued at tender stage will require approval of the Chief Executive prior to the issue of the contract for execution

12 COST IMPACT

[To be provided when negotiations are complete]

13 CONTRACT DOCUMENTATION

The documentation for this contract has been prepared by CIÉ Group Solicitors reflecting the instructions of the procurement project team

Chief Procurement Officer,

Inchicore.

On-Board Passenger Information System (PIS) Replacement on GDA

1. DECISION SOUGHT

The approval of the Board is sought to conclude a tender and award a contract for the replacement of on board Passenger Information Systems (PIS) on rail vehicles serving the greater Dublin area.

Funding is proposed from the NTA programme 2011.

2. BACKGROUND

2.1 Project Sponsor

The Project Sponsor for the project is the Chief Mechanical Engineer (CME) who is responsible for the business case.

2.2 Executing Department

The executing department is the CME which has responsibility for delivering the project to the specified scope, on time and within budget.

2.3 Project Objectives

The project objective is the identification and selection of a preferred replacement PIS system for selected Iarnród Eireann fleets serving the greater Dublin area (GDA).

2.4 Business requirement

Iarnród Éireann operates a diverse fleet of rolling stock on GDA services procured within the past 20 years. Virtually all of our trains are fitted with some form of on board Passenger Information System ranging from simple internal displays to scrolling internal and external displays (front and side) with automated multi lingual voice-over announcements. These systems are by their very nature highly complex and utilise the hardware and software technologies that were available at the time of the build. One legacy of the "small batch" rolling stock procurement strategy over recent years is that we now have a multitude of different systems, different technologies and different suppliers. These systems are not cross compatible, are obsolete and difficult to maintain and lack manufacturer support. In addition, one of the biggest sources of passenger complaints relates to the lack of on-board information or the lack of operation of these systems. There is a clear requirement to replace these different types and poorly operating systems with a single type, modern and reliable system that has the guaranteed support of its OEM.

2.5 History to Date

In 2008 the Board approved the expenditure of [redacted] for project CIR00488 to undertake a detailed feasibility study for the replacement of obsolete and unreliable PIS systems across the

Iarnród Éireann fleets. This study concluded in 2009 with a detailed Technical Specification completed and a full assessment done on the existing systems. The next stage is to move forwards with a tender process to determine market pricing and choose a preferred supplier.

3. CURRENT POSITION

The reliability and performance of the current PIS systems are poor due to five main causes:

1) Poor design, poor reliability, poor diagnostics – system and software failures, unpredictable operation, system "freeze" incidents, lack of diagnostic tools.
2) Obsolescent and aged technology – obsolete hardware, expensive material & repair costs, very long lead times.
3) Poor product support – suppliers have disappeared, technical advice unavailable, no ability to adjust or upgrade (e.g. Irish language character sets).
4) Lack of compatibility – incompatible between systems, multiple systems requires multiple spares.
5) Very poor configuration tools – database management tools to change the PPIS not well developed, remote centralised downloads poor or non-existent.

The current disposition of systems across the GDA fleets is:

Train Model	Train Manufacturer	Quantity	PIS / PA system
8100 EMU	Siemens (Refurb)	76 vehicles (38 x2)	Televic
8200 EMU	GEC Alstom	10 vehicles (5x2)	MP Electronics
8500 EMU	TCC Mitsui	16 vehicles (4x4)	MP Electronics
8510 EMU	TCC Mitsui	12 vehicles (3x4)	MP Electronics
8520 EMU	TCC Mitsui	40 vehicles (10x4)	IKUSI
2800 DMU	TCC Mitsui	20 vehicles (10x2)	Sanyo / Koito
29000 DMU	CAF	116 vehicles (29x4)	IKUSI

It is quite reasonable to suggest that PIS (including PA) systems are in principle an essential requirement for passengers that are visually and hearing impaired. In addition, a working PA is a safety critical system in an emergency situation. Despite all efforts to provide functional equipment, it has not been possible to provide reliable performance consistently. A few examples clarify the position.

3.1 The recent survey of DART PIS systems showed that 99% of systems on the refurbished 8100 fleet (supplier Televic) were consistently reliable. However, on the other DART unit classes only 61% were working consistently, mainly due to unavailability and obsolescence of hardware.

3.2 During 2008 and 2009 the imposition of very onerous contractual remedies on Mitsui ensured that Rotem and their supplier, Axion, did the necessary redesign and hardware modification work to the installed integrated PIS, CCTV and PA systems that ensured the

correct commissioning and operation. As an example, the integrated PIS, CCTV and PA system was procured from SA Viewcom originally – but by 2008 SA Viewcom had imploded and Axion had procured some of the products and obligations of the original company.

3.3 Within 3 years of CAF delivering the Class 29000 fleets, the master controller of the Ikuzi PIS/CCTV system on these fleets was claimed as "obsolete" by the supplier, Ikuzi. Ikuzi attempted to charge Iarnród Éireann [redacted] per repair of a single pcb card (of which the manufacturing costs are about [redacted].

4. PROPOSAL

It is proposed to formally launch a tender to a shortlist of preferred suppliers to design, supply and install a modern and reliable passenger information system across the listed GDA fleets on a framework basis. The exact implementation plan would be determined by the CME team however a programme of works and detailed costs for this will form part of the tender submission.

The CME department has completed the detailed technical specification and have pre-qualified a number of suppliers (e.g. Halcrow/Televic, MRSE/Televic, DataDisplay/Interalia, GSP, etc.) according to the criteria formally agreed with the Board. The next stage is to invite tenders to propose a replacement system. The tender will be launched for a turn-key project to provide a replacement PIS system type across the following GDA fleets:

Train Model	Train Manufacturer	Quantity
8500 EMU	TCC Mitsui	16 vehicles (4x4)
8510 EMU	TCC Mitsui	12 vehicles (3x4)
8520 EMU	TCC Mitsui	40 vehicles (10x4)
8200 EMU	GEC Alstom	10 vehicles (5x2)
2800 DMU	TCC Mitsui	20 vehicles (10x2)
29000 DMU	CAF	116 vehicles (29x4)
	Total	214 vehicles

There will be a considerable amount of design work, both mechanically and electrically, required to interface the generic system with each vehicle type. Note that the refurbished Class 8100 DART is fitted with a new system from Televic, a Belgian supplier that is well regarded in the market. This system meets our performance criteria and it is performing very well.

The framework contract will include a performance regime to ensure long term reliable performance against onerous criteria. In addition security in the form of an on demand bond or similar will be required to address system or component obsolescence risk over a minimum 8 year period.

5. FUNDING

The proposal will seek the use of available funds the NTA for improvements to GDA services.

The expected costs for the project are as follows:

Train Model	Train Manufacturer	Quantity	Estimated cost
8200 EMU	GEC Alstom	10 vehicles (5x2)	€252,340
8500 EMU	TCC Mitsui	16 vehicles (4x4)	€403,744
8510 EMU	TCC Mitsui	12 vehicles (3x4)	€302,808
8520 EMU	TCC Mitsui	40 vehicles (10x4)	€1,009,360
2800 DMU	TCC Mitsui	20 vehicles (10x2)	€504,680
29000 DMU	CAF	116 vehicles (29x4)	€2,927,144
		TOTAL	**€5,400,076**

6. PROJECT TIMESCALES

The timescale to award this tender is approximately 3 months (September) by which stage the Board will be presented with an award proposal and final fixed costs. Given the lead-times for design work, it is expected that initial vehicle installation would commence in early 2012 with fleet completion within 18 months.

Projected expenditure is as follows:

2011	[redacted]
2012	[redacted]

7. SUMMARY

In summary, the Board is asked to authorise the completion of the PIS procurement process for the replacement PIS system on GDA fleets.

Chief Mechanical Engineer

Inchicore

Author: [redacted] CME Head of Projects	**CAPEX REPLACEMENT OF PIS SYSTEM ON DART 8500 FLEET**	Reviewed by: EG 14/10/20
Submitted by: [redacted] CME		Approved by: [redacted] CEO

DECISION SOUGHT

The approval of the board of Iarnród Éireann is sought for the expenditure of [redacted] (including non-recoverable VAT) to replace the on board passenger information system on the DART fleet Classes 8500, 8510, 8520 EMU.

The NTA have agreed to provide funding of [redacted]

1 PROJECT SPONSOR AND PROGRAMME MANAGEMENT ARRANGEMENTS

The Project Sponsor is the Chief Mechanical Engineer who is responsible for project delivery.

2 PROJECT OBJECTIVES & BENEFITS

The complete replacement of the Passenger Information System (PIS) on board the DART fleet of 17 x 4 car EMU sets which is almost 50% of the operational DART fleet. This will provide for a modern and up to date digital PIS system with modern features as found on a new fleet. The system will be fully supported by the manufacturer over a long period.

3 DESCRIPTION

3.1 Project Overview

Iarnród Éireann (IÉ) currently operate and maintain the DART fleet of 8500, 8510 and 8520 EMU fleet of 17 x 4 carriage train sets normally in 8 carriage formation. These are maintained at Fairview Depot. They were delivered into service by Tokyu Car (JTREC) of Japan between the years 2000-2005. The fleet is fitted with a now obsolete Passenger information system that can no longer be maintained and is at best 50% operable with constant technical problems related to accuracy of information and announcements. It is the source of frequent customer complaint and representation from elected officials and bodies such as the NTA and lobby groups for mobility impaired customers or Irish language bodies. To aid staff and passenger safety and security it is required to replace the complete system on board.

The original 76 carriages of the DART 8100 Class was retrofitted with a modern system from Televic in 2007 -2009 and it is functioning very well. It served to highlight the poor performance of the remaining 68 carriages of the 8500 class. It is proposed to replace this equipment with modern, reliable and best in class systems, which will provide consistent, reliable, accurate and timely information, with improved visual displays and audio functionality.

The new PIS equipment will be a standalone system, which can be fitted into the existing fleet with minimal modifications required and minimum interface to the other on-board equipment. The specification requires that the system has necessary feeds into NTCC systems and platform CIS systems currently under development. The specified system will feature full compatibility with relevant legislation such as the Irish language act and with the EU TSI for Persons of Reduced Mobility.

3.2 Project timetable/milestones

Project milestones (sample)	Month
Funding approval received from NTA	**0**
Complete Tender and IE Board approval for Capex	**0**
Award Contract to supplier	**1**
First of class installation	**10**
Completion of fleet installation (end 2021)	**13**
Project Retention (2022)	**25**

4 FINANCIAL INFORMATION

The costs of the project are as follows:

4.1 Project elements

Item	€
Award of contract 20% (2020)	[redacted]
Installation of 17 x train sets and commissioning (2021)	[redacted]
Retention 10%	[redacted]
Non recoverable VAT	[redacted]
Contingency	[redacted]
Total	[redacted]

4.2 Cash Flow

	Q1 €'000	Q2 €'000	Q3 €'000	Q4 €'000	Total €'000
2020				[redacted]	[redacted]
2021			[redacted]	[redacted]	[redacted]
2022				[redacted]	[redacted]
				TOTAL excluding contingency	[redacted]

5 PROCUREMENT STRATEGY

All Contractors/Services/goods will be procured in accordance with CIE Group Policies and Procedures.

6 POSSIBLE RISK FACTORS AND PROPOSED MITIGATION MEASURES

- Cost escalation – Tender will seek a fixed price fully inclusive cost.
- Timescales – The tender timescale allowing for award of contract before end 2020 has some recovery built in to enable the fleet to be fitted in Q2-Q4 2021. The timeline to install the 17 x trainsets is not overly onerous.
- Complexity leading to delays – There are a limited number of suppliers able to undertake this project. The Tender prequalification process ensures only capable and reputable suppliers are bidding to minimise project delivery risk. The system is stand alone and does not need integration with other vehicle systems
- Installation – The supplier will undertake installation at Fairview on one train set at a time
- Approvals leading to delays– the system will comply with the requirements of the EU TSI for Persons of Reduced Mobility. This will required notified body approval. Internal approvals will be via RU-SMS-014. The Proposed replacement is not novel and is a system replacement in the course of maintenance.
- Unforeseen technical issues – A contingency amount is provided for unforeseen issues.

7 COMPLIANCE WITH ACCESSIBILITY REQUIREMENTS

All designs will be compliant with current accessibility standards and legislative requirements.

8 DATES & DETAILS OF PREVIOUS BOARD APPROVALS (IF APPLICABLE)

Date	PAS/BAS	Description
n/a		

Peter Smyth

Chief Mechanical Engineer

October 2020

Author: [redacted] CME Head of Projects	**CAPEX REPLACEMENT OF PIS SYSTEM ON DART 8500 FLEET**	Reviewed by: EG 14/10/20
Submitted by: [redacted] CME		Approved by: [redacted] CEO

DECISION SOUGHT

The approval of the board of Iarnród Éireann is sought for the expenditure of [redacted] (including non-recoverable VAT) to replace the on board passenger information system on the DART fleet Classes 8500, 8510, 8520 EMU.

The NTA have agreed to provide funding of [redacted]

1 PROJECT SPONSOR AND PROGRAMME MANAGEMENT ARRANGEMENTS

The Project Sponsor is the Chief Mechanical Engineer who is responsible for project delivery.

2 PROJECT OBJECTIVES & BENEFITS

The complete replacement of the Passenger Information System (PIS) on board the DART fleet of 17 x 4 car EMU sets which is almost 50% of the operational DART fleet. This will provide for a modern and up to date digital PIS system with modern features as found on a new fleet. The system will be fully supported by the manufacturer over a long period.

3 DESCRIPTION

3.1 Project Overview

Iarnród Éireann (IÉ) currently operate and maintain the DART fleet of 8500, 8510 and 8520 EMU fleet of 17 x 4 carriage train sets normally in 8 carriage formation. These are maintained at Fairview Depot. They were delivered into service by Tokyu Car (JTREC) of Japan between the years 2000-2005. The fleet is fitted with a now obsolete PIS that can no longer be maintained and is at best 50% operable with constant technical problems related to accuracy of information and announcements. It is the source of frequent customer complaint and representation from elected officials and bodies such as the NTA and lobby groups for mobility impaired customers or Irish language bodies. To aid staff and passenger safety and security it is required to replace the complete on-board PIS system ~~on board~~.

The original 76 carriages of the DART 8100 Class was retrofitted with a modern system from Televic in 2007 -2009 and it is functioning very well. It served to highlight the poor performance of the remaining 68 carriages of the 8500 class. It is proposed to replace this equipment with modern, reliable and best in class systems, which will provide consistent, reliable, accurate and timely information, with improved visual displays and audio functionality.

The new PIS equipment will be a standalone system, which can be fitted into the existing fleet with minimal modifications required and minimum interface to the other on-board equipment. The specification requires that the system has necessary feeds into NTCC systems and platform CIS systems currently under development. The specified system will feature full compatibility with relevant legislation such as the Irish language act and with the EU TSI for Persons of Reduced Mobility.

3.2 Project timetable/milestones

Project milestones (sample)	Month
Funding approval received from NTA	**0**
Complete Tender and IE Board approval for Capex	**0**
Award Contract to supplier	**1**
First of class installation	**10**
Completion of fleet installation (end 2021)	**13**
Project Retention (2022)	**25**

4 FINANCIAL INFORMATION

The costs of the project are as follows:

4.1 Project elements

Item	€
Award of contract 20% (2020)	[redacted]
Installation of 17 x train sets and commissioning (2021)	[redacted]
Retention 10%	[redacted]
Non recoverable VAT	[redacted]
Contingency	[redacted]
Total	[redacted]

4.2 Cash Flow

	Q1 €'000	Q2 €'000	Q3 €'000	Q4 €'000	Total €'000
2020				[redacted]	[redacted]
2021			[redacted]	[redacted]	[redacted]
2022				[redacted]	[redacted]
				TOTAL excluding contingency	[redacted]

5 PROCUREMENT STRATEGY

All Contractors/Services/goods will be procured in accordance with CIE Group Policies and Procedures.

6 POSSIBLE RISK FACTORS AND PROPOSED MITIGATION MEASURES

- Cost escalation – Tender will seek a fixed price fully inclusive cost.
- Timescales – The tender timescale allowing for award of contract before end 2020 has some recovery built in to enable the fleet to be fitted in Q2-Q4 2021. The timeline to install the 17 x trainsets is not overly onerous.
- Complexity leading to delays – There are a limited number of suppliers able to undertake this project. The Tender prequalification process ensures only capable and reputable suppliers are bidding to minimise project delivery risk. The system is stand alone and does not need integration with other vehicle systems
- Installation – The supplier will undertake installation at Fairview on one train set at a time
- Approvals leading to delays– the system will comply with the requirements of the EU TSI for Persons of Reduced Mobility. This will required notified body approval. Internal approvals will be via RU-SMS-014. The Proposed replacement is not novel and is a system replacement in the course of maintenance.
- Unforeseen technical issues – A contingency amount is provided for unforeseen issues.

7 COMPLIANCE WITH ACCESSIBILITY REQUIREMENTS

All designs will be compliant with current accessibility standards and legislative requirements.

8 DATES & DETAILS OF PREVIOUS BOARD APPROVALS (IF APPLICABLE)

Date	PAS/BAS	Description
n/a		

[redacted]

Chief Mechanical Engineer

October 2020

Iarnród Éireann
Irish Rail

DEROGATION FROM THE REQUIREMENT TO PUBLISH A CALL FOR COMPETITION

The CIE Group Procurement Policies and Procedures authorise a Procurement Manager to approve a derogation from the requirement to publish a call for competition in exceptional circumstances. The derogation must be prepared and signed off in accordance with Notes 1 & 2. Please note the derogation does not apply to other obligations such as having a Contract Award Recommendation and Executed Contract in place for requirements in excess of €50,000.

Item:	DART 8500 and 8510 Passenger information systems – Health Checks
Estimated Total Cost:	[redacted]
Vendor:	VEMISA (Quaestor)
Commencement Date:	29/05/2017
Expiry Date:	
Department:	Chief Mechanical Engineer
Reason for Derogation:	Iarnród Éireann (IÉ) have experienced numerous reliability issues on the Passenger Information Systems (PIS) installed in the 8500 and 8510 fleets of Electrical Multiple Unit (EMU). The PIS were originally supplied by VEMISA. IÉ have an immediate requirement to address these reliability issues with a view to (a) understanding the root cause of the reliability issues; (b) quantifying the required material and labour costs associated with returning the systems to full working order; (c) making a decision on undertaking the required remedial actions; and (d) agreeing a maintenance regime which will maintain the systems in full working order in line with VEMISA expected operational parameters of reliability. VEMISA in their capacity as OEM are the only company who have access to the technical information and spare parts necessary to undertake the required works.
Basis of Derogation: **Please refer to Note 1.**	In so far as is strictly necessary where, for reasons of extreme urgency brought about by events unforeseeable by the contracting entity, the time limits laid down for open procedures, restricted procedures and negotiated procedures with prior call for competition cannot be complied with. The circumstances invoked to justify extreme urgency shall not in any event be attributable to the contracting entity;
Where the basis of the derogation is Note 1: (c) to (f) inclusive describe what action can/will be undertaken to demonstrate value for money is being achieved.	(e) in the case of supply contracts for additional deliveries by the original supplier which are intended either as a partial replacement of supplies or installations or as the extension of existing supplies or installations, where a change of supplier would oblige the contracting entity to acquire supplies having different technical characteristics which would result in incompatibility or disproportionate technical difficulties in operation and maintenance;
Prepared By (Function Manager):	Name [redacted]
	Signature: [redacted]
	Date: 29/05/2017

D6921

Iarnród Éireann
Irish Rail

Approved By: **Please refer to Note 2.**	Name:
	Signature:
	Date:
Approved By Procurement Manager:	Name: [redacted] Procurement Manager)
	Signature: [redacted]
	Date: 29/05/2017

NOTE: this form must be completed, signed off and retained on file.

GUIDANCE NOTES

Note 1 Basis of a Derogation:

Please select one of the following to support the basis of the derogation:

(a) where no tenders or no suitable tenders or no requests to participate or no suitable requests to participate have been submitted in response to a procedure with a prior call for competition, provided that the initial conditions of the contract are not substantially altered. A tender shall be considered not to be suitable where it is irrelevant to the contract, being manifestly incapable, without substantial changes, of meeting the contracting entity's needs and requirements as specified in the procurement documents.

(b) where a contract is purely for the purpose of research, experiment, study or development, and not for the purpose of securing a profit or of recovering research and development costs, and insofar as the award of such contract does not prejudice the competitive award of subsequent contracts which do seek, in particular, those ends;

(c) where the works, supplies or services can be supplied only by a particular economic operator for any of the following reasons:

(i) the aim of the procurement is the creation or acquisition of a unique work of art or artistic performance;

(ii) competition is absent for technical reasons;

(iii) the protection of exclusive rights, including intellectual property rights.

The exceptions set out in points (ii) and (iii) shall only apply when no reasonable alternative or substitute exists and the absence of competition is not the result of an artificial narrowing down of the parameters of the procurement;

(d) in so far as is strictly necessary where, for reasons of extreme urgency brought about by events unforeseeable by the contracting entity, the time limits laid down for open procedures, restricted procedures and negotiated procedures with prior call for competition cannot be complied with. The circumstances invoked to justify extreme urgency shall not in any event be attributable to the contracting entity;

(e) in the case of supply contracts for additional deliveries by the original supplier which are intended either as a partial replacement of supplies or installations or as the extension of existing supplies or installations, where a change of supplier would oblige the contracting entity to acquire supplies having different technical characteristics which would result in incompatibility or disproportionate technical difficulties in operation and maintenance;

(f) for new works or services consisting in the repetition of similar works or services assigned to the contractor to which the same contracting entities awarded an earlier contract, provided that such works or services conform to a basic project for which a first contract was awarded.
The basic project shall indicate the extent of possible additional works or services and the conditions under which they will be awarded. As soon as the first project is put up for tender, the possible use of this procedure shall be disclosed and the total estimated cost of subsequent works or services shall be taken into consideration by the contracting entities;

(g) for supplies quoted and purchased on a commodity market;

(h) for bargain purchases, where it is possible to procure supplies by taking advantage of a particularly advantageous opportunity available for a very short time at a price considerably lower than normal market prices;

(i) for purchases of supplies or services under particularly advantageous conditions from either a supplier which is definitively winding up its business activities or the liquidator in an insolvency procedure, an arrangement with creditors or a similar procedure under national laws or regulations;

(j) where the service contract concerned follows a design contest and is to be awarded, under the rules provided for in the design contest, to the winner or to one of the winners of that contest; in the latter case, all the winners shall be invited to participate in the negotiations.

Iarnród Éireann
Irish Rail

Note 2 Authorisation

All derogations from the requirement to publish a call for competition should be prepared by the Function Manager. Derogations should be approved in accordance with the table below:

Threshold	Approval
Up to €500,000	Function Manager & Procurement Manager
Up to €1M	The relevant Procurement Manager and any one of,
	A Chief Executives/Managing Directors/Assistant Chief Executives
	B Group Chief Financial Officer: Chief Operating Officers
	C Direct reports of A or B or their nominated delegates
Up to €2M	The relevant Procurement Manager and any two of,
	A Chief Executives/Managing Directors/Assistant Chief Executives
	B Group Chief Financial Officer; Chief Operating Officers
	C Direct reports of A or B or their nominated delegates
Up to €5M	Relevant subsidiary Board
No limit	Relevant subsidiary Board and CIE Board

In all cases where derogation is contingent on Board approval the Board paper and minutes of decision must be attached.

From: [redacted]
[redacted]
Subject: Dart fleets PIS
Date: Wednesday 12 May 2010 18:08:53

[redacted],
As requested today, an update on the dart fleets for PIS.
With the addition of the new Clongriffen Station we have the following problems :
8100R – Televic -We are able to update this fleet. We have modified the database and added the audio files, tested and proved. The depot personal have been trained how to update the fleet by [redacted] This is being done presently.
8200s – Eurunion -The equipment on this fleet is obsolete. We got a controller from Operations to try add the station but the connection lead is missing from the controller and we don't have another one to replace it. If we were to get one made up we are afraid we would blow the controller and have been warned this is a possibility. The system is an old Eprom system so we don't even know if the system can take another station in its Memory.
8500s, 8510's – MP Electronics -Again obsolete systems. The database tools for this system is corrupt and we have tried several options to try re-generate it to no avail. Both of these systems have been taken over by a company Called Vemisa, whom we got over to examine the fleets. They have done this fleet check and have submitted costs to reactivate the systems using as much of the existing displays etc as possible. All cost were forwarded previously to all concerned. Martin is looking to get a budget for this.
8520's – IKSUI- We checked the software supplied with this system today and it does not allow the system to add more stations without being re-programmed. This was confirmed by the supplier and they have sent quotes to make the changes to allow us to modify in future if we want to proceed with it.
On the 2700 fleet we still have the issue of these controllers, Albatross still won't give us the breakdown on costs and are looking for [redacted] to add 5 stations to the fleet. We're still not confident that the panels and controllers will all work now as this too is obsolete.
Similar situation on the 2600 and 2800 fleets, they have automated scrolls with the destinations on them and they are full now. We would have to get new scrolls made up and get new face plates on the controllers made to suit the additional stations we could get on them, but this would be at the cost of removing some of the existing stations.
I think we should have a meeting to discuss these and decide what's the best options to take with the PIS systems on them.
Regards,
[redacted]
CME Business Systems Executive
CME Business Systems Department, Heuston Station, Dublin 8.
[redacted] *(W)*
www.irishrail.ie
There are 10 8200's, Eurunion
There are 16 8500's. MP Electronics
There are 12 8510's. MP Electronics
There are 40 8520's. IKUSI **92.502,69**
There are 76 8100s Televic
8200 = EURUNION
8500/8510 = MP Electronics
8520= Ikusi
8100=Televic

From: [redacted]
Subject: Dart passenger information system
Date: Tuesday 1 October 2019 14:44:36

[redacted]

The 17 Japanese dart trains (68 carriages) represents nearly 50% of the dart fleet. The passenger information system (PIS) is completely obsolete and largely inoperative on this fleet. The 76 carriage Dart fleet by contrast has a modern system that works well.

The system is a source of frequent customer complaint and public representation and Dail representative submissions. We have developed a specification to completely replace the equipment with a modern system. The cost will be [redacted]. The procurement process if started now would lead to an award of contract in Q3 2020 with the equipment being installed during 2021. I would expect expenditure of [redacted] in 2020 and [redacted] in 2021.

A formal application for funding can be made quickly. If you need more Information please let me know.

Regards

[redacted]

Get Outlook for iOS

From: [redacted]
[redacted]
Subject: DART PIS
Date: Monday 4 November 2019 10:47:43

For info - NTA funding confirmation has been received for the long awaited DART PIS replacement (8500, 8510, 8520 fleets)

We will now commence the procurement process. I would expect contract award in 2020 and installation in 2021 for the 17 x 4 car sets

Regards

[redacted]
Chief Mechanical Engineer
Irish Rail
[redacted]

From: [redacted]
[redacted]
Subject: Dart PIS
Date: Tuesday 21 March 2017 18:53:04
Attachments: Quaestor Vemisa collaboration letter.pdf
ATT00001.txt

[redacted]

Attached letter from Vemisa supports Quaestor working on the Dart 8500 and 8510. They are already in place on the 8520 on behalf of Ikusi. I want to put them into Fairview to undertake health checks and repairs on the 7 trains and propose this needs a derogation. Can you confirm agreement.

[redacted]

V.E.M.I.S.A.

Madrid, March, 14th, 2017

[redacted], as Venta y Explotación de Material Industrial, S.A. (V.E.M.I.S.A.) CEO,

CERTIFIES THAT

V.E.M.I.S.A. will supply QUAESTOR technical assistance, spare parts and repairings for the Passenger Information Systems on 8500 and 8510 Irish Rail Dart fletes under an agreed contractual terms, when negotiated.

C/ FERNANDEZ CARO, 44 · V.E.M.I.S.A. · 28027 MADRID ·

[redacted]

From: [redacted]
Subject: DART PIS
Date: Monday 29 January 2018 13:22:00
Attachments: image001.png

[redacted]

Can you give me an up to date summary of the latest situation on the DART regarding PIS system status. What are still the known issues that we have to deal with and what is in hand?
For example we have a PO on Vemisa and quaestor to repair the 8500 and 8510 fleets. Equipment is due in April / May. We also have a PO on Quaestor for the repair of the 8520s as well.
Are the databases now correct on all DART. Do we still have any incorrect announcements such as ferry etc remaining.
We have a good few complaints in from passengers about sets announcing in the wrong direction and with incorrect locations.

Appreciate an up to date overview.
Thanks

[redacted]
Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin
D08 K6Y3
[redacted]

From: [redacted]
[redacted]
Subject: Dart PIS
Date: Friday 14 June 2019 16:41:53

We have completed the tender technical specification for the replacement of the PIS on the 17 x 4 Japanese Dart trains 8500, 8510 and 8520 series. This has now been passed to procurement to take its place in the queue and to be managed though the system.

Note that assuming a 12 month period to get to contract execution it would take another 12 months to deliver kit and start fitting. This means we will have the existing PIS until at least late 2021.

Note that the [redacted] projected cost is not yet currently funded. Expenditure will be incurred in 2021 and 2022 if we were to proceed.

Regards

[redacted]

Sent from my iPhone

NTA
Údarás Náisiúnta Iompair
National Transport Authority

Dún Scéine, Lána Fhearchair
Baile Átha Cliath 2, D02 WT20

Dún Scéine, Harcourt Lane
Dublin 2, D02 WT20

t 01 879 8300

info@nationaltransport.ie
www.nationaltransport.ie

[redacted]
Head of Projects,
CME Department,
Connolly Station,
1 Amiens Street,
Dublin 1.

2nd December 2020

Re: 7317 – Passenger Information System (PIS) Upgrade: DART EMU Fleets – 8500, 8510 and 8520 Classes, Contract Award

Dear [redacted]

Thank you for submitting the tender evaluation report for upgrading the Passenger Information System (PIS) on the DART EMU Fleets (8500, 8510 and 8520 Classes).

I have reviewed the submission and confirm approval to award in line with the recommendations of the tender evaluation report and confirm our intention to support the contract to completion.

Yours sincerely,

[redacted]

Head of Public Transport Investment

cc. [redacted] – NTA
Iarnród Éireann

IARNRÓD ÉIREANN - JOINT OIREACHTAS COMMITTEE ACCESSIBILITY REPORT - UPDATE JUNE 2019

Iarnród Éireann supports the goal of the Joint Committee on Transport, Tourism and Sport to pave the way towards equal access to public transport services for people with disabilities in Ireland.

This will be achieved both through investment in infrastructure, stations and fleet, and through systems and resources which ensure our services are easy to buy, and easy to use for all customers.

As the Committee outlines, the recommendations in its report will require funding and policy support from Government and regulatory bodies to ensure that public transport operators can comprehensively deliver on the report's recommendations.

This paper summarises the recommendations of the report as they relate to Iarnród Éireann, and indicates the current status of each.

The Joint Committee on Transport, Tourism and Sport recommends that Government seeks to achieve the following:

Recommendation 1: **Equal access -** Strive for equal access to all public transport services for people with disabilities (across all operators, physical infrastructure and facilities) as soon as practicably possible.

Iarnród Éireann status
All of our Intercity trains have dedicated wheelchair spaces, and wheelchair accessible toilets, and all are accessible via a mobile ramp.

All DART and Commuter trains are accessible via a mobile ramp, and have an open area which can accommodate wheelchairs as well as designated areas.

We are also developing the specification for new rolling stock as part of the National Development Plan. Accessibility requirements are a key consideration in this process. The new DART fleet will be specified to meet the platform stepping height and distance requirements dictated by the PRM TSI (persons of reduced mobility technical specification for interoperability). It is intended that the tender scoring will award higher scores to carriage builders who provide the best platform train interface solution.

All new stations and all major station refurbishment programmes ensure accessibility is incorporated into the design, including ramps and/or lifts for access to all platforms. With accessibility funding now increased, Iarnrod Éireann are working through the delivery of the upgrade/improvement works identified in 2014 report across 54 stations. We are prioritising stations identified in the report to provide full accessibility at these stations. Carlow and Ennis stations will be completed by end of Q1, 2020.

Design features for the visually-impaired such as tactile markings on platforms, and colour contrasts on board services have enhanced the safety and usability of the travelling environment.

Recommendation 2: **Planning and decision making -** Ensure that the transport requirements of people with disabilities are a core feature of all public transport planning, funding and development.

Iarnród Éireann status
In 1995 we established an Access Liaison Officer, and have continuously adopted the latest accessibility standards for fleet and buildings since then.

The Disability Users Group established in 1997 includes the major representative bodies for the mobility and sensory impaired. The group includes representative from Irish Wheelchair Association, Chime, Irish Guide Dogs for the Blind, CRC, NCBI, Independent People with Disabilities, Blind Legal Alliance and newly expanded over the past six months to include Headway Ireland, AsIAm (Autism/Aspergers) and Alzheimer's Society of Ireland.

This ensures that the benefits of exchequer-funded investment in trains, stations, infrastructure, and customer systems throughout the intervening decades were enjoyed by all customers, and with direct input to design via our Disability Users Group. This will continue as we embark on investment under the National Development Plan.

Recommendation 3: **Towards a fully accessible public transport service**
In advance of the systemic reform necessary to achieve a fully accessible public transport system, and recognising that achieving this will require resources (including time and monetary investment), it is recommended that the following measures be taken to improve the accessibility of public transport services in the short term:

3.3 Rail transport
3.3.1 Ensure clear announcements of all station stops
3.3.2 Ensure that access is available (e.g. ramps, working lifts) in all stations
3.3.3 Ensure that emergency call buttons for wheelchair users are active and live
3.3.4 Consider the unstaffing of stations with particular reference to the implications of this for the accessibility of services for people with disabilities
3.3.4.1 Review capacity to safeguard access, particularly in instances where multiple journeys occur concurrently.
3.3.4.2 Discontinue the unstaffing of stations if such a policy proves to result in difficulties for disabled passengers.

Iarnród Éireann status
3.3.1 *Whilst all trains are equipped with Passenger Information Systems (PIS), 47% of the DART fleet is in need of upgraded PIS. The required funding for this is [redacted] and funding application is currently in progress with the NTA. If approved and following a tender process, the vehicles would be retrofitted in a 24 month timescale. Iarnród Éireann wishes to significantly improve the Customer Information System with customers countrywide, i.e. at stations, on-board train services and across multi-media communication platforms. Iarnrod Éireann is procuring technical assistance for the development of a network wide Customer Information Systems Strategy (CISS) to meet current needs, and which is technologically future proofed for anticipated requirements.*
The proposal is being taken to June board for expenditure approval and thereafter funding will be sought from the NTA. Once approved, the procurement process will commence with consultant engaged and report completed by end Q1, 2020.
3.3.2 *Lifts monitored and reports issued internally on a daily basis.*
3.3.3 *All staff are being rebriefed on the process for activating the emergency call button.*
3.3.4 *Hub Station concept established on DART and Commuter to cover unmanned stations, with 24,500 successful assists in the first year. The new app being developed targets greater certainty and confidence in assistance arrangements and will be live in August, 2019 following trialling with regular mobility and sensory impaired rail customers.*
3.3.4.1 *Any demanning of Intercity stations will occur in parallel with introduction of Customer Service Officers on all Intercity services in 2019, which will ensure assistance always available on Intercity services.*
3.3.4.2 *General capacity issues at present at peak for all customers – progress on both short-term fleet requirements and NDP-funded expansion of fleet by the purchase of 300 vehicles.*

Recommendation 4: **A whole journey approach -**
4.1 Secure mobility for people with disabilities on a 'whole journey' basis.
4.2 Establish a centralised hub, or a single point of access portal, to provide travel information and journey planning on an intermodal basis, to include:
4.2.1 A dedicated customer service contact point specifically to address queries in relation to accessibility (via phone, text messaging, email and live chat)
4.2.2 Information provided and produced in a range of formats (e.g. mobile apps, accessible leaflets, hardcopy timetables, subtitled audio-visual content and Irish
4.3 Provide accessibility information concerning route linkages between locations as part of travel information provision so as to facilitate passengers to make informed decisions regarding their journey
4.4 Provision for passengers to discretely indicate the requirement for extra time and consideration in their engagement with staff or services (e.g. the JAM card)
4.5 Ensure adequate facilities are available at major transport hubs (e.g. provision of Changing Places facilities)

Iarnród Éireann status
4.1 *Iarnród Éireann will engage with the NTA to progress a whole journey approach for people with disabilities.*
4.2 *This will be the responsibility of the National Transport Authority.*
4.3 *Information on routes, links and travel information provided on our website.*
4.4 *Head of Customer Experience is part of NTA working group set up to establish the Jam card by Q4, 2019.*
4.5 *A location for a changing places toilet at Heuston station is currently being sought, with further opportunities being investigated in other major stations.*

Recommendation 5: **Orientation and wayfinding**
Provide (appropriate) orientation and familiarisation programmes for people with disabilities (re services, infrastructure and facilities)

Iarnród Éireann status
NTA to lead across all Operators.

Recommendation 6: **Service interruptions**

6.1 Establish common standards of service for ongoing journeys of people with disabilities in the event of service disruption, curtailment or cancellation

6.2 In the event of curtailed/cancelled train services, replacement bus services should be accessible. If this is not possible:
- Any change to the accessibility status of services should be clearly communicated to all passengers
- Passengers should be provided with appropriate assistance to enable access (e.g. use of ramps)

6.3 If accessible replacement options for disrupted train/bus journeys are not possible due to operational reasons (i.e. a high floor coach or a low floor bus with a non-functioning ramp is utilised), wheelchair accessible taxis to facilitate passengers to complete their journeys should be provided by the operator

Iarnród Éireann status
These processes are in place currently. Where accessible bus fleet is not available, accessible taxis will be provided.

Recommendation 7: **Clear feedback and/or complaint pathways**

7.1 Establish a centralised contact hub for customer feedback regarding barriers to accessing public transport across all modes

7.2 Ensure both the existence and role of the contact hub are widely publicised and accessible via a variety of formats

7.3 Ensure that the contact hub is responsive, with clear and transparent protocols for addressing the feedback and/or complaints received

7.4 Collect data to track both the types of complaints received and the nature of the responses and/or actions arising on foot of these complaints

Iarnród Éireann status
This process is in place currently via Accessibility Officer and central customer feedback handling system for Iarnród Éireann.

Recommendation 8: **Performance**

8.1 Conduct a baseline audit of the public transport system taking a 'whole journey' approach, with periodic audits thereafter

8.1.1 Develop performance measures to assess accessibility standards across transport modes, operators, infrastructure and facilities

8.1.2 Monitor performance metrics to track the extent to which accessible public transport is being delivered

8.2 Undertake research with people with disabilities concerning their perceptions and experience of using public transport

8.2.1 Periodically survey passengers with disabilities to obtain their views on the accessibility of public transport services

8.2.2 Conduct longitudinal research with specific cohorts of passengers (e.g. wheelchair users, guide dog users) to track mobility patterns over time

8.2.3 Engage in research with people with disabilities not currently using public transport services to ascertain perceptions and/or previous experience of public transport, as well as any potential barriers to public transport usage taking a 'whole journey' approach (whilst also including a modality specific perspective)

Iarnród Éireann status

8.1 *As this relates to the entire public transport system, this would be best addressed by the NTA.*

8.2 *Mystery shopping on DART hub accessibility process took place in January, 2019. Further focus groups with accessibility users planned for Q4, 2019. Results reported to Disability User groups as part of Quarterly meetings.*

Recommendation 10: **Unplanned travel**

10.1 Remove barriers to impromptu or spontaneous travel for people with disabilities

10.1.1 Eliminate the requirement for notice time in advance of travel

10.1.2 Ensure that the necessary accessibility infrastructure and/or assistance is available without pre-booking.

Iarnród Éireann status

The assistance pilot, forthcoming app, and Customer Service Officer roles will improve access to work towards this goal. While current assistance notice is shorter than the EC1371 standards, measures proposed at European Parliament level will also enhance assistance, including turn up and go for stations with 10,000+ passengers per day. This will further strengthen rail's position as having the strongest EU-wide provisions for accessibility assistance of all transport modes.

Recommendation 11: **Technological innovation**

11.1 Actively explore ways in which technology can enhance the accessibility of public transport for people with disabilities

11.1.1 Utilise evolving smartphone and wayfinding technology to better inform people with disabilities about their surrounding environment, as well as any potential service disruptions

11.1.2 Provide real-time service information (including details of service interruptions) via dynamic mediums

Iarnród Éireann status

- *New App currently being developed to assist users booking assistance and to ensure certainty and confidence in assistance booking process.*
- *Talks ongoing with other providers regarding App development, e.g. accessibility app for station arrival to notify staff.*

Recommendation 9: **Travel costs – *not applicable to Iarnród Éireann - Department of Social and Family Affairs***

Recommendation 12: **Commercial bus and coach services – *not applicable***

Recommendation 13: **Accessible taxis - *not applicable***

Recommendation 14: **Role of the National Disability Authority - *not applicable***

Recommendation 16: **Implementation of Government policy - *not applicable to Iarnród Éireann***

IARNRÓD ÉIREANN QUOTATION REQUEST

DART 8500 AND 8510 PASSENGER INFORMATION SYSTEMS – HEALTH CHECKS

Introduction

Iarnród Éireann (IÉ) have experienced numerous reliability issues on the Passenger Information Systems (PIS) installed in the 8500 and 8510 fleets of Electrical Multiple Unit (EMU).

The PIS were originally supplied by VEMISA.

IÉ have an immediate requirement to address these reliability issues with a view to (a) understanding the root cause of the reliability issues; (b) quantifying the required material and labour costs associated with returning the systems to full working order; (c) making a decision on undertaking the required remedial actions; and (d) agreeing a maintenance regime which will maintain the systems in full working order in line with VEMISA expected operational parameters of reliability.

Accordingly, IÉ are seeking a commercial offer from Quaestor Analytic Ltd. For the following sequence of works;

a. **Root Cause Failure Analysis**
   a1: Provide a fixed price per 4 car set for undertaking the required health and status checks.
   a2: Prepare a technical report on the findings from the health and status checks providing insights into the root cause of the reliability issues being experienced.
   a3. Prepare a technical report, making recommendations on how best to manage and remedy the current technical difficulties.
b. **Costed Proposal for Repairs**[1]
   b1. Provide a costed option for repairing each 4 car set to include all labour and material costs[2].
   b2. Propose a line unit replacement (LRU) repair cost for each identifiable piece of defective equipment.
   b3. Provide a fixed price for all main LRU for instances where equipment is life expired, obsolete or beyond economic repair.
c. **Project Planning and Lead Times**
   c1. Provide a project plan outlining the timescales for achieving the recommendations in b1 and b2.
   c2. List all lead times for supply of new equipment, repair of existing equipment and timeframes required to undertake repairs to each 4 car set (i.e. vehicle downtime).

---

[1] n re at on to tems b1, b2 and b3, you are requested to prov de a fu breakdown of costs for a repa r types, spec f ca y w th reference to (a) costs for repa r ng tems of equ pment by Quaestor n house; and (b) costs for send ng equ pment back to VEM SA for repa r and the assoc ated Quaestor hand ng charges for same VEM SA repa rs and VEM SA new equ pment supp y sha be managed on y at an agreed Quaestor hand ng charge and shou d be fu y transparent n your commerc a offer

[2] You are requ red to prepare a mater a s costs tak ng cogn sance of ex st ng spare equ pment he d current y by É

d. On-Going Maintenance

d1. Provide a technical report outlining the preferred maintenance activities prescribed to maintain the VEMISA expected operational parameters of reliability post vehicle repair.

Commercial Offer

You are required to submit your commercial offer in the following format;

	Cost	**Units**	**Total**
a1	€0.00	7[redacted]	[redacted]
a2	€0.00	1 [redacted]	[redacted]
a3	€0.00	1 [redacted]	[redacted]
b1	€0.00	1	
b2	€0.00	1	
c1	€0.00	1	
c2	€0.00	1	
d1	€0.00	1	
Additional Technical Labour (Per Hour) outside of section a, b, c or d	€0.00		

Please note that IÉ will make a final decision on proceeding with repairs upon receipt of the costed options. IÉ may decide not to proceed with the repairs at this stage.

Any agreement will be made subject to IÉ's standard terms and conditions which are available on request.

Quotation to remain valid for consideration for 3 months from submittal date.

From: [redacted]
[redacted]
Subject: FINAL VERSION DTTAS - Joint Oireachtas Committee Accessibility Report Update - 11.06.19
Date: Thursday 4 July 2019 12:30:37
Attachments: DTTAS - Joint Oireachtas Committee Accessibility Report Update - 11.06.19.docx

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All
I have updated the file.
Thanks
Heidi

IARNRÓD ÉIREANN - JOINT OIREACHTAS COMMITTEE ACCESSIBILITY REPORT - UPDATE JUNE 2019

Iarnród Éireann supports the goal of the Joint Committee on Transport, Tourism and Sport to pave the way towards equal access to public transport services for people with disabilities in Ireland.

This will be achieved both through investment in infrastructure, stations and fleet, and through systems and resources which ensure our services are easy to buy, and easy to use for all customers.

As the Committee outlines, the recommendations in its report will require funding and policy support from Government and regulatory bodies to ensure that public transport operators can comprehensively deliver on the report's recommendations.

This paper summarises the recommendations of the report as they relate to Iarnród Éireann, and indicates the current status of each.

The Joint Committee on Transport, Tourism and Sport recommends that Government seeks to achieve the following:

Recommendation 1: **Equal access -** Strive for equal access to all public transport services for people with disabilities (across all operators, physical infrastructure and facilities) as soon as practicably possible.

Iarnród Éireann status
All of our Intercity trains have dedicated wheelchair spaces, and wheelchair accessible toilets, and all are accessible via a mobile ramp.

All DART and Commuter trains are accessible via a mobile ramp, and have an open area which can accommodate wheelchairs as well as designated areas.

We are also developing the specification for new rolling stock as part of the National Development Plan. Accessibility requirements are a key consideration in this process. The new DART fleet will be specified to meet the platform stepping height and distance requirements dictated by the PRM TSI (persons of reduced mobility technical specification for interoperability). It is intended that the tender scoring will award higher scores to carriage builders who provide the best platform train interface solution.

All new stations and all major station refurbishment programmes ensure accessibility is incorporated into the design, including ramps and/or lifts for access to all platforms. With accessibility funding now increased, Iarnrod Éireann are working through the delivery of the upgrade/improvement works identified in 2014 report across 54 stations. We are prioritising stations identified in the report to provide full accessibility at these stations. Carlow and Ennis stations will be completed by end of Q1, 2020.

Design features for the visually-impaired such as tactile markings on platforms, and colour contrasts on board services have enhanced the safety and usability of the travelling environment.

Recommendation 2: **Planning and decision making -** Ensure that the transport requirements of people with disabilities are a core feature of all public transport planning, funding and development.

Iarnród Éireann status
In 1995 we established an Access Liaison Officer, and have continuously adopted the latest accessibility standards for fleet and buildings since then.

The Disability Users Group established in 1997 includes the major representative bodies for the mobility and sensory impaired. The group includes representative from Irish Wheelchair Association, Chime, Irish Guide Dogs for the Blind, CRC, NCBI, Independent People with Disabilities, Blind Legal Alliance and newly expanded over the past six months to include Headway Ireland, AsIAm (Autism/Aspergers) and Alzheimer's Society of Ireland.

This ensures that the benefits of exchequer-funded investment in trains, stations, infrastructure, and customer systems throughout the intervening decades were enjoyed by all customers, and with direct input to design via our Disability Users Group. This will continue as we embark on investment under the National Development Plan.

Recommendation 3: **Towards a fully accessible public transport service**
In advance of the systemic reform necessary to achieve a fully accessible public transport system, and recognising that achieving this will require resources (including time and monetary investment), it is recommended that the following measures be taken to improve the accessibility of public transport services in the short term:

3.3 Rail transport
3.3.1 Ensure clear announcements of all station stops
3.3.2 Ensure that access is available (e.g. ramps, working lifts) in all stations
3.3.3 Ensure that emergency call buttons for wheelchair users are active and live
3.3.4 Consider the unstaffing of stations with particular reference to the implications of this for the accessibility of services for people with disabilities
3.3.4.1 Review capacity to safeguard access, particularly in instances where multiple journeys occur concurrently.
3.3.4.2 Discontinue the unstaffing of stations if such a policy proves to result in difficulties for disabled passengers.

Iarnród Éireann status
3.3.1 *Whilst all trains are equipped with Passenger Information Systems (PIS), 47% of the DART fleet is in need of upgraded PIS. The required funding for this is [redacted] and funding application is currently in progress with the NTA. If approved and following a tender process, the vehicles would be retrofitted in a 24 month timescale. Iarnród Éireann wishes to significantly improve the Customer Information System with customers countrywide, i.e. at stations, on-board train services and across multi-media communication platforms. Iarnrod Éireann is procuring technical assistance for the development of a network wide Customer Information Systems Strategy (CISS) to meet current needs, and which is technologically future proofed for anticipated requirements.*
The proposal is being taken to June board for expenditure approval and thereafter funding will be sought from the NTA. Once approved, the procurement process will commence with consultant engaged and report completed by end Q1, 2020.
3.3.2 *Lifts monitored and reports issued internally on a daily basis.*
3.3.3 *All staff are being rebriefed on the process for activating the emergency call button.*
3.3.4 *Hub Station concept established on DART and Commuter to cover unmanned stations, with 24,500 successful assists in the first year. The new app being developed targets greater certainty and confidence in assistance arrangements and will be live in August, 2019 following trialling with regular mobility and sensory impaired rail customers.*
3.3.4.1 *Any demanning of Intercity stations will occur in parallel with introduction of Customer Service Officers on all Intercity services in 2019, which will ensure assistance always available on Intercity services.*
3.3.4.2 *General capacity issues at present at peak for all customers – progress on both short-term fleet requirements and NDP-funded expansion of fleet by the purchase of 300 vehicles.*

Recommendation 4: **A whole journey approach -**
4.1 Secure mobility for people with disabilities on a 'whole journey' basis.
4.2 Establish a centralised hub, or a single point of access portal, to provide travel information and journey planning on an intermodal basis, to include:
4.2.1 A dedicated customer service contact point specifically to address queries in relation to accessibility (via phone, text messaging, email and live chat)
4.2.2 Information provided and produced in a range of formats (e.g. mobile apps, accessible leaflets, hardcopy timetables, subtitled audio-visual content and Irish
4.3 Provide accessibility information concerning route linkages between locations as part of travel information provision so as to facilitate passengers to make informed decisions regarding their journey
4.4 Provision for passengers to discretely indicate the requirement for extra time and consideration in their engagement with staff or services (e.g. the JAM card)
4.5 Ensure adequate facilities are available at major transport hubs (e.g. provision of Changing Places facilities)

Iarnród Éireann status
4.1 *Iarnród Éireann will engage with the NTA to progress a whole journey approach for people with disabilities.*
4.2 *This will be the responsibility of the National Transport Authority.*
4.3 *Information on routes, links and travel information provided on our website.*
4.4 *Head of Customer Experience is part of NTA working group set up to establish the Jam card by Q4, 2019.*
4.5 *A location for a changing places toilet at Heuston station is currently being sought, with further opportunities being investigated in other major stations.*

Recommendation 5: **Orientation and wayfinding**
Provide (appropriate) orientation and familiarisation programmes for people with disabilities (re services, infrastructure and facilities)

Iarnród Éireann status
NTA to lead across all Operators.

Recommendation 6: **Service interruptions**

6.1 Establish common standards of service for ongoing journeys of people with disabilities in the event of service disruption, curtailment or cancellation

6.2 In the event of curtailed/cancelled train services, replacement bus services should be accessible. If this is not possible:
- Any change to the accessibility status of services should be clearly communicated to all passengers
- Passengers should be provided with appropriate assistance to enable access (e.g. use of ramps)

6.3 If accessible replacement options for disrupted train/bus journeys are not possible due to operational reasons (i.e. a high floor coach or a low floor bus with a non-functioning ramp is utilised), wheelchair accessible taxis to facilitate passengers to complete their journeys should be provided by the operator

Iarnród Éireann status
These processes are in place currently. Where accessible bus fleet is not available, accessible taxis will be provided.

Recommendation 7: **Clear feedback and/or complaint pathways**

7.1 Establish a centralised contact hub for customer feedback regarding barriers to accessing public transport across all modes

7.2 Ensure both the existence and role of the contact hub are widely publicised and accessible via a variety of formats

7.3 Ensure that the contact hub is responsive, with clear and transparent protocols for addressing the feedback and/or complaints received

7.4 Collect data to track both the types of complaints received and the nature of the responses and/or actions arising on foot of these complaints

Iarnród Éireann status
This process is in place currently via Accessibility Officer and central customer feedback handling system for Iarnród Éireann.

Recommendation 8: **Performance**

8.1 Conduct a baseline audit of the public transport system taking a 'whole journey' approach, with periodic audits thereafter

8.1.1 Develop performance measures to assess accessibility standards across transport modes, operators, infrastructure and facilities

8.1.2 Monitor performance metrics to track the extent to which accessible public transport is being delivered

8.2 Undertake research with people with disabilities concerning their perceptions and experience of using public transport

8.2.1 Periodically survey passengers with disabilities to obtain their views on the accessibility of public transport services

8.2.2 Conduct longitudinal research with specific cohorts of passengers (e.g. wheelchair users, guide dog users) to track mobility patterns over time

8.2.3 Engage in research with people with disabilities not currently using public transport services to ascertain perceptions and/or previous experience of public transport, as well as any potential barriers to public transport usage taking a 'whole journey' approach (whilst also including a modality specific perspective)

Iarnród Éireann status

8.1 *As this relates to the entire public transport system, this would be best addressed by the NTA.*

8.2 *Mystery shopping on DART hub accessibility process took place in January, 2019. Further focus groups with accessibility users planned for Q4, 2019. Results reported to Disability User groups as part of Quarterly meetings.*

Recommendation 10: **Unplanned travel**

10.1 Remove barriers to impromptu or spontaneous travel for people with disabilities

10.1.1 Eliminate the requirement for notice time in advance of travel

10.1.2 Ensure that the necessary accessibility infrastructure and/or assistance is available without pre-booking.

Iarnród Éireann status

The assistance pilot, forthcoming app, and Customer Service Officer roles will improve access to work towards this goal. While current assistance notice is shorter than the EC1371 standards, measures proposed at European Parliament level will also enhance assistance, including turn up and go for stations with 10,000+ passengers per day. This will further strengthen rail's position as having the strongest EU-wide provisions for accessibility assistance of all transport modes.

Recommendation 11: **Technological innovation**

11.1 Actively explore ways in which technology can enhance the accessibility of public transport for people with disabilities

11.1.1 Utilise evolving smartphone and wayfinding technology to better inform people with disabilities about their surrounding environment, as well as any potential service disruptions

11.1.2 Provide real-time service information (including details of service interruptions) via dynamic mediums

Iarnród Éireann status

- *New App currently being developed to assist users booking assistance and to ensure certainty and confidence in assistance booking process.*
- *Talks ongoing with other providers regarding App development, e.g. accessibility app for station arrival to notify staff.*

Recommendation 9: **Travel costs – *not applicable to Iarnród Éireann - Department of Social and Family Affairs***

Recommendation 12: **Commercial bus and coach services – *not applicable***

Recommendation 13: **Accessible taxis - *not applicable***

Recommendation 14: **Role of the National Disability Authority - *not applicable***

Recommendation 16: **Implementation of Government policy - *not applicable to Iarnród Éireann***

From: [redacted]
Subject: FW: 8500 PIS
Date: Wednesday 4 November 2015 20:00:00
Attachments: Technical Specification for DART PIS - Issue 1.2 2015.docx
image001.png

Print for me – careful of the size it might be large!

[redacted]
Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin
[redacted]

From: [redacted]
Sent: 04 November 2015 17:11
To: [redacted]
Subject: FW: 8500 PIS

Hi [redacted]
Please find attached revision 1.2 for the DART PIS spec.
Kind regards,

[redacted]
Technical Services,
CME Dept., Iarnród Éireann,
Inchicore, Dublin D08 K6Y3, Ireland
☎: +353 1 703 3830 ✉: [redacted]

From: [redacted]
Sent: 25 September 2015 14:31
To: [redacted]>
Subject: RE: 8500 PIS

H [redacted]
I have reviewed and added some comments to the attached. If you read over it and update as necessary please. Also when [redacted] is back next week ask him to go through his spec for the loco re-power with you, there are some bits of it that might be useful, things like:

- Approvals
- Warranty
- Selection / award criteria
- Standards

We can sit down next week and go through it when your ready.
[redacted]

From: [redacted]
Sent: 21 August 2015 10:20
To: [redacted]
Subject: 8500 PIS

Hi [redacted]
Can you please review the first draft of the PIS Spec?
Kind regards,

[redacted]
Technical Services,
CME Dept., Iarnród Éireann,
Inchicore, Dublin D08 K6Y3, Ireland
☎: +353 1 703 3830 [redacted]

Reference No.	CME/SPEC/***
Version	Issue 1.0
Operative Date	21/08/2015
Status	Live
Prepared by	[redacted]
Checked by	
Approved by	

Technical Specification

Passenger Information System Upgrade for DART EMU Class 8500/8510/8520 fleets.

DART
DART

Contents:

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Appendices to Specification:

	Title
A	CME-TMS-316 Engineering Change Process

1. - Introduction & Current Arrangement

1.1 Iarnród Éireann - Irish Rail (IÉ) procured a fleet of 4 car EMUS from Tokyu Car (Japan) in 2000-2004. These are the Class 8500 series, Class 8510 series and Class 8520 series EMUs. The fleet operates the Dublin DART commuter service powered by overhead 1500v DC.

1.2 Each EMU set is formed of 4 cars permanently coupled. There are 4 x 8500 units, 3 x 8510 units and 10 x 8520 units. Therefore a total of 17 x units from 68 cars.

1.3 All EMUs are based at Fairview EMU depot Dublin for all routine and heavy maintenance.

1.4 The current Passenger Information System (PIS) for the 8500 is supplied by Eurunion, the 8510 is supplied by Eurunion and the 8520 is supplied by Ikusi. A tender for replacement of the PIS system is being sought by IÉ due to the reliability issues of the aforementioned PIS system.

1.5 The purpose of this tender is to source a railway approved PIS system, that are 'fit for purpose', providing accurate and timely information with good visibility/readability (displays) and good intelligibility (audio), consistently and reliably. This specification defines the minimum requirements for the replacement PIS.

1.6 The new PIS equipment will be installed as a standalone system.

2 - Core Requirement

2.1 The core requirement is for the supply of a high quality PIS system, which can be fitted to the train with a minimum of interfacing or modification, shall include:

2.1.1 Destination Displays on the ends of each unit.

2.1.2 Moving Message Displays in each end of the saloon.

2.1.3 Side Destination Display.

2.1.4 Automatic Voice Announcements.

2.1.5 Public Address (PA) System.

2.2 The new PIS system will be required for all 17 units.

2.3 The services to be supplied will include all equipment necessary to fully integrate it into the existing vehicle.

2.4 Each Passenger Information System shall be controlled through an operator control console in each coach. When more than one, two coach sets are coupled through automatic couplers, each individual system will be synchronized to work under the control of the lead system controlled by the operator.

2.5 A system and installation that complies with both EU and National legislation.

2.6 Minimal future support to be required and 'low maintenance', i.e. simplified database preparation and distribution, self diagnostics and fault reporting.

3 - Installation

3.1 The Supplier will install the new PIS system and any associated PIS equipment to the vehicles.

3.2 The Supplier will provide specific installation instructions for the new PIS equipment and any associated PIS equipment mechanically/electrically.

3.3 The installation work will take place at Irish Rail premises in Dublin (or such other site as agreed) and the Contractor will comply with any site specific requirements required for site access and undertaking vehicle modifications.

4 – Environmental Conditions

4.1. Thermal Range

Powered: -25^{0}C to +55^{0}C external to the equipment,

i.e. EN50155, class T1.

Operational: -10^{0}C to +55^{0}C.

Storage: -30^{0}C to +70^{0}C ambient.

4.2. Humidity Range:

95% up to +55^{0}C, to be demonstrated by a damp heat cyclic test including temperature change at 30^{0}C /minute maximum from -25^{0}C to +55^{0}C at maintained relative humidity.

4.3. Contaminants:

Heavy interior use, applicable to rail environment; e.g. dust with oil particles from diesel engines and conductive dust from brake pads. Salt mist – DART services operate along the east coast of Ireland.

5 - Technical Requirements

5.1 The new PIS system must be a standalone system and contain a PIS controller with the following features:

5.2 PIS Distance Measuring System

5.2.1 The primary distance measuring system shall be based upon wheel distance travelled, using the trains odometer.

5.2.2 The system shall use GPS to locate itself periodically and to determine its position at power-up and upon recovery from a fault. The GPS shall also be used to calibrate any distance measurements/calculations periodically. Functionality shall be maintained when GPS is not available.

5.2.3 The use of the 'Door Open Signals (left/right)' shall also be used to indicate the train has stopped at a platform. The exact station determined from the GPS and/or the trains odometer. It should be noted that doors may be released several times at the same location, so the PIS shall not solely depend upon door release for triggers.

5.3 Audio and PA System

5.3.1 Audio for the Passenger Information System, must comply with TSI-PRM:

5.3.2 An audio speaker system must be each saloon and drivers cab.

5.3.3 The PIS controller will make automated announcements in both Irish and English for particular events.

5.3.4 The driver must also be able to play predefined messages that will override automated audio announcements.

5.3.5 The system shall provide the ability for the driver and/or CTC communications, to override automated audio announcements with PA voice announcements.

5.4 Visual Displays

5.4.1 The Visual Displays shall include internal (saloon), external (side) and front of train displays and must comply with TSI-PRM.

5.4.2 Displays shall be capable of displaying messages in both English and Irish languages.

5.4.3 Displays shall be capable of displaying all the set of characters for the Irish Gaelic Language as established in the Irish Standard Specification for '*Information Technology – Irish 7-bit Coded Character Sets*' (I.S. 433:1999), and in the '*Information Technology – 8-bit single-byte coded graphic character sets*' (ISO/IEC 8859-15:1999).

5.4.4 Displayed characters shall be in a high contrast, to their background display.

5.4.5 Front of train displays shall be installed into the location presently occupied by a destination display, i.e. shall replace existing electronic or roller displays. The preferred character height (capital) is 150mm.

5.4.6 One side display per vehicle side is required and shall be secured to the outside of the train and must not infringe the train gauge.

5.4.7 Internal displays shall be installed at the vehicle ends, above the doors to the inter-vehicle gangway or to the cab, i.e. two displays per vehicle. The preferred character height (capital) is 70mm.

5.5 Timetable

5.5.1 Each system is required to store the DART passenger timetable. The timetable shall relate Train Number to:

5.5.2 Departure and arrival times at all stations.

5.5.3 Day(s) of week when this train runs.

5.5.4 Date of commencement and date of finishing of this timetable.

5.5.5 Any special days e.g. Christmas when this train does not run.

5.5.6 Any special days when this train runs e.g. extra trains only programmed for Christmas period.

5.6 Software

5.6.1 Route simulator/editor software must be provided to IÉ and user training. The Software provided must be compatible with Windows 7, Windows 8 and Windows 10 and all associated service pack updates. The software package should include the following:

5.6.2 Addition of extra stations names in Irish and English.

5.6.3 Addition of the co-ordinates and distances for the extra stations.

5.6.4 Modification of the co-ordinates and distances for existing stations.

5.6.5 Definition of train numbers using a maximum of three letters and five numbers. Blanks will be permitted at leading and trailing portions to facilitate the current two letter, four number system e.g.

XXX #####
Typical current number
ZZ 1032

5.6.6 Selection of train starting station from a list.

5.6.7 Selection of train destination station from a list.

5.6.8 Selection of train intermediate stations from a list. The order of selection will indicate the order of stopping.

5.6.9 Definition of arrival and departure times for all stopping stations. Non-stop stations shall have the same arrival and departure time. Obviously starting stations only have departure times and destination stations only have arrival times.

5.6.10 Definition of the day(s) of the week when this train runs. This is to be optional, as specials will not use this function.

5.6.11 Definition of any prescribed dates when this trains runs to allow for specials.

5.6.12 Definition of dates when this train does not run, this can either be a list of dates or a range of dates or a combination of ranges and list of dates.

5.6.13 The software shall allow the copying of train details to a new train id number to speed up the timetable generation.

5.6.14 Each complete timetable shall have a unique sensible filename, format to be agreed with Iarnród Éireann.

5.6.15 The software shall allow the copying of existing complete timetables which currently are in a .vpt format, to allow easy generation of new ones.

5.6.16 For particular train I.D.s, it shall be possible to insert or delete stations.

5.6.17 The timetable generation software shall provide Iarnród Éireann with the facility to create edit, modify, or delete any of the audio or visual messages. Editing of the audio messaged need only consist of erasing and re-recording.

5.6.18 It must be possible to upload changes to timetable, route patterns and audio messages remotely.

5.7 Driver Interface

5.7.1 Route I.D. shall be taken from the drivers input into the train radio.

5.7.2 Location selections i.e. override the automatic location data in case of distance measurement system failure.

5.7.3 Driver selection of special messages.

5.7.4 Driver shutdown and restart of the system.

5.7.5 Driver check on current system location.

5.7.6 Driver check on current and next system message.

5.8 Automatic update of system clock in relation to Daylight Savings Time is required.

5.9 Future proofing of equipment and software is required.

6. Optional Extras

rail network. A very large screen would be required, e.g. 50", which is not practical inside vehicles. Options include horizontal scrolling, TSI non-compliance, or using a separate LED display for statutory/operational information.

One arrangement we have considered is to mount a pair of screens side by side as a 'video wall' and the message would scroll between the two. However, such an arrangement will feature a gap in the text, typically 20mm, because of the frames of the screens (See figure below). This gap may mask up to two characters of a word, i.e. in the case of at, to, an, by, etc. This arrangement is unlikely to comply with displaying the station name for a minimum of 2 seconds. However, assuming that the display text on each text is correctly positioned and synchronised to preserve the dimensions/aspect of the 'blanked' word, and the message is scrolling, then the string may be readable, but this solution is untested by any NoBo.

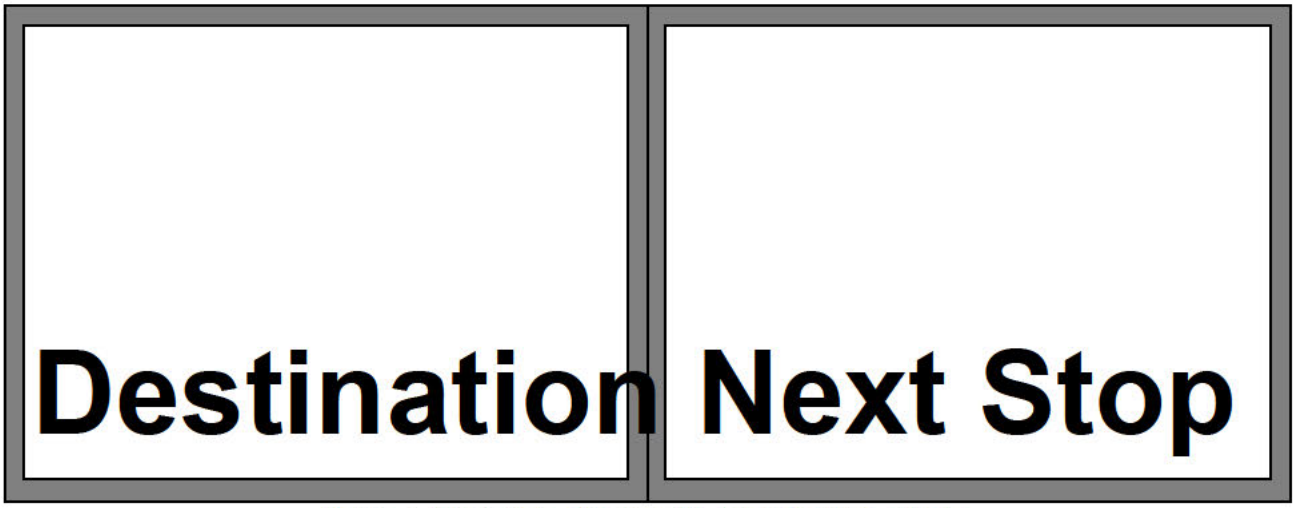


Figure 4. Illustration of issue with gap using two screens

7.2.1 Screen options

Screens currently available in the market include the following:

a) Single display;
b) Doubly display – two screens;
c) Single back to back display – two screens;
d) Quad display – four screen.

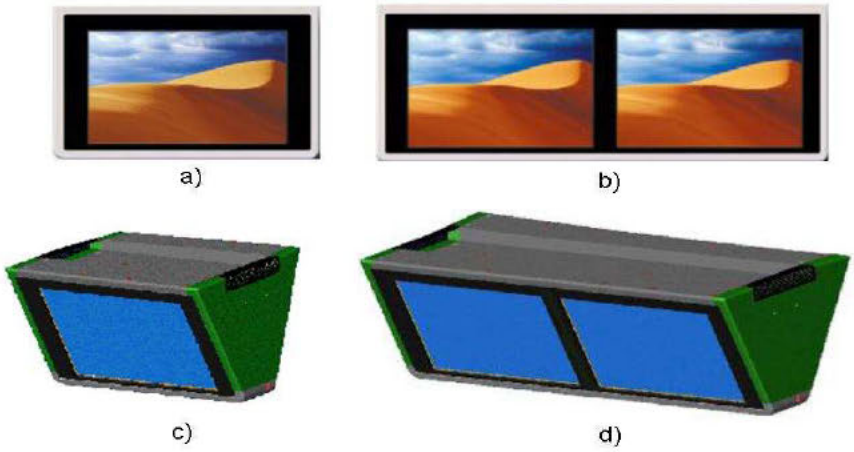


Figure 5. Example of screens used in Infotainment (Courtesy Inova Multimedia)

7.2.2 Screen layout options

Some of the screens layouts currently used in the rail market are listed below. Note: it is important to highlight that the following examples would only be acceptable as supplementary information, as long as there is a dedicated screen for the TSI-PRM statutory passenger and routeing information.

- Dynamic route map on single display.

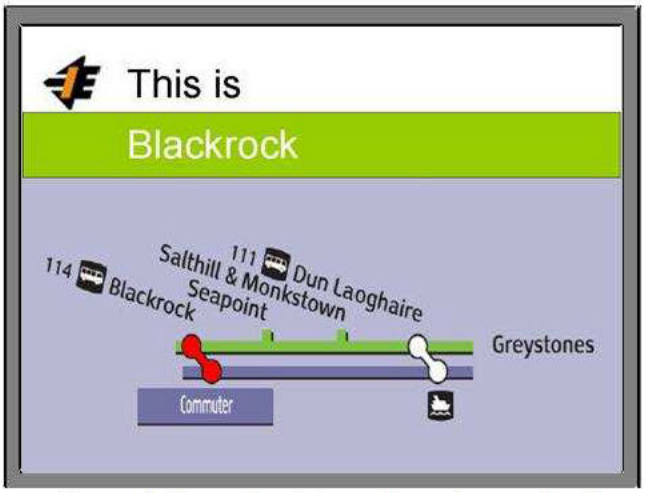


Figure 6. Example of dynamic route map for IE

- Dynamic route map and information on single display: single screen layout with permanent next stop information, while showing video content plus animated advertisement.

- Dynamic route map and information on double display: one screen is used only for passenger information, while the other shows a mixture of news and advertisement.

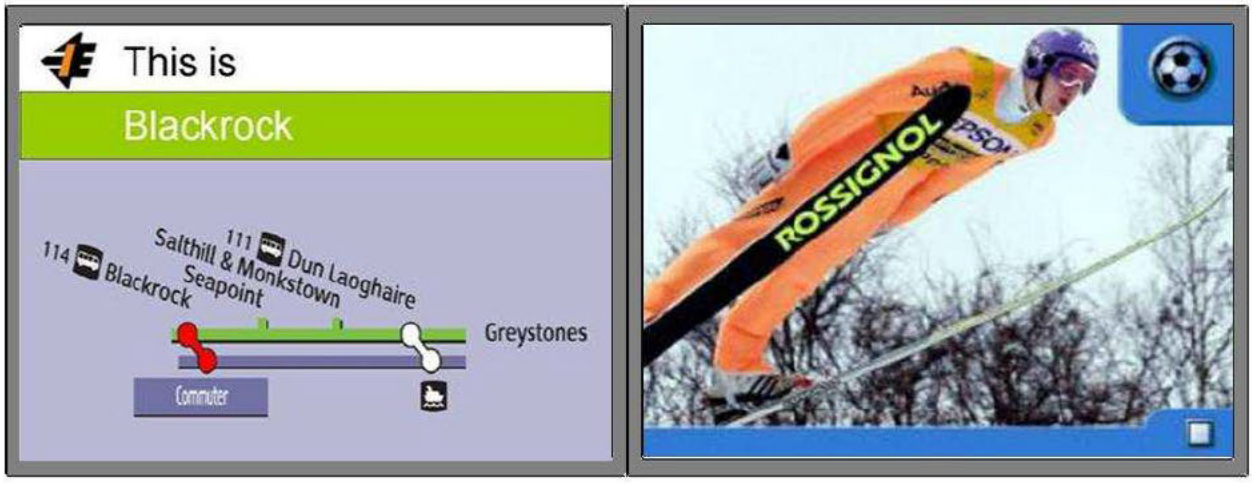


Figure 7. Example of dynamic route map and information on double display

- Information on double display: both screens are used to show a mixture of advertisement, news, etc. Supplementary passenger information could be shown on the bottom of the screen.

Figure 8. Example of information on double display with route information on the bottom

7.2.3 Screen considerations

The following factors need to be considered when using screens onboard:

- Use of the appropriate type of safety glass in the front of the screen;
- Enclosure of the screen to prevent ingress of dust, environment sealing to IP65;
- Thermal management;
- Vibration and shock resistance;
- Vandal resistance;
- Compliance with the appropriate electrical requirements, e.g. EMC;
- Fire performance and materials.

7.2.4 Integrated PIS and Infotainment Concept

Infotainment systems incorporate one or more PC-hardware based 'Media Players' installed onboard each train to control and play programmes. These Media Players feed an Audio/Video distribution unit fitted in each coach, which in turn feeds the onboard LCD TFT screens. However, a new concept being developed by TrainFX, allows for the Media Player to link passenger infotainment with the passenger information systems (LED displays), as well as other subsystems, e.g. CCTV, PA.

The Media Players on the train need to be connected together via an onboard dedicated Ethernet network; this enables them to share location, route information, an interface to the TMS, and a wireless LAN connection. Sharing such information minimises the number of aerials required and reduces the installation work on the train. The wireless LAN connection allows upload and download of programme data and logs whenever the train is near a fixed wireless LAN access point.

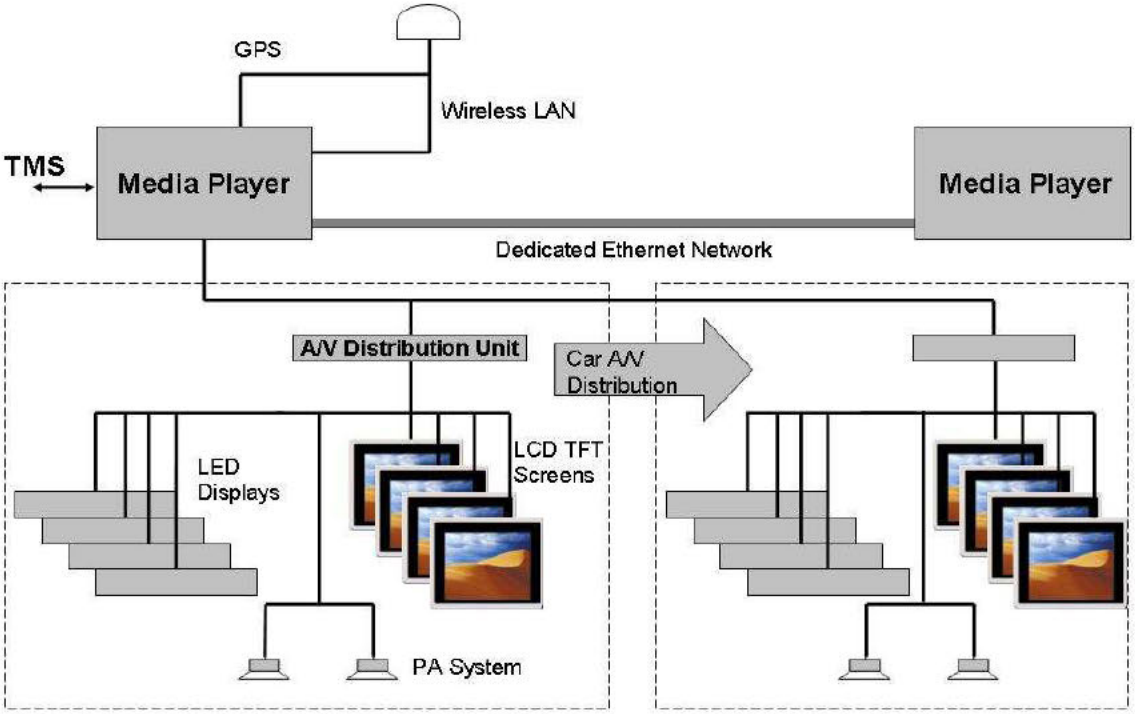


Figure 9. Integrated PIS & Passenger Infotainment System Architecture

7.2.5 Information Management Infrastructure

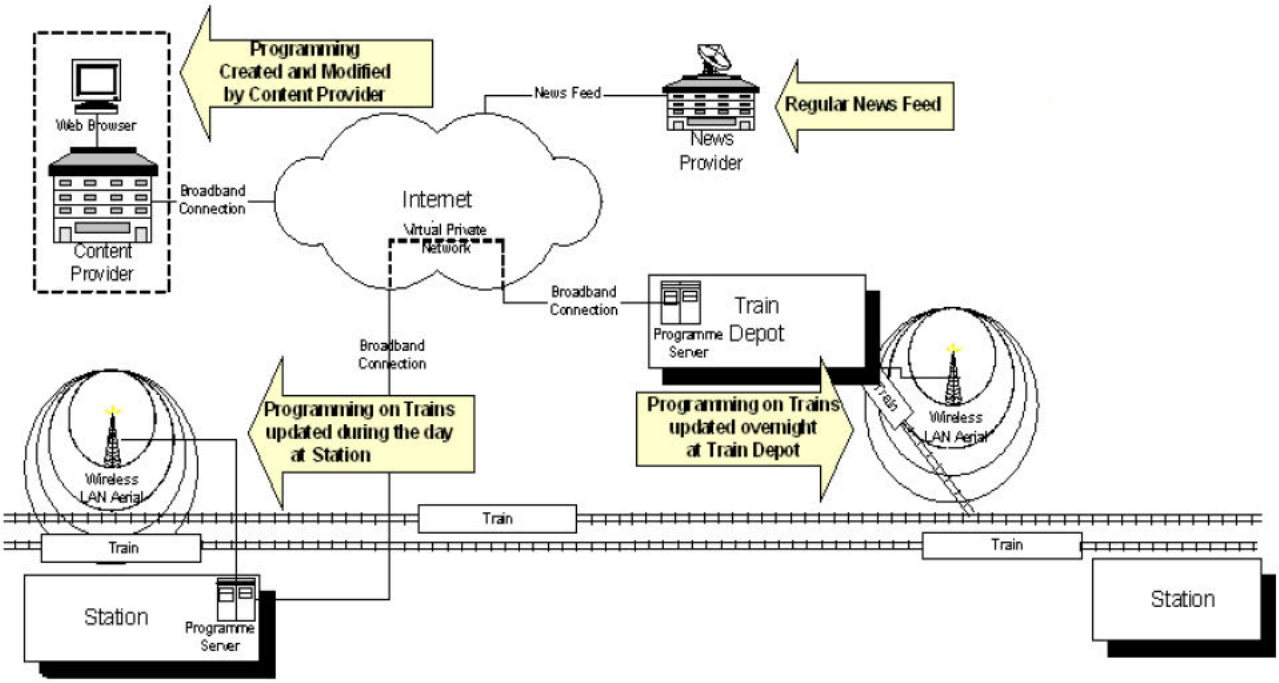


Figure 10. System overview (Courtesy – L3-ASA Communications)

8 INSTALLATION OF PASSENGER INFOTAINMENT

This section will set out a number of options for the Passenger Infotainment System; these are based on existing onboard infotainment systems around the world, and IE's fleet characteristics. The following factors are relevant for the system's installation:

- Transversal seating;
- Internal LED displays to be fitted at the body ends. Note: the existing PIS arrangements are described in more detail in 'Feasibility Study for Replacement Passenger Information Systems';
- 2 vestibules per car;
- Adverts placed in overhead frames above the passenger seats or luggage rails;
- 15" widescreen TFT display assumed, but if at all possible a larger screen would be preferable, i.e. 18";
- Advertisements shall not be combined with the routeing and information systems;
- Inside trains the font size shall be not less than 35mm on the PIS screens.

Figure 11. Current layout for EMU and DMU units (8520 left – 2600 right)

8.1 SCREEN LOCATIONS AND TYPE OF SCREENS

8.1.1 Ceiling Mounted

A common concept is to suspend the screens from the ceiling of the train. Back to back screens would be preferable since this would provide viewing access of two sides from one display. The figure below illustrates the possible locations of the screens. An alternative location is to put the screens on the vestibules, but factors such as air conditioning, space clearance would have to have to be considered.

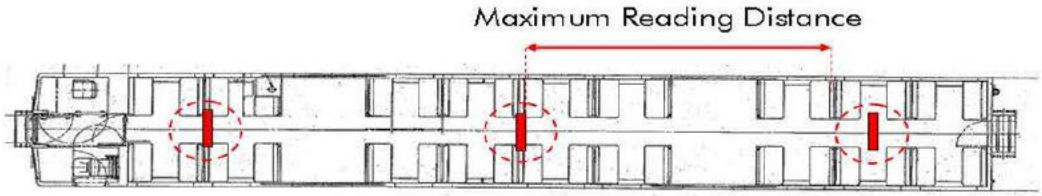


Figure 12. Proposed locations of screens on a DMU

It should be noted that the maximum viewing distance identified for this option would be approximately 6,680mm (7,300mm for the case of an EMU). For a person with normal visual acuity, a font height of 30mm will be readable over this distance.

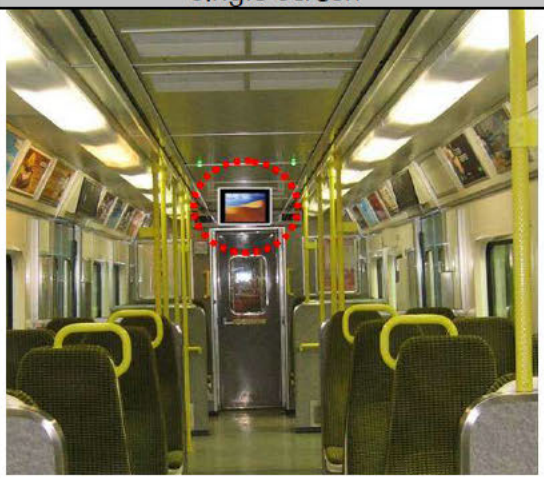
	Single Screen	Double Screen
Illustration		
Advantages	• TSI compliant as existing LED displays would provide the statutory information; • Possible to display video advertisement; • Lower cost than double screen option; • No alteration to existing advertising panels.	• TSI compliant as existing LED displays would provide the statutory information; • Possible to display video advertisement; • Better quality of information provided; • No alteration to existing advertising panels.
Disadvantages	• Potential safety hazard to passengers, i.e. some passengers could hit their heads on the display; • Visual obstruction of the LED displays; • Limited type of information could be provided; • Passengers at the ends of the car will not be able to see the screens if one sided screens are used; • Impact on the aesthetic of the saloon interior.	• Potential safety hazard to passengers, i.e. some passengers could hit their heads on the display; • Higher sight obstruction than single screen of the LED displays; • More expensive than single screen option; • Impact on the aesthetic of the saloon interior.

Table 3. Ceiling mounted screens comparison table

8.1.2 Wall Mounted

Another common practice is to mount the screens from the wall of the train, either at the car ends or in the draught screens of the vestibules. The figure below shows the possible location of the screens. Again, this shall be specified by the supplier.

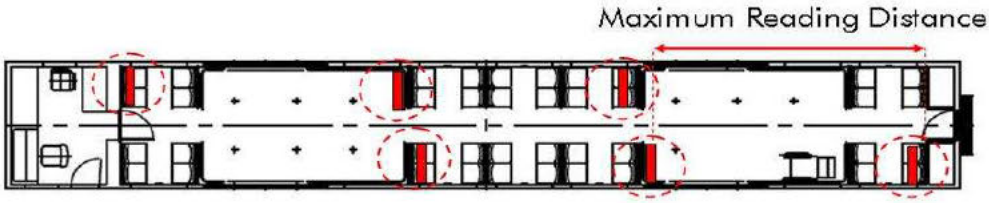


Figure 13. Proposed locations of screens on an EMU

It should be noted that the maximum distance identified for this option would be approximately 6,800mm (6,750mm for the case of a DMU), which would allow for a smaller character size, i.e. approximately 28mm.

	Single Screen	Double Screen
Illustration		
Advantages	• TSI compliant as existing LED displays would provide the statutory information; • Possible to display video advertisement; • Reduced safety hazard for passengers; • Reduced obstruction of the LED displays; • Reduced impact on the aesthetic of the saloon interior; • Lower cost than double screen option.	• TSI compliant as existing LED displays would provide the statutory information; • Possible to display video advertisement; • Reduced safety hazard for passengers; • Reduced obstruction of the LED displays; • Reduced impact on the aesthetic of the saloon interior; • Better quality of information provided.
Disadvantages	• Limited type of information that can be provided; • Alteration to existing advertising panels.	• More expensive than single screen option; • Alteration to existing advertising panels.

Table 4. Wall mounted screens comparison table

9 COST BENEFIT ANALYSIS

This section of the report presents a cost benefit analysis based on the arrangements described in section 9.1. The analysis takes into consideration that the investment for the infotainment system is made by IE, while Titan Outdoor manages the advertisements. However, an alternative business model is described in section 9.8.

9.1 BASELINE ASSUMPTIONS

- Inflation has been excluded from this analysis. This is for simplification but the omission may be justified as the price of LCD screens and display technology should continue to fall as it develops.
- This analysis does not make any provision for profit or funding, i.e. costs are original system supplier costs. Capital investment is assumed to be paid up front with no allowance for servicing debt or return on capital employed.
- Lifetime of the system is 20 years. This time period is equivalent to the expected lifetime of similar onboard PIS and communication systems.
- This analysis considers the cost of the 'infotainment' facility only and excludes the statutory PIS parts of the system. However, since the PIS is required, there will be some contribution to the cost, i.e. through train communications are assumed to be available.
- A cost of [redacted] per fleet for infotainment engineering design will be considered, this will be amortised over the lifetime of the system, i.e. [redacted] per year.

9.2 NUMBER OF TRAINS AND SCREENS

- The analysis will be done separately for the DART and Commuter units. Note: we have amortised programme costs, i.e. news/weather.
- Two fleet replacement scenarios will be considered, see Table 3 for the fleet breakdown:
  - A) 100% fleet replacement
  - B) 50% fleet replacement
- For the ceiling mounted options, a double-sided screen will be assumed.
- For the wall mounted options, a single sided screen will be assumed.
- 6 screens per car will be assumed (15" LCD TFT screens).

	DART				Commuter			
Class	8500	8510	8520	8200	2800	2600	2700	29000
No. of units	4	3	10	10	10	8	13	29
Cars per unit	4	4	4	2	2	2	2	4
Total (100%)	16	12	40	20	20	16	26	116
50%	8	6	20	10	10	8	13	58

Table 5. IE's rolling stock break down

9.3 ADVERTISING RATES

- An assumption of [redacted] static panel/2weeks will be considered, based from previous projects carried out by ITL. Refer to section 6.7 for background information on advertising rates.
- The screen will attract an x4 premium, i.e. [redacted] panel/2weeks.
- We do not have any information regarding the distribution of revenue income, supporting materials/labour between Titan Outdoor and Iarnrod Eireann. We will assume that IE benefits 50%, i.e. [redacted] /TFT-panel/2weeks.
- We will assume that the screen will show advertising for only 50% of the time, so a further 50% will be discounted, [redacted] /panel/2weeks.
- We will assume that for the preferred wall mounted versions, space for the existing advertising panels will be affected, i.e. the space lost will reduce existing revenue from current static advertisement to [redacted] /panel/2weeks. For the ceiling mounted options, no changes on the existing advertising will occur.
- Titan Outdoor divides their posting calendar into cycles consisting of 2 weeks each, thus 26 weeks for advertising per year will be considered. This will be added to the net cost for each option.

Note: the income value from the advertising rates should be used with caution, as Titan Outdoor did not provide any potential income from digital onboard advertising since they do not have any previous experience in the field.

9.4 ANALYSIS FOR CEILING MOUNTED OPTIONS

9.4.1 DART

Capital costs

The notional cost of a dual double-sided 15" TFT display will be in the order of [redacted] each; for a double-sided single screen a value, of [redacted] has been assumed. Additionally, a Media Server will be required – one per unit will be assumed. The cost per Media Server is around [redacted]

	Single Screen		Double Screen	
Fleet replacement	88 vehicles (100%)	44 vehicles (50%)	88 vehicles (100%)	44 vehicles (50%)
Screens per car	3		3	
Total number of TFT screens	528	264	528	264
Total Cost Screens	[redacted]	[redacted]	[redacted]	[redacted]
Number of Media Servers	27	14	27	14
Cost	[redacted]	[redacted]	[redacted]	[redacted]
Total cost	[redacted]	[redacted]	[redacted]	[redacted]

Table 6. Capitol costs for DART

Life Cycle costs

TFT displays use a cold cathode backlight and lifetime is typically quoted as 50,000 hours. Experience with current LED PIS displays suggests that they are capable of a 20 years life without needing overhaul. If we assume the TFT displays will be active for 20 hours per day, 364 days a year, this equates to a useful life of approximately 7 years. The backlights do not necessary all fail at this time, but the light output will be less than 50% of original, other problems may progressively degrade the visual impact of the displays. Whilst it is possible to replace backlights, experience suggests that replacement costs are high and the displays will be suffering a number of pixel failures at this time and significant failure at 14 years. The entire display panel should be replaced every seven years. The cost of screen replacement will be around [redacted] for a double-sided dual screen, and for a double-sided single screen the cost will be approximately [redacted].

Over the lifetime of the system (20 years), the displays will need to be replaced twice (at 7 years and 14 years). It should be noted that unlike LED displays there is no actual experience over this lifetime.

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Number of screen replacements	2		2	
Cost of replacement	[redacted]	[redacted]	[redacted]	[redacted]
Life cycle cost	[redacted]	[redacted]	[redacted]	[redacted]
Annual life cycle cost	[redacted]	[redacted]	[redacted]	[redacted]

Table 7. Life cycle costs for DART

Operating costs

This will include factors such as management of the Infotainment, additional maintenance, and video feed (i.e. news, sports, etc). The cost for management of the infotainment system and video feed, based from previous projects, would be around [redacted] the cost has been split 50/50 between the DART and Commuter units, i.e. [redacted]. Note: The cost of the video feed will depend on the news/entertainment provider, e.g. Skynews, and therefore there could be significantly variability in this cost.

	Cost	
Fleet replacement	100%	50%
Management of Infotainment system (per annum)	[redacted]	
Video feed (per annum)	[redacted]	
Additional maintenance (per annum)	[redacted]	[redacted]
Total annual costs	[redacted]	[redacted]

Table 8. Infotainment operating costs

Income

The following table summarises the potential income IE could achieve from onboard advertising.

	Both cases	
Fleet replacement	100%	50%
Number of screens	528	264
Advert rate	[redacted]	
Weeks	26	26
Annual income	[redacted]	[redacted]

Table 9. Advert income

<u>Income/Cost results</u>

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Income	[redacted]	[redacted]	[redacted]	[redacted]
Capital & Life Cycle costs	[redacted]	[redacted]	[redacted]	[redacted]
Opex costs	[redacted]	[redacted]	[redacted]	[redacted]
Nett cost (pa)	[redacted]	[redacted]	[redacted]	[redacted]

Table 10. Income/costs summary

9.4.2 Commuter Units

<u>Capital costs</u>

Refer to section 9.4.1 for background description.

	Single Screen		Double Screen	
Fleet replacement	178 vehicles (100%)	89 vehicles (50%)	178 vehicles (100%)	89 vehicles (50%)
Screens per car	3		3	
Number of TFT screens	1068	534	1068	534
Cost	[redacted]	[redacted]	[redacted]	[redacted]
Number of Media Servers	60	30	60	30
Cost	[redacted]	[redacted]	[redacted]	[redacted]
Total cost	[redacted]	[redacted]	[redacted]	[redacted]

Table 11. Capitol costs for Commuter units

Life Cycle costs

Refer to section 9.4.1 for background description.

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Number of screen replacements	2		2	
Cost of replacement	[redacted]	[redacted]	[redacted]	[redacted]
Life cycle cost	[redacted]	[redacted]	[redacted]	[redacted]
Annual life cycle cost	[redacted]	[redacted]	[redacted]	[redacted]

Table 12. Life cycle costs for Commuter units

Operating costs

Refer to section 9.4.1 for background description.

	Cost	
Fleet replacement	100%	50%
Management of Infotainment system (per annum)	[redacted]	
Video feed (per annum)	[redacted]	
Additional maintenance (per annum)	[redacted]	[redacted]
Total annual costs	[redacted]	[redacted]

Table 13. Infotainment operating costs

Income

	Both cases	
Fleet replacement	100%	50%
Number of screens	1068	534
Advert rate	[redacted]	
Weeks	26	
Annual income	[redacted]	[redacted]

Table 14. Advert income

Income/Costs results

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Income	[redacted]	[redacted]	[redacted]	[redacted]
Capital & Life Cycle costs	[redacted]	[redacted]	[redacted]	[redacted]
Opex costs	[redacted]	[redacted]	[redacted]	[redacted]
Nett cost (pa)	[redacted]	[redacted]	[redacted]	[redacted]

Table 15. Income/costs summary

9.5 ANALYSIS FOR WALL MOUNTED OPTIONS

9.5.1 DARTS

Capital costs

The notional cost of a dual single sided 15" TFT display will be in the order of [redacted] each; for a single screen a value of €1,850 has been assumed. Additionally, a Media Server will be required – one per unit will be assumed. The cost per Media Server is around [redacted]

	Single Screen		Double Screen	
Fleet replacement	88 vehicles (100%)	44 vehicles (50%)	88 vehicles (100%)	44 vehicles (50%)
Screens per car	6		6	
Total number of TFT screens	528	264	528	264
Total Cost Screens	[redacted]	[redacted]	[redacted]	[redacted]
Number of Media Servers	27	14	27	14
Cost	[redacted]	[redacted]	[redacted]	[redacted]
Total cost	[redacted]	[redacted]	[redacted]	[redacted]

Table 16. Capitol costs for DART

Life Cycle costs

The entire display panel should be replaced every seven years. The cost of screen replacement will be around [redacted] for a single sided dual screen, and for a single screen the cost will be approximately [redacted].

Over the lifetime of the system (20 years), the displays will need to be replaced twice (at 7 years and 14 years). It should be noted that unlike LED displays there is no actual experience over this lifetime.

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Number of screen replacements	2		2	
Cost of replacement	[redacted]	[redacted]	[redacted]	[redacted]
Life cycle cost	[redacted]	[redacted]	[redacted]	[redacted]
Annual life cycle cost	[redacted]	[redacted]	[redacted]	[redacted]

Table 17. Life cycle costs for DART

Operating costs

Refer to table 8, as the same life cycle costs apply for this option.

Income

	Both cases	
Fleet replacement	100%	50%
Number of screens	528	264
Advert rate	[redacted]	
Weeks	26	26
Annual income	[redacted]	[redacted]

Table 18. Advert income

Income/Cost results

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Income	[redacted]	[redacted]	[redacted]	[redacted]
Capital & Life Cycle costs	[redacted]	[redacted]	[redacted]	[redacted]
Opex costs	[redacted]	[redacted]	[redacted]	[redacted]
Nett cost (pa)	[redacted]	[redacted]	[redacted]	[redacted]

Table 19. Income/costs summary

9.5.2 Commuter Units

Capital costs

Refer to section 9.5.1 for background description.

	Single Screen		Double Screen	
Fleet replacement	178 vehicles (100%)	89 vehicles (50%)	178 vehicles (100%)	89 vehicles (50%)
Screens per car	6		6	
Number of TFT screens	1068	534	1068	534
Cost	[redacted]	[redacted]	[redacted]	[redacted]
Number of Media Servers	60	30	60	30
Cost	[redacted]	[redacted]	[redacted]	[redacted]
Total cost	[redacted]	[redacted]	[redacted]	[redacted]

Table 20. Capitol costs for Commuter units

Life Cycle costs

Refer to section 9.5.1 for background description.

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Number of screen replacements	2		2	
Cost of replacement	[redacted]	[redacted]	[redacted]	[redacted]
Life cycle cost	[redacted]	[redacted]	[redacted]	[redacted]
Annual life cycle cost	[redacted]	[redacted]	[redacted]	[redacted]

Table 21. Life cycle costs for Commuter units

Operating costs

Refer to table 13, as the same operating costs apply for this option.

Income

	Both cases	
Fleet replacement	100%	50%
Number of screens	1068	534
Advert rate	[redacted]	
Weeks	26	
Annual income	[redacted]	[redacted]

Table 22. Advert income

Income/Costs results

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Income	[redacted]	[redacted]	[redacted]	[redacted]
Capital & Life Cycle costs	[redacted]	[redacted]	[redacted]	[redacted]
Opex costs	[redacted]	[redacted]	[redacted]	[redacted]
Nett cost (pa)	[redacted]	[redacted]	[redacted]	[redacted]

Table 23. Income/costs summary

9.6 Intangible Benefits

The following points summarise just a few of the intangible benefits an Infotainment system could provide:

- Improved passenger experience – more enjoyable journey;
- Better informed passengers – more efficient journey;
- Improved image for Iarnrod Eireann;
- Improvement in tourism – better informed tourists;
- Improvements in safety – ability to disseminate safety information faster and in more detail.

It is very difficult to attribute a value against these benefits, but they will contribute to both 'customer satisfaction' and 'safety'. If we were to use a notional value for these benefits of €0.01 per passenger journey and assume an average of 29,300,000[1] passenger journeys per annum, this would translate into approximately [redacted] of additional income for IE.

9.7 Cost/Benefit Analysis Summary

The following tables summarise the results from section 9, but now considering the intangible benefits mentioned above.

[1] This value was obtained from Titan Outdoor and will be assumed for both DARTs and Commuter units

9.7.1 DART summary ceiling mounted results

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Nett cost	[redacted]	[redacted]	[redacted]	[redacted]
Intangible benefits	[redacted]		[redacted]	
Result	[redacted]	[redacted]	[redacted]	[redacted]

Table 24. DART ceiling mounted results

9.7.2 DART summary wall mounted results

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Nett cost	[redacted]	[redacted]	[redacted]	[redacted]
Intangible benefits	[redacted]		[redacted]	
Result	[redacted]	[redacted]	[redacted]	[redacted]

Table 25. DART wall mounted results

9.7.3 Commuter summary ceiling mounted results

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Nett cost	[redacted]	[redacted]	[redacted]	[redacted]
Intangible benefits	[redacted]		[redacted]	
Result	[redacted]	[redacted]	[redacted]	[redacted]

Table 26. Commuter ceiling mounted results

9.7.4 Commuter summary wall mounted results

	Single Screen		Double Screen	
Fleet replacement	100%	50%	100%	50%
Nett cost	[redacted]	[redacted]	[redacted]	[redacted]
Intangible benefits	[redacted]		[redacted]	
Result	[redacted]	[redacted]	[redacted]	[redacted]

Table 27. Commuter wall mounted results

9.8 ALTERNATIVE MODEL

We are aware that some infotainment systems, particularly in national railways, have been troubled by over optimistic revenue estimates. For instance, one TOC in the UK is understood to have been offered several million pounds over the period of a franchise for the privilege of having an advertising TV system on their trains. However, there is a history of suppliers going out of business because their advertising projections have been too optimistic. As a result, confidence in video advertising onboard trains has been significantly reduced.

Infotainment system suppliers are considering other ways to 'sell' the infotainment concept. For instance, an example is where the supplier shares the capital costs of system with the train operator. This still includes 'selling' the idea of video advertising, which is also shared between the supplier and operator, as the supplier will be in charge of managing the advertisement. However, it should be noted that in order to make this concept more attractive, the business case is 'sold' on other benefits, e.g. PIS integration, CCTV, real time PIS, data downloads, etc.

10 OTHER OPPORTUNITIES

10.1 PROXIMITY MARKETING

Advertising to consumers onboard the train using Bluetooth mobile phone technology could provide a future option that could be considered. This could transmit information to passengers' mobile phones within a 25 meter radius by using Bluetooth technology. Providing that passengers' mobile phones support this kind of technology, files such as text messages, animated image (GIF), static image, MP3, amongst others, could be sent.

Examples of how this technology could be used:

- Attract passengers to restaurants or cafes, near to a certain station, by sending a message offering a discount if they display the message when entering the restaurant.
- Electronic coupons
- Advertise new cultural/sporting events.
- Provide passenger with messages offering discounts for retail outlets or shopping malls.
- Provide weather information.
- Tourist information, i.e. venues, special offers, etc.
- Timetable changes.

11 CONCLUSIONS

Clearly onboard Passenger Infotainment Systems can provide a better variety of information than basic statutory Passenger Information Systems. The various forms of information range from statutory requirements through to more casual information such as news, weather, etc. Although infotainment systems give the perception of a more modern and stylish onboard environment, it has been found that they can also annoy some passengers, particularly if sound is used.

The Technical Specification for Interoperability relating to 'Persons with Reduced Mobility' (TSI-PRM) states the requirements for passenger information and for the systems providing it. These regulations greatly constrain the potential introduction and benefits of a common technology that displays both statutory and commercial information; hence, two separate distinct information systems are required. In terms of the display technologies available, currently Liquid Crystal TFT displays are the vogue for the video capable infotainment displays.

A cost benefit analysis was undertaken to determine if there is a business case for introducing video advertising onboard IE's fleets. Two basic arrangements for the DART and Commuter units were considered; it is important to highlight that in both cases, LED displays would have to be provided in order for the PIS system to comply with the TSI-PRM. The assessment determined that there is no business case on the basis of advertising revenue alone. However, advertising may be considered as a means of funding the infotainment technology if the benefit is taken from 'enhanced information provision', i.e. news, weather.

This study concluded that options are available and a number of examples are provided. However, infotainment is significantly constrained by the requirements set out in the TSI-PRM and not a strong business cases from advertising revenue alone; even more, advertising companies for the railway industry, i.e. static panel adverts, declared that the value for video advertising is limited. Infotainment systems, particularly in national railways, have been troubled by over optimistic revenue estimates, and there is a history of system suppliers going out of business because their advertising projections have been too optimistic. As a result, suppliers now offer other benefits besides advertising in order to make their product attractive, e.g. an integrated system managing various subsystems. Therefore, the fitment of onboard screens should be considered only as another form to present better route and service information, rather than for revenue advertising, since graphical information provides benefits in terms of how the information is presented, i.e. the use of colours, images and pictograms makes reading information easier and quicker. Additionally, benefits for IE in terms of projecting a better image, i.e. more modern, towards their customers is, also an important consideration for implementing this type of system.

12 RECOMMENDATIONS

12.1 TSI COMPLIANCE

IE should set up a demonstration of the different options and seek comment from the various disability authorities. A cautious approach to consultation is needed to ensure that the chosen solution is compliant, but at the same time practical and cost effective. Without pre-empting this process, the wall mounted or vestibule screen mounted version is preferred since the sight line to the LED PIS display is maintained. Independently, two separate systems are recommended, i.e. one system for the statutory information (LED matrix displays), and a separate system comprised of TFT screens for additional information. However, an option to consider for future consultation is if a separate video sequence of route information and advertising/entertainment would be compliant with the TSI-PRM.

12.2 ADVERTISING

IE should decide on their policy for advertising onboard trains using digital media. The analysis carried out illustrated that the revenue from advertising may be limited. Additionally, IE should enter into formal discussions with Titan Outdoor with the purpose of undertaking a market evaluation for the potential of digital media advertising on trains. However, it is recommended that no audible advertisement is provided since some passengers find this intrusive.

12.3 DELIVERY TECHNOLOGY

At the moment, LCD TFT screens provide the best option for Infotainment systems. The choice of the screen would depend on available space in the trains, cost, and the type of information provided. Further investigations on the space envelopes for the Infotainment system should be made. Additionally, a study to identify whether any additional measures could be taken to optimise the screens' reliability should be undertaken.

12.4 SYSTEM TRIAL

Should IE have further interest in implementing this system in their fleets, it is recommended that a trial of the system should be carried out in one unit. Subsequently, a survey should be undertaken in order to ascertain the customer's opinion relating to this system.

12.5 FEASIBILITY STUDY FOR REPLACEMENT PASSENGER INFORMATION SYSTEMS

Review report 'Feasibility Study for Replacement Passenger Information Systems' for aspects that are relevant for the implementation of an Infotainment system, e.g. Integrated Information Management.

Interfleet Technology

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Our Ref : T26657
Sub. Ref : 20100909-LET-IARE.doc
Your Ref :

F.A.O: [redacted]

9 September 2010

Dear [redacted]

REVIEW OF VEMISA PROPOSED DESIGN CHANGES ON PIS

This letter includes a summary of our technical review of information provided by VEMISA (Madrid, Spain) with respect to suitability of their design / modification proposals. This letter may be used to substantiate formal evaluation and approval of design changes but does not independently constitute approval or endorsement of their system.

In the period 17th August through to 2nd September we received a series of e-mails from VEMISA covering their design proposals for PIS upgrades on fleets 8200, 8500 and 8510. Initially, the information was incomplete, lacked detail and in the case of the proposed computer didn't reflect current status. However, after exchange of several e-mails we have now reached the point where it is possible to provide this summary report.

Firstly, we must clarify we have undertaken a 'documentation review' and have not undertaken a scrutiny of the actual equipment or installation, so we assume the information that has been provided is both accurate and will be deployed in the manner proposed.

Secondly, we also need to give context to standards used for this review. We have assumed that EN50155:1996 would have been the standard originally used by the train builder and that any new or modified system should tolerate electrical supplies to the same standard. Further, given that this version of the standard made provision for harsher transient source resistance, i.e. 5R instead of 100R, then the worst case should apply. This assumption is based upon known supply problems experienced by the present system, evidenced by the installed supply filters to displays – that will be retained – and poor reliability of existing DC-DC converters. In respect of EMC standards, the current EMC standard EN50121-3-2:2006 should apply where possible but it is acknowledged that parts of the existing system may not have been tested to this standard (earlier versions limited EMC emission and susceptibility testing to 1GHz).

1. Replacement Power Supply

The power supply circuit design has been reviewed for suitability in this application and following clarification that the circuit power supply is type SD100D with component parts ZD1 = TVR14241-D(KSW) and Q1 = IRFP450 we are satisfied with suitability for EN50155:1996 (100R

source). However, we recommended more robust transient protection suitable for 5R waveform D. Subsequently, it was confirmed that this power supply is used in conjunction with the supply filter units which will provide this additional protection.

The supply operating range has been confirmed to be 72V to 144V DC. The isolation has been confirmed to be 1500V DC which is >1000V rms equivalent as required by EN50155. VEMISA were reminded and advised of the method to be used for 100% factory testing isolation.

The electrical design of the power supply includes components normally associated with good EMC practise. We have not seen an EMC report for this item but understand that it is a commercial design used extensively. We recommend that VEMISA include an existing test report in their design submission and, on the assumption that a generic EMC standard was used, should draw attention to comparing emissions limits with EN50121-3-2 [Note: generic standards generally have tighter limits than the railway standard]. In respect of susceptibility, a generic standard will not have tested to the same level, so there is a small risk of perturbation from train borne EMC. However, the main risk of surge and transient is adequately covered by the components evaluated.

2. Replacement Computer AEC6910

This unit is a fanless embedded controller that will be fitted with a PCI I/O card. An external DC supply will be used to power this controller, i.e. not powered directly from vehicle supply.

A type test document 'AEC-6910 EN50155 Type Test' was supplied. Whilst EN50155 is referenced, the testing relates to surge and transient aspects only, although other EMC tests have been undertaken according to EN50121-3-2 and the cross referenced EN61000-4-n series tests are also included. This report provides reasonable confidence, but we have two observations:

a) The tests were conducted to the original (unofficial) version of EN50121-3-2 and although page 10, point 6 makes reference to 2300MHz, the table only provides evidence of testing to 1000MHz. N.B. Prior to 1996, EN50121-3-2 had not been adopted as the railway standard as it was considered deficient, it was used in conjunction with supplementary testing above 1GHz.
b) Fast Transient Burst testing to EN61000-4-4 was not representative of this application where the PCI card will be fitted together with several I/O interfaces at train supply potential all without transient suppression or filtering.

In the case of observation a), the risk relates mainly to susceptibility of the PIS equipment and this risk could be mitigated by operating mobile phones in the 1800MHz band close to the unit during acceptance testing. In the case of observation b), VEMISA provided photographs showing that the PCI card would be screened from the sensitive components of the controller unit, the risk mainly relates to disruption of PIS rather than train. Should this become an issue in testing or in service, then snap on ferrites could be fitted to cables to remedy.

On the basis described, the computer (embedded controller) appears to be adequate for this application. We have not evaluated mechanical fixing arrangements / mass and fire / materials which should be independently assessed.

3. PCI I/O Card (P8R8) and Interfaces to Vehicles

We understand that this card is used in the present PIS system and that the interfaces and wiring arrangement will be the same. Also, we understand from [redacted] that our concern about

isolation of the TELOC interface has been closed since galvanic isolation is provided within the TELOC unit itself. On this basis, the observations and comments that follow below are considered low risk, but we strongly recommend these comments should be addressed for any further introduction of this PIS system:

The PCB layout and components fitted to the PCI-P8R8 card was analysed, the I/O interfaces are a mixture of inputs from the train at 110V and other 12V/24V I/Os of the PIS system, and the TELOC interface. Our concerns relate to EN50124-1 creepage and clearance distances on the PCB and interface connector (D connector). Whilst PCI-P8R8 claims to provide adequate isolation between all interfaces and the computer, it is the interaction between the different interfaces that is a concern. Particularly, in respect of train supply related interfaces which are unsuppressed and unfiltered. Under these circumstances the 8400V transient (waveform G) must be considered.

When considering creepage and clearance it is normal practise to respect the same clearances between individual circuits of the I/O. The solution normally involves fitting transient suppression on each I/O to reference 0V (typically a 350V Varistor or Transil on 110V interfaces) and then designing PCBs to provide creepage and clearance between circuits on this basis and isolation at 1000V between other supplies and ground, for PD1 classification 3.2mm is then acceptable. We observed clearance of only 1.5mm in some locations and there is no suppression, under these circumstances a significantly larger clearance would be needed. We therefore conclude a high risk of arcing across tracks should transients appear on the 110V interfaces. As a consequence, there may be longer term breakdown of the PCB materials to eventually become conductive. Further, arcing will generate localised EMC radiation which could affect the computer and PIS system reliability. The fact that the current arrangement on these vehicles has not manifested problems is either down to good luck that there are no transients present at this point or perhaps the interfaces are filtered / protected elsewhere.

Interfleet recommends that the resistor modification (for 110V operation) should be external to the PCI-P8R8, together with transient suppression and/or a capacitor. Given that an external 10KR series resistor is needed to increase the working voltage, particularly if a wire-wound / inductive type is used, then a capacitor of suitable type would be adequate to provide transient and RF filter protection.

In conclusion, items 1 and 2 have been satisfactorily closed out. For item 3 we have made recommendations for the future but given that the arrangement is identical to existing and the small number of vehicles involved the risk and impact of problems would appear to be low.

We trust this letter satisfactorily concludes our review of the VEMISA PIS proposals, should you require further support or clarification on the points raised then please do not hesitate in contacting me.

Yours sincerely

[redacted]

Principal Consultant

On-Board Passenger Information System (PIS) Replacement

1. DECISION SOUGHT

The approval of the Board is sought to advertise a tender for replacement on board Passenger Information Systems (PIS). This tender will include options for a system trial, inclusion of infotainment and various fleet installation scenarios. When market pricing is identified from a preferred bidder a submission will be made to the board to allocate funding from rolling stock capital projects and award of contract.

2. BACKGROUND

2.1 Project Sponsor

The Project Sponsor for the project is the Chief Mechanical Engineer (CME) who is responsible for the business case.

2.2 Executing Department

The executing department is the CME which has responsibility for delivering the project to the specified scope, on time and within budget.

2.3 Project Objectives

The project objective is the identification and selection of a preferred replacement PIS system for selected Iarnród Eireann fleets. The chosen system will undergo in service trials to confirm suitability and then the system will be rolled out across fleets on a prioritised basis. Infotainment systems from the same provider will be trialled at the same time.

2.4 Business requirement

Iarnród Éireann operates a diverse Intercity, EMU and DMU fleet of rolling stock procured within the past 20 years. Virtually all of our trains are fitted with some form of on board Passenger Information System ranging from simple internal displays to scrolling internal and external displays (front and side) with automated multi lingual voice-over announcements. These systems are by their very nature highly complex and utilise the hardware and software technologies that were available at the time of the build. One legacy of the “small batch” rolling stock procurement strategy over recent years is that we now have a multitude of different systems, different technologies and different suppliers. These systems are not cross compatible, are obsolete and difficult to maintain and lack manufacturer support. In addition, one of the biggest sources of passenger complaints relates to the lack of on-board information or the lack of operation of these systems. There is a clear requirement to replace a minimum of 7 very different types and poorly operating systems with a single type, modern and reliable system that has the guaranteed support of its OEM.

2.5 Transport 21

The project is not included in Transport 21 as a separate project, but proposed funding for this project will be drawn from existing Transport 21 projects.

2.6 History to Date

In 2008 the Board approved the expenditure of [redacted] for project CIR00488 to undertake a detailed feasibility study for the replacement of obsolete and unreliable PIS systems across the Iarnród Éireann fleets. This study concluded in 2009 with a detailed Technical Specification completed and a full assessment done on the existing systems. The next stage is to move forwards with a tender process to determine market pricing and choose a preferred supplier.

3. CURRENT POSITION

The reliability and performance of the current PIS systems are poor due to five main causes:

1) Poor design, poor reliability, poor diagnostics – system and software failures, unpredictable operation, system "freeze" incidents, lack of diagnostic tools.
2) Obsolescent and aged technology – obsolete hardware, expensive material & repair costs, very long lead times.
3) Poor product support – suppliers have disappeared, technical advice unavailable, no ability to adjust or upgrade (e.g. Irish language character sets).
4) Lack of compatibility – incompatible between systems, multiple systems requires multiple spares.
5) Very poor configuration tools – database management tools to change the PPIS not well developed, remote centralised downloads poor or non-existent.

The current disposition of systems across the fleets is:

Train Model	Train Manufacturer	Quantity	PIS / PA system
Mark IV	CAF	67 vehicles (8x8 & 3)	IKUSI
22000 Railcars	Hyundai-Rotem	183 vehicles (31x3, 15x6)	S.A.Viewcom
8100 EMU	Siemens (Refurb)	76 vehicles (38 x2)	Televic
8200 EMU	GEC Alstom	10 vehicles (5x2)	MP Electronics
8500 EMU	TCC Mitsui	16 vehicles (4x4)	MP Electronics
8510 EMU	TCC Mitsui	12 vehicles (3x4)	MP Electronics
8520 EMU	TCC Mitsui	40 vehicles (10x4)	IKUSI
2600 DMU	TCC Mitsui	16 vehicles (8x2)	No interior, External Koito
2700 DMU	GEC Alstom	26 vehicles (12x2,2x1)	No interior, External Sepsa
2800 DMU	TCC Mitsui	20 vehicles (10x2)	Sanyo / Koito
29000 DMU	CAF	116 vehicles (29x4)	IKUSI
De Dietrich	Managed by NIR (all maintenance and PIS systems)		

It is quite reasonable to suggest that PIS (including PA) systems are in principle an essential requirement for passengers that are visually and hearing impaired. In addition, a working PA is a safety critical system in an emergency situation. Despite all efforts to provide functional equipment, it has not been possible to provide reliable performance consistently. A few examples clarify the position.

3.1 The recent survey of DART PIS systems showed that 99% of systems on the refurbished 8100 fleet (supplier Televic) were consistently reliable. However, on the other unit classes only 61% were working consistently, mainly due to unavailability and obsolescence of hardware.

3.2 During 2008 and 2009 the imposition of very onerous contractual remedies on Mitsui ensured that Rotem and their supplier, Axion, did the necessary redesign and hardware modification work to the installed integrated PIS, CCTV and PA systems that ensured the correct commissioning and operation. As an example, the integrated PIS, CCTV and PA system was procured from SA Viewcom originally – but by 2008 SA Viewcom had imploded and Axion had procured some of the products and obligations of the original company.

3.3 Within 3 years of CAF delivering the Class 29000 fleets, the master controller of the Ikuzi PIS/CCTV system on these fleets was claimed as "obsolete" by the supplier, Ikuzi. Ikuzi attempted to charge Iarnród Éireann [redacted] per repair of a single pcb card (of which the manufacturing costs are about [redacted]

4. INFOTAINMENT

The last four to five years have seen a number of infotainment solutions appear in the market place. The real benefit of infotainment is that it provides revenue opportunities while it also, to varying degrees, allow for PIS-Infotainment integration and a reduction in costs because it shares parts of a typical PIS system (e.g. communications interface can download PIS routes as well as infotainment content). It is proposed that this project will attempt to achieve a technical solution that delivers both PIS and infotainment with due consideration to the objectives of reliability, cost and flexibility.

5. PROJECT CONCEPT

The project concept includes three distinct phases, each with a separate technical and cost impacts, and a maintenance phase. The cost for each phase will be identified in the proposed tender:

1) Procurement – This is scoped as identification of a preferred system and supplier and as a consequence the procurement of PIS and PA systems, segregated or integrated, with the appropriate interfaces to the train management system and communication

equipment. As discussed above, we will invite tenderers to include infotainment proposals. There are no costs associated for this element of the project.

2) Trial – The preferred supplier will install the chosen system that best meets the detailed technical specification on a number of DART trains. It is suggested that the 8510 fleet of 3 x 4 vehicle units would be installed. A minimum 6 month trial would be undertaken with supplier support to prove the system. The cost for the trial will be fixed within the tender price as an option.

3) Installation of system – The physical installation, testing and commissioning of the systems, from re-cabling (if appropriate) through to installing control cubicles. In addition, the appropriate support software for the management of the route database and the remote downloading route plans are to be supplied. The exact implementation plan (by class) on up to 323 vehicles would be determined by the CME team however a programme of works and detailed costs for this will form part of the tender submission.

4) Maintenance of the system – This phase is excluded from this project but will be an integral part of the procurement process. The successful supplier will be expected to provide two years of warranty support and a maintenance contract for 5 years. The maintenance contract will have a performance regime (as the CME department have implemented with engines, power rafts, etc) that will have very specific availability and reliability targets, each with appropriate commercial remedies. The cost of this phase is envisaged as an Opex cost per annum.

5)

6. SPECIFICATION AND ITT

The CME department has completed the detailed technical specification and have pre-qualification a number of suppliers (e.g. Halcrow/Televic, MRSE/Televic, DataDisplay/Interalia, GSP, etc.) according to the criteria agreed with the Board in 2009. The next stage is to invite tenders to select a replacement system. An invitation to tender will be launched for a turn-key project to provide a generic replacement PIS system type across the following fleets:

Train Model	Train Manufacturer	Quantity
8500 EMU	TCC Mitsui	16 vehicles (4x4)
8510 EMU	TCC Mitsui	12 vehicles (3x4)
8520 EMU	TCC Mitsui	40 vehicles (10x4)
8200 EMU	GEC Alstom	10 vehicles (5x2)
2600 DMU	TCC Mitsui	16 vehicles (8x2)
2700 DMU	GEC Alstom	26 vehicles (12x2,2x1)
2800 DMU	TCC Mitsui	20 vehicles (10x2)
29000 DMU	CAF	116 vehicles (29x4)
MkIV Carriages	CAF	67 vehicles
	Total	323 vehicles

There will be a considerable amount of design work, both mechanically and electrically, required to interface the generic system with each vehicle type. Note that the refurbished DART is fitted with a new system from Televic, a Belgian supplier that is well regarded in the market. This system meets our performance criteria and it is performing very well. It is also not proposed to include the jointly owned Enterprise service or the Intercity Railcar Fleet in the fleet replacement programme, as the replacement of this fleet's PIS is more appropriately done at the mid-life overhaul.

The tender will require detailed proposals and costing split across the various options:

- System selection and trial on DART 8510 class
- System installation against plan across nominated fleets
- System to include Infotainment in the trial and fleet installations

7. FUNDING

No funding is required for this stage of the project. Upon selection of preferred bidder a proposal will be made to the board to proceed with the contract for the trial and fleet installation.

The proposal will seek the use of unallocated funds from rolling stock capital projects from the existing Transport 21 vehicle procurement contracts for this project. These funds primarily represent unspent contingency funds or retention monies that will not be released to a total of [redacted] All of these new build fleets are considerably out of warranty and the unspent funds have no earmarked use. In addition, retention funds (CAF Class 29000 and CAF MkIV) has a very well documented commercial case and using it for the rectification of these systems is in line with the contractual retention conditions.

The details per existing project are as follows:

Project code	Train Model	Train Manufacturer	Quantity	Proposed funding re-allocation
PAS3991	**8510 EMU**	TCC Mitsui	12 vehicles (3x4)	[redacted]
PAS4283	**8520 EMU**	TCC Mitsui	16 vehicles (4x4)	[redacted]
PAS4336	**8520 EMU**	TCC Mitsui	24 vehicles (6x4)	[redacted]
PAS4019	**29000 DMU**	CAF	80 vehicles (20x4)	[redacted]
PAS4541	**29000 DMU**	CAF	36 vehicles(9x4)	[redacted]
PAS4350	**MkIV**	CAF	67 vehicles	[redacted]
			Total	[redacted]

8. ESTIMATED COST

Until the conclusion of the tender process the final cost is uncertain, but it is likely that the cost of a complete replacement PIS system (excluding infotainment) will be in the region of [redacted] per vehicle giving a projected total cost of [redacted] euro for all 323 vehicles. In the event that additional funds are required, more of the retention monies on the Class 29000 and MkIV fleets can be considered.

9. TIMESCALES

The timescale to conclude this tender process is approximately 4 months by which stage the Board will be presented with an award proposal and implementation plan. Given the lead-times for design work and a staged fleet introduction, it is expected that initial vehicle installation would commence in 2011 with fleet completion within 18 - 24months.

10. SUMMARY

In summary, the Board is asked to authorise the initiation of the PIS procurement process and issue tender documents for the replacement PIS system to include a detailed system trial on a DART fleet and options for fleet installation and the inclusion of Infotainment. There is no request for funds at this stage of the project.

Chief Mechanical Engineer

Inchicore

8200
8500
8510
Series report

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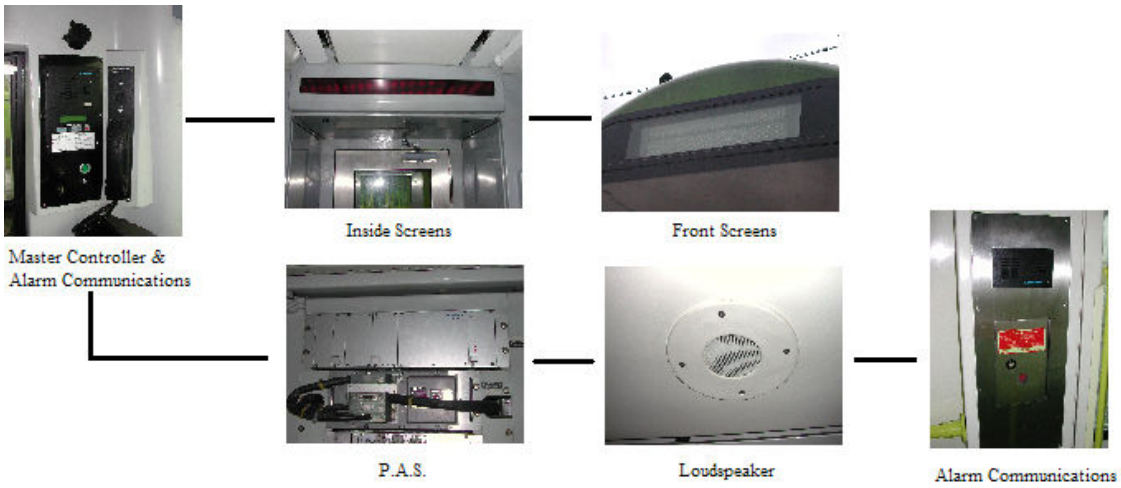
- *8200, 8500 AND 8510 SERIES REPORT-*

This report is made alter VEMISA's visit in Fairview Depot in 29th and 30th, June, and 01st and 2nd, July. The aim is to inform about the real status of the units with Eurunion and M&P P.A. Systems.

8200 SERIES BLOCK DIAGRAM



The 8200 series trains are two carriages units with the following equipment:

- Two master controller units: one per each cabin.
- Two driver alarm communicators: one per each cabin.
- Four inside one line red led screens: two per each carriage.
- Two outside two lines white led screens: one per each carriage.
- Four passenger alarm communicators: two per each carriage.
- Two P.A.S. master controllers: one per each cabin.
- Eighteen loudspeakers: nine per each carriage.

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1.- *8202-8402 UNIT.*

This unit has now its P.A.S. in service. The main problem in this unit was the wiring: it was wrong in the data filter cards in each main controller (x2) and in each screen (x6). Due to this wrong wiring, some fuses were blown and needed replacement. Also the main controller unit in 8202 had a problem in the audio output to passengers, and was switched by the 8204 one.

VEMISA's actions:

- Wire correctly data connections in screens and master controller.
- Wire correctly power connections in one inside screen.
- Test the screens.
- Adjust general audio inside carriages.
- Test the general audio.
- Test the two master controllers: data base, driver's audio, general audio, open-close doors signals, emergency signals.
- Test the alarm communications.
- Test the whole system at the same time.

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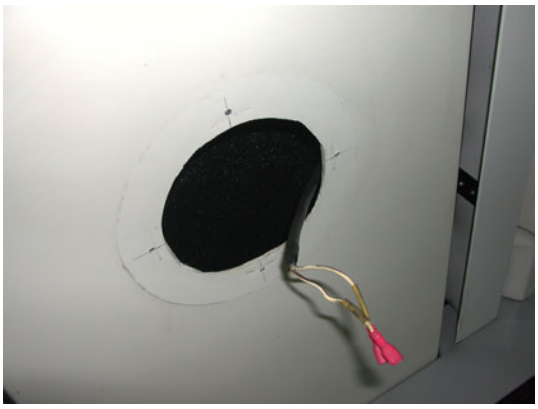
2.- *8405-8205-8401-8021-8404-8204 UNITS.*

These units could not be tested because some parts of the P.A.S. equipment were missing, or in very bad condition, or the unit could not be powered from the overhead wires.

The result of the visual visit is:

- 8405: A passenger alarm communicator is missing (picture below).

- 8205: Master controller unit and one loudspeaker missing (pictures below).



- 8401: Master controller needs repairing and an inside screen is missing.
- 8021: Master controller needs repairing.
- 8404: Master controller and one inside screen are missing.
- 8204: Master controller needs repairing (just general audio is broken).

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8500 SERIES BLOCK DIAGRAM

The 8500 series trains are four carriages units with the following equipment:

- Two master controller units: one per each cabin.
- Two driver alarm communicators: one per each cabin.
- Eight inside one line red led screens: two per each carriage.
- Two outside rolling screens: one per each carriage.
- Eight passenger alarm communicators: two per each carriage.
- Two P.A.S. master controllers: one per each cabin.
- Two P.A.S. boosters: one per each non-cabin carriage.
- Twenty-eight loudspeakers: seven per each carriage.

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3.- *8606-8506-8505-8605 UNIT.*

This unit could not be tested because it could not be powered. The result of the visual visit is that no P.A.S. equipment is missing.

4.- *8602-8502-8501-8601 UNIT.*

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This unit has now its P.A.S. in service. The main problem in this unit was the general audio. It was solved by adjusting the auto-volume cards.

VEMISA's actions:

- Test the screens.
- Adjust general audio inside carriages and repair 8501 booster.
- Test the general audio.
- Test the two master controllers: data base, driver's audio, general audio, open-close doors signals, emergency signals.
- Test the alarm communications.
- Test the whole system at the same time.

5.- *8607-8507-8508-8608 UNIT.*

This unit could only be tested from one cabin because we did not have the key to open the other cabin. **The result of the test is that the inside screens and the 8607 front screen are not working, but the rest of the system is working correctly (from 8607 cabin).**

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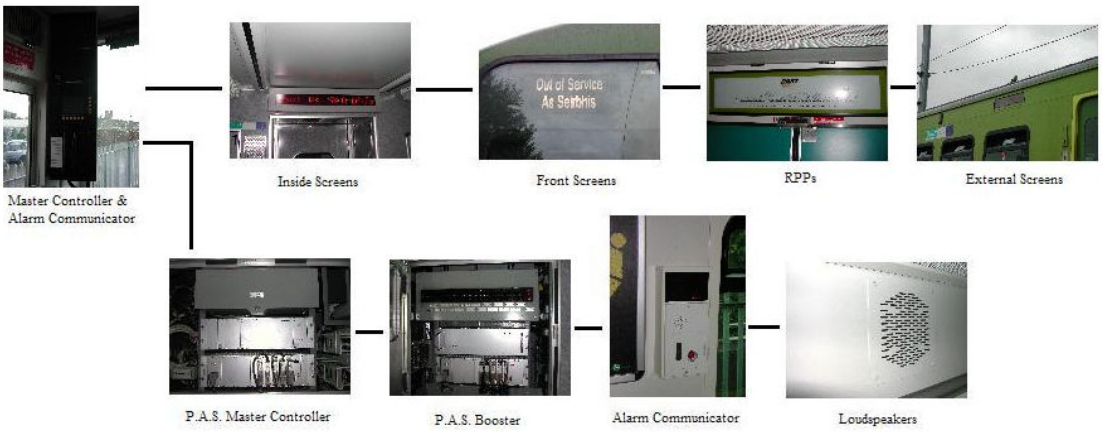
VEMISA's actions:

- Test the screens: inside screens and 8607 front screen are not working. Could be a wiring problem.
- Adjust general audio inside carriages.
- Test the general audio.
- Test the 8607 master controller: data base, driver's audio, general audio, open-close doors signals, emergency signals.
- Test the alarm communications: 8507, 8508 and 8608 are noisy. Could need repairing.
- Test the whole system at the same time from the 8607 cabin.

8510 SERIES BLOCK DIAGRAM



The 8510 series trains are four carriages units with the following equipment:

- Two master controller units: one per each cabin.
- Two driver alarm communicators: one per each cabin.
- Eight inside one line red led screens: two per each carriage.
- Eight outside two line orange led screens: two per each carriage.
- Sixteen RPPs: four per each carriage.
- Two outside rolling screens: one per each carriage.
- Eight passenger alarm communicators: two per each carriage.
- Two P.A.S. master controllers: one per each cabin.
- Two P.A.S. boosters: one per each non-cabin carriage.
- Twenty-eight loudspeakers: seven per each carriage.

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6.- *8612-8512-8511-8611 UNIT.*

The original idea was to test one 8510 series unit running in the line due to the "software freezing problems" in order to detect them, but weather condition made it impossible (tracks flooded and train detection systems not working).

The visit to this unit in the depot indicates that the **8612 master controller (PC and driver's screen) and the 8611 frontal screen are not working but the rest of the system is working properly.**

VEMISA's actions from the 8611 cabin:

- Test the screens: the 8611 frontal screen and outside screens are not working. Could be a wiring problem.
- Adjust general audio inside carriages.
- Test the general audio.
- Test the 8611 master controller: data base, driver's audio, general audio, open-close doors signals, emergency signals. GPS is not working.
- The 8612 PC needs repairing and driver's screen needs substitution (picture below).

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- Test the alarm communications.
- Test the whole system at the same time.

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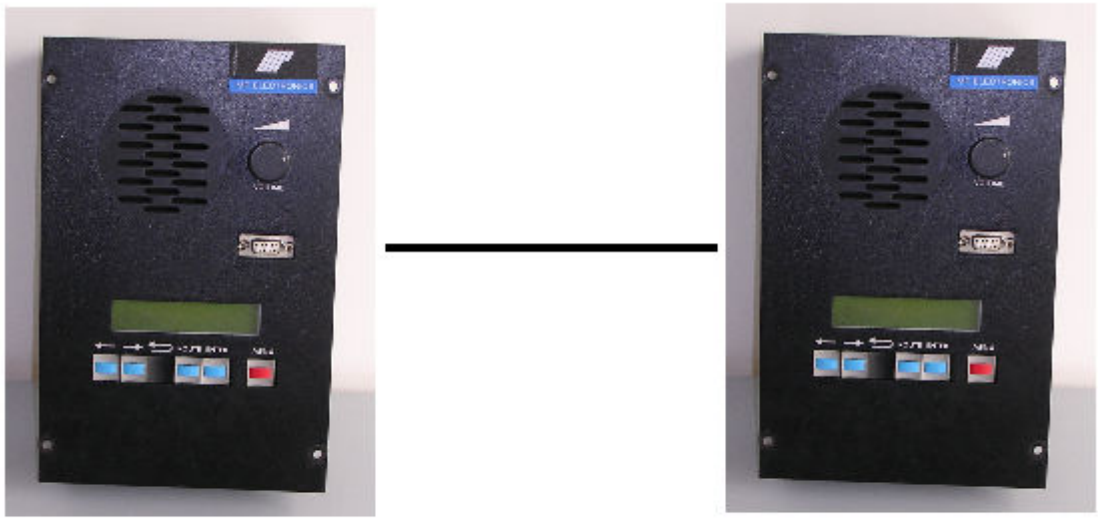
PROPOSALS

1.- Repair the systems as they are right now.

2.- Repair the systems as they are right now, and substitute the master programmer (route editor) by a standard laptop (and an adapter to connect with the master controllers inside the units) and develop a software to edit routes in Windows.



Today's situation

Proposed situation

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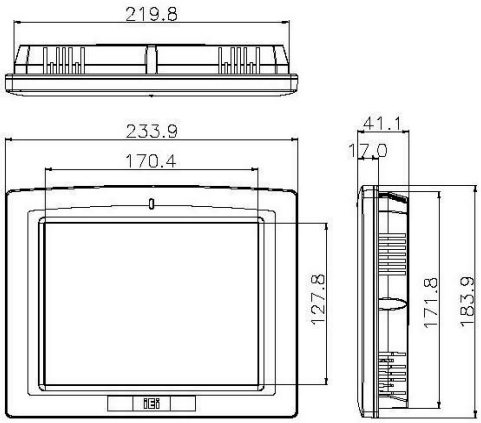
This way it will be easier to modify the existing routes. To modify text or audio data bases would still be necessary to change the flash memories where these data bases are stored (as nowadays). The normal operation by the driver would be the same as today.

3.- Repair the whole system on board the units, but replacing the master controller by a touch panel pc (or similar, adapting to the necessity of the units –door signals, tachometer, gps).



This way, wiring inside the train, screens, alarm communications systems and P.A. do not need to be replaced (repaired, if necessary).

Route edition and normal use would be easier and faster than now. New text and audio data base could be installed easily by the user.

8200
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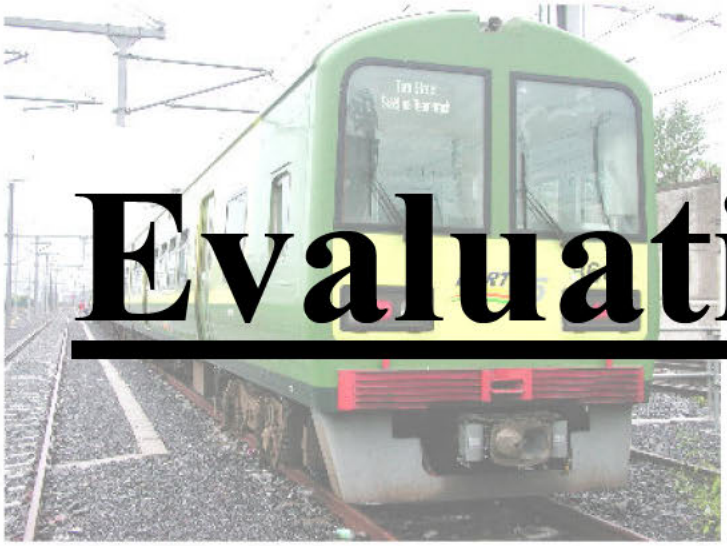
Series



Evaluation

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V.E.M.I.S.A.

V.E.M.I.S.A.

1.- AIM OF THIS DOCUMENT.

The aim of this document is to report the state of the Passenger Information Systems on board 8200, 8500 and 8510 series.

The master controllers of the trains have not been tested due to the objective of this project is to substitute them and maintain the rest of the system.

2.- REPORT OF DAMAGED ITEMS PER CARRIAGE.

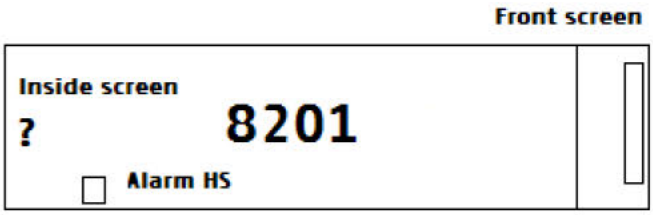
Now we will report items and carriages:

- ***8405***: Alarm handset near the cabin needs repairing and power supply for the inside screen near 8205 needs substitution. Now coupled to 8203 (June, 2010).

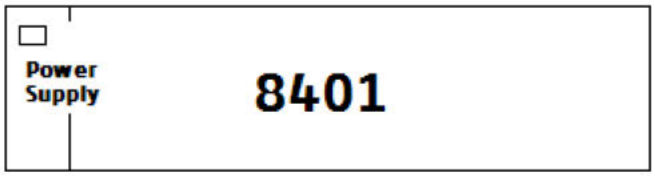
- ***8205***: power supply for inside screen near the cabin needs substitution. Now coupled to 8403. Unknown state (June, 2010).

V.E.M.I.S.A.

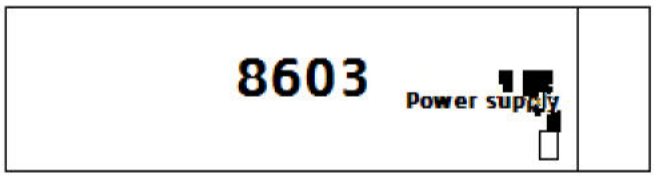
- ***8201***: Alarm handset near 8401 needs repairing; frontal outside screen in the cabin needs repairing; inside screen next to the 8401 cannot be tested: no 110Vcc.



- ***8401***: marker light signal always active (check after uncoupling unit); power supply for the inside screen near the cabin needs substitution.



- ***8603***: power supply for the inside screen near the cabin needs substitution.



- ***8503***: inside screen near 8603 needs repairing; power supply for the inside screen near 8504 needs substitution; inside screen near 8504 needs repairing.

V.E.M.I.S.A.

- ***8504***: inside screen near 8503 needs repairing.

- ***8604***: inside screen near the cabin needs repairing, and power supply for this screen needs substitution.

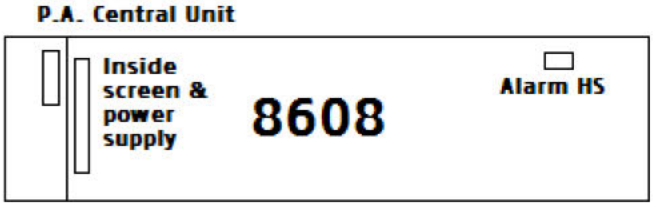
- ***8607***: PA malfunction (amplifier); inside screen near 8507 needs repairing.

- ***8507***: inside screen near 8508 needs repairing, and power supply for this one needs substitution.

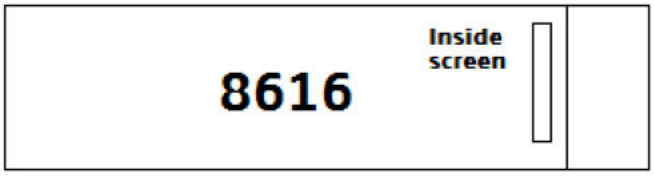
V.E.M.I.S.A.

- ***8508***: inside screen near 8608 needs repairing and power supply needs substitution.

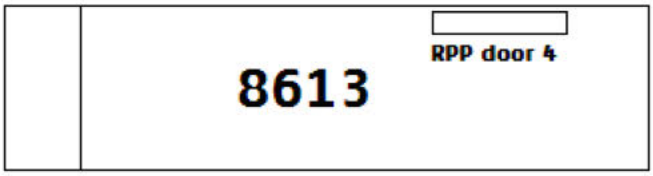
- ***8608***: inside screen near the cabin needs repairing and power supply needs substitution; alarm handset near 8508 needs repairing; PA malfunction (amplifier).



- ***8616***: inside screen near the cabin needs repairing.

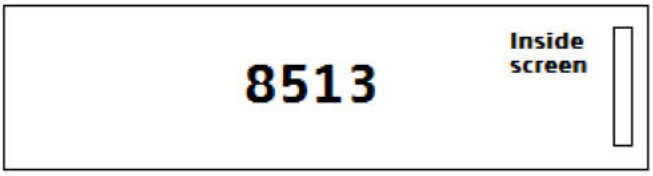


- ***8613***: RPP above door number 4 needs repairing.



V.E.M.I.S.A.

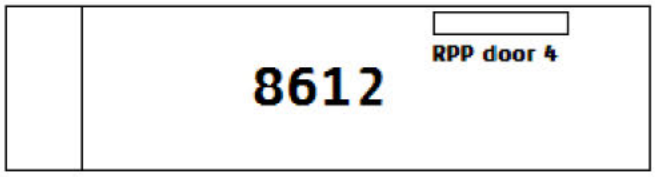
- ***8513***: inside screen near 8514 needs repairing.



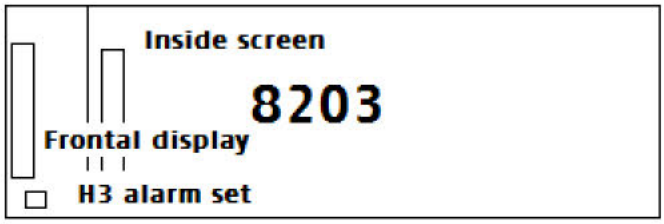
- ***8204***: NOT POWERED (missing batteries): 2 inside screens missing, 1 loudspeaker missing. Rest of equipment not tested.

- ***8404***: NOT POWERED (missing batteries): 1 alarm handset missing, 1 inside screen and 1 power supply missing. Rest of equipment not tested.

- ***8612***: RPP above door number 4 needs repairing.



- ***8203:*** inside screen near the cabin, front destination display and driver's alarm set need repairing. Now coupled to 8405 (June, 2010)



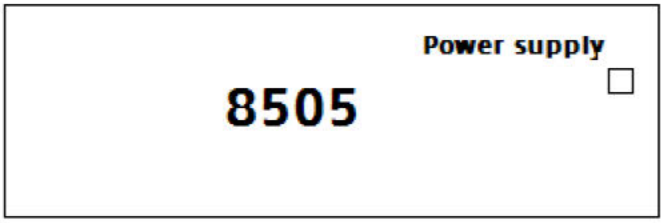
- ***8403***: at Inchicore, not tested.

V.E.M.I.S.A.

- ***8606:*** two faulty power supplies.

- ***8506:*** power supply next to 8606 broken.

- ***8505:*** power supply next to 8605 broken.



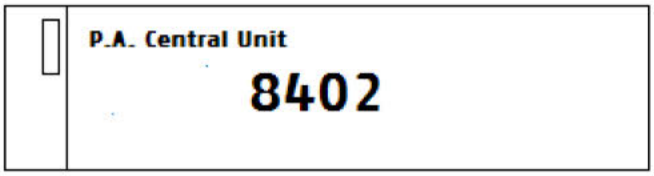
- ***8605:*** two faulty power supplies.

- ***8502-8501:*** noisy alarm handsets. It is not an equipment problem. Review train wiring.

V.E.M.I.S.A.

- ***8202***: power supply near 8402 needs substitution.

- ***8402***: 15Vcc relay always active. Central unit needs repairing.



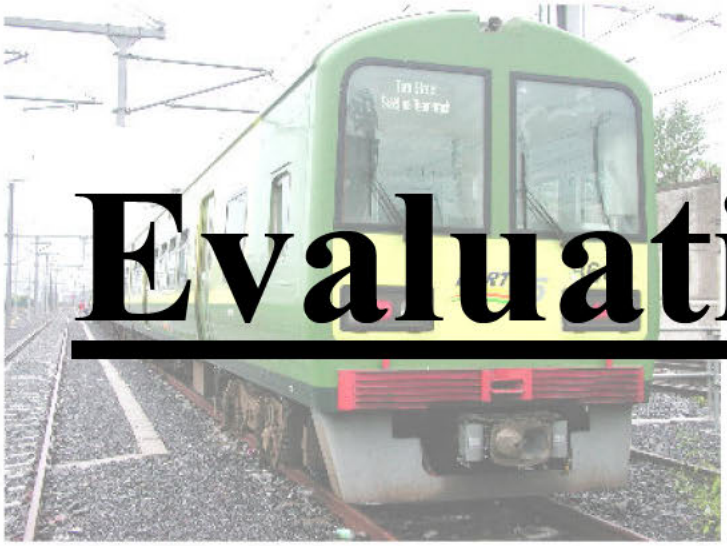
- ***Notes:***

In all units a filter cables for data wires for screens (outside and inside) are installed. We noticed that in the 8200 and 8500 series these filters (fuses) were exploded. Due to the absence of damaged filters in the 8510 series, we decided to remove all damaged filter cables (instead of substituting the fuses) because the problem must be in the 8200 and 8500 series controller (it is the same model for the two fleets). The RS485 port must be damaged.

Due to the substitution of all master controllers, these filter cables are no longer needed. Ports in new computer are opto-isolated and 3000V (peak) isolated.

Carriages not appearing in this report have no damage in any part of the PIS.

8200
8500
8510
Series



Evaluation

V.E.M.I.S.A.
C/Fernández Caro, 44, 28027, Madrid
Tel.: 914077497 – Fax: 914074849
http://www.vemisa.net

V.E.M.I.S.A.

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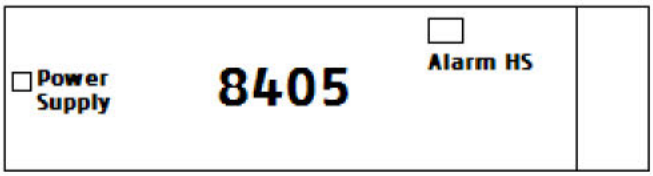
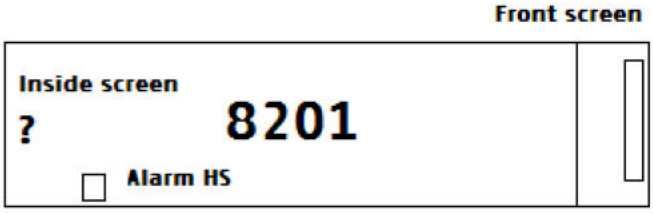


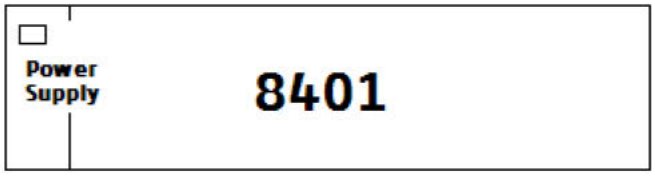
- ***8205***: power supply for inside screen near the cabin needs substitution.

- ***8201***: Alarm handset near 8401 needs repairing; frontal outside screen in the cabin needs repairing; inside screen next to the 8401 cannot be tested: no 110Vcc.

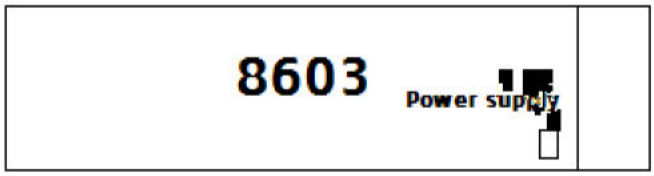


V.E.M.I.S.A.

- ***8401***: marker light signal always active (check after uncoupling unit); power supply for the inside screen near the cabin needs substitution.



- ***8603***: power supply for the inside screen near the cabin needs substitution.



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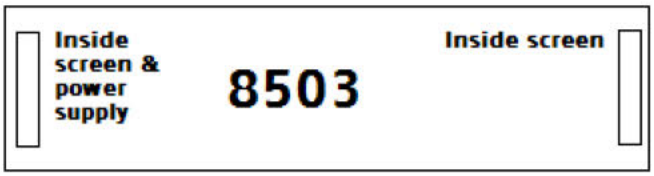
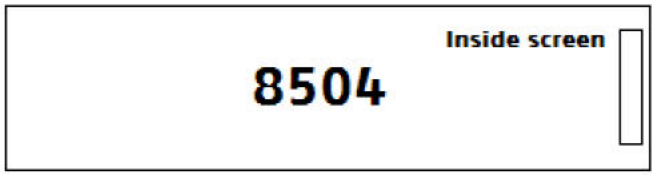


- ***8504***: inside screen near 8503 needs repairing.



- ***8604***: inside screen near the cabin needs repairing, and power supply for this screen needs substitution.

V.E.M.I.S.A.

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- ***8507***: inside screen near 8508 needs repairing, and power supply for this one needs substitution.

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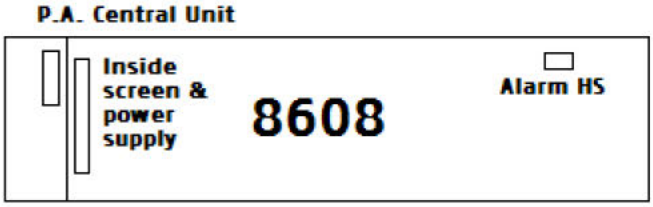
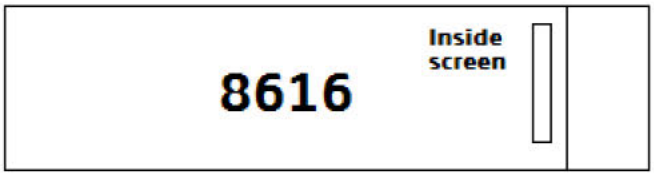


V.E.M.I.S.A.

- ***8616***: inside screen near the cabin needs repairing.



- ***8613***: RPP above door number 4 needs repairing.

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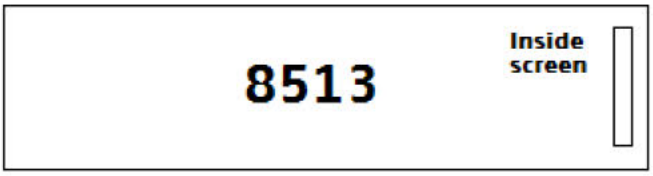

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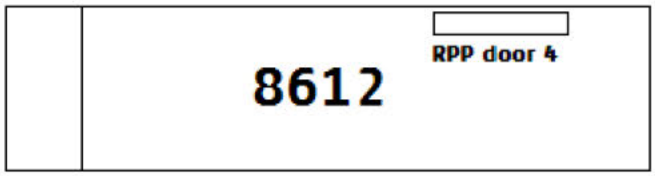
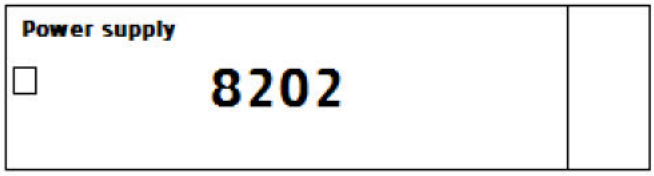
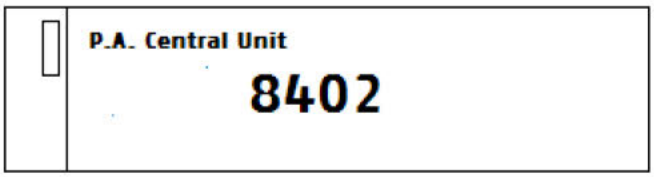


- ***8203-8403***: at Inchicore, not tested.
- *8606-8506-8505-8605*: at Inchicore, not tested.
- ***8602-8502-8501-8605***: Splitted unit, at Fairview. Not tested.

- ***8202***: power supply near 8402 needs substitution.



- ***8402***: 15Vcc relay always active. Central unit needs repairing.



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Carriages not appearing in this report have no damage in any part of the PIS.

Údarás
Náisiúnta Iompair
National **Transport** Authority

GRANT APPLICATION FORM

PROJECT TITLE: Passenger Information System (PIS) Upgrade for DART EMU Class 8500/8510/8520

This document is to be followed when applying for grant funding from the National Transport Authority in respect of transport projects.

All applications must be accompanied with an appropriately scaled map clearly identifying the location and extent of the project.

All documentation, maps and additional supporting documentation should be clearly itemised and attached as an annexe to each criterion heading.

1. **Title of Project**

Passenger Information System (PIS) Upgrade of DART EMU Class 8500/ 8510/ 8520

2. **Identify NTA Project Type (tick <u>one only</u>)**

a) Cycling / Walking Programme;
b) Bus Network Programme;
c) Traffic Management Programme;
d) Safety Programme; **or**
e) Other Projects. **X**

3. **Delivery Agency:**

Chief Mechanical Engineer, Iarnród Éireann

4. **Design Agency:**

Chief Mechanical Engineer, Iarnród Éireann

5. **Full Description of Works Proposed**

The Dublin Area Rapid Transit Electric Motive Unit (DART EMU) fleet currently consists of 144 carriages and 68 (47.2%) of these are fitted with obsolete and inoperative Passenger Information Systems (PIS). These are the 8500, 8510 and 8520 classes respectively. The three fleets were procured by IÉ in 2000-2004 from Tokyu Car Japan. Each EMU is configured to form 4 cars which are permanently coupled. There are currently 4 x 8500 units, 3 x 8510 units and 10 x 8520 units totalling to 17 x units from 68 carriages.

It is now intended to upgrade all three fleets with a common standalone PIS that is reliable, modern and with a robust design that is fit for use on the railway system. A technical specification has been developed with this in mind and below are some of the basic features.

1. Automated announcements and high quality Light Emitting Diode (LED) matrix displays.
2. Additional Thin Film Transistor (TFT) or Active Liquid Crystal Display (LCD) internal displays to show route and operational information. This aims to include information such as service disruption, carriage loading, and route and station statuses.
3. Remote accessibility to allow ease of managing the new PIS.

Moreover, a reliable PIS combined with displays to show informative content will greatly improve passenger satisfaction. Also, the remote access feature of the new system will allow us to manage

service disruptive messages on individual trains and the additional displays will feature real time passenger information (RTPI) which will allow passengers to plan their journey ahead.

6. Description of Project Benefits

The Passenger Information System on the DART EMU 8500, 8510 & 8520 is now obsolete and most units are no longer operable. An upgrade to the PIS on all three fleets is necessary to improve customer's travel comfort and ensure the fleets comply with legislation and Technical Specification Interoperability – Persons with Disabilities and Reduced Mobility (TSI-PRM).

Over the years, the Japanese DART fleets have been a source of constant complaint due to PIS malfunction and broken systems on several train sets. This mostly affects tourists, people who are unfamiliar with the route and people with reduced mobility, as they depend more on the automated announcements and displays when traveling on the train.

There is a big benefit of having a common PIS installed on all the Japanese EMUS. A common PIS will ensure compatibility when any of the 2 train sets are coupled together. The individual PIS on each train set must be able to integrate seamlessly to form a single set.

The heart of the PIS is central processing unit. This is where the main processing component and storage device of the system is located. The PIS on a set will fail when this component fails, hence, the PIS central processing unit needs to be of a robust design that will be able to work efficiently under extreme conditions of a railway environment. This is part of the core requirement of the PIS upgrade specification.

Another important feature that will be on the new PIS is the capability for remote access. This allows for ease of access to the on-board PIS database used in announcements. This feature will also allow ease in performing diagnostics and fast turnaround time when investigating reported issues.

In addition to this, the installation of the ceiling mounted internal displays will allow for best visibility of the necessary information to passengers on the train.

The audio speaker system in each carriage will also have the feature to sense ambient noise and automatically adjust the loudness of the audio announcements. This will ensure that announcements are fully audible to passengers and overcome any noise in the background.

The less reliable front roller displays will also be replaced with high quality and high resolution LED matrix displays. This will greatly reduce maintenance cost since mechanical elements of the moving mechanism are eliminated. This will mean great reduction of the front displays failing or becoming faulty.

There will also be the additional internal TFT displays in the carriages to show information that is relevant to passengers. It is aimed to show information such as route and station status, carriage loading per car and service disruption information.

7. Consistency with Plans

The DART PIS upgrade will ensure the fleets are all compliant to EU legislation including but not limited to the TSI-PRM.

8. Proposed Programme for Design, Tender, Construction, Monitoring Stages

Subject to NTA approval and funding and DEPR approvals, the DART PIS technical specification once it goes to tender will allow us to discover and explore what suppliers have to offer for the fleets all while taking into consideration the core requirements and technical details of the specification. Contract award and execution if initiated now is expected in Q3 2020 with target completion in Q4 of 2021.

PROJECT TIMELINE FOR 17 DART EMU SETS

	2019	2020				2021				
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Comment
Procurement Process	[redacted]									
Contract Award				[redacted]						
Design Review Sign Off				[redacted]						
Materials Delivery & Install				[redacted]		[redacted]				
Commissioning & Introduction to Service					[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
Safety Approval Process	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	

9. Costs

The application should clearly identify key cost information, as listed below:

- Estimated Overall Total Cost of Project (all phases);
- Grant Sought from NTA (€) (all phases);
- Source of co-funding (if any);
- Cost of project to Date (if applicable) (€); and
- NTA contribution to Date (if applicable) (€).

[redacted]

Funding Amount Sought for Current Year [redacted]
If multi annual the estimated overall total cost of the project is as follows if available:

Year	Actual or Estimated	NTA Funding (€'000)	Other Funding (Indicate source)
2020	Estimated	[redacted]	0
2021	Estimated		0
Total Estimated			0

Note – for future years where costs cannot be correctly determined insert TBD – To be determined.

All cost figures above include irrecoverable VAT.

10. Statutory Approvals Status

The new PIS will be subject to SMS 14 approval - Safety Approval of Changes in Plant, Equipment, Infrastructure and Operations (PEIO). The testing and commissioning process is expected to be routine.

11. Contact Person (responsible for project implementation [redacted]

Phone [redacted]
E-mail:

12. Contact Person (responsible for project administration): [redacted]

Phone [redacted]

E-mail: [redacted]

Signed: [redacted]

Date: 23/10/14

Implementing Agency: Iarnród Éireann

Figure 1- Roller type front display

Figure 2- Non-functioning route information

Figure 3- Internal scrolling display

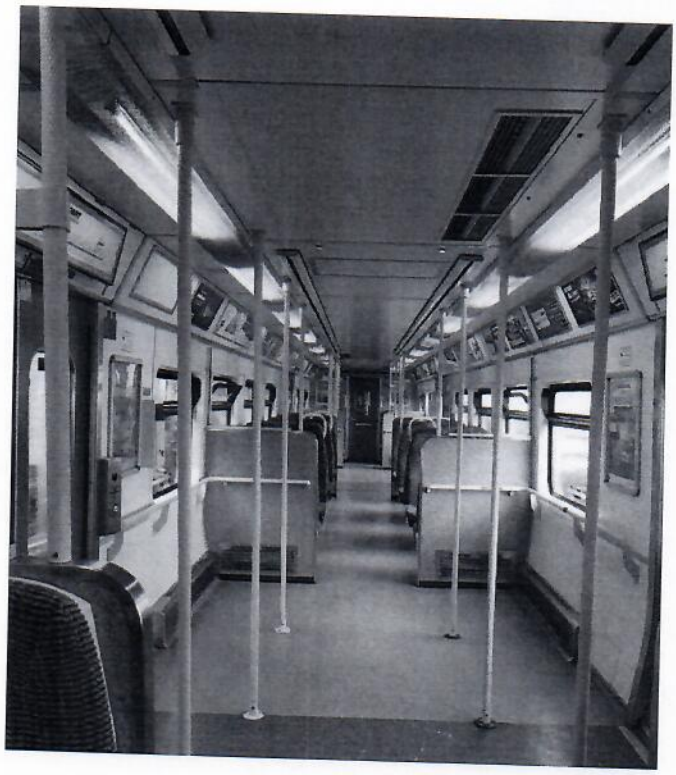

Figure 4- Interior of an 8520 carriage

Figure 5- The PIS HMI on the driver's cab

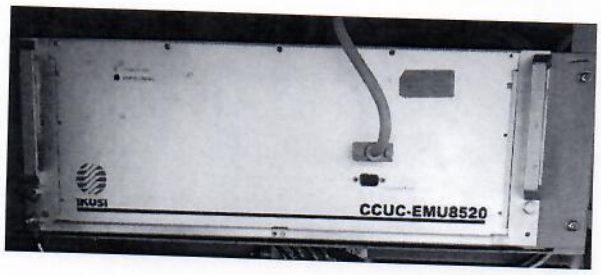

Figure 6- The IKUSI PIS central processing unit

From: [redacted]

Subject: On Board PIS funding

Date: Monday 5 November 2018 11:42:18

[redacted]

Further to the meeting this morning I can advise that a sum of [redacted] inc VAT should be requested / provisioned for the replacement of the on board PIS on the 17 x 4 car DART Japanese sets. Assuming we commenced procurement by the start of 2019 the funding would be needed for expenditure in 2020.

Regards

[redacted]

Sent from my iPad

Passenger Information Systems - [redacted]

[redacted] are a UK company based in [redacted]. They prequalified for the supply of the PIS and tendered. The tender process took a long time due to issues with legal documentation and a change of scope from originally being a framework for all fleets and was revised in 2012 to solution only for DART 85xx.

- Their tender return states that it is fully compliant to the technical and commercial requirements of the tender which is highly unusual.
- [redacted].

The concerns on contract award for a replacement PIS system relate to the financial and technical ability of [redacted] to deliver the product and support the product going forward.

1. RU procurement ran a Dun & Bradstreet health check on [redacted] and associated companies. The result was that [redacted] has a risk rating of 4 (very bad) and has a high risk of business failure. I am aware that [redacted] have had problems paying their staff in the UK in 2013
2. [redacted] offered a parent company guarantee from their Chinese parent
3. RU procurement advised me that a parent company guarantee could prove to be unsustainable and inadvisable.
4. CIE legal sought advice from McCann FitzGerald on the enforceability of a Chinese parent company guarantee. The opinion was that s Chinese parent guarantee could be difficult to enforce and very costly and ineffective.

On this basis an award of contract to [redacted] for the replacement PIS is not advisable.

Other information

- The engineering advisor to the Board (former Non exec director) has advised that he has intelligence that the company is struggling and may not continue trading and / or supporting their equipment

- They had 1 key technical person responsible for all their system designs and he left the company in mid 2013 as a result of not being paid his salary.

- They have provided replacement systems to only 3 x customers and all in the UK on the following TOCs - ATW Class, FGW class 165, Southern 313

- AI have spoken with all three UK TOCs and all of these retrofits have experienced considerable tech issues and mod programmes similar to that currently presented on the DART fleet PIS (freezing displays, inaudible pa and auto announcements, wrong stations displayed etc)

From: [redacted]
Subject: PIS / PA fleet check
Date: Friday 19 September 2014 11:32:00
Attachments: image001.png

[redacted]

Undertake a dynamic fleet check on all the DART units (Jap and German) to check PIS functionality, PA auto announcements, auto volume control, PA volume levels
Report findings and corrective actions to me in a month please.
Quaestar will come in and do the 8520 sets again just to give them a once over.
Ensure unit 8107 is checked quickly as it is reported as making multiple announcements about feet on seats.

[redacted]
Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin 8
[redacted]

From: [redacted]
Subject: PIS
Date: Monday 6 October 2014 09:40:00
Attachments: image001.png

[redacted]

During October and November undertake a detailed check of the on board passenger information systems on the DART fleet. The checks should involve functional inspection and testing in the maintenance location and in service to ensure the correct information is being displayed and announced and that volume levels are audible. Involve the on board equipment suppliers Ikusi Quaestar, Vemisa, Televic as required and undertake any necessary repairs.
Thanks

[redacted]
Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin 8
[redacted]

PROJECT FUNDING – DART PASSENGER INFORMATION SYSTEM

1. PROJECT NAME

DART Passenger Information System

2. COST

The project cost is [redacted] (ex VAT)

3. DESCRIPTION

To supply and install a modern Passenger information system on the DART 8500 / 8510 / 8520 fleet of 17 x trains (68 carriages).

4. BENEFITS

The DART fleet constructed between 2000 and 2005 (Class 8500, 8510, 8520) has an obsolete and poorly functioning Passenger Information System (PIS). This represents nearly 50% of the operational fleet. The remaining fleet has a modern system installed in the refurbishment programme undertaken in 2007 under Transport 21. The poorly performing PIS system is the largest source of passenger complaints on the DART fleet and our obligations to passengers of reduced mobility are not being delivered as little or no information is provided on board.

5. TIMELINE

The procurement department will undertake a tender process. The selected supplier will supply and fit the chosen PIS system on to the 17 x trains. The project will be delivered between 2018 and 2020.

	2017	2018	2019	2020
DART PIS		[redacted]	[redacted]	[redacted]

Chief Mechanical Engineer
Iarnród Éireann
May 2017

Project Initiation Documentation

Project Name:	DART EMU Class 8500 PIS Upgrade		
Date:	29/07/2021	**Release:**	Draft
Author:	[redacted]		
Owner:	IÉ CME		
Client:			
Document Number:	2.0		

Revision History

Date of next revision:

Revision Date	Previous Revision Date	Summary of Changes	Changes Marked
1	13/05/2021	Update in-line with NTA commentary	

Approvals

This document requires the following approvals. A signed copy should be placed in the project files.

Name	Signature	Title	Date of Issue	Version

Distribution

This document has been distributed to:

Name	Title	Date of Issue	Version

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1. Background

The DART fleet currently consists of 144 Electrical Motive Units (EMU) carriages. A total of 68 carriages (47% of the fleet) are fitted with obsolete and inoperative Passenger Information Systems (PIS). These are the 8500, 8510 and 8520 EMU classes of carriages which were procured by IÉ from 2000-2004 from the Tokyu Car Japan Company. Each EMU is configured to form 4 cars which are permanently coupled. There are currently 4 x 8500 units, 3 x 8510 units, and 10 x 8520 units totalling to 17 x units from 68 carriages.

The existing PIS on the 8500 Class DART fleet is c.20 years old and is not fit for purpose to meet modern train passenger needs. It relies heavily on manual intervention which can lead to highly unreliable information to customers. The 8500s & 8510s PIS manufacturer is Eurunion. This company has since been bought out by Vimesa and current support for repair on the Eurunion components has an approximate 12 month lead time. IÉ has attempted to repair the system in-house on a patch and repair basis which has helped to reduce the lead time but not sufficiently to keep all units operating correctly.

The 8520 PIS manufacturer is Ikusi. Support for the components on this system is a little better than the 8500/8510 Eurunion system. However there are significant problems with the memory capacity of the cards holding the database information. IÉ is unable to reliably update these cards with new information for stopping patterns or passenger information.

The roller displays are obsolete in the current PIS system and there are significant anomalies in the existing technology which often leads to station stop information either being one stop out of sequence or the entire route information being sequenced in the wrong direction of travel. The existing PIS system will not be able to process new DART stations and route information when the DART network is expanded considerably as planned under Ireland's current National Development Plan commitments, which will see the network treble in coverage by 2027.

Over the years the Japanese 8500 Class DART fleets have been a source of constant complaint due to malfunction of the PIS and broken systems on many of the train sets. This mostly affects tourists, people who are unfamiliar with the route and people with reduced mobility, as they depend more on the automated announcements and displays when travelling on the network.

Detailed analysis was carried out on all components and an upgrade to the current PIS design was proposed and costed by VEMISA, these costs in 2010 were deemed to be an uneconomical method of providing an effective solution for the PIS. In the intervening 10 years the option to upgrade the PIS to the 2010 proposal has disappeared through obsolescence. A redesign would need to be considered, which would take a considerable amount of time and an unforecastable cost. This upgrade would also require a derogation from Procurement policy, to directly award VEMISA a potentially lower cost option.

More complex based digital systems are not considered appropriate due to the large investment required and poss ble need for reconfiguration of the fleet and these were also discounted at an early stage as a viable option. The specification chosen for this project and descr bed below meets the key project objectives listed above and is the chosen option for consideration in the CEA, as it is a more competitively priced investment option.

The heart of the PIS system is the central processing unit which is where the main processing unit and storage device of the system is located. The PIS on a train will fail when this component fails therefore the new PIS central processing unit needs to be of a robust design that will be able to work efficiently under the extreme conditions of a railway environment. This is part of the core requirement of the PIS specification.

Another important feature of the new PIS system is the capability of remote access. This allows for ease of access to the on-board PIS database used in announcements. The ceiling mounted internal displays will be conveniently located to allow for maximum passenger visibility.

In February 2020, the NTA approved funding of [redacted] for the upgrade of the PIS on the DART Class 8500 fleets. The tender process started in March 2020, with three compliant

tenderers being invited to provide a best and final offer during the post tender clarifications. Ikusi were selected as the preferred bidder and were awarded a contract for the provision of a Passenger Information System for the DART Class 8500 fleets.

Ikusi expect the completion of the upgraded Passenger Information System on the DART 8500 EMU Fleets to take 18 months from contract award, with a 24 month warranty period. The cost for the project is planned to be [redacted] including contingencies.

A Contract Award has been executed which incorporates confirmation that technical, financial, procurement and legal risks arising in the process to date have been considered and are being managed.

1.1. Project Objectives

There is a priority requirement to upgrade all three DART 8500 EMU fleets (8500s, 8510s & 8520s) with a common standalone PIS that is reliable, modern and with a robust design that is fit for purpose on the DART service network.

Ikusi were selected as the preferred bidder and expect the completion of the upgraded Passenger Information System on the DART 8500 EMU Fleets to take 18 months from contract award, with a 24 month warranty period.

The cost for the project is planned to be [redacted] including contingencies.

It is proposed to replace the equipment with a modern, reliable and best in class system, which will provide consistent, reliable, accurate and timely information, with improved visual displays and audio functionality.

1.2. Desired Outcomes

To upgrade all three DART 8500 EMU fleets (8500s, 8510s & 8520s) with a common standalone PIS that will fully comply with Technical Specification on Interoperability – Persons with Disabilities and Reduced Mobility (TSI-PRM). Whilst ensuring the PIS will be reliable, modern, and with a robust design that is fit for purpose on the DART service network.

Overall the new harmonised PIS will significantly improve level of service to passengers and increase the customer satisfaction rating befitting the very high standards already set by the DART service. Thus making the DART an even more attractive and safer mode of transport for passengers.

The less reliable front roller displays will be replaced with high quality and high resolution LED matrix displays. This will greatly reduce maintenance cost since mechanical elements of the moving mechanism are eliminated. This in turn lessens the front displays failures or faults.

There will be additional internal TFT displays in the DART carriages to show information that is relevant to passengers e.g. route and station status, carriage loading per car and service disruption information.

The audio speaker system in each carriage will also have the feature to sense ambient noise and automatically adjust the loudness of the audio announcement to best suit the prevailing carriage conditions.

The new PIS system will be linked to the GSM-R digital radio system and will also be integrated with a new Customer Information System which is being developed separately by IÉ. This will significantly improve safety and the customer experience on DART by enabling announcements to be on an individual train or all-train bulletin mode in emergency situations. Real-time passenger loading information on-board arriving trains can also be transmitted to monitors at calling stations allowing for improved passenger loading and comfort as well as

safer travelling conditions.

The upgraded PIS will help facilitate the DART 8500 EMU fleets in expansion of the DART network as planned in Ireland's National Development Plan.

1.3. Project Scope and Exclusions

The project is consistent with the objectives of the National Disability Inclusion Strategy 2017-2021 issued by the Department of Justice and Equality of Ireland. This calls for the improvement of transport information, including audible announcements, to make rail travel more accessible to the mobility and sensory impaired. The implementation of consistent and reliable on-board audio and visual announcements on all forms of public transport in Ireland is a key objective of the Strategy.

The DART Class 8500 Fleets PIS upgrade will ensure that the fleet is compliant with the European Railway Agency's People with Reduced Mobility Technical Specification for Interoperability (PRM-TSI) and will display all of the letters in the Irish and English alphabets in both upper and lower case, including correctly aligned ascenders and descenders. The proposed system is compliant with both the Official Languages Act 2003 and 8 bit Unicode Transformation Format (UFT-8), which is the most common encoding system for web pages.

The core requirement is for the supply and install of a high quality PIS system. Which can be fitted to the train with minimum interfacing or modification to existing structures. The PIS system shall include:

- Front Exterior Destination Displays on each driver cab unit
- Internal Displays in each saloon
- Exterior Side Displays on each carriage unit
- Human Machine Interface (HMI) Display on each cab
- Automated Pre-recorded Announcements
- Public Address (PA) System and Passenger Emergency Intercom (PEI)
- Real time PIS interface and message updates to the existing CTC and new NTCC
- Communication with NTCC for voice and text communication messages
- Database/ Route Editor with a Route Simulator Software
- Remote access to the PIS central unit on the train
- Supply and install the new PIS for all 17 units

The scope of the signed contract includes:

- Design, supply, integration and commissioning of the replacement system
- Provision of support to IÉ for obtaining safety approvals
- Training of IÉ staff in the first line maintenance of the system
- Fixed pricing for the supply of spare parts for 5 years post commissioning

The services to be supplied will include system design, integration, include all equipment necessary to fully integrate it into the existing vehicle and support for safety approvals.

Exclusion

The upgrade of the DART Class 8100 fleet, as the PIS on this fleet type is reliable and complies with TSI-PRM.

1.4. The User(s) and any Other Known Interested Parties

The following categories of end users will be affected by the change. This may be in terms of the task they are performing (including removing tasks), the information they are provided with, and / or the tools or equipment they use for safety critical activities.

Commented [PC1]: Not clear if any of these stakeholders are ticked

Are there other key stakeholders to consider

Clarify how these stakeholders will be managed and communicated with as part of the project

Commented [DJ2R1]: Apologies the requirement for a tick was copy and paste error

- Passengers
- Drivers
- CME Safety Maintenance Staff
- IÉ Railway Undertaking Operations – Timetable Planning
- CTC Regulators
- NTCC Train Management System
- Ikusi

1.5. Interfaces

Commented [PC3]: Any interfaces with other systems to be considered and managed including existing and planned data interchange with IE websites and data shared with NTA

Commented [JD4R3]: Additional interfaces included

The PIS will interface directly with passengers, IÉ Train Management Software and Central Traffic Control.

The PIS will have a GSM connection to the ground using an API, to IÉ's Enterprise Service Bus.

- The data from the ground to the train including timetable updates and new audio recordings.
- From the train to the ground, the PIS control unit will send various types of messages, including PIS component failure message, GPS location and passenger loadings.

From the Enterprise Service Bus the data can be made available to various departments/organisations.

2. Business Case

The project is consistent with the objectives of the National Disability Inclusion Strategy 2017-2021 issued by the Department of Justice and Equality of Ireland. This calls for the improvement of transport information, including audible announcements, to make rail travel more accessible to the mobility and sensory impaired. The implementation of consistent and reliable on-board audio and visual announcements on all forms of public transport in Ireland is a key objective of the Strategy.

The DART Class 8500 Fleets PIS upgrade will ensure that all DART fleets are compliant with all EU legislation including but not limited to the TSI-PRM.

2.1. Current Condition

The existing PIS on the 8500 Class DART fleet is c.20 years old and is not fit for purpose to meet modern train passenger needs. It relies heavily on manual intervention which can lead to highly unreliable information to customers. The 8500s & 8510s PIS manufacturer is Eurunion. This company has since been bought out by Vimesa and current support for repair on the Eurunion components has an approximate 12 month lead time. IÉ has attempted to repair the system in-house on a patch and repair basis which has helped to reduce the lead time but not sufficiently to keep all units operating correctly.

The 8520 PIS manufacturer is Ikusi. Support for the components on this system is a little better than the 8500/8510 Eurunion system. However there are significant problems with the memory capacity of the cards holding the database information. IÉ is unable to reliably update these cards with new information for stopping patterns or passenger information.

The roller displays are obsolete in the current PIS system and there are significant anomalies in the existing technology which often leads to station stop information either being one stop out of sequence or the entire route information being sequenced in the wrong direction of travel. The existing PIS system will not be able to process new DART stations and route information when the DART network is expanded considerably as planned under Ireland's current National Development Plan commitments, which will see the network treble in coverage by 2027.

Over the years the Japanese 8500 Class DART fleets have been a source of constant complaint due to malfunction of the PIS and broken systems on many of the train sets. This mostly affects tourists, people who are unfamiliar with the route and people with reduced mobility, as they depend more on the automated announcements and displays when travelling on the network.

The current PIS system is obsolete, unreliable and does not meet modern customer expectations of service. Independent qualitative Market Research of DART passengers is carried out regularly on behalf of IÉ by specialised firm. This involves both on-board survey and customer feedback focus groups. The feedback from the customer focus groups in relation to the on board DART PIS system highlights a number of recurring key communication problems identified by passengers, including:

"Next station alerts on board can be wrong at times"

"Difficult to hear audible messages when transmitted"

"Audible messages sometimes not available"

"Messages are inconsistent and confusing"

In addition to its Access Officer, in 1997 IÉ established a Disability User Group. This User Group provide a forum for IÉ to consult with and update disability organisations and individuals on accessibility proposals and developments, and for disability organisations to raise operational and other accessibility issues. The IÉ User Group includes representatives from the Irish Wheelchair Association (IWA), Chime (Deaf Hear), Irish Guide Dogs for the Blind, the Central Remedial Clinic (CRC), the National Council for the Blind Ireland (NCBI), Independent People with Disabilities, Blind Legal Alliance, Headway Ireland, AsIAm (Autism/Asperger's) and Alzheimer's Society of Ireland. The lack of announcements on the DART fleet has been continuously raised by these groups and individually by people with disabilities, many of whom have written directly to the Customer Experience Manager. Access bility for All Users (this title is the same as per Articles 4 and 37 of TEN-T Regulation 1315 of 2013).

In Census 2016, the overall number of people in Ireland with disabilities increased to 13.5% of the total population. The National Disability Inclusion Strategy (NDIS) is the key "whole of Government" strategy in Ireland to ensure the equal participation of people with disabilities in society. The NDIS contains a number of actions relating to access ble public transport including Action 111 of the NDIS which specifically commits the Government to "the implementation of consistent and reliable on-board audio and visual announcements on all public transport vehicles including buses, coaches, DART (our emphasis) trains and trams and to monitoring and maintaining this aspect of accessibility".

The Comprehensive Employment Strategy for People with Disabilities (CES) 2015-2024 is another key Government Strategy to ensure that people with disabilities, who, are able to, and want to work, are supported to do so. Action 2.19 of the CES commits the Government to the "Implementation of on-board announcements of next stops on all public transport to assist those with a visual impairment". The independent Chair of the Steering Group which monitors progress on the CES, stated in his 2017 Report that "people with a disability routinely report that the single greatest barrier between them and the world of work is the lack of adequately accessible public transport". Since then the Government has significantly increased funding for public transport accessibility such that the Chair acknowledged in his 2018 Report that "Investment in more accessible public transport is paying visible dividends." The DART PIS project builds on that progress.

Ireland's policy is that all new public transport facilities and infrastructure should be accessible from the design stage. However, there are issues with legacy facilities and infrastructure which required retro-fitting to make them access ble for all users, such as this project on the DART PIS.

The provision of reliable audio visual communications is important for all members of society and particularly for those with a disability, for example those who are deaf, or visually impaired, or older people. By 2040, 23% of Ireland's population will be aged 65 or older, which will be much higher than the EU average. Ireland 's policy of progressively making public transport accessible for all users is in line with Article 4 of the United Nations Convention on the Rights of People with Disabilities (UNCRPD) which the Irish Parliament (Dáil Éireann) ratified in 2018. This application also specifically aligns with EU policy on accessibility and disability, for example, Articles 4 (v), 10(e) and 37 of EU Regulation 1315/2013.The DART PIS upgrade will

ensure that the DART fleet is fully compliant with all EU legislation including but not limited to the TSI-PRM and EU Access bility Directive referred to earlier.

IÉ also conducts 'Passenger Mystery Shopper' inspections on board DART trains to monitor performance across a range of indicators. In February 2019 a sample of around 30 passenger assist mystery shoppers travelled on DART trains across the network. The aggregated feedback observations specifically relating to the on-board PIS is set out below.

February 2019 DART Passenger Mystery Shopper Collated Feedback – On-board PIS

Journeys	LCD Displays on-board	Announcements On-board
Connolly-Bayside	The LCD displays were working but they were not loud enough.	The announcements were working but were not loud enough.
Bayside-Tara Street	The LCD display kept displaying this was the last stop throughout the journey.	There were no audio announcements or driver announcements on-board.
Salthill and Monkstown-Pearse	The LCD displays were working correctly.	There were no audio announcements or driver announcements on-board.
Pearse-Dalkey	The LCD displays were working correctly and were loud enough to hear.	The announcements were working. The driver made announcements.
Dalkey-Booterstown	The LCD displays kept displaying next stop is Dalkey throughout the journey.	The driver did not make announcements until a few minutes after arriving at Booterstown. The announcement asked for the person that required assistance make themselves known to platform staff.
Booterstown-Connolly	The LCD displays were working correctly.	The announcements were working but were quiet. The driver also made announcements when approaching Connolly.
Connolly-Howth Junction and Donaghmede	The LCD displays were working correctly.	The announcements were quiet.
Clontarf Road-Malahide	N/A unable to complete journey.	N/A unable to complete journey.
Malahide-Connolly	N/A unable to complete journey.	N/A unable to complete journey.
Sandymount-Sandycove	The LCD was not working on this service.	The announcements were working.
Sandycove-Bray	The LCD was not working on this service.	The announcements were working.
Bray-Blackrock	The LCD was not working on this service.	The announcements were working.
Connolly-M3 Parkway	The LCD was not working on this service.	There were no announcements on-board.
Rush and Lusk-Broomsbridge	The LCD display was working correctly.	The announcements were working but were not loud enough.
Maynooth-Leixlip Confrey	The LCD was not working on this service.	There were no announcements on this service.
Leixlip Confrey-Connolly	The LCD display was working correctly.	The announcements working but were jittery and quiet.

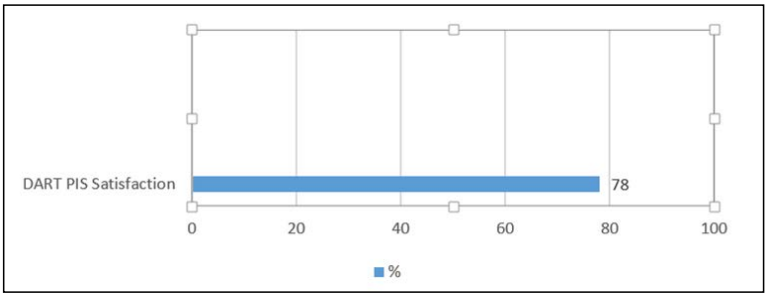
The feedback from the latest Mystery Shopper exercise highlights the scale of the problem with the existing obsolete PIS. The lack of information and inconsistency / inaudibility of the information when delivered is confusing for passengers and is not up to the standard required for DART, which is the busiest service in the entire heavy rail network.

IÉ also commissioned an independent research company called B&A Research & Insight to undertake a detailed market research exercise of DART passengers twice yearly. A total of c.1,500 interviews of DART passengers have been carried out each year during the Spring and Summer period across a range of service criteria including the provision of information (quality/clarity) during the Journey.

The result of the interviews in relation to the provision of information during DART journeys is set out below in terms of customer satisfaction. The National Transport Authority in Ireland

reported that in 2018 DART services enjoyed a very high customer satisfaction rating of 93%. The satisfaction ratings for the on-board PIS are well below the standards set for customer satisfaction ratings recorded for DART in general (average score 78%).

DART On-Board PIS passenger satisfaction score* last three years V's overall DART service passenger satisfaction (2018)



**Applies to the full DART fleet (144 carriages) not just the Class 8500/8510/8520 fleet which has significant problems with the PIS. Figure therefore is likely to overestimate the passenger satisfaction score for the PIS on the latter fleet which is the subject of this Business Case.*

DART Overall Satisfaction:

The PIS systems on the DART fleets are also different and do not integrate with each other. The system does not comply with legislation and the Technical Specification on Interoperability – Persons with Disabilities and Reduced Mobility (TSI-PRM). The system is confusing and frustrating for people with visual and sensory impairments. Surveys indicate that around 11% of the existing DART passenger user profile is aged 65+ years and c.34% of customers are not frequent travellers on the DART system. A modern functioning PIS system is also very important to this cohort of passengers.

2.2. Project Objectives

The PIS upgrade will endeavour to;

- Assist all users, and specifically people with disabilities and older people, to use public transport services
- Replace obsolete and non-harmonised PIS in 68 DART carriages out of a total DART fleet of 144 carriages
- Significantly improve level of service to passengers
- Comply with Technical Specification on Interoperability – Persons with Disabilities and Reduced Mobility (TSI-PRM)
- Introduce a harmonised and integrated system with remote access functionality
- Provide a PIS system with a customer satisfaction rating befitting the very high standards already set by the DART service

- Make the DART an even more attractive mode of passenger travel
- Make the DART an even safer mode of transport
- Facilitate the expansion of the DART network as planned in Ireland's National Development Plan

2.3. Benefits of the Project

A Cost Effectiveness Analysis (CEA) of the proposed project has been undertaken over the project life cycle as this is considered the most appropriate form of appraisal for a project of this nature and scale of investment. The key qualitative benefits of the project are;

- There will be reliable real-time information provided to customers on displays offering superior image quality, both for static images and video content. Customers will receive accurate real-time information in relation to route and station status, carriage loading per train and service disruption information.
- Significant improvement to customer travel comfort, safety and user experience.
- Remote access bility will allow IÉ to manage service disruption messages on individual trains or to all trains.
- Displays will provide reliable real time passenger information (RTPI). It will also allow for ease of access to the on-board PIS database used in announcements and will ensure that announcements are fully audible. This feature will also allow for better diagnostic performance and fast turnaround time when investigating reported incidents.
- The on-board mounted displays will provide the best visibility of the necessary information to all passengers on the train.
- All announcements will be fully audible to passengers and will adjust automatically to prevailing background noise on board the train.
- The new displays will provide maintenance cost savings as mechanical elements of the moving mechanism are eliminated.
- There will be a significant reduction in failing or equipment developing faults.
- The DART PIS upgrade will ensure that the DART fleet is fully compliant with all EU legislation including but not limited to the TSI-PRM.

2.4. Cost Benefit Analysis - Project Appraisal Balance Sheet

Criteria	*Statement*
Economy / Financial	
Transport Efficiency and Effectiveness	The project will significantly improve the efficiency and effectiveness of the DART system by providing an integrated and harmonised information system across the fleet with remote access functionality.
Transport Reliability and Quality	Passengers will get clear, accurate real-time information on station location, next stop announcements, train loadings and service disruption bulletins.
Maintenance Savings	Maintenance savings will arise due to the replacement of an obsolete system with a state-of-the-art technology. Based on an analysis of historical maintenance records available and information relating to internal labour resources within IÉ also required to maintain the current system, it is estimated that the annual parts and labours savings of migrating to a new PIS system would be of the order of €50K p.a.

Commented [PC5]: Is there a current baseline and expected improvement associated with these?

Current Customer Experience Survey/Measures and Uplift
Customer Complaints reduction
Customer Enquiries reduction
Are these all components of the [redacted] maintenance savings?
- Time/Cost to address service disruption
- Reduction in Service Disruption/Outage/Incident Investigation Duration
- Reduction in failing / equipment faults

Commented [DJ6R5]: Current condition section added above to offer more context to the benefits of the project

Commented [DJ7R5]: In addition to the project objectives

Commented [PC8]: In addition to [redacted] measurable savings for maintenance costs, are there any other measures and targets associated with any of the benefits:
Transport Efficiency & Effectiveness
Transport Reliability and Quality

Is the cost benefit analysis in terms of hard savings
Cost [redacted], Saving [redacted] pa or are there other quantified savings?

Commented [DJ9R8]: Difficult to quantify a true CBA in financial terms The PIS upgrade will aim to make the DART fleet a more attractive mode of travel, with an improved PIS system

Safety	
Health & Safety	Improves real-time safety bulletins to passengers and provides customers with better information on actual train loadings in real-time providing better opportunity for safe and comfortable passenger loading particularly at peak times.
Environment	
Air Quality	N/A
Noise and Vibration	N/A
Landscape and Visual Quality	N/A
Biodiversity	N/A
Social	
Vulnerable Groups	Conforms to Technical Standards of Interoperability for mobility and sensory impaired passengers.
Integration	
Transport Integration	Improves the attraction of the railway to existing and new users.
Policy Integration	The project is consistent with the objectives of the National Disability Inclusion Strategy 2017-2021 issued by the Department of Justice and Equality of Ireland. The DART PIS upgrade will ensure that the DART fleet is fully compliant with all EU legislation including but not limited to the TSI-PRM.

Commented [PC10]: Does this project maintain compliance or enable compliance with EU legislation i e is there a must do element to the business case

Commented [DJ11R10]: To enable compliance

2.5. Risk of Project Non-Delivery

The DART PIS upgrade will ensure the fleets are all compliant to EU legislation including but not limited to the TSI-PRM.

There is also the risk of reputational damage to the very successful DART brand which enjoys very high satisfaction ratings currently across the board, expect for the PIS which scores consistently badly as a result of the poorly performing current system.

The current PIS system is a health and safety risk to passengers as it does not facilitate information on actual train loadings in real-time providing better opportunity for safe and comfortable passenger loading particularly at peak times.

Commented [PC12]: Are these risks of not doing the project rather than risks associated with delivering the project What are the project delivery risks that exist and how will these be managed through project delivery

e g Supplier, Product, Solution, Interfaces, Access/Availability to DART Units for Installation Risks, likelihood and how they will be mitigated

Commented [DJ13R12]: Yes these risk are associated with non-delivery of the project Headings and numbering have been refined to avoid confusion Project delivery risks will be captured in section 6

2.6. Constraints and Assumptions

One DART 8500 EMU unit will be permitted to be out of service at any one time and therefore the impact of the upgrade works on fleet availability may offer some constraints.

Commented [PC14]: Maybe move assumptions to section before risk management plan? / Include Constraints as part of in scope or out of scope statements or risks that will be managed by the project

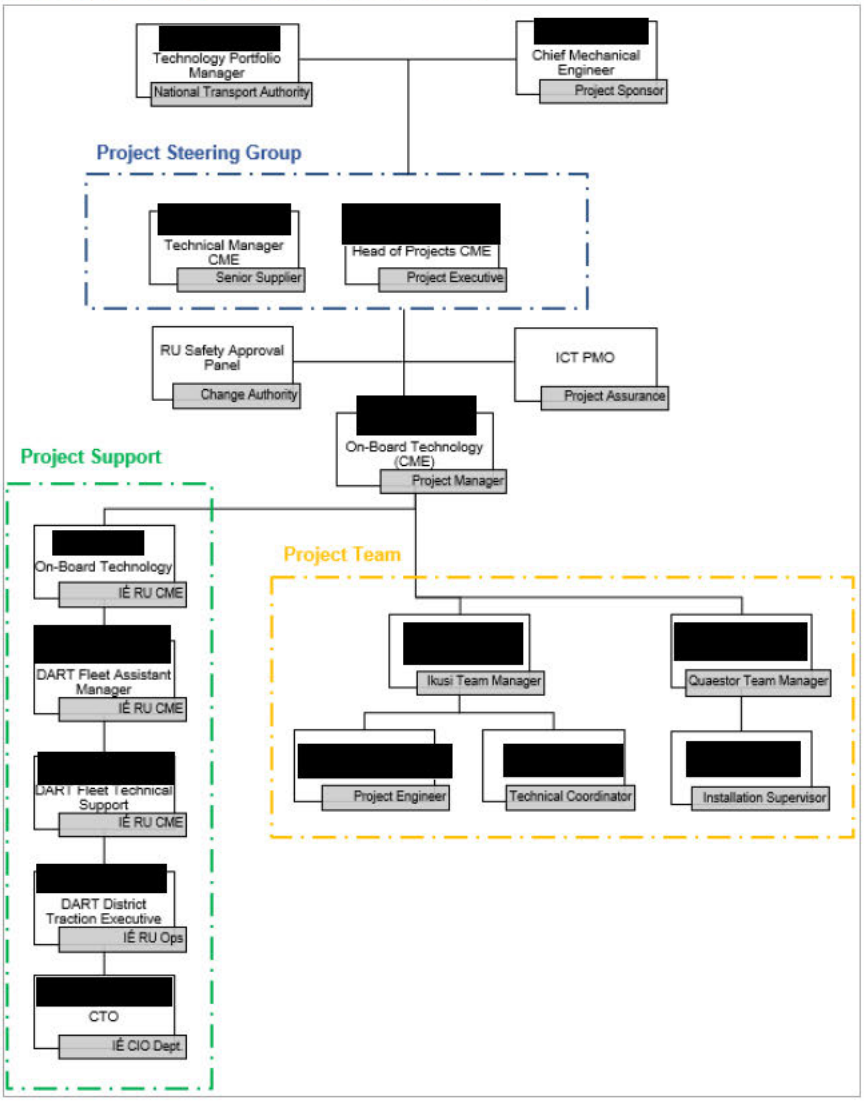
Be clear how any assumptions will be validated and managed as part of project delivery to avoid them becoming issues to be managed

Commented [JD15R14]: Moved to business case section

After the installation of the head of series, IÉ will identify a process with Ikusi and Quaester to progress the installation of the PIS equipment on the fleet in line with running maintenance activities. To reach a point in the installation process, where one unit will then need to be removed from service to complete the full installation and commissioning of the PIS.

This process will be managed through daily/weekly progress meetings with the team leaders and DART Depot production/maintenance staff to ensure unit availability aligns with the installation process.

3. Project Management Team Structure



Commented [PC16]: Please include how the project will be governed

Who is the Project Sponsor – Accountable for the Successful delivery of the project and realisation of the benefits

What element of the project are each of the project managers responsible for?

Is there a project steering group or project board?
How are supplier groups managed?
What are the governance forums and meetings associated with the project for change management, project status review, issues and risk management and escalation

Clarify how elements of the project are assigned across the team and who is responsible for what in the delivery of the project Others may be consulted of informed in relation to the project

Have business resources been included in the project budget and approved by the project sponsor

Interactions with IE CME Management Forums and IE ICT PMO

Is there interaction with a Change Advisory Board for approval of release to production environments

Include the NTA / NTA Technology Portfolio Manager linking in with IE PMO and Project Board

Any submission of deliverables for hold points or for Gateway Approval to the NTA should be following approval by Project Sponsor or Project Board

Approval for changes to project scope require NTA approval

Can you also Include me as NTA Technology Portfolio Manager – Responsibilities:

- Provides oversight of project viability, compliance and value delivery on behalf of the NTA as outlined in the NTA Project Approval Guidelines for NTA funded programmes and projects
- Reviews and confirms NTA Approval for project deliverables submitted as part of Gateway and Hold Point Reviews or otherwise advises on remediation actions engaging with other NTA Stakeholders as required
- Reviews and confirms NTA approval for requests to change project scope or funding engaging other NTA stakeholders as required

Name	Project Role	Responsibility
[redacted]	NTA Technology Portfolio Manager	Provides oversight of project viability compliance and value delivery on behalf of the NTA as outlined in the NTA Project Approval Guidelines for NTA funded programmes and projects. Reviews and confirms NTA Approval for project deliverables submitted as part of Gateway and Hold Point Reviews or otherwise advises on remediation actions engaging with other NTA Stakeholders as required. Reviews and confirms NTA approval for requests to change project scope or funding engaging other NTA stakeholders as required.
[redacted]	Project Sponsor	Chief Mechanical Engineer, owner and maintainer of all IÉ rolling stock assets. Provides unified direction to the project and Project Manager, including the resources and authorise the funds for the project. Reviews and confirms approval for requests to change project scope or funding engaging with other stakeholders as required, prior to NTA approval.
[redacted]	Project Executive	Head of Projects, CME Dept. responsible for the development and implementation of rolling stock capital investment projects, delivery plans and the management of the interfaces with other external and internal parties. Reviews and confirms project status, provides quarterly updates Project Status updates to NTA. Specifies the requirements for the project products, whilst ensuring the solution will meet the needs of the Users, especially in terms of quality and ease of use, and against requirements.
[redacted]	Senior Supplier	Technical Manager, CME Dept. responsible for setting and implementation of standards that allow the maintenance, renewal and safe provision of IÉ rolling stock assets through compliance, auditing, monitoring and reporting. Reviews and confirms project compliance with relevant technical standards.
[redacted]	Project Manager	On-Board Technology Team Leader, CME Dept. responsible for technical support for PIS, SRS, CCTV, RTD across É rolling stock assets. Appointed project manager for the 8500 PIS upgrade, responsible for the day to day management of the project safety application and reports to project board. Responsible for the project support & team, ensuring work packages are delivered.
RU Safety Approval Panel	Change Authority	The cross-departmental panel responsible for assessing the Application for Safety Approval. t issues an RU Certificate of Safety Approval

		authorising the start of a phase in a change. The Railway Undertaking Safety Approval Panel (RUSAP) is the Approval Authority for changes to be approved as per this standard. Departmental change approval standards may specify alternative Approval Authorities. Responsible for changes to be approved using the process set out in RU-SMS-014. i.e. Changes which: • Require APIS; • Are deemed to be Significant; or • Affect more than one department of the RU.
ICT PMO	Project Assurance	Head of Project Management Office, CIO Dept. responsible for the development and implementation of ICT investment projects, delivery plans and the management of the interfaces with other external and internal parties. Responsible for Project assurance in the form of NTA assurance and reporting should ensure that the right people have contributed to each NTA report, PAG, that they contains the correct and up to date information, and that it has been quality checked and signed off.
[redacted]	Project Support	On-Board Technology, CME Dept. responsible for technical support for PIS, SRS, CCTV, RTD across IÉ rolling stock assets. Responsible for PIS equipment technical support throughout all project stages.
[redacted]	Project Support	DART Depot Assistant Manager, CME Dept. responsible for all maintenance on the DART fleets. Responsible for 8500 unit allocation during installation process.
[redacted]	Project Support	DART Fleet Technical Support, CME Dept. responsible for day to day electrical technical support on all DART fleets. Responsible for electrical technical support throughout all project stages.
[redacted]	Project Support	DART District Traction Executive, RU Operations responsible for managing the competence and skills required for DART Drivers. Assisting in the training and development of Drivers and is responsible for the certification of their competence to drive safely. Representative for DART drivers in the project throughout all project stages, ensuring their needs are met.
[redacted]	Project Support	ICT CTO, responsible for Technology project integration throughout IÉ. Responsible for supporting train to IÉ network feed.
[redacted]	Project Team	kusi Team Manager, responsible for coordinating all of kusi's work-packages, ensuring delivery of all contractual obligations.

[redacted]	Project Team	kusi Project Engineer, technical support for Team Manager.
[redacted]	Project Team	kusi Technical Architect, responsible for software and hardware integration.
[redacted]	Project Team	Quaester Team Manager, responsible for the installation and warranty issues with the 8500 PIS equipment.
[redacted]	Project Team	Quaester Installation Team Leader, responsible for the installation of all 8500 PIS equipment.

4. Quality Management Strategy

The following QMS will apply to the PIS Upgrade on the DART Class 8500 Fleets:

IÉ CME Department Quality Management Processes have been assessed and certified against ISO 9001, ISO 14001, ISO 50001 and ECM 455/2011. Using CME-QMS-001: Quality Manual CME Department as guidance.

Ikusi have been assessed and certified against ISO 9001 and IRIS Certification Rules: 2017 and based on ISO/TS 22163:2017.

5. Configuration Management Strategy

The Iarnród Éireann Railway Undertaking (IÉ RU) will comply with requirements of Irish and European Law which are applicable to changes in Plant, Equipment, Infrastructure and Operations (PEIO). A PEIO for the PIS will be subject to a safety approval process before they are implemented on DART Class 8500 Fleets.

A PEIO application is controlled through the RU Safety Management System:

RU-SMS-014: Part A is for Safety Approvals of Change in Plan, Equipment, Infrastructure and Operations

6. Risk Management Strategy

Commented [PC17]: Include top Risk, Issues, Assumptions and Dependencies and how they will be managed as part of the project

IÉ CME will use for the RU SMS for safety related risks:

- *Common Safety Method – Risk Evaluation and Assessment (CSM-REA) 352/2009 and 402/2013 or a good industry practice in conjunction with Railway Safety Act 2005*
- *RU-SMS-014: Part A is for Safety Approvals of Change in Plan, Equipment, Infrastructure and Operations*
- *CME-SMS-005: Contractors and Permit-to-Work System*
- *CME-SMS-006: Hazards and Risk Assessments*

A RAG project status dashboard will be used to manage project management risks.

6.1. Key Risks

Ref	Date Raised	Risk Owner	Risk Description	Status	Impact Severity	Likelihood	Established Controls	Status
[R01]	01/07/20	[redacted]	Contract award before end of year 2020, to align with funding approval	Closed	High	Mid	Ensure all components of Tender Process are completed on schedule	Closed
[R02]	01/07/20	[redacted]	Complexity in design leading to delays in beginning of installation process	Open	High	Low	Design reviews and tasks are closed within given timeframe	Open
[R03]	01/07/20	[redacted]	PIS will comply with the requirements of the EU TSI for Persons of Reduced Mobility	Open	High	Low	Appointment for notified body approval	Open
[R04]	18/01/21	[redacted]	Unforeseen technical issues with commissioning of PIS	Open	High	High	Contingency budget included to address issues should they arise	Open
[R05]	18/01/21	[redacted]	Removal of units from service to install all the PIS equipment	Open	High	High	The supplier will undertake installation 1 unit at a time	Open
[R06]	01/06/21	Ikusi	Electronic chip shortage risks delay in shipment of components in 2022	Open	High	Mid	The supplier is working closely with their manufacturers to ensure no delays	Open

6.2. Key Assumptions

Ref	Date Raised	Assumption	Author	Validated By	Date Validated	Status
[A01]	18/01/21	Project member's availability during key milestones in project i.e. installation of head of series, commissioning each unit.	[redacted]	[redacted]	25/01/21	G
[A02]	18/01/21	8500 Fleet availability to complete installation and commissioning	[redacted]	[redacted]	25/01/21	G
[A03]	18/01/21	Achieving key milestones on time in Project Plan i.e. Design Freeze, 1st Article Inspection, Head of Series Installation, etc.	[redacted]	[redacted]	25/01/21	G
[A04]	18/01/21	Supplier delivery times of components.	[redacted]	[redacted]	25/01/21	G
[A05]	18/01/21	Installation of components within given timeframe to return unit to service with PIS in working order.	[redacted]	[redacted]	25/01/21	G

6.3. Key Issues

Ref	Date Identified	Issue	Impact	Owner	Action	Target Date
[01]	18/01/21	RU Safety Approvals Process	High	[redacted]	Submissions to RU Safety Approval Panel to be completed in line with project timeline.	On-Going to Completion
[02]	18/01/21	Location for each component for the new PIS equipment.	High	[redacted]	Site visit to each 8500 series type to perform a detailed survey for each components location. Trial brackets to be designed and fitted to units to ensure they will be fit for purpose.	03/09/21

[03]	18/01/21	Delivery of all PIS components.	High	[redacted]	Delivery schedule of components to align with installation process	24/09/21
[04]	18/01/21	Installation process being completed within projected timeframe.	High	[redacted]	Daily and weekly progress briefings during the installation process.	On-Going to Completion
[05]	18/01/21	Commissioning process	High	[redacted]	End to end commissioning on each unit as installation is completed. Commissioning procedure to be prepared and signed-off.	On-Going to Completion
[06]	18/01/21	System final test sign-off	High	[redacted]	Final system check for all project deliverables	22/07/22

6.4. Key Dependencies

The successful completion of the project is dependent on the following factors. These dependencies will be proactively managed in accordance with the agreed governance processes. Dependencies should be represented on the project plan with a milestone and associated deliverable.

Ref	Date Identified	Dependency	Impact	Owner	Action	Target Date
[D01]	18/01/21	First Article Inspection and Design Freeze	High	[redacted]	Ensure all tasks, documentation and design features are supplied prior to First Article Inspection.	06/09/21
[D02]	18/01/21	Head of Series installation	High	[redacted]	1st 8500 DART to be made available for 6 weeks to Project Team to complete the Head of Series installation and commissioning.	20/09/21
[D03]	18/01/21	Unit availability to complete installation process.	High	[redacted]	Work closely with Project Team and Project Support to ensure units are made available to complete the PIS installation.	On-Going to Completion
[D04]	18/01/21	Commissioning process to ensure a fully functional PIS system is operating.	High	[redacted]	Detailed commissioning procedure to be prepared and followed.	O C
[D05]	18/01/21	RU Safety Approvals Certification	High	[redacted]	Submissions to RU Safety Approval Panel to be completed in line with project timeline.	O C

Commented [PC18]: What controls / meetings apply for Ikusi & Quaestor?

What is the format, agenda inputs and outcomes of each meeting

Include the following (include link to PAG document if necessary):

Requirement to maintain compliance with the Public Spending Code and NTA PAG Gateway Governance and any Hold Points as they apply to the project

Requirements to issue quarterly review report on project status for review with NTA as part of quarterly reviews

Requirement to report updates to project gateway milestone dates

Requirements to submit any required project deliverables and gateway reports for NTA review as part of compliance with NTA Project Approval Guidelines

Requirements to secure NTA Approval in writing for deliverables, hold points and gateways, as applicable, before proceeding with any subsequent project activity

Requirements to provide a project cashflow forecast based on matured liabilities and aligned with payment milestones, approved project gateways or matured liabilities and maintain it aligned with changes to the delivery timeline

Requirement for approval by Project Board and NTA for changes to project scope or cost including contingency call down

7. Communication Management Strategy

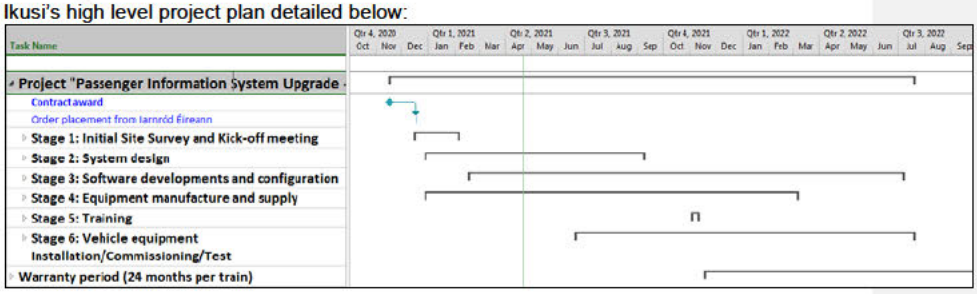
7.1. Communication Method

Group	Information/Agenda	Frequency	Means and format
Project Board	1. Full project status report. 2. Project progress update. 3. Advice on project issues. 4. Submit required project deliverables and gateway reports. 4. Secure Approval in writing for deliverables, hold points and gateways, as applicable, before proceeding with any	1. Period Progress Review 2. Bi-Weekly 3. Ad-Hoc 4. As Planned, on exception	1. Teams Meeting, email proje status dashboard 2. Email, phone call 3. Email, phone call 4. Teams Meeting, presentatic PAG Report

	subsequent project activity. 5. Report project cash flow forecast based on matured liabilities and aligned with payment milestones, approved project gateways or matured liabilities and maintain it aligned with changes to the delivery timeline. 6. Submit for approval for changes to project scope or cost including contingency call down.	5. Quarterly, on exception 6. As required	5. Email 6. Email, Teams Meeting, Report
Team Meeting	1. Design reviews 2. Installation progress/issue report 3. Ad-Hoc discussion on project issues/plan	1. Bi-Weekly 2. Weekly during installation 3. Ad-Hoc	1. WebEx Meeting, email, meeting notes 2. WebEx Meeting, Depot Meeting, email, phone call 3. Phone call, email
Support Team	1. Risk Evaluation & Assessment 2. Design reviews 3. Installation progress/issue report 4. Ad-Hoc discussion on project issues/plan	1. As Req 2. Period Review 3. Weekly during installation 4. Ad-Hoc	1. Teams Meeting, email project status dashboard 2. Email, phone call 3. Depot Meeting, email, phone call 4. Email, phone call
Safety Application	Safety Application Certification for each Phase	As required	Application Submission, Teams Meeting and Presentation of Project
NTA	1. Quarterly review report on project status, report updates to project gateway milestone dates 2. Submit required project deliverables and gateway reports 3. Secure Approval in writing for deliverables hold points and gateways as applicable before proceeding with any subsequent project activity. 4. Report project cash flow forecast based on matured liabilities and aligned with payment milestones, approved project gateways or matured liabilities and maintain it aligned with changes to the delivery timeline. 5. Submit for approval for changes to project scope or cost including contingency call down.	1. Quarterly, on exception 2. As Planned, on exception 3. As Planned, on exception 4. Quarterly, on exception 5. As required	1. Teams Meeting, email project status dashboard 2. Teams Meeting, presentation and PAG Report 3. Teams Meeting, presentation and PAG Report 4. Email, report 5. Email, Teams Meeting, Report

8. Project Plan

Ikusi's high level project plan detailed below:



8.1. Key Milestones

The key milestones for this Band 2 Project are as shown below.

Milestone Ref.	Milestone	Responsible	Planned Date	Approver
G0.031	Approval for Concept Completed	[redacted]	Completed	
G1.01	Approval for Initiation Completed	[redacted]	Completed	IÉ
G2.01	Approval for Planning Completed	[redacted]	Completed	IÉ
M0	Order Placed	[redacted]	Completed	
G3.01	Approval for Procure Completed	[redacted]	Completed	IÉ
G4.01	NTA Approval for Analyse & Design Completed	[redacted]	15/11/2021	NTA
MS1	Go Live Approval	[redacted]	Completed	NTA
G5.01	NTA Approval for Build & Test Completed	[redacted]	15/11/2021	NTA
	1st Article Inspection	[redacted]	24/09/2021	IÉ
	Design Freeze*	[redacted]	31/09/2021	IÉ
	Head of Series Installation & Commissioning*	[redacted]	12/11/2021	IÉ
	OEM User Training *	[redacted]	12/11/2021	IÉ
	PIS Route Editor/Maintenance Software Beta	[redacted]	19/11/2021	IÉ
G6.01	NTA Approval for Deploy / Rollout Completed	[redacted]	29/07/2022	NTA
	Fleet Installation and Commissioning Process (per uni	[redacted]	15/07/2022	IÉ
	Final System Test *	[redacted]	22/07/2022	IÉ
	Test Rig for PIS *	[redacted]	22/07/2022	IÉ
	PIS Route Editor/Maintenance Software Final *	[redacted]	22/07/2022	IÉ
G7.01	NTA Approval for Handover & BAU Completed	[redacted]	22/07/2024	NTA
	24 Month Warranty and Defects Period *	[redacted]	15/07/2024	IÉ
	Capital Spare Purchase *	[redacted]	22/07/2024	IÉ
G8.01	NTA Approval for Benefit Review Completed	[redacted]	22/08/2024	NTA

** Denotes a Payment Milestone*

8.2. Key Deliverables

The following table lists the deliverables that will be produced:

Module	Milestone Ref.	Milestone Description	Deliverable	Acceptance Criteria	Delivery Responsibility	Approval Responsibility	Planned Date
Project	M0.1	Mobilisation Completed	D01: Approved Project Initiation Document	Sponsor Review	[redacted]		
Project	M0.2	Preliminary Review Report Approved	D02: Approved Preliminary Review Report	Steering Group Review			
Project	M1.1	1st Article Inspection	D03: FAT Report	Steering Group Review	Ikusi	[redacted]	
Project	M1.2	Design Freeze	D04: Design Freeze Sign-Off	Steering Group Review	Ikusi	[redacted]	
Project	M1.3	Head of Series Installation & Commissioning	D05: Commissioning Documentation	Steering Group Review	Ikusi	[redacted]	
Project	M1.4	OEM User Training	D06: Train the Trainer	Steering Group Review	Ikusi	[redacted]	
Project	M1.5	PIS Route Editor/Maintenance Software Beta	D07: Ikusi Route Editor Software	Steering Group Review	Ikusi	[redacted]	
Project	G4&5	PAG 4&5	D08: PAG Gateway Report	NTA	[redacted]	Steering Group Review	
Project	M2.1	Fleet Installation and Commissioning Process (per unit)	D09: Fully Functional PIS on 8500	Steering Group Review	Ikusi	[redacted]	
Project	M2.2	Final System Test	D10: End to End Testing of All PIS Deliverables	Steering Group Review	Ikusi	[redacted]	

Module	Milestone Ref.	Milestone Description	Deliverable	Acceptance Criteria	Delivery Responsibility	Approval Responsibility	Planned Date
Project	M2.3	Test Rig for PIS	D11: Test Wall to IÉ Premises	Steering Group Review	Ikusi	[redacted]	
Project	M2.4	PIS Route Editor/Maintenance Software Final	D12: Final Route Editor/Maintenance Software Installed on I E Servers	Steering Group Review	Ikusi	[redacted]	
Project	G6	PAG 6	D13: PAG Gateway Report	NTA	[redacted]	Steering Group Review	
Project	M3.1	24 Month Warranty and Defects Period	D14: Final Acceptance Sign-Off per Unit	Steering Group Review	Ikusi	[redacted]	
Project	M3.2	Capital Spare Purchase	D15: Delivery of Capital Spares to IÉ	Steering Group Review	Ikusi	[redacted]	
Project	G7	PAG 7	D16: PAG Gateway Report	NTA	[redacted]	Steering Group Review	
Project	G8	PAG 8	D17: PAG Gateway Report	NTA	[redacted]	Steering Group Review	

9. Tailoring of PRINCE2

The DART EMU Class 8500 PIS Upgrade will have the following gateways:

Commented [PC19]: Please include the PAG Gateway and Deliverable Tables and populate with the project deliverables for each phase/gateway

NTA Technology Portfolio PAG Delive

Phase 0 Concept – Complete:

IE.19.0008 DART PIS.pdf

Combined Phase 1 Initiation, Phase 2 Planning & Phase 3 Procure – Complete:
NTA Ref: IR.21.21 DART PIS

Project-Funding-Continuance-Form_IR.:

Combined Phase 4 Analysis & Design and Phase 5 Build & Test – In Progress:
With interfaces and nuances of retrofitting an upgraded PIS, both Phase 4 and Phase 5 will be combined.

This will enable the development of software will rely on the devices and connections throughout the DART Local Area Network (LAN). Whilst beginning the installation of the LAN:

- Ethernet Loop
- Inter-car Ethernet Jumper
- Ethernet Switches
- Wireless Unit-Unit Ethernet Jumpers
- Development and Configuration of WLAN

A key milestone in with Ikusi will be the First Article Inspection on a Test Wall of all devices connected to ensure the operation of the PIS, prior to the Deploy and Rollout phase. Planned to be completed in September 2021.

The head of series will be then installed and commissioned on a DART unit, over an approx. 6 week period to ensure the equipment works in its environment. Planned to be completed in October 2021.

Phase 6 Deploy & Rollout – Planned:
Will begin after PAG 4&5 November 2021.

The installation is expected to take 4 weeks to complete 2 units. With all 17 units planned to be completed by June 2022.

A final system check and commissioning is planned to be completed in July 2022.

Combined Phase 7 Handover & BAU and Phase 8 Benefits Review – Planned:
Will begin after PAG 6 August 2022.

Planned to be completed in tandem with RI-SMS-014 Certificate A – Full Operation August 2023. *Note: 12 months is the general accepted period for interim operation*

10. NTA Project Approval Guidelines Deliverables

What are the PAG Deliverables delivered by the project?

This project is an NTA Funded project and will be managed in accordance with the Project Approval Guidelines (PAG). As a number of phases of this project have already been progressed outside of the PAG methodology (Phase 0 – Concept through to Phase 3 Procure) the project will commence the adherence/management to PAG from Phase 4 (Analyse & Design) through to Phase 8 (Benefits Review).

Commented [PC20]: PAG governance came into effect from 1 February 2021 as per NTA Circular Letter NTA/TPI/01/2021 "The Project Approval Guidelines shall be applied to all NTA funded projects from 1 February 2021 The requirements of the Project Approval Guidelines will not be retrospectively applied to existing projects, but it will be necessary to meet the requirements of the Guidelines at the next applicable Gateway

The following table lists the PAG deliverables that will be produced with a rationale for any combined or excluded.

Band 2 Project - Total NTA Funded Project Value below €10,000,000 and greater or equal to €500,000: Deliverables required for Compliance with the NTA Project Approval Guidelines and Public Spending Code				
NTA Deliverable Name	**Project Milestone Reference**	**Project Deliverable Reference**	**Project Deliverable Name**	**Rationale for Tailoring, Combining or Excluding**
ICT Phase 0: Concept				
D0.1 Grant Application Form	MS0	IE.19.0008 DART PIS.pdf	IE.19.0008 DART PIS	
ICT Phase 1: Initiation				
D1.1 Option Selection Report - NTA Hold Point				Not Applicable as phase completed in 2020 prior to PAG Compliance from 01.02.21
D1.2 Indicative Procurement Strategy				
D1.4 Project Initiation Document (PID)				
D1.5 Project Appraisal - NTA Hold Point				
D1.7 Kick-Off Meeting Documentation				
D1.8 Gateway 1 Report				
ICT Phase 2: Planning				
D2.1 Project Plan				Not Applicable as phase completed in 2020 prior to PAG Compliance from 01.02.21
D2.2 Procurement Plan				
D2.3 Preliminary Business Case				
D2.4 Detailed Requirements Specification				
D2.5 Test Strategy				
D2.7 RACI Matrix				
D2.8 Budget				
D2.9 Software Environments Plan				
D2.10 Business Operations Plan				
D2.11 Gateway 2 Report				
ICT Phase 3: Procure - Band 2 Projects				
D3.1 Tender and Contract Documents				Not Applicable as phase completed in 2020 prior to PAG Compliance from 01.02.21
D3.2 Final Business Case				
D3.3 Signed Contract				
D3.4 Procurement Governance Document				
D3.5 Updated Project Initiation Document (PID)				
D3.6 Gateway 3 Report				
ICT Phase 4: Analysis & Design				
D4.1 System Requirements Specification	MS1		Technical Specification & Signed Contract	

Band 2 Project - Total NTA Funded Project Value below €10,000,000 and greater or equal to €500,000: Deliverables required for Compliance with the NTA Project Approval Guidelines and Public Spending Code				
NTA Deliverable Name	**Project Milestone Reference**	**Project Deliverable Reference**	**Project Deliverable Name**	**Rationale for Tailoring, Combining or Excluding**
D4.2 Non-functional Requirements Specification			Risk/Hazard Matrix	
D4.3 Architecture Document	MS1		Electrical Schematics	
D4.4 Functional & Technical Design	MS1		Technical Specification	
D4.5 Test Plan	MS1		1st Article Inspection	
D4.6 Security Design	MS1		Risk/Hazard Matrix	
D4.7 Training Requirements & Support Model	MS1		User and Maintenance Training	
~~D4.8 Privacy Impact Assessment~~	MS1			NA for PIS
D4.9 Update Project Plan	MS1		Project Plan	
~~D4.10 Gateway 4 Report~~	MS1			Combined Phase 4 & 5
ICT Phase 5: Build and Test				
D5.1 Working Software Demos	MS1		1st Article Inspection	Combined with D4.5
D5.2 Test Reports	MS1		1st Article Inspection	Combined with D4.5
D5.3 Release to Production Approval	MS1		Head of Series Installation	
D5.4 Change Advisory Board Request	MS1		If required	
~~D5.5 Go/No Go Decision Paper~~	MS1			
D5.6 User / Operation Guides	MS1		User and Maintenance Training Manuals	
D5.7 Source Code Review	MS1		Head of Series Commissioning	
D5.8 Gateway 5 Report	MS1		PAG	Combined Phase 4 & 5
ICT Phase 6: Deploy/Rollout				
D6.1 Deployed Software	MS2		Installation of remaining 16 units	
D6.2 Production Bench Tests	MS2		Commissioning of remaining 16 units	
~~D6.3 Run Book (Operators Guides)~~	MS2			Covered in manuals produced in D4.7 and D5.6
D6.4 Secure Source Code	MS2		Full System Test	
D6.5 Gateway 6 Report	MS2		PAG	
ICT Phase 7: Handover and BAU				
D7.1 Lesson Learned Document	MS3		LLD	
D7.2 Project Closure Report	MS3		RU SAP Cert A PCR for NTA	
D7.4 Gateway 7 Report	MS3		PAG	
ICT Phase 8: (Post Project) Benefits Review				
D8.1 Benefits Realisation Report	MS4		BRR	

11. Project Budget

Based on the NTA Value Banding for Projects based on total project value, this project is a Band 2 project based on the total project value of [redacted]

Project Costs and Effort Estimates are presented below inclusive of all irrecoverable VAT and Contingency at 15%

Total Project Cost incl Irrecoverable VAT and Contingency @ 15%	[redacted]

Project Cost Breakdown:

7317 - PIS DART - BAFO Analysis				IKUSI - BAFO Cost Analysis		
Item No.	Description	Comments	Qty	Cost Price [BAFO]	Total Cost - ex VAT [BAFO]	Total Cost - Inc VAT [BAFO]
	IÉ CORE PIS REQUIREMENT					
1	Design Fee for Project	To include the Design, and all necessary documentation, Drawings, Schematics, Technical Manuals and details of Specialised Equipment required for the Installation, Configuration, Maintenance and Overhaul of the Passenger Information System Upgrade - DART both Mechanically and Electrically [in line with IE Specification]	1	[redacted]		
2	Complete Material Installation Kit for a DART 4 Car Unit [Set] [Equipment Supply Costs]	To include all materials necessary [installation kits & PIS items] for the installation and interface of the system on and with the Train Unit as per the IÉ Specification.	17			
3	Installation and Commissioning of 1no. DART 4 Car Unit [Set]	1no. Set includes 4 Cars [in-line with IÉ Specification]	17			
4	Software and Equipment Required to Operate & Maintain proposed PIS	To include all software and special equipment/tooling required to maintain and operate the system [in line with IÉ Specification].	1			
5	Training to be Provided to IÉ Staff to enable them operate and maintain the system	All documentation to be reviewed prior to the commencement of training [in-line with IÉ Specification]	1			
6	Capital Spare Parts [Proposed]		1			
	TOTAL - IE CORE PIS REQUIREMENT					
	Additional Cost incurred to meet IE's required Insurance Levels		1			
	Additional Cost incurred to meet IE's Advance Payment Bond requirements		1			
	TOTAL - ADDITIONAL COSTS					
	OVERALL TOTAL - IE CORE PIS REQUIREMENT					
	IÉ OPTIONAL PIS REQUIREMENT					
7	Test Rig for the new PIS System	To facilitate testing, on-going maintenance, fault finding and operational training.	1			
8	Multi-functional Internal Visual TFT Displays [Saloon]	Additional display screens to display information as outlined in Section 6.2 of IÉ Specification	136			
	TOTAL - IE OPTIONAL PIS REQUIREMENT					
	OVERALL TENDER TOTAL					

Contingency @15%

11.1. Payment Profile

Year	Q1 €'000	Q2 €'000	Q3 €'000	Q4 €'000	Total €'000
2020				[redacted]	[redacted]
2021			[redacted]	[redacted]	[redacted]
2022	[redacted]	[redacted]			[redacted]
2023					0
2024		[redacted] (10% Retention)			[redacted]
TOTAL excluding 15% contingency					[redacted]

V.E.M.I.S.A.

Monday, June the 25th.

DETAIL OF WORKS ALONG WEEK 18TH – 22ND, JUNE

In this document we detail works done in sets already upgraded from the 8500 and 8510 fleet, noticing the situation in 2009-2010 (evaluation) and real situation last week:

	EVALUATION	***REAL***
8608	PAU 8508 side, internal screen power supply cabin side, P.A. Central	H3, PAU 8508 side, internal screen power supply cabin side (VEMISA model), P.A. Central
8508	Internal screen power supply 8608 side and internal screen	Internal screen power supply 8608 side (VEMISA model)
8507	Internal screen power supply 8508 side and internal screen	Internal screen power supply 8508 side (EURUNION model)
8607	Internal screen cabin side, P.A. Central	Internal screen cabin side, internal screen power supply 8507 side (VEMISA model)
8613	--	P.A. Central
8513	1 inside screen	Both inside screens
8514	--	--
8614	--	External display (no spares), H4
8615	--	--
8515	--	Internal display 8615 side (not repaired, just checked)
8516	--	--
8616	Internal screen cabin side	Internal screen cabin side (not repaired, just checked), H4 (no spares), frontal destination broken

- "Not repaired, just checked" → material sent to Spain to repair, but it was not broken, so it only was checked to verify correct operation.
- "No spares" → the part is still in the train, but it is broken and there are no spares to substitute it.
- "VEMISA/EURUNION model" → referred to internal/external screens power supplies. Where EURUNION model is working, no substitution. VEMISA model are the new units, under warranty.

Report of journeys "Malahide – Greystones"/"Greystones – Malahide":

Problems in updating screens when the units were coupled and out of time stations announcement were reported. On Monday 18th the list below was done in sets 01-02, 03-04 and 05-06 (already upgraded and needed adjusting):

- Charge in screens line when coupled was configured in the RS485 port to solve screens problems.
- Due to the differences in wheel sizes (error about 10% in the longest route calculated between the smallest and the biggest wheel), the system was configured to assume this error. It was also included an option to modify distance per tacho pulse (now set to 50m).

On Tuesday, 19th, VEMISA personnel travelled with Gavin Doyne from 8:20 to 16:30 in SET 01-02-03-04 along the routes above to check the adjustments were OK.

No failures were detected in the system, but:

- Drivers start the route with the train moving, and not at the beginning. Route must be set in the first station with the train stopped (or in any other station with the "Mark Position" option, but with the train stopped). It is very important to maintain the tacho counter OK and stations are announced in time.
- Drivers start the route, and with the train moving, they use "Mark Position". Every operation dealing with starting routes must be done with the train stopped.
- Drivers select wrong routes. The first and the last stops are the correct ones, but the route does not contain all the stops, so the system does not announce all stops (because the route is the wrong one).

F om [redacted]
Sent [redacted] nouncements on DART on vices
Date Tuesday 2 May 2016 12 37 00
A tachments image003.png
image002.jpg

Thank [redacted]
This s unde stood and unt l the eplacement P S system is funded fo the 50% of the DART fleet that has an obsolete system we will have no cho ce but to live with th s [redacted] and I we e at the Exec last week and the subject of funding the DART PIS was elevated. Hopefully we can get into 2017 funding.

[redacted]
Mechanical Engineer
Iarnrod E reann
Inchicore
Dubl n
D08 K6Y3
[redacted]

From [redacted]
Sent 03 May 2016 09 45
To [redacted]
Sub ect announcements on DART se v ces
Hi [redacted] still ongoing incorrect announcements on DART9, sample attached -
[redacted]

[redacted]

From: [redacted]
[redacted]
Subject: RE: Dail Question No.232
Date: Thursday 17 June 2021 14:11:51
Attachments: image001.png

[redacted]

The PIS is checked on every C exam ,which is every 20,000 kms on the 8100 fleet and every 30,000 kms on the 8500/10/20 fleet or every 60 days or 90 days approx.
The 8500/10 units are more problematic as you know as it is the old Eurounion system which in fairness to [redacted] and his team has kept it going.
I was talking to [redacted] yesterday and he is going to put some costs together . If you want any further information we can discuss it at our meeting tomorrow.

Regards,

[redacted]

From: [redacted]
Sent: 15 June 2021 19:17
To: [redacted]
Cc: [redacted]
Subject: Dail Question No.232

I have been asked to answer a Dail query. The question relates to that favourite topic of DART PIS systems.

To what extent can we answer the query:
Dail Question No: 232

To ask the Minister for Transport the amount Iarnród Éireann spent on improving the quality of audio announcements on the DART in each of the years of 2019, 2020 and to date in 2021; if all announcement systems on the DART are currently in full working order; and the frequency with which the audio announcement system is tested to ensure full working order.

I am not sure if routine maintenance falls under the "improving the quality of audio announcements". Certainly we would not have spent any Capex on DART PIS in 2019 however in 2020 we awarded the big contract to replace the Jap system so I can refer to that. I think I can also state that the audio system is not in full working order hence why we are replacing it

[redacted] – Can you advise any specific costs for 2019, 2020 and to date in 2021 against DART PIS systems or audio announcements (other than the big 2020 capex for 8500) for labour and materials

[redacted] – Can you advise the frequency with which the audio announcement is tested

[redacted] – Will you pull and send to me any previous responses I have given on DART PIS, DART audio announcements, DART information displays etc

I will need by early next week to respond in time

Thanks

[redacted]
Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin
D08 K6Y3
[redacted]

From: [redacted]
Subject: Re: Dart passenger information system
Date: Tuesday 1 October 2019 16:26:47

OK will do so. Regards

[redacted]
Chief Mechanical Engineer
Irish Rail
[redacted]

From: [redacted]
Sent: Tuesday, October 1, 2019 2:57:43 PM
To: [redacted]>
Subject: RE: Dart passenger information system

Thanks [redacted] that. I am pretty sure that we could fund this. Can you get it formalised as a normal project application and we'll process it then. Regards, [redacted]

From: [redacted]]
Sent: 01 October 2019 14:45
To: [redacted]
Subject: Dart passenger information system

[redacted]

The 17 Japanese dart trains (68 carriages) represents nearly 50% of the dart fleet. The passenger information system (PIS) is completely obsolete and largely inoperative on this fleet. The 76 carriage Dart fleet by contrast has a modern system that works well.

The system is a source of frequent customer complaint and public representation and Dail representative submissions. We have developed a specification to completely replace the equipment with a modern system. The cost will be [redacted]. The procurement process if started now would lead to an award of contract in Q3 2020 with the equipment being installed during 2021. I would expect expenditure of [redacted] in 2020 and [redacted] in 2021.

A formal application for funding can be made quickly. If you need more Information please let me know.

Regards

[redacted]

Get Outlook for iOS

Iarnrod Eireann Irish Rail, cuideachta ghniomhaiochta ainmnithe, faoi theorainn scaireanna, claraithe in Eirinn ag Staisiun Ui Chonghaile, Baile Atha Cliath 1, Ur. 119571 Ur. CBL: IE 4812851 O
Iarnrod Eireann Irish Rail, a designated activity company, limited by shares, registered in Ireland at Connolly Station, Dublin 1, No. 119571 VAT No. IE 4812851 O

Tá eolas sa teachtaireacht leictreonach seo a d'fhéadfadh bheith príobháideach nó faoi rún agus b'fhéidir go mbeadh ábhar rúnda nó pribhléideach ann. Is le h-aghaidh an duine/na ndaoine nó le h-aghaidh an aonáin atá ainmnithe thuas agus le haghaidh an duine/na ndaoine sin amháin atá an t-eolas. Tá cosc ar rochtain don teachtaireacht leictreonach seo do aon duine eile. Murab ionann tusa agus an té a bhfuil an teachtaireacht ceaptha dó bíodh a fhios agat nach gceadaítear nochtadh, cóipeáil, scaipeadh nó úsáid an eolais agus/nó an chomhaid seo agus b'fhéidir d'fhéadfadh bheith mídhleathach.

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'.

From: [redacted]
Subject: RE: Maintenance proposal.
Date: Tuesday 3 November 2015 15:34:00
Attachments: image001.png

[redacted]

This is excellent. It might be useful if they were to state that they are the agents of IKUSI in the offer.
Let's get an order in place to proceed once you have this.
Peter

[redacted]
Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin
[redacted]

From: [redacted])
Sent: 03 November 2015 10:19
To: [redacted]
Subject: FW: Maintenance proposal.

[redacted]

Please find attached quote for the repair of the 8520 PIS system from Quaestor.
Regards,

[redacted]

From: [redacted]
Sent: 30 October 2015 14:39
To: [redacted]
Subject: Maintenance proposal.

Hi [redacted]

Further to our meeting on Friday 23rd October 2015, please find attached our quotation to perform a full preventive maintenance programme on the 8520 Fleet.

We would be in a position to commence this work in January 2016.

When convenient, could I please arrange collection of any faulty displays that you currently have so that we can assess the displays in our workshop.

Could you kindly bear with me and I will also send you a list of the new parts that we have here in Quaestor.

Many thanks.

Kind regards,

[redacted]

From: [redacted]
Subject: RE: PQ Referred: 30746/21, for answer 15/06/2021, Written from - [redacted]
Date: Monday 28 June 2021 15:54:17
Attachments: image001.png

It was
[redacted] exactly

From: [redacted]
Sent: 28 June 2021 15:32
To: [redacted]>
Subject: RE: PQ Referred: 30746/21, for answer 15/06/2021, Written from - [redacted]
How much did we pay Ikusi in 2020 for the new DART PIS system. Was it [redacted]

Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin
D08 K6Y3
[redacted]

From: [redacted]
Sent: 28 June 2021 14:58
To: [redacted]
Subject: RE: PQ Referred: 30746/21, for answer 15/06/2021, Written from - [redacted]

Talked to [redacted] and we have finalised the cost. Please see below the breakdown
Materials [redacted]
Labour [redacted]
Total [redacted]
Regards
[redacted]

From: [redacted]
Sent: 28 June 2021 14:46
To: [redacted]
Subject: RE: PQ Referred: 30746/21, for answer 15/06/2021, Written from - [redacted]
Was that material only and no labour?

Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin
D08 K6Y3
[redacted]

From: [redacted]
Sent: 28 June 2021 14:33

To: [redacted]
Subject: RE: PQ Referred: 30746/21, for answer 15/06/2021, Written from - Catherine Murphy
[redacted]
Will send u on the final figure later today as what waiting on Paul to review my draft numbers.
The initial figure based on data from Paul was only €62K
Regards
[redacted]

From: [redacted]
Sent: 28 June 2021 14:16
To: [redacted]>
Subject: FW: PQ Referred: 30746/21, for answer 15/06/2021, Written from - [redacted]
Have you managed to pull these costs together to answer this PQ?
[redacted]
Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin
D08 K6Y3
[redacted]

From: [redacted]
Sent: 15 June 2021 18:48
To: [redacted]
[redacted]>
Subject: FW: PQ Referred: 30746/21, for answer 15/06/2021, Written from - [redacted]
Please see below 2 PQ's (due back for response in 10 days).
[redacted]
Can you advise on **DQ232** please and can you advise on testing etc, would you have these costs or should I go to procurement?
[redacted]
Can you advise on **DQ233** please, you provided information or a similar PQ last year (copy attached FYI).
Thanks
[redacted] Chief Executive, Iarnród Éireann, Connolly Station, Dublin 1, D01 V6V6.
☎ 00 353 1 703 2454 ✉ heidi.reardon@irishrail.ie 🌐 www.irishrail.ie

---

From: ePQ (Transport) [mailto:transport-epq-noreply@cloud.gov.ie]
Sent: 15 June 2021 16:14
To: [redacted]
Subject: PQ Referred: 30746/21, for answer 15/06/2021, Written from - [redacted]
CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.
Both PQs are Deputy Catherine Murphy

PQ 30746/21 has been refered to Iarnród Éireann by [redacted]

Dail Question No: 232

To ask the Minister for Transport the amount Iarnród Éireann spent on improving the quality of audio announcements on the DART in each of the years of 2019, 2020 and to date in 2021; if all announcement systems on the DART are currently in full working order; and the frequency with which the audio announcement system is tested to ensure full working order.

Dail Question No: 233

To ask the Minister for Transport the amount Iarnród Éireann has received from advertisement boards within its stations in each of the years 2018, 2019, 2020 and to date in 2021, in tabular form.

Answer

As the Minister for Transport, I have responsibility for policy and overall funding in relation to public transport. However, I am not involved in the day-to-day operations of public transport.

The issues raised are operational matters for Iarnród Éireann and I have forwarded the Deputy's questions to the company for direct reply.

Please advise my private office if you do not receive a response within ten working days.

From: [redacted]
Subject: RE: PQ Referred: 30746/21, for answer 15/06/2021, Written from - [redacted]
Date: Monday 28 June 2021 15:54:17
Attachments: image001.png

It was
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Subject: RE: PQ Referred: 30746/21, for answer 15/06/2021, Written from - [redacted]
How much did we pay Ikusi in 2020 for the new DART PIS system. Was it [redacted]

Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin
D08 K6Y3
[redacted]

From: [redacted]
Sent: 28 June 2021 14:58
To: [redacted]
Subject: RE: PQ Referred: 30746/21, for answer 15/06/2021, Written from - [redacted]

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Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin
D08 K6Y3
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Inchicore
Dublin
D08 K6Y3
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[redacted]
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Thanks
[redacted] Chief Executive, Iarnród Éireann, Connolly Station, Dublin 1, D01 V6V6.
☎ 00 353 1 703 2454 ✉ heidi.reardon@irishrail.ie 🌐 www.irishrail.ie

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From: ePQ (Transport) [mailto:transport-epq-noreply@cloud.gov.ie]
Sent: 15 June 2021 16:14
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The issues raised are operational matters for Iarnród Éireann and I have forwarded the Deputy's questions to the company for direct reply.

Please advise my private office if you do not receive a response within ten working days.

From: [redacted]
Subject: Re: VEMISA
Date: Tuesday 21 March 2017 18:49:18

Hopefully it will do. I will check with procurement. I will revert

[redacted]

Sent from my iPhone

On 21 Mar 2017, at 11:54, [redacted]ie> wrote:

> [redacted]
> We have received a letter from VEMISA, please see the attachment.
> Please let me know if this letter is sufficient, to allow Quaestor to work on VEMISA PIS Systems on Iarnrod Eireann EMU train sets.
> Kind regards
> [redacted]
>
> ---
>
> **From:** [redacted]
> **Sent:** Friday, March 10, 2017 5:36 PM
> **To:** [redacted]
> **Subject:** Re: VEMISA
> Great thanks
>
> Sent from my iPhone
>
> On 10 Mar 2017, at 16:04, [redacted]> wrote:
>
> > [redacted]
> > We have been in contact with VEMISA by telephone.
> > We have asked VEMISA to define an official relationship between the 2 companies VEMISA and Quaestor, in a letter format on VEMISA headed paper.
> > We have followed this telephone conversation with an email.
> > I will keep you updated.
> > Kind regards
> > [redacted]
> >
> > ---
> >
> > **From:** [redacted]
> > **Sent:** Thursday, March 9, 2017 12:36 PM
> > **To:** [redacted]
> > **Subject:** RE: VEMISA
> > [redacted]
> > Thanks for this. Do you think you can provide a letter from Vemisa advising that Quaestor may act as their agents or similar in Ireland for the repair for DART on board systems
> > Regards
> > [redacted]
> > **Chief Mechanical Engineer**
> > Iarnrod Eireann

Inchicore
Dublin
D08 K6Y3
[redacted]

<image001.gif>

From: [redacted] ie]
Sent: 09 March 2017 11:37
To: [redacted]
Subject: VEMISA

Hello [redacted]
Please see the attachment.
Kind regards
[redacted]

Iarnrod Eireann Irish Rail, cuideachta ghniomhaiochta ainmnithe, faoi theorainn scaireanna, claraithe in Eirinn ag Staisiun Ui Chonghaile, Baile Atha Cliath 1, Ur. 119571 Ur. CBL: IE 4812851 O
Iarnrod Eireann Irish Rail, a designated activity company, limited by shares, registered in Ireland at Connolly Station, Dublin 1, No. 119571 VAT No. IE 4812851 O

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Checked by AVG - www.avg.com
Version: 2016.0.7998 / Virus Database: 4756/14080 - Release Date: 03/09/17

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Version: 2016.0.7998 / Virus Database: 4756/14109 - Release Date: 03/13/17

<Quaestor Vemisa collaboration letter.pdf>

8200 8500 8510 Series

PIS

renewal proposal

V.E.M.I.S.A.
C/Fernández Caro, 44, 28027, Madrid
Tel.: 914077497 – Fax: 914074849
http://www.vemisa.net

V.E.M.I.S.A.

C/Fernández Caro, 44, 28027, Madrid
Tel.: 914077497 – Fax: 914074849
administracion@vemisa.net
calidad@vemisa.net
http://www.vemisa.net

The aim of this document is to suggest the renewal of the Passenger Information System in the units below. In order to maintain screens, public address system and train wiring, only main controller unit substitution is considered.

- ***8200 & 8500 renewal-***

In these two models, the whole controller unit is located near the driver, and it manages all train information system. The idea is to replace this main controller by a tft screen and install a pc somewhere in the driver's cabin, moving the wiring arriving to the current controller to the new pc location. This way, like in 8510 units, we will have the driver's interface to operate the Passenger Information System, and the PC receiving data from the driver and from the train (taco, alarms, gps, public address system).

New controller unit would be composed by:

- 6.4'' VGA tft display (with a touch screen or a trackball).
- A computer running under WindowsXP with a relay card to manage train signals, 2 sound cards for automatic announcement to driver and to passengers and background music, 1 serial port card for the screens, VGA output, LAN connection and USB ports, with a 110Vcc power supply in order to use the train battery.

C/Fernández Caro, 44, 28027, Madrid
Tel.: 914077497 – Fax: 914074849
administracion@vemisa.net
calidad@vemisa.net
http://www.vemisa.net

Simulating the final product, we can show you the real image:

8200 witth 6.5'' touchscreen for PIS control

8200 with 6.5'' display with trackball

8500 with 6.5'' touchscreen

8500 with 6.5'' display with trackball

Difference between the two options:

- Touchscreen: you can manage the system by touching the display.
- Trackball: you need to use the mouse to manage the system.

C/Fernández Caro, 44, 28027, Madrid
Tel.: 914077497 – Fax: 914074849
administracion@vemisa.net
calidad@vemisa.net
http://www.vemisa.net

-8510 renewal-

In this unit the proposal is to change the driver´s screen by a tft display (with touchscreen or trackball) and to change the computer installed inside the cabin by a newer one, running under WindowsXP, and using the same control program as 8200 and 8500. This way, the PIS in the three series will run the same way, but using the particular train condition (different models of screens, taco, gps or not).

New controller unit would be composed by:

- 6.4'' VGA tft display (with a touch screen or a trackball).
- A computer running under WindowsXP with a relay card to manage train signals, 2 sound cards for automatic announcement to driver and to passengers and background music, 1 serial port card for the screens, 1 gps card, VGA output, LAN connection and USB ports, with a 110Vcc power supply in order to use the train battery.

C/Fernández Caro, 44, 28027, Madrid
Tel.: 914077497 – Fax: 914074849
administracion@vemisa.net
calidad@vemisa.net
http://www.vemisa.net

Simulating the final product, we can show you the real image:

8510 with 6.5'' touchscreen

8510 with 6.5'' display with trackball

Difference between the two options:

- Touchscreen: you can manage the system by touching the display.
- Trackball: you need to use the mouse to manage the system.

-Necessary operations-

- Repair devices staying in the units: screens, pa system and alarm system.
- Change the metal front where driver's screen and main controller is now located to adapt to the new system.
- In case of the 8200 and 8500, find a location for the new computer, move the necessary signal wiring and 110Vcc supply wiring.
- Supply the necessary parts.
- Supply the control program (no need of route editor, it will be included).
- Install the new system with the new program.

C/Fernández Caro, 44, 28027, Madrid
Tel.: 914077497 – Fax: 914074849
administracion@vemisa.net
calidad@vemisa.net
http://www.vemisa.net

-Technical data-

6,4'' lcd display.

Open Frame LCD

6.4"

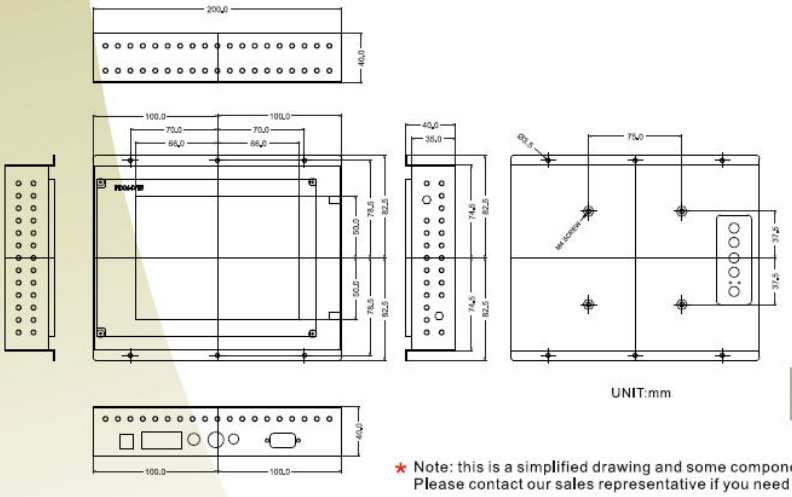
RoHS COMPLIANT 2002/95/EC

Specifications

Model Name	R06T200-OFP1
Viewable Size Image	6.4"
Active Display Area(mm)	129.6(H)x97.44(V)
Pixel Pitch(mm)	0.203(H)x0.203(V)
Number of Pixels	640x480
Contrast Ratio	400:1(typ.)
Display Color	262144(6bit/colors)
Brightness(cd/m²)	400
Viewing Angle(CR>=10)	-50~50(H);-35~15(V)(typ.)
Synchronization Range Horizontal/Vertical	31.5~37.5KHz/60~75Hz
Recommended Resolution	640x480@60Hz, 75Hz
Signal Connector	15 pin D-Sub
Power Source	AC100~240V, Universal, ±10%
Power Consumption	15W typical, normal operation
Power Management	VESA DPMS Compliant
Plug & Play	VESA DDC 1/2B
Optional Video Input	S-Video, Composite
Optional DVI Input	No
Optional Touch Screen	Resistive,SAW

Remarks:R06T200 series= VGA input only
R06T230 series= VGA+Video Input

Mechanical Drawing



UNIT:mm

Rev.	Reasons	Revised Date
1.0	Picture change	Jul-23-09

★ Note: this is a simplified drawing and some components are not marked in detail.
Please contact our sales representative if you need further product information.

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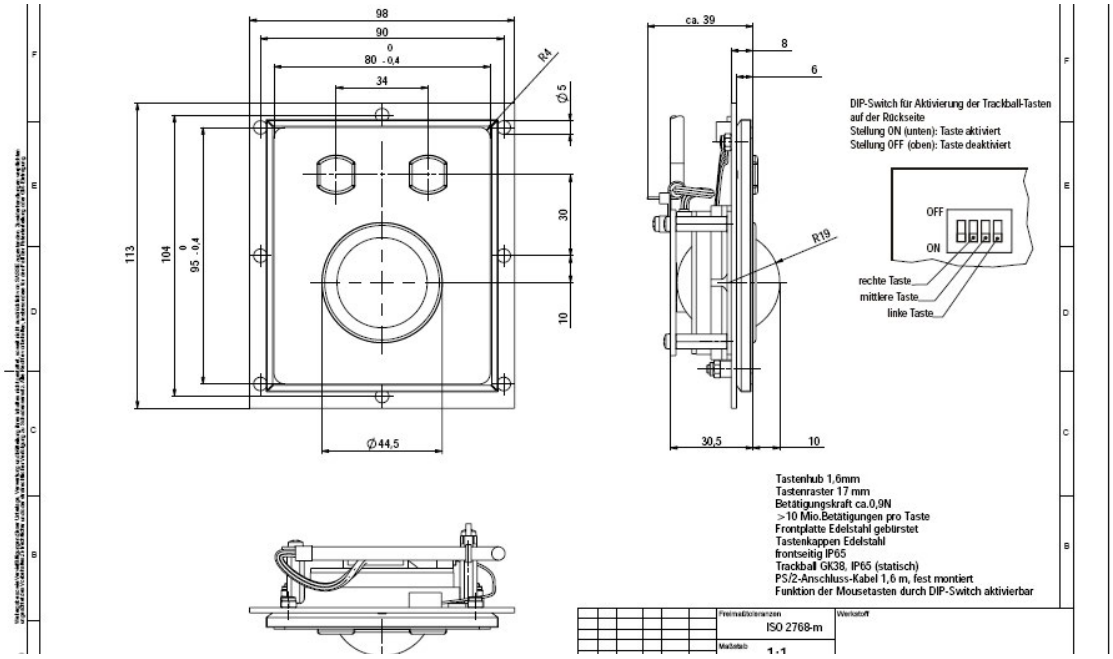
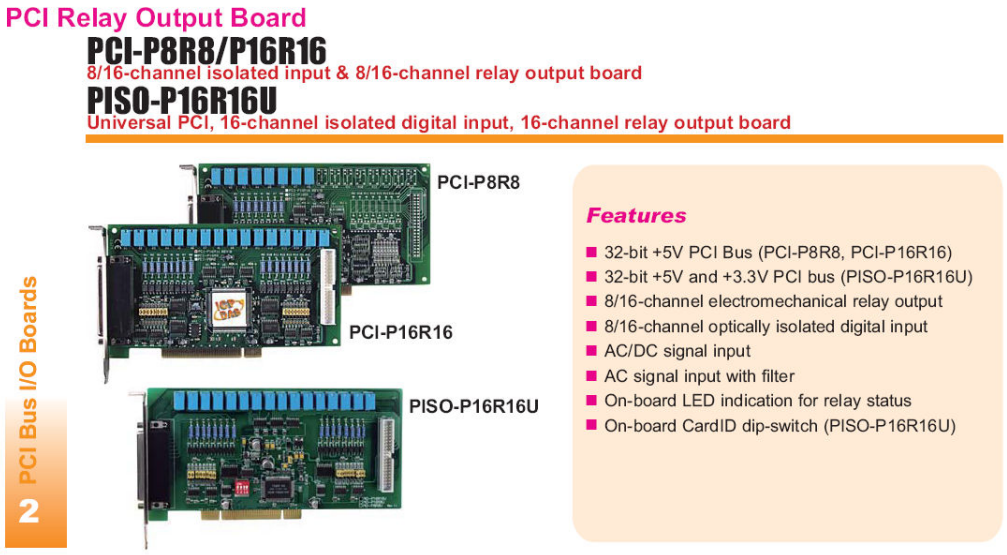
Trackball.



Relay card.



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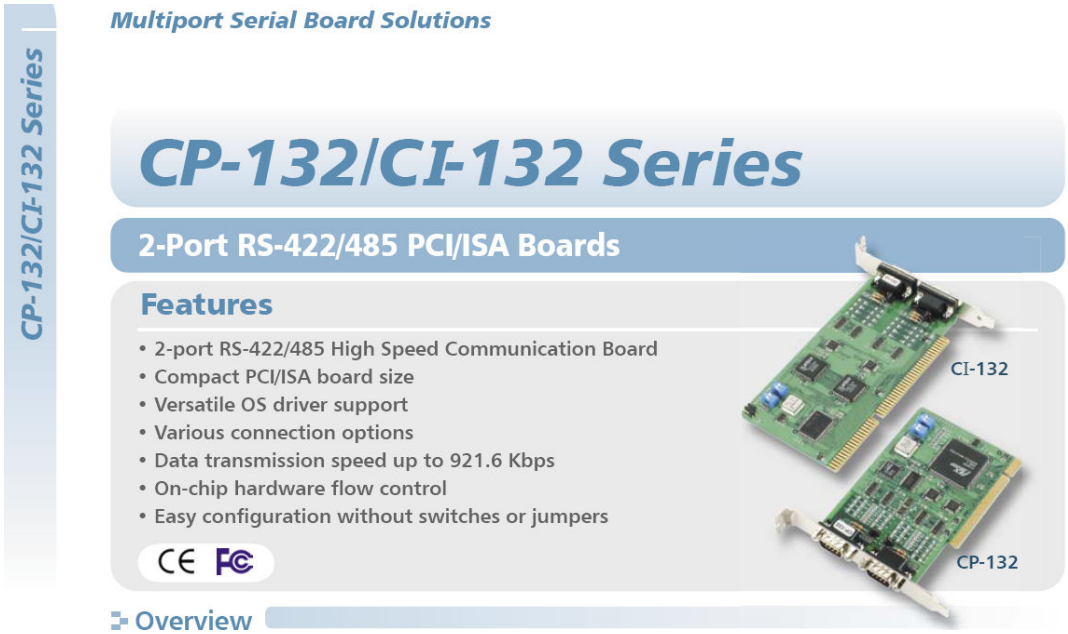
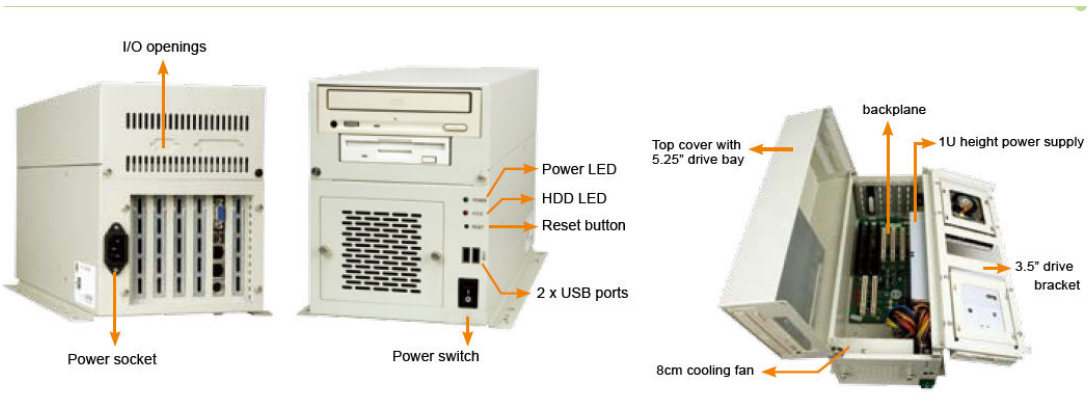
Serial port card.



Computer.



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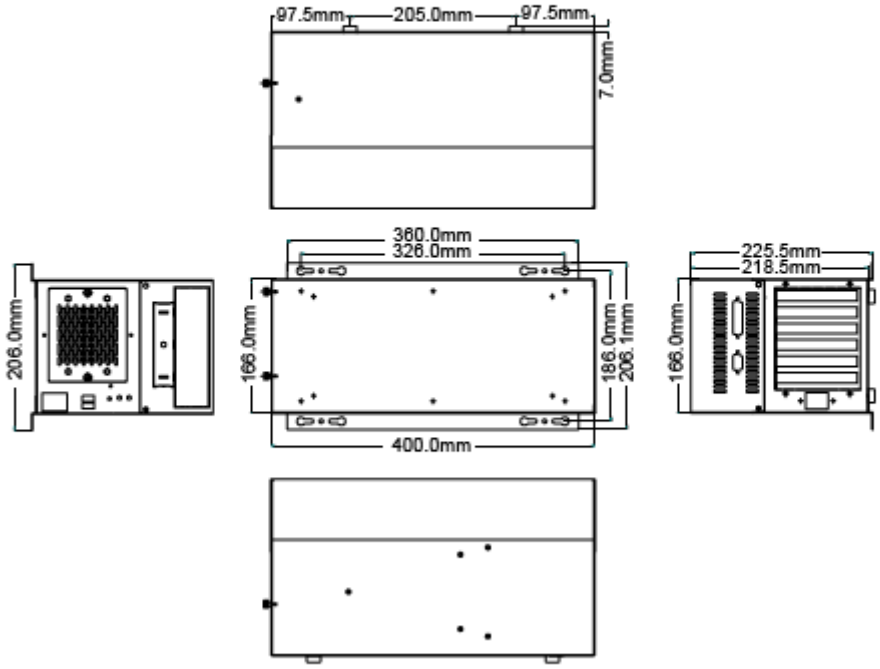
Dimensions



Program functions.

- Route management (selection, edition, updating)
- Automatic announcement in screens and PA managed by taco and GPS (if it exists).
- Background music.
- Test functions to check the system.
- Pre-defined automatic messages.
- Windows environment.
- Upgradable with new functions if necessary.

V.E.M.I.S.A.

25th, June, 2012

REPAIRED MATERIAL STATUS

Here we detail materials status. Expected materials do not include 8200 fleet units cancelled.

Type	Expected	Done	Difference
PI16-5 Screens (internals)	5	9	+4
H3 Driver Alarm	1	2	+1
H4 Driver Alarm	0	1	+1
PAU	3	4	+1
PA Central Bus	0	4	+4
PA Amplifier	1	5	+4
PA logic control	0	3	+3
Booster	0	2	+2
Internal power supplies	5	15	+10

Technical Specification for Replacement Passenger Information Systems

Date: 11th August 2009
Draft 1.2

Iarnród Éireann

Drafted By:				
Checked By:				
Approved By:				

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1 Glossary of terms

AC	Alternating Current
AFILS	Audio Frequency Induction Loop System
AGC	Automatic Gain Control
APN	Access Point Name
ASB	As built (documentation status)
BOM	Bill of Materials
CAD	Computer Aided Design
CAPEX	Capital Expenditure
CAWS	Cab Audible Warning System
C-C	Cab to Cab
CCB	Contractor Compliance Body
CCTV	Closed Circuit Television
CFA	Call For Aid
CIS	Customer Information System (at station)
COP	Code Of Practice
DART	Dublin Area Rapid Transit
DBE	Data Base Editor
dBW	Decibel (power) reference 1millWatt
DC	Direct Current
DMU	Diesel Multiple Unit
DMS	Driving Motor Standard
DNS	Domain Name System
DSP	Digital Signal Processing
DST	Daylight Saving Time, i.e. summer time.
DTS	Driving Trailer Standard
DVA	Digital Voice Announcer
DVD	Digital Versatile Disc
EDGE	Enhanced Data Rates for GSM Evolution
EGNOS	European Geostationary Navigation Overlay Service
EMC	Electro-Magnetic Compatibility
EMU	Electric Multiple Unit
EN	European Norm
ESCROW	Legal arrangement where an asset (e.g. Design data, software) is deposited with a neutral third party with defined condition on the neutral party (e.g. asset is available for use by the beneficiary (IE), with restrictions, upon failure (force majeure, administration, breach of contract, etc) of a given contractor.
EU	European Union
FAI	First Article Inspection
FAT	Factory Acceptance Test (supplier premises)
FDR	Final Design Review
FMECA	Failure Modes and Effects Criticality Analysis
FOT	Front of Train
FTP	File Transfer Protocol
FTS	Fleet Technical Support
GMT	Greenwich Mean Time (UTC shall be taken as the same time for the purpose of this contract)
$GPRMC	Global Positioning Recommended Minimum Data for GPS

GPRS	General packet radio Service, also = 2.5G
GPS	Global Positioning System (Navstar)
GRP	Glass-Reinforced Plastic
GSM	Global System for Mobile Communications, also = 2G
HDOP	Horizontal Dilution of Precision
Hz	Hertz
ID	Identification
IE	Iarnród Éireann
IP	Internet Protocol
IPsec	Internet Protocol Security
ITL	Interfleet Technology Limited
ITT	Invitation To Tender
IVB	Independent Verification Body
LCC	Life Cycle Cost
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LRU	Line Replaceable Unit (individual entity considered for spares)
LTP	Long Term Planning
mcd	Milli-candelas
MDU	Mobile Download Unit
MMI	Man Machine Interface
MOD	Modification
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
MVB	Multi-Vehicle Bus
NAT	Network Address Translation
N/A	Not Applicable
NMEA	National Maritime Electronics Association (America)
NoBo	Notified Body
OEM	Original Equipment Manufacturer
OJEU	Official Journal of the European Union
OLE	Overhead Line Equipment (Catenary and associated equipment that are assumed to be electrified at 1.5kV DC)
OPEX	Operating Expenditure
OR-ed	Logical disjunction, e.g. if ‘A’ or ‘B’ is true, if ‘A’ is true, OR ‘B’ is true, OR if both ‘A’ and ‘B’ are true
PA	Public Address
PC	Personal Computer
PDA	Personal Digital Assistant (hand held PC)
PDR	Preliminary Design Review
PEI	Passenger Emergency Intercom
PIS	Passenger Information System
PISC	Passenger Information System Controller
PoE	Power over Ethernet
PMS	Pantograph Motor Standard
PRM	Persons of Reduced Mobility
PTS	Personal Track Safety (IE certification of competency required for mainline railway trackside duties)
PTT	Push to Talk
RAMS	Reliability, Availability, Maintainability and Safety
RASTI	Rapid Speed Transmission Index

RFID	Radio Frequency Identification
RGS	Railway Group Standard
RIA	Railway Industries Association
RS	Requirement Specification
RSC	Railway Safety Commission
RSS	Real Simple Syndication
RTPI	Real Time Passenger Information
RVAR	Rail Vehicle Accessibility Regulations
SAT	System Acceptance Test (vehicle integrator, depot or on Network Rail line)
SBAS	Satellite Based Assistance Services
SDO	Selective Door Operation
SI	Statutory Instrument
SIL	Safety Integrity Level
SIM	Subscriber Identity Module relating to a GSM device
STP	Short Term Planning (IE update to LTP)
TCF	Technical Construction File
TCP	Transmission Control Protocol
TDR	Train Data Recorder, e.g. TELOC
TFT	Thin Film Transistor
The 'Engineer'	The Project Engineer of Iarnród Éireann, or his/her delegate
The 'Installer'	The company that undertakes the physical installation of the PIS components onto the train including associated wiring.
The 'Contractor'	The 'Contractor' is the entity that will contract with IE and sub-contract (as necessary) with other parties, e.g. the PIS 'Supplier'. The contractor shall be responsible for overall integration of the PIS systems and vehicles. The contractor shall ensure that the clauses within this document are contracted 'back to back' with the PIS supplier, installer and any other sub-contractor. For example, with ongoing support of spares beyond the warranty period the contractor shall ensure that IE receives full benefit of the 'contractor – PIS supplier' contract.
The PIS 'Supplier'	The 'Supplier' is normally the OEM of the major components and undertakes detailed design work such as preparation of customised software.
The 'System'	All components of the PIS and associated systems.
TIPLOC	Timing Point Location code (5 alpha), timing points stations, junctions and signal boxes, etc.
TMS	Train Management System
TSI	Technical Specification for Interoperability
TW	Train Wire
UMTS	Universal Mobile Telecommunications System (3G)
UPS	Uninterruptible Power Supply
UTC	Universal Time Coordinated (GMT with insignificant difference)
V	Volts
VMI	Vehicle Maintenance Instruction
VOI	Vehicle Overhaul Instruction
VPN	Virtual Private Network

VSTP	Very Short Term Plan
WAV	WAVeform audio file Format
WiFi	Wireless Fidelity 802.11b (Internet on-board)
WLAN	Wireless Local Area Network
WMAN	Wireless Metropolitan Area Network
WSP	Wheel Slide Prevention system

2 Introduction

2.1 Document Hierarchy

This document is for technical reference only and any technical response to this document shall conform to all the division of responsibilities and acceptance of risk, with respect to vehicle integration, as well as the contractual terms and conditions listed and detailed in the *Framework Agreement for the Supply of Replacement Passenger Information Systems*.

This Requirement Specification shall be included in full within sub-contracts to PIS OEM's and supplier/s.

2.2 Terminology Used Within This Specification

Within this Requirement Specification, each requirement is stated in the context of 'preferable', 'provision for', 'mandatory' or 'optional'.

'Preferable' means that Iarnród Éireann (IE) will not reject any offer that excludes the preferable item, feature or method; but may increase the score if several 'preferred' items are included in the offer. The words 'preferred', 'preferable', 'may' or 'should' are used in this context.

'Provision for...' means that IE may wish to introduce an item, feature or method in future stages after 'completion of train unit'. It will therefore be expected that certain provisions are included within the base offer enabling minimal impact, re-work and additional cost in the future, the following examples should be observed:

- Space shall be provisioned, e.g. for a modular component a position within a card frame.
- Power shall be provisioned, e.g. DC-DC converter shall have sufficient capacity for the future provision.
- Connectivity shall be provisioned, e.g. spare cables installed; communications capacity for future payloads.
- Software / firmware interfaces shall be provisioned – core software shall be written such that introducing the provision will have minimal impact, e.g. production of new or update of existing to support the introduction of the provision.
- Price – prices for 'provisions' are not required at the time of bid. However, if the provision is required in the future, the price will be considered on the basis of whether it is 'reasonable', judged against these requirements.

'Mandatory' means that the item, feature or method shall be included to be compliant with this specification. Mandatory is signified by the use of the verb 'shall'. Non-compliance with this specification will reduce the bid evaluation score, based upon its significance and weighting. Bidders are advised that some mandatory items such as standards and safety requirements cannot be relaxed and consequently non-compliance would inevitably lead to the bid being rejected.
'Options' are clearly summarised in section 7 of this specification. They shall be individually priced; any issues shall be clarified in the offer, e.g.:

- Whether any individual option has a dependency on any other option.

- Validity in relation to the base offer, e.g. sometimes the business case for an option may not be apparent until a particular design stage is reached.

2.2.1 Clause by Clause Compliancy Statement

This specification and the relevant sections of TSI-PRM shall be acknowledged by a 'Clause by Clause Compliancy Statement', a document that references each individual clause in this specification. The following simple responses are required:

- 'NOTED' – meaning that the contractor acknowledges and accepts parts such as introductions, background descriptions, guidance notes, etc, and has no issue to declare.
- 'COMPLIANT' – meaning the offer fully complies with the requirement wherever a mandatory 'shall' is stated; a brief explanation as to how the contractor achieves compliance shall be provided. Alternatively, the statement 'NOT COMPLIANT' is used. The statement 'PART COMPLIANT' may be used where clarifications are provided.

The sections of TSI-PRM required for the clause by clause compliancy statement are: 4.2.2.3, 4.2.2.6.3.1, 4.2.2.8, 4.2.4 and 5.4.2. However, this does not limit the contractors obligations to comply (as appropriate) with other clauses in TSI-PRM.

2.3 Background

IE operates diverse fleets of rolling stock that have been procured within the past 20 years. Each fleet is fitted with some form of on board Passenger Information System, ranging from basic front of train displays to scrolling internal and side displays with automated multi lingual voice over announcements. This has lead to a multitude of systems – from different suppliers – that are obsolete, not cross compatible, difficult to maintain, and lack support to update them.

A major source of complaints for IE relates to the lack of on board information or to the deficient operation of the PIS. Therefore, IE has identified that there is a clear requirement to replace the multitude of poorly operational systems with a single generic type, providing a modern and reliable solution that has guaranteed support from the manufacturer for the system lifetime.

The purpose of this document is to define the technical requirements for these new PIS systems on the specified rolling stock fleets operated by IE.

The scope of this specification is restricted to the performance, engineering and the engineering documentation aspects of the equipment.

2.4 Fundamental Objectives and Requirements

PIS system installations are to be implemented throughout various Iarnród Éireann EMU and DMU train fleets in accordance with the table provided in section 2.5.1. The key objectives are as follows:

- The contractor shall provide a turnkey solution that includes installation design, vehicle integration and submission of Engineering Change and Approvals documentation to the satisfaction of IE, NoBo and the Railway Safety Commission (RSC).
- A system and installation that complies with both EU and National legislation.

- A common generic design across fleets, with minimal variants.
- Systems that are 'fit for purpose', providing accurate and timely information with good visibility / readability (displays) and good intelligibility (audio), consistently and reliably.
- Information to be inclusive for Persons of Reduced Mobility.
- Minimal future support to be required and 'low maintenance', i.e. simplified database preparation and distribution, self diagnostics and fault reporting.
- Good equipment reliability and long life.
- Good value for money.
- Phased programme of upgrades.
- Retention of existing equipment where it is found serviceable, functional and reliable, e.g. the PA and PEI / Call for Aid components.

2.5 Train Types

This Requirement Specification is generic for all of the fleets detailed. The *Framework Agreement for the Supply of Replacement Passenger Information Systems* will identify the specific fleet/s to be bid for in the ITT. Bidders are required to investigate the entire fleets set out below so their system design concepts are suitable for adaptation to each fleet in the future. Whilst the ITT may be limited to first priority fleets, a bona fide bid shall clearly state any arising future additional costs (e.g. for Engineering) for later ITT's covering other priorities / phases.

Phase 1

8500 EMU – Priority 1		
	Manufacturer	TCC Mitsui
	Year in service	2000
	Quantity	16 Vehicles (4x4)
	Power supply voltage	1500V DC
	Coupler	Dellner
	Formation	DTS + PMS + PMS + DTS
	Cab	Full cab
	Maximum service train length	8 cars
	Gauge	1600mm
	Maximum speed	100 km/h

8510 EMU – Priority 1		
	Manufacturer	TCC Mitsui
	Year in service	2001
	Quantity	12 Vehicles (3x4)
	Power supply voltage	1500V DC
	Coupler	Scharfenberg
	Formation	DTS +PMS + PMS + DTS
	Cab	Full cab
	Maximum service train length	8 cars
	Gauge	1600mm
	Maximum speed	100 km/h

8520 EMU – Priority 1		
	Manufacturer	TCC Mitsui
	Year in service	2003-04
	Quantity	40 Vehicles (10x4)
	Power supply voltage	1500V DC
	Coupler	Scharfenberg
	Formation	DTS + PMS + PMS + DTS
	Cab	Full cab
	Maximum service train length	8 cars
	Gauge	1600mm
	Maximum speed	100 km/h

8200 EMU – Priority 2		
	Manufacturer	GEC Alstom
	Year in service	1999
	Quantity	10 vehicles (5x2)
	Power supply voltage	1500V DC
	Coupler	Scharfenberg
	Formation	DMS+DTS
	Cab	Full cab
	Maximum service train length	8 cars
	Gauge	1600mm
	Maximum speed	100 km/h

2800 DMU – Priority 2		
	Manufacturer	TCC Mitsui
	Year in service	2000
	Quantity	20 Vehicles (10x2)
	Power supply voltage	n/a
	Coupler	Dellner
	Formation	DC1+DC2
	Cab	Part cab
	Maximum service train length	2 cars
	Gauge	1600mm
	Maximum speed	120 km/h

2600 DMU – Priority 3		
	Manufacturer	TCC Mitsui
	Year in service	1993
	Quantity	16 Vehicles (8x2)
	Power supply voltage	n/a
	Coupler	Dellner
	Formation	DC1+DC2
	Cab	Part cab
	Maximum service train length	2 cars
	Gauge	1600mm
	Maximum speed	112 km/h

2700 DMU – Priority 3		
	Manufacturer	GEC Alstom
	Year in service	1997-98
	Quantity	26 Vehicles (13x2)
	Power supply voltage	n/a
	Coupler	Scharfenberg
	Formation	M1+M2
	Cab	Part cab
	Maximum service train length	2 cars
	Gauge	1600mm
	Maximum speed	120 km/h

Phase 2

29000 DMU – Priority 4		
	Manufacturer	CAF
	Year in service	2002-05
	Quantity	116 Vehicles (29x4)
	Power supply voltage	n/a
	Coupler	Scharfenberg
	Formation	DM1+MDT+MT+ DM2
	Cab	Full cab
	Maximum service train length	2 cars
	Gauge	1600mm
	Maximum speed	120 km/h

2.5.1 Fleet Summary

Fleet type	Phase	Priority for Replacement	Architecture	PA/Audio	Number of vehicles	Subtotals per phase
8500 EMU	1	1	1	OK	16	
8510 EMU	1	1	1	OK	12	Phase 1, Priority 1
8520 EMU	1	1	1	OK	40	68
8200 EMU	1	2	1	OK	10	Phase 1 Σ EMUs 78
2800 DMU	1	2	1	OK	20	Phase 1 Priority 2 = 30
2600 DMU	1	3	1	OK	16	
2700 DMU	1	3	1	OK	26	Phase 1 Priority 3 = 42
		Subtotal, Phase 1			140	
29000 DMU	2	4	2	Note 3	116	
		Grand total			256	

Notes:

1. Architecture is discussed in section 2.7.
2. PA / Audio 'OK' means that IE considers the systems to have useful service life. However, the contractor is responsible for evaluating this system to establish that it is suitable for integration and is capable of providing the performance required in this specification.

3. The PA/Audio system is fully integrated with the visual system; therefore any replacement on these units shall include both systems.

2.6 Relevant Fleet Documentation

The following drawings and schematics relating to the fleets are considered sufficient for the purpose of preparing bids. Further information may be available subject to written request to e-mail: louis.gilvarry@irishrail.ie

Fleet	Reference	Description
2600 DMU	C110008952	General Arrangement of Diesel Railcar (DC1)
	C110008953	General Arrangement of Diesel Railcar (DC2)
	520050-020	3 Phase Circuit DC1-DC2
	520050-044	Public Address Circuit
	B130013043	JB, Jumper Connector. Inter Connection Diagram
	B1110168861	Cab End Structure (drawings 1 through 4)
2700 DMU	SPA 06 144 01 075	Public Address System (drawings 1 through 9)
	SPA 06 144 01 077	Destination Indicator (drawings 1 through 3)
	SPA 06 144 01 081	Train Lines (drawings 1 through 25)
	SPA 06 704 07 000 (1/4)	Cabine Lateral Covering (Driver Side)
	SPA 06 704 07 000 (2/4)	Cabine Lateral Covering (Aux. Driver Side)
	SPA 06 704 13 000	Cabin Ceiling Assembly
	SPA 06 703 07 000	Assy Cab Floor Facing
	SPA 06 701 11 000	Bicab Septum Isolation Assembly
	SPA 06 701 07 000	Cabin Isolation
	SPA 06 317 12 000	Cab End Supports Assembly
	SPA 06 332 01 000	Cab End Structure
	E1912X50A01	Ventana Abatible (Hopper Window)
	SPA 06 771 06 000	Window Installation
	E1912X50B01	Ventana Abatible (Hopper Window)
2800 DMU	C110011481	General Arrangement of Diesel Railcar (DC1)
	C110011482	General Arrangement of Diesel Railcar (DC2)
	C130016299	Communication Circuit
	B130016301	Passenger Information Control Circuit
	B130016309	JB, Jumper Connector. Inter Connection Diagram
	B110011472	Driver's Cab Construction (drawings 1 through 6)
	B113-28670	Hopper Over Fixed-Large
	B113-28671	Hopper Over Fixed-Small
	B113-28672	Emergency Window-Fixed
8200 EMU	SPA 18 144 01 043	Public Address System (drawings 1 through 10)
	SPA 18 144 01 044	Passenger Information System (drawings 1 through 4)
	SPA 18 144 01 081	Train Lines (drawings 1 through 15)
	SPA 18 144 02 043	Public Address System (drawings 1 through 10)

Fleet	Reference	Description
	SPA 18 144 02 044	Passenger Information System (drawings 1 through 4)
	SPA 18 144 02 081	Train Lines (drawings 1 through 15)
	SPA 18 332 01 000	Cab End Structure
	SPA 18 704 A2 000	Cab Ceiling Assembly
	SPA 18 772 03 000	Windscreen Assembly
	SPA 18 801 15 000	Lay to Cabin B.T
	SPA 18 801 13 000	Lay to Cabin B.T
8500 EMU	C110011540	Train Formation
	C130016225 1/2	Passenger Information System Circuit
	C130016225 2/2	Passenger Information System Circuit
	B130016320 1/2	Train Lines
	B130016320 2/2	Train Lines
	C136012587 1/2	Shield Wires Grounding Diagram
	B111021474	Cab Framing (drawings 1 through 3)
	B111021475 (1/2)	Cab Framing
	B111021475 (2/2)	Cab Framing
8510 EMU	C110012047	Train Formation
	C130016799 1/2	Passenger Information System Circuit
	C130016799 2/2	Passenger Information System Circuit
	B130016826 1/2	Train Lines
	B130016826 2/2	Train Lines
8520 EMU	C110012888	Train Formation
	B130018030 1/2	Passenger Information System Circuit
	C130018030 2/2	Passenger Information System Circuit
	B130018039 1/2	Train Lines
	B130018039 2/2	Train Lines
	B110012898 (1/2)	Arrangement of Driver's Cab
	B110012898 (2/2)	Arrangement of Driver's Cab
	C115038360	Passenger Information Device Installation
	B132024402	Arrangement of Driver's Cab (drawings 1 through 4)
29000 DMU	C.78.40.001	Hopper Window
	C.78.40.012	Fixed Window
	C.78.33.001.00 1/2	Forward Cover Mounting
	C.78.33.001.00 2/2	Forward Cover Mounting
	C.78.33.002.00 1/2	Forward Cover Assembly
	C.78.33.002 00.2/2	Forward Cover Assembly
	C.78.33.003.01	GPRh Front End (drawings 1 through 4)

2.7 Integration of new PIS system

2.7.1 Existing fleets – Systems Fitted

The equipment already fitted on these existing train fleets is important because this will determine the extent of the system replacement required for the new PIS. Where possible, replacement systems shall make use of existing wiring where confirmed to be serviceable for the life of the train.

Existing visual displays and control system shall be replaced with new. Existing audio systems (PA, PEI, etc) shall be retained wherever possible, this is to be decided during the ITT / bid phase following vehicle surveys by the bidder. The new (replacement) visual PIS shall be designed to interface with the audio communications systems as and where it is retained. *Guidance note: the bidder will be able to conduct any tests they consider relevant on the PIS system during the vehicle surveys, and therefore should bring the appropriate equipment to undertake the tests.*

2.7.2 Existing Fleets - System Architecture

The following descriptions are based on analysis of schematics for each fleet. Bidders shall undertake more detailed investigations to satisfy themselves about the scope and complexity of interfacing and then validate their interface design concepts.

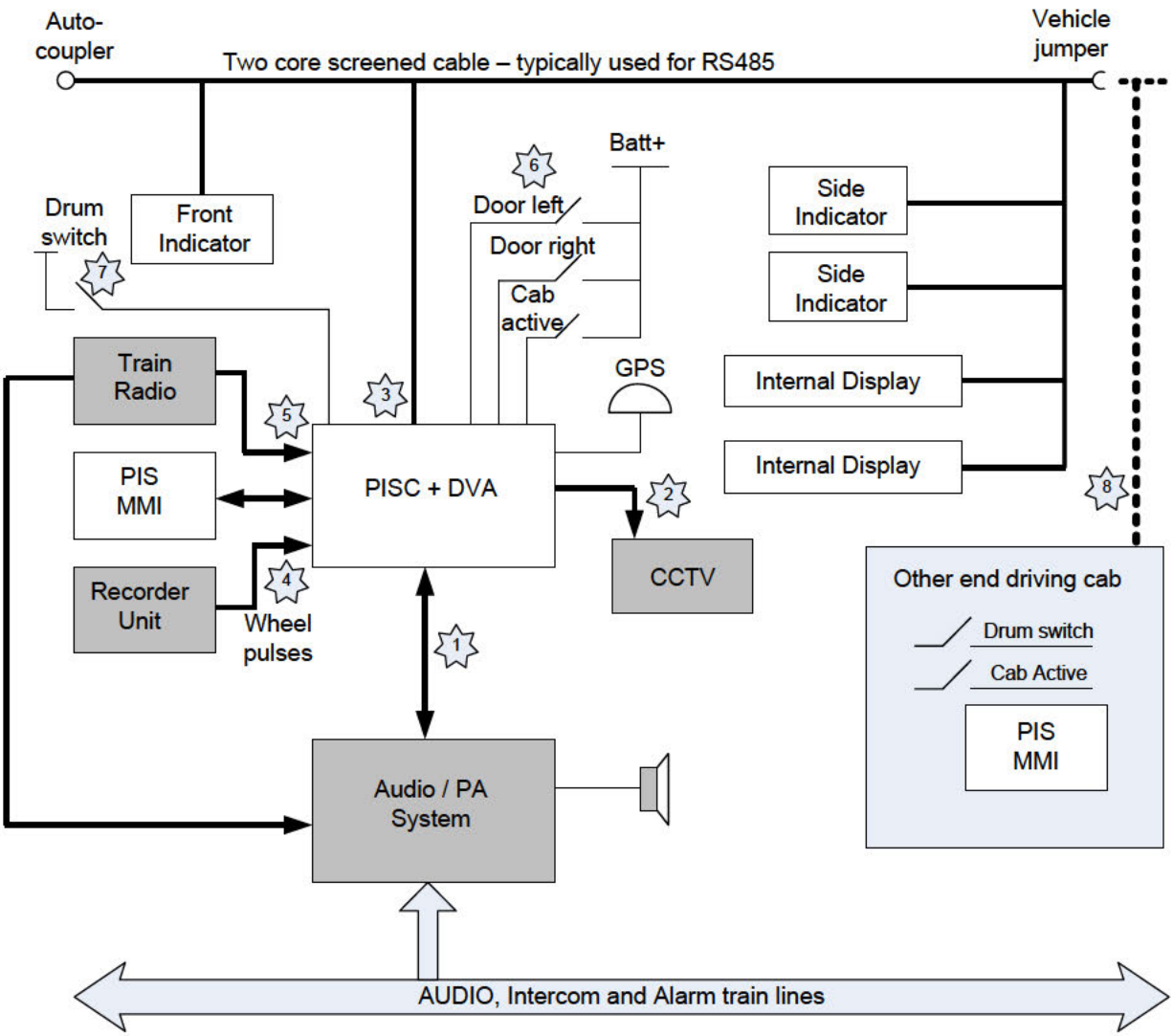
There are two existing architectures, determined by the extent of current integration between the audio system and the visual PIS. Whilst each may be categorised as one of two types, the interfaces of these systems do vary from fleet to fleet and a detailed study is required. The contractor shall be responsible for undertaking this detailed investigation of these interfaces, and validating integration of their system to existing train systems.

Of the listed fleets, the 29000 has a Type 2 architecture where audio and visual systems are fully integrated, the remaining fleets have Type 1 architecture where the systems are generally independent. Refer to the table in section 2.5.1.

PIS systems offered in response to the ITT shall provision for future upgrade of the Audio System (PA / PEI, etc). Where the existing Audio System is deemed to be unserviceable (in agreement with the Engineer) or may prevent the PIS system from being compliant with this specification, then the replacement of the current Audio System shall be proposed as an option within the bid. Under these circumstances the replacement audio communication system shall comply with section 6 of this specification.

2.7.3 Typical arrangement for Architecture Type 1

A diagram illustrating the typical arrangement of new PIS with Architecture Type 1 is provided over the page:



Interface 1 – PIS DVA audio and control interface to Audio System.
The contractor shall identify the existing interfaces and undertake investigations to determine the exact characteristics and requirements.

Guidance Note - This interface is expected to be characterised as follows:

- *Audio from the DVA delivered to the PA system. The signal level may vary from fleet to fleet but the expected range is 100mV to 5V. A source impedance of 20R may be required to drive the train wires, i.e. similar to UIC568. A transformer isolated interface is recommended.*
- *PA enable signal, i.e. when the DVA requests the priority of the Audio / PA system. This is expected to be a volt free relay contact rated for 5V 1mA to 110V 0.5A rating.*
- *PA in use signal, i.e. when this output from the PA system is active, the DVA delays its announcement. This is expected to be an opto-isolated input, capable of operation 5V DC to 110V DC.*

- *DVA abort, i.e. when the PA system is active, the DVA aborts its current announcement. This is expected to be an opto-isolated input, capable of detecting 5V DC to 110V DC. N.B. This may be a signal taken from the PA handset cradle or PTT switch, for example.*
- *Audio input to the monitor speaker in the PIS MMI from the audio system accounting for the facility to independently control DVA originated announcements and mute the monitor when local PA handset PTT is operated, or the cab handset is removed from its stowage point.*

2.7.3.1 Interface 2 – PIS to CCTV

This interface is already provided on some trains, allowing the PIS system to provide time and reference data for the CCTV system. In the future, location reference data shall also be provided. The new PIS shall support the existing CCTV systems by replicating the current interface and in addition make provision for future CCTV replacements using a serial data interface.

Guidance Note – The following observations are made relating to existing interfaces:

> *Where already fitted with compatible CCTV (8510), an interface providing a volt free relay contact closure for 1 sec commencing 1 second before each hour roll over is required, i.e. contact opens to its quiescent state when the hour rolls over. This observation shall be validated by on-train investigations.*
>
> *Provision shall be made for a future standard interface to new CCTV systems. This interface to comprise an RS485 link with PIS as the bus master, recommended data rate 9600b/s, 8, 1, N. The PIS system sending a 1 second poll comprising a NMEA $GPRMC message interleaved with a reply from CCTV containing a CCTV status message. Further special messages (from PIS to CCTV) may be used to replace occasional $GPRMC messages with the following information:*
>
> - *Selected PEI (when activated by the passenger and selected by the driver)*
> - *DST or UTC time mode.*

2.7.3.2 Interface 3 – PIS Data-bus

This interface is provided on existing trains although the type of cable used in each case has not been established. The contractor shall satisfy themselves that the existing cable, inter-vehicle connections and auto-couplers are capable of supporting a reliable new PIS system. This will depend upon the technical solutions to be provided with the new system, i.e. data rates, electrical interface to be used for through train communications. Where the existing arrangements are considered to be deficient, the contractor shall produce a priced option for remedial works, e.g. new cables, new inter-vehicle jumpers, modifications to auto-couplers (changes to pins / pads).

Guidance Note – through train data communications:

> *The contractor is free to choose the most suitable method of communication. It is expected that RS485, at lower data rates (less than or equal to 19.2kb/s) may be viable over the existing interfaces. Given*

that the current interface comprises one pair of wires in most cases (with no common return) and galvanic isolation between equipment and the bus is required, then the master communicating device should produce a line conditioning 'preamble' preceding each new transmit session. Care is also needed to ensure that bus loading is correct in all combinations of multiple units, at the same time maximising current through auto-couplers. Galvanic isolation shall be provided between vehicles, i.e. cable screens shall not be bonded between vehicle chassis.

2.7.3.3 Interface 4 – Wheel Rotation pulses

Wheel pulses are potentially available from the Secheron TELOC (or similar) event recorders fitted to existing fleets and already used by the current PIS / DVA on fleets such as 8510 and 8500.

Fleet	WSP	TELOC (or other make of event recorder)	ATP/CAWS	Other e.g. chopper
8100R	1	2530 (See Note 3)	1	1
8500	1	2200 (See Note 2)	1	1
8510	1	2200 (See Note 2)	1	1
8520	1	2530 (See Note 3)	1	1
2600	1	2200 (See Note 1)	1	0
2700	1	Sepsa Cesis (See Note 4)	1	0
2800	1	2200 (See Note 1)	1	0
29000	1	2530 (See Note 1)	1	0

1 = present, 0 = not present

Note 1: Speed pulse output from TELOC to be made available by moving the existing odometer signal from the transistor output to a relay output. PIS to use transistor output.
Note 2: Speed pulse output used for flange lubrication – a new wheel probe shall be fitted to provide wheel pulse signals to the PIS.
Note 3: Speed pulse output used by existing PIS, like for like changeover.
Note 4: No output available, but upgrade to TELOC planned for late 2009.

Guidance Note – Wheel pulse interfaces:

In the case of 8510 and 8500, the pulses are provided on two wires described as +12V and -12V, the number of pulses, their duty cycle and timing are not known. The contractor is to undertake investigations to confirm voltage, source resistance, isolation, etc. Ideally, the same interface should be specified for other fleets, but it is the contractor's responsibility to communicate with the Event Recorder OEM to establish the capability of each variant across the fleet. Any costs arising from upgrades or modifications required to facilitate this interface are to be identified in a priced option.

In the cases of 8520 and 29000, the schematics indicate that a 'tachometer' or wheel probe is directly connected to the existing PIS

system. The type of wheel probe interface (buffered digital or open collector) is not known. The arrangement is to be investigated.

It is considered feasible for the PIS supplier to design a universal interface that may require basic configuration by PCB links / jumpers to suit each interface variant. The number of pulses per distance travelled is not known but a wide range should be expected. Some systems provide a high pulse rate such as 5000 pulses / rotation if taken directly from a wheel probe. Important characteristics of the wheel rotation interface are the ability to deal with a wide range of pulses, provide galvanic isolation, high impedance load when in parallel with other systems, and high integrity input with no risk of failure modes impacting parallel connected systems. Where wheel probes are uniquely allocated to PIS, it shall have the capability to provide an isolated power supply configurable between 12V to 24V of up to 100mA.

Where a parallel connection is required on a wheel probe and the system is SIL ≥ 1, the contractor shall seek agreement from the supplier of the host system and the Engineer. Note: Flange lubrication is SIL 0. Output to the flange lubrication system from Teloc is a one second pulse for every 300m travelled which may not provide sufficient resolution given the short distances between certain stations

2.7.3.4 Interface 5 – Train Radio

Refer to section 12.3, Appendix 3. It should be noted that IE will upgrade to GSM-R in the future. Where audio system replacements are included, then a GSM-R to PA interface shall be provisioned.

2.7.3.5 Interface 6 – Train Digital Interfaces

The following interfaces are generally required by PIS systems and in most cases will already be available. The design of the new PIS system shall ensure that the interfaces are isolated from safety critical systems by relay contact segregation, if necessary by introducing a new slave relay:

Cab Active (occupied) – this signal is required so that a master PISC can be set to control the train.

Doors open, left/right. In some cases a single input may be provided. This input is activated whenever doors have been enabled for opening.

2.7.3.6 Interface 7 – Drum switch

Some PIS system addressing schemes require to identify the unit position within the train formation. This is sometimes accomplished in combination with the state of the drum switch (auto-coupler cover position).

Guidance Note – Drum Switch interfaces:

In most cases there are no spare relay contacts so the contractor is required to provide a slave relay, where required. The PIS supplier is to

note that in some cases; as many as four units may be coupled into multiple unit formation for passenger service.

2.7.3.7 Interface 8 – Other cab end

The diagram in page 18 shows Interface 8 although this is part of the PIS system. There are several ways of dealing with the PIS controls and interfaces of the second cab within a unit. The PIS supplier must decide the most suitable solution based upon information within this specification and survey of the fleets:

Guidance Note – PIS system structure:

The PISC and DVA are shown as an integrated entity. Some PIS designs duplicate this entity on each train unit by use of identical designs in each driving vehicle (cab). Other systems make use of a single entity, either in just one cab or located within an intermediate vehicle. Where a single entity PISC and DVA is used, the location shall be stated in the offer.

i. *Method 1 – Identical equipment in each cab. Some suppliers use identical equipment in each cab to the extent that GPS receivers and DVAs are all duplicated. There are advantages in having a common design and in some cases this can be put to good use by providing a fallback facility, i.e. available by the duplication of sub-systems. However, this method tends to introduce a cost penalty.*

ii. *Method 2 – Master equipment at one cab end, slave equipment at the other cab end. The controller, GPS receiver and DVA are installed at one end. The MMI at the other end, then, remotely interfaces to the master end. This method is frequently used and has the benefit of minimising cost with just one common PISC and PIS database. The disadvantage is that there is no duplication of subsystems. Also, some PIS suppliers require additional cables and therefore may necessitate additional inter-vehicle jumpers. Availability of door open signal, cab active signal from the non equipped cab requires consideration.*

iii. *Method 3 – The PIS controller is located within an intermediate vehicle. The advantage to this method is that the equipment design of both cabs will be identical and the GPS antenna in the intermediate cab provides a consistent location, regardless of unit orientation.*

Suppliers offering method 1 may be less competitive but offer better availability under the following conditions:

a) *Where GPS/navigation interfaces are duplicated (system in each cab), then the design should include cross checking of the location and be capable of navigating by the location determined from either cab in case of failure of one of the systems.*

b) *Only one communications gateway (GSM modem) is to be used so that IE is only required to fund the OPEX of a single GSM SIM account for each train unit. Where private communication solutions (e.g. WiFi) are used then there will be no restrictions on duplicating the gateway.*

c) *Where the PIS database is stored in both locations,, the on-board system shall ensure that the same versions are installed at both ends*

2.8 Fleet Compatibility

The following fleets are compatible electrically and mechanically, i.e. couple in normal operation:

	8500 EMU	**8510 EMU**	**8520 EMU**	**8200 EMU**	**2800 DMU**	**2600 DMU**	**2700 DMU**	**29000 DMU**
8500 EMU		✓	✓	✓	×	×	×	×
8510 EMU	✓		✓	✓	×	×	×	×
8520 EMU	✓	✓		✓	×	×	×	×
8200 EMU (See note1)	✓	✓	✓		×	×	×	×
2800 DMU	×	×	×	×		✓	✓	✓
2600 DMU	×	×	×	×	✓		✓	✓
2700 DMU	×	×	×	×	✓	✓		✓
29000 DMU	×	×	×	×	✓	✓	✓	

✓ = Compatible ; × = Not compatible

In passenger service, trains may be operated up to eight vehicles. Under extreme circumstances, such as recovery of a failed unit, up to sixteen vehicles may be coupled. Audio communications / PA shall be available with sixteen vehicles connected.

Compatibility shall not be restricted or limited to more than that found between the fleets currently. However, by standardisation on a common design, greater compatibility is anticipated albeit limited by other factors, e.g. auto-coupler design and layout.

Note 1: Although the 8200 fleet is compatible with the specified units, IE's current policy for the 8200 fleet is not to operate with any other units.

Note 2: Class 8100/8300 units are not compatible with any other of IE's fleets.

2.9 Migration Constraints

The impact of PIS upgrades shall be considered at an early stage to ensure minimal disruption to fleet availability during the new PIS modification programme. A Migration Plan shall be devised and the following objectives shall be met:

2.9.1 Coupling of unmodified and modified units in any combination shall not result in the Audio / PA system being disrupted.

2.9.2 The leading unit front, side and internal displays shall function on the unmodified and modified units depending whichever is leading.

2.9.3 Where possible, it is preferable to retain operation of the PIS displays throughout the train. However, it is acceptable for the displays in the trailing units to be 'out of order' as long as they do not show incorrect

information, i.e. they should be set to blank. In order to satisfy this requirement, it is necessary to ensure that unmodified and modified systems - potentially incompatible – can share the same through train data bus without interfering with each other.

2.9.4 Audio announcements shall work as intended from the leading unit driving PA to all other units, i.e. an unmodified leading unit may continue without a DVA by means of manual announcements from the driver.

3 SCOPE OF SUPPLY

3.1 Scope Summary

The scope of supply is outlined below:

3.1.1 Develop a design that will satisfy the requirements set out in this specification.

3.1.2 Survey of the vehicles to identify interfaces (dimensions, fixing points, space envelope, existing cables, etc).

3.1.3 Tests to be performed on existing vehicles to analyse interfaces, e.g. PA and audio communications interface. Validate interface designs.

3.1.4 Detailed analysis of relevant vehicle drawings.

3.1.5 Submit a detailed design package for review and approval by IE.

3.1.6 Engage a NoBo to approve the design.

3.1.7 Supply of 'mock up' samples for each LRU and undertake trial fit to validate design.

3.1.8 Produce documentation to support the Installation Design and NoBo submission.

3.1.9 Provide detailed design documentation to IE for the purpose of design review.

3.1.10 Undertake type and system testing and then provide documentation packs to support design approvals, engineering change and submissions for IE and RSC.

3.1.11 Undertake first of class testing installation, test and commissioning.

3.1.12 Provide an adequate level of well documented training to certify competence of IE staff covering operation, testing and maintenance for each of the following staff: Project / FTS Engineer, operating staff, and maintenance staff. In the case of operating staff, IE will nominate a limited number of persons from their training team who will be responsible for training train crew.

3.1.13 Fleet installation and test.

3.1.14 Warranty support.

3.2 Prices to be submitted with the offer

The following breakdown of prices shall be provided:

3.2.1 PIS Equipment prices – for each fleet.

3.2.2 PIS Equipment prices – for spares, if different to 3.2.1. #

3.2.3 PIS ground system and off train supporting products - price breakdown.

3.2.4 PIS System Engineering, Design Support, Documentation – generic price for common design and documentation and individual prices to customise each fleet.

3.2.5 PIS Systems installation, test and commissioning - for each fleet.

3.2.6 Project Management – priced on the assumption of sequential fleet upgrades.

3.2.7 Special tools – price for tools and test equipment.

3.2.8 Price list for consumables, i.e. replacement flash cards.

3.2.9 Cable harnesses for two test walls (or test rigs) for use in IE depots. See section 4.10 for details on the test wall.

3.2.10 Each of the above shall be referenced in a matrix that clearly identifies the base offer and options detailed in section 7.

3.2.11 Life cycle costs, refer to section 4.6.4.

3.3 Documentation to be submitted with the Offer (Bid)

The following information shall be provided with the bid:

3.3.1 Before PIS equipment can be delivered, all modules (or LRUs) shall be approved, and a factory FAI / FAT test shall be undertaken, using documents including those items marked with #. With prior agreement by IE, the tests may be conducted prior to final system software so long as the hardware can be demonstrated to support the specified functionality.

3.3.2 A brief statement of capability, i.e. a minimum of 3 recent previous project experiences in railway vehicle applications.

3.3.3 Copies of quality approval certificates.

3.3.4 List of subcontractors, including previous project experiences and copies of quality approval certificates.

3.3.5 A clause by clause response to this specification and relevant sections of the TSIs.

3.3.6 Project programme – detailing activities, dependencies, milestone dates, resources and external support / resource required (i.e. IE or other external organisations).

3.3.7 A description of the system offered.

3.3.8 A detailed statement of what is not included in the offer.

3.3.9 A detailed list of equipment offered detailing each Line Replaceable Unit (LRU) and the OEM supplier part number. This list shall identify whether each item is new, modified or exactly as supplied on other projects.

3.3.10 A block diagram for each vehicle class identifying the location of major system components and required train connectivity.

3.3.11 Type test plan – identifying tests needed to confirm compliance with this specification and referenced standards.

3.3.12 A Risk Register identifying any risks (safety, technical, commercial, milestones, etc).

3.3.13 Power budget for the system offered with regard to the impact on vehicle batteries. Clarification of mitigations, i.e. load shed.

3.3.14 Reliability data and overview of anticipated failure modes for the systems offered.

3.3.15 Life cycle costs based upon a 20 year period, which is considered the system life expectancy, with all systems in use. Refer to section 4.6.4.

3.3.16 Define the procedure and any configuration that will be required when changing individual LRUs.

3.4 Deliverables for Preliminary Design Review (PDR)

Where practical, two design review stages will be used; the 'Preliminary Design Review' (PDR) and 'Final Design Review' (FDR). PDR submissions shall become due within 8 weeks of signed contracts. The following activities are to be completed for the PDR stage:

3.4.1 Updates of all documents detailed in section 3.3 above shall be submitted, along with:

3.4.2 Detailed design description – equipment description, functional description, interfaces, etc.

3.4.3 Detailed Project Plan i.e. detailed to show supplier, IE and sub-contractor dependencies.

3.4.4 Detailed drawings for each LRU.

3.4.5 Connector and cable definitions document, connector type, pin / socket types, pin allocations, strain relief arrangements, cable definitions, data-sheets and required tooling.

3.4.6 Type test plan with due consideration of notice periods for witnessing of tests.

3.4.7 EMC plan.

3.4.8 Equipment earth policy statements, e.g. clarifying where screened cable earth bonds are made.

3.4.9 Earth bonding detail drawings for each separate electrical component (LRU).

3.4.10 Reliability and FMECA analysis.

3.4.11 Risk Register update.

3.4.12 IE shall review and comment on the PDR submission within 10 working days of receipt, unless otherwise agreed, the contractor may be required to re-submit as a PDR 2 submission, etc if the submission is deemed unsuitable, in error or inadequate.

3.4.13 Delivery of LRU mock-ups for trial fit, 10 working days following IE PDR approval.

3.5 Deliverables for Final Design Review (FDR)

Documentation originally presented at PDR may be raised to FDR status where the PDR submissions are fully approved or conditionally approved. The following additional documentation shall be supplied at FDR. The delivery of the documentation shall be sequential to allow time for IE to review, which IE shall comment and/or approve within 10 working days of receipt or otherwise agreed:

3.5.1 Type test procedures. #

3.5.2 Type test reports. #

3.5.3 Technical Construction File. #

3.5.4 RAMS information, and detailed FMECA. This shall include method statements of how the RAMS and FMECA have been calculated.

3.5.5 Routine tests specifications. #

3.5.6 Vehicle interface documents.

3.5.7 Comprehensive installation method statements, installation drawings, general arrangements and schematics (or checking of documents provided by the installer).

3.5.8 Evidence of compliance with specified standards. #

3.5.9 Detailed technical descriptions including software design specifications, interface details, design validations and calculations. #

3.5.10 User guides and/or updates to existing driver/crew manuals.

3.5.11 Factory Acceptance Test procedure. #

3.5.12 System integration test procedure. #

3.5.13 Commissioning/dynamic test procedure (for the first train).

3.5.14 Installer commissioning test procedure (routine test).

3.5.15 Maintenance and overhaul manuals.

3.5.16 Service and fault finding manuals.

3.5.17 Training material, e.g. training manuals.

3.5.18 Detailed list of connectors, cables and part numbers, including supplier names and references

3.5.19 Configuration management documentation.

3.5.20 The supplier shall enter into an ESCROW agreement where all manufacturing data, BOM (detailed component level), drawings, artworks, CAD files, software source/execution code, procedures, parameters, protocol specifications, etc shall be deposited. #

3.5.21 Preparation of information/data for RSC for each fleet.

3.5.22 Configuration Management database.

3.5.23 Final mass control document.

3.5.24 Bills of Material for LRUs and any item needing overhaul, i.e. identifying part numbers and suppliers. For example, if a PIS display is manufactured by a third party, or for any component that requires routine replacement.

3.6 Ongoing Document Deliverables (during the Design Phase)

3.6.1 Bi-weekly update of the project programme.

3.6.2 Safety and reliability risk register updates.

3.6.3 EMC plan (reviewed and updated).

3.6.4 Project risk register maintained by regular review.

3.6.5 Minutes of design review meetings.

3.6.6 Type test plan/schedule (including 2-week notification of intention to undertake a type test).

3.6.7 Updates to Configuration Management Database, which shall be submitted to IE whenever a change is made, but also on a monthly basis.

3.7 Document Deliverables (During the Warranty)

Following 'First of Class' acceptance, 'As built' drawings and documentation shall be submitted.

3.7.1 Monthly Report – Analysis to criteria set out in systems performance, fault report, repairs, details, reasons, diagnosis, etc.

3.7.2 Three Monthly – Engineers review of reports – endemic problems, repeated problems and recommended improvements.

3.7.3 Updates to Configuration Management Database, which shall be submitted to IE whenever a change is made, but also on a monthly basis.

3.7.4 Change Request documentation (as and when needed).

3.7.5 Annual – Performance Review.

4 General Requirements

The following General Requirements are suggested by IE, but contractors are advised to familiarise themselves with the vehicles, the operating conditions, and if necessary to undertake additional investigations to validate the vehicle environmental parameters as stated, since the conditions may differ at localised areas within the vehicles:

4.1 Environmental Conditions

The PIS system shall function normally without degradation under all of the following environmental conditions:

4.1.1 Thermal Range

Powered: -25^{0}C to +55^{0}C external to the equipment, i.e. EN50155, class T1.

Operational: -10^{0}C to +55^{0}C.

Storage: -30^{0}C to +70^{0}C ambient

Guidance note: To be demonstrated by dry heat / cold testing. The PIS system is expected to operate normally if powered up after 12 hour pre-conditioning at -10^{0}C. If the system is pre-conditioned at -25^{0}C, then powered up, this shall not prevent normal operation as the temperature rises to -10^{0}C. PIS displays shall be tolerant of solar gain and operating temperatures >70^0 C may prevail on the display screen in combination with the maximum ambient temperature surrounding the display. Type testing should include simulation of sunlight by operating the display for extended periods under halogen flood lights.

4.1.2 Humidity Range: 95% up to +55^{0}C, to be demonstrated by a damp heat cyclic test including temperature change at 30C/minute maximum from -250C to +550C at maintained relative humidity.

4.1.3 Vibration: EN61373 as referenced from EN50155:2007. In addition, individual LRUs to be checked during FAI by visual scrutiny of equipment construction and internal assemblies.

4.1.4 Enclosures: In order to provide compliance with fire / materials standards and protection against dust / water ingress all equipment shall have a minimum ingress protection to IP65, or IP66 if floor mounted. To be type tested in accordance with EN60529:1992.

4.1.5 Contaminants: Heavy interior use applicable to rail environment, e.g. dust with oil particles from diesel engines, conductive dust from brake pads. Salt mist – DART and Commuter services operate along the east coast of Ireland.

4.1.6 Fire: Equipment shall comply with GM/RT2130 or alternative standards as listed in section 11. In the event of fire, internal or external to the

equipment, flame shall not spread and toxic smoke shall not be generated.

4.1.7 Robustness: All equipment shall be mounted to the vehicle in compliance with the structural requirements of GM/RT2100 when installed.

4.1.8 Electrical: The EMU fleets provide an auxiliary battery backed supply of Un = 110V.

The DMU fleets provide an auxiliary battery backed supply of Un = 24V.

Guidance Note: The voltage range, surge and transients are as specified in EN50155:2007. Supply interruptions equal to Class S2 may occur and should not disrupt the PIS system under worst case conditions; this is to be tested at maximum and minimum operating voltages, and with displays filled with characters '8', and then 'H'. Equipment should not be disrupted by 10 milli-second supply interruptions. With longer interruptions, equipment should automatically reset and re-start without manual intervention when the power supply dips below the minimum voltages shown above, for any duration or rate of voltage change.

Inputs and outputs (I/Os) shall also be tested for appropriate surge and transient levels. Direct transients as defined in EN50155 apply to any battery related or referenced circuit. Indirect transients apply to circuits that are isolated from supplies. With the agreement of the Engineer, certain interfaces protected by screened cables may sometimes be excluded from direct transient testing.

4.1.9 EMC: Refer to Section 4.7.10.

4.1.10 Light: Internal lighting levels and arrangements are to be identified by the PIS supplier during a vehicle survey. The internal displays shall be designed to provide optimum contrast and brightness, avoiding reflections from lighting and reflections from LED displays onto ceiling panels.

4.2 Requirements for Electronic Equipment

Electronic equipment shall be designed, constructed, tested, manufactured and documented to comply with EN50155:2007. The contractor shall declare any use of the following items within the equipment offered and state the maintenance / replacement periodicity:

- Fans or other electro-mechanical components.
- Air filters.
- Batteries.
- Internal non self resetting fuses.
- Toxic or hazardous substances.
- Degradable materials.

4.3 Fire Performance

4.3.1 The PIS equipment and materials used for the installation of the system shall be assessed against the requirements of EN45545-2 category A. Alternatively, whilst the European standard remains at draft status, GM/RT2130 issue 1 & BS6853 category 1b shall be used.

4.3.2 The supplier shall ensure compliance to one of these standards so the risk of ignition, construction methods, use of materials, flammability and toxicity are fully considered. The supplier shall provide evidence of compliance to the Engineer to assist with an assessment of the complete installation on each vehicle type. The suppliers shall be required to list all materials that may represent a risk, and the total mass with supporting material data sheets for each product/vehicle.

4.3.3 If the materials within an enclosure are to be disregarded, then the suppliers shall demonstrate (to the satisfaction of the Engineer) fire / smoke containment, i.e. IP65 (or better) sealed enclosures. The contractor is advised that the preferred design of the PIS components will use sealed enclosures.

4.4 Lifetime and Utilisation

4.4.1 Product Lifetime

The product lifetime shall be 20 years from the date of system final acceptance. During this period, the contractor shall continue to support the products and spares shall continue to be available. The contractor shall note clauses 10.4 & 10.5 in this respect.

4.4.2 Fleet Operating Cycle

The vehicles are utilised 20 hours per day and the train power system may be isolated from the PIS displays when the train is shut down. The PIS Controller and Gateway shall use minimal power (less than 15W) if they are required to be kept operational overnight to support software and database uploads for Option 1.

The PIS system shall be available and fully functional within 60 seconds of being powered for operational service.

4.5 Target Mass

The supplier shall produce a 'mass control document'. The mass shall be identified as ‘actual’, ‘calculated’ or ‘estimated’ and the centre of gravity of the mass and its location in the vehicle shall be identified. Entities of the new PIS systems shall be designed for minimal mass. *Guidance note: enclosures for displays, etc are expected to be of aluminium sheet or GRP rather than mild steel.*

4.6 Reliability and Availability

4.6.1 The supplier shall provide reliability data (MTBFs) for each individual LRU and calculated reliability for the complete system to be installed in

each train unit arrangement of each vehicle class. The quoted reliability shall form part of the contract, and warranty obligations shall not be completed until such time as the reliability figure is achieved in service operation. *Guidance note: Contractors are advised that the stated reliability and required maintenance support as demonstrated by the LCC are considered on equal terms as price of the system / installation.*

4.6.2 The supplier shall consider failure modes of the system and associated interfaces and produce an FMECA analysis. Particular attention shall be given to any failure mode that may impact the vehicle and other sub-systems.

4.6.3 The supplier shall maintain a system of recording failures by category, item and serial number. Actual reliability performance shall be monitored during the warranty period as described in section 8.4.5 and any shortfall against agreed target reliability shall be corrected at the suppliers cost by modifications and improvements as part of a reliability growth programme. The procedure for recording, the presentation, and detail of reports shall be agreed with the Engineer. The reports shall be provided at two weekly intervals for the duration of the warranty period. Reliability shall be detailed for each individual fleet, using 12 week averaging periods.

4.6.4 Life Cycle Cost

The contractor shall declare a standard repair charge for each LRU, considering labour and material costs; the standard repair charge shall also include packaging / delivery from depot to repair facility and return. Time to Repair each LRU shall be declared using the assumption that the staff are already in the depot and on-board the vehicle, and considering a rate of €50 per hour. Excluding CAPEX, the contractor shall provide the OPEX over a 20 year period, which is considered the system life expectancy, using 2009 prices.

The contractor shall declare the expected number of Service Affecting Failures (SAFs) per annum per fleet during the warranty period, which is described in section 8.4.5. A SAF is defined as a failure that results in the following:

- A 5 minute delay to service;
- passengers having to be evacuated from a vehicle;
- A unit or train unsuitable to go into service as scheduled or requires being withdrawn from service.

A SAF shall be considered when one or a combination of the following systems is not functioning: PA, CFA, PEI, or Front display of train.

The contractor shall set aside a cost of €500 against each SAF.

4.6.5 The supplier shall state the depot support hours required through to the end of the warranty.

4.6.6 The supplier shall state their maximum response time to any fault reported. *Guidance note: it is envisaged that IE depot staff will provide basic LRU changeover during the warranty period within the agreed number of hours. The supplier is required to indicate their response time for escalation of fault finding and repairs.*

4.7 Interfacing and Compatibility

Interfacing and compatibility issues shall be considered at the earliest stage of design and where necessary any concerns shall be declared on the project risk register.

The contractor shall not degrade any existing on-train system by virtue of any activity or new equipment introduced on the vehicles.

The contractor shall provide full co-operation to other suppliers / organisations working on this and other upgrades. In particular, to participate in interface meetings and trials before and during train installations.

4.7.1 Connectors and Cables

Connectors shall be of robust professional quality with gold plated contacts providing a minimum 500 mating cycles. Examples of suitable multi-pin connectors are the AB Connectors Ltd. ABCIRH range of circular (halogen free) connectors and the Harting M12 crimp pin connector for the Ethernet databus. The mating connector shall include a strain relief and a polariser - so that it is not possible for the connector to be incorrectly mated. Each cable loom and equipment connector shall be labelled with a reference number by an approved and indelible marker. The use of direct soldered or screw-tightened connections is not acceptable. All connector pins / sockets shall use crimps or approved spring pressure contacts. The supplier / installer shall operate a recognised control procedure to maintain the quality of crimp terminations and tools.

All cables shall be of railway approved types, satisfying all materials and flammability requirements.

Particular attention shall be given to avoiding the use of the same connector type and polarisation within the same location unless incorrect mating is prevented, e.g. by cable length or other means. The contractor shall provide two sets of cable harnesses to IE for the production of test walls in two depots.

4.7.2 Electrical - Surge/Transient and Interruption

The surge and transient conditions described within EN50155 are to be used as the base standard for power supply quality. This standard identifies harsh surge and transient characteristics on the train supply and as a consequence on input/output circuits referenced to the train supply. In addition, inputs not directly referenced to train supply may be subject to indirect transients. The train supply may also be subject to interruptions (Class S2 - 10 milliseconds) and to dips below minimum

operating voltage. The equipment shall not be affected by interruptions, surge/transient or extended supply dips. Supply interruptions >10 milli-seconds may cause disruption or total shutdown but the individual PIS system components shall re-start normally when power is restored.

The in-rush current to each LRU shall be kept to a minimum to avoid disruption to the power systems of the train.

4.7.3 Electrical – Load Shedding

When the vehicle batteries are no longer being charged, a system of load shedding shall be provided.

The preferred method requires the PIS displays to blank and enter low power mode at a critical voltage. This software configurable (threshold) voltage shall be in the range 67V to 90V for equipment that operates from a nominal 110V DC supply; 17V to 22V for a 24V DC nominal supply. The PIS displays shall shut down and reduce their power consumption to less than 5W each. The threshold voltage shall have hysteresis (>5% suggested) before the PIS system is allowed to power up.

Alternatively, the load shed arrangement may be provided by a voltage sensing relay, feeding the PIS display supply. Where this non-preferred method is required, the additional equipment shall be included as part of the contractor scope.

4.7.4 Electrical – Galvanic Isolation

The contractor shall ensure that within their equipment, the train supply 0V (and positive) are kept isolated from the equipment chassis and consequently from the vehicle chassis. This isolation shall be tested (100%) at production factory by shorting all train supply referenced connections together and undertaking the following test:

i) Connect the insulation and proof test voltages between equipment chassis and the train supply referenced connections of the LRU.

ii) Insulation test at 500V DC and record the resistance.

iii) Apply 1000V AC (or 1.4kV DC) for 1 minute, i.e. Proof or breakdown test. N.B. This proof test voltage may be reduced to 500V AC for 24V DC powered equipment.

iv) Insulation test at 500V DC and check there has been no degradation in the resistance reading.

v) Perform functional tests; confirm the LRU is operating normally.

This test shall be repeated whenever the equipment is repaired or following significant overhaul.

4.7.5 Electrical – Equipotential Earth Bonds

All equipment enclosures shall be provided with a reliable low resistance connection to a bonding stud, mounted on the vehicle body frame. Contractors are responsible for provision of a connection point on the vehicle. The earth bond cable shall be designed with suitably rated conductors based on the expected range of supply circuit breakers that may be used.

The earth bond on each item of electrical equipment shall be robust comprising a minimum M5 fixing with an arrangement of washers and locking washers. All earth bonds are to be tightened to a torque level specified on the associated drawing and sealed. The resistance across the connection shall also be measured and recorded. The arrangement shall be detailed on a drawing and the Engineer shall approve this prior to manufacture.

Multiple point earth bonds are not permitted as potential differences do occur in the vehicle chassis, particularly between different vehicles. Particular attention shall be given to screened data circuits where normal practice dictates a single point bond. *Guidance note: for EMC purposes the cable may be gapped at a mid point, or the normally open end may be coupled to chassis through a capacitor.*

4.7.6 Vehicle Integration

The following considerations shall be made as part of the installation design:

4.7.6.1 Vandalism

Installations in public areas shall be robust and vandal resistant. The installation and equipment shall have a good cosmetic finish suitable for cleaning by water based cleaning solutions and light solvents for the removal of graffiti.

4.7.6.2 Security

PIS control equipment shall be installed within a secure enclosure requiring a special tool to gain access. Fixtures that may be removed by flat and standard 'star' screwdrivers shall not be used.

4.7.6.3 Safety

The screens of PIS displays shall conform to a glazing safety standard equivalent to that used for vehicle windows, e.g. BS857 or equivalent. Displays and other equipment shall be free from sharp edges so they do not present a risk to staff or passengers in case of an accident.

4.7.7 Mock Up Equipment

One of each LRU item shall be supplied as a mock up sample following design review and approval of space envelope drawings. Mock up LRUs shall be dimensionally accurate and complete with fixing holes, labels, simulated user interfaces, connector shells, earth connections, etc. Following completion of the PDR phase it shall be confirmed, by use of the mock up, that:

a) Each LRU fits into the space allocated using the fixing method intended.

b) The cable looms reach the LRU connectors with surplus length to allow re-work and the bend radius and length of the loom are suitable.
c) Labels are visible when the LRU is installed.
d) User controls, indicators and access are ergonomically arranged.
e) Train crew, representative or management may be consulted about new equipment locations.

The above shall be demonstrated to the satisfaction of the Engineer.

4.7.8 Maintainability

The driver MMIs in the active and non-active cabs shall have the facility to identify and alert PIS system malfunctions affecting normal and accurate delivery of PIS information.

For maintenance purposes, a simple and reliable method of identifying faulty LRUs shall be provided, e.g. via a password protected menu on the MMI. A more advanced facility shall be provided as software to operate on a notebook PC, to be connected to the on train PIS system. Diagnostic software shall operate on the Windows (©Microsoft Corporation) XP operating system. The software shall be user friendly and intuitive to anyone familiar with Microsoft application software, i.e. menu prompts, navigation, etc. All maintenance activities and tools shall be fully documented.

The PIS supplier shall provide details of any automatic testing that their system can provide as an aid to maintenance. In particular, the extent of information provided, and how the maintainer can be notified without involvement of the Train Operator.

It shall be possible to update the PIS system software and database via a single interface, directly accessible to maintenance staff, and without the removal of any equipment. The method of updating shall be proposed by the supplier and agreed by the Engineer. The time from when the maintenance staff uploads the file up to when it has been downloaded and ready to operate shall not exceed 5 minutes.

The total time needed to identify and replace a faulty part, then re-test the whole PIS system shall be kept to a minimum, not exceeding 30 minutes.

4.7.9 Equipment Labelling

A label shall be affixed to each individual LRU and major sub-assembly in a position legible without having to dismount the modules. The label shall include the manufacturer name and telephone number together with the manufacturer's part number, serial number, date of manufacture (for warranty) and MOD strike record numbers. These labels shall be indelible and securely affixed to each LRU. The contractor shall seek approval from the Engineer where it is inappropriate to fit a label for minor / simple items.

Where software, hardware or other configurables (FPGA, ASIC, etc) are used in an item, separate version identification labels shall be used for the modification. In addition to labels, the supplier shall provide details on how software versions can be determined, e.g. by means of an electronic display within or part of the product.

The contractor shall maintain a Configuration Management Database, so that software / hardware and modification status of each product is recorded by serial number with records identifying each supplied item. The system of configuration management, validation and testing for the release of software shall conform to a recognised Quality Management Procedure.

4.7.10 Electro-Magnetic Compatibility

The contractor shall ensure that the PIS system is suitable for use on all of the intended vehicles, having full compatibility with existing vehicle and train systems. Any requirements necessary to maintain the suppliers EMC certification shall be stated in the offer.

The contractor shall provide the Engineer with all the evidence necessary to demonstrate compliance with the EU EMC directive (2004/108/EC) and all associated EMC standards. A Technical Construction File shall be provided. Evidence of compliance to BS EN50121-3-2: 2006 shall be included.

Existing evidence cannot automatically be assumed to be adequate for the purpose of ensuring compliance of the complete vehicle installation. The evidence itself shall be independently reviewed by a competent body against the vehicle installation and system requirements. It must be noted that the outcome of any review may require the supplier to repeat tests or conduct additional tests and consequently modify designs where discrepancies arise.

4.8 Documentation

All stages of the project life cycle operation shall be supported by appropriate documentation. The contractor shall provide instructions suitable for incorporation into the existing vehicle documentation. These shall be produced using 'Microsoft Word' and provided in both printed and electronic format. Drawings provided by the contractor shall be provided in .dsn or .dfx format. The outline requirements in EN50155:2007 section 11 shall be used.

4.9 First Article Inspection

Before the shipment of PIS equipment commences, IE requires to undertake a First Article Inspection (FAI) and Factory Acceptance Test (FAT) at the supplier’s works. Normally, FAI and FAT are combined in the same supplier visit.

4.10 Integration Test Facility

The supplier shall establish a factory integration test facility (or test wall). This integration test facility shall be wired as the train, using the same cable types, and equivalent cable lengths. The test facility shall be assembled as one complete train unit of PIS equipment to support FAT tests. Full train rakes of 16 vehicles shall be simulated by cable length and loading of transmission circuits. Following FAT acceptance, a reduced test facility shall be agreed and the basis of it being sufficient to support software modifications or problem investigations. A block diagram of the proposed integration test facility, identifying where it will be simplified following FAT shall be submitted for approval by the Engineer.

The integration test facility shall be completed in time for the start of software testing by the contractor and shall remain intact for the warranty period and

preferably thereafter to support ongoing maintenance / repairs. Refer to sections 8 and 9.3.1.

4.11 Factory Acceptance Test

The integration test facility shall be used by the supplier for proving the system and its associated software. The Engineer will participate in a Factory Acceptance Test (FAT) to be satisfactorily completed before material deliveries commence.

Any subsequent changes to software within the system shall include a complete or partial repeat of the integration test procedure.

The Engineer shall be given a minimum two weeks notice of intent to undertake any FAT test. Where partial testing is proposed, following minor software change, the extent of re-test shall be agreed with the Engineer.

5 Particular requirements – Passenger Information System

5.1 Displays

5.1.1 Displays – general requirements

5.1.1.1 A limited range of standard displays are preferred. *Guidance note: Standardised internal and side displays may be possible but at least two variants of front display will be required. The standard designs may be adapted to each vehicle by means of customised fixing brackets.*

5.1.1.2 LED technology is preferred but alternatives will be considered if benefits can be demonstrated. The contractor shall demonstrate that the choice of LED component is based upon performance and reliability rather than least cost. *Guidance note: LED supplier details and datasheet should be provided during PDR.*

5.1.1.3 Displays shall comply with TSI-PRM, some requirements are reiterated in the following clauses 5.1.1.4 to 5.1.1.10. *Guidance note: TSI-PRM sets out the requirements in European law and as adopted in Irish Law. The contractor is required to obtain certification of compliance from a NoBo.*

5.1.1.4 Displays shall be capable of displaying messages in both English and Irish languages. *Guidance note: by cycling between the languages at user configured timed intervals.*

5.1.1.5 Displays shall be capable of displaying all the set of characters for the Irish Gaelic Language as established in the Irish Standard Specification for '*Information Technology – Irish 7-bit Coded Character Sets*' (I.S. 433:1999), and in the '*Information Technology – 8-bit single-byte coded graphic character sets*' (ISO/IEC 8859-15:1999).

5.1.1.6 Displayed characters shall be yellow in colour set against a dark background to provide a high contrast.

5.1.1.7 Scrolling text shall not exceed a rate of 6 characters per second and the longest station name shall be completely visible for a minimum of 2 seconds. *Guidance Note: Scrolling text is defined by the text entering the display area from the right hand side and smoothly scrolling to the left of the display. The scroll repeats when the end of the text string exits the display area at the left, or there is a defined space between successive scrolls.*

5.1.1.8 Rolling text shall persist as static text for a user defined period between 2 seconds and 10 second resolved in 0.5 second increments, the roll transition shall be user defined between 0.1 sec and 1 sec in 0.1 sec increments. *Guidance note: rolling text is defined by new text entering the display area from below as old text exits the display area at the top. Rather than substituting new static text for old text, the roll transition provides the illusion of a rolling display since both old and new text is momentary visible with a normal line width between the bottom of old text and the top of new text.*

5.1.1.9 Sans Serif fonts shall be used in mixed case. *Guidance note: the contractor to make both upper and lower case characters available. Typical fonts are: Arial, Helvetica, and Verdana. IE will ensure correct application of mixed case.*

5.1.1.10 Font descenders shall have a minimum size ratio of 20% compared to capital characters.

5.1.1.11 Fonts shall preserve normal horizontal and vertical proportionality, i.e. the matrix horizontal /vertical ratio shall be 1:1 +/- 10%.

5.1.1.12 The horizontal width of the displays shall be calculated based on the scrolling of the largest station name identified for each display, satisfying the TSI-PRM, based upon actual scrolling rate, and 2 seconds full visibility of the longest station name. *Guidance note: Refer to Appendix 4 for a list of the station names on the Irish rail network, in both English and Irish.*

5.1.1.13 The text in the Irish Language shall appear first.

5.1.1.14 The text in the Irish Language shall not be less prominent, visible or legible than the text in the English Language.

5.1.1.15 A word in the text in the Irish Language shall not be abbreviated unless the word in the text English Language, of which it is the translation, is also abbreviated.

5.1.1.16 It shall be possible to modify or substitute the display fonts individually for each display type, i.e. remotely from the PISC or preferably from the ground system using the Option 1 (Communications Gateway).

5.1.1.17 Displays shall be environmentally sealed to a minimum of IP65.

5.1.1.18 Displays shall be rated under the worst extreme of all conditions set out in section 4 for continuous operation (12 hours) with the display matrix filled with the character '8' in every available character position of the display. The 'worst' condition includes maximum sunlight level, i.e. operating the LEDs at maximum brightness.

5.1.1.19 Displays shall include thermal protection to limit internal temperatures to be within the component ratings. However, thermal protection shall not adversely affect the availability or performance of the display. *Guidance note: External displays in particular may be subject to solar gain with a risk of poor reliability. Protection may be invoked only under extreme direct sunlight conditions with small reduction in LED output, e.g. by pulse width control.*

5.1.1.20 The display shall include a controller, i.e. a micro-controller to service the display, the communications interface, etc.

5.1.1.21 If the communications link between the PISC (central controller) and the display is lost or fails for more than 120 sec, the display controller shall blank the display.

5.1.1.22 The display controller shall have the capability to be reset by the PISC.

5.1.1.23 The display controller shall incorporate several test patterns for the purpose of testing individual LEDs during a 'walk through' check. *Guidance note: the patterns should allow individual LED failure and short circuits between adjacent LEDs to be identified. A polka dot pattern or moving vertical block is often provided.*

5.1.1.24 It shall be possible to instruct displays to show their serial number, firmware, and font versions. This feature shall be activated from the MMI maintenance menu.

5.1.1.25 The installation of the displays shall make maximum use of the available window space; consideration for tolerances shall be made to avoid parallax affecting the display readability.

5.1.1.26 The displays shall be capable of displaying the station names as listed in Appendix 4.

5.1.1.27 The following quality accept/reject criteria shall apply to displays:

a) At SAT (first installed):

i) All LEDs/pixels shall be working. Flashing or flickering LEDs are not acceptable.

ii) LEDs shall be colour and intensity matched with no adverse variance.

iii) LEDs/pixels shall be horizontally and vertically aligned and consistently spaced.

b) At the end of the warranty period:

i) Front of Train (FOT) displays: Up to 0.1% (rounded up to integer value) total LEDs may be accepted as failures due to intensity or colour mismatch. However, they shall be randomly placed and two failures shall not be within five pixels (horizontal or vertical).

ii) Side and internal displays: Up to 0.05% (rounded up to integer value) total LEDs may be accepted as failures due to intensity or colour mismatch. However, they shall be randomly placed and two failures shall not be within five pixels (horizontal or vertical).

iii) Flashing and flickering LEDs are not acceptable.

iv) Average intensity shall not have reduced since SAT by more than 5%.

v) LED/pixel alignment shall be maintained.

5.1.2 Front of Train Displays

Up to three different Front of Train display variants may be required, referenced as follows:

FOT 1 – for the 30% width cab windows of the 2600, 2700, and 2800 units.

FOT 2 – for the 50% width cab windows of the 8510, 8520, and 8500 units.

FOT 3 – full width as 8200 and 29000 units.

Displays FOT1 and FOT2 shall be capable of operating either single line or two lines of text, but FOT2 shall be larger in size to suit available space. Display FOT3 shall be single line only.

5.1.2.1 Front of train displays shall be installed into the location presently occupied by a destination display, i.e. shall replace existing electronic or roller displays.

5.1.2.2 The display enclosure shall be semi-matt black in colour to enhance contrast of the display area when viewed through the cab window.

5.1.2.3 During installation of the display, the inside of the cab or display window shall be cleaned.

5.1.2.4 The display shall be sealed by a rubber gasket to the internal cab window to prevent dirt accumulating on the inside face of the cab window.

5.1.2.5 The display enclosure shall be designed to prevent internal condensation. *Guidance note: displays fitted to external windows may be subject to rapid temperature change, a pressure equalisation valve or similar may prevent internal condensation within the sealed display enclosure.*

5.1.2.6 The display vertical resolution shall be 16 LEDs minimum per line of text. *Guidance note: FOT3 minimum 16 LEDs, FOT1 and FOT2 minimum 32 LEDs with two LED rows space between lines.*

5.1.2.7 The horizontal width of the display shall be in accordance with the maximum available window space and the largest station name (abbreviated) for the purpose of TSI-PRM. See Appendix 4 for the station names in the Irish network..

5.1.2.8 The preferred character height (capital) is 150mm, the minimum acceptable height is 70mm. *Guidance note: Where space permits, particularly on FOT3 display, the largest possible size approaching 150mm should be used.*

5.1.2.9 The displays shall include at least four different fonts of different height and different line widths. Within each font set, six configurable graphics shall be provisioned – two spares, the IE logo, LUAS logo, DART/Commuter logo, and an aeroplane symbol. *Guidance note: the line width is sometimes termed single strike, double strike, etc. The smallest*

font would be 70mm and single strike, i.e. one LED line width. The largest preferred font is 150mm and the line width is two or three LEDs.

5.1.2.10 The largest font may exclude the Fada (accent) above capital characters, but the Fada shall be produced on the small character fonts and all lower case characters where sufficient vertical space is available.

5.1.2.11 Text displayed as static or rolling text shall be automatically centralised. For FOT1 and FOT2 displays it shall additionally allow for single or two line operation. *Guidance note: large stations names could be broken down into two lines, e.g. Gabhal Bhinn Eadair/Domhnach Mide can be divided as: 1st line: Gabhal Bhinn Eadair/, 2nd line: Domhnach Mide.*

5.1.2.12 The display controller shall perform a 'best fit' algorithm, i.e. using the largest font for the size of text. In the case of FOT1 and FOT2 the 'best fit' algorithm shall include operating the display in single or two lines. Where single is used, it shall be vertically centred allowing the use of the largest fonts.

5.1.2.13 It shall be possible to override the best fit algorithm by commanding the use of a specific font or use of lines within the message, as configured within the Database Editor.

5.1.2.14 The display shall be visible in sunlight and with dirt accumulated on the external face of the cab window. Each LED shall have a minimum incident intensity of 2000mcd at full display brightness. *Guidance note: The design should account for sunlight and performance shall be demonstrated to the satisfaction of the Engineer during the PDR stage. Operating the LED brightness at a higher level to overcome the dirt accumulation is a preferred solution.*

5.1.2.15 Automatic LED brightness adjustment shall be provided, proportional to average external ambient light level. The control system shall measure an average ambient level over the preceding three second period. This adjustment shall limit the lower brightness level to a configurable minimum value; adjustment shall be continuously variable or have a minimum of ten steps to the maximum brightness level. *Guidance note: front windows of the train, and in particular intermediate coupled cab windows are infrequently washed. A small light sensor in the non-drivers side wiper swept area of the front cab window is a preferred solution to metering the correct external ambient light level.*

5.1.2.16 Front of train displays located within intermediate cabs of coupled multiple units shall be blank, i.e. no displayed messages other than display test messages. Only the front and rear displays of the full train shall be fully operational.

5.1.2.17 The display viewing angles shall be a minimum 100º (horizontal, inclusive angle) and 90º (vertical, inclusive angle) for >50% intensity referenced to the incident LED light output level.

5.1.2.18 The display controller shall support command or 'scripting' within text messages sent by the central PISC allowing complex sequences of

messages to be joined together using different delays and text display modes. Text message lengths may be up to 500 characters. At least six configurable phases shall be available. The following examples illustrate the requirement:

a) [roll up] <Irish station name> [delay 4 seconds] [roll up] <English station name> [delay 4 seconds], loop back to Irish station name.

b) [static text] <Irish station name> [delay 4 seconds] [static text] <English station name> [delay 4 seconds], loop back to Irish station name.

c) [scroll] <long Irish station name> {when scroll completed} [scroll] <English station name> {when scroll completed}, loop back to Irish station name.

d) [roll up] <Irish station name part 1> [delay 4 seconds] [roll up] <Irish station name part 2> [delay 4 seconds] [roll up] <English station name part 1> [delay 4 seconds] [roll up] <English station name part 2> [scroll] <long Irish special message> {when scroll completed} [scroll] <long English special message> {when scroll completed}, loop back to Irish station name (beginning).

When FOT1 and FOT2 displays are used in two line mode, the transition of both lines shall be synchronised.

Guidance note: Sequence a) is the preferred method of application. The 'static text' transition of sequence b) is an instantaneous change of text. Sequence d) is an improbable application but the example is given to illustrate what is meant by six phases. The text display mode (static, scrolling or roll), and the delay between each text message phase are configured from the Database Editor. Fonts, transition times (scroll and roll), use of single or both lines are to be configurable by remote uploading of software by maintenance technicians.

5.1.2.19 Upon power up, the display shall perform a self test taking no longer than 5 seconds and then display the IE logo for 30 seconds. If so commanded by the PISC, it shall display alternative messages immediately following self test.

5.1.3 Side Displays

5.1.3.1 Side displays shall be installed into the upper portion of an existing large window. *Guidance note: in order to use large hopper windows, the opening hopper section should be removed, ideally non-hopper (large) windows will be used.*

5.1.3.2 Commuter trains shall be fitted with two side displays per vehicle side, using the nearest large windows to the doors. *Guidance note: emergency windows shall not be used.*

5.1.3.3 DART trains shall be fitted with two side displays per vehicle side, using the nearest large windows to the doors. *Guidance note: emergency windows shall not be used.*

5.1.3.4 The display enclosure as viewed from the outside of the train shall be semi-matt black in colour in order to enhance contrast of the display area when viewed through the vehicle window. *Guidance note: fixtures, cables, etc shall not be visible under all external lighting conditions.*

5.1.3.5 During installation of the display, the inside of the window shall be cleaned. *Guidance note: to satisfy the requirements of good contrast, consideration may be given to the application of a tint film on the inside of the window area to be occupied by the display.*

5.1.3.6 The display shall be sealed by a rubber gasket / seal to the window to prevent dirt accumulating on the inside face of the window. The display shall be installed such that light pressure is applied between seal and the window thus maintaining a seal and preventing vibration noise from the display / window interface.

5.1.3.7 The display shall be covered from the passenger (inside) such that all fixtures, cables and interfaces between display and window frame are concealed. The cover shall be fixed using security fasteners. The arrangement shall be secure and shall not cause vibration noise (rattles) to be generated. *Guidance note: the cover may be directly screw fixed to the rear of the display but using security grade screws or key operated single turn fixings.*

5.1.3.8 The display and its cover shall not protrude into the passenger environment further than existing window frame or internal side panels. *Guidance note: Available depth of the window frames is limited, so the displays must be thin. This inevitably points to a design using surface mounted LEDs and possibly no secondary screen, i.e. open front with the vehicle window /gasket forming the IP65 seal of the display.*

5.1.3.9 The display enclosure shall be designed to prevent internal condensation. *Guidance note: displays fitted to external windows may be subject to rapid temperature change, a pressure equalisation valve or similar may prevent internal condensation within the sealed display enclosure.*

5.1.3.10 The display vertical resolution shall be 24 LEDs minimum.

5.1.3.11 The display shall have the capability to show two lines of 11 LEDs (capital and descender) or revert to single line as commanded by the PISC.

5.1.3.12 The horizontal resolution of the display shall be in accordance to the maximum available window space and the largest station name (abbreviated) for the purpose of TSI-PRM. See Appendix 4 for the station names in the Irish network.

5.1.3.13 The preferred character height (capital) is 150mm (single line); the minimum acceptable height is 50mm (two line mode). *Guidance note:*

Where space permits, the largest size approaching 150mm should be used.

5.1.3.14 The display shall include at least four different fonts of different height and different line widths, two for single line application and two different fonts for two line application Within each font set, six configurable graphics shall be provisioned – two spares, the IE logo, LUAS logo, DART/Commuter logo, and an aeroplane symbol. *Guidance note: the line width is sometimes termed single strike, double strike, etc. The two line font would use the full 11 pixels in height with the capital at least 50mm, one font single strike, i.e. one LED line width; the other double strike. The single line fonts may be of different heights using two or three LED line widths, the largest font should provide 150mm capitals as a minimum.*

5.1.3.15 The largest single line font and the two line fonts may exclude the Fada (accent) above capital characters, but the Fada shall be produced on the small single line character and lower case fonts where sufficient vertical space is available.

5.1.3.16 Text displayed as static or rolling text shall be automatically centralised by the display controller.

5.1.3.17 The display controller shall perform a 'best fit' algorithm, i.e. using the largest font for the size of text.

5.1.3.18 It shall be possible to override the best fit algorithm by commanding the use of a specific font, and use of single or two lines within the message as configured within the Database Editor.

5.1.3.19 The display shall be visible in sunlight and with some dirt accumulated on the external window face. Each LED shall have a minimum incident intensity of 500mcd at full display brightness. *Guidance note: The design should account for sunlight and performance of an equivalent display shall be demonstrated to the satisfaction of the Engineer during the PDR stage. Side windows of vehicles are regularly washed.*

5.1.3.20 Automatic LED brightness adjustment shall be provided, controlled proportional to average external ambient light level. The control system shall measure an average ambient level over the preceding three second period. This adjustment shall limit the lower brightness level to a configurable minimum value; adjustment shall be continuously variable or have a minimum of ten steps to the maximum brightness level. *Guidance note: the light sensor should be internally placed in the display; adjacent to the display matrix area.*

5.1.3.21 Side displays shall be activated whenever a new Train ID is entered. Upon leaving the first station on the route (starting station or stopping station) the side displays shall be blanked. Side displays shall be once again activated upon approaching the next stopping station. *Guidance note: it is preferable for the display to remain active until leaving the station boundary, i.e. until exiting the station GPS geofence or after travelling a distance typically 500m.*

5.1.3.22 The display viewing angles shall be a minimum 120º (horizontal, inclusive angle) and 120º (vertical, inclusive angle) for >50% intensity referenced to the incident LED light output level.

5.1.3.23 The display controller shall support command or 'scripting' within text messages sent by the central PISC allowing complex sequences of messages to be joined together using different delays and text display modes. In total, text message lengths may be up to 500 characters. At least six configurable phases shall be available. The following examples illustrate the requirement:

a) Using one line: [roll up] <Irish station name> [delay 4 seconds] [roll up] <English station name> [delay 4 seconds], loop back to Irish station name.

b) Using one line: [static text] <Irish station name> [delay 4 seconds] [static text] <English station name> [delay 4 seconds], loop back to Irish station name.

c) Using two lines: [roll up] {line 1}< Tá an traein seo ag dul go dtí > {line 2} <Irish station name> [delay 4 seconds] [roll up] {line 1}<Destination> {line 2} <English station name> [delay 4 seconds] , loop back to Irish station name.

d) Using two lines: [roll up] {line 1}< Tá an traein seo ag dul go dtí > {line 2} <Irish station name> [delay 4 seconds] [roll up] {line 1}< An chéad stáisiún eile > {line 2} <Irish next stop station name> [delay 4 seconds] [roll up] {line 1}<Destination:> {line 2} <English station name> [delay 4 seconds] [roll up] {line 1}<Next stop:> {line 2}<English next stop station name> [delay 4 seconds], loop back to Irish destination.

e) Using two lines: [roll up] {line1} <Irish station name> [delay 4 seconds] [roll up] <English station name> [delay 4 seconds], loop back to Irish station name. On {line 2} [scroll] <long Irish text> {when scroll completed} [scroll] <English text> {when scroll completed}, loop back to Irish station name.

Guidance note: The examples above are just a small selection of the expected capabilities of the side displays. The choice of one or two lines, text display mode (static, scrolling or roll), and the delay between each text message phase are configured from the Database Editor. Fonts, transition times (scroll and roll) are to be configurable by remote uploading of software by maintenance technicians.

5.1.3.24 Upon power up, the display shall perform a self test taking no longer than 5 seconds and then display the IE logo for 30 seconds. If so commanded by the PISC, it shall display alternative messages immediately following self test.

5.1.4 Internal Displays

5.1.4.1 Internal displays shall be installed at the vehicle ends, above the doors to the inter-vehicle gangway or to the cab, i.e. two displays per vehicle.

5.1.4.2 Internal displays shall be securely integrated to the vehicle with a good cosmetic finish. Where CCTV cameras are installed within existing display covers, the same arrangement shall be provided as part of the new display / cover. *Guidance note: a separate cover is not strictly required. The display itself may be designed with good cosmetic finish but connectors, cables, fixing points, etc shall be concealed. In the future, new CCTV systems will use overt dome cameras; hence provision of future cameras is not required.*

5.1.4.3 Where covers are used, they shall seal to the vehicle and display to prevent entrapment of dust and entry of foreign objects. The cover shall not produce vibration noise.

5.1.4.4 The display vertical resolution shall be 16 LEDs minimum.

5.1.4.5 The horizontal width of the display shall be in accordance to maximum available space above the doors to the inter-vehicle gangway or to the cab and the largest station name for the purposes of TSI-PRM. See Appendix 4 for the station names in the Irish network.

5.1.4.6 Internal displays shall be visible to 51% of passengers in their normal forward facing field of vision.

5.1.4.7 The character height (capital) shall be based upon reading distance, using the formula H = R / 250, where H = capital character height (mm) and R = reading distance (mm). The minimum height shall be 50mm (this takes precedence over the height stated in TSI-PRM). *Guidance note: since the displays are installed at the ends of each vehicle, to satisfy a 51% reading audience the required furthest reading distance may extend to 17.5m in some cases where a character height of 70mm would be required.*

5.1.4.8 Within each font set, six configurable graphics shall be provisioned – two spares, the IE logo, LUAS logo, DART/Commuter logo, and an aeroplane symbol. *Guidance note: the line width is sometimes termed single strike, double strike, etc.*

5.1.4.9 Fonts may exclude the Fada (accent) above capital characters, but it shall be displayed for lower case characters.

5.1.4.10 Text displayed as static or rolling text shall be configurable in the message as left justified or centralised.

5.1.4.11 The font shall be specified within the message as configured within the Database Editor; the default font shall be configurable.

5.1.4.12 The display shall be legible providing high contrast under all expected internal lighting conditions.

5.1.4.13 LED brightness shall be at a fixed but configurable level. *Guidance note: lighting levels may vary slightly between fleets. The displays should be optimised for sufficient brightness, not too bright, avoiding 'mirror' reflections on ceiling and body panels.*

5.1.4.14 The display viewing angles shall be a minimum 140º (horizontal, inclusive angle) and 140º (vertical, inclusive angle) for >50% intensity referenced of the incident LED light output level. The display and covers shall be designed to avoid 'parallax' masking in the quoted viewing angles.

5.1.4.15 The display controller shall support command or 'scripting' within text messages sent by the central PISC allowing complex sequences of messages to be joined together using different delays and text display modes. In total, text message lengths may be up to 1500 characters. At least six configurable phases shall be available. The following examples illustrate the requirement:

a) [scroll] <long Irish text string up to 750 characters> {when scroll completed} [scroll] <long English text string up to 750 characters> {when scroll completed}, loop back to Irish station name.

b) [scroll and halt] <long Irish text string up to 750 characters> [pause for defined interval showing static Irish text] [scroll] <long English text string up to 750 characters> [pause for defined interval showing static English text], loop back to Irish text.

c) [static text, left justified] <Destination: Irish station name> [delay 4 seconds] [roll up] <Next station: Irish station name > [delay 4 seconds] [static text, left justified] <Destination: English station name> [delay 4 seconds] [roll up] <Next station: English station name > [delay 4 seconds], loop back to Irish destination station name.

d) [roll up] <Destination: Irish station name> [delay 4 seconds] [roll up] < Ag stopadh ag > [delay 2 seconds] [roll up] <Irish stopping station name 1> [delay 2 seconds] [roll up] <Irish stopping station name 2> {continue up to twenty station stops} [roll up] <Destination: English station name> [delay 2 seconds] [roll up] <Calling at…> [delay 2 seconds] [roll up] <English stopping station name 1> [delay 2 seconds] [roll up] <English stopping station name 2> {continue up to twenty station stops, when completed, loop back to beginning}.

Guidance note: The number of potential phases increases to above fifty where sequence d) is used. The font, text display mode (static, scrolling or roll) and the delay between each text message phase are configured from the Database Editor. Fonts, transition times (scroll and roll) are to be configurable by remote uploading of software by maintenance technicians.

5.1.4.16 The internal display shall be synchronised with other internal displays through the train and with the delivery of audio announcements. *Guidance note: for scrolling messages, the maximum scrolling rate is 6 characters per second but the actual scrolling rate should closely match the spoken announcement. Sample announcements will be provided by the Engineer. The design should support synchronisation corrections using timing markers. For example, a timing marker may be applied at the beginning of a new sentence of a long scrolling message. As a further example, in sequence d) of 5.1.4.15, a timing marker would be applied to each station name as it rolls up such that the audio and visual messages correspond.*

5.1.4.17 Upon power up, the display shall perform a self test taking no longer than 5 seconds and then and display the IE logo for 30 seconds. If so commanded by the PISC, it shall display alternative messages immediately following self test.

5.2 Driver MMI Interface

Existing PIS displays on the IE fleets have several different driver interfaces ranging from a basic thumbwheel switch to select the destination to full graphical interfaces on TFT LCD displays. A new Driver MMI unit shall be supplied for the fleets to be refurbished; this will be a stand alone unit. However, contractors shall consider that in the future their system may be considered for use on new build projects where integration within a TMS based driver MMI is a preferred solution. It is therefore, strongly recommended that the design makes provision for controlling the interfaces described in this section through a serial communications interface.

5.2.1 This section describes the requirements for PIS on the assumption that existing audio communications facilities will be retained. The requirements within section 6 shall be considered so the Driver MMI is fully provisioned to support future replacement of the audio system.

5.2.2 The driver MMI shall be of a common and consistent design, i.e. layout, controls, size, labelling, etc.

5.2.3 The contractor shall survey cabs of the IE fleet and propose a design concept to the requirements of this specification. Integration of the MMI within the cab shall be to the satisfaction of the Engineer and IE driver representatives.

5.2.4 Controls such as buttons and / or 'touch –boxes' on screens shall be adequately sized and distinguished accounting for human factors.

5.2.5 Buttons shall have a tactile positive feel to confirm operation. Where buttons, such as screen 'touch-boxes' or membrane style keypads are provided, a supplementary positive audible 'click' shall be produced.

5.2.6 The visual display screen of the MMI shall be adequate to support the functionality whilst constrained by the allowed space.

5.2.7 The MMI screen shall be capable of displaying four lines of twenty monochrome characters each. *Guidance note: in the base offer a text only display is considered adequate. Option 4 requires greater resolution and a display colour graphics capability is envisaged.*

5.2.8 Text shall be displayed in English language.

5.2.9 Screen and indicator brightness / contrast shall be compatible with cab conditions, i.e. accounting for day / night operation. Automatic backlighting adjustment is preferred.

5.2.10 Legends on controls such as keypads and buttons shall be legible and durable under all operating conditions.

5.2.11 The design shall ensure that the driver cannot be distracted or confused by the introduction of the MMI. *Guidance note: the design should avoid using green LEDs as they could be reflected within the cab to cause a risk of confusion with railway signals. Noises generated on the monitor loudspeaker shall not conflict with other cab warning sounds.*

5.2.12 The MMI shall be robust and 'vandal resistant'.

5.2.13 The MMI shall be IP65 sealed.

5.2.14 The MMI shall include a monitor loudspeaker.

5.2.15 The monitor loudspeaker shall broadcast audio communications from the train audio communication bus to the cab. Given that automatic audio announcement originate from the PIS DVA system an independent monitor level for DVA announcements shall be determined to avoid disturbing the driver with repetitive announcements. The level shall be configurable from fully muted through to a maximum level equal to other audio signals.

5.2.16 The MMI shall include a monitor loudspeaker volume control operated via keypad buttons. The upper and lower levels of the volume control shall be configurable.

5.2.17 The monitor loudspeaker shall be muted when the cab handset / microphone is used. *Guidance note: requires an interface with the handset cradle switch or handset / microphone PTT button.*

5.2.18 The keypad shall support entry of alpha-numeric characters. Given space limitation of the MMI, the keypad shall be arranged as a standard telephone keypad, i.e. button 5 may select characters J, K and L. *Guidance note: the keypad should be capable of selecting the Train ID, in the normal form 'A123', where the first character is alphabetic, and the next three are numeric. Character entry shall be intuitive, predicting alphabetic or numeric. However, the entry system should also allow entry of any combination, e.g. '0123' or 'ABCD'. Special route codes may be programmed using codes other than 'annn' (a=alphabetic, n=numeric). Additionally, due to expansion of IE's network, Train IDs may be required to be in the form 'annnn', see section 12.2.1.*

5.2.19 The MMI screen shall display the current time in the format HH:MM:SS using the 24 hour clock. Time shall be UTC corrected for DST. Time shall be referenced to UTC derived from GPS and shall not drift by more than +/- 0.5 second per day when GPS is unavailable.

5.2.20 The MMI screen shall indicate by text or a graphic when the cab is active (driver key inserted, master controller away from OFF).

5.2.21 When a Train ID has been entered, the MMI screen shall display the selected Train ID destination station name.

5.2.22 The PISC shall be configured to start or re-start operating a Train ID in one of three modes:

a) Whenever entered on the MMI keypad by the driver, or

b) Whenever the driver enters a new Train ID on the train radio, or

c) Either a) or b), whichever is the last action.

When the Train ID is entered, the PISC shall search its timetable database to determine the station stopping pattern relevant to the Train ID on the given date and day of the week. If the Train ID is not valid today, the MMI shall display 'Train ID invalid today' but allow an option to proceed anyway or cancel the Train ID. If the entered Train ID is not within the database, the MMI shall display 'Train ID not found' and revert to the entry prompt. *Guidance note: Voyagerplan timetable data identifies 'days run' and the timetable may include two entries of the same Train ID number but with non-overlapping 'days run', e.g. A1234 may exist with a Monday to Saturday station stopping pattern and separately with a different Sunday stopping pattern.*

5.2.23 When a Train ID has been entered, the MMI screen shall provide descriptive information confirming the current location. *Guidance note: The following navigation status messages are envisaged:*

- *'Before start <start station>' – This message is given if the Train ID is entered at a location other than the starting station, i.e. from the depot.*
- *'At start <station name>' – This message is given when the train arrives at the starting station or the Train ID is entered at the starting station. This message is also provided upon arrival (doors open) at stopping stations*
- *'This train is for <next station name>. Next Station <next station name>' - This message is given when the train leaves a stopping station (including the starting station).*
- *'Approaching <station name>' – This message is provided upon approach; at the same time that PIS displays are updated.*
- *'Terminating at <destination station name>' – This message is produced when doors are opened at the destination station. The message may also be combined with a 60 second countdown timer before the system shuts down, awaiting a new Train ID.*

5.2.24 When a GPS location fix is unavailable, the MMI shall request confirmation of assumed location. The MMI shall, under these circumstances, allow the driver to step through locations: 'Before start', '<Start station>', '<First stopping station>' … until <final stopping station>'

5.2.25 The MMI screen shall provide high level status information relating to the system, i.e. System Healthy, DVA fault, PIS fault. This information may be provided using graphical symbols.

5.2.26 The MMI shall include a function to halt the DVA / PIS in case the system is delivering erroneous information. Use of this facility shall be logged and reported as a fault.

5.2.27 The MMI shall include a function to select and trigger manual (stored preset) messages by direct selection using a two digit code, or by rolling through a list. The screen shall display a brief transcript of the message for the driver to review before confirming the selection to be delivered to the DVA / PIS displays.

5.2.28 The MMI shall include a selection of sub-menu's allowing less frequently used functions to be selected. The functions are summarised below in priority order:

- Review the list of station stops, allowing deleting/adding stops.
Guidance note: deleting/adding stops only required prior to stage 5.2.23.
- Skip the next station, i.e. where short term station closure has occurred.
- Adjustments such as monitor volume, backlight level, etc.
- Enable test mode (shall be disabled whilst running an active Train ID)
- Display of navigation data, i.e. reveal GPS coordinates, speed and wheel pulse count.
- Odometer display.
- System status – high level fault status (descriptive) and status of inputs such as doors, drum switch, etc.
- Software version: Equipment software and database version.
- Cancel or stop current Train ID.
- Manual reset of the PIS system.
- Password entry to maintenance menus.
- Manual change of time and date, in the event of GPS failure.

5.2.29 For maintenance purposes, detailed system information and diagnostics shall be accessible via a password protected menu.

5.2.30 The MMI of the active cab shall assume priority over controlling the PIS system.

5.2.31 The MMI of inactive cabs shall support all functions described, with the following exceptions:

5.2.31.1 The MMI screen shall indicate that the cab is inactive.

5.2.31.2 The MMI shall allow a Train ID to be entered (via keypad) only when there is no other active cab. When any cab on the train becomes active, and a Train ID is entered, the inactive cab MMI shall relinquish control, i.e. the PIS train ID of an active cab shall always take priority.

5.2.31.3 Manual messages triggered from inactive cabs shall be of a lower priority than manual messages triggers from the active cab

5.2.31.4 Section 5.4 clarifies system functionality in more detail.

5.3 PIS Controller (PISC)

5.3.1 New PIS system Architecture

The architecture of existing PIS and audio systems is explained in section 2.7. The requirements for new / replacement PIS systems are summarised below:

5.3.1.1 The contractor shall survey the fleets to confirm that the existing audio communications system is adequate and can be suitably interfaced.

5.3.1.2 The contractor shall determine the architecture for the new PIS system. *Guidance note: Some PIS system designs will use a single PISC and DVA on each train unit but this type of design generally requires additional data and audio circuits between cabs. Other systems may use a PISC and DVA located at each cab end and have the potential to satisfy this specification using existing train wires (PIS display RS485 circuits and audio communication speech pair). The contractor is at liberty to choose either method but must quote his experience to justify the selection, the proposal to be judged on the merits of cost and reliability. Where PISC / DVA are duplicated on each unit, some fall-back capability providing resilience shall be offered to overcome the potentially lower overall reliability through having additional operating equipment.*

5.3.2 PISC Physical Arrangements

5.3.2.1 Adequate enclosures are available within cabs and in some cases at body ends of vehicles. The contractor shall declare the preferred location and required space envelope at the time of bidding.

5.3.2.2 The PISC shall be installed within a sealed IP65 enclosure.

5.3.2.3 A maintenance / programming port shall be provided; the preferred connector for Ethernet is an M12 type. A dust cap shall be provided, secured by a wire / chain.

5.3.2.4 Routine uploading of PIS databases shall take one person no longer than five minutes per train unit from the time of accessing the port. *Guidance note: LTP data files are in the order of 20MB but they do .ZIP to approximately 2MB.*

5.3.2.5 It shall be possible to format the PISC flash memory and copy new speech data and operating firmware via the maintenance / programming port. Updates to individual speech files shall be supported, i.e. so that it is not necessary to update the entire speech database for small changes.

5.3.2.6 The PISC flash memory shall use a recognised modular format (PCMCIA, SD, Compact, etc). It shall be possible to exchange the memory module within 5 minutes. The module shall be secure, and protected against theft. Removal of the module shall not necessitate handling of sensitive electronic assemblies, i.e. removal of a processor card where anti-static precautions may be required.

5.3.2.7 The PISC shall either be modular (e.g. using a Eurocard frame or 19" rack) or the entire PISC unit shall be designed for rapid replacement (four easy access fixing bolts).

5.3.2.8 The PISC will inevitably be associated to the specific train unit or vehicle ID. This association is preferably retained during equipment change. *Guidance note: The preferred solution is a coding plug or dongle chain / wire fixed to the vehicle. The PISC is required to provide an Odometer function and the distance value shall be retained with the vehicle. The dongle / coding plug should be of a simple and highly reliable design. Coding arrangements of the Train Radio are to be investigated.*

5.3.3 PISC Location (Navigation) System

The PIS system has a fundamental need to locate the train along the railway at any point in time. GPS is an excellent way of determining absolute location, but in a railway environment there are several problems with availability of a location fix so it is necessary to consider several methods of augmentation or fallback. The classic methods are:

5.3.3.1 The PISC shall augment GPS location using the 'Door Open Signals (left / right)'. The contractor shall ensure that the signals are isolated from safety critical circuits. The dedicated relay contact/s shall provide battery positive from door release to door close command or interlock. *Guidance note: Two inputs may be required, namely Doors Open Left and Doors Open Right, the two inputs may be OR-ed allowing a single Door Open input to be used. Door open signals are very useful as they normally occur at every stopping station and no other locations (other than on depot). Normally, PIS suppliers use a navigation algorithm where a train must firstly enter a valid geofence determined from GPS or from within a valid distance travelled. The door open signal is then taken to indicate the train has stopped at a platform, the exact station determined from the geofence or distance. It should be noted that doors may be released several times at the same location, so the PIS shall not solely depend upon door release for triggers, i.e. also using odometer or GPS to identify it has moved to the next station location.*

5.3.3.2 The PISC shall use odometry to augment the location determined by GPS. Wheel rotation pulses can be obtained from several different sources, as detailed in 2.7.3.4. The wheel pulse / probe interface shall be designed for high integrity; and failure risks shall be fully considered using FMECA techniques. *Guidance note: In case of sharing a wheel probe, it is recommended that the wheel pulse interface uses a dedicated connector of such a design having low risk of short circuiting the interface. Loading and isolation of the wheel probe should also be considered, i.e. the PIS load shall be high impedance and with full galvanic isolation. Sharing is permitted on SIL 0 flange lubrication; but on higher SIL (≥ 1) levels systems such as WSP, the Engineer and other system supplier approval is required.*

5.3.3.3 The odometer system shall be self calibrating using known good GPS data. *Guidance note: The navigation and location solution should store a variable in non-volatile memory of the PISC. This variable is a*

multiplication factor for the wheel pulse system allowing accurate distance measurement to be provided. When GPS is correctly functioning with low HDOP <2.0, the speed calculated by GPS is highly accurate and may be used to calculate the relationship of wheel pulses to speed. The calculated value should be averaged since it will vary only at a slow rate as determined by wheel wear on the tachometer axle.

5.3.3.4 The contractor shall provide a priced option (Option 6) for adding MEMS INS augmentation for use by the GPS receiver. When used in combination with the odometer, the system shall have the capability of reconciling absolute position within +/-100m when GPS satellites are obscured for 3km or 5 minutes, whichever is first reached.

5.3.3.5 Regardless of 5.3.3.4, the PIS system shall be capable of operating normally with the complete failure of the GPS receiver / antenna sub-system on the assumption that wheel pulses are available, and the driver has correctly confirmed a reference location, and the train is operated on the planned route as determined in the LTP for that Train ID.

5.3.3.6 Regardless of 5.3.3.4, the PIS system shall be capable of operating normally with the complete failure of the wheel pulses on the assumption that the GPS system is available.

5.3.3.7 The navigation and location sub-system of the PISC shall report any failures of either the GPS or odometer systems.

5.3.3.8 Contractors shall note RSSB Guidance Note GE/GN8578 as it provides background information on using GPS on rolling stock. In respect of this PIS refurbishment, a 'state of the art' Class C GPS receiver will be deemed to be adequate other than as varied by the optional MEMS INS.

5.3.3.9 The GPS receiver shall provide a minimum of twelve channels, i.e. simultaneous communication and resolution of up to twelve satellites.

5.3.3.10 The GPS receiver shall have provision for an upgrade to support the Galileo public service.

5.3.3.11 The GPS receiver Time To First Fix (TTFF, cold start) shall be no more than 45 seconds on the assumption that at least four satellites are in line of sight and it has been no more than 48 hours since the receiver was last communicating with satellites.

5.3.3.12 The receiver and its antenna shall be correctly matched (impedance and gain) to provide good sensitivity (better than -140dBW).

5.3.3.13 The receiver input stage shall be protected against excessive input signals of up to +10dBW. *Guidance note: the contractor is responsible for determining the position of the GPS receiver antenna on the train roof and ensuring that there will be no detrimental reduction in performance of the GPS or other train system through interaction.*

5.3.3.14 The receiver's algorithm for determining a valid position fix shall preferably be determined by the system software using HDOP of the

satellites rather than by reliance upon the OEM GPS receiver. The PIS system shall thus support future re-configuration such that the balance of accuracy and availability may be determined.

5.3.3.15 The GPS receiver shall include a method of detecting and mitigating multipath errors.

5.3.3.16 The GPS receiver shall include a method of reporting when the antenna is disconnected.

5.3.4 Accumulated Distance Odometer

5.3.4.1 The odometer system described in 5.3.3.3 automatically self corrects for wheel wear and, given that a correction factor must be saved in non-volatile memory, this arrangement shall also store accumulated distance travelled.

5.3.4.2 The preferred solution involves retaining the data with the vehicle, i.e. using a dongle / coding plug that is permanently retained with the vehicle.

5.3.4.3 During system commissioning it shall be possible to enter a starting distance reading.

5.3.4.4 The odometer shall resolve distance to the nearest km with a reading range to seven digits.

5.3.4.5 Where train to ground communications are provided (Option 1), the reading shall be communicated to the ground computer on a daily basis. The ground system shall maintain odometer totals from the fleet.

5.3.5 PISC Interfaces

5.3.5.1 Electrical interfaces are described within section 2.7.3; the contractor shall investigate existing arrangements on IE's fleets and provide a solution that fully validates the compatibility between new PIS / DVA and existing train systems without degrading the performance and reliability.

5.3.5.2 The PISC location system described in section 5.3.3 requires several interfaces for augmentation signals. Where possible, existing PIS interfaces shall be utilised but in some cases, new interfaces, segregated by a relay, will be required.

5.3.6 PISC Communications

5.3.6.1 The PISC requires communicating with displays, other PISCs and driver MMIs throughout the train. A robust and reliable method of communication shall be established between all of these entities.

5.3.6.2 The contractor shall evaluate existing through train data communication wiring to establish whether the existing cables, inter-vehicle jumper and auto-coupler arrangements are suitable for supporting the new PIS.

Where any part of the arrangement is considered unsuitable then fully priced alternatives shall be proposed in the offer. *Guidance note: Auto-couplers use silver plated pin / pad arrangements, upgrading to gold plated pins / pads may be considered. Where schematics may show spare pins / pads and the contractor wishes to make use of the spares, this is to be declared at the time of the bid.*

5.3.6.3 Loading on data buses shall be fully analysed to consider maximising current flowing through auto-couplers whilst ensuring correct matching impedance and avoiding over load.

5.3.6.4 Where the contractor proposes new inter-vehicle jumpers, an allowance shall be made for 10% spares plus the inclusion of two railway approved and compliant CAT5e cables using CAT5e grade connectors (e.g. M12 internal connectors, Quintax, Quadrax, or M12 CAT5e or CAT6 in jumper connectors).

5.3.6.5 All data communications transmissions shall be error checked. Erroneous data shall be rejected and then re-transmitted.

5.3.6.6 Inter-vehicle communications shall be galvanically isolated. *Guidance note: Using Ethernet 100baseT, Tx/Rx are isolated by transformers; cable screen to be gapped at the inter-vehicle jumper. Using RS485, each node to be optically isolated and powered from an isolated supply, the common (0V) reference of the supply to be connected between nodes and 'lightly' referenced to ground. Where the cable does not provide a common reference, the master and replying transmitters shall pre-condition the RS485 interface with a preamble.*

5.3.6.7 Addressing and configuration shall be simple. Programming devices and notebook PC shall not be required when changing LRUs e.g. displays, PISC, DVA, etc.

5.3.7 DVA

The DVA is assumed to be an integral module within the PISC. Should this module be a PC Sound card then suppliers shall take note that miniature jack plugs are considered to be unsuitable for use on rolling stock based on service experiences.

5.3.7.1 Memory capacity shall be sufficient for two language versions of every message.

5.3.7.2 Memory shall be sufficient for all IE stations names (in Irish and English) and have the following characteristics:

Parameter	Value	Storage Memory
Number of inflections (I)	3 different	
Number of Languages (L)	2 (Irish and English)	
Number of stations (S)	160 (of 2 seconds each)	I x L x (160x2) = 1920 seconds
Number of system messages (SM)	50 (of 10 seconds each)	L x (50x10) = 1000 seconds
Number of fixed messages (FM)	99 (of 30 seconds each)	L x (99x30) 5940 seconds
Number of advert messages (AM)	20 (of 1 minutes each)	L x (20x60) 2400 seconds
Total (+50% spare)		S+SM+FM+AM=11260 50% spare = 5630 Total =16,890 seconds

5.3.7.3 When programmed with the messages detailed in 5.3.7.1and 5.3.7.2, less than 50% of the available memory shall be used.

5.3.7.4 The DVA shall have the capability to receive up to ten temporary messages of one minute each, i.e. the temporary messages stored in volatile RAM or in non-volatile flash memory. The PISC shall ensure that these messages are only retained for their validity period.

5.3.7.5 The DVA shall reject and alert invalid file formats or files with data errors.

5.3.7.6 Audio produced by the DVA shall mute out digital noise disturbance due to data errors and incorrect file formats.

5.3.7.7 The DVA audio bandwidth shall exceed 100Hz to 8kHz for speech and 100Hz to 16kHz for chimes, gongs and jingles.

5.3.7.8 The DVA audio signal to noise ratio shall be better than 55dB.

5.3.7.9 The DVA audio access time for the first and subsequently linked speech files shall be faster than 10 milli-second, i.e. the replay of announcements shall not include 'stutters' due to long access times.

5.3.7.10 The DVA shall always be synchronised with PIS messages although it shall be possible to configure some messages as audio only, or visual only.

5.3.7.11 To maintain synchronisation, a system of timing markers shall be provided to link specific parts of visual text strings to the triggering of associated audio.

5.3.7.12 If the PA system is already in use, the DVA shall wait up to 30 seconds (time to be configurable) before accessing the PA system. If the PA system remains in use after this time, the announcement shall be aborted.

5.3.7.13 Some announcements are to be configured as high priority, e.g. emergency messages. The DVA shall broadcast emergency announcements immediately unless PA is used in the active cab or a Train Radio PA broadcast is received.

5.3.7.14 The DVA shall support the capability for some announcements to be programmed to repeat continuously until cancelled, or repeat at defined intervals for a given time period.

5.3.7.15 The drivers MMI shall provide the capability to cancel / abort announcements with immediate effect.

5.3.8 Standard Antenna

A roof mounted antenna occupies valuable space since the potential for cross-coupling with other antennas will require co-location distance of more than several metres. It is important that this space is best used; therefore the antenna shall be useful for additional / future applications. *Guidance note: a typical example antenna is the Huber and Suhner Sencity part number 84002818, details provided in Appendix 1.*

5.3.8.1 The antenna shall be robust and of high quality. It shall be sufficiently robust to withstand impacts e.g. bird strike and brushes of the train wash facility.

5.3.8.2 The antenna shall be well proven on European railway rolling stock.

5.3.8.3 The antenna shall support GPS L1 band reception and have a broadband capability in the range 870MHz to 5.8GHz. Space shall be provisioned such that in the future, this broadband antenna may be shared for GSM, WiFi and/or WiMAX using a Triplexer to split the frequency bands. The GPS antenna shall include a head end amplifier, either integral or separate but located near to the antenna. Where a separate amplifier is offered, it is preferred to have at least four buffered outputs allowing future systems to share the GPS antenna feed.

5.3.8.4 The antenna shall be protected against direct contact with 1500V DC. Higher voltage levels should be used when calculating voltage rise for earth bond determination, i.e. voltage rise of the train roof should not exceed ELV, additional bonds between roof and chassis to be fitted if required.

5.3.8.5 The antenna shall be mounted on an adequate metallic ground plane (train roof) with a low resistance bond between antenna and roof.

5.3.8.6 The antenna shall include protection (or provide a DC short circuit) to prevent voltages exceeding ELV from reaching the PISC equipment.

5.3.8.7 The antenna, when installed, shall provide IP68 protection and shall be suitable for high speed (100 mph/160kph) operation.

5.4 Functional Requirements of the Train System

The following descriptions provide examples of the typical functionality expected of the PIS system:

5.4.1 Start up

Start up is assumed to be the condition following connection of the batteries (at the battery isolator). The PISC may continue to operate in a lower power state to support data downloads (Option 1) with the engines (DMUs) and auxiliaries switched off or pantograph down (EMUs).

5.4.1.1 When power is applied, the PISC shall perform a self test to check that its memory (RAM) is fully available. The PISC shall also check the validity of initialisation files and databases.

5.4.1.2 This self test shall be completed within 30 seconds.

5.4.1.3 At power up, the MMI shall display a screen warning that self-test is in progress.

5.4.1.4 Upon completion of self test, the test results and version numbers of software / firmware databases shall be displayed for 10 seconds. It shall be possible to review the results at a later time from the MMI menu.

5.4.1.5 The PISC and MMI shall enter a low power mode if the vehicle isn't enabled within 60 seconds from start, i.e. if the following conditions are not met: cab active on the train, engines running or auxiliaries on.

5.4.1.6 Where the conditions are satisfied, the PISC / MMI shall enter the 'Ready for Train ID' mode.

5.4.1.7 PIS displays shall not be active unless the auxiliary supplies are at an acceptable level as detailed in section 4.1.8. The PISC shall monitor the status of the remote displays to ensure that messages are current, i.e. a display that is powered after a message has been sent by the PISC shall be automatically corrected with the current message.

5.4.2 MMI – 'Ready for Train ID'

5.4.2.1 The MMI shall display current time as described in 5.2.19.

5.4.2.2 The MMI shall set the loudspeaker monitor level to the default level.

5.4.2.3 Where the MMI includes manual control of back light, it shall start at the default level.

5.4.2.4 The MMI shall prompt for entry of the Train ID.

5.4.2.5 The menu system shall allow selection of test modes or selection of special messages from the manually triggered messages, for example, 'Not in Service', 'Depot', etc. There may be corresponding messages on the side and internal displays. The train may operate with such messages

permanently enabled, regardless of subsequent entry of a Train ID on the train radio.

5.4.2.6 When connected / configured, Train ID data received from the train radio shall appear on the MMI for at least 3 seconds.

5.4.2.7 Train ID may be manually entered on the MMI by the driver, in case the train radio is not connected or the link between train radio and PIS has failed.

5.4.2.8 Manual entry shall automatically support the form 'annnn', where a = alphabetic and n = numeric. The entry method shall be similar to a mobile telephone keypad entry. For example, keypad button 2, when operated in the first character position shall initially produce A; if quickly pressed again B, if quickly pressed again C, if quickly pressed again 2, then cycling back. The 2nd, 3rd, 4th, and 5th positions shall favour numeric entry first. The entry method shall, by this extended method, support entry of 'nnnnn' to be used for special purposes, for example 'Not in Service', 'Depot', etc. It shall be possible to check and if necessary re-enter the Train ID before accepting the entry. The PISC shall validate the Train ID against the current timetable database, advising the user of invalid entries, non-existent entries and ensure that the route (station stopping pattern) is appropriate to the given date / day of the week. *Guidance note: Train IDs are currently required to be in the form 'annn', However, until the time in which a four number Train ID is required, the input of the Train ID shall insert a zero automatically after the letter, e.g. if the driver is setting Train ID A123, it shall be displayed as A0123. The same shall apply to Train IDs provided by Train Radio. The system shall be configurable to support four numeric entries in the future.*

5.4.2.9 When a valid Train ID has been entered the PISC shall operate the PIS as determined by the Train ID for that date. If the Train ID is not valid for that date, a warning message shall be provided. *Guidance note: VoyagerPlan may use the same Train ID for different days run or time of the day, so the Train ID requires to be validated.*

5.4.2.10 Where the Train ID is valid, the MMI shall identify the destination, current location and next station within 3 seconds. The MMI shall provide a means of accepting or cancelling the Train ID.

5.4.2.11 If the current location cannot be determined, the MMI shall allow the location to be selected along the route as defined by stations relevant to the selected Train ID (the route). The default location is the starting station of the route but the driver may select location as 'before starting station' or any of the 'stopping stations' along the route.

5.4.2.12 Menu items described in section 5.2.28 shall be available prior to Train ID entry.

5.4.2.13 It shall be possible to select and send manually triggered announcements prior to a Train ID being entered and with no current active Train ID. *Guidance note: Entry of an all numeric 'Train ID' is one possible method, e.g. code entry 10nn (where nn = 01 to 99).*

5.4.2.14 When a Train ID has been entered, it shall be possible to cancel the entry and re-start this sequence at any time.

5.4.3 MMI – 'Route Running'

5.4.3.1 The MMI shall display the following information whilst running the route: Time (hh:mm:ss), Destination and Train ID.

5.4.3.2 The MMI shall display current location as detailed in 5.2.23. This arrangement shall enable the driver to check that the PIS system has determined the correct current location in relation to the next stop. As the train progresses along the route, the current location messages are automatically updated.

5.4.3.3 The menu of functions described in section 5.2.28 shall be available whilst running the route. However, test mode on the PIS displays shall not be supported whilst running the route.

5.4.3.4 Using the menu, the first selection allows the driver to 'skip next station'; this selection is effective from the time doors are opened at a preceding station. When selected by the driver, the following events will be triggered:

a. The PIS system shall immediately announce a correction, e.g. 'Correction – This train will not be stopping at Drogheda. We apologise for this inconvenience'.

b. The PIS system shall then continue to provide automatic PIS messages omitting the next station.

5.4.3.5 Some of the stations along the route may be classified as major. PIS system functionality may be enhanced at major stations when compared to 'minor' stations, for example:

a. At 'major' stations a standard safety message may be triggered.

b. At 'major' stations on commuter routes, the PIS system may announce the 'calling at..' stations, i.e. the remaining stopping stations along the route.

5.4.3.6 Special safety messages may be announced for individual stations and travel directions, for example east bound trains at <station x> may require a message to 'mind the gap between train and platform.

5.4.3.7 The PIS system shall have the capability to announce interchange information at given stations. Interchange information shall be configurable to operate at a specific station based upon rules comprising: Destination or direction, day of the week and time of day.

5.4.3.8 The MMIs shall allow the manually triggered message to be cancelled and the system to revert to the most recent automatic message. Otherwise,

the system shall automatically replace the manually triggered message with the next automatic message trigger point.

5.4.3.9 If the driver wishes to permanently set a manually triggered message, the automatic route (Train ID) shall be reset. Manually triggered messages are then retained until cancelled or a new Train ID is entered.

5.4.4 MMI – 'Route terminating'

5.4.4.1 Upon approach to the terminating station, the PIS system shall provision for a special message relating to the pending termination, for example 'This train will terminate at the next station, please remember to take all of your belongings with you'

5.4.4.2 Upon arrival at the destination station and release of the train doors, the MMI shall update the location to Terminating at <destination station>.

5.4.4.3 The PIS system shall make provision for a special terminating message, for example 'All change please, this train terminates here'.

5.4.4.4 Following door release, a 60 second countdown shall be displayed before the Train ID entry screen is offered. It shall be possible for the driver to cancel and immediately re-enter a new Train ID.

5.4.4.5 The PIS displays and DVA shall continue to complete their announcements in full. However, additional cycles of messages (e.g. scrolling) shall not be repeated following the 60 second timeout. If the previous Train ID is cancelled, or a new Train ID is entered, the messages of the previous route shall immediately clear.

5.5 PIS Ground Systems

Each year IE amends the operating timetable and there is a fundamental objective to automate the production of corresponding PIS databases. The annual update is known as the Long Term Plan (LTP); however, in practice this is may involve short term changes accounting for Engineering work or other adjustments. Where such changes are applied, this is known as the Short Term Plan (STP).

The PIS Ground Systems are a collection of supporting software systems, in the following typical parts:

- Database Editor – this is a tool for configuring common data such as stations (names, location, interchange information, etc), standard message, rules / macros, etc.
- Speech Editor – this is a tool for manipulating and editing recorded speech, it may be proprietary software such as Adobe Audition (previously CoolEdit) or even a freeware .WAV editor such as Goldwave. The software shall include a speech compression engine to reduce the size of data files.
- Where Option 1 is selected, a Communication Scheduler – the fleets are defined and GSM network communications are provided. The scheduler also links to other systems and packages, possibly using FTP.

Contractors may offer different arrangements but these three elements will be described in more detail to illustrate expectations:

5.6 Database Editor

The term 'Database Editor' (DBE) is used to describe the software used to create the output data to be loaded onto the train fleet. The DBE defines unique aspects of the railway system and may be considered by several data sets that need to be defined by the user. As a fundamental principle, the DBE shall not be required to process a change of timetable where stations and message formats are unchanged, i.e. the messages generated for individual Train IDs and stopping patterns (routes) shall be automatic once the basic information has been defined. The DBE is required when new stations are introduced; station, interchange, safety or manually triggered messages are changed.

Where message strings are entered, the DBE shall always consider the messages as bi-lingual, i.e. both English and Irish. The DBE shall make provision for additional languages to be introduced at locations such as ports and airports, for example.

5.6.1 Global data

The following are examples of data that may be defined as global or common to the entire railway network, for example:

5.6.1.1 Timetable change dates and time (calendar). The PIS system shall accept a current and future LTP / PIS database. Future data shall have a configurable effective date and time, normally the time when the new timetable comes into effect.

5.6.1.2 Static IP address or DNS address for particular PIS communication functions, i.e. defining how the fleet shall communicate tracking, fault reporting when Options 1 and 2 are provided.

5.6.1.3 PIS system configurable timeouts, e.g. delay before triggering messages on door open, display load shed timeout, audio repeat intervals, tracking interval, etc.

5.6.1.4 Global default values, e.g. GPS trigger threshold.

5.6.1.5 Global messages, e.g. safety messages, greeting and farewell messages.

5.6.1.6 Individual fleet characteristics – some functions may differ between fleets, for example the functionality of the Commuter fleet is expected to be different to the DART fleet. For example, configuration data such as output level of the DVA may be unique on each fleet.

5.6.2 Macros, locations rules and message data

The DBE shall provide a facility for configuring rules and macros. Rules shall be defined for each entity of the PIS system and each location. Entities are summarised as:

- Front (and rear) of Train displays.

- Side Displays.
- Internal Displays.
- Drivers MMI.
- Other cab MMIs.
- DVA.

Locations are summarised as:

- Prior to starting station.
- At starting station.
- Departing starting station (journey to first stop).
- Approaching (normal) station stop.
- Approaching (major) station stop.
- At (normal) station stop.
- At (major) station stop.
- Departing station (journey to next station).
- Approaching terminating station (destination).
- At destination station (terminating).

Macros are summarised as:

- The capability to pick short or long stations names, i.e. the full station name may be suitable for an internal display but the short or abbreviated name may be required on the front of train.
- The string 'Calling at <station x>, <station y> and <station destination>' is an automated macro.
- A second string in the form 'Calling at the following principal stations <major station x>, <major station y> and <station destination> is another form of an automated macro.
- Determination of <next station>, <destination>, etc are macro functions.
- Macros shall support conditional decisions e.g. IF next station is major, DO.., ELSE, etc.
- Macros may be conditional based upon days of week, time, lines, etc.

5.6.2.1 Conditional decisions shall be supported, for example, there will be exceptions if the service is an express, i.e. destination only, with no stopping stations. Under these circumstances macros such as 'calling at ...' are inappropriate. A further example is the capability to make different announcements at major and minor stations.

5.6.2.2 For each of the locations, a unique rule may be configured for each individual entity.

5.6.2.3 Individual stations may have their own rules based on train direction, date and time, e.g. interchange messages.

5.6.2.4 Macros shall support the preparation of standardised message strings and associated speech files. For example, 'The next station is…', 'Welcome on board this Iarnród Éireann service to...', 'We are now approaching…' etc.

5.6.2.5 The arrangement shall ensure the correct association of speech files with the correct context of station name accounting for two speech inflections.

Guidance note: The two inflections relate to the middle and end of a sentence. For example 'This train will call at <station A>, <station B> and <station C>', station C shall be announced as an end inflection but it may also appear in the context 'This train will call at <station B>, <station C> and <station D>', announcing station C in mid-inflection. The speech files shall be identified by unique file names, for example the TIPLOC code may be used with a simple change (capital or lower case) to distinguish mid or end inflection. The DBE and PIS system shall be expected to automatically resolve the correct use of inflection for each announcement such that any combination of stations may be compiled automatically from the LTP without manual assistance.

5.6.3 Stations and Interchange rules

For each individual station, the following data set shall be programmed:

5.6.3.1 TIPLOC code.

5.6.3.2 English station name (full).

5.6.3.3 English station name (abbreviated).

5.6.3.4 Irish Station name (full).

5.6.3.5 Irish Station name (abbreviated).

5.6.3.6 Station type – major or minor.

5.6.3.7 Latitude.

5.6.3.8 Longitude.

5.6.3.9 Geofence radius (default value may be changed).

5.6.3.10 Special messages on approach, typically interchange messages.

5.6.3.11 Special messages at station, typically safety message, e.g. 'Mind the gap'.

5.6.3.12 Special messages on departure, typically 'ticket inspection messages, etc'.

Where interchange messages are defined, it shall be possible to create rules based upon the following conditions:

5.6.3.13 TIPLOC codes within the onward journey.

5.6.3.14 TIPLOC codes of previous stations.

5.6.3.15 Calendar / Day of the week.

5.6.3.16 Time of day.

5.6.4 Segments and Lines

Segments and lines allow the relationship between stations to be defined by distance and distinct lines to be identified as a network. This data is critical to the train navigation / location system and to the drivers MMI since additional station stop options will be obvious at any given location. *Guidance note: some inter-station distances are very short, e.g. Kilbarrack to Howth Junction.*

5.6.5 Manually Triggered Messages

Manually triggered messages are those provided to the driver (or train crew) for ad-hoc use. For example 'Stand clear of the doors'.

5.6.5.1 Messages shall be categorised for easy access as follows:

- General – messages for regular use, e.g. 'Stand Clear of the doors'.
- Delays & Diversions – messages with approximate time of delay, messages containing reasons for delay and messages describing diversion and impact.
- Safety – a range of safety messages.
- Emergencies – Fire, evacuation, etc.

5.6.5.2 The DBE shall permit entry of a short textual transcript (typically less than 40 characters), this transcript shall be presented to the driver or train crew before confirmation and delivery of the full announcement to passengers.

5.6.5.3 The DBE shall enable the message to be addressed to individual entities, i.e. it shall be possible to individually control each display type and / or the DVA.

5.6.5.4 Messages shall be configurable in respect of number of repeats (or single play), repeat interval and total duration.

5.6.5.5 Emergency messages shall be high priority; with a facility to increase the volume of emergency DVA announcements and override lower priority messages.

5.6.6 Importing the Plan

Both the LTP and STP are available from the train planning system – VoyagerPlan. Arrangements can be made by IE to export theses files to the PIS Ground Systems using an FTP. An example of the file format, together with a description, is provided in Appendix 2.

5.6.6.1 The PIS database and LTP / STP may be kept separate and 'compiled' in real time on the train. An alternate method may involve the LTP / STP being 'post processed' by the DBE. In either case, the PIS Ground system shall be capable of automatically requesting the LTP (and STP as Option 4) and then compiling the relevant target files for the trains.

5.6.6.2 The DBE role shall be limited to entering the 'rules of PIS' and associating text strings for displays and audio announcement trigger codes associated with each text string. In practice, such a system shall only require

infrequent updates to the core PIS data, for example when new stations are built or if new announcements are needed.

5.6.6.3 The arrangement shall be compatible with Options 1 and 4 where fully automatic provision of the LTP and STP are considered.

5.6.7 Route (Train ID) Simulation on the DBE

A pre-requisite requirement for simulation is provision of a plan (LTP / STP) to the DBE. After selecting a particular plan of Train ID, it shall be possible to select a given location and date / time window.

5.6.7.1 The available Train IDs, at that location and within a selected time window shall be offered for selection by the user.

5.6.7.2 The process of selection shall be similar to that used on the train MMI.

5.6.7.3 The simulator shall then provide a number of windows simulating each type of train display, i.e. drivers display, internal display, front and side displays.

5.6.7.4 The simulated visual displays shall accurately represent the sizes, fonts, scrolling / rolling rates and effects provided by the on-train displays.

5.6.7.5 Audio announcements shall also be available for monitoring.

5.6.7.6 Train operation shall be simulated with configurable acceleration, top speed and braking along with automated door opening. The simulator shall support real time running according to the planned times of arrival at each station. The objective of this simulation is to check delivery timings in relation to a real journey.

5.6.7.7 There shall be a facility to increase speed (thus reducing simulation time) when running between stations.

5.6.7.8 For any given Train ID within the plan it shall be possible to review and monitor the audio / visual information to be provided to the driver and the passengers.

5.6.7.9 The DBE simulator shall fully support the review of timings, synchronisation and special effects of the PIS audio / visual system and test that the configured data is correct.

5.6.7.10 The DBE shall provide a method of exporting programmed coordinates and station names (or code) allowing the positions to be overlaid on a map for checking station GPS coordinates.

5.6.8 Database Editor Outputs

5.6.8.1 The DBE shall compile target database files for the fleets either as one standard file or as files customised for individual fleet. It shall detect and report errors during the compilation process.

5.6.8.2 The output files shall be automatically archived with a 'restore' capability.

5.6.8.3 The DBE shall support the following printed reports:

a) Station data – TIPLOC, short name, long name, GPS coordinates, major / minor, etc.
b) Rules, macros, etc.
c) Summary of standard message strings and associated speech file names.
d) Manually triggered messages. (Note 1)
e) Summary of stops for each train ID.
f) Detailed step by step PIS system output for a given Train ID. (Note 2)

Note 1: Printed in a format where this could be laminated on two sides of A4.
Note 2: Printed in a format that may be used by Commissioning Engineers to check each event on a selected route (Train ID).

5.6.9 Route (Train ID) Simulation on the train

A further level of simulation shall be provided whereby a computer programme is made available for 'on-train' simulation of GPS and wheel pulses.

5.6.9.1 This simulator shall be connected to a maintenance port of the on-board PISC.

5.6.9.2 Whilst connected, the simulator shall provide GPS location, wheel pulses and door open signals to the on-board PIS system.

5.6.9.3 The user interface shall allow the date, Train IDs, and locations to be available for selection. The process of selection shall be similar to that used on the train MMI.

5.6.9.4 The simulator shall graphically indicate location (on a map), progress to next station shall be displayed (distance count down).

5.6.9.5 Train operation shall be simulated with configurable acceleration, top speed and braking along with automated door opening. The simulator shall support real time running according to the planned times of arrival at each station. The objective of this simulation is the check delivery timings in relation to a real journey.

5.6.9.6 There shall be a facility to increase speed (and reduce simulation time) when running between stations.

5.6.9.7 A door open signal shall be, either manually or automatically, provided at simulated stopping stations.

5.6.9.8 The on train PIS entities (displays, DVA, MMI) shall operate as if the train were operating a real route. The user may walkthrough the train to check each display and listen to announcements.

5.6.9.9 This simulator shall also support maintenance of the on-board system, i.e. software, firmware, database uploads, diagnostics, etc.

5.6.10 Speech Editor

5.6.10.1 Audio editing software (two licences) shall be supplied.

5.6.10.2 Where speech files are to be edited as .WAV format, any compression process shall support batch processing of files.

5.6.10.3 For speech editing purposes, edit resolution shall be less than or equal to 10 milli-seconds.

5.6.10.4 Speech files shall be logically named allowing station names to be automatically associated when the routes are compiled and using the correct inflection based on sentence context and language.

6 Particular Requirements – Audio Communications

This section is for reference since replacement of the existing audio communication systems is not anticipated in the early phases of PIS replacement. The following information is therefore useful in setting out the scope for future replacement of audio systems.

6.1 Vehicle Power Supply

Basic audio communications for PA, Cab to Cab, and PEI are train safety systems. As such, these critical functions shall continue to be available with no active cab on the train and until the battery voltage reaches 67V (EMU) or 17V (DMU) or is disconnected by an external load shedding arrangement. The contractor shall ensure minimal quiescent current consumption (value to be advised) and support separate load shedding arrangement for the non-essential visual system as detailed in 4.7.3.

6.2 Additional Requirements of the User MMI

6.2.1 The MMI shall include additional controls and indicators to operate the audio communication system. *Guidance note: the following controls and indicators are suggested - a button labelled PA and an associated yellow indicator; a button labelled IC or C-C and an associated colour indicator – which shall be distinctive, but avoiding yellow, red, green – to enable cab to cab communication; and a button labelled PEI and an associated red indicator for Passenger Emergency Intercom labelled PEI or PC.*

6.2.2 Control buttons shall be adequately sized.

6.2.3 Indicators shall be visible without becoming a distraction for the driver.

6.2.4 Controls, indicators and legends shall be visible under all cab lighting conditions.

6.2.5 Audio communication control functions are critical for train safety, the design shall provide fallback functionality in case of failures within the MMI or PISC. *Guidance note: to provide acceptable availability, audio control functions sometimes operate through the MMI data communications interface but may also be duplicated using simple control wiring. In case of failure within the complex processing systems of the MMI and PISC, basic operation of PA, C-C and PEI shall be assured.*

6.2.6 A cab handset and stowage shall be provided.

6.2.7 The handset shall be robust and vandal resistant.

6.2.8 The handset shall withstand ten repeated drops from different orientations and ten drops when suspended by its cord from 1m onto a

concrete floor. *Guidance note: cosmetic damage acceptable but no physical damage or cracks.*

6.2.9 The handset cord shall be robust, armoured cords are preferred. It shall withstand a pull test using a 20kg load.

6.2.10 The stowage device shall positively latch the handset in place and the handset shall remain in situ when tested to EN61373, mounted in its normal orientation.

6.2.11 The stowage device shall provide an electrical signal to the MMI so that selected audio communication modes can be automatically cancelled when the handset is replaced in its stowage. This feature is also required to suppress the MMI monitor loudspeaker.

6.2.12 The handset shall include a PTT button that is robust and positioned ergonomically allowing the button to be operated and held with one hand.

6.2.13 The handset shall have a good acoustic performance, particularly for PA. *Guidance note: A frequency response of 100Hz to 8KHz +/-3dB and noise cancellation is expected.*

6.2.14 The handset PTT button shall be held operated during PA announcements, i.e. driver can mute the microphone by releasing the button at any time.

6.2.15 During cab to cab and PEI communication modes, the handset PTT button shall again be held operated but subsequent communications shall be full duplex (talk and listen simultaneously).

6.2.16 During all handset communications, sidetone shall be provided. In full duplex communication modes, releasing the PTT button shall reduce the handset transmit level and increase the receive level, i.e. louder for the driver.

6.2.17 The handset design shall exclude handling or PTT button noise when the handset is used for PA.

6.2.18 The monitor loudspeaker of the MMI shall be fully integrated with audio communications providing support for the following functions:

- Monitoring PA announcements made from other cabs.
- Monitoring cab to cab communications when the handset in that cab is stowed.
- Broadcasting cab to cab call tone and other warnings (keypad audible feedback).
- Monitoring PEI communication between passenger and driver, or monitoring in the driving cab whilst the driver operates other communications modes.

6.2.19 Facility to show the location of PEIs that are activated.

6.2.20 Facility to select individual PEIs for communication.

6.2.21 Enhanced CCTV interface allowing the selection of a camera corresponding to activated PEIs or subsequently PEIs involved with driver – passenger communications.

6.2.22 Facility to advise the driver when the Train Radio has accessed the PA system.

6.3 Passenger Emergency Intercom

Unless otherwise specified, or already provided on the current system, one PEI shall be installed at each doorway vestibule and two PEI, within toilets with facilities for wheelchair users.

6.3.1 The PEI unit shall feature a large red button (60mm) that is protected against accidental operation, but is capable of being operated by persons with hand disabilities, i.e. may be operated by the palm of a hand. The operating force shall be more than 12N but less than 15N.

6.3.2 The PEI shall include an AFILS facility and labelling to indicate that persons who are hard of hearing may set their hearing aid to the 'T' position.

6.3.3 The PEI shall include a warning indicator to confirm that the button has been operated.

6.3.4 The PEI shall include a warning sounder to confirm that the button has been operated.

6.3.5 The PEI shall incorporate a loudspeaker and a microphone.

6.3.6 The PEI shall function normally for passengers located within 600mm of the PEI, under all operating conditions.

6.3.7 Communications shall be clear and intelligible under all operating conditions.

6.3.8 When the driver acknowledges the PEI call, the warning sound shall cease and another indicator shall operate whilst the PEI is connected to the driver for communication. The warning sound occurs only when first initiated and shall not return until the PEI has been reset and then operated again.

6.3.9 When multiple calls occur, each call shall be placed in a queue and shall be presented in time priority order.

6.3.10 The driver shall have the facility to communicate with each caller in turn, each identified by a unique location. The arrangement shall allow the driver to connect back to a caller that has been previously connected or to individual callers; at the same time it shall remain possible to change to other communication modes (PA, Cab to Cab intercom) and

then return to communicating with the passenger/s. *Guidance Note: Unique location means Vehicle ID / type or position within the train (car 1, car 2 etc) and location such as doorway number, toilet etc.*

6.3.11 Communications shall be full duplex. *Guidance note: the system to provide sufficient sensitivity and signal level to support the requirements of clause 6.3.6. Adaptive Echo cancellation technology, or similar DSP processing, is therefore expected.*

6.3.12 MMIs throughout the train shall display the locations of activated PEI's and the PEI in communication with the driver.

6.4 PA System

PA systems shall be designed with fault tolerance and resilience and shall be capable of operating in accordance with the TSI (conventional railway) and for 30 minutes with a fire.

6.4.1 Where new transmission and loudspeaker circuits are added, the cables shall be fire resistant for 30 minutes.

6.4.2 Within each vehicle, loudspeakers shall be inter-leaved, operating from two independent circuits and amplifiers.

6.4.3 PA amplifiers feeding the duplicated circuits shall be powered from diverse supplies.

6.4.4 The transmission paths, amplifiers and loudspeaker distribution shall be monitored with fault reporting.

6.4.5 PA system volume shall be automatically adjusted to be 10dB above ambient. This level shall be configurable as shall be the upper and lower volume levels.

6.4.6 The PA system shall support a frequency response of 100Hz to 10kHz, ± 3 dB.

6.4.7 The PA system Signal to Noise ratio shall be better than 55dB when operated and less than 70dB when PA is not selected.

6.4.8 The PA system shall provide RASTI performance equal to or better than 0.7 throughout passenger areas.

6.5 Audio Communications System Priorities

A fundamental principle of the audio communication system is the train driver (occupant of the active cab) having ultimate control of audio communications. Any selection made by the driver shall take priority. There is one exception to this rule, i.e. where train radio selects the PA system and takes ultimate priority. However, after 2 minutes of selection by Train radio the audio communication system shall clear the train radio selection returning control to the on-board systems until the Train Radio PA is de-selected then re-select again.

6.5.1 New audio communication systems shall be designed with two audio communications speech paths through the train. *Guidance note: The two speech paths may be digital or there may be two separate analogue speech paths. This is to be agreed with the Engineer, particularly where this requirement implies the addition of new inter-vehicle jumpers.*

6.5.2 With two speech paths, it shall be possible for the DVA or PA system from other cabs to deliver an announcement to passengers simultaneous with a driver communicating cab to cab or with a PEI. The two speech paths (Transmission) shall have the capability of independent routing thus support compliance with the future TSI (conventional railways): *Guidance note: 'The equipment should be able to remain on standby and function independent of the catenary supply for at least three hours. The public address system should be designed so as to operate 50 % of its loudspeakers in the event of a failure of one of the transmission elements.'*

6.5.3 Driver PA shall override PA operated from any other cab.

6.5.4 Drivers shall have the facility to switch between modes, i.e. receive a PEI call, then communicate to other cabs, then make a PA announcement, then revert to the PEI, etc.

6.5.5 The status of the audio communication system shall be shown on every MMI throughout the train, i.e. selected communication mode.

6.5.6 The replacement audio communications system shall be designed with provision for potential introduction of GSM-R, accounting for the required PA interface. This interface shall be the highest priority access to onboard PA.

6.5.7 The replacement audio communications system shall provide a full duplex intercom.

7 Options

The following options shall be priced as incremental additions to the base offer. Where an option depends upon the adoption of another option there shall be a clear statement to that effect and the total price shall be shown in each case.

7.1 Option 1 – GSM Communications Gateway

This option provides for train to ground communications using the GSM mobile network.

7.1.1 GSM modem and antenna

7.1.1.1 The GSM modem shall be provided as a module within the PISC or as an associated sub-system. The module or separate sub-system shall be designed with provision for future upgrades, accounting for developments in mobile communications.

7.1.1.2 The GSM shall be of a robust design intended for the M2M market. It shall feature a tri-band radio capability supporting GPRS, UMTS and EDGE.

7.1.1.3 Only a single GSM modem shall be allocated to each train unit.

7.1.1.4 The SIMs will be supplied free issue by IE.

7.1.1.5 The SIM shall be secure from theft. *Guidance note: within a locked enclosure or retained behind a cover fixed with special security screws.*

7.1.1.6 The contractor shall ensure that the SIMs are not activated until the individual system acceptance test is carried out prior to the train being returned into IE service.

7.1.1.7 The system shall ensure that association of a given SIM to a particular train unit shall be automatic. *Guidance note: If the GSM modem is changed, or the PISC is changed, the association should be automatic. Data sent by the GSM modem should therefore include the 'physical static address' read from the PISC coding plug or similar arrangement.*

7.1.1.8 The design shall be based upon the assumption that the SIMs use dynamic IP operating over a public APN.

7.1.1.9 The design shall be based upon mobile initiated communications. *Guidance note: Since the mobile IP address may change due to dynamic re-allocation within the mobile network, or through equipment change due to maintenance, the mobile is expected to provide a regular 'heartbeat' to the ground system. In practice, the heartbeat is the tracking packet.*

7.1.1.10 The design shall aim for low cost of operation. The contractor shall provide operating estimates for review by the Engineer.

7.1.1.11 The GSM modem shall include 'anti-streaming' protection to limit the amount of data allowed for transmission in a given period.

7.1.1.12 The GSM modem shall make use of the broadband antenna described in 5.3.8. Direct connection to the broadband antenna may be assumed; however, the design shall make provision for a Triplexer to be installed in the future in case other users require sharing the antenna.

7.1.2 Communication Scheduler

This software, to be loaded onto a PC server, provided by IE IT department, maintains constant communications with the fleet and supports the following functions:

7.1.2.1 The PC server shall have access to the fleet via the IE IT corporate network, using either a dedicated APN or public internet with appropriate configuration of the firewall.

7.1.2.2 IT shall have a facility to manage the 'Fleets Database'. The scheduler shall be able to configure and allocate different groups of trains, i.e. train class, or sub-groups within a class. Manual entries are required in order to define train unit identity numbers equipped with GSM communications.

7.1.2.3 The fleet database shall be automatically updated when data is received from individual trains, i.e. where equipment containing the SIM has been changed (use of spares), and the change is automatically dealt with by the scheduler.

7.1.2.4 The scheduler shall include a facility to report the association of SIM number to train unit, including a printed report.

7.1.2.5 The scheduler shall include a facility to report on usage (data received and data sent) for each mobile (SIM), including a printed report.

7.1.2.6 The scheduler shall support the preparation of routine tasks, i.e. similar to Windows Task Manager.

7.1.2.7 Tasks may be scheduled in the long term over many years but resolved to particular times and dates. *Guidance note: Dates for timetable change may be determined in advance, it is anticipated that the annual LTP will be downloaded from VoyagerPlan by FTP, then automatically processed before transmission to the fleets.*

7.1.2.8 The Task Manager shall allow the system user to check status before the system proceeds to the next stage, when so configured. For example, when the LTP has been compiled into the PIS database allowing the user to check the DBE before permitting the scheduler to distribute the file to the fleet.

7.1.2.9 The scheduler shall provide reports and feedback on progress, for example where it has been commanded to upload files to a given fleet, failure to upload to any train units in that fleet or sub-group.

7.1.2.10 The scheduler and DBE are separate systems but may co-exist on the same computer and may have a common user.

7.1.3 Communications Manager

The scheduler shall include a communications management process to support the following functions:

7.1.3.1 Configuration of the internet interface with firewall supporting communications to the mobile network APN.

7.1.3.2 Simultaneous communications with the fleet via the mobile network.

7.1.3.3 FTP support (or alternatives) for interface with VoyagerPlan connected via the corporate IT network.

7.1.3.4 For Option 2 only web server support, allowing internal and external users to access train positions as data (for CIS interface) or as graphic data overlaid onto maps.

7.1.3.5 Web support for access by maintenance team, i.e. PIS systems status.

7.1.3.6 Automatic distribution of e-mail alerts to maintenance teams based upon configurable fault status priorities.

7.1.3.7 For Option 5 only support for a Real Time PIS Manager MMI – train positions shown on maps with menu system allowing access to send free-form messages with metadata, as described in section 7.5.

7.2 Option 2 – Train Tracking

7.2.1 On-train system

The tracking function requires Option 1 to be provided. Otherwise, it is assumed that the PISC is capable of providing all of the data required to support the tracking function. However, there is one possible exception where a sub-option may be considered to offer an RFID reader in order to provide a better location resolution.

7.2.1.1 Each train unit with an active cab shall provide regular tracking communications to the Tracking Manager.

7.2.1.2 The tracking interval shall be configurable within the Scheduler Communications Manager, covering the range 30 seconds to 10 minutes, in 10 second increments. Since the GSM Communication Gateway is mobile initiated, the configured timing shall be communicated to the fleet. *Guidance note: The contractor should establish the validity period of the mobile network NAT Router routing table and set the upper time limit within (typically 180 seconds), i.e. where using the tracking packet for the Ground systems to identify the IP address of the mobiles.*

7.2.1.3 The tracking (heartbeat) packet shall be designed for least cost operation and shall be contained within the minimum billable packet. *Guidance note: the packet may be sent as a UDP datagram, but considering that the header and data are charged as part of the billable payload.*

7.2.1.4 The following data shall be contained within the tracking packet:

- Source IP address / port (dynamic mobile).
- Destination address / port (fixed ground system).
- Train unit ID (a null value shall be agreed to signify no Train ID entered).
- Date and time of report.
- Vehicle/unit ID.
- Longitude.
- Latitude.
- Heading.
- Speed.
- Last station TIPLOC.
- Next/current station TIPLOC.
- Destination station TIPLOC (Note 1).
- Distance to next station.
- Odometer reading (Note 1).
- Door status – open/closed.

Note 1 – This data is only required once for each operated Train ID / route, a second tracking packet may be defined for this data allowing the regular tracking packet size to be kept to a minimum.

7.2.1.5 The train location and tracking system shall have the capability to identify and report that a train has passed through a particular location, e.g. through one of the train washing facilities. *Guidance note: Some of the train washing facilities are on depots that are close to main lines. Trains pass through wash facilities in one direction only and must pass at low speed, typically 5 km/h.*

7.2.1.6 As a sub option, a price shall be given for including an RFID reader on each train unit. *Guidance note: A passive RFID tag would be installed in the infrastructure, e.g. at train wash facilities. Guidance note: RFID solutions are available from companies such as Hima-Sella (Tracklink 3), Tagmaster, Harting and Balogh.*

7.2.1.7 The tracking system shall log the travel history of the fleet and archive the data. It shall be possible to extract reports, as listed below:

- Current odometer readings of the fleet, detailing individual units.
- Distance travelled over a defined period for a given fleet, showing individual units.
- Hours in service (operating a Train ID), by train unit over a given period.
- Frequency of passing or visiting particular locations, e.g. by TIPLOC and train wash facilities.

7.3 Option 3 – WiFi Communications Gateway

This option shall be proposed as an alternative to Option 1. It provides a benefit in having negligible operating cost but has the disadvantage that it cannot support communications in real time during normal train service.

7.3.1 WiFi Client and antenna

7.3.1.1 The WiFi gateway shall be provided as a module within the PISC or as an associated sub-system. The module or separate sub-system shall be designed with provision for future upgrades, accounting for developments in WLAN and WMAN technologies.

7.3.1.2 Only a single WiFi client shall be allocated to each train unit.

7.3.1.3 IP address of a particular train unit shall be allocated by DCHP.

7.3.1.4 The WiFi Client shall make use of the broadband antenna described in 5.3.8. Direct connection to the broadband antenna may be assumed; however, the design shall make provision for a Triplexer to be installed in the future in case other users require sharing the antenna.

7.3.2 WiFi Access Points

7.3.2.1 WiFi Access Points shall be installed by the contractor at each train depot providing sufficient coverage of all stabling roads and internal vehicle workshops. *Guidance note: DART fleets are operated from Fairview depot. Commuter DMU fleets are operated from Drogheda depot.*

7.3.2.2 Access Points shall be either hardwired or make use of point to point Ethernet extensions back to a central point within each depot, thus is within the contractor's scope. From that central point, IE shall be responsible for back haul connectivity to the centralised location of the Scheduler.

7.3.3 Communication Scheduler

Facilities of the WiFi Communication Scheduler are identical to those described in section 7.1.2

7.4 Option 4 – Short Term Plan Updates and Driver Information

In practice STP updates may be infrequent but it will be assumed that the updates could be daily. This option therefore increases the frequency of re-compiling the plan to each day, i.e. timetable alterations decided on the previous day may be implemented on the fleet, or on selected parts of the fleet. *Guidance note: If the LTP is retained by the fleet and only selected parts of the STP (one week look ahead) are to be uploaded, the STP data file size may be reduced to approx. 50kB. Using a GSM / GPRS data link this equates to approx 10 to 15 seconds download time required each day for each train.*

7.4.1 Communications Scheduler and DB

7.4.1.1 The STP shall be extracted from VoyagerPlan and automatically processed for uploading to the fleet.

7.4.1.2 The daily update may be compressed significantly by considering a limited look ahead (one week) and limiting data to variances to the LTP. It may be further compressed by restricting the data to relevant fleets, i.e. freight, Enterprise, etc are not relevant.

7.4.2 Enhanced Driver MMI using VoyagerPlan data

Train drivers are currently issued with printed notes that identify the Train IDs to be used for each service. However, with Engineering works it is difficult to convey information regarding changes. This option provides this capability.

7.4.2.1 The drivers MMI shall be enhanced with a larger screen of higher resolution colour graphics capability.

7.4.2.2 Any changes compared to the LTP shall be highlighted to the driver.

7.4.2.3 Prior to entry of Train ID, the system shall determine all potential Train IDs for that location within a defined time window of current time. For example, the driver may be presented with a small selection of valid Train IDs and associated destinations and departure times. The driver shall manually select the correct Train ID, or may enter the Train ID on the train radio using the MMI as a substitute for train crew notes.

7.4.2.4 Following entry of Train ID, the MMI shall allow all of the station stops and arrival / departure times to be reviewed.

7.4.2.5 It shall be possible for the driver to implement last minute changes by adding or deleting stops, i.e. creating a very Short Term Plan (VSTP)

7.4.2.6 Location status messages on the MMI shall be supplemented with arrival / departure times as appropriate, i.e. 'At start <station y> dep. 21:15:00', 'Journey to <station x> arr. 21:22:30'. Timing information shall be presented for all calling points along the route and additionally shall include the capability to show other TIPLOC locations for timing purpose, i.e. junctions, signal boxes, etc.

7.5 Option 5 – Real Time Passenger Information System (RTPI)

7.5.1 Real Time Passenger Information is where up to the minute events and delays are communicated to passengers on board the trains. The information shall be timely, accurate and relevant. It shall therefore be assumed that Option 2 (Tracking) must be adopted. As an example of application, passengers arriving in Dublin may be given alternative interchange information in case of disruption to LUAS or public transport. Delays, disruptions and diversions (bus substitution) may be clearly explained to passengers.

7.5.2 On train PIS system changes

The following changes / additions are envisaged:

7.5.2.1 The on-trains systems shall have the capability of receiving messages and metadata from a central RTPI controller.

7.5.2.2 Messages shall be up to 1000 characters in length.

7.5.2.3 Metadata shall support the following information:

- Priority of message – low (public information), medium (disruptions), high (emergencies).
- Validity – from hh:mm to hh:mm.
- Frequency – minutes.
- Geofence – boundary of affected stations.
- Direction.
- Type.

7.5.2.4 Trains shall discard all RTPI information at a pre-determined time each day, otherwise when the data is no longer valid.

7.5.2.5 The on-train PIS system shall allocate time slots for the presentation of RTPI that avoid conflict with the normal PIS trigger locations, i.e. typically during the journey phase between stations.

7.5.2.6 The DVA shall have the capability of receiving associated speech files (compressed data) to be associated to the message.

7.5.3 RTPI Ground System

The RTPI system shall be for use by the train operations staff within the control centre. It shall be supplied as software to operate on a PC. The PC shall be linked to the Communications Scheduler via the IE IT network.

7.5.3.1 The RTPI software shall be capable of co-existing with other applications running on the same PC.

7.5.3.2 The PC may be connected to IE operating and Train Describer systems such that the user is aware of the operating conditions throughout the IE network. Through other communication channels the user will be aware of the operating status of other transport systems, e.g. LUAS, roads / buses, etc.

7.5.3.3 The user shall be presented with the tracking output from the fleets overlaid on a map, refer to 7.2. Individual trains shall be highlighted in respect of travel direction and Train ID.

7.5.3.4 The user shall have the capability to select individual Train ID or groups of trains and then send messages to the individual or groups.

7.5.3.5 The user shall have the capability to create audio and visual messages, to be stored in a memory (short term scratchpad and long term).

7.5.3.6 Audio recording facilities shall be available to the user and a desk top microphone shall be provided.

7.5.3.7 Having generated a message, the user shall then have the facility to create the metadata associated to that audio / visual message.

7.5.3.8 The user shall have the facility to check / monitor the audio / visual message before it is distributed to the fleet.

7.5.3.9 The RTPI system shall distribute the message / metadata to relevant trains within the fleet. Relevant means that a message for a DART service would not be distributed to a Commuter train, etc.

7.5.3.10 The message in the form of data shall be stored on-board relevant trains for action as and when required. Alternatively, the ground system may retain control and deliver triggers to the relevant trains based upon knowledge of current location from train tracking data.

7.6 Option 6 – MEMS INS Augmentation

MEMS INS augmentation is to be used by the GPS receiver. When used in combination with the odometer, the system shall have the capability of reconciling absolute position within +/- 100m when GPS satellites are obscured for 3 km or 5 minutes. Refer to 5.3.3.4.

8 Design Validation and Type Testing

8.1 Bid stage

8.1.1 Bidders are required to submit the information detailed in section 3.3. Any new / novel hardware or software and any modifications to existing designs shall be clearly stated, including any validation or type tests required whilst undertaking the project.

8.2 Type Tests

Typically, type testing is carried out on single unit samples of each LRU, the samples shall be of production standard and to be retained for reference. Some type tests may be repeated on a random basis to ensure production samples do not differ from original design, or in case the design has been modified. Type testing shall comprise the following test parameters, but the list below is not exhaustive:

- Functional
- Vibration
- Bump and Shock
- Dry heat/cold
- Damp/humidity
- EMC
- Surge and transient
- Supply min/max and interruption
- Endurance
- IP rating, dust and water spray

8.2.1 Type test samples shall be retained as 'glass case' equipment references and shall not be supplied as part of the contract equipment for use on trains. A data pack containing type test results shall be supplied. Reliability and endurance testing to be included where applicable, any failures encountered during burn-in or type testing shall be logged and recorded. Reliability figures are to be calculated and graphically plotted during the warranty period. The warranty period shall not terminate until reliability is at a stable value better or equal to the values quoted in the bid response.

8.2.2 In order to demonstrate system functionality, a FAT is required as detailed in section 4.11. The test wall shall comprise an agreed sub-set of PIS equipment. Representative wiring shall be used, paying particular attention to replicating any wiring considered to be a risk, e.g. operation over extended length such as maximum coupled train length. The test wall details shall be subject to approval by the Engineer as part of the type test specification and shall be fully detailed therein.

8.2.3 Production equipment shall be to the same design standard that was used for type testing, traceable to existing type test reports and certification or to the new tests to be undertaken as part of this project.

The 'glass case' type test samples shall be available for inspection and comparison.

8.2.4 IE or its delegates, shall have right of access to attend any development, validation type, or routine test. Prior to undertaking the type test, the contractor shall submit a programme (with at least four weeks notice), of test procedures and/or method statements for approval by IE. If the equipment offered has been previously type tested then the extent and nature of the type test results shall be clearly identified in the offer. IE shall reserve the right to request additional or repeated type tests, particularly if the equipment is to be specially modified for use on this project.

8.3 Production/Routine Tests

Details of the test and frequency of sampling shall be agreed with IE. Production testing shall include 100% testing of function, galvanic isolation, earth continuity, low voltage start up and burn in accordance with EN50155. These tests are in addition to normal quality assurance procedures.

All test results shall be recorded by product serial number and shall be made available for review by IE.

8.4 System Acceptance Tests

The contractor shall define a series of System Acceptance Tests covering the following milestones:

8.4.1 Installation Acceptance – This stage involves static testing of the train unit and inspection / scrutiny of the installation and installation records. This acceptance is required before hand back to IE. IE shall be responsible for fitness to run inspections. The contractor shall be responsible for coordinating NoBo, IVB or CCB inspections if so required.

8.4.2 First of Class Acceptance – Validation and proving the design and configuration values for the first of each fleet type. The contractor shall make provision for attendance of staff to monitor and support the First of Class vehicle until two fault free full days running have been completed.

8.4.3 Following First of Class Acceptance, the contractor shall be responsible for the Configuration Management Database, so that software / hardware and modification status of each product is recorded by serial number with records identifying each supplied item, any changes made shall be authorised by IE. The contractor shall also provide details on the change control process for all equipment installed on the vehicle.

8.4.4 Completion of Train Unit – Following First of Class Acceptance, limited proving test is required on each unit when it re-enters service. The train shall be accompanied on two typical Train ID runs, i.e. approx 0.5 day to confirm fault free operation.

8.4.5 Warranty Acceptance – The warranty period shall not commence until 'Completion of Train Unit' has been achieved for each individual train

unit. The consolidated warranty period shall be a cumulated average two years for each vehicle class but no less than one year on an individual train unit. The end of the warranty period shall not occur until such time as the reliability performance meets or betters the contractually agreed values. *Guidance note: the 'consolidated warranty period' may be calculated from elapsed weeks in service, for example the first train of the fleet may be completed in January, the last train of that fleet in December this effectively places termination of the warranty period in some time in the summer in two years time.*

8.4.6 Completion of Warranty Period – The warranty period ends on the date determined from 8.4.5, (Guidance note: calculation method). But only where the reliability, depot hours and SAF are within contracted limits. Where targets are not met, the period shall extend in 12 week increments allowing targets to be reviewed until within contracted limits.

9 Training

The contractor shall provide suitable training in the programming, operation and maintenance of the PIS systems for each of the following staff: Project/FTS engineers, Operating staff, and Maintenance staff. In the case of IE operating staff, the supplier shall train the IE Trainer. Training courses shall assess the competence of the individual trainees and certificates of competency shall be issued to those trainees that have achieved an acceptable level.

For each of the individual training courses detailed below, the contractor shall produce course notes, presentations and handouts, which shall be submitted previously to IE for review and approval.

9.1 Ground Systems

Training courses in the use of the ground systems shall be provided following delivery of these systems. This event shall take place at least four weeks before PIS equipped trains are due to enter service to provide sufficient time for data preparation.

9.1.1 Database Editor and Speech Programming

Two training sessions shall be provided for users of the DBE, Speech Editor.

9.1.1.1 An objective of the first training session is that the contractor shall assist in the transfer of existing data (GPS coordinates) and throughout the preparation of the core database. An efficient design of DBE will enable this activity to be undertaken in a short time period. The speech programming system shall be demonstrated.

9.1.1.2 The second training session may be shorter since the core data will have been generated during the first session.

9.1.1.3 IE shall be responsible for providing voice recordings.

9.1.1.4 Both sessions shall conclude with training the process of uploading the data on the train.

9.1.2 Communications Scheduler

If this option is taken, training shall be provided on configuration and use of the scheduler.

9.2 Operations

The PIS supplier shall provide training services for IE staff, the following training course are envisaged:

9.2.1 Simulator

The contractor shall provide an MMI simulator for training purposes. The simulator may comprise a real Driver MMI that is fully functional or a PC based simulation.

9.2.2 Driver and Train Crew Trainers

The contractor shall provide two separate training courses for the driver and train crew trainers. This training shall be provided in a timely manner so that the train drivers may be fully trained in using the system prior to introduction on the fleet.

9.2.3 Tracking Option

Where the tracking option is provided, a single training session shall be provided for the IE IT team to allow set up and access by users throughout IE.

9.2.4 RTPI Option

The contractor shall provide two separate training sessions in the operation of RTPI from the control room PC.

9.3 Maintenance

A quantity of five separate depot based training courses to be attended by up to five persons (each course). The course shall be undertaken on each train type serviced by the depot and shall involve hands on learning and use of the download unit/maintenance tools and shall be assessed by simulation of a range of expected failures. In addition, the course shall include testing, fault finding, replacement of LRUs routine maintenance, etc.

9.3.1 Depot Test Wall (one for DMU, one for EMU – location to be decided)

Prior to the training course, the contractor shall supply documentation, connectors (mating halves) connected to cable harnesses to allow IE to build two test walls to the contractors requirements, i.e. to replicate the test wall at contractor premises as described in section 4.10. The contractor shall provide LRU test procedures and training in the test process. The objective of this test facility shall be to replicate the PIS OEM test procedure to avoid returns with 'No Fault Found' NFF.

9.3.2 On–train Fault Finding, Test and Commission

Extensive training shall be provided by the contractor with simulated faults and diagnosis together with changing of LRUs fully demonstrated.

9.3.3 Ground System Maintenance

Fault finding, software installation and other general maintenance shall be demonstrated to IE IT department.

10 Spares

10.1 Spares quantities

The contractor shall recommend an appropriate level of spares for each depot based upon the reliability of the PIS equipment and the time taken to repair failed component at the suppliers repair facility. There shall be sufficient spares to ensure the stock levels remain adequate at all times through the life of the systems.

10.2 Spares Prices

Prices shall be quoted with validity from the award of contract until two years following the end of the warranty period. The contractor shall act reasonably in the pricing and availability of spares and shall propose a regime for supporting spares in the future. For example, declaring the price mark up to be used. IE acknowledges this may depend on whether the contractor needs to maintain individual components or LRUs in stock or simply acts as a procurement agent for third party materials.

10.3 Warranty Spares

The contractor shall make sufficient provision of spares such that the PIS systems are maintained and available. The contractor shall also provide the MTBF and spares repair turnaround times to support the stated quantities. IE shall provide secure storage on depots and an agreed number of man hours for exchange of LRUs during the warranty period. Where reliability does not achieve agreed objectives, the contractor shall be responsible for all costs in increasing the provision of spares and meeting the cost of additional depot resources.

During the warranty period, IE depot staff resources may be required for first level support such as changing failed LRUs. The required man hours shall be stated in the bid and the cost of providing this support will be considered during tender evaluation. Where depot support time exceeds 25% of the agreed hours, on average in a given month, the contractor shall either provide their own additional resources on depot or agreed to fund additional IE resources.

At the end of the warranty period, IE shall be given the option to purchase serviceable and 'as new condition' spares at the agreed contract rate. The contractor shall provide notice within 30 days of the completion of warranty with a 90 day open option for purchase.

10.4 Design and Endemic Faults

The contractor shall provide sufficient spares, float stock and on-site support to undertake remedies in case of endemic failures or design faults. Depot labour normally reserved for routine reliability and maintenance issue shall not be used for rectification of such faults. The contractor shall agree modification campaigns with IE.

An endemic fault shall be defined as when 10% of the fleet fitted has been affected in a 1 year period, or where individual component failure rate is x10 greater than the declared MTBF.

Design changes and modifications shall not be undertaken following FAT acceptance without prior approval from IE.

If the contractor fails to address and resolve design / endemic faults in a timely manner, IE shall require the contractor to provide an action plan. In cases where the contractor fails to provide the action plan or reasonably acts according to the plan then notice of arbitration shall be raised. In the event of ongoing failure to resolve, and depending upon the outcome of arbitration, a potential outcome may include IE using detailed design information within ESCROW to support third party investigations and remedies.

10.5 Obsolescence

The contractor shall set out a policy for dealing with component obsolescence. Modular replacements of equivalent or better performance / function shall be developed throughout the life of the PIS system. Costs associated with engineering and validating substitutes shall be borne by the contractor.

The contractor shall ensure that where component obsolescence risks the ongoing operation of the PIS system, adequate 'last time' procurement notice for additional spares is provided to IE.

If the contractor fails to address and resolve obsolescence problems in a timely manner, IE shall require the contractor to provide an action plan. In cases where the contractor fails to provide the action plan or reasonably acts according to the plan then notice of arbitration shall be raised. In the event of ongoing failure to resolve, and depending upon the outcome of arbitration, a potential outcome may include IE using detailed design information within ESCROW to support third party investigations and remedies.

11 Standards and Reference Documents used

All relevant European Standards and railway industry standards current at time of contract placement shall be met. The following list of standards highlight those frequently considered, it is not an exhaustive list of applicable standards. Note: the following sections are listed in order of precedence, i.e. European Standards are first priority, then Irish Standards, and so on.

11.1 European Standards

Number / Date	Title
2004/108/EC, July 2007	European Union Directive on Electromagnetic Compatibility.
1999/5/EC, March 1999 Note 1	Radio Equipment and Telecommunications Terminal Equipment.
2001/16/EC, March 2001 Note 2	Interoperability of the conventional rail system
2008/232/EC, February 2008 (Issue 2) Note 3	Technical specification for interoperability relating to the rolling stock sub-system of the trans-Europe high speed rail system referred to in directive 96/48/EC. Note: sections relating to communications & information, PA and passenger alarm are relevant.
2008/164/EC	Technical specification for interoperability for Persons with Reduced Mobility
EN50121-3-1: 2006	European Standard: Railway applications - Electromagnetic compatibility - Part 3-1: Rolling stock – Whole vehicle emissions.
EN50121-3-2: 2006	European Standard: Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock – Apparatus.
EN50121-4:2006	European Standard: Railway applications - Electromagnetic compatibility - Part 4: Emissions and Immunity of the Signalling and Telecommunications Apparatus.
EN50124-1:2007	European Standard: Railway applications – Insulation coordination – Part 1: Basic requirements (Creepage and clearance)
EN50124-2:2001	European Standard: Railway applications – Insulation coordination – Part 2: Over voltage and related protection
EN50125-1:1999	European Standard: Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock
EN50126-1:2006	European Standard: Railway applications – Specification and demonstration of Reliability, Availability, Maintainability and safety (RAMS) – Part 1: Basic Requirement and Generic Process.
EN50128:2001 Note 4	European Standard: Railway applications – Communication, signalling and processing – Software for railway control and protection systems.

Number / Date	Title
EN 50153:2002	British / European Standard: Railway applications – Rolling Stock. Protective Provisions Relating to Electrical Hazards.
EN50155: 2007	British / European Standard: Railway applications - Electronic equipment used on rolling stock.
EN60529: 1992	Degrees of protection provided by enclosures (IP code).
EN61373: 1999	British / European Standard: Railway applications - Rolling stock equipment - Shock and vibration tests.
Note 5	Fire Standard
ISO/IEC 8859-15:1999	Information Technology – 8-bit single-byte coded graphic character sets
BS857:1967	Safety glass for land transport

Notes:

1. Relevant to application and use of communications technology, e.g. GSM modem, WiFi, etc.
2. TSI for conventional rail does not currently have a technical specification for rolling stock.
3. As a consequence of Note 2, the Technical Specification for Interoperability of High Speed Railways (Rolling Stock) will be used.
4. Alternative recognised Software Management and Quality Systems will be considered. For reference to EN50128, the PIS system shall be deemed to have safety integrity SIL 0.
5. Fire standard to be agreed between the contractor and IE, refer to section 4.3.

11.2 Irish Standards

Description	Reference
Energy, OHLE Interface for IE Rolling Stock	CME/TS/TECH/06
Electromagnetic Compatibility, EMC	CME/TS/TECH/08
Information Technology – Irish 7-bit Coded Character Sets	I.S. 433:1999
Irish Language Regulation	Statutory Instrument No. ????
IE Rolling Stock Projects – Approval Process v2.10	See Appendix 5

11.3 RSSB Standards

Description	Reference
Structural Requirements For Railway Vehicles	GM/RT2100
Railway Group Standard: Requirements for the Control of Risks Arising from Fires on Railway Vehicles.	GM/RT2130

Description	Reference
Railway Group Standard: Equi-potential Bonding of Rail Vehicles to Running Rail Potential.	GM/RT2304
Requirements for Driving Cabs of Railway Vehicles	GM/RT2161
Code of Practice for Structural Aspects of Railway Vehicle Interiors	GM/RC2502
Commentary on Structural Requirements for Railway Vehicles	GM/RC2504
Code of Practice – Rail Vehicles – Equi-potential Bonding	GM/RC2514
Electromagnetic compatibility between railway infrastructure and trains	GE/RT8015
Code of practise for EMC between the Railway and its neighbourhood.	GM/RC1500
Guidance on the Application of Selective Door Operation Systems	GE/GN8577
Guidance on the Use of Satellite Navigation	GE/GN8578
Guidance on Digital Wireless Technology for Train Operators	GE/GN8579

The standards referenced above are available from www.rgsonline.co.uk

11.4 International Standards

Number / Date	Title
MIL HDBK 217 Issue F (Ground Mobile) DEF STAN 00-41 Issue 3 NPRD - 95	Reliability Prediction of Electronic Equipment

11.5 UIC Standards

Description	Reference
Loudspeaker and telephone systems in RIC coaches. Standard technical characteristics	UIC 568

12 Appendices

12.1 Appendix 1 – Sencity Antenna

HUBER+SUHNER®
SENCITY®RAIL ANTENNA
FOR TRAINBORNE WIRELESS COMMUNICATION

SWA 0859/360/4/0/DFRX30

Multiband antenna: GSM 900, GSM 1800, GSM/PCS,1900, UMTS, 2.4, 3.5, 5.3 and 5.8 GHz Bands and GPS/Galileo incl. LNA

Technical Data

Electrical Properties Multiband Antenna

Frequency range (MHz)	870 - 960	1710 - 2170	2400 - 2700	3400 – 3700	5150 - 5875
Impedance	50 Ω				
VSWR*	1.5	1.5	1.5	1.5	2.0
Polarization	linear, vertical				
Gain (using a ø1 m ground plane)	6 dBi	8.5 dBi	9.5 dBi	9.5 dBi	8.5 dBi
Max. power	100 W (CW) at 50°C				

* Note that all VSWR values are guaranteed with and without ground plane.

Electrical Properties GPS/Galileo Antenna

Frequency range	1575.42 ± 1.023 MHz				
Impedance	50 Ω				
VSWR	1.6				
Polarization	circular, right				
Antenna gain (using ø1 m ground plane)	6 dBi (ref. to a circularly polarized isotropic antenna)				
Gain LNA	27 ± 2 dB				
Noise figure	≤ 2.7 dB, typ. 2 dB				
Operating voltage	3.0 to 5.5 VDC feed at centre conductor of GPS antenna				
Current consumption	≤ 25 mA, typ. 20 mA				
Out of band attenuation	> 20 dB at f_0 ± 50 MHz > 40 dB at f_0 ± 100 MHz				
Isolation between ports	> 30 dB	> 40 dB	> 40 dB	> 37 dB	> 28 dB

Mechanical & Environmental Properties

Dimensions	260 x 100 x 90 mm (10.24" x 3.94" x 3.54")
Weight	1.2 kg (2.65 lbs.)
Radome material	high impact acrylic styrene acrylonitrile (HRA150)
Radome colour	RAL 7043 (dark grey)
Back/base plane material	aluminium with polyurethane powder coating
Back/base plane colour	RAL 7043 (dark grey)
Operating temperature range	- 40°C to + 85°C
Storage temperature range	- 40°C to + 85°C

Meets the following requirements:
- Protected against the effects of continuous immersion in water IP68 (only if correctly installed).
- EN 50155, electronic equipment used on rolling stock.
- EN 50124-1, insulation coordination (27.5 kV AC and 3.8 kV DC).
- High voltage and high current protection according to Deutsche Bahn specifications (protection against short circuits of 40 kA).
- EN 50121-3-2, electromagnetic compatibility.

Available Types	**Article no.**	
1399.17.0044	84002818	2 x N female

Mounting Hardware	**Article no.**	
9091.99.0189	84008192	Adapter panel[1]

[1]: Allowing the replacement of the antenna from another antenna manufacturer, without any modifications of the original mounting holes located on the vehicle's roof. Using this interface, the mounting holes dimension for the broadband and GPS connectors have to be 25 ...38 mm and 35 ...38 mm respectively (ref. to mounting instruction). The antenna has to be secured using four M10 screws.

Documents	
01.02.0777	security instruction
Doc.N°. 0000197864	mounting instruction

Material: The antenna is designed according the military standard MIL-F-14072D, which guarantees a long-life without corrosion.
Mounting: On a plane conductive surface clear of paint and other contaminants.
To ensure a correct sealing between the antenna and the roof, the connector mounting hole dimensions have to be 17 ... 38 mm for the broadband antenna and 35 ... 38 mm for GPS antenna. The antenna has to be secured using four M8 screws.
Grounding and high voltage protection: All antenna parts are grounded to protect against lightning and catenary lines according to UIC 533.

12.2 Appendix 2 – VoyagerPlan RPI Long Term Plan Output

Note: the formatting has been preserved as imported from Notepad without adding extra spaces. This .RPI LTP is valid from 09/12/2007 until 13/12/2008 and was produced 7/11/2008 at 10:38:51. 9/12/2007 was a Sunday and the days run are shown from that date.

```
RPI     100     DEC07           IE      09-12-2007 00:00:00     13-12-2008 00:00:00
        07-11-2008 10:38:51     0
THD     A       IE      A121    99351   0       10-12-2007 00:00:00
        NYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNY
YYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYY
YYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYY
YYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYY
YYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYY
YNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYY
        BFSTC           06:50:00        CNLLY           09:05:00
TDT     A       1       -1                      DD/90
TSP     A       1       BFSTC                   06:50:00                        +00'00
        Y
TMV     A       2       BFSTC           LBURN                   06:50:00        07:01:00
                +00'00  +00'00  +00'00  +00'00
TMV     A       3       LBURN           LURGN                   07:01:00        07:12:00
                +00'00  +00'00  +00'00  +02'00
TMV     A       4       LURGN           PDOWN                   07:12:00        07:17:00
                +00'00  +00'00  +00'00  +00'00
TSP     A       5       PDOWN           07:17:00        07:19:00                +00'00  -02'00
        N       N
TMV     A       6       PDOWN           PPASS                   07:19:00        07:29:30
                +00'00  +00'00  +00'00  +00'00
TMV     A       7       PPASS           NEWRY                   07:29:30        07:39:00
                +00'00  +01'00  +00'00  +00'00
TSP     A       8       NEWRY           07:39:00        07:41:00                +00'00  -02'00
        N       N
TMV     A       9       NEWRY           DDALK                   07:41:00        07:57:00
                +00'00  +01'00  +00'00  +00'00
TSP     A       10      DDALK           07:57:00        07:59:00                +00'00  -02'00
        N       N
TMV     A       11      DDALK           DGHDA                   07:59:00        08:18:30
                +00'00  +00'00  +00'00  +00'00
TSP     A       12      DGHDA           08:18:30        08:20:30                +00'00  -02'00
        N       N
TMV     A       13      DGHDA           MSNEY                   08:20:30        08:29:30
                +00'00  +03'00  +00'00  +00'00
TMV     A       14      MSNEY           BBRGN                   08:29:30        08:33:30
                +00'00  +01'00  +00'00  +00'00
TMV     A       15      BBRGN           SKRES                   08:33:30        08:38:00
                +00'00  +02'00  +00'00  +00'00
TMV     A       16      SKRES           MHIDE                   08:38:00        08:45:00
                +00'00  +00'00  +00'00  +00'00
TMV     A       17      MHIDE           HWTHJ                   08:45:00        08:52:00
                +00'00  +04'00  +00'00  +00'00
TMV     A       18      HWTHJ           CNLLY                   08:52:00        09:05:00
                +03'00  +00'00  +00'00  +03'00
TSP     A       19      CNLLY           09:05:00        09:05:00                +00'00  +00'00
        N       N
```

```
TRF   A     1     -1     ACC   F
TRF   A     1     -1     RES   R
THD   A     IE    A122   99352 0     10-12-2007 00:00:00
      NYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNY
YYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYY
YYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYY
YYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYY
YYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYY
YNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYY
      CNLLY       07:35:00    BFSTC       09:39:00
TDT   A     1     -1                DD/90
TSP   A     1     CNLLY             07:35:00                  +00'00
      Y
TMV   A     2     CNLLY       HWTHJ             07:35:00      07:43:00
            +00'00 +00'00 +00'00 +00'00
TMV   A     3     HWTHJ       MHIDE             07:43:00      07:46:00
            +00'00 +00'00 +00'00 +00'00
TMV   A     4     MHIDE       SKRES             07:46:00      07:53:00
            +00'00 +00'00 +00'00 +00'00
TMV   A     5     SKRES       BBRGN             07:53:00      07:56:00
            +00'00 +00'00 +00'00 +00'00
TMV   A     6     BBRGN       MSNEY             07:56:00      07:59:00
            +00'00 +00'00 +00'00 +00'00
TMV   A     7     MSNEY       DGHDA             07:59:00      08:05:00
            +00'00 +00'00 +00'00 +00'00
TSP   A     8     DGHDA       08:05:00    08:07:00            +00'00  -02'00
      N     N
TMV   A     9     DGHDA       DDALK             08:07:00      08:30:00
            +00'00 +03'00 +00'00 +00'00
TSP   A     10    DDALK       08:30:00    08:32:00            +00'00  -02'00
      N     N
TMV   A     11    DDALK       NEWRY             08:32:00      08:48:00
            +00'00 +00'00 +00'00 +00'00
TSP   A     12    NEWRY       08:48:00    08:50:00            +00'00  -02'00
      N     N
TMV   A     13    NEWRY       PPASS             08:50:00      08:58:30
            +00'00 +00'30 +00'00 +00'00
TMV   A     14    PPASS       PDOWN             08:58:30      09:09:00
            +00'00 +00'00 +00'00 +00'00
TSP   A     15    PDOWN       09:09:00    09:11:00            +00'00  -02'00
      N     N
TMV   A     16    PDOWN       LURGN             09:11:00      09:19:00
            +00'00 +02'00 +00'00 +00'00
TMV   A     17    LURGN       LBURN             09:19:00      09:28:00
            +00'00 +00'00 +00'00 +00'00
TMV   A     18    LBURN       BFSTC             09:28:00      09:39:00
            +01'00 +00'00 +00'00 +00'00
TSP   A     19    BFSTC       09:39:00    09:39:00            +06'00  +00'00
      N     N
TRF   A     1     -1     ACC   F
TRF   A     1     -1     RES   R
```

VoyagerPlan is a train planning and diagramming tool from Atos Origin currently used by IE. It embodies the concepts of the Long Term Plan (LTP) and the Short Term Plan (STP). The LTP in the case of IE is normally valid for twelve months. The

STP can deal with shorter time domains down to the next day, STP's may include alteration for emergency Engineering work, for example.

12.2.1 VoyagerPlan Output

The example above provides a small extract of the first two services listed in a VoyagerPlan .RPI extract file. This file embodies critical details relating to the LTP, a similar file is available for the STP. This report will not analyse the detailed properties of exporting from the .RPI file but will provide sufficient discussion to qualify the simplicity of automatically importing this data to a PIS system. It would be possible to arrange regular extracts of the LTP (monthly) and STP (daily) with the files available to the PIS ground system via FTP. The following parameters deserve an explanation:

Data identifier – each new line type is identified by the three characters

Train ID – On IE services, train IDs are in the form 'annn', where 'a' is a letter followed by three numbers. The following letters are valid for passenger services:

Code	Train Type
A	Mainline Passenger
B	Mainline Passenger Special
D	Diesel Suburban (Outer Destinations)
E	Electric (EMU)
P	Diesel Suburban (Inner Destination)

IE Passenger services Train IDs

The Train IDs are highlighted in bold, A121 and A122 for the two services shown above. The first two examples are Enterprise services but the principles apply to all services including DART. Note: Due to planned expansions on IE's network, the Train ID will have to be in the form 'annnn'. However, until the time in which a four number Train ID is required, the input of the Train ID shall be in the same manner as it is now, i.e. 'annn', but the number 0 shall be automatically placed right after the letter, e.g. if the driver is setting Train ID A123, it shall be displayed as A0123. The system shall be configurable to support full four numeric entry in the future.

TIPLOC – This is a unique location within the railway, identified by a unique code of five characters, and it may be a station, a junction, a signal box, depot or other defined railway location. By way of an example, the stations (stopping) of Train ID A121 have been highlighted in bold and italics, and their corresponding station names are listed below:

BFSTC	**Belfast Central**
LBURN	Lisburn
LURGN	Lurgan
PDOWN	**Portadown**
PPASS	Poyntzpass
NEWRY	**Newry**
DDALK	**Dundalk**
DGHDA	**Drogheda**
MSNEY	Mosney
BBRGN	Balbriggan

SKRES	Skerries
MHIDE	Malahide
HWTHJ	Howth Junction
CNLLY	**Dublin Connolly**

The stopping stations are shown in bold.

Days run – the day the service runs can be identified from a long sequence of Y and N characters, signifying Yes and No. In the example of A121, this service isn't run on Sundays as determined by the NYYY.. sequence, with Sunday 9th December 2007 as the start of the timetable. The same Train ID may be used with non-overlapping day run, i.e. A121 could have a different stopping pattern on Sundays.

Timings – timing are given for arrivals and departures at stopping station and also given for pass through stations and other timing points identified by TIPLOC codes.

12.2.2 VoyagerPlan Data Application for PIS

Both the LTP and STP files are large at approx. 20MB each, the data is tab separated and textual. There is significant scope for compression and a basic ZIP compression will reduce the file to 2MB. There is scope for greater compression since many Train IDs will not be relevant to the particular fleets in question so some filtering of the Train IDs should be possible.

12.2.3 Implementation by the PIS supplier

Analysis of the .RPI file with reference to the Working Timetable allows the file format to be understood with little need for other support. Some support from IE IT on integration within the corporate IT network may be required.

12.3 Appendix 3 – Train Radio Interface

AEG Mobile Communication ZFM90-IR
Issue of train numbers via RS485 data interface
Supplement to "Data interface for issue of train numbers" specification

Author: Stefan Wilken
Version: 00.07
Date: 12.09.2001
Status: final
Signatures:

AEG Mobile Communication Document history

Version	Date	Author	Comments
00.01	11.06.01	S. Wilken	First draft
00.02	18.06.01	S. Wilken	Sec. 4.6
00.03	20.06.01	S. Wilken	Sec. 4.2
00.04	26.06.01	S. Wilken	Sec. 4.8
00.05	11.07.01	S. Wilken	Sec. 4.1
00.06	29.08.01	S. Wilken	Sec. 4.5
00.07	12.09.01	S. Wilken	Revision of RS485 protocol

1 Introduction

This document is the supplement for the specification mentioned in /1/ for transmission of train numbers via an RS422 data interface. The background is provided by the following changes to be implemented for IR:

• Linking via RS485 bus instead of RS422 point-to-point

• Expansion of the interface protocol with addressing information

• Modification of the interface protocol to support the RS485 bus structure

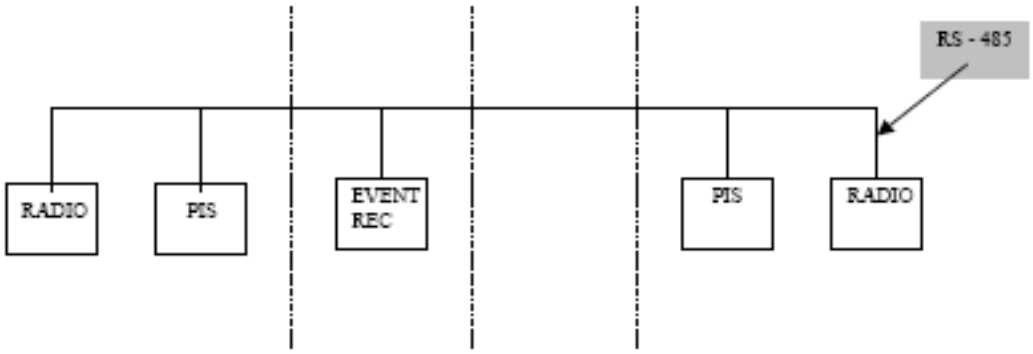
The following diagram illustrates the use of the ZFM90 referred to integration of the RS485 interface.
Only the active users have their own address on the bus. The passive users are, it is true, physically present on the bus, but do not participate in bus communications. The active users are determined by the direction of travel of the train. In a train consist with a number of locomotives > 1, only one locomotive can be active. All other locomotives are passive. The RS485 equipment of the active locomotive is correspondingly also active.
The following users will therefore be active:

1. ZFM90 radio of the active locomotive

2. PIS of the active locomotive

3. The train's event recorder

Where a number of the combinations described in the figure above, consisting of two locomotives with an interpositioned train-section in each case, are used in sequence, only the leading locomotive is active. The subsequent combinations in each case are passive. Both ZFM90s on these RS485 lines, which are in each case independent of one another, are therefore passive. In this case, the PIS of the appurtenant RS485 bus assumes the function of the ZFM90.



in which:
Radio ZFM90
PIS Passenger information system
Event Rec Event recorder

The document describes data transfer via the RS485 interface and the physical circumstances of the interface.

2 References

/1/ Specification for a data interface for issue of train numbers, ZFM90/ABB, V01.03/DE, 27.1.97
/2/ EEFAE-C78.94.112

3 Abbreviations and definitions

3.1 Abbreviations

DPR Dualported RAM
IR Irish Rail
µC µController 80C537 in the control system of the TFZ installation
Loco Locomotive
tbd to be defined
TFZ ZFM motive-power unit system
ZFM90 Mobile train-radio system 90, supply condition as since approx. 1990

3.2 Definitions

4 Properties of the interface

4.1 Physical properties

The interface has the following properties:

• Symmetrical insulated voltage interface in accordance with EIA RS485

• Asynchronous data transmission

• Semi-duplex operation, RS485 two-wire bus

A plug-connector with pin contacts is used as the connection to the ZFM90
Number of poles: 15
Plug type: Sub-D with enhanced number of contacts (VGA socket)
Plug type: female
Plug assignment:

Pin	Signal	Meaning	Level	Direction
1	VCC2	Voltage supply, secondary side	4.5 to 7.5V	Output
2	Y	Output 1 RS485	RS485	Output
3	A_JP	Terminator 120 Ohm for input	-	Output
4	A	Input 1 RS485	RS485	Input
5	GND2	Voltage supply, secondary side, ground	0V	Output
6	Z	Output 2 RS485	RS485	Output
7	Y_JP	Terminator 120 Ohm for output	-	Output
8	B	Input 2 RS485	RS485	Input
9	ADR1a	Input 1 for address bit 1	Max. 20V	Input
10	ADR3a	Input 1 for address bit 3	Max. 20V	Input
11	ADR2a	Input 1 for address bit 2	Max. 20V	Input
12	ADR3b	Input 2 for address bit 3	Max. 20V	Input
13	ADR2b	Input 2 for address bit 2	Max. 20V	Input
14	ADR1b	Input 2 for address bit 1	Max. 20V	Input
15	GND2	Voltage supply, secondary side, ground	0V	Output

The feed voltage necessary for activation of the opto-coupler can be obtained from the interface supply voltage. The wiring in the connecting-cable connector to the RS485 bus has the following appearance referred to the example described:

- Connect Pin 9 (ADR1a) to Pin 1 (VCC2)

- Connect Pin 14 (ADR1b) to Pin 5 or Pin 15 (GND2)

Since the RS485 interface is to be used in a two-wire bus structure, the following pins in the connector on the connecting cable for the RS485 bus must be connected to one another:

- Connect Pin 4 (A) to Pin 2 (Y)

- Connect Pin 8 (B) to Pin 6 (Z)

A jumper should be soldered between Pin 3 (A_JP) and Pin 4 (A) additionally if the bus is to be fitted with a terminator.

4.2 Character format

The following format is used:

- 1 start bit

- 8 information bits, order: LSB first

- Parity: Even

- 1 stop bit

4.3 Control characters used

See /1/ for the control characters used

4.4 Data format

The basic structure corresponds to the data format described in /1/. Address information for the respective user must be transmitted additionally, however, since the interface is operated on an RS485 bus. A telegram is thus composed as follows:

SOH	STX	ADZ	ADQ	6-digit ASCII train number	ETX	LP	EOT

in which:
SOH Start of data block
STX Start of information section
ADZ Target address as ASCII value (30h to 37h for Address 0 to 7)
ADQ Source address as ASCII value (30h to 37h for address 0 to 7)
Train number 6-digit train number, ASCII coded
ETX End of information section
LP Longitudinal parity (values from 00h to FFh)
EOT End of data block

The longitudinal parity is generated as follows:
Exclusive-Or-Link of individual bytes STX, ADZ, ADQ, train number, ETX.
See /1/ for details.

4.5 Telegram types used

Serial No.	Telegram	Meaning
1	SOH STX ADZ ADQ Train number 6-digit ASCII ETX LP EOT	Transfer of current train number Reply: ACK Acknowledge telegram (Serial No. 2) Possible target addresses (ADZ): 1, 2 Possible source addresses (ADQ): 0 (depending on the connection of the address inputs)
2	SOH ACK ADZ ADQ EOT in which: ADZ Target address from the viewpoint of the acknowledgement-sending element ADQ Source address of the acknowledgement-sending element	Acknowledgement to telegram Possible target addresses (ADZ): 0 (depending on the connection of the address inputs) Possible source addresses (ADQ): 1, 2

4.6 Issue of addresses on the RS485 bus

The following table is a proposal for the issue of the RS485 bus addresses:

User	Address
ZFM90 active	0
PIS	1
Event recorder	2

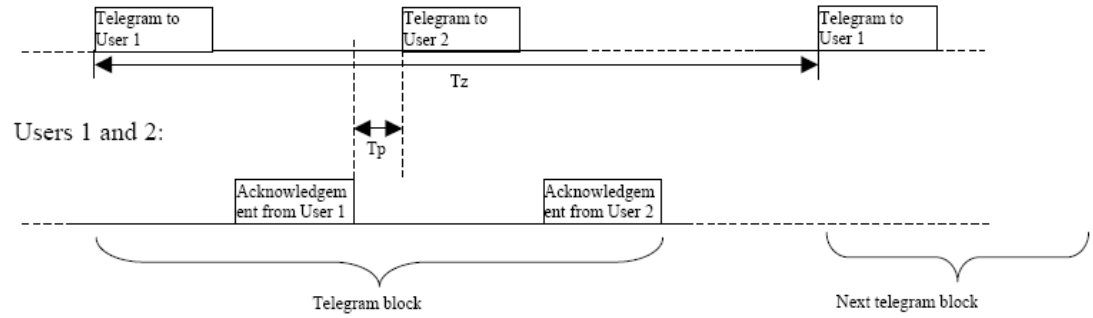
After activation of the interface, the ZFM90 will attempt to transmit the train number currently set in sequence to the users with addresses 1 and 2. The ZFM90 expects from each of the users an ACQ acknowledgement telegram. The ZFM90 will repeat transmission of the train number to any user from whom no valid acknowledgement is received. If transfer of train number fails with not less than one user (no valid ACK acknowledgement received after three attempts one after the other), this is notified to the locomotive driver by a "*" symbol prefixed to the train number. Transfer of the train number is deemed successful after transmission of the train number to both users provided both users have acknowledged the transfer.

4.7 Procedure

The following modifications must be performed vis-à-vis the procedure described in /1/ as a result of the change in the physical configuration to an RS485 bus structure. Firstly, cyclical display of the Readiness-for-reception status by means of XON and XOFF is deleted. Instead, the train-number telegram will be transmitted cyclically with a cycle time Tz to the users with addresses 1 and 2. In this context, a complete data transfer between the ZFM90 and both users, including acknowledge telegrams,

is defined as a telegram block. Cycle time Tz determines the time between the start of a telegram block and the start of the next telegram block.
The following diagram illustrates the procedure in principle:

ZFM90:



in which:
Tz Cycle time
Tp Pause time following end of a valid acknowledgement up to the start of transmission of the train-number telegram to the user with Address 2

Readiness-for-reception status is determined directly by means of reception of a telegram acknowledgement from the bus partners.

In addition, the information for the source and target addresses is inserted into the telegram structure. The cross parity obtained up to now from the individual information bytes STX, train number and ETX is deleted.
The basic functional procedures largely conform with the procedural diagram described in /1/, however. The states described under /1/ will therefore be retained for further explanation of the procedures.
The individual state types are described in detail below.

4.7.1 State 0 – Basic state

The basic state is characterized by the fact that the interface is ready for transmission and for reception. Departure from the basic state occurs in case of the following occurrences:

- Request from ZFM90 for transmission of train number

Return to the basic state occurs as a result of the following occurrences:

- Reception of the ACK telegrams after complete transmission of the data block to users with addresses 1 and 2

- After breakdown of an ACK telegram reception as a result of a transmission error (e.g. timeout, incorrect parity, incorrect telegram structure)

- After n attempts to transmit a telegram: Value for n: n = 3. This means that the telegram to be transmitted to a bus partner will be repeated a maximum of twice following the first failure to receive a telegram acknowledgement. This procedure applies to both the users to be contacted

4.7.2 State 1 – Transmit data block

Transmission of a data block is always performed integrally, starting with the SOH control character. The target address valid from the point of view of the sender and the own source address is inserted into the telegram to be transmitted. The state end with transmission of the final character EOT.

4.7.3 State 2 – Waiting for acknowledgement

In this state, the data terminal device is waiting for the telegram acknowledgement from the other end. Waiting time is: Tq = 50 ms, counting from the end of the transmission of EOT.

The address information is checked after receipt of an acknowledgement:

- Target address in telegram identical to own address

- Source address in telegram identical to target address of the data block to be acknowledged

- Timeout breaktime

Departure from State 2 occurs either if a correct acknowledgement has been received or time Tq has expired. if Tq has expired, a changeover to State 1 occurs for the purpose of repetition of the data block if the maximum number of data blocks to be transmitted has not yet been reached.

4.7.4 State 3 – Receive data block

In State 3, a completely received data block is checked for correctness. Only the acknowledgement to a train-number telegram from the ZFM90 is legal as the reception data block. The check criteria are:

- Correct frame

- Target address in the data block equates to the data terminal device's own address

State 3 occurs after reception of an SOH and departure from it occurs when the following criteria are fulfilled:

- Target address not the same as own address

- Target address same as own address and final byte of a data block received (EOT).

4.7.5 State 5 – Waiting for Readiness-for-reception

Unlike the State 5 described in /1/, Readiness-for-reception of the other end is no longer indicated by means of the two control characters XON and XOFF. Readiness-for-reception by the respective other end can be checked as follows:
Readiness-for-reception on the part of partners with Addresses 1 and 2:
The ZFM90 recognizes Readiness-for-reception by the partners stated solely on the basis of the acknowledgement received in response to a train-number telegram.
Readiness-for-reception on the part of the ZFM90:

The remaining partners recognize the Readiness-for-reception of the ZFM90 on the basis of the train-number telegrams transmitted cyclically.

12.4 Appendix 4 – Irish rail network station names

Existing Network			
English	**Note**	**Irish**	**Note**
Adamstown		Baile Adaim	
Arklow		An tlnbhear Mór	
Ashtown		Baile an Ásaigh	
Athenry		Baile Átha an Rí	
Athlone		Baile Átha Luain	
Athy		Baile Átha Í	
Attymon		Áth Tíomáin	
Bagnalstown		Muine Bheag	
Balbriggan		Baile Bhrigín	
Ballina		Béal an Átha	
Ballinasloe		Béal Átha na Sluaighe	2
Ballybrophy		Baile Uí Bhróithe	
Ballycullane		Baile Uí Choileáin	
Ballyhaunis		Baile Átha hAmhnais	
Ballymote		Baile an Mhóta	
Banteer		Bántír	
Bayside		Cois Bá	
Belfast		Béal Feirste	
Birdhill		Cnocán an Éin Fhinn	2
Blackrock		An Charraig Dhubh	
Booterstown		Baile an Bhóthair	
Boyle		Mainistir an Búille	
Bray		Bré	
Bridgetown		Baile an Droichid	
Broombridge		Droichead na Scuab	
Cahir		An Chathair	
Campile		Ceann Poill	
Carlow		Ceatharlach	
Carrick-on-Shannon		Cora Droma Rúisc	
Carrick-on-Suir		Carraig na Siúire	
Carrigaloe		Carraig an Ló	
Castlebar		Caisleán an Bharraigh	
Castleconnell		Caisleán Uí Chonaill	
Castleknock		Caisleán Cnucha	
Castlerea		An Caisleán Riabhach	
Charleville		An Ráth	
Cherry Orchard		Gort na Silíní	
Clara		Clóirtheach	
Claremorris		Clár Chlainne Mhuiris	
Clondalkin		Cluain Dolcáin	
Clonmel		Cluain Meala	
Clonsilla		Cluain Saileach	
Clontarf Road		Bóthar Cluain Tarbh	
Clonydonnin		Cúil Mhuine	

Existing Network			
English	**Note**	**Irish**	**Note**
Cloughjordan		Cloch Shiurdáin	
Cobh		An Cóbh	
Colloney		Cúil Mhuine	
Connolly Station		Stáisiún Uí Chonghaile	2
Coolmine		Cúil Mín	
Cork		Corcaigh	
Dalkey		Deilginis	
Docklands		Dugthailte	
Donabate		Domhnach Bat	
Drogheda		Droichead Átha	
Dromod		Dromad	
Drumcondra		Droim Conrach	
Dún Laoghaire		Dún Laoghaire	
Dundalk		Dún Dealgan	
Edgeworthstown		Meathas Troim	
Enfield		An Bóthar Buí	
Ennis		Inis	
Enniscorthy		Inis Córthaidh	
Farranfore		An Fearann Fuar	
Fota		Fóta	
Galway		Gaillimh	
Glenageary		Gleann na gCaorach	
Glounthaune		An Gleanntán	
Gorey		Guaire	
Gormanston		Baile Mhic Gormáin	
Gort		An Gort	
Grand Canal Dock		Dug na Canálach Móire	
Greystones		Na Clocha Liatha	
Harmonstown		Baile Hearman	
Hazelhatch & Celbridge	1	Collchoill /Cill Droichid	1
Heuston Station		Stáisiún Heuston	
Howth		Binn Éadair	
Howth Junction Donaghmede	2	Gabhal Bhinn Éadair/Domhnach Míde	1
Kilbarrack		Cill Bharróg	
Kilcock		Cill Choca	
Kilcoole		Cill Chomhghaill	
Kildare		Cill Dara	
Kilkeny		Cill Chainnigh	
Killarney		Cill Airne	
Killester		Cill Easra	
Killiney		Cill Iníon Léinín	
Lansdowne Road		Bóthar Lansdún	
Laytown		An Inse	
Leixlip Confey		Léim an Bhradáin Confey	2
Leixlip Louisa Bridge		Léim an Bhradáin Louisa	2
Limerick		Luimneach	
Limerick Junction		Gabhal Luimnigh	
Lisburn		Lisburn	

Existing Network			
English	**Note**	**Irish**	**Note**
Littleisland		An tOileán Beag	
Longford		Longfort	
Lurgan		Lurgan	
Malahide		Mullach Íde	
Mallow		Mala	
Manulla Junction		Gabhal Mhaigh Nulla	
Maynooth		Maigh Nuad	
Millstreet		Sráid an Mhuilinn	
Monasterevin		Mainistir Eimhín	
Mosney		Maigh Muirí	
Mullingar		An Muileann gCearr	
Nenagh		An tAonach	
Newbridge		Droichead Nua	
Newry		Newry	
Pearse Station		Stáisiún na bPiarsach	
Phoenix Park		Páirc an Fhionnuisce	
Portadown		Portadown	
Portarlington		Cúil an tSúdaire	
Portlaoise		Port Laoise	
Portmarnock		Port Mearnóg	
Raheny		Ráth Eanaigh	
Rathdrum		Ráth Droma	
Rathmore		An Ráth Mhór	
Roscommon		Ros Comáin	
Roscrea		Ros Cré	
Rosslare Europort		Calafort Rosláir	
Rosslare Strand		Trá Ros Láir	
Rush & Lusk		An Ros & Lusca	
Rushbrooke		Rinn an Chabhlaigh	
Sallins & Naas		Na Solláin & Nás	
Salthill & Monkstown		Cnoc an tSalainn/Baile na Manach	1
Sandycove & Glasthule	1	Cuas an Ghainimh&Glas Tuathail	1
Sandymount		Dumhnach Thrá	
Seapoint		Rinn na Mara	
Shankill		Seanchill	
Skerries		Na Sceirí	
Sligo		Sligeach	
Sutton		Cill Fhionntáin	
Sydney Parade		Paráid Sydney	
Tara street		Sráid na Teamhrach	
Templemore		An Teampall Mór	
Thomastown		Baile Mhic Andáin	
Thurles		Durlas	
Tipperary		Tiobraid Árann	
Tralee		Trá Lí	
Tuam		Tuaim	
Tullamore		Tulach Mhór	

Existing Network			
English	**Note**	**Irish**	**Note**
Waterford		Port Láirge	
Wellingtonbridge		Droichead Eoin	
Westport		Cathair na Mart	
Wexford		Loch Garman	
Wicklow		Cill Mhantáin	
Woodlawn		Móta	

Planned Network Extensions for DART			
English	**Note**	**Irish**	**Note**
Baldoyle/Clongriffin	1	Baile Dúill/Cluain Grífín	1
Kildare Line			
Kishogue		An Chiseog	
Middleton Line			
Carrigtwohill		Carraig Thuathail	
Middleton			
Western Corridor			
Ardrahan		Ard Raithin	
Craughwell		Creachmhaoil	
Gort		An Gort	
Oranmore		Órán Mór	
Sixmilebridge		Droichead Abhann Ó gCearnaigh	2

Note 1: Station name could be broken down into two lines for the case of FOT1 and FOT2 displays.
Note 2: Possible station abbreviations to be advised by IE.

12.5 Appendix 5 –IE Approval Process v2.10

IÉ Rolling Stock Projects

Approvals Process

Version: 2.10
Date: 27th April 2009

Revisions

ISSUE	DATE	REVISED SECTIONS	DRAFTED BY	CHECKED BY
2.4	31/7/08		KEVIN MARNANE (KM)	-
2.5	08/8/08		KM	-
2.6	18/8/08		KM	PETER SMYTH (PS)
2.7	25/8/08		KM	-
2.8	07/11/08	CHANGE IN TITLE. TYPO RE IA CHANGED - 3.1 (M), (N), (O) & 3.2	KM	-
2.9	17/12/08	CHANGE OF TERM 'VERIFICATION BODY' (VB) TO 'CONTRACTOR COMPLIANCE BODY' (CCB).	KM	-
2.10	27/4/09	ADDITION OF TABLE OF CONTENTS AND DEFINITIONS PAGE.	KM	-

Approvals Process

1 General Principle:

1.1 Where TSIs are applicable the approval process shall be a conformity assessment that is performed by the Notified Body (NoBo). The NoBo is appointed by the Contractor.

1.2 Where there are no TSIs the approval process shall be performed by the CCB (appointed by the Contractor), IÉ and the IVB (appointed by IÉ).

1.3 In general terms the Contractor Compliance Body (CCB) shall have a responsibility for ensuring the design and construction of the Units by the Contractor meets the requirements of the technical specification and applicable Standards and Law, whilst IÉ and the IVB will assess the safety management system for the contract, interfaces with IÉ's maintenance and operational activities, IÉ's Operational Safety Case and shall act as a shadow of the RSC, in order to test whether the submissions to the RSC are likely to gain approval.

2 Iarnród Éireann (IÉ):

2.1 IÉ is the owner and operator of the Units which the Contractor shall supply. As the railway operator, it is IÉ's responsibility to ensure that a New Rolling Stock Assessment (NRSA) is submitted to the RSC. The NRSA is to be prepared by the Contractor. IÉ will supply, for inclusion in the NRSA by the Contractor, all the information for which IÉ is responsible.

2.2 IÉ shall appoint a Safety Manager to support the generation of the NRSA by the Contractor and ensure integration of IÉ's submissions into the NRSA. The Safety Manager shall also ascertain if IÉ's Operational Safety Case is affected by the new fleet. If it is found to be affected they shall coordinate all Contractor and IÉ submission deemed necessary by the Safety Manager to facilitate required adjustments to IÉ's Operational Safety Case.

3 Contractor:

3.1 It is an obligation of the Contractor, under the Framework Agreement, to obtain all the approvals, letters and certifications necessary such that the Units can be operated in passenger service. These shall include but not be limited to:

a) An RSC Letter of Acceptance for Detailed Design.
b) An RSC Letter of Acceptance for Testing and Commissioning.
c) An RSC Letter of Acceptance for Passenger Service.
d) All Certificates of Verification from NoBo.
e) 'EC' Declaration of Verification to European Directive 2008/57/EC and any other applicable European Directives for the rolling stock and subsystems.
f) An IVB Letter of Conformance for Vehicle Design.
g) An IVB Letter of Conformance for Vehicle Construction.
h) An IVB Letter of Conformance for Testing and Commissioning.

i) An IVB Letter of Conformance for Passenger Service.
j) An Iarnród Éireann Route Availability Approval (route clearance).
k) An Iarnród Éireann approval for the Operational Safety Case of testing, commissioning and passenger service stages (Company Standard 56).
l) All Independent Professional Review reports such that they are in accordance with Railway Safety Act 2005 (ref. RSC-G-015).
m) An Independent Professional Review Report for Detailed Design.
n) An Independent Professional Review Report for Testing and Commissioning.
o) An Independent Professional Review Report for Passenger Service.

3.2 It is an obligation of the Contractor, under the Framework Agreement, to employ a Notified Body (NoBo) and a Contractor Compliance Body (CCB), as well as Independent Professionals as required under Railway Safety Act 2005 (ref. RSC-G-015). The appointment of the NoBo, CCB and Independent Professionals shall be subject to agreement with IÉ. In addition to its other roles the CCB may also act as the Independent Professional. IÉ must be satisfied that the Independent Professional is suitably qualified and independent. The NoBo must demonstrate to IÉ the requisite knowledge and competence to assess compliance of the Units to the Technical Specification for Interoperability (TSI).

3.3 It is an obligation of the Contractor, under the Framework Agreement, to appoint a Safety Manager who will ensure that the full NRSA is produced in line with all applicable Standards and Law. The Safety Manager will ensure that all the Contractors safety obligations in relation to this project are fulfilled in a timely manner

3.4 The CCB must demonstrate the requisite knowledge and competence to assess the safety management processes applied, the compliance of the Units to all applicable Standards and Law and to assess the safety of the Units for passenger service operation through the compilation of the NRSA. The NoBo and CCB may be the same entity, subject to the demonstration of suitable clarity and definition of roles and appropriate control measures.

3.5 It is an obligation of the Contractor to ensure that the CCB and NoBo carry out any such verification, validation and due diligence reviews, audits, investigations, observations and tests such as will be required to ensure that the Contractor has fully complied with the Technical Specification and the applicable Standards and Law such that successful applications for approvals can be made to the RSC.

3.6 It is an obligation of the Contractor to regularly make submissions to IÉ and its appointed Independent Verification Body (IVB) such as would have to be made to the RSC for safety approvals. These submissions will be structured as formal submissions such as would be made to the RSC and will be assessed by the IVB as if it were final submissions. No submissions will be made directly to the RSC by the Contractor or any of his sub-contractors without the prior approval of IÉ and the IVB.

3.7 The contractor must identify the Standards and Law that have been applied to the vehicles and must produce a clause by clause statement, along with test procedures, results and other relevant documentation, to show compliance to those Standards and Law in its submissions to the IVB. The Standards and Law must first be selected from the Standards and Law that are listed in the Technical Specification. If the contractor wishes to apply an alternative standard to one in the technical specification he shall apply for a deviation.

3.8 It is an obligation of the Contractor to supply any such required information, drawings, documentation, technical reports, technical descriptions, certifications, test procedures and results or supporting information applicable to the Units as required by the IVB in its role to assess and verify the compliance of the Units to the Standards and Law as defined in the Technical Specification.

3.9 It is an obligation of the Contractor to ensure at all times that any information supplied to and used by the NoBo is also supplied simultaneously to the IVB i.e. the IVB shall be copied on all communications/information going between the NoBo and the Contractor

3.10 It is an obligation of the Contractor, under the Framework Agreement, to ensure that any information and or decisions required from IÉ in order to complete the NRSA is requested at least 28 days prior to when the information is required.

3.11 The IVB shall have 21 days to review the information from the Contractor. The IVB shall consider whether the information that is supplied is adequate and shall respond as follows:

a) If the IVB considers the information is sufficient the response shall confirm this.

b) If the IVB considers the information shows there is a non-compliance with the obligations of the Contractor the response shall indicate the area of the non-compliance and give reasons.

c) If the IVB considers the information is insufficient, the IVB will indicate the nature of additional information that is required and shall give reasons.

d) The Contractor shall submit revised or additional information that address any issues that are raised by the IVB. This will then be reconsidered by the IVB and a further response shall be provided within 21 days.

3.12 It is an obligation of the Contractor, under the Framework Agreement, to ensure that all the IÉ approvals required to support the Operational Safety Case are achieved according to the timelines agreed. These are the CME approvals at each Design review stage and the IE safety department stage approvals of design, testing, commissioning and passenger service

4 Notified Body (NoBo):

4.1 The Contractor shall contract a notified body with the obligation to assess the units against all applicable TSIs. The notified body shall issue a Certificate of Verification for the Units and a Technical File. The relevant Directives are transposed into Irish law under SI 61 of 2004, SI 212 of 2006 and SI 61 of 2008.

4.2 Where TSIs refer to Contracting Entity it shall mean IÉ. Where the TSIs refer to the main contractor it shall mean the Contractor. The Contractor shall be considered to be the main contractor that is responsible for the whole project (including in particular responsibility for subsystem integration). The Contractor shall operate a quality management system for manufacture and final product inspection that would be sufficient to allow either module SD or module SH2 of the TSIs to be applied.

4.3 The Contractor shall ensure that the flow of information shall follow Figure 1: EU Route. All information which is required by the NoBo as part of its approval process shall also be supplied to the IVB. All correspondence between the Contractor and NoBo in relation to the approval process must also be distributed through the IVB.

4.4 In accordance with Clause 3.7, the Contractor shall submit any declarations, derogations and supporting documentation to the RSC to gain formal approval for the rolling stock on behalf of IÉ.

4.5 The Contractor shall contract a NoBo with the specific obligation to supply 6-weekly "Approval Progress Reports" containing all the relevant information (as defined by IÉ) on the progress with its approval process to IÉ, the IVB and the CCB. Any approvals that are not progressing to schedule and any elements that are not likely to gain compliance under the NoBo's remit must be specifically highlighted and identified in such Approval Progress Reports.

5 Contractor Compliance Body (CCB):

5.1 The Contractor shall contract a CCB, that is independent of the Contractor, with the specific obligation to verify that the Units have been designed, built and can be maintained and operated in accordance with the applicable Standards and Law as referenced in the Technical Specification and according to the requirements of the RSC Guidelines.

5.2 The Contractor shall contract a CCB with a specific obligation to compile NRSA submissions to gain Letter of Acceptance for Detailed Design, Letter of Acceptance for Testing and Commissioning and Letter of Acceptance for Passenger Service, and any other approvals required in accordance with the RSC's Guidelines and such other guidelines that the RSC may issue from time to time. The Contractor, supported by the CCB, shall make full and complete NRSA submissions to IÉ and the IVB prior to making any submissions to the RSC. This shall be conducted in accordance with Figure 2: NRSA Route.

5.3 The Contractor shall contract a CCB with the specific obligation to compile and document a "Rolling Stock Technical File", the format of which will be agreed with IÉ, that will contain all the relevant information on the Units such as drawings, documentation, technical reports, technical descriptions, component and system information, test procedures and results or supporting information and clause by clause as is required by the IVB in its role to assess the compliance of the Units to the Standards and Law as defined in the Technical Specification.

5.4 The CCB shall:

a) Ensure the Units are designed and built in accordance with the technical specification and any Standards and Law that are referred to within the specification.
b) Ensure that there is correct integration of the TSI requirements with the remaining project related safety requirements and that there are no "gaps or contradictions" between these.
c) Ensure the completeness of the overall project related safety requirements.
d) Ensure that the Contractor employs an appropriate quality management system in accordance with the Technical Specification and the Standards and Law called up therein, and that this is complied with throughout the design, build, testing, commissioning and warranty phases of the project.
e) Ensure that maintenance and overhaul manuals are provided that meet the requirements of the technical specification and are sufficient to maintain the units in a safe condition and to ensure the units can meet reliability targets.
f) Ensure that operating manuals are provided that meet the requirements of the technical specification and are sufficient to operate the units safely and reliably.
g) Assess the design and construction of the Units against the requirements of the NRSA.
h) Assess the manuals for the Units against the requirements of the NRSA.

5.5 The CCB shall assess and record all non-compliances, concessions and derogations. This should include the preparation of a comprehensive list of all these deviations. These non-compliances, concessions and derogations shall have been assessed for any impact on safety, maintenance, operations, etc.

5.6 The Contractor shall contract a CCB with the specific obligation to supply 6-weekly "Approval Progress Reports" containing all the relevant information (as defined by IÉ) on the progress with its approval process to IÉ, the IVB and the NoBo. Any approvals that are not progressing to schedule and any elements that are not likely to gain compliance under the CCB's remit must be specifically highlighted and identified in such Approval Progress Reports.

6 Independent Verification Body (IVB):

6.1 IÉ shall appoint an Independent Verification Body (IVB) to independently assess that all the requirements of the NRSA have been met.

6.2 IÉ shall employ an IVB to:

a) Assess the suitability of the Contractors Safety Management System.
b) Assess all required elements of the NoBo and CCB assessments are being adequately performed.
c) Conduct whatever investigations, audits, checks and other such actions required to independently verify that the Contractor is adhering to the quality required in accordance with the Technical Specification.
d) Assess the Contractors and IÉ's safety submissions in the role of an Independent Assessor in accordance with Railway Safety Act 2005 (ref. RSC-G-015) and to submit suitable associated reports to IÉ as required.
e) Assess that where the design responsibility of the supplier interfaces with IE's technical requirements, IÉ's maintenance, IÉ's operations and IÉ's Operational Safety Case that IÉ and the Contractor jointly fulfil the project related safety requirements.
f) Assess that when IÉ is taking over the design responsibility from the Contractor, that IÉ fulfils all project safety related requirements.
g) Assess from a higher level perspective "that there are no gaps or contradictions" in the completeness of the overall set of project related safety requirements and associated evidence.

6.3 The IVB shall provide regular reports of compliance (in line with the NRSA stages).

6.4 The IVB shall receive the NRSA submissions from the CCB and IÉ (IÉ Operational Safety Case), and shall take cognisance of the assessments complete or outstanding with the NoBo. The IVB shall undertake a detailed review of the entire project so as to ensure the complete safety approval of the rolling stock.

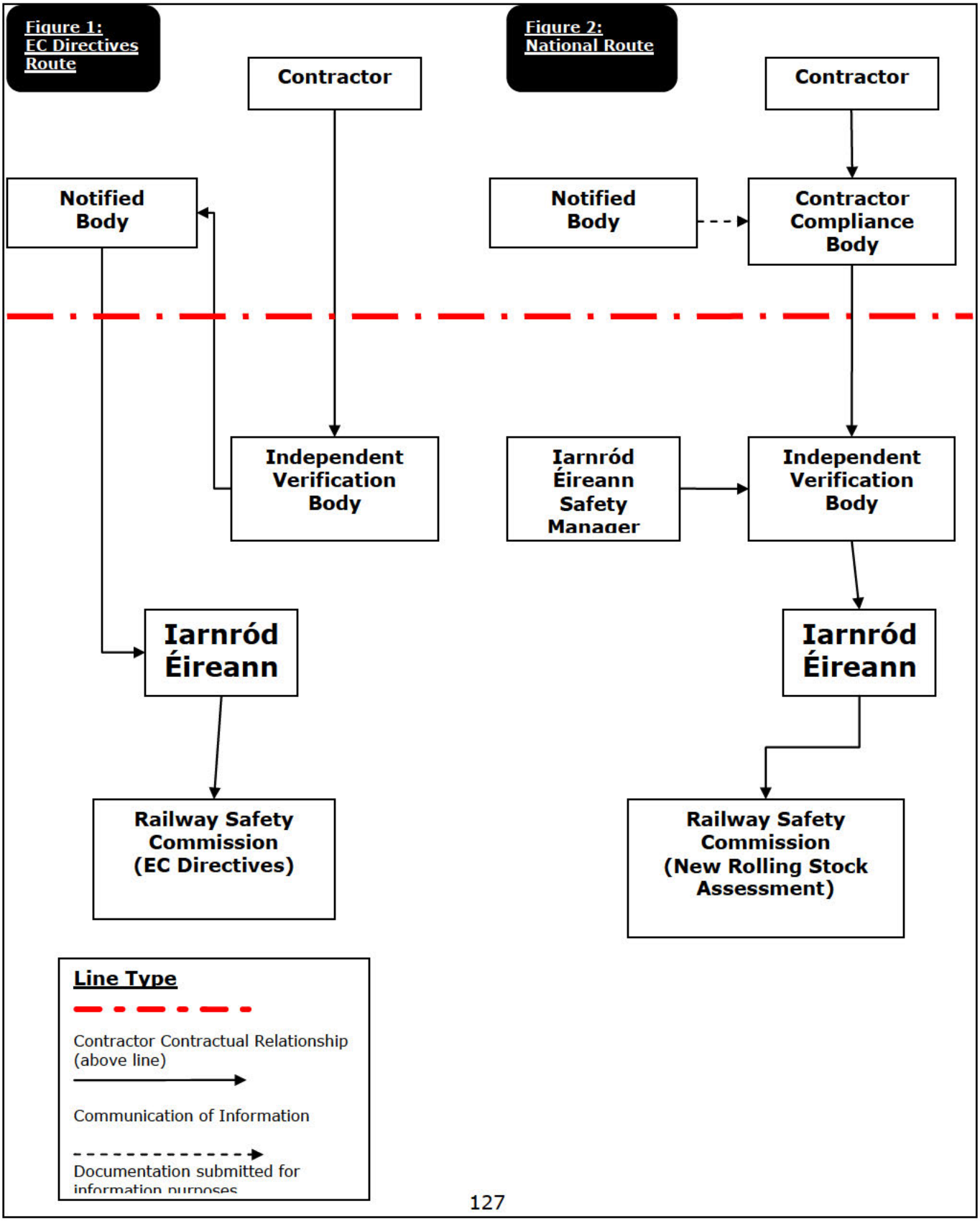
6.5 The IVB shall write a high level verification report after doing both the high and low level verifications in line with Technical Specification and referenced Standards and Law.

6.6 The IVB shall carry out its assessments as if it were acting as the National Safety Authority (RSC) and shall do this in an intrusive way as deemed necessary.

7 Railway Safety Commission (RSC):

The RSC was established under the authority of the Railway Safety Act. 2005 and its role is defined therein and as amended by Irish Statutory Instrument 61 2008. To this end the RSC have produced a number of guidance documents, available at www.rsc.ie , that explain its role and what the Contractor must do in the design and build, and how they are to prove to the RSC's satisfaction that the rolling stock supplied to IÉ are safe to operate in passenger service on the IE network.

Process Flow Diagram



From: [redacted]
[redacted]
Subject: Response letter to Mr Fitzgerald re DART PIS
Date: Thursday 2 March 2017 15:40:00
Attachments: image003.png

Passenger communication problems – DART services

Dear Mr Fitzgerald.

Thanks you for your letter dated the 22nd February 2017 (received on the 24th) regarding passenger communication problems on the DART services. I take the opportunity to apologise for what is an unacceptable level of performance on this system. I would fully agree with your observation that there is a problem on board which is well known and I can state that Irish Rail would very much like to address this. There are two main issues at the heart of this, one technical and one human with the technical issue being by far the biggest challenge.

From a technical point of view the background is as follows: The original 1984 DART fleet makes up 55% of the fleet, this fleet was refurbished with an excellent system during 2007-2009 and this is functioning to a high standard. This continues to be the case as reported regularly by maintenance staff whom I have travelling on board the trains to test the systems. The remaining fleet is 14 – 17 years old and is fitted with obsolete Spanish computer systems that drive the passenger information system displays and announcements. This equipment is the PC equivalent of trying to operate with a Windows 95 PC in that spare parts are unobtainable and the hardware no longer supported by the manufacturer. We have known for some time that the systems needed to be replaced and that expected costs will be [redacted] This requires capital investment to fit a new modern system and quite simply funding has not been available in recent years for well-known reasons.

With something of an economic recovery and a rise in passenger numbers occurring this is now seeing investment returning to our railway which is welcome and long overdue. A modern replacement Passenger Information System for DART trains is included in our capital investment plans made to the National Transport Authority and the Department of Transport. These are being reviewed so that funding can be allocated to projects with the best return on investment either in financial sense or in terms of passenger impact. However it's important to note that if funding were to be provided, that the timescales to procure a new system and begin fitting train would be 18 months approximately. In the meantime we have taken a number of actions to extract the best performance we can from the existing system.

We have:

- invested own funds in establishing an "in house" electronics repair facility to repair these items of equipment and save on cost.
- spent over [redacted] on partially upgrading the hardware on this fleet
- contracted with Irish electronics experts (Quaestor Electronics) to test, survey and repair the systems on these trains.

This has resulted in the replacement of a large number of parts and we are hopeful that an improvement will result from an audio and visual message perspective. I accept that this is something of a false economy but it has been necessary to provide some improvement in the short term.

From a human factors point of view the train driver is required to enter the correct information to eh system at the outset of the journey. Failure to do this will result in poor system performance and incorrect information. Drivers are aware of this and I note that the driver would have little knowledge of an issue during the journey as he generally would not hear or see the announcements from the cab. I propose to run an awareness campaign of this amongst our

drivers and to place a visual reminder in the cab to prompt for the information input.
I note your comment re other European cities and I would point out that solid and reliable passenger information systems are a significant problem in many countries including for example in UK Cities where I personally lived, worked and travelled for many years and also on recent travels in France and Germany. The issue, in my view, seems to be that the industry builds trains in small quantities and these complicated "bolt on" systems are often provided by suppliers who are transient in the industry with resulting performance issues and reliability issues that the supply chain are not interested in resolving. Recent developments of European standards for these systems will be helpful to address this.
I hope this provides some greater background and understanding to the issues. We are listening and we are trying hard to fix this and given the opportunity we will do so but in the meantime we will do the best we can to provide a working solution.
Yours sincerely

[redacted]
Chief Mechanical Engineer

Peter Smyth
Chief Mechanical Engineer
Iarnrod Eireann
Inchicore
Dublin
D08 K6Y3
[redacted]

Technical Specification

for

Replacement On-Board Passenger Information Systems

Date: 15th December 2011
Issue 1.4

Iarnród Éireann

Drafted By:	[redacted]			
Checked By:	[redacted]			
Approved By:	[redacted]			

Revision 1.2: Section 2.8 Fleet Compatibility. Required Situation. added text 'emergency alarms and emergency voice communication to be compatible'
Revision 1.3: Section 6.4 PA System changed to 15 minutes in a fire. Reference to GM/RT2130 issue 3. Various sections edited in accordance with comments. Reference: KM e mail to RM sent 8 December 2011
Revision 1.4: Sections 2.5, 3.2, 3.3, 3.4, and 4.6.3 edited. Reference: KM e mail to RM sent 15 December 2011

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1. GLOSSARY OF TERMS

AC	Alternating Current
AFILS	Audio Frequency Induction Loop System
AGC	Automatic Gain Control
AP	Access Point
ASB	As built (documentation status)
BOM	Bill of Materials
CAD	Computer Aided Design
CAPEX	Capital Expenditure
CAWS	Cab Audible Warning System
C-C	Cab to Cab
CCB	Contractor Compliance Body
CCTV	Closed Circuit Television
CFA	Call For Aid
CG	Communications Gateway
CIS	Customer Information System (at station)
COP	Code Of Practice
DART	Dublin Area Rapid Transit
CS	Communication Scheduler
DBE	Data Base Editor
dBW	Decibel (power) reference 1millWatt
DC	Direct Current
DMU	Diesel Multiple Unit
DMS	Driving Motor Standard
DNS	Domain Name System
DSP	Digital Signal Processing
DST	Daylight Saving Time, i.e. summer time.
DTS	Driving Trailer Standard
DVA	Digital Voice Announcer
DVD	Digital Versatile Disc
EDGE	Enhanced Data Rates for GSM Evolution
EGNOS	European Geostationary Navigation Overlay Service
EMC	Electro-Magnetic Compatibility
EMU	Electric Multiple Unit
EN	European Norm
ESCROW	Legal arrangement where an asset (e.g. Design data, software) is deposited with a neutral third party with defined condition on the neutral party (e.g. asset is available for use by the beneficiary (IÉ), with restrictions, upon failure (force majeure, administration, breach of contract, etc) of a given contractor.
EU	European Union
FAI	First Article Inspection
FAT	Factory Acceptance Test (supplier premises)
FDR	Final Design Review
FMECA	Failure Modes and Effects Criticality Analysis
FOT	Front of Train
FTP	File Transfer Protocol
FTS	Fleet Technical Support
GMT	Greenwich Mean Time (UTC shall be taken as the same time for the purpose of this contract)

$GPRMC	Global Positioning Recommended Minimum Data for GPS
GPRS	General packet radio Service, also = 2.5G
GPS	Global Positioning System (Navstar)
GRP	Glass-Reinforced Plastic
GSM	Global System for Mobile Communications, also = 2G
HDOP	Horizontal Dilution of Precision
Hz	Hertz
ID	Identification
IÉ	Iarnród Éireann
IP	Internet Protocol
IPsec	Internet Protocol Security
ITL	Interfleet Technology Limited
ITT	Invitation To Tender
IVB	Independent Verification Body
LCC	Life Cycle Cost
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LRU	Line Replaceable Unit (individual entity considered for spares)
LTP	Long Term Planning
mcd	Milli-candelas
MDU	Mobile Download Unit
MMI	Man Machine Interface
MOD	Modification
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
MVB	Multi-Vehicle Bus
NAT	Network Address Translation
N/A	Not Applicable
NMEA	National Maritime Electronics Association (America)
NoBo	Notified Body
OEM	Original Equipment Manufacturer
OJEU	Official Journal of the European Union
OLE	Overhead Line Equipment (Catenary and associated equipment that are assumed to be electrified at 1.5kV DC)
OPEX	Operating Expenditure
OR-ed	Logical disjunction, e.g. if ‘A’ or ‘B’ is true, if ‘A’ is true, OR ‘B’ is true, OR if both ‘A’ and ‘B’ are true
PA	Public Address
PC	Personal Computer
PDA	Personal Digital Assistant (hand held PC)
PDR	Preliminary Design Review
PEI	Passenger Emergency Intercom
PIS	Passenger Information System
PISC	Passenger Information System Controller
PoE	Power over Ethernet
PMS	Pantograph Motor Standard
PRM	Persons of Reduced Mobility
PTS	Personal Track Safety (IÉ certification of competency required for mainline railway trackside duties)
PTT	Push to Talk

RAMS	Reliability, Availability, Maintainability and Safety
RASTI	Rapid Speed Transmission Index
RFID	Radio Frequency Identification
RGS	Railway Group Standard
RIA	Railway Industries Association
RS	Requirement Specification
RSC	Railway Safety Commission
RSS	Real Simple Syndication
RTPI	Real Time Passenger Information
RVAR	Rail Vehicle Accessibility Regulations
SAF	Service Affecting Failure
SAT	System Acceptance Test (vehicle integrator, depot or on Network Rail line)
SBAS	Satellite Based Assistance Services
SDO	Selective Door Operation
SI	Statutory Instrument
SIL	Safety Integrity Level
SIM	Subscriber Identity Module relating to a GSM device
STP	Short Term Planning (IÉ update to LTP)
TCF	Technical Construction File
TCP	Transmission Control Protocol
TDR	Train Data Recorder, e.g. TELOC
TFT	Thin Film Transistor
The 'Engineer'	The Project Engineer of Iarnród Éireann, or his/her delegate
The 'Installer'	The company that undertakes the physical installation of the PIS components onto the train including associated wiring.
The 'Contractor'	The ‘Contractor’ is the entity that will contract with IÉ and sub-contract (as necessary) with other parties, e.g. the PIS ‘Supplier’. The contractor shall be responsible for overall integration of the PISs and vehicles. The contractor shall ensure that the clauses within this document are contracted ‘back to back’ with the PIS supplier, installer and any other sub-contractor. For example, with ongoing support of spares beyond the warranty period the contractor shall ensure that IÉ receives full benefit of the ‘contractor – PIS supplier’ contract.
The PIS 'Supplier'	The ‘Supplier’ is normally the OEM of the major components and undertakes detailed design work such as preparation of customised software.
The 'System'	All components of the PIS and associated systems.
TIPLOC	Timing Point Location code (5 alpha), timing points stations, junctions and signal boxes, etc.
TMS	Train Management System
TSI	Technical Specification for Interoperability
TW	Train Wire
UMTS	Universal Mobile Telecommunications System (3G)
UPS	Uninterruptible Power Supply
UTC	Universal Time Coordinated (GMT with insignificant difference)
V	Volts

VMI	Vehicle Maintenance Instruction
VOI	Vehicle Overhaul Instruction
VPN	Virtual Private Network
VSTP	Very Short Term Plan
WAV	WAVeform audio file Format
WiFi	Wireless Fidelity 802.11b/g/n (Internet on-board)
WLAN	Wireless Local Area Network
WMAN	Wireless Metropolitan Area Network
WSP	Wheel Slide Prevention system

2. INTRODUCTION

2.1 Document Hierarchy

This document is for technical reference only and any technical response to this document shall conform to all the division of responsibilities and acceptance of risk, with respect to vehicle integration, as well as the contractual terms and conditions listed and detailed in the *Framework Agreement for the Supply of Replacement Passenger Information Systems*.

This Requirement Specification shall be included in full within sub-contracts to PIS OEM's and supplier/s.

2.2 Terminology Used Within This Specification

Within this Requirement Specification, each requirement is stated in the context of 'preferable', 'provision for', 'mandatory' or 'optional'.

'Preferable' means that Iarnród Éireann (IÉ) will not reject any offer that excludes the preferable item, feature or method; but may increase the score if several 'preferred' items are included in the offer. The words 'preferred', 'preferable', 'may' or 'should' are used in this context.

'Provision for...' means that IÉ may wish to introduce an item, feature or method in future stages after 'completion of train unit'. It will therefore be expected that certain provisions are included within the base offer enabling minimal impact, re-work and additional cost in the future, the following examples should be observed:

- Space shall be provisioned, e.g. for a modular component a position within a card frame.
- Power shall be provisioned, e.g. DC-DC converter shall have sufficient capacity for the future provision.
- Connectivity shall be provisioned, e.g. spare cables installed; communications capacity for future payloads.
- Software / firmware interfaces shall be provisioned – core software shall be written such that introducing the provision will have minimal impact, e.g. production of new or update of existing to support the introduction of the provision.
- Price – prices for 'provisions' are not required at the time of bid. However, if the provision is required in the future, the price will be considered on the basis of whether it is 'reasonable', judged against these requirements.

'Mandatory' means that the item, feature or method shall be included to be compliant with this specification. Mandatory is signified by the use of the verb 'shall'. Non-compliance with this specification will reduce the bid evaluation score, based upon its significance and weighting. Bidders are advised that some mandatory items such as standards and safety requirements cannot be relaxed and consequently non-compliance would inevitably lead to the bid being rejected.

'Options' are clearly summarised in section 7 of this specification. They shall be individually priced; any issues shall be clarified in the offer, e.g:

- Whether any individual option has a dependency on any other option.

- Validity in relation to the base offer, e.g. sometimes the business case for an option may not be apparent until a particular design stage is reached.

2.2.1 Clause by Clause Compliancy Statement

This specification and the relevant sections of TSI-PRM shall be acknowledged by a 'Clause by Clause Compliancy Statement', a document that references each individual clause in this specification. The following simple responses are required:

- 'NOTED' – meaning that the contractor acknowledges and accepts parts such as introductions, background descriptions, guidance notes, etc, and has no issue to declare.
- 'COMPLIANT' – meaning the offer fully complies with the requirement wherever a mandatory 'shall' is stated; a brief explanation as to how the contractor achieves compliance shall be provided. Alternatively, the statement 'NOT COMPLIANT' is used. The statement 'PART COMPLIANT' may be used where clarifications are provided.

The sections of TSI-PRM required for the clause by clause compliancy statement are: 4.2.2.3, 4.2.2.6.3.1, 4.2.2.8, 4.2.4 and 5.4.2. However, this does not limit the contractors obligations to comply (as appropriate) with other clauses in TSI-PRM.

2.3 Background

IÉ operates diverse fleets of rolling stock that have been procured within the past 20 years. Each fleet is fitted with some form of on board Passenger Information System, ranging from basic front of train displays to scrolling internal and side displays with automated multi lingual voice over announcements. This has lead to a multitude of systems – from different suppliers – that are obsolete, not cross compatible, difficult to maintain, and lack support to update them.

A major source of complaints for IÉ relates to the lack of on board information or to the deficient operation of the PIS. Therefore, IÉ has identified that there is a clear requirement to replace the multitude of poorly operational systems with a single generic type, providing a modern and reliable solution that has guaranteed support from the manufacturer for the system lifetime.

The purpose of this document is to define the technical requirements for these new PISs on the specified rolling stock fleets operated by IÉ.

The scope of this specification is restricted to the performance, engineering and the engineering documentation aspects of the equipment.

2.4 Fundamental Objectives and Requirements

PIS installations are to be implemented throughout various IÉ EMU and DMU train fleets in accordance with the table provided in section 2.5.1. The key objectives are as follows:

- The contractor shall provide a turnkey solution that includes installation design, vehicle integration and submission of Engineering Change and Approvals documentation to the satisfaction of IÉ, NoBo and the Railway Safety Commission (RSC). Please note that the equipment has to comply with relevant TSI, therefore section 1 of Apendix 5 titled Approvals Process is to be followed.

- A system and installation that complies with both EU and National legislation.
- A common generic design across fleets, with minimal variants.
- Systems that are 'fit for purpose', providing accurate and timely information with good visibility / readability (displays) and good intelligibility (audio), consistently and reliably.
- Information to be inclusive for Persons of Reduced Mobility (PRM).
- Minimal future support to be required and 'low maintenance', i.e. simplified database preparation and distribution, self diagnostics and fault reporting.
- Good equipment reliability and long life.
- Good value for money.
- Phased programme of upgrades.
- Retention of existing equipment where it is found serviceable, functional and reliable, e.g. the PA and PEI / Call for Aid components.

2.5 Train Types

This Requirement Specification is generic for all of the fleets detailed. Bidders are required to investigate all of the fleets set out below so their system design concepts are suitable for adaptation to each fleet in the future. In responding to the ITT a bona fide bid shall clearly state the prices for all the fleets set out below under this section 2.5. IE may, but is not required to issue one or more Purchase Orders under the *Framework Agreement for the Supply of Replacement Passenger Information Systems.* **It is also a requirement of the ITT to trial the system for 6 months on a Priority 1 fleet to demonstrate reliability.**

Phase 1

8500 EMU – Priority 1		
	Manufacturer	TCC Mitsui
	Year in service	2000
	Quantity	16 Vehicles (4x4)
	Power supply voltage	1500V DC
	Coupler	Dellner
	Formation	DTS + PMS + PMS + DTS
	Cab	Full cab
	Maximum service train length	8 cars
	Rescue condition	16 cars
	Gauge	1600mm
	Maximum speed	100 km/h
	PIS Supplier	Eurunion

8510 EMU – Priority 1		
	Manufacturer	TCC Mitsui
	Year in service	2001
	Quantity	12 Vehicles (3x4)
	Power supply voltage	1500V DC
	Coupler	Scharfenberg
	Formation	DTS +PMS + PMS + DTS
	Cab	Full cab
	Maximum service train length	8 cars
	Rescue condition	16 cars
	Gauge	1600mm
	Maximum speed	100 km/h
	PIS Supplier	Eurunion

8520 EMU – Priority 1		
	Manufacturer	TCC Mitsui
	Year in service	2003-04
	Quantity	40 Vehicles (10x4)
	Power supply voltage	1500V DC
	Coupler	Scharfenberg
	Formation	DTS + PMS + PMS + DTS
	Cab	Full cab
	Maximum service train length	8 cars
	Rescue condition	16 cars
	Gauge	1600mm
	Maximum speed	100 km/h
	PIS Supplier	Ikusi

29000 DMU – Priority 2		
	Manufacturer	CAF
	Year in service	2002-05
	Quantity	116 Vehicles (29x4)
	Power supply voltage	n/a
	Coupler	Scharfenberg
	Formation	DM1+MDT+MT+DM2
	Cab	Full cab
	Maximum service train length	8 cars
	Rescue condition	16 cars
	Gauge	1600mm
	Maximum speed	120 km/h
	PIS Supplier	Ikusi

2800 DMU – Priority 3		
	Manufacturer	TCC Mitsui
	Year in service	2000
	Quantity	20 Vehicles (10x2)
	Power supply voltage	n/a
	Coupler	Dellner
	Formation	DC1+DC2
	Cab	Part cab
	Maximum service train length	8 cars
	Rescue condition	16 cars
	Gauge	1600mm
	Maximum speed	120 km/h
	PIS Supplier	Sanyo

2.5.1 Fleet Summary

Fleet type	Phase	Priority for Replacement	Architecture	PA/Audio
8500 EMU	1	1	1	OK
8510 EMU	1	1	1	OK
8520 EMU	1	1	1	OK
29000 DMU	1	2	2	Note 3
2800 DMU	2	3	1	OK

Notes:

1. Architecture is discussed in section 2.7.
2. PA / Audio 'OK' means that IÉ considers the systems to have useful service life. However, the contractor is responsible for evaluating this system to establish that it is suitable for integration and is capable of providing the performance required in this specification.
3. The PA/Audio system is fully integrated with the visual system; therefore any replacement on these units shall include both systems.

2.6 Relevant Fleet Documentation

The following drawings and schematics relating to the fleets are considered sufficient for the purpose of preparing bids. Further information may be available subject to written request to e-mail: [redacted]

Fleet	Reference	Description
2800 DMU	C110011481	General Arrangement of Diesel Railcar (DC1)
	C110011482	General Arrangement of Diesel Railcar (DC2)
	C130016299	Communication Circuit
	B130016301	Passenger Information Control Circuit
	B130016309	JB, Jumper Connector. Inter Connection Diagram
	B110011472	Driver's Cab Construction (drawings 1 through 6)
	B113-28670	Hopper Over Fixed-Large
	B113-28671	Hopper Over Fixed-Small
	B113-28672	Emergency Window-Fixed
8500 EMU	C110011540	Train Formation
	C130016225 1/2	Passenger Information System Circuit
	C130016225 2/2	Passenger Information System Circuit
	B130016320 1/2	Train Lines
	B130016320 2/2	Train Lines
	C136012587 1/2	Shield Wires Grounding Diagram
	B111021474	Cab Framing (drawings 1 through 3)
	B111021475 (1/2)	Cab Framing
	B111021475 (2/2)	Cab Framing
8510 EMU	C110012047	Train Formation
	C130016799 1/2	Passenger Information System Circuit
	C130016799 2/2	Passenger Information System Circuit
	B130016826 1/2	Train Lines
	B130016826 2/2	Train Lines
8520 EMU	C110012888	Train Formation
	B130018030 1/2	Passenger Information System Circuit
	C130018030 2/2	Passenger Information System Circuit
	B130018039 1/2	Train Lines
	B130018039 2/2	Train Lines
	B110012898 (1/2)	Arrangement of Driver's Cab
	B110012898 (2/2)	Arrangement of Driver's Cab
	C115038360	Passenger Information Device Installation
	B132024402	Arrangement of Driver's Cab (drawings 1 through 4)

29000 DMU	C.78.40.001	Hopper Window
	C.78.40.012	Fixed Window
	C.78.33.001.00 1/2	Forward Cover Mounting
	C.78.33.001.00 2/2	Forward Cover Mounting
	C.78.33.002.00 1/2	Forward Cover Assembly
	C.78.33.002 00.2/2	Forward Cover Assembly
	C.78.33.003.01	GPRh Front End (drawings 1 through 4)

2.7 Integration of new PIS

2.7.1 Existing fleets – Systems Fitted

The equipment already fitted on these existing train fleets is important because this will determine the extent of the system replacement required for the new PIS. Where possible, replacement systems shall make use of existing wiring where confirmed to be serviceable for the life of the train.

Existing visual displays and control system shall be replaced with new. Existing audio systems (PA, PEI, etc) shall be retained wherever possible, this is to be decided during the ITT / bid phase following vehicle surveys by the bidder. The new (replacement) visual PIS shall be designed to interface with the audio communications systems as and where it is retained. *Guidance note: the bidder will be able to conduct any tests they consider relevant on the PIS during the vehicle surveys, and therefore should bring the appropriate equipment to undertake the tests.*

2.7.2 Existing Fleets - System Architecture

The following descriptions are based on analysis of schematics for each fleet. Bidders shall undertake more detailed investigations to satisfy themselves about the scope and complexity of interfacing and then validate their interface design concepts.

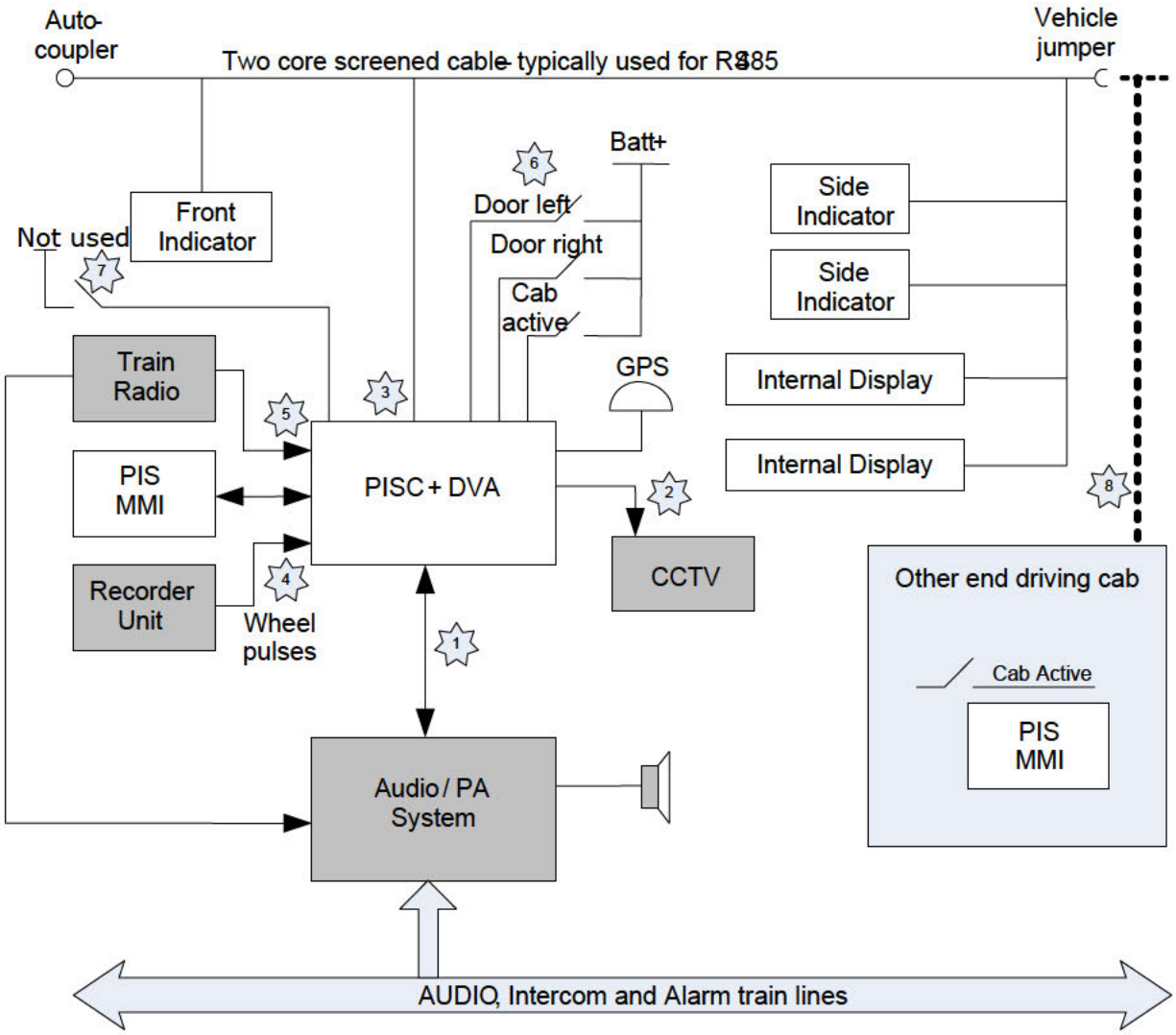
There are two existing architectures, determined by the extent of current integration between the audio system and the visual PIS. Whilst each may be categorised as one of two types, the interfaces of these systems do vary from fleet to fleet and a detailed study is required. The contractor shall be responsible for undertaking this detailed investigation of these interfaces, and validating integration of their system to existing train systems.

Of the listed fleets, the 29000 has a Type 2 architecture where audio and visual systems are fully integrated, the remaining fleets have Type 1 architecture where the systems are generally independent. Refer to the table in section 2.5.1.

PISs offered in response to the ITT shall provision for future upgrade of the Audio System (PA / PEI, etc). Where the existing Audio System is deemed to be unserviceable (in agreement with the Engineer) or may prevent the PIS from being compliant with this specification, then the replacement of the current Audio System shall be proposed as an option within the bid. Under these circumstances the replacement audio communication system shall comply with section 6 of this specification.

2.7.3 Typical arrangement for Architecture Type 1

A diagram illustrating the typical arrangement of new PIS with Architecture Type 1 is provided over the page:



Interface 1 – PIS DVA audio and control interface to Audio System.
The contractor shall identify the existing interfaces and undertake investigations to determine the exact characteristics and requirements.

Guidance Note - This interface is expected to be characterised as follows:

- *Audio from the DVA delivered to the PA system. The signal level may vary from fleet to fleet but the expected range is 100mV to 5V. A source impedance of 20R may be required to drive the train wires, i.e. similar to UIC568. A transformer isolated interface is recommended.*

- *PA enable signal, i.e. when the DVA requests the priority of the Audio / PA system. This is expected to be a volt free relay contact rated for 5V 1mA to 110V 0.5A rating.*
- *PA in use signal, i.e. when this output from the PA system is active, the DVA delays its announcement. This is expected to be an opto-isolated input, capable of operation 5V DC to 110V DC.*
- *DVA abort, i.e. when the PA system is active, the DVA aborts its current announcement. This is expected to be an opto-isolated input, capable of detecting 5V DC to 110V DC. N.B. This may be a signal taken from the PA handset cradle or PTT switch, for example.*
- *Audio input to the monitor speaker in the PIS MMI from the audio system. It shall be possible to independently control volume for DVA originated announcements and mute the monitor when local PA handset PTT is operated, or the cab handset is removed from its stowage point.*
- *Please note that the Drum Switch arrangement is not used on the IE fleets*

2.7.3.1 Interface 2 – PIS to CCTV

This interface is already provided on some trains, allowing the PIS to provide time and reference data for the CCTV system. In the future, location reference data shall also be provided. The new PIS shall support the existing CCTV systems by replicating the current interface and in addition make provision for future CCTV replacements using a serial data interface.

Guidance Note – The following observations are made relating to existing interfaces:

> *Where already fitted with compatible CCTV (8510), an interface providing a volt free relay contact closure for 1 sec commencing 1 second before each hour roll over is required, i.e. contact opens to its quiescent state when the hour rolls over. This observation shall be validated by on-train investigations.*
>
> *Provision shall be made for a future standard interface to new CCTV systems. This interface to comprise an RS485 link with PIS as the bus master, recommended data rate 9600b/s, 8, 1, N. The PIS sending a 1 second poll comprising a NMEA $GPRMC message interleaved with a reply from CCTV containing a CCTV status message. Further special messages (from PIS to CCTV) may be used to replace occasional $GPRMC messages with the following information:*
>
> - *Selected PEI (when activated by the passenger and selected by the driver).*
> - *DST or UTC time mode, as automatically determined by PIS..*
>
> *Class 29000 currently integrates PIS and CCTV / TMS through the same MMI. A separate MMI is proposed for the replacement PIS but it will be necessary for the contractor to provide interfaces to the existing systems that will be retained. The contractor is required to investigate current arrangements and reverse Engineer existing data protocols. The 29000 CCTV is to be replaced under a separate agreement. The interface will be required to work with the existing and replacement CCTV system.*

2.7.3.2 Interface 3 – PIS Data-bus

This interface is provided on existing trains although the type of cable used in each case has not been established. The contractor shall satisfy themselves that the existing cable, inter-vehicle connections and auto-couplers are capable of supporting reliable new PIS. This will depend upon the technical solutions to be provided with the new system, i.e. data rates, electrical interface to be used for through train communications. Where the existing arrangements are considered to be deficient, the contractor shall produce a priced option for remedial works, e.g. new cables, new inter-vehicle jumpers, modifications to auto-couplers (changes to pins / pads).

Guidance Note – through train data communications:

> *The contractor is free to choose the most suitable method of communication. It is expected that RS485, at lower data rates (less than or equal to 19.2kb/s) may be viable over the existing interfaces. Given that the current interface comprises one pair of wires in most cases (with no common return) and galvanic isolation between equipment and the bus is required, then the master communicating device should produce a line conditioning 'preamble' preceding each new transmit session. Care is also needed to ensure that bus loading is correct in all combinations of multiple units, at the same time maximising current through auto-couplers. Galvanic isolation shall be provided between vehicles, i.e. cable screens shall not be bonded between vehicle chassis.*

2.7.3.3 Interface 4 – Wheel Rotation pulses

Wheel pulses are potentially available from the Secheron TELOC (or similar) event recorders fitted to existing fleets and already used by the current PIS / DVA on fleets such as 8510 and 8500.

Fleet	WSP	TELOC (or other make of event recorder)	ATP/CAWS	Other e.g. inverter/ chopper
8100R	1	2530 (See Note 3)	1	1
8500	1	2200 (See Note 2)	1	1
8510	1	2200 (See Note 2)	1	1
8520	1	2530 (See Note 3)	1	1
2800	1	2200 (See Note 1)	1	0
29000	1	2530 (See Note 1)	1	0

1 = present, 0 = not present

Note 1: Speed pulse output from TELOC to be made available by moving the existing odometer signal from the transistor output to a relay output. PIS to use transistor output interface.
Note 2: Speed pulse output used for flange lubrication – a new wheel probe shall be fitted to provide wheel pulse signals directly to the PIS.
Note 3: Speed pulse output used by existing PIS, like for like changeover.

Note 4: No output available, but upgrade to TELOC planned for late 2009. 2 speed pulses will be provided on the new Teloc 2530. 1 for PIS and 1 spare (for the possible Passenger Counting System if implemented in future)

Guidance Note – Wheel pulse interfaces:

> *In the case of 8510 and 8500, the pulses are provided on two wires described as +12V and -12V, the number of pulses, their duty cycle and timing are not known. The contractor is to undertake investigations to confirm voltage, source resistance, isolation, etc. Ideally, the same interface should be specified for other fleets, but it is the contractor's responsibility to communicate with the Event Recorder OEM to establish the capability of each variant across the fleet. Any costs arising from upgrades or modifications required to facilitate this interface are to be identified in a priced option.*
>
> *In the cases of 8520 and 29000, the schematics indicate that a 'tachometer' or wheel probe is directly connected to the existing PIS. The type of wheel probe interface (buffered digital or open collector) is not known. The arrangement is to be investigated.*
>
> *It is considered feasible for the PIS supplier to design a universal interface that may require basic configuration by PCB links / jumpers to suit each interface variant. The number of pulses per distance travelled is not known but a wide range should be expected. Some systems provide a high pulse rate such as 5000 pulses / rotation if taken directly from a wheel probe. Important characteristics of the wheel rotation interface are the ability to deal with a wide range of pulses, provide galvanic isolation, high impedance load when in parallel with other systems, and high integrity input with no risk of failure modes impacting parallel connected systems. Where wheel probes are uniquely allocated to PIS, it shall have the capability to provide an isolated power supply configurable between 12V to 24V of up to 100mA.*
>
> *Where a parallel connection is required on a wheel probe and the system is SIL ≥ 1, the contractor shall seek agreement from the supplier of the host system and the Engineer. Note: Flange lubrication is SIL 0. Output to the flange lubrication system from Teloc is a one second pulse for every 300m travelled which may not provide sufficient resolution given the short distances between certain stations*

2.7.3.4 Interface 5 – Train Radio

Refer to section 12.3, Appendix 3. It should be noted that IÉ will upgrade to GSM-R in the future. Where audio system replacements are included, then a GSM-R to PA interface shall be provisioned.

2.7.3.5 Interface 6 – Train Digital Interfaces

The following interfaces are generally required by PIS and in most cases will already be available. The design of the new PIS shall ensure that the interfaces are isolated from safety critical systems by relay contact segregation, if necessary by introducing

a new slave relay. This could be achieved by ensuring that all digital inputs on the PIS are opto-isolated similar to that on the Teloc 2530.

Cab Active (occupied) – this signal is required so that a master PISC can be set to control the train.

Doors open, left/right. In some cases a single input may be provided. This input is activated whenever doors have been enabled for opening.

2.7.3.6 Interface 7 – Drum switch ***Please note that this is not used on IE Fleets***

Some PIS addressing schemes require to identify the unit position within the train formation. This is sometimes accomplished in combination with the state of the drum switch (auto-coupler cover position).

Guidance Note – Drum Switch interfaces:

> *In most cases there are no spare relay contacts so the contractor is required to provide a slave relay, where required. The PIS supplier is to note that in some cases; as many as four units may be coupled into multiple unit formation for passenger service.*

2.7.3.7 Interface 8 – Other cab end

The diagram at the beginning of 2.7.3 shows Interface 8 although this is part of the PIS. There are several ways of dealing with the PIS controls and interfaces of the second cab within a unit. The PIS supplier must decide the most suitable solution based upon information within this specification and survey of the fleets:

Guidance Note – PIS structure:

> *The PISC and DVA are shown as an integrated entity. Some PIS designs duplicate this entity on each train unit by use of identical designs in each driving vehicle (cab). Other systems make use of a single entity, either in just one cab or located within an intermediate vehicle. Where a single entity PISC and DVA is used, the location shall be stated in the offer.*

i. *Method 1 – Identical equipment in each cab. Some suppliers use identical equipment in each cab to the extent that GPS receivers and DVAs are all duplicated. There are advantages in having a common design and in some cases this can be put to good use by providing a fallback facility, i.e. available by the duplication of sub-systems. However, this method tends to introduce a cost penalty.*

ii. *Method 2 – Master equipment at one cab end, slave equipment at the other cab end. The controller, GPS receiver and DVA are installed at one end. The MMI at the other end, then, remotely interfaces to the master end. This method is frequently used and has the benefit of minimising cost with just one common PISC and PIS database. The disadvantage is that there is no duplication of subsystems. Also, some PIS suppliers require additional cables and therefore may necessitate additional inter-vehicle*

jumpers. Availability of door open signal, cab active signal from the non equipped cab requires consideration.

iii. *Method 3 – The PIS controller is located within an intermediate vehicle. The advantage to this method is that the equipment design of both cabs will be identical and the GPS antenna in the intermediate cab provides a consistent location, regardless of unit orientation.*

Suppliers offering method 1 may be less competitive but offer better availability under the following conditions:

a) *Where GPS/navigation interfaces are duplicated (system in each cab), then the design should include cross checking of the location and be capable of navigating by the location determined from either cab in case of failure of one of the systems.*

b) *Where the PIS database is stored in both locations, the on-board system shall ensure that the same versions are installed at both ends*

2.8 Fleet Compatibility

Current Situation
The following fleets are compatible electrically and mechanically, i.e. couple in normal operation:

	8100 EMU	**8500 EMU**	**8510 EMU**	**8520 EMU**	**8200 EMU**	**2800 DMU**	**2600 DMU**	**2700 DMU**	**29000 DMU**
8100 EMU		×	×	×	×	×	×	×	×
8500 EMU	×		✓	✓	✓	×	×	×	×
8510 EMU	×	✓		✓	✓	×	×	×	×
8520 EMU	×	✓	✓		✓	×	×	×	×
8200 EMU (See note1)	×	✓	✓	✓		×	×	×	×
2800 DMU	×	×	×	×	×		✓	✓	X
2600 DMU	×	×	×	×	×	✓		✓	X
2700 DMU	×	×	×	×	×	✓	✓		X
29000 DMU	×	×	×	×	×	×	×	×	

✓ = Compatible ; × = Not compatible

In passenger service, trains may be operated up to eight vehicles. Under extreme circumstances, such as recovery of a failed unit, up to sixteen vehicles may be coupled. Audio communications / PA shall be available with sixteen vehicles connected.

Compatibility shall not be restricted or limited to less than that found between the fleets currently. However, by standardisation on a common design, greater compatibility is anticipated albeit limited by other factors, e.g. auto-coupler design and layout.

Note 1: Although the 8200 fleet is compatible with the specified units, IÉ's current policy for the 8200 fleet is not to operate with any other units.

Note 2: Class 8100 units are not compatible with any other of IÉ's fleets.

Required Situation

For the Dart fleet we only require the emergency alarms and emergency voice communication to be compatible with the current 8100 system

	8500	**8510**	**8520**
8100	✓	✓	✓

✓ = Compatible ; × = Not compatible

For the DMU fleet the requirement is for the 2600, 2700 and 2800 to be compatible.

	2600	**2700**	**2800**	**2900**
2600		✓	✓	×
2700	✓		✓	×
2800	✓	✓		×
2900	×	×	×	

Compatibility shall not be restricted or limited to less than that found between the fleets currently. However, by standardisation on a common design, greater compatibility is anticipated albeit limited by other factors, e.g. auto-coupler design and layout.

2.9 Migration Constraints

The impact of PIS upgrades shall be considered at an early stage to ensure minimal disruption to fleet availability during the new PIS modification programme. A Migration Plan shall be devised and the following objectives shall be met:

2.9.1 Coupling of unmodified and modified units in any combination shall not result in the Audio / PA system being disrupted.

2.9.2 The leading unit front, side and internal displays shall function correctly when unmodified and modified units are coupled. Ideally, a method shall be provided to allow modified units in non-leading positions to have their PIS system set up to run independently.

2.9.3 Where possible, it is preferable to retain operation of the PIS displays throughout the train. However, it is acceptable for the displays in the trailing units to be 'out of order' as long as they do not show incorrect information, i.e. they should be set to blank. In order to satisfy this requirement, it is necessary to ensure that unmodified and modified systems - potentially incompatible – can share the same through train data bus without interfering with each other.

2.9.4 Audio announcements shall work as intended from the leading unit driving PA to all other units, i.e. an unmodified leading unit may continue without a DVA by means of manual announcements from the driver.

3. SCOPE OF SUPPLY

3.1 Scope Summary

The scope of supply is outlined below:

3.1.1 Develop a design that will satisfy the requirements set out in this specification.

3.1.2 Survey of the vehicles to identify interfaces (dimensions, fixing points, space envelope, existing cables, etc).

3.1.3 Tests to be performed on existing vehicles to analyse interfaces, e.g. PA and audio communications interface. Validate interface designs.

3.1.4 Detailed analysis of relevant vehicle drawings.

3.1.5 Submit a detailed design package for review and approval by IÉ.

3.1.6 Engage a NoBo to approve the design.

3.1.7 Supply of 'mock up' samples for each LRU and undertake trial fit to validate design.

3.1.8 Produce documentation to support the Installation Design and NoBo submission.

3.1.9 Provide detailed design documentation to IÉ for the purpose of design review.

3.1.10 Undertake type and system testing and then provide documentation packs to support design approvals, engineering change and submissions for IÉ and RSC.

3.1.11 Undertake first of class testing installation, test and commissioning.

3.1.12 Provide an adequate level of well documented training to certify competence of IÉ staff covering operation, testing and maintenance for each of the following staff: Project / FTS Engineer, operating staff, and maintenance staff. In the case of operating staff, IÉ will nominate a limited number of persons from their training team who will be responsible for training train crew.

3.1.13 Fleet installation and test.

3.1.14 Warranty support.

3.2 Prices to be submitted with the Form of Tender

The following breakdown of prices shall be provided:

3.2.1 PIS Equipment prices – for each fleet.

3.2.2 PIS Equipment prices – for spares, if different to 3.2.1.

3.2.3 PIS ground system and off train supporting products - price breakdown.

3.2.4 PIS System Engineering, Design Support, Documentation – generic price for common design and documentation and individual prices to customise each fleet.

3.2.5 PIS Systems installation, test and commissioning - for each fleet.

3.2.6 Project Management – priced on the assumption of sequential fleet upgrades.

3.2.7 Special tools – price for tools and test equipment.

3.2.8 Price list for consumables, i.e. replacement flash cards.

3.2.9 Build and supply two complete test walls (or test rigs) including cabling for use in IÉ depots. See section 4.10 for details on the test wall.

3.2.10 Each of the above shall be referenced in a matrix that clearly identifies the base offer and options detailed in section 7.

3.2.11 Life cycle costs, refer to section 4.6.4.

3.3 Documentation to be submitted with Form of Tender

The following information shall be provided with the bid:

3.3.1 A brief statement of capability, i.e. a minimum of 3 recent previous project experiences in railway vehicle applications.

3.3.2 Copies of quality approval certificates.

3.3.3 List of subcontractors, including previous project experiences and copies of quality approval certificates.

3.3.4 A clause by clause response to this specification and relevant sections of the TSIs.

3.3.5 Project programme – detailing activities, dependencies, milestone dates, resources and external support / resource required (i.e. IÉ or other external organisations).

3.3.6 A description of the system offered.

3.3.7 A detailed statement of what is not included in the offer.

3.3.8 A detailed list of equipment offered detailing each Line Replaceable Unit (LRU) and the OEM supplier part number. This list shall identify whether each item is new, modified or exactly as supplied on other projects.

3.3.9 A block diagram for each vehicle class identifying the location of major system components and required train connectivity.

3.3.10 Type test plan – identifying tests needed to confirm compliance with this specification and referenced standards.

3.3.11 A Risk Register identifying any risks (safety, technical, commercial, milestones, etc).

3.3.12 Power budget for the system offered with regard to the impact on vehicle batteries. Clarification of mitigations, i.e. load shed.

3.3.13 Reliability data and overview of anticipated failure modes for the systems offered.

3.3.14 Life cycle costs based upon a 20 year period, which is considered the system life expectancy, with all systems in use. Refer to section 4.6.4.

3.3.15 Define the procedure and any configuration that will be required when changing individual LRUs.

3.3.16 Information necessary for the Railway Safety Commission Submission and assistance with the approval process

3.4 Deliverables for Preliminary Design Review (PDR)

Where practical, two design review stages will be used; the 'Preliminary Design Review' (PDR) and 'Final Design Review' (FDR). PDR submissions shall become due within 8 weeks of the executed Purchase Order. The following activities are to be completed for the PDR stage:

3.4.1 Updates of all documents detailed in section 3.3 above shall be submitted, along with:

3.4.2 Detailed design description – equipment description, functional description, interfaces, etc.

3.4.3 Detailed Project Plan i.e. detailed to show supplier, IÉ and sub-contractor dependencies.

3.4.4 Detailed drawings for each LRU.

3.4.5 Connector and cable definitions document, connector type, pin / socket types, pin allocations, strain relief arrangements, cable definitions, data-sheets and required tooling.

3.4.6 Type test plan with due consideration of notice periods for witnessing of tests.

3.4.7 EMC plan.

3.4.8 Equipment earth policy statements, e.g. clarifying where screened cable earth bonds are made.

3.4.9 Earth bonding detail drawings for each separate electrical component (LRU).

3.4.10 Reliability and FMECA analysis.

3.4.11 Risk Register update.

3.4.12 IÉ shall review and comment on the PDR submission within 10 working days of receipt, unless otherwise agreed, the contractor may be required to re-submit as a PDR 2 submission, etc if the submission is deemed unsuitable, in error or inadequate.

3.4.13 Delivery of LRU mock-ups, installation plan and electrical schematics for trial fit, 10 working days following IÉ PDR approval.

3.5 Deliverables for Final Design Review (FDR)

Documentation originally presented at PDR may be raised to FDR status where the PDR submissions are fully approved or conditionally approved. The following additional documentation shall be supplied at FDR. The delivery of the documentation shall be sequential to allow time for IÉ to review, which IÉ shall comment and/or approve within 10 working days of receipt or otherwise agreed. Before PIS equipment can be delivered, all modules (or LRUs) shall be approved, and a factory FAI / FAT test shall be undertaken, using documents including those items marked with #. With prior agreement by IÉ, the tests may be conducted prior to final system software acceptance so long as the hardware can be demonstrated to support the specified functionality:

3.5.1 Type test procedures. #

3.5.2 Type test reports. #

3.5.3 Technical Construction File or fully documented EMC type test reports. #

3.5.4 RAMS information, and detailed FMECA. This shall include method statements of how the RAMS and FMECA have been calculated.#

3.5.5 Routine tests specifications. #

3.5.6 Vehicle interface documents. #

3.5.7 Comprehensive installation method statements, installation drawings, general arrangements and schematics (or checking of documents provided by the installer). #

3.5.8 Evidence of compliance with specified standards. #

3.5.9 Detailed technical descriptions including software design specifications, interface details, design validations and calculations. #

3.5.10 User guides and/or updates to existing driver/crew manuals.

3.5.11 Factory Acceptance Test procedure. #

3.5.12 System integration test procedure.#

3.5.13 Commissioning/dynamic test procedure (for the first train).

3.5.14 Installer commissioning test procedure (routine test).

3.5.15 Maintenance and overhaul manuals.

3.5.16 Service and fault finding manuals.

3.5.17 Training material, e.g. training manuals.

3.5.18 Detailed list of connectors, cables and part numbers, including supplier names and references

3.5.19 Configuration management documentation.

3.5.20 The contractor and PIS supplier shall enter into an ESCROW agreement where all manufacturing data, BOM (detailed component level), drawings, artworks, CAD files, software source/execution code, procedures, parameters, protocol specifications, etc shall be deposited. #

3.5.21 Preparation of approvals/submissions for the RSC. #

3.5.22 Configuration Management database.

3.5.23 Final mass control document. #

3.5.24 Bills of Material for LRUs and any item needing overhaul, i.e. identifying part numbers and suppliers. For example, if a PIS display is manufactured by a third party, or for any component that requires routine replacement. #

3.6 Ongoing Document Deliverables (during the Design Phase)

3.6.1 Bi-weekly update of the project programme.

3.6.2 Safety and reliability risk register updates.

3.6.3 EMC plan (reviewed and updated).

3.6.4 Project risk register maintained by regular review.

3.6.5 Minutes of design review meetings.

3.6.6 Type test plan/schedule (including 2-week notification of intention to undertake a type test).

3.6.7 Updates to Configuration Management Database, which shall be submitted to IÉ whenever a change is made, but also on a monthly basis. Also required are the Maintenance, Operation and Fault Finding manuals

3.7 Document Deliverables (During the Warranty)

Following 'First of Class' acceptance, 'As built' drawings and documentation shall be submitted.

3.7.1 Monthly Report – Analysis to criteria set out in systems performance, fault report, repairs, details, reasons, diagnosis, etc.

3.7.2 Three Monthly – Engineers review of reports – endemic problems, repeated problems and recommended improvements.

3.7.3 Updates to Configuration Management Database, which shall be submitted to IÉ whenever a change is made, but also on a monthly basis.

3.7.4 Change Request documentation (as and when needed).

3.7.5 Annual – Performance Review.

4. GENERAL REQUIREMENTS

The following General Requirements are suggested by IÉ, but contractors are advised to familiarise themselves with the vehicles, the operating conditions, and if necessary to undertake additional investigations to validate the vehicle environmental parameters as stated, since the conditions may differ at localised areas within the vehicles:

4.1 Environmental Conditions

The PIS shall function normally without degradation under all of the following environmental conditions:

4.1.1 Thermal Range

Powered: -25^{0}C to +55^{0}C external to the equipment, i.e. EN50155, class T1.

Operational: -10^{0}C to +55^{0}C.

Storage: -30^{0}C to +70^{0}C ambient

Guidance note: To be demonstrated by dry heat / cold testing. The PIS is expected to operate normally if powered up after 12 hour pre-conditioning at -10^{0}C. If the system is pre-conditioned at -25^{0}C, then powered up, this shall not prevent normal operation as the temperature rises to -10^{0}C. PIS displays shall be tolerant of solar gain and operating temperatures >70^0 C may prevail on the display screen in combination with the maximum ambient temperature surrounding the display. Type testing should include simulation of sunlight by operating the display for extended periods under halogen flood lights.

4.1.2 Humidity Range : 95% up to +55^{0}C, to be demonstrated by a damp heat cyclic test including temperature change at 30^{0}C /minute maximum from -25^{0}C to +55^{0}C at maintained relative humidity.

4.1.3 Vibration: EN61373 as referenced from EN50155:2007. In addition, individual LRUs to be checked during FAI by visual scrutiny of equipment construction and internal assemblies.

4.1.4 Enclosures: In order to provide compliance with fire / materials standards and protection against dust / water ingress all equipment shall have a minimum ingress protection to IP65, or IP66 if floor mounted. To be type tested in accordance with EN60529:1992.

4.1.5 Contaminants: Heavy interior use applicable to rail environment, e.g. dust with oil particles from diesel engines, conductive dust from brake pads. Salt mist – DART and Commuter services operate along the east coast of Ireland.

4.1.6 Fire: Equipment shall comply with EN45545 or alternative standards as listed in section 4.3. In the event of fire, internal or external to the

equipment, flame shall not spread and toxic smoke shall not be generated.

4.1.7 Robustness: All equipment shall be mounted to the vehicle in compliance with the structural requirements of EN 12663 when installed.

4.1.8 Electrical: The EMU fleets provide an auxiliary battery backed supply of Un = 110V. The DMU fleets provide an auxiliary battery backed supply of Un = 24V.

Guidance Note: The voltage range, surge and transients are as specified in EN50155:2007. Supply interruptions equal to Class S2 may occur and should not disrupt the PIS under worst case conditions; this is to be tested at maximum and minimum operating voltages, and with displays filled with characters '8', and then 'H'. Equipment should not be disrupted by 10 milli-second supply interruptions. With longer interruptions, equipment should automatically reset and re-start without manual intervention when the power supply dips below the minimum voltages shown above, for any duration or rate of voltage change.

Inputs and outputs (I/Os) shall also be tested for appropriate surge and transient levels. Direct transients as defined in EN50155:1996 apply to any battery related or referenced circuit. Indirect transients apply to circuits that are isolated from supplies. With the agreement of the Engineer, certain interfaces protected by screened cables may sometimes be excluded from direct transient testing.

Creepage and clearances on connectors and PCBs shall comply with EN50124-1.

4.1.9 EMC: Refer to Section 4.7.11.

4.1.10 Light: Internal lighting levels and arrangements are to be identified by the PIS supplier during a vehicle survey. The internal displays shall be designed to provide optimum contrast and brightness, avoiding reflections from lighting and reflections from LED displays onto ceiling panels.

4.2 Requirements for Electronic Equipment

Electronic equipment shall be designed, constructed, tested, manufactured and documented to comply with EN50155:2007. The contractor shall declare any use of the following items within the equipment offered and state the maintenance / replacement periodicity:

- Fans or other electro-mechanical components.
- Air filters.
- Batteries. (The number required is to be minimised)
- Internal non self resetting fuses.
- Toxic or hazardous substances.
- Degradable materials.

4.3 Fire Performance

4.3.1 The PIS equipment and materials used for the installation of the system shall be assessed against the requirements of EN45545-2 category A. Alternatively, whilst the European standard remains at draft status, GM/RT2130 issue 3 & BS6853 category 1b may be used.

4.3.2 The contractor shall ensure compliance to one of these standards so the risk of ignition, construction methods, use of materials, flammability and toxicity are fully considered. The contractor shall provide evidence of compliance to the Engineer to assist with an assessment of the complete installation on each vehicle type. The suppliers shall be required to list all materials that may represent a risk, and the total mass with supporting material data sheets for each product/vehicle.

4.3.3 If the materials within an enclosure are to be disregarded, then the suppliers shall demonstrate (to the satisfaction of the Engineer) fire / smoke containment, i.e. IP65 (or better) sealed enclosures. The contractor is advised that the preferred design of the PIS components will use sealed enclosures.

4.4 Lifetime and Utilisation

4.4.1 Product Lifetime

The product lifetime shall be 20 years from the date of system final acceptance. During this period, the contractor shall continue to support the products and spares shall continue to be available. The contractor shall note clause 10.4 in this respect.

4.4.2 Fleet Operating Cycle

The vehicles are utilised 20 hours per day and the train power system may be isolated from the PIS displays when the train is shut down. The PIS Controller and Gateway shall use minimal power (less than 15W) if they are required to be kept operational overnight to support software and database uploads for Option 1.

The PIS shall be available and fully functional within 60 seconds of being powered for operational service.

4.5 Target Mass

The contractor shall produce a 'mass control document'. The mass shall be identified as ‘actual’, ‘calculated’ or ‘estimated’ and the centre of gravity of the mass and its location in the vehicle shall be identified. Entities of the new PIS shall be designed for minimal mass. *Guidance note: enclosures for displays, etc are expected to be of aluminium sheet or GRP rather than mild steel.*

4.6 Reliability and Availability

4.6.1 The contractor shall provide reliability data (MTBFs) for each individual LRU and calculated reliability for the complete system to be installed in

each train unit arrangement of each vehicle class. The quoted reliability shall form part of the contract, and warranty obligations shall not be completed until such time as the reliability figure is achieved in service operation. *Guidance note: Contractors are advised that the stated reliability and required maintenance support as demonstrated by the LCC are considered on equal terms as price of the system / installation.*

4.6.2 The contractor shall consider failure modes of the system and associated interfaces and produce an FMECA analysis. Particular attention shall be given to any failure mode that may impact the vehicle and other sub-systems.

4.6.3 The contractor shall maintain a system of recording failures by category, item and serial number. Actual reliability performance shall be monitored during the warranty period as described in the Framework Agreement for the supply of Replacement Passenger Information Systems and any shortfall against agreed target reliability shall be corrected at the contractors cost by modifications and improvements as part of a reliability growth programme. The procedure for recording, presentation, and detail of reports shall be agreed with the Engineer. The reports shall be provided at monthly intervals or a shorter time as specified by IE from time to time for the duration of the warranty period. Reliability shall be detailed for each individual fleet, using 12 week averaging periods.

4.6.4 Life Cycle Cost

The contractor shall declare a standard repair charge for each LRU, considering labour and material costs; the standard repair charge shall also include packaging / delivery from depot to repair facility and return. Time to Repair each LRU shall be declared using the assumption that the staff are already in the depot and on-board the vehicle, and considering a rate of €50 per hour. Excluding CAPEX, the contractor shall provide the OPEX over a 20 year period, which is considered the system life expectancy, using 2011 prices.

The contractor shall declare the expected number of Service Affecting Failures (SAFs) per annum per fleet during the warranty period, which is described in section 8.4.5. A SAF is defined as a failure that results in the following:

- A 5 minute delay to service;
- passengers having to be evacuated from a vehicle;
- A unit or train unsuitable to go into service as scheduled or requires being withdrawn from service.

A SAF shall be considered when one or a combination of the following systems is not functioning: PA, CFA, PEI, or Front display of train.

4.6.5 The contractor shall state the depot support hours required through to the end of the warranty.

4.6.6 The contractor shall state their maximum response time to any fault reported. *Guidance note: it is envisaged that IÉ depot staff will provide basic LRU changeover during the warranty period within the agreed number of hours. The contractor is required to indicate their response time for escalation of fault finding and repairs.*

4.7 Interfacing and Compatibility

Interfacing and compatibility issues shall be considered at the earliest stage of design and where necessary any concerns shall be declared on the project risk register.

The contractor shall not degrade any existing on-train system by virtue of any activity or new equipment introduced on the vehicles.

The contractor shall provide full co-operation to other suppliers / organisations working on this and other upgrades. In particular, to participate in interface meetings and trials before and during train installations.

4.7.1 Connectors and Cables

Connectors shall be of robust professional quality, with gold plated contacts providing a minimum 500 mating cycles. Examples of suitable multi-pin connectors are the AB Connectors Ltd. ABCIRH range of circular (halogen free) connectors and the Harting M12 crimp pin connector for the Ethernet databus. The mating connector shall include a strain relief and a polariser - so that it is not possible for the connector to be incorrectly mated. Each cable loom and equipment connector shall be labelled with a reference number by an approved and indelible marker. The use of direct soldered or screw-tightened connections is not acceptable. All connector pins / sockets shall use crimps or approved spring pressure contacts. The supplier / installer shall operate a recognised control procedure to maintain the quality of crimp terminations and tools.

All cables shall be zero halogen of railway approved types, satisfying all materials and flammability requirements.

Particular attention shall be given to avoiding the use of the same connector type and polarisation within the same location unless incorrect mating is prevented, e.g. by cable length or other means. The contractor shall provide two sets of cable harnesses to IÉ for the production of test walls in two depots.

4.7.2 Electrical - Surge/Transient and Interruption

The surge and transient conditions described within EN50155 are to be used as the base standard for power supply quality. This standard identifies harsh surge and transient characteristics on the train supply and as a consequence on input/output circuits referenced to the train supply. In addition, inputs not directly referenced to train supply may be subject to indirect transients. The train supply may also be subject to interruptions (Class S2 - 10 milliseconds) and to dips below minimum

operating voltage. The equipment shall not be affected by interruptions, surge/transient or extended supply dips. Supply interruptions >10 milli-seconds may cause disruption or total shutdown but the individual PIS components shall re-start normally when power is restored.

The in-rush current to each LRU shall be kept to a minimum to avoid disruption to the power systems of the train.

4.7.3 Electrical – Load Shedding

When the vehicle batteries are no longer being charged, a system of load shedding shall be provided.

The preferred method requires the PIS displays to blank and enter low power mode at a critical voltage. This software configurable (threshold) voltage shall be in the range 67V to 90V for equipment that operates from a nominal 110V DC supply; 17V to 22V for a 24V DC nominal supply. The PIS displays shall shut down and reduce their power consumption to less than 5W each. The threshold voltage shall have hysteresis (>5% suggested) before the PIS is allowed to power up.

Alternatively, the load shed arrangement may be provided by a voltage sensing relay, feeding the PIS display supply. Where this non-preferred method is required, the additional equipment shall be included as part of the contractor scope.

4.7.4 Electrical – Galvanic Isolation

The contractor shall ensure that within their equipment, the train supply 0V (and positive) are kept isolated from the equipment chassis and consequently from the vehicle chassis. This isolation shall be tested (100%) at production factory by shorting all train supply referenced connections together and undertaking the following test:

i) Connect the insulation and proof test voltages between equipment chassis and the train supply referenced connections of the LRU.

ii) Insulation test at 500V DC and record the resistance.

iii) Apply 1000V AC (or 1.4kV DC) for 1 minute, i.e. Proof or breakdown test. N.B. This proof test voltage may be reduced to 500V AC for 24V DC powered equipment.

iv) Insulation test at 500V DC and check there has been no degradation in the resistance reading.

v) Perform functional tests; confirm the LRU is operating normally.

This test shall be repeated whenever the equipment is repaired or following significant overhaul.

4.7.5 Electrical – Isolation between individual I/O's

Creepage and clearance distances on PCB's and connectors shall meet the requirements of EN50124-1 *Guidance Note: An I/O connected or referenced to train supply shall be rated at the peak sure and transient voltage as defined in EN50155. Transient protection, clamping to a lower voltage that can then be considered as the peak shall therefore be provided close to the point of entry (connector) for each I/O.*

4.7.6 Electrical – Equipotential Earth Bonds

All equipment enclosures shall be provided with a reliable low resistance connection (<0.1R) to a bonding stud, mounted on the vehicle body frame. Contractors are responsible for provision of a connection point on the vehicle. The earth bond cable shall be designed with suitably rated conductors based on the expected range of supply circuit breakers that may be used.

The earth bond on each item of electrical equipment shall be robust comprising a minimum M5 fixing with an arrangement of washers and locking washers. All earth bonds are to be tightened to a torque level specified on the associated drawing and sealed. The resistance across the connection shall also be measured and recorded. The arrangement shall be detailed on a drawing and the Engineer shall approve this prior to manufacture.

Screened cables shall be connected to the bonding stud via a low resistance (<0.1R) path from the point of entry to individual LRU's.

Multiple point earth bonds are not permitted as potential differences do occur in the vehicle chassis, particularly between different vehicles. Particular attention shall be given to screened data circuits where normal practice dictates a single point bond. *Guidance note: for EMC purposes the cable may be gapped at a mid point, or the normally open end may be coupled to chassis through a capacitor.*

4.7.7 Vehicle Integration

The following considerations shall be made as part of the installation design:

4.7.7.1 Vandalism

Installations in public areas shall be robust and vandal resistant. The installation and equipment shall have a good cosmetic finish suitable for cleaning by water based cleaning solutions and light solvents for the removal of graffiti.

4.7.7.2 Security

PIS control equipment shall be installed within a secure enclosure requiring a special tool to gain access. Fixtures that may be removed by flat and standard 'star' screwdrivers shall not be used.

4.7.7.3 Safety

The screens of PIS displays shall conform to a glazing safety standard equivalent to that used for vehicle windows, e.g. BS857 or equivalent. Displays and other equipment shall be free from sharp edges so they do not present a risk to staff or passengers in case of an accident.

4.7.8 Mock Up Equipment

One of each LRU item shall be supplied as a mock up sample following design review and approval of space envelope drawings. Mock up LRUs shall be dimensionally accurate and complete with fixing holes, labels, simulated user interfaces, connector shells, earth connections, etc. Following completion of the PDR phase it shall be confirmed, by use of the mock up, that:

a) Each LRU fits into the space allocated using the fixing method intended.
b) The cable looms reach the LRU connectors with surplus length to allow re-work and the bend radius and length of the loom are suitable.
c) Labels are visible when the LRU is installed.
d) User controls, indicators and access are ergonomically arranged.
e) Train crew, representative or management may be consulted about new equipment locations.

The above shall be demonstrated to the satisfaction of the Engineer.

4.7.9 Maintainability

The driver MMIs in the active and non-active cabs shall have the facility to identify and alert PIS malfunctions affecting normal and accurate delivery of PIS information.

For maintenance purposes, a simple and reliable method of identifying faulty LRUs shall be provided, e.g. via a password protected menu on the MMI. A more advanced facility shall be provided as software to operate on a notebook PC, to be connected to the on train PIS. Diagnostic software shall operate on the Windows (©Microsoft Corporation) XP operating system on the notepad PC with support for Windows 7 as the next generation of operating system. The software shall be user friendly and intuitive to anyone familiar with Microsoft application software, i.e. menu prompts, navigation, etc. All maintenance activities and tools shall be fully documented.

The PIS supplier shall provide details of any automatic testing that their system can provide as an aid to maintenance. In particular, the extent of information provided, and how the maintainer can be notified without involvement of the Train Operator.

It shall be possible to update the PIS software and database via a single interface, directly accessible to maintenance staff, and without the removal of any equipment. It shall also be possible to update software and database via the WiFi and 3G interfaces subject to a robust and secure method. The method of updating shall be proposed by the contractor and agreed by the Engineer. The time taken to upload the LTP file (20MB), via WiFi or local connection, to the PIS becoming ready to operate the new LTP shall not exceed 3 minutes. The time taken to upload the speech files (100MB), via WiFi or local connection, to the PIS becoming ready to

operate the using the new files shall not exceed 5 minutes. The minimum effective WiFi link data throughput is assumed to be 5Mb/s in this respect.

The total time needed to identify and replace a faulty part, then re-test the whole PIS shall be kept to a minimum, not exceeding 30 minutes.

4.7.10 Equipment Labelling

A label shall be affixed to each individual LRU and major sub-assembly in a position legible without having to dismount the modules. The label shall include the manufacturer name and telephone number together with the manufacturer's part number, serial number, date of manufacture (for warranty) and MOD strike record numbers. These labels shall be indelible and securely affixed to each LRU. The contractor shall seek approval from the Engineer where it is inappropriate to fit a label for minor / simple items.

Where software, hardware or other configurable components (FPGA, ASIC, etc) are used in an item, separate version identification labels shall be used for the modification. In addition to labels, the contractor shall provide details on how software versions can be determined, e.g. by means of an electronic display within or part of the product.

The contractor shall maintain a Configuration Management Database, so that software / hardware and modification status of each product is recorded by serial number with records identifying each supplied item. The system of configuration management, validation and testing for the release of software shall conform to a recognised Quality Management Procedure.

4.7.11 Electro-Magnetic Compatibility

The contractor shall ensure that the PIS is suitable for use on all of the intended vehicles, having full compatibility with existing vehicle and train systems. Any requirements necessary to maintain the contractors EMC certification shall be stated in the offer.

The contractor shall provide the Engineer with all the evidence necessary to demonstrate compliance with the EU EMC directive (2004/108/EC) and all associated EMC standards. A Technical Construction File shall be provided. Evidence of compliance to BS EN50121-3-2: 2006 shall be included.

Existing evidence cannot automatically be assumed to be adequate for the purpose of ensuring compliance of the complete vehicle installation. The evidence itself shall be independently reviewed by a competent body against the vehicle installation and system requirements. It must be noted that the outcome of any review may require the contractor to repeat tests or conduct additional tests and consequently modify designs where discrepancies arise.

4.8 Documentation

All stages of the project life cycle operation shall be supported by appropriate documentation. The contractor shall provide instructions suitable for incorporation into the existing vehicle documentation. These shall be produced using 'Microsoft Word' and provided in both printed and electronic format. Drawings provided by the

contractor shall be provided in .dgn or .dfx format. The outline requirements in EN50155:2007 section 11 shall be used.

Vehicle Maintenance Instructions (VMIs), Vehicle Overhaul Instructions (VOI) and Component Overhaul Instructions (COI) shall be supplied in English language. IÉ will supply Word templates for each document type. A simple VMI introduction document is attached as Appendix 6, section 12.6.

4.9 First Article Inspection

Before the shipment of PIS equipment commences, IÉ requires to undertake a First Article Inspection (FAI) and Factory Acceptance Test (FAT) at the contractor or supplier's works. Normally, FAI and FAT are combined in the same supplier visit.

4.10 Integration Test Facility

The supplier shall establish a factory integration test facility (or test wall). This integration test facility shall be wired as the train, using the same cable types, and equivalent cable lengths. The test facility shall be assembled as one complete train unit of PIS equipment to support FAT tests. Full train rakes of 16 vehicles shall be simulated by cable length and loading of transmission circuits. Following FAT acceptance, a reduced test facility shall be agreed and the basis of it being sufficient to support software modifications or problem investigations. A block diagram of the proposed integration test facility, identifying where it will be simplified following FAT shall be submitted for approval by the Engineer.

The integration test facility shall be completed in time for the start of software testing by the contractor and shall remain intact for the warranty period and preferably thereafter to support ongoing maintenance / repairs. Refer to sections 8 and 9.3.1.

4.11 Factory Acceptance Test

The integration test facility shall be used by the contractor for proving the system and its associated software. The Engineer will participate in a Factory Acceptance Test (FAT) to be satisfactorily completed before material deliveries commence.

Any subsequent changes to software within the system shall include a complete or partial repeat of the integration test procedure.

The Engineer shall be given a minimum two weeks notice of intent to undertake any FAT test. Where partial testing is proposed, following minor software change, the extent of re-test shall be agreed with the Engineer.

Work location

The work or a portion of the work will be undertaken at an IE facility at any of the following locations; Fairview DART Depot Dublin 3, Drogheda Depot, Inchicore Works Dublin 8 or Connolly Depot Dublin 1.

5. PARTICULAR REQUIREMENTS – PASSENGER INFORMATION SYSTEM

5.1 Displays

5.1.1 Displays – general requirements

5.1.1.1 A limited range of standard displays are preferred. *Guidance note: Standardised internal and side displays may be possible but at least two variants of front display will be required. The standard designs may be adapted to each vehicle by means of customised fixing brackets.*

5.1.1.2 LED technology is preferred but alternatives will be considered if benefits can be demonstrated. The contractor shall demonstrate that the choice of LED component is based upon performance and reliability rather than least cost. *Guidance note: LED supplier details and datasheet should be provided during PDR.*

5.1.1.3 Displays shall comply with TSI-PRM, some requirements are reiterated in the following clauses 5.1.1.4 to 5.1.1.10. *Guidance note: TSI-PRM sets out the requirements in European law and as adopted in Irish Law. The contractor is required to obtain certification of compliance from a NoBo.*

5.1.1.4 Displays shall be capable of displaying messages in both English and Irish languages. *Guidance note: by cycling between the languages at user configured timed intervals.*

5.1.1.5 Displays shall be capable of displaying all the set of characters for the Irish Gaelic Language as established in the Irish Standard Specification for '*Information Technology – Irish 7-bit Coded Character Sets*' (I.S. 433:1999), and in the '*Information Technology – 8-bit single-byte coded graphic character sets*' (ISO/IEC 8859-15:1999).

5.1.1.6 Displayed characters shall be yellow in colour set against a dark background to provide a high contrast.

5.1.1.7 Scrolling text shall not exceed a rate of 6 characters per second and the longest station name shall be completely visible for a minimum of 2 seconds. *Guidance Note: Scrolling text is defined by the text entering the display area from the right hand side and smoothly scrolling to the left of the display. The scroll repeats when the end of the text string exits the display area at the left, or there is a defined space between successive scrolls.*

5.1.1.8 Rolling text shall persist as static text for a user defined period between 2 seconds and 10 second resolved in 0.5 second increments, the roll transition shall be user defined between 0.1 sec and 1 sec in 0.1 sec increments. *Guidance note: rolling text is defined by new text entering the display area from below as old text exits the display area at the top. Rather than substituting new static text for old text, the roll transition provides the illusion of a rolling display since both old and new text is*

momentary visible with a normal line width between the bottom of old text and the top of new text.

5.1.1.9 Sans Serif fonts shall be used in mixed case. *Guidance note: the contractor to make both upper and lower case characters available. Typical fonts are: Arial, Helvetica, and Verdana. IÉ will ensure correct application of mixed case.*

5.1.1.10 Font descenders shall have a minimum size ratio of 20% compared to capital characters.

5.1.1.11 Fonts shall preserve normal horizontal and vertical proportionality, i.e. the matrix horizontal /vertical ratio shall be 1:1 +/- 10%.

5.1.1.12 The horizontal width of the displays shall be calculated based on the scrolling of the largest station name identified for each display, satisfying the TSI-PRM, based upon actual scrolling rate, and 2 seconds full visibility of the longest station name. *Guidance note: Refer to Appendix 4 for a list of the station names on the Irish rail network, in both English and Irish.*

5.1.1.13 The text in the Irish Language shall appear first.

5.1.1.14 The text in the Irish Language shall not be less prominent, visible or legible than the text in the English Language.

5.1.1.15 A word in the text in the Irish Language shall not be abbreviated unless the word in the text English Language, of which it is the translation, is also abbreviated.

5.1.1.16 It shall be possible to modify or substitute the display fonts individually for each display type, i.e. remotely from the PISC or preferably from the ground system using the Communications Gateway.

5.1.1.17 Displays shall be environmentally sealed to a minimum of IP65.

5.1.1.18 Displays shall be rated under the worst extreme of all conditions set out in section 4 for continuous operation (12 hours) with the display matrix filled with the character ‘8’ in every available character position of the display. The ‘worst’ condition includes maximum sunlight level, i.e. operating the LEDs at maximum brightness.

5.1.1.19 Displays shall include thermal protection to limit internal temperatures to be within the component ratings. However, thermal protection shall not adversely affect the availability or performance of the display. *Guidance note: External displays in particular may be subject to solar gain with a risk of poor reliability. Protection may be invoked only under extreme direct sunlight conditions with small reduction in LED output, e.g. by pulse width control.*

5.1.1.20 The display shall include a controller, i.e. a micro-controller to service the display, the communications interface, etc.

5.1.1.21 If the communications link between the PISC (central controller) and the display is lost or fails for more than 120 sec, the display controller shall blank the display.

5.1.1.22 The display controller shall have the capability to be reset by the PISC.

5.1.1.23 The display controller shall incorporate several test patterns for the purpose of testing individual LEDs during a 'walk through' check. *Guidance note: the patterns should allow individual LED failure and short circuits between adjacent LEDs to be identified. A polka dot pattern or moving vertical block is often provided.*

5.1.1.24 It shall be possible to instruct displays to show their serial number, firmware, and font versions. This feature shall be activated from the MMI maintenance menu.

5.1.1.25 The installation of the displays shall make maximum use of the available window space; consideration for tolerances shall be made to avoid parallax affecting the display readability.

5.1.1.26 The displays shall be capable of displaying the station names as listed in Appendix 4.

5.1.1.27 The following quality accept/reject criteria shall apply to displays:

a) At SAT (first installed):

i) All LEDs/pixels shall be working. Flashing or flickering LEDs are not acceptable.

ii) LEDs shall be colour and intensity matched with no adverse variance.

iii) LEDs/pixels shall be horizontally and vertically aligned and consistently spaced.

b) At the end of the warranty period:

i) Front of Train (FOT) displays: Up to 0.1% (rounded up to integer value) total LEDs may be accepted as failures due to intensity or colour mismatch. However, they shall be randomly placed and two failures shall not be within five pixels (horizontal or vertical).

ii) Side and internal displays: Up to 0.05% (rounded up to integer value) total LEDs may be accepted as failures due to intensity or colour mismatch. However, they shall be randomly placed and two failures shall not be within five pixels (horizontal or vertical).

iii) Flashing and flickering LEDs are not acceptable.

iv) Average intensity shall not have reduced since SAT by more than 5%.

v) LED/pixel alignment shall be maintained.

5.1.2 Front of Train Displays

Up to three different Front of Train display variants may be required, referenced as follows:

FOT 1 – for the 30% width cab windows of the 2600, 2700, and 2800 units.

FOT 2 – for the 50% width cab windows of the 8510, 8520, and 8500 units.

FOT 3 – full width as 8200 and 29000 units.

Displays FOT1 and FOT2 shall be capable of operating either single line or two lines of text, but FOT2 shall be larger in size to suit available space. Display FOT3 shall be single line only.

5.1.2.1 Front of train displays shall be installed into the location presently occupied by a destination display, i.e. shall replace existing electronic or roller displays.

5.1.2.2 The display enclosure shall be semi-matt black in colour to enhance contrast of the display area when viewed through the cab window.

5.1.2.3 During installation of the display, the inside of the cab or display window shall be cleaned.

5.1.2.4 The display shall be sealed by a rubber gasket to the internal cab window to prevent dirt accumulating on the inside face of the cab window.

5.1.2.5 The display enclosure shall be designed to prevent internal condensation. *Guidance note: displays fitted to external windows may be subject to rapid temperature change, a pressure equalisation valve or similar may prevent internal condensation within the sealed display enclosure.*

5.1.2.6 The display vertical resolution shall be 16 LEDs minimum per line of text. *Guidance note: FOT3 minimum 16 LEDs, FOT1 and FOT2 minimum 32 LEDs with two LED rows space between lines.*

5.1.2.7 The horizontal width of the display shall be in accordance with the maximum available window space and the largest station name (abbreviated) for the purpose of TSI-PRM. See Appendix 4 for the station names in the Irish network..

5.1.2.8 The preferred character height (capital) is 150mm, the minimum acceptable height is 70mm. Guidance note: Where space permits, particularly on FOT3 display, the largest possible size approaching 150mm should be used.

5.1.2.9 The displays shall include at least four different fonts of different height and different line widths. Within each font set, six configurable graphics shall be provisioned – two spares, the IÉ logo, LUAS logo,

DART/Commuter logo, and an aeroplane symbol. *Guidance note: the line width is sometimes termed single strike, double strike, etc. The smallest font would be 70mm and single strike, i.e. one LED line width. The largest preferred font is 150mm and the line width is two or three LEDs.*

5.1.2.10 The largest font may exclude the Fada (accent) above capital characters, but the Fada shall be produced on the small character fonts and all lower case characters where sufficient vertical space is available.

5.1.2.11 Text displayed as static or rolling text shall be automatically centralised. For FOT1 and FOT2 displays it shall additionally allow for single or two line operation. *Guidance note: large stations names could be broken down into two lines, e.g. Gabhal Bhinn Eadair/Domhnach Mide can be divided as: 1st line: Gabhal Bhinn Eadair/, 2nd line: Domhnach Mide.*

5.1.2.12 The display controller shall perform a 'best fit' algorithm, i.e. using the largest font for the size of text. In the case of FOT1 and FOT2 the 'best fit' algorithm shall include operating the display in single or two lines. Where single is used, it shall be vertically centred allowing the use of the largest fonts.

5.1.2.13 It shall be possible to override the best fit algorithm by commanding the use of a specific font or use of lines within the message, as configured within the Database Editor.

5.1.2.14 The display shall be visible in sunlight and with dirt accumulated on the external face of the cab window. Each LED shall have a minimum incident intensity of 2000mcd at full display brightness. *Guidance note: The design should account for sunlight and performance shall be demonstrated to the satisfaction of the Engineer during the PDR stage. Operating the LED brightness at a higher level to overcome the dirt accumulation is a preferred solution.*

5.1.2.15 Automatic LED brightness adjustment shall be provided, proportional to average external ambient light level. The control system shall measure an average ambient level over the preceding three second period. This adjustment shall limit the lower brightness level to a configurable minimum value; adjustment shall be continuously variable or have a minimum of ten steps to the maximum brightness level. *Guidance note: front windows of the train, and in particular intermediate coupled cab windows are infrequently washed. A small light sensor in the non-drivers side wiper swept area of the front cab window is a preferred solution to metering the correct external ambient light level.*

5.1.2.16 Front of train displays located within intermediate cabs of coupled multiple units shall be blank, i.e. no displayed messages other than display test messages. Only the front and rear displays of the full train shall be fully operational.

5.1.2.17 The display viewing angles shall be a minimum 100º (horizontal, inclusive angle) and 90º (vertical, inclusive angle) for >50% intensity referenced to the incident LED light output level.

5.1.2.18 The display controller shall support command or 'scripting' within text messages sent by the central PISC allowing complex sequences of messages to be joined together using different delays and text display modes. Text message lengths may be up to 500 characters. At least six configurable phases shall be available. The following examples illustrate the requirement:

a) [roll up] <Irish station name> [delay 4 seconds] [roll up] <English station name> [delay 4 seconds], loop back to Irish station name.

b) [static text] <Irish station name> [delay 4 seconds] [static text] <English station name> [delay 4 seconds], loop back to Irish station name.

c) [scroll] <long Irish station name> {when scroll completed} [scroll] <English station name> {when scroll completed}, loop back to Irish station name.

d) [roll up] <Irish station name part 1> [delay 4 seconds] [roll up] <Irish station name part 2> [delay 4 seconds] [roll up] <English station name part 1> [delay 4 seconds] [roll up] <English station name part 2> [scroll] <long Irish special message> {when scroll completed} [scroll] <long English special message> {when scroll completed}, loop back to Irish station name (beginning).

When FOT1 and FOT2 displays are used in two line mode, the transition of both lines shall be synchronised.

Guidance note: Sequence a) is the preferred method of application. The 'static text' transition of sequence b) is an instantaneous change of text. Sequence d) is an improbable application but the example is given to illustrate what is meant by six phases. The text display mode (static, scrolling or roll), and the delay between each text message phase are configured from the Database Editor. Fonts, transition times (scroll and roll), use of single or both lines are to be configurable by remote uploading of software by maintenance technicians.

5.1.2.19 On splitting train services it will be necessary to show two destinations, each destination may be displayed in a different phases. To identify the train as splitting, several methods shall be provided:

a) [roll up] <Irish destination 1 name &> [delay 4 seconds] [roll up] <& Irish destination 2 name> [delay 4 seconds] [roll up] <English destination 1 name &> [delay 4 seconds] [roll up] <& English destination 2 name> [delay 4 seconds]; loop back to Irish destination 1.

b) [static text] <Irish destination 1 & destination 2> [delay 4 seconds] [static text] <English destination 1 & Destination 2> [delay 4 seconds], loop back to Irish station name.

c) If space permits to include a reference to the train portions e.g. 'Destination 1 (Front) &', '& Destination 2 (Middle/Rear)'. The text and symbol '&' shall be configurable in the database editor.

5.1.2.20 Upon power up, the display shall perform a self test taking no longer than 5 seconds and then display the IÉ logo for 30 seconds. If so commanded by the PISC, it shall display alternative messages immediately following self test.

5.1.3 Side Displays

5.1.3.1 Side displays shall be installed into the upper portion of an existing large window. *Guidance note: If it is not possible to use a large window, then in order to use large hopper windows, the opening hopper section should be removed, ideally non-hopper (large) windows will be used.*

5.1.3.2 Commuter trains shall be fitted with two side displays per vehicle side, using the nearest large windows to the doors. *Guidance note: emergency windows shall not be used.*

5.1.3.3 DART trains shall be fitted with one side display per vehicle side, using the nearest large windows to the doors. The 8500 fleet does not currently have any side displays fitted. *Guidance note: emergency windows shall not be used.*

5.1.3.4 The display enclosure as viewed from the outside of the train shall be semi-matt black in colour in order to enhance contrast of the display area when viewed through the vehicle window. *Guidance note: fixtures, cables, etc shall not be visible under all external lighting conditions.*

5.1.3.5 During installation of the display, the inside of the window shall be cleaned. *Guidance note: to satisfy the requirements of good contrast, consideration may be given to the application of a tint film on the inside of the window area to be occupied by the display.*

5.1.3.6 The display shall be sealed by a rubber gasket / seal to the window to prevent dirt accumulating on the inside face of the window. The display shall be installed such that light pressure is applied between seal and the window thus maintaining a seal and preventing vibration noise from the display / window interface.

5.1.3.7 The display shall be covered from the passenger (inside) such that all fixtures, cables and interfaces between display and window frame are concealed. The cover shall be fixed using security fasteners. The arrangement shall be secure and shall not cause vibration noise (rattles) to be generated. *Guidance note: the cover may be directly screw fixed to the rear of the display but using security grade screws or key operated single turn fixings.*

5.1.3.8 The display and its cover shall not protrude into the passenger environment further than existing window frame or internal side panels. *Guidance note: Available depth of the window frames is limited, so the displays must be thin. This inevitably points to a design using surface*

mounted LEDs and possibly no secondary screen, i.e. open front with the vehicle window /gasket forming the IP65 seal of the display.

5.1.3.9 The display enclosure shall be designed to prevent internal condensation. *Guidance note: displays fitted to external windows may be subject to rapid temperature change, a pressure equalisation valve or similar may prevent internal condensation within the sealed display enclosure*.

5.1.3.10 The display vertical resolution shall be 24 LEDs minimum.

5.1.3.11 The display shall have the capability to show two lines of 11 LEDs (capital and descender) or revert to single line as commanded by the PISC.

5.1.3.12 The horizontal resolution of the display shall be in accordance to the maximum available window space and the largest station name (abbreviated) for the purpose of TSI-PRM. See Appendix 4 for the station names in the Irish network.

5.1.3.13 The preferred character height (capital) is 150mm (single line); the minimum acceptable height is 50mm (two line mode). *Guidance note: Where space permits, the largest size approaching 150mm should be used.*

5.1.3.14 The display shall include at least four different fonts of different height and different line widths, two for single line application and two different fonts for two line application Within each font set, six configurable graphics shall be provisioned – two spares, the IÉ logo, LUAS logo, DART/Commuter logo, and an aeroplane symbol. *Guidance note: the line width is sometimes termed single strike, double strike, etc. The two line font would use the full 11 pixels in height with the capital at least 50mm, one font single strike, i.e. one LED line width; the other double strike. The single line fonts may be of different heights using two or three LED line widths, the largest font should provide 150mm capitals as a minimum.*

5.1.3.15 The largest single line font and the two line fonts may exclude the Fada (accent) above capital characters, but the Fada shall be produced on the small single line character and lower case fonts where sufficient vertical space is available.

5.1.3.16 Text displayed as static or rolling text shall be automatically centralised by the display controller.

5.1.3.17 The display controller shall perform a ‘best fit’ algorithm, i.e. using the largest font for the size of text.

5.1.3.18 It shall be possible to override the best fit algorithm by commanding the use of a specific font, and use of single or two lines within the message as configured within the Database Editor.

5.1.3.19 The display shall be visible in sunlight and with some dirt accumulated on the external window face. Each LED shall have a minimum incident intensity of 500mcd at full display brightness. *Guidance note: The design should account for sunlight and performance of an equivalent display shall*

be demonstrated to the satisfaction of the Engineer during the PDR stage. Side windows of vehicles are regularly washed.

5.1.3.20 Automatic LED brightness adjustment shall be provided, controlled proportional to average external ambient light level. The control system shall measure an average ambient level over the preceding three second period. This adjustment shall limit the lower brightness level to a configurable minimum value; adjustment shall be continuously variable or have a minimum of ten steps to the maximum brightness level. *Guidance note: the light sensor should be internally placed in the display; adjacent to the display matrix area.*

5.1.3.21 Side displays shall be activated whenever a new Train ID is entered. Upon leaving the first station on the route (starting station or stopping station) the side displays shall be blanked. Side displays shall be once again activated upon approaching the next stopping station. *Guidance note: it is preferable for the display to remain active until leaving the station boundary, i.e. until exiting the station GPS geofence or after travelling a distance typically 500m.*

5.1.3.22 The display viewing angles shall be a minimum 120º (horizontal, inclusive angle) and 120º (vertical, inclusive angle) for >50% intensity referenced to the incident LED light output level.

5.1.3.23 The display controller shall support command or 'scripting' within text messages sent by the central PISC allowing complex sequences of messages to be joined together using different delays and text display modes. In total, text message lengths may be up to 500 characters. At least six configurable phases shall be available. The following examples illustrate the requirement:

a) Using one line: [roll up] <Irish station name> [delay 4 seconds] [roll up] <English station name> [delay 4 seconds], loop back to Irish station name.

b) Using one line: [static text] <Irish station name> [delay 4 seconds] [static text] <English station name> [delay 4 seconds], loop back to Irish station name.

c) Using two lines: [roll up] {line 1}< Tá an traein seo ag dul go dtí > {line 2} <Irish station name> [delay 4 seconds] [roll up] {line 1}<Destination> {line 2} <English station name> [delay 4 seconds] , loop back to Irish station name.

d) Using two lines: [roll up] {line 1}< Tá an traein seo ag dul go dtí > {line 2} <Irish station name> [delay 4 seconds] [roll up] {line 1}< An chéad stáisiún eile > {line 2} <Irish next stop station name> [delay 4 seconds] [roll up] {line 1}<Destination:> {line 2} <English station name> [delay 4 seconds] [roll up] {line 1}<Next stop:> {line 2}<English next stop station name> [delay 4 seconds], loop back to Irish destination.

e) Using two lines: [roll up] {line1} <Irish station name> [delay 4 seconds] [roll up] <English station name> [delay 4 seconds], loop back to Irish

station name. On {line 2} [scroll] <long Irish text> {when scroll completed} [scroll] <English text> {when scroll completed}, loop back to Irish station name.

Guidance note: The examples above are just a small selection of the expected capabilities of the side displays. The choice of one or two lines, text display mode (static, scrolling or roll), and the delay between each text message phase are configured from the Database Editor. Fonts, transition times (scroll and roll) are to be configurable by remote uploading of software by maintenance technicians.

5.1.3.24 On splitting train services it will be necessary to show two destinations, each destination may be displayed in two different phases. To identify the train as splitting, several methods shall be provided:

a) [roll up] <Irish destination 1 name &> [delay 4 seconds] [roll up] <& Irish destination 2 name> [delay 4 seconds] [roll up] <English destination 1 name &> [delay 4 seconds] [roll up] <& English destination 2 name> [delay 4 seconds]; loop back to Irish destination 1.

d) [static text] <Irish destination 1 & destination 2> [delay 4 seconds] [static text] <English destination 1 & Destination 2> [delay 4 seconds], loop back to Irish station name.

e) To include a reference to the train portions e.g. 'Destination 1 (Front) &', '& Destination 2 (Middle/Rear)'. The text and symbol '&' shall be configurable in the database editor.

f) To optionally include a warning message 'This train will divide at <station name>', associated to the Irish and English text phases.

5.1.3.25 Upon power up, the display shall perform a self test taking no longer than 5 seconds and then display the IÉ logo for 30 seconds. If so commanded by the PISC, it shall display alternative messages immediately following self test.

5.1.4 Internal Displays

5.1.4.1 Internal displays shall be installed at the vehicle ends, above the doors to the inter-vehicle gangway or to the cab, i.e. two displays per vehicle.

5.1.4.2 Internal displays shall be securely integrated to the vehicle with a good cosmetic finish. Where CCTV cameras are installed within existing display covers, the same arrangement shall be provided as part of the new display / cover. *Guidance note: a separate cover is not strictly required. The display itself may be designed with good cosmetic finish but connectors, cables, fixing points, etc shall be concealed. In the future, new CCTV systems will use overt dome cameras; hence provision of future cameras is not required.*

5.1.4.3 Where covers are used, they shall seal to the vehicle and display to prevent entrapment of dust and entry of foreign objects. The cover shall not produce vibration noise.

5.1.4.4 The display vertical resolution shall be 16 LEDs minimum.

5.1.4.5 The horizontal width of the display shall be in accordance to maximum available space above the doors to the inter-vehicle gangway or to the cab and the largest station name for the purposes of TSI-PRM. See Appendix 4 for the station names in the Irish network.

5.1.4.6 Internal displays shall be visible to >51% of passengers in their normal forward facing field of vision.

5.1.4.7 The character height (capital) shall be based upon reading distance, using the formula H = R / 250, where H = capital character height (mm) and R = reading distance (mm). The minimum height shall be 50mm (this takes precedence over the height stated in TSI-PRM). *Guidance note: since the displays are installed at the ends of each vehicle, to satisfy a 51% reading audience the required furthest reading distance may extend to 17.5m in some cases where a character height of 70mm would be required.*

5.1.4.8 Within each font set, six configurable graphics shall be provisioned – two spares, the IÉ logo, LUAS logo, DART/Commuter logo, and an aeroplane symbol. *Guidance note: the line width is sometimes termed single strike, double strike, etc.*

5.1.4.9 Fonts may exclude the Fada (accent) above capital characters, but it shall be displayed for lower case characters.

5.1.4.10 Text displayed as static or rolling text shall be configurable in the message as left justified or centralised.

5.1.4.11 The font shall be specified within the message as configured within the Database Editor; the default font shall be configurable.

5.1.4.12 The display shall be legible providing high contrast under all expected internal lighting conditions.

5.1.4.13 LED brightness shall be at a fixed but configurable level. *Guidance note: lighting levels may vary slightly between fleets. The displays should be optimised for sufficient brightness, not too bright, avoiding 'mirror' reflections on ceiling and body panels.*

5.1.4.14 The display viewing angles shall be a minimum 140º (horizontal, inclusive angle) and 140º (vertical, inclusive angle) for >50% intensity referenced of the incident LED light output level. The display and covers shall be designed to avoid 'parallax' masking in the quoted viewing angles.

5.1.4.15 The display controller shall support command or 'scripting' within text messages sent by the central PISC allowing complex sequences of messages to be joined together using different delays and text display

modes. In total, text message lengths may be up to 1500 characters. At least six configurable phases shall be available. The following examples illustrate the requirement:

a) [scroll] <long Irish text string up to 750 characters> {when scroll completed} [scroll] <long English text string up to 750 characters> {when scroll completed}, loop back to Irish station name.

b) [scroll and halt] <long Irish text string up to 750 characters> [pause for defined interval showing static Irish text] [scroll] <long English text string up to 750 characters> [pause for defined interval showing static English text], loop back to Irish text.

c) [static text, left justified] <Destination: Irish station name> [delay 4 seconds] [roll up] <Next station: Irish station name > [delay 4 seconds] [static text, left justified] <Destination: English station name> [delay 4 seconds] [roll up] <Next station: English station name > [delay 4 seconds], loop back to Irish destination station name.

d) [roll up] <Destination: Irish station name> [delay 4 seconds] [roll up] < Ag stopadh ag > [delay 2 seconds] [roll up] <Irish stopping station name 1> [delay 2 seconds] [roll up] <Irish stopping station name 2> {continue up to twenty station stops} [roll up] <Destination: English station name> [delay 2 seconds] [roll up] <Calling at…> [delay 2 seconds] [roll up] <English stopping station name 1> [delay 2 seconds] [roll up] <English stopping station name 2> {continue up to twenty station stops, when completed, loop back to beginning}.

Guidance note: The number of potential phases increases to above fifty where sequence d) is used. The font, text display mode (static, scrolling or roll) and the delay between each text message phase are configured from the Database Editor. Fonts, transition times (scroll and roll) are to be configurable by remote uploading of software by maintenance technicians.

5.1.4.16 The internal display shall be synchronised with other internal displays through the train and with the delivery of audio announcements. *Guidance note: for scrolling messages, the maximum scrolling rate is 6 characters per second but the actual scrolling rate should closely match the spoken announcement. Sample announcements will be provided by the Engineer. The design should support synchronisation corrections using timing markers. For example, a timing marker may be applied at the beginning of a new sentence of a long scrolling message. As a further example, in sequence d) of 5.1.4.15, a timing marker would be applied to each station name as it rolls up such that the audio and visual messages correspond.*

5.1.4.17 On splitting train services it will be necessary to provide clear unambiguous information concerning the two different destinations and where each portion of the train will service. Given that the communications architecture may not be capable of supporting simultaneous and different announcements, the following principles shall be adopted:

a) Up to the point of train splitting, where destination names are displayed, a configurable text string shall be automatically inserted, e.g. 'Destination 1 *(Front of train)'* text in italics is configurable in the Database Editor.
b) The second destination shall be added with configurable text such as '&' or 'and', e.g. where normally 'Destination' is a single name, it may be shown as 'Destination 1 (Front of Train) and Destination 2 (Middle and Rear). Alternative locations on the train are: Front, Rear, Front and Middle, Middle and Rear.
c) It shall be possible to announce 'This train will divide at <station name>.
d) Where stopping stations are announced, they shall be treated independently after the splitting station. For example 'This train will call at <station A>, <station B> and<station C> where this train will divide. The front portion will continue to <station D>,<station E> and <station F>. The middle and rear portions will continue to <station G> and<station H>. Please ensure you are in the correct portion of this train'.

5.1.4.18 Upon power up, the display shall perform a self test taking no longer than 5 seconds and then and display the IÉ logo for 30 seconds. If so commanded by the PISC, it shall display alternative messages immediately following self test.

5.2 Driver MMI Interface

Existing PIS displays on the IÉ fleets have several different driver interfaces ranging from a basic thumbwheel switch to select the destination to full graphical interfaces on TFT LCD displays. A new Driver MMI unit shall be supplied for the fleets to be refurbished; this will be a stand alone unit. However, contractors shall consider that in the future their system may be considered for use on new build projects where integration within a TMS based driver MMI is a preferred solution. It is therefore, strongly recommended that the design makes provision for controlling the interfaces described in this section through a serial communications interface.

5.2.1 This section describes the requirements for PIS on the assumption that existing audio communications facilities will be retained. The requirements within section 6 shall be considered so the Driver MMI is fully provisioned to support future replacement of the audio system.

5.2.2 The driver MMI shall be of a common and consistent design, i.e. layout, controls, size, labelling, etc.

5.2.3 The contractor shall survey cabs of the IÉ fleet and propose a design concept to the requirements of this specification. Integration of the MMI within the cab shall be to the satisfaction of the Engineer and IÉ driver representatives.

5.2.4 Controls such as buttons and / or 'touch –boxes' on screens shall be adequately sized and distinguished accounting for human factors.

5.2.5 Buttons shall have a tactile positive feel to confirm operation. Where buttons, such as screen 'touch-boxes' or membrane style keypads are provided, a supplementary positive audible 'click' shall be produced.

5.2.6 The visual display screen of the MMI shall be adequate to support the functionality whilst constrained by the allowed space.

5.2.7 The MMI screen shall be capable of displaying four lines of twenty monochrome characters each. *Guidance note: in the base offer a text only display is considered adequate. Option 4 requires greater resolution and a display colour graphics capability is envisaged.*

5.2.8 Text shall be displayed in English language.

5.2.9 Screen and indicator brightness / contrast shall be compatible with cab conditions, i.e. accounting for day / night operation. Automatic backlighting adjustment is preferred.

5.2.10 Legends on controls such as keypads and buttons shall be legible and durable under all operating conditions.

5.2.11 The design shall ensure that the driver cannot be distracted or confused by the introduction of the MMI. *Guidance note: the design should avoid using green LEDs as they could be reflected within the cab to cause a risk of confusion with railway signals. Noises generated on the monitor loudspeaker shall not conflict with other cab warning sounds.*

5.2.12 The MMI shall be robust and 'vandal resistant'.

5.2.13 The MMI shall be IP65 sealed.

5.2.14 The MMI shall include a monitor loudspeaker.

5.2.15 The monitor loudspeaker shall broadcast audio communications from the train audio communication bus to the cab. Given that automatic audio announcement originate from the PIS DVA system an independent monitor level for DVA announcements shall be determined to avoid disturbing the driver with repetitive announcements. The level shall be configurable from fully muted through to a maximum level equal to other audio signals.

5.2.16 The MMI shall include a monitor loudspeaker volume control operated via keypad buttons. The upper and lower levels of the volume control shall be configurable.

5.2.17 The monitor loudspeaker shall be muted when the cab handset / microphone is used. *Guidance note: requires an interface with the handset cradle switch or handset / microphone PTT button.*

5.2.18 The keypad shall support entry of alpha-numeric characters. Given space limitation of the MMI, the keypad shall be arranged as a standard

telephone keypad, i.e. button 5 may select characters J, K and L. *Guidance note: the keypad should be capable of selecting the Train ID, in the normal form 'A123', where the first character is alphabetic, and the next three are numeric. Character entry shall be intuitive, predicting alphabetic or numeric. However, the entry system should also allow entry of any combination, e.g. '0123' or 'ABCD'. Special route codes may be programmed using codes other than 'annn' (a=alphabetic, n=numeric). Additionally, due to expansion of IÉ's network, Train IDs may be required to be in the form 'annnn', see section 12.2.1.*

5.2.19 The MMI screen shall display the current time in the format HH:MM:SS using the 24 hour clock. Time shall be UTC, automatically corrected for DST. Time shall be referenced to UTC derived from GPS and shall not drift by more than +/- 0.5 second per day when GPS is unavailable.

5.2.20 The MMI screen shall indicate by text or a graphic when the cab is active (driver key inserted, master controller away from OFF).

5.2.21 When a Train ID has been entered, the MMI screen shall display the selected Train ID, destination station name and next stop (see 5.2.23) throughout the journey.

5.2.22 The PISC shall be configured to start or re-start operating a Train ID in one of three modes:

a) Whenever entered on the MMI keypad by the driver, or

b) Whenever the driver enters a new Train ID on the train radio, or

c) Either a) or b), whichever is the last action.

When the Train ID is entered, the PISC shall search its timetable database to determine the station stopping pattern relevant to the Train ID on the given date and day of the week. If the Train ID is not valid today, the MMI shall display 'Train ID invalid today' but allow an option to proceed anyway or cancel the Train ID. If the entered Train ID is not within the database, the MMI shall display 'Train ID not found' and revert to the entry prompt. *Guidance note: Voyagerplan timetable data identifies 'days run' and the timetable may include two entries of the same Train ID number but with non-overlapping 'days run', e.g. A1234 may exist with a Monday to Saturday station stopping pattern and separately with a different Sunday stopping pattern. The Database Editor provided with PIS shall also support the preparation of special route codes to be used as a fallback. A special route code may be numeric only, i.e.'nnnn'. The special route codes have a fixed stopping pattern, applicable every day of the week.*

5.2.23 When a Train ID has been entered, the MMI screen shall provide descriptive information confirming the current location. *Guidance note: The following navigation status messages are envisaged:*

- *'Before start <start station>' – This message is given if the Train ID is entered at a location other than the starting station, i.e. from the depot.*
- *'At start <station name>' – This message is given when the train arrives at the starting station or the Train ID is entered at the starting station. This message is also provided upon arrival (doors open) at stopping stations*
- *'This train is for <next station name>. Next Station <next station name>' - This message is given when the train leaves a stopping station (including the starting station).*
- *'Approaching <station name>' – This message is provided upon approach; at the same time that PIS displays are updated.*
- *'Terminating at <destination station name>' – This message is produced when doors are opened at the destination station. The message may also be combined with a 60 second countdown timer before the system shuts down, awaiting a new Train ID.*

5.2.24 When a GPS location fix is unavailable, the MMI shall request confirmation of assumed location. The MMI shall, under these circumstances, allow the driver to step through locations: 'Before start', '<Start station>', '<First stopping station>' … until <final stopping station>'

5.2.25 The MMI screen shall provide high level status information relating to the system, i.e. System Healthy, DVA fault, PIS fault. This information may be provided using graphical symbols.

5.2.26 The MMI shall include a function to halt the DVA / PIS in case the system is delivering erroneous information. Use of this facility shall be logged and reported as a fault.

5.2.27 The MMI shall include a function to select and trigger manual (stored preset) messages by direct selection using a two digit code, or by rolling through a list. The screen shall display a brief transcript of the message for the driver to review before confirming the selection to be delivered to the DVA / PIS displays.

5.2.28 The MMI shall include a selection of sub-menu's allowing less frequently used functions to be selected. The functions are summarised below in priority order:

- Review the list of station stops (on the route beyond current location) for the selected Train ID or special route code, allowing deleting / adding of stops.
- Skip the next station, i.e. where short term station closure has occurred (this feature shall be easy to access with minimal buttons to operate).
- Adjustments such as monitor volume, backlight level, etc.
- Enable test mode (shall be disabled whilst running an active Train ID)
- Display of navigation data, i.e. reveal GPS coordinates, speed and wheel pulse count.
- Odometer display.
- System status – high level fault status (descriptive) and status of inputs such as doors, drum switch, etc.

- Software version: Equipment software and database version.
- Cancel or stop current Train ID.
- Manual reset of the PIS.
- Password entry to maintenance menus.
- Manual change of time and date, in the event of GPS failure.

5.2.29 For maintenance purposes, detailed system information and diagnostics shall be accessible via a password protected menu.

5.2.30 The MMI of the active cab shall assume priority over controlling the PIS.

5.2.31 The MMI of inactive cabs shall support all functions described, with the following exceptions:

5.2.31.1 The MMI screen shall indicate when the cab is inactive.

5.2.31.2 The MMI shall allow a Train ID to be entered (via keypad) only when there is no other active cab. When any cab on the train becomes active, and a Train ID is entered, the inactive cab MMI shall relinquish control, i.e. the PIS train ID of an active cab shall always take priority.

5.2.31.3 Manual messages triggered from inactive cabs shall be of a lower priority than manual messages triggers from the active cab

5.2.31.4 Section 5.5 clarifies system functionality in more detail.

5.2.31.5 The MMI screen (if touch operated) will not be based on resistive technology. The screen will be based on technology that does not require a stylus to operate.

5.3 PIS Controller (PISC)

5.3.1 New PIS Architecture

The architecture of existing PIS and audio systems is explained in section 2.7. The requirements for new / replacement PISs are summarised below:

5.3.1.1 The contractor shall survey the fleets to confirm that the existing audio communications system is adequate and can be suitably interfaced.

5.3.1.2 The contractor shall determine the architecture for the new PIS. *Guidance note: Some PIS designs will use a single PISC and DVA on each train unit, but this type of design generally requires additional data and audio circuits between cabs. Other systems may use a PISC and DVA located at each cab end and have the potential to satisfy this specification using existing train wires (PIS display RS485 circuits and audio communication speech pair). The contractor is at liberty to choose either method but must quote his experience to justify the selection, the proposal to be judged on the merits of cost and reliability. Where PISC / DVA are duplicated on each unit, some fall-back capability providing resilience shall be offered to overcome the potentially lower overall reliability through having additional operating equipment.*

5.3.2 PISC Physical Arrangements

5.3.2.1 Adequate enclosures are available within cabs and in some cases at body ends of vehicles. The contractor shall declare the preferred location and required space envelope at the time of bidding.

5.3.2.2 The PISC shall be installed within a sealed IP65 enclosure.

5.3.2.3 A maintenance / programming port shall be provided; the preferred connector for Ethernet is an M12 type. A dust cap shall be provided, secured by a wire / chain.

5.3.2.4 Routine uploading of PIS databases will take place via the WiFi and 3G Communications Gateway. Additionally, via the maintenance / programming port and it shall take one person no longer than five minutes per train unit from the time of accessing the port. *Guidance note: LTP data files are in the order of 20MB but they do .ZIP to approximately 2MB.*

5.3.2.5 Occasional updates to speech data and operating firmware shall be supported via the WiFi CG and the maintenance / programming port. Updates to individual speech files shall be supported so that it is not necessary to update the entire speech database for small changes, e.g. additional station names, changes to manual messages etc

5.3.2.6 The PISC flash memory shall use a recognised industrial modular format (PCMCIA, SD, Compact, etc). It shall be possible to exchange the memory module within 5 minutes. The system shall ensure proper management of the memory, where necessary providing facilities and warnings to re-format if required. The memory module shall be secure, and protected against theft. Removal of the module shall not necessitate handling of sensitive electronic assemblies, i.e. removal of a processor card where anti-static precautions may be required.

5.3.2.7 The PISC shall either be modular (e.g. using a Eurocard frame or 19” rack) or the entire PISC unit shall be designed for rapid replacement (four easy access fixing bolts).

5.3.2.8 The PISC will inevitably be associated to the specific train unit or vehicle ID. This association is preferably retained during equipment change. *Guidance note: The preferred solution is a coding plug or dongle chain / wire fixed to the vehicle. The PISC is required to provide an Odometer function and the distance value shall be retained with the vehicle. The dongle / coding plug should be of a simple and highly reliable design. Coding arrangements of the Train Radio are to be investigated.*

5.3.3 PISC Location (Navigation) System

The PIS has a fundamental need to locate the train along the railway at any point in time. GPS is an excellent way of determining absolute location, but in a railway environment there are several problems with availability of a location fix. Therefore it

is necessary to consider several methods of augmentation or fallback. The classic methods are:

5.3.3.1 The PISC shall augment GPS location using the 'Door Open Signals (left / right)'. The contractor shall ensure that the signals are isolated from safety critical circuits. The dedicated relay contact/s shall provide battery positive from door release to door close command or interlock. *Guidance note: Two inputs may be required, namely Doors Open Left and Doors Open Right, the two inputs may be OR-ed allowing a single Door Open input to be used. Door open signals are very useful as they normally occur at every stopping station and no other locations (other than on depot). Normally, PIS suppliers use a navigation algorithm where a train must firstly enter a valid geofence determined from GPS or from within a valid distance travelled. The door open signal is then taken to indicate the train has stopped at a platform, the exact station determined from the geofence or distance. It should be noted that doors may be released several times at the same location, so the PIS shall not solely depend upon door release for triggers, i.e. also using odometer or GPS to identify it has moved to the next station location.*

5.3.3.2 The PISC shall use odometry to augment the location determined by GPS. Wheel rotation pulses can be obtained from several different sources, as detailed in 2.7.3.4. The wheel pulse / probe interface shall be designed for high integrity; and failure risks shall be fully considered using FMECA techniques. *Guidance note: In case of sharing a wheel probe, it is recommended that the wheel pulse interface uses a dedicated connector of such a design having low risk of short circuiting the interface. Loading and isolation of the wheel probe should also be considered, i.e. the PIS load shall be high impedance and with full galvanic isolation. Sharing is permitted on SIL 0 flange lubrication; but on higher SIL (≥ 1) levels systems such as WSP, the Engineer and other system supplier approval is required.*

5.3.3.3 The odometer system shall be self calibrating using known good GPS data. *Guidance note: The navigation and location solution should store a variable in non-volatile memory of the PISC. This variable is a multiplication factor for the wheel pulse system allowing accurate distance measurement to be provided. When GPS is correctly functioning with low HDOP <2.0, the speed calculated by GPS is highly accurate and may be used to calculate the relationship of wheel pulses to speed. The calculated value should be averaged since it will vary only at a slow rate as determined by wheel wear on the tachometer axle.*

5.3.3.4 The contractor shall provide a priced option (Option 6) for adding MEMS INS augmentation for use by the GPS receiver. When used in combination with the odometer, the system shall have the capability of reconciling absolute position within +/-100m when GPS satellites are obscured for 3km or 5 minutes, whichever is first reached.

5.3.3.5 Regardless of 5.3.3.4, the PIS shall be capable of operating normally with the complete failure of the GPS receiver / antenna sub-system on the assumption that wheel pulses are available, and the driver has correctly

confirmed a reference location, and the train is operated on the planned route as determined in the LTP for that Train ID.

5.3.3.6 Regardless of 5.3.3.4, the PIS shall be capable of operating normally with the complete failure of the wheel pulses on the assumption that the GPS system is available.

5.3.3.7 The navigation and location sub-system of the PISC shall report any failures of either the GPS or odometer systems.

5.3.3.8 Contractors shall note RSSB Guidance Note GE/GN8578 as it provides background information on using GPS on rolling stock. In respect of this PIS refurbishment, a 'state of the art' Class C GPS receiver will be deemed to be adequate other than as varied by the optional MEMS INS.

5.3.3.9 The GPS receiver shall provide a minimum of twelve channels, i.e. simultaneous communication and resolution of up to twelve satellites.

5.3.3.10 The GPS receiver shall have provision for an upgrade to support the Galileo public service.

5.3.3.11 The GPS receiver Time To First Fix (TTFF, cold start) shall be no more than 45 seconds on the assumption that at least four satellites are in line of sight and it has been no more than 48 hours since the receiver was last communicating with satellites.

5.3.3.12 The receiver and its antenna shall be correctly matched (impedance and gain) to provide good sensitivity (better than -140dBW).

5.3.3.13 The receiver input stage shall be protected against excessive input signals of up to +10dBW. *Guidance note: the contractor is responsible for determining the position of the GPS receiver antenna on the train roof and ensuring that there will be no detrimental reduction in performance of the GPS or other train system through interaction.*

5.3.3.14 The receiver's algorithm for determining a valid position fix shall preferably be determined by the system software using HDOP of the satellites rather than by reliance upon the OEM GPS receiver. The PIS shall thus support future re-configuration such that the balance of accuracy and availability may be determined.

5.3.3.15 The GPS receiver shall include a method of detecting and mitigating multipath errors.

5.3.3.16 The GPS receiver shall include a method of reporting when the antenna is disconnected.

5.3.4 Accumulated Distance Odometer

5.3.4.1 The odometer system described in 5.3.3.3 automatically self corrects for wheel wear and, given that a correction factor must be saved in non-volatile memory, this arrangement shall also store accumulated distance travelled.

5.3.4.2 The preferred solution involves retaining the data with the vehicle, i.e. using a dongle / coding plug that is permanently retained with the vehicle.

5.3.4.3 During system commissioning it shall be possible to enter a starting distance reading.

5.3.4.4 The odometer shall resolve distance to the nearest km with a reading range to seven digits.

5.3.4.5 The reading shall be communicated to the ground system on a daily basis. The ground system shall maintain odometer totals from the fleet.

5.3.5 PISC Interfaces

5.3.5.1 Electrical interfaces are described within section 2.7.3; the contractor shall investigate existing arrangements on IÉ's fleets and provide a solution that fully validates the compatibility between new PIS / DVA and existing train systems without degrading the performance and reliability.

5.3.5.2 The PISC location system described in section 5.3.3 requires several interfaces for augmentation signals. Where possible, existing PIS interfaces shall be utilised but in some cases, new interfaces, segregated by a relay, will be required.

5.3.6 PISC Communications

5.3.6.1 The PISC requires communicating with displays, other PISCs and driver MMIs throughout the train. A robust and reliable method of communication shall be established between all of these entities.

5.3.6.2 The contractor shall evaluate existing through train data communication wiring to establish whether the existing cables, inter-vehicle jumper and auto-coupler arrangements are suitable for supporting the new PIS. Where any part of the arrangement is considered unsuitable then fully priced alternatives shall be proposed in the offer. *Guidance note: Auto-couplers use silver plated pin / pad arrangements, upgrading to gold plated pins / pads may be considered. Where schematics may show spare pins / pads and the contractor wishes to make use of the spares, this is to be declared at the time of the bid.*

5.3.6.3 Loading on data buses shall be fully analysed to consider maximising current flowing through auto-couplers whilst ensuring correct matching impedance and avoiding over load.

5.3.6.4 Where the contractor proposes new inter-vehicle jumpers, an allowance shall be made for 10% spares plus the inclusion of two railway approved and compliant CAT5e cables using CAT5e grade connectors (e.g. M12 internal connectors, Quintax, Quadrax, or M12 CAT5e or CAT6 in jumper connectors).

5.3.6.5 All data communications transmissions shall be error checked. Erroneous data shall be rejected and then re-transmitted.

5.3.6.6 Inter-vehicle communications shall be galvanically isolated. *Guidance note: Using Ethernet 100baseT, Tx/Rx shall be isolated by transformers; cable screen to be gapped at the inter-vehicle jumper. Using RS485, each node to be optically isolated and powered from an isolated supply, the common (0V) reference of the supply to be connected between nodes and 'lightly' referenced to ground. Where the cable does not provide a common reference, the master and replying transmitters shall pre-condition the RS485 interface with a preamble.*

5.3.6.7 Addressing and configuration shall be simple. Programming devices and notebook PC shall not be required when changing LRUs e.g. displays, PISC, DVA, etc.

5.3.7 DVA

The DVA is assumed to be an integral module within the PISC. Should this module be a PC Sound card then suppliers shall take note that miniature jack plugs are considered to be unsuitable for use on rolling stock based on service experiences.

5.3.7.1 Memory capacity shall be sufficient for two language versions of every message.

5.3.7.2 Memory shall be sufficient for all IÉ stations names (in Irish and English) and have the following characteristics:

Parameter	Value	Storage Memory
Number of inflections (I)	3 different	
Number of Languages (L)	2 (Irish and English)	
Number of stations (S)	160 (of 2 seconds each)	I x L x (160x2) = 1920 seconds
Number of system messages (SM)	50 (of 10 seconds each)	L x (50x10) = 1000 seconds
Number of fixed messages (FM)	99 (of 30 seconds each)	L x (99x30) 5940 seconds
Number of advert messages (AM)	20 (of 1 minutes each)	L x (20x60) 2400 seconds
Total (+50% spare)		S+SM+FM+AM=11260 50% spare = 5630 Total =16,890 seconds

5.3.7.3 When programmed with the messages detailed in 5.3.7.1 and 5.3.7.2, less than 50% of the available memory shall be used.

5.3.7.4 The DVA shall have the capability to receive up to ten temporary messages of one minute each, i.e. the temporary messages stored in volatile RAM or in non-volatile flash memory. The PISC shall ensure that these messages are only retained for their validity period.

5.3.7.5 The DVA shall reject and alert invalid file formats or files with data errors.

5.3.7.6 Audio produced by the DVA shall mute out digital noise disturbance due to data errors and incorrect file formats.

5.3.7.7 The DVA audio bandwidth shall exceed 100Hz to 8kHz for speech and 100Hz to 16kHz for chimes, gongs and jingles.

5.3.7.8 The DVA audio signal to noise ratio shall be better than 55dB.

5.3.7.9 The DVA audio access time for the first and subsequently linked speech files shall be faster than 10 milli-second, i.e. the replay of announcements shall not include 'stutters' due to long access times.

5.3.7.10 The DVA shall always be synchronised with PIS messages although it shall be possible to configure some messages as audio only, or visual only.

5.3.7.11 To maintain synchronisation, a system of timing markers shall be provided to link specific parts of visual text strings to the triggering of associated audio.

5.3.7.12 If the PA system is already in use, the DVA shall wait up to 30 seconds (time to be configurable) before accessing the PA system. If the PA system remains in use after this time, the announcement shall be aborted.

5.3.7.13 Some announcements are to be configured as high priority, e.g. emergency messages. The DVA shall broadcast emergency announcements immediately unless PA is used in the active cab or a Train Radio PA broadcast is received.

5.3.7.14 The DVA shall support the capability for some announcements to be programmed to repeat continuously until cancelled, or repeat at defined intervals for a given time period.

5.3.7.15 The drivers MMI shall provide the capability to cancel / abort announcements with immediate effect.

5.4 Communications Gateway

5.4.1 Communications Gateway Concept

The Communications Gateway (CG) shall support train to ground data communications using WiFi for the following functions as a minimum:

a) Downloading of the LTP from the ground server, typically every six months

b) Downloading of the STP on a daily basis.
c) Uploading of fault reports / logs to the ground server.
d) Uploading of odometer readings to the ground server.
e) Uploading Enhanced event Logging and Tracking reports, subject to adoption of option 1.
f) Real time access for fault diagnostics and to support software updates.

5.4.2 Communications Gateway Requirements

5.4.2.1 The CG shall support WiFi operating to IEEE 802.11 a/b/g/n standards and 3G.

5.4.2.2 The CG shall communicate with existing WiFi Access Points (APs) / Bridges already installed at some IÉ stations (supporting seat reservation downloads to the Class 22000 and Mk4 fleets). The existing systems support FTP transfers from the IÉ ground server, using Filezilla Server.

5.4.2.3 IÉ will provide additional WiFi APs / Bridges at depots and some stations to support this project.

5.4.2.4 The CG shall either be a module within the PISC or an associated sub-system. The module or separate sub-system shall be designed to allow for future upgrades, accounting for developments in WLAN and WMAN technologies. External interfaces and configuration shall be fully documented to support this objective.

5.4.2.5 The CG shall include or provision for a Switch to provide four additional Ethernet ports permitting other train systems to share the CG and its communications link to the ground server.

5.4.2.6 The CG shall make use of the broadband antenna described in 5.4.3. This shall include an associated Triplexer to support future sharing of the antenna with other systems that require to share the antenna for GSM spectrum use.

5.4.2.7 The radio design loss / gain budget of the CG, antenna cable, filters (e.g. Triplexer) and antenna shall be fully evaluated. Design calculations shall be provided to demonstrate the design is optimal. *Guidance Note: The design calculation shall demonstrate selection of cables and components to ensure there is no adverse signal loss.*

5.4.3 Standard Antenna

A roof mounted antenna occupies valuable roof space. The potential for cross-coupling with other antennas will require separation of at least 2 metres. It is important that this space is best used; therefore the antenna shall be useful for additional / future applications. *Guidance note: a typical example broadband antenna is the Huber and Suhner Sencity part number 84002818, details provided in Appendix 1.*

5.4.3.1 The antenna shall be robust and of high quality. It shall be sufficiently robust to withstand impacts e.g. bird strike and brushes of the train wash facilities.

5.4.3.2 The antenna shall be well proven on European railway rolling stock.

5.4.3.3 The antenna shall support GPS L1 band reception and have a broadband capability in the range 870MHz to 5.8GHz.

5.4.3.4 The broadband antenna for WiFi shall be shared with GSM 900MHz and 1800 to 2100MHz. A Triplexer shall be supplied to split the frequency bands into three, i.e. WiFi , GSM 1800MHz – 2100MHz, GSM 900MHz.

5.4.3.5 The GPS antenna shall include a head end amplifier, either integral or separate but located near to the antenna. Where a separate amplifier is offered, it is preferred to have at least four buffered outputs allowing future systems to share the GPS antenna feed.

5.4.3.6 The antenna shall be protected against direct contact with 1500V DC overhead lines. The peak overhead line voltage and current capacity shall be used when checking voltage rise to earth bond resistance, i.e. voltage rise of the train roof should not exceed ELV, additional bonds between roof and chassis shall be fitted if required.

5.4.3.7 The antenna shall be mounted on an adequate metallic ground plane (train roof) with a low resistance bond between antenna and roof.

5.4.3.8 The antenna shall include protection (or provide a DC short circuit) to prevent voltages exceeding ELV from reaching the connected equipment.

5.4.3.9 The antenna, when installed, shall provide IP68 protection and shall be suitable for high speed (100 mph/160kph) operation.

5.4.3.10 The antenna shall not infringe on the IÉ Dynamic gauge.

5.4.3.11 The radio design loss / gain budget of the train antenna to station AP antenna shall be fully evaluated. *Guidance Note: There are existing AP installations that may be used as benchmarks. For example, Heuston Station is equipped with several different fixed WiFi AP's. Using Heuston as a benchmark the location of the antenna as it will be installed on the train shall be evaluated.*

5.4.3.12 Antenna optimal positioning and interaction with other train antennae shall be fully considered, evidence of analysis shall be provided. *Guidance Note: The RSSB website has results of research into train roof antenna positioning document 'T739_rpt_final.pdf' and in the near future GK/GN0602 will be published.*

5.5 Functional Requirements of the Train System

The following descriptions provide examples of the typical functionality expected of the PIS:

5.5.1 Start up

Start up is assumed to be the condition following connection of the batteries (at the battery isolator). The PISC may continue to operate in a lower power state to support data downloads with the engines (DMUs) and auxiliaries switched off or pantograph down (EMUs). The battery current consumed in this condition shall be minimal and declared at the time of bidding.

5.5.1.1 When power is applied, the PISC shall perform a self test to check that its memory (RAM) is fully available. The PISC shall also check the validity of initialisation files and databases.

5.5.1.2 This self test shall be completed within 30 seconds.

5.5.1.3 At power up, the MMI shall display a screen warning that self-test is in progress.

5.5.1.4 Upon completion of self test, the test results and version numbers of software / firmware databases shall be displayed for 10 seconds. It shall be possible to review the results at a later time from the MMI menu.

5.5.1.5 The PISC and MMI shall enter a low power mode if the vehicle isn't enabled within 60 seconds from start, i.e. if the following conditions are not met: cab active on the train, engines running or auxiliaries on.

5.5.1.6 Where the conditions are satisfied, the PISC / MMI shall enter the 'Ready for Train ID' mode.

5.5.1.7 PIS displays shall not be active unless the auxiliary supplies are at an acceptable level as detailed in section 4.7.3. The PISC shall monitor the status of the remote displays to ensure that messages are current, i.e. a display that is powered after a message has been sent by the PISC shall be automatically corrected with the current message.

5.5.2 MMI – 'Ready for Train ID'

5.5.2.1 The MMI shall display current time as described in 5.2.19.

5.5.2.2 The MMI shall set the loudspeaker monitor level to the default level.

5.5.2.3 Where the MMI includes manual control of back light, it shall start at the default level.

5.5.2.4 The MMI shall prompt for entry of the Train ID.

5.5.2.5 The menu system shall allow selection of test modes or selection of special messages from the manually triggered messages, for example, 'Not in Service', 'Depot', etc. There may be corresponding messages on

the side and internal displays. The train may operate with such messages permanently enabled, regardless of subsequent entry of a Train ID on the train radio.

5.5.2.6 When connected / configured, Train ID data received from the train radio shall appear on the MMI for at least 3 seconds.

5.5.2.7 Train ID may be manually entered on the MMI by the driver, in case the train radio is not connected or the link between train radio and PIS has failed.

5.5.2.8 Manual entry shall automatically support the form 'annnn', where a = alphabetic and n = numeric. The entry method shall be similar to a mobile telephone keypad entry. For example, keypad button 2, when operated in the first character position shall initially produce A; if quickly pressed again B, if quickly pressed again C, if quickly pressed again 2, then cycling back. The 2nd, 3rd, 4th, and 5th positions shall favour numeric entry first. The entry method shall, by this extended method, support entry of 'nnnnn' to be used for special purposes, for example 'Not in Service', 'Depot', etc. It shall be possible to check and if necessary re-enter the Train ID before accepting the entry. The PISC shall validate the Train ID against the current timetable and special route code database, advising the user of invalid entries, non-existent entries and ensure that the route (station stopping pattern) is appropriate to the given date / day of the week. *Guidance note: Train IDs are currently required to be in the form 'annn', However, until the time in which a four number Train ID is required, the input of the Train ID shall insert a zero automatically after the letter, e.g. if the driver is setting Train ID A123, it shall be displayed as A0123. The same shall apply to Train IDs provided by Train Radio. The system shall be configurable to support four numeric entries in the future.*

5.5.2.9 When a valid Train ID has been entered the PISC shall operate the PIS as determined by the Train ID for that date. If the Train ID is not valid for that date, a warning message shall be provided. *Guidance note: VoyagerPlan may use the same Train ID for different days run or time of the day so the Train ID requires to be validated. Special route codes may be identified by a unique number (for example all numeric). Special route codes are additional to the working timetable, they are not day / date related, they simply provide a destination and station stops.*

5.5.2.10 Where the Train ID is valid, the MMI shall identify the destination, current location and next station within 3 seconds. The MMI shall provide a means of accepting or cancelling the Train ID.

5.5.2.11 If the current location cannot be determined, the MMI shall allow the location to be selected along the route as defined by stations relevant to the selected Train ID (the route). The default location is the starting station of the route but the driver may select location as 'before starting station' or any of the 'stopping stations' along the route.

5.5.2.12 Menu items described in section 5.2.28 shall be available prior to Train ID entry.

5.5.2.13 It shall be possible to select and send manually triggered announcements prior to a Train ID being entered and with no current active Train ID. *Guidance note: Entry of an all numeric 'Train ID' as a special route code is one possible method, e.g. code entry 10nnn (where nn = 01 to 99).*

5.5.2.14 Leading zero's shall be automatically added on numeric entries, i.e. if the driver enters digit 1 only, then accepts the entry, it shall be processed as '00001'.

5.5.2.15 When a Train ID has been entered, it shall be possible to cancel the entry and re-start this sequence at any time.

5.5.3 MMI – 'Route Running'

5.5.3.1 The MMI shall display the following information whilst running the route: Time (hh:mm:ss), Destination and Train ID.

5.5.3.2 The MMI shall display current location as detailed in 5.2.23. This feature allows the driver to check that the PIS has determined the correct current location in relation to the next stop. As the train progresses along the route, the current location messages are automatically updated.

5.5.3.3 The menu of functions described in section 5.2.28 shall be available whilst running the route. However, test mode on the PIS displays shall not be supported whilst running the route.

5.5.3.4 Using the menus, the driver shall have the facility to delete selected stops or to make additional stops between the current location and the destination. If a station is deleted during the route (other than at initial set up), the PIS shall make a correction announcement following this event:

a. The PIS shall immediately announce a correction, e.g. 'Correction – This train will not be stopping at Drogheda (and other stations if applicable). We apologise for this inconvenience'.

b. The PIS shall then continue to provide automatic PIS messages omitting the deleted station/s.

5.5.3.5 Using the menu, the driver may select 'skip next station'; this selection is effective from the time doors are opened at a preceding station. When selected by the driver, the following events will be triggered:

a. The PIS shall immediately announce a correction, e.g. 'Correction – This train will not be stopping at Drogheda. We apologise for this inconvenience'.

b. The PIS shall then continue to provide automatic PIS messages omitting the next station.

Guidance Note: Delete station and 'Skip to Next' are similar functions. However, 'Skip to Next' shall involve a minimum of MMI button operations.

5.5.3.6 Some of the stations along the route may be classified as major. PIS functionality may be enhanced at major stations when compared to 'minor' stations, for example:

a. At 'major' stations a standard safety message may be triggered.

b. At 'major' stations on commuter routes, the PIS may announce the 'calling at..' stations, i.e. the remaining stopping stations along the route.

5.5.3.7 Special safety messages may be announced for individual stations and travel directions, for example east bound trains at <station x> may require a message to 'mind the gap between train and platform.

5.5.3.8 The PIS shall have the capability to announce interchange information at given stations. Interchange information shall be configurable to operate at a specific station based upon rules comprising: Destination or direction, day of the week and time of day.

5.5.3.9 The PIS shall allow the train cab to be de-activated along the route and the PIS to continue without disruption during the de-activation and when the driver activates the same or a different cab, i.e. cab end change.

5.5.3.10 Sometimes the train may call at a terminus (line end) station within a route and then continue leaving the terminus station in the direction it entered. In doing so, the train may also stop again at station where it previously stopped. The PIS shall correctly deal with this situation. *Guidance Note: in situations where a second stop at a station will occur this will be evident in Voyagerplan output.*

5.5.3.11 The system shall support joining trains. Two different train units, starting from different stations, both having a common destination, will join at a station along their route. At the station where they are scheduled to join, the first train unit to arrive will move to the exit end of the platform, the driver of this train will release the doors allowing passengers to exit or board. Prior to joining a manual message will be triggered advising that the doors will be closed whilst trains are coupled, the driver will then de-activate the cab. The PIS shall continue as the final destination has not been reached. The second train unit will have arrived on the platform; it too will have released its doors for passengers to exit or board. On this train unit a manual message will be triggered to warn of pending door closure and coupling. After all doors are closed, the rear train unit drives to the front unit and couples. The driver of the rear unit (now in a middle cab) will de-activate that cab. At the front of the train, the cab will be re-activated, the driver is required to re-enter the Train ID for train radio or PIS. However, the Train ID will be the same as one of the two joining trains. The doors may once again be opened for passengers before subsequent closure and departure. The PIS shall continue to operate automatically from the joining station, i.e. correctly synchronised to

current location along the route. *Guidance Note: One of the two Train IDs is the main leg, i.e. origin – joining station – destination. The contractor, in collaboration with IÉ Train Planning, shall investigate whether the circumstance of a joining service can be identified from VoyagerPlan LTP / STP output. Alternatively, since joining services are infrequent, it may be necessary to separately identify joining services, i.e. a separate definition file.*

5.5.3.12 The system shall support splitting trains. From the originating station, the train may comprise several train units (three units maximum). At a station along the route, the train will split (divide) and the two halves will continue to different destinations. If there are two train units, the split is obvious; if there are three units the split point is pre-determined by Train Planning. In the case of two units, the passengers are informed in the context 'Front' and 'Rear', in the case of three units 'Front', 'Middle' and 'Rear' At the splitting station, the driver will release the doors for passengers. Prior to the split, the driver will activate a manual message and then de-activate the cab. A second driver will enter the cab that will lead the rear train, making this cab active and uncoupling by reversing the rear unit/s. The driver of this rear unit will then release the doors again and will be required to enter a new Train ID. The driver of the leading unit re-activates the cab, it shall automatically continue to run the previous Train ID and when the doors are again released the manual message (warning of door closure and train uncoupling) will automatically revert to the automatic PIS messages ready for train departure. *Guidance Note: the contractor shall, in collaboration with IÉ Train Planning, define a methodology for determining train splits from the VoyagerPlan output or from a separate definition file.*

5.5.3.13 The MMI shall allow manually triggered messages to be cancelled and the system to revert to the most recent automatic message. Otherwise, the system shall automatically replace the manually triggered message with the next automatic message trigger point.

5.5.3.14 The MMI shall allow the manually triggered message to be cancelled and the system to revert to the most recent automatic message. Otherwise, the system shall automatically replace the manually triggered message with the next automatic message trigger point.

5.5.3.15 If the driver wishes to permanently set a manually triggered message, the automatic route (Train ID) shall be reset. Manually triggered messages are then retained until cancelled or a new Train ID is entered.

5.5.4 MMI – 'Route terminating'

5.5.4.1 Upon approach to the terminating station, the PIS shall provision for a special message relating to the pending termination, for example 'This train will terminate at the next station, please remember to take all of your belongings with you'

5.5.4.2 Upon arrival at the destination station and release of the train doors, the MMI shall update the location to Terminating at <destination station>.

5.5.4.3 The PIS shall make provision for a special terminating message, for example 'All change please, this train terminates here'.

5.5.4.4 Following door release, a 60 second countdown shall be displayed before the Train ID entry screen is offered. It shall be possible for the driver to cancel and immediately re-enter a new Train ID.

5.5.4.5 The PIS displays and DVA shall continue to complete their announcements in full. However, additional cycles of messages (e.g. scrolling) shall not be repeated following the 60 second timeout. If the previous Train ID is cancelled, or a new Train ID is entered, the messages of the previous route shall immediately clear.

5.6 PIS Ground Systems

Twice yearly IÉ amends the operating timetable and there is a fundamental objective to automate the production and distribution of corresponding PIS databases. The update is known as the Long Term Plan (LTP); however, in practice this is may involve short term changes accounting for Engineering work or other adjustments. Where such changes are applied, this is known as the Short Term Plan (STP). STP updates are available on a daily basis covering several days ahead.

The PIS Ground System shall include a collection of supporting software systems, typically:

- Database Editor – this is a tool for configuring common data such as stations (names, location, interchange information, etc), standard message, rules / macros, etc.
- Speech Editor – this is a tool for manipulating and editing recorded speech, it may be proprietary software such as Adobe Audition or a freeware .WAV editor such as Goldwave, for example. The software normally includes a speech compression engine to reduce the size of .WAV data files.
- Communication Scheduler (CS) – the fleets are defined and associated to particular depots / line services in CS. The CS also communicates with other systems and packages, possibly using FTP.

5.6.1 Communication Scheduler (CS)

This software shall be supplied under this contract, to be loaded onto a PC server, the computer hardware will supplied by IÉ IT department. CS as a stand alone function is conceptual as there may be existing IT applications available.

5.6.1.1 IÉ already maintains a server to support seat reservation uploads to the Class 22000 and Mk4 coaching stock fleets. The server supports FTP using Filezilla Server.

5.6.1.2 The CS conceptually deals with provision of files and management of file placed in the IÉ FTP server. It must deal with any difference between the train fleets. *Guidance Note: The LTP and STP could be filtered to individual service types or maintained as a common file shared by DART, commuter and Intercity services. There will be differences in PIS Database configuration accounting for physical and operational*

differences between the train fleets. Consequently, files at the FTP may require attributes (in filename for instance) associating them to specific fleets.

5.6.1.3 IÉ shall be provided with a facility to manage the 'Fleets Database'. The CS shall be able to configure and allocate different groups of trains, i.e. train class, or sub-groups within a class. This facility shall automatically associate the unit / vehicles using their fixed coding plugs, i.e. it should not be necessary to manually configure unit / vehicles to a given MAC address.

5.6.1.4 All MAC addresses present by the CGs on the fleet and on spares shall be declared as they will be used in the fixed infrastructure firewalls to prevent unauthorised access to IÉ FTP server.

5.6.1.5 The CS shall include a facility to report the current association of MAC address to train unit / vehicle 'painted number', including a printed report and Excel export.

5.6.1.6 The scheduler shall include a facility to report on usage and errors logged (data received and data sent, files transferred, errors etc), including a printed report and Excel export.

5.6.1.7 The CS shall support the preparation of routine tasks, i.e. similar to Windows Task Manager.

5.6.1.8 Tasks may be scheduled in the long term over many years but resolved to particular times and dates. *Guidance note: Dates for timetable LTP change may be determined in advance. STP updates would be scheduled daily, to be available from 03:00 each day, for example.*

5.6.1.9 Manual control of tasks shall also be supported, e.g. Train Planning may initiate the distribution of LTP when it is ready for release.

5.6.1.10 It shall be possible to disable certain tasks. For example, to disable STP uploads. The on-board systems shall always default to using the LTP if there is no valid STP.

5.6.1.11 The PISC on board the trains shall ensure the use of the transferred files from the earliest opportunity of FTP transfer at the same time observing validity dates.

5.6.1.12 The CS shall provide reports and feedback on progress, for example where it has been commanded to upload files to a given fleet, failure to upload to any train units in that fleet or sub-group.

5.6.1.13 The CS shall support access by the fleet maintenance team, so that the transfer of fault and system status / event logs can be requested from individual units or for a group of units.

5.6.1.14 The PIS shall support the configuration of major events / faults that automatically trigger a download event. When this type of file is downloaded, the fleet support team shall be e-mailed. *Guidance Note:*

Whether the process is FTP, with the e-mail generated by IEs FTP server, or by other method shall be agreed between the contractor and IÉ.

5.6.1.15 The CS and DBE are separate systems but may co-exist on the same computer and may have a common user.

5.6.2 Database Editor

The term 'Database Editor' (DBE) is used to produce a database or file that defines the configuration of the PIS for specific train fleet/s. The DBE defines unique aspects of the railway system and may be considered by several data sets that need to be defined by the user. As a fundamental principle, manual changes to the database shall not be required to process a change of timetable where stations and message formats are unchanged, i.e. the messages generated for individual Train IDs and stopping patterns (routes) shall be automatic once the basic configuration has been defined. The DBE is required when new stations are introduced; station, interchange, safety or manually triggered messages are changed.

Where message strings are entered, the DBE shall always consider the messages as bi-lingual, i.e. both English and Irish. The DBE shall make provision for additional languages to be introduced at locations such as ports and airports, for example.

Based upon existing PIS designs, some systems process the LTP and STP within the DBE which then provides a consolidated output file. Other systems present the LTP and STP direct to the train fleet and the DBE does not process the timetable.

The following are examples of data that may be defined as global or common to the entire railway network, for example:

5.6.2.1 Timetable change dates and time (calendar). The DBE defined parameters may require changing at the same time as an LTP change. There shall be a configurable effective date and time, normally the time when the new timetable comes into effect. This may be controlled by the CS to be consistent with task management of the LTP

5.6.2.2 PIS configurable timeouts, e.g. delay before triggering messages on door open, display load shed timeout, audio repeat intervals, etc.

5.6.2.3 Global default values, e.g. GPS trigger threshold.

5.6.2.4 Global messages, e.g. safety messages, greeting and farewell messages.

5.6.2.5 Individual fleet characteristics – some functions may differ between fleets, for example the functionality of the Commuter fleet is expected to be different to the DART fleet. Configuration data such as audio output level of the DVA may be unique on each fleet.

5.6.2.6 Macros, locations rules and message data

The DBE shall provide a facility for configuring rules and macros. Rules shall be defined for each entity of the PIS and each location. Entities are summarised as:

a) Front (and rear) of Train displays.

b) Side Displays.
c) Internal Displays.
d) Drivers MMI.
e) Other cab MMIs.
f) DVA.

Locations are summarised as:

g) Prior to starting station.
h) At starting station.
i) Departing starting station (journey to first stop).
j) Approaching (normal) station stop.
k) Approaching (major) station stop.
l) At (normal) station stop.
m) At (major) station stop.
n) Departing station (journey to next station).
o) Approaching terminating station (destination).
p) At destination station (terminating).

Macros are summarised as:

i) The capability to pick short or long stations names, i.e. the full station name may be suitable for an internal display but the short or abbreviated name may be required on the front of train.
ii) The string 'Calling at <station x>, <station y> and <station destination>' is an automated macro.
iii) A second string in the form 'Calling at the following principal stations <major station x>, <major station y> and <station destination> is another form of an automated macro.
iv) Determination of <next station>, <destination>, etc are macro functions.
v) Macros for dealing with splitting and joining train functions.
vi) Macros shall support conditional decisions e.g. IF next station is major, DO.., ELSE, etc.
vii) Macros may be conditional based upon days of week, time, lines, etc.

5.6.2.7 Special Route Codes may be defined with the following attributes:

a) A code that is distinct from Train ID's and manual messages, i.e. a numeric entry excluding 01 to 99 or a code in the form 'annn' where a does not conflict with normal use of Train ID's in the LTP.
b) Destination
c) Starting station
d) Route, line / segment to be used
e) Stopping stations

Guidance Note: Special route codes will be used at times of major disruption. To maintain a minimum quantity of special codes, Train Planners may wish to configure 'all stops' along a particular line. The train driver may then select the special code and deselect station stops as required.

5.6.2.8 Conditional decisions shall be supported, for example, there will be exceptions if the service is express, i.e. destination only, with no stopping stations. Under these circumstances macros such as 'calling at ...' are inappropriate. A further example is the capability to make different announcements at major and minor stations.

5.6.2.9 For each of the locations, a unique rule may be configured for each individual entity.

5.6.2.10 Individual stations may have their own rules based on train direction, date and time, e.g. interchange messages.

5.6.2.11 Macros shall support the preparation of standardised message strings and associated speech files. For example, 'The next station is…', 'Welcome on board this Iarnród Éireann service to...', 'We are now approaching…' etc.

5.6.2.12 The arrangement shall ensure the correct association of speech files with the correct context of station name accounting for two languages, each using two possible speech inflections. *Guidance note: The two inflections relate to the middle and end of a sentence. For example 'This train will call at <station A>, <station B> and <station C>', station C shall be announced as an end inflection but it may also appear in the context 'This train will call at <station B>, <station C> and <station D>', announcing station C in mid-inflection. The speech files shall be identified by unique file names, for example the TIPLOC code may be used with a simple change (capital or lower case) to distinguish mid or end inflection. The DBE and PIS shall be expected to automatically resolve the correct use of inflection for each announcement such that any combination of stations may be compiled automatically from the LTP without manual assistance.*

5.6.2.13 Stations and Interchange rules

For each individual station, the following data set shall be programmed:

a) TIPLOC code.
b) English station name (full).
c) English station name (abbreviated).
d) Irish Station name (full).
e) Irish Station name (abbreviated).
f) Station type – major or minor.
g) Latitude.
h) Longitude.
i) Geofence radius (default value may be changed).
j) Special messages on approach, typically interchange messages.
k) Special messages at station, typically safety message, e.g. 'Mind the gap'.
l) Special messages on departure, typically 'ticket inspection messages, etc'.

Where interchange messages are defined, it shall be possible to create rules based upon the following conditions:

i) TIPLOC codes within the onward journey.

ii) TIPLOC codes of previous stations.
iii) Calendar / Day of the week.
iv) Time of day.

5.6.2.14 Segments and Lines

Segments and lines allow the relationship between stations to be defined by distance and distinct lines to be identified as a network. This data is critical to the train navigation / location system and to the drivers MMI since additional station stop options will be obvious at any given location. *Guidance note: some inter-station distances are very short, e.g. Kilbarrack to Howth Junction.*

5.6.2.15 Manually Triggered Messages

Manually triggered messages are those provided to the driver (or train crew) for ad-hoc use. For example 'Stand clear of the doors'.

Messages shall be categorised for easy access as follows:

a) General – messages for regular use, e.g. 'Stand Clear of the doors'.
b) Delays & Diversions – messages with approximate time of delay, messages containing reasons for delay and messages describing diversion and impact.
c) Safety – a range of safety messages.
d) Emergencies – Fire, evacuation, etc.

5.6.2.16 The DBE shall permit entry of a short textual transcript (typically less than 40 characters), this transcript shall be presented to the driver or train crew before confirmation and delivery of the full announcement to passengers.

5.6.2.17 The DBE shall enable the message to be addressed to individual entities, i.e. it shall be possible to individually control each display type and / or the DVA.

5.6.2.18 Messages shall be configurable in respect of number of repeats (or single play), repeat interval and total duration.

5.6.2.19 Emergency messages shall be high priority; with a facility to increase the volume of emergency DVA announcements and override lower priority messages.

5.6.3 Importing the Plan

Both the LTP and STP are available from the train planning system – VoyagerPlan. Arrangements can be made by IÉ to export theses files to the PIS Ground Systems using FTP. An example of the file format, together with a description, is provided in Appendix 2.

5.6.3.1 The PIS database and LTP / STP may be kept separate and 'compiled' in real time on the train. An alternate method may involve the LTP / STP being 'pre processed' by the DBE. In either case, the PIS Ground system shall be capable of automatically requesting the LTP / STP and then compiling the relevant target files for the trains.

5.6.3.2 The DBE role shall be limited to entering the 'rules of PIS' and associating text strings for displays and audio announcement trigger codes associated with each text string. In practice, such a system shall only require infrequent updates to the core PIS data, for example when new stations are built or if new announcements are needed.

5.6.3.3 The DBE shall compile target database files for the fleets either as one standard file or as files customised for individual fleets. It shall detect and report errors during the compilation process.

5.6.3.4 The output files shall be automatically archived with a 'restore' capability.

5.6.3.5 The DBE shall support the following printed reports and Excel exports:

a) Station data – TIPLOC, short name, long name, GPS coordinates, major / minor, etc.
b) Rules, macros, etc.
c) Summary of standard message strings and associated speech file names.
d) Manually triggered messages. (Note 1)
e) Summary of stops for each train ID.
f) Detailed step by step PIS output for a given Train ID. (Note 2)

Note 1: Printed in a format where this could be laminated on two sides of A4.
Note 2: Printed in a format that may be used by Commissioning Engineers to check each event on a selected route (Train ID).

5.6.4 Route (Train ID) Simulation (Independent application or part of DBE)

A pre-requisite requirement for simulation of PIS as it will operate on the train but before it is submitted to the CS for distribution to the fleet/s. After selecting a particular plan, train fleet and Train ID, it shall then be possible to select a given location and date.

5.6.4.1 The simulator application shall be available to several users other than the PIS DBE programmer, so this may be provided as an independent application or as a version of the DBE where the configuration features

are disabled, controlled by password. The DBE operator will also require to use the simulator.

5.6.4.2 The process of selection shall be similar to that used on the train MMI. *Guidance Note: This would be a useful feature as a training tool for train drivers.*

5.6.4.3 The simulator shall then provide a number of windows simulating each type of train display, i.e. drivers display, internal display, front and side displays. The windows shall be automatically configured to match the actual displays used on the selected fleet.

5.6.4.4 The simulated visual displays shall accurately represent the sizes, fonts, scrolling / rolling rates, timing and transitional effects provided by the on-train displays.

5.6.4.5 Audio announcements shall also be available for monitoring.

5.6.4.6 Train operation shall be simulated with configurable acceleration, top speed and deceleration along with automated door opening. The simulator shall support real time running according to the planned times of arrival at each station. The objective of this simulation is to check delivery timings in relation to a real journey.

5.6.4.7 There shall be a facility to increase speed (thus reducing simulation time) when running between stations.

5.6.4.8 For any given Train ID within the plan it shall be possible to review and monitor the audio / visual information to be provided to the driver and the passengers.

5.6.4.9 The simulator shall fully support the review of timings, synchronisation and special effects of the PIS audio / visual system and test that the configured data is correct.

5.6.4.10 The DBE shall provide a method of exporting programmed coordinates and station names (or code) allowing the positions to be overlaid on Google Earth for checking station GPS coordinates.

5.6.5 Route (Train ID) Simulation on-board the train

A further level of simulation shall be provided whereby a computer programme is made available for ‘on-train’ simulation of GPS and wheel pulses.

5.6.5.1 This simulator shall be connected to a maintenance port of the on-board PISC.

5.6.5.2 Whilst connected, the simulator shall provide GPS location, wheel pulses and door open signals to the on-board PIS.

5.6.5.3 The user interface shall allow the date, Train IDs, and locations to be available for selection. The process of selection shall be similar to that used on the train MMI.

5.6.5.4 The simulator shall graphically indicate location (on a map), progress to next station shall be displayed (distance countdown).

5.6.5.5 Train operation shall be simulated with configurable acceleration, top speed and deceleration along with automated door opening. The simulator shall support real time running according to the planned times of arrival at each station. The objective of this simulation is the check delivery timings in relation to a real journey.

5.6.5.6 There shall be a facility to increase speed (and reduce simulation time) when running between stations.

5.6.5.7 A door open signal shall be, either manually or automatically, provided at simulated stopping stations.

5.6.5.8 The on train PIS entities (displays, DVA, MMI) shall operate as if the train were operating a real route. The user may walkthrough the train to check each display and listen to announcements.

5.6.5.9 This simulator shall also support maintenance of the on-board system, i.e. software, firmware, database uploads, diagnostics, etc.

5.6.6 Speech Editor

5.6.6.1 Audio editing software (two licences) shall be supplied.

5.6.6.2 Where speech files are to be edited as .WAV format, any file conversions to a compressed format shall be batch processed.

5.6.6.3 For speech editing purposes, edit resolution shall be less than or equal to 10 milli-seconds.

5.6.6.4 Speech files shall be logically named allowing station names to be automatically associated when the routes are compiled and using the correct inflection based on sentence context and language.

6. PARTICULAR REQUIREMENTS – AUDIO COMMUNICATIONS

This section is for use where existing audio communication systems are to be replaced.

6.1 Vehicle Power Supply

Basic audio communications for PA, Cab to Cab, and PEI are train safety systems. As such, these critical functions shall continue to be available with no active cab on the train and until the battery voltage reaches 67V (EMU) or 17V (DMU) or is disconnected by an external load shedding arrangement. The contractor shall ensure minimal quiescent current consumption (value to be advised) and support separate load shedding arrangement for the non-essential visual system as detailed in 4.7.3.

6.2 Additional Requirements of the User MMI

6.2.1 The MMI shall include additional controls and indicators to operate the audio communication system. *Guidance note: the following controls and indicators are suggested - a button labelled PA and an associated yellow indicator; a button labelled IC or C-C and an associated colour indicator – which shall be distinctive, but avoiding yellow, red, green – to enable cab to cab communication; and a button labelled PEI and an associated red indicator for Passenger Emergency Intercom labelled PEI or PC.*

6.2.2 Control buttons shall be adequately sized and robust.

6.2.3 Indicators shall be visible without becoming a distraction for the driver.

6.2.4 Controls, indicators and legends shall be visible under all cab lighting conditions.

6.2.5 Audio communication control functions are critical for train safety, the design shall provide fallback functionality in case of failures within the MMI or PISC. *Guidance note: to provide acceptable availability, audio control functions sometimes operate through the MMI data communications interface but may also be duplicated using simple control wiring. In case of failure within the complex processing systems of the MMI and PISC, basic operation of PA, C-C and PEI shall be assured.*

6.2.6 A cab handset and stowage shall be provided.

6.2.7 The handset shall be robust and vandal resistant.

6.2.8 The handset shall withstand ten repeated drops from different orientations and ten drops when suspended by its cord from 1m onto a concrete floor. *Guidance note: cosmetic damage acceptable but no physical damage or cracks.*

6.2.9 The handset cord shall be robust, armoured cords are preferred. It shall withstand a pull test using a 20kg load.

6.2.10 The stowage device shall positively latch the handset in place and the handset shall remain in situ when tested to EN61373, mounted in its normal orientation.

6.2.11 The stowage device shall provide an electrical signal to the MMI so that selected audio communication modes can be automatically cancelled when the handset is replaced in its stowage. This feature is also required to suppress the MMI monitor loudspeaker.

6.2.12 The handset shall include a PTT button that is robust and positioned ergonomically allowing the button to be operated and held with one hand.

6.2.13 The handset shall have a good acoustic performance, particularly for PA. *Guidance note: A frequency response of 100Hz to 8KHz +/-3dB and noise cancellation is expected.*

6.2.14 The handset PTT button shall be held operated during PA announcements, i.e. driver can mute the microphone by releasing the button at any time.

6.2.15 During cab to cab and PEI communication modes, the handset PTT button shall again be held operated but subsequent communications shall be full duplex (talk and listen simultaneously).

6.2.16 During all handset communications, side-tone shall be provided. In full duplex communication modes, releasing the PTT button shall reduce the handset transmit level and increase the receive level, i.e. louder for the driver.

6.2.17 The handset design shall exclude handling or PTT button noise when the handset is used for PA.

6.2.18 The monitor loudspeaker of the MMI shall be fully integrated with audio communications providing support for the following functions:

a) Monitoring PA announcements made from other cabs.
b) Monitoring cab to cab communications when the handset in that cab is stowed.
c) Broadcasting cab to cab call tone and other warnings (keypad audible feedback).
d) Monitoring PEI communication between passenger and driver, or monitoring in the driving cab whilst the driver operates other communications modes.

6.2.19 Facility to show the location of PEIs that are activated.

6.2.20 Facility to select individual PEIs for communication.

6.2.21 Enhanced CCTV interface allowing the selection of a camera corresponding to activated PEIs or subsequently PEIs involved with driver – passenger communications.

6.2.22 Facility to advise the driver when the Train Radio has accessed the PA system.

6.3 Passenger Emergency Intercom

A Passenger Emergency Intercom (alarm) shall be designed in accordance to the TSI. Unless otherwise specified, or already provided on the current system, one PEI shall be installed at each doorway vestibule and two PEI, within toilets with facilities for wheelchair users.

6.3.1 The PEI unit shall feature a large red button (60mm) that is protected against accidental operation, but is capable of being operated by persons with hand disabilities, i.e. may be operated by the palm of a hand. The design and operating force shall be in accordance with TSI-PRM.

6.3.2 The PEI shall include an AFILS facility and labelling to indicate that persons who are hard of hearing may set their hearing aid to the 'T' position.

6.3.3 The PEI shall include audible and visual warning indicators to confirm that the button has been operated in accordance with TSI-PRM.

6.3.4 The PEI shall incorporate a loudspeaker and a microphone.

6.3.5 The PEI shall function normally for passengers located within 600mm of the PEI, under all operating conditions.

6.3.6 Communications shall be clear and intelligible under all operating conditions.

6.3.7 When the driver acknowledges the PEI call, the warning sound shall cease and another indicator shall operate whilst the PEI is connected to the driver for communication. The warning sound occurs only when first initiated and shall not return until the PEI has been reset and then operated again.

6.3.8 When multiple calls occur, each call shall be placed in a queue and shall be presented in time priority order.

6.3.9 The driver shall have the facility to communicate with each caller in turn, each identified by a unique location. The arrangement shall allow the driver to connect back to a caller that has been previously connected or to individual callers; at the same time it shall remain possible to change to other communication modes (PA, Cab to Cab intercom) and then return to communicating with the passenger/s. *Guidance Note: Unique location means Vehicle ID / type or position within the train (car 1, car 2 etc) and location such as doorway number, toilet etc.*

6.3.10 Communications shall be full duplex. *Guidance note: the system to provide sufficient sensitivity and signal level to support the requirements*

of clause 6.3.5. Adaptive Echo cancellation technology, or similar DSP processing, is therefore expected.

6.3.11 MMIs throughout the train shall display the locations of activated PEI's and the PEI in communication with the driver.

6.4 PA System

PA systems shall be designed with fault tolerance and resilience and shall be capable of operating in accordance with the TSI (conventional railway) and GM/RT2130 issue 3 for 15 minutes with a fire.

6.4.1 Where new transmission and loudspeaker circuits are added, the cables shall be fire resistant for 30 minutes.

6.4.2 Within each vehicle, loudspeakers shall be inter-leaved, operating from two independent circuits and amplifiers. An individual loudspeaker can be sacrificial in fire so long as its failure mode does not short/open circuit distribution to other loudspeakers. There should be diversity in the two through train transmissions channels.

6.4.3 PA amplifiers feeding the duplicated circuits shall be powered from diverse supplies.

6.4.4 The transmission paths, amplifiers and loudspeaker distribution shall be duplicated and monitored with fault reporting.

6.4.5 PA system volume shall be automatically adjusted to be 10dB above ambient. This level shall be configurable as shall be the upper and lower volume levels.

6.4.6 The PA system shall support a frequency response of 100Hz to 10kHz, ± 3 dB.

6.4.7 The PA system Signal to Noise ratio shall be better than 55dB when operated and less than 70dB when PA is not selected.

6.4.8 The PA system shall provide RASTI performance equal to or better than 0.7 throughout passenger areas. *Guidance Note: Whilst TSI-PRM states a minimum 0.5, IÉ has an objective to achieve better performance.*

6.5 Audio Communications System Priorities

A fundamental principle of the audio communication system is the train driver (occupant of the active cab) having ultimate control of audio communications. Any selection made by the driver shall take priority. There is one exception to this rule, i.e. where train radio selects the PA system and takes ultimate priority. However, after 2 minutes of selection by Train radio the audio communication system shall clear the train radio selection returning control to the on-board systems until the Train Radio PA is de-selected then re-select again.

6.5.1 New audio communication systems shall be designed with two audio communications speech paths through the train. *Guidance note: The two speech paths may be digital or there may be two separate analogue speech paths. This is to be agreed with the Engineer, particularly where this requirement implies the addition of new inter-vehicle jumpers.*

6.5.2 With two speech paths, it shall be possible for the DVA or PA system from other cabs to deliver an announcement to passengers simultaneous with a driver communicating cab to cab or with a PEI. The two speech paths (Transmission) shall have the capability of independent routing thus support compliance with the future TSI (conventional railways): *Guidance note: 'The equipment should be able to remain on standby and function independent of the overhead line supply for at least three hours. The public address system should be designed so as to operate 50 % of its loudspeakers in the event of a failure of one of the transmission elements.'*

6.5.3 Driver PA shall override PA operated from any other cab.

6.5.4 Drivers shall have the facility to switch between modes, i.e. receive a PEI call, then communicate to other cabs, then make a PA announcement, then revert to the PEI, etc.

6.5.5 The status of the audio communication system shall be shown on every MMI throughout the train, i.e. selected communication mode.

6.5.6 The replacement audio communications system shall be designed with provision for potential introduction of GSM-R, accounting for the required PA interface. This interface shall be the highest priority access to onboard PA.

6.5.7 The replacement audio communications system shall provide a full duplex intercom.

7. OPTIONS

The following options shall be priced as incremental additions to the base offer. Where an option depends upon the adoption of another option there shall be a clear statement to that effect and the total price shall be shown in each case.

7.1 Option 1 – Enhanced Event Logging and Train Tracking

7.1.1 In section 5.6.1, the CS supports the transfer of fault and event logs to support analysis and management of system events. This option extends the range of features to be provided.

7.1.2 With this option, it shall be possible to log the following events for engineering maintenance, individually logged with date, time, Latitude/Longitude and train speed:

a) Power up and power down
b) Cab activation
c) I/O change
d) GPS triggers and locations
e) System events
f) User actions on the MMI
g) Train ID

7.1.3 A subset of the data above will be required by the IÉ Operations team for post incident analysis, for example in the event of PIS reported as not working or working incorrectly, to identify driver actions.

7.1.4 The data shall be captured and compressed such that file size is compact and suitable for transfer via the CG and 3G/WiFi link.

7.1.5 A software application shall be provided to support analysis of the data logged for a given Train ID on a particular date.

7.1.6 The logs shall be archived by the application.

7.1.7 The application shall provide timeline analysis and graphical presentation of logged data.

7.1.8 The application shall log the travel history of the individual train unit and fleet, archiving the data as and when needed. It shall be possible to extract reports, as listed below:

- Current odometer readings of the fleet, detailing individual units.
- Distance travelled over a defined period for a given fleet, showing individual units.
- Hours in service (operating a Train ID), by train unit over a given period.
- Frequency of passing or visiting particular locations, e.g. by TIPLOC.

7.2 Option 2 – Real Time Passenger Information System (RTPI)

7.2.1 Real Time Passenger Information is where up to the minute events and delays are communicated to passengers on board the trains. The information shall be timely, accurate and relevant. As an example of application, passengers arriving in Dublin may be given alternative interchange information in case of disruption to public transport. Delays, disruptions and diversions (bus substitution) may be clearly explained to passengers.

7.2.2 On train PIS changes

The following changes / additions are envisaged:

7.2.2.1 The on-trains systems shall have the capability of receiving messages and metadata from a central RTPI controller or RSS feed.

7.2.2.2 The frequency of RTPI update will be determined by the number and location of stations with installed WiFi APs, this will be under IÉ control and if found to be necessary additional stations may be equipped.

7.2.2.3 Messages shall be up to 1000 characters in length.

7.2.2.4 Metadata shall support the following information:

- Priority of message – low (public information), medium (disruptions), high (emergencies).
- Validity – from hh:mm to hh:mm.
- Frequency – minutes.
- Geofence – boundary of affected stations.
- Direction.
- Type.

7.2.2.5 Trains shall discard all RTPI information at a pre-determined time each day, otherwise when the data is no longer valid.

7.2.2.6 The on-train PIS shall allocate time slots for the presentation of RTPI that avoid conflict with the normal PIS trigger locations, i.e. typically during the journey phase between stations.

7.2.2.7 The DVA shall have the capability of receiving associated speech files (compressed data) to be associated to the message.

7.2.3 RTPI Ground System

The RTPI system shall be for use by the train operations staff within the control centre. It shall be supplied as software to operate on a PC. The PC shall be linked to the Communications Scheduler via the IÉ IT network.

7.2.3.1 The RTPI software shall be capable of co-existing with other applications running on the same PC.

7.2.3.2 The user shall have the capability to select individual Train ID or groups of trains and then send messages to the individual or groups.

7.2.3.3 The user shall have the capability to create audio and visual messages, to be stored in a memory (short term scratchpad and long term).

7.2.3.4 Audio recording facilities shall be available to the user and a desk top microphone shall be provided.

7.2.3.5 Having generated a message, the user shall then have the facility to create the metadata associated to that audio / visual message.

7.2.3.6 The user shall have the facility to check / monitor the audio / visual message before it is distributed to the fleet.

7.2.3.7 The RTPI system shall distribute the message / metadata to relevant trains within the fleet. Relevant means that a message for a DART service would not be distributed to a Commuter train, etc.

7.2.3.8 The message in the form of data shall be stored on-board relevant trains for action as and when required. Alternatively, the ground system may retain control and deliver triggers to the relevant trains based upon knowledge of current location from train tracking data.

7.3 Option 3 – GPS Enhanced Augmentation

7.3.1 MEMS INS augmentation shall be added the GPS receiver. When used in combination with the odometer, the system shall have the capability of reconciling absolute position within +/- 100m when GPS satellites are obscured for up to 3 km or 5 minutes. Refer to 5.3.3.4.

7.3.2 GPS assistance (A-GPS) to be provided to improve cold and warm start up times.

7.4 Option 4 – Advertising and Infotainment System

7.4.1 An advertising system, proven as suitable for use on railway vehicles shall be provided as a costed option on each Unit comprising of

a) A number of high resolution colour screens per vehicle.
b) A control unit per Unit.

7.4.2 The size and number of screens to be provided per vehicle shall be specified by the Contractor as part of the tender response. The system shall be designed such that 80% of passengers have a view of at least one advertising screen.

7.4.3 The installation arrangement of the screens shall be designed so that in the event the screen is not in use it does not have a negative impact on the aesthetics of the saloon interior. The screens shall be sealed to prevent the build up of dust.

7.4.4 The screens shall incorporate toughened glass and suitable measures shall be taken to protect them from vandalism.

7.4.5 The screens shall be sufficiently bright for their location and environment. Ideally, brightness shall automatically adjust accounting for ambient light and lifetime degradation of the screen back light.

7.4.6 The screens shall be compatible with the PIS, i.e. they shall comply with the advertising / PIS relationship as stated in TSI PRM; they shall not affect PIS compliance with TSI-PRM by reducing the passenger visibility of the PIS display.

7.4.7 The advertising system shall be video only, no sound.

7.4.8 To preserve the life of the displays and conserve energy usage, the system shall shutdown when the vehicle is not in service or no information is scheduled to be displayed. The energy saving features built into the system shall be detailed in the bid.

7.4.9 The control unit shall contain sufficient memory to store 60 separate 1 minute high definition video files.

7.4.10 The control unit will share the PIS GPS antenna but the signal will be segregated by an antenna splitter. Alternatively, refer to 7.4.17.

7.4.11 The system shall provide an accurate and detailed advertising log, which shall provide the Customer with the facility to demonstrate to advertisers the number of times their adverts have been displayed and that the display screens were functional.

7.4.12 The logging system shall include a method for monitoring that a screen is working, with reasonable confidence.

7.4.13 The advertising log shall have sufficient memory to store 60 days of system data.

7.4.14 A facility shall be provided to select individual & multiple video files for sequentially displaying on the saloon displays. The system shall allow a video play sequence to be set for different train diagrams based on the Train ID reference and for individual/multiple videos to play at a specific

time or locations. A variable repeat set sequence function shall be provided.

7.4.15 It shall be possible to display Really Simple Syndication (RSS) information feeds via selected websites and for these to be displayed in between the video play sequence.

7.4.16 The system shall interface to the train communications gateway via a fast Ethernet (or better), international open standard, IP based, communications bus. As system integrator the Contractor shall provide full documentation covering system architecture, operation and protocols.

7.4.17 The system shall obtain Train ID, location, data and time data from PIS via the train communications gateway.

7.4.18 The advertising system shall be capable of supplementing manual messages triggered on PIS, i.e. some manual messages to have a corresponding video sequence.

7.4.19 The Contractor shall provide the necessary software functionality required for a local maintenance tool and the remote train interface. The remote train interface functionality shall include, but not be limited to:

- The downloading of individual or multiple video files on a scheduled basis to individual or multiple Units.
- The downloading of system settings and configurations including video sequencing, advertising log etc.
- Analysis of individual or multiple advertising logs to determine usage for particular advertisers.
- Presentation of advertising log data in tabular and graphical representations.
- User configurable reports in electronic and printable formats.
- Exporting of data and reports into other standard formats including XML, CSV, Microsoft Word, Excel, Access etc.

8. DESIGN VALIDATION AND TYPE TESTING

8.1 Bid stage (ITT or any Invitation for a Proposal)

8.1.1 Bidders are required to submit the information detailed in section 3.3. Any new / novel hardware or software and any modifications to existing designs shall be clearly stated, including any validation or type tests required whilst undertaking the project.

8.2 Type Tests

Typically, type testing is carried out on single unit samples of each LRU, the samples shall be of production standard and to be retained for reference. Some type tests may be repeated on a random basis to ensure production samples do not differ from original design, or in case the design has been modified. Type testing shall comprise the following test parameters, but the list below is not exhaustive:

- Functional
- Vibration
- Bump and Shock
- Dry heat/cold
- Damp/humidity
- EMC
- Surge and transient
- Supply min/max and interruption
- Endurance
- IP rating, dust and water spray

8.2.1 Type test samples shall be retained as ‘glass case’ equipment references and shall not be supplied as part of the contract equipment for use on trains. A data pack containing type test results shall be supplied. Reliability and endurance testing to be included where applicable, any failures encountered during burn-in or type testing shall be logged and recorded. Reliability figures are to be calculated and graphically plotted during the warranty period. The warranty period shall not terminate until reliability is at a stable value better or equal to the values quoted in the bid response.

8.2.2 In order to demonstrate system functionality, a FAT is required as detailed in section 4.11. The test wall shall comprise an agreed sub-set of PIS equipment. Representative wiring shall be used, paying particular attention to replicating any wiring considered to be a risk, e.g. operation over extended length such as maximum coupled train length. The test wall details shall be subject to approval by the Engineer as part of the type test specification and shall be fully detailed therein.

8.2.3 Production equipment shall be to the same design standard that was used for type testing, traceable to existing type test reports and certification or to the new tests to be undertaken as part of this project. The ‘glass case’ type test samples shall be available for inspection and comparison.

8.2.4 IÉ or its delegates, shall have right of access to attend any development, validation type, or routine test. Prior to undertaking the type test, the contractor shall submit a programme (with at least four weeks notice), of test procedures and/or method statements for approval by IÉ. If the equipment offered has been previously type tested then the extent and nature of the type test results shall be clearly identified in the offer. IÉ shall reserve the right to request additional or repeated type tests, particularly if the equipment is to be specially modified for use on this project.

8.3 Production / Routine Tests

Details of the test and frequency of sampling shall be agreed with IÉ. Production testing shall include 100% testing of function, galvanic isolation, earth continuity, low voltage start up and burn in accordance with EN50155. These tests are in addition to normal quality assurance procedures.

All test results shall be recorded by product serial number and shall be made available for review by IÉ.

8.4 System Acceptance Tests

The contractor shall define a series of System Acceptance Tests covering the following milestones:

8.4.1 Installation Acceptance – This stage involves static testing of the train unit and inspection / scrutiny of the installation and installation records. This acceptance is required before hand back to IÉ. IÉ shall be responsible for fitness to run inspections. The contractor shall be responsible for coordinating NoBo, IVB or CCB inspections if so required.

8.4.2 First of Class Acceptance – Validation and proving the design and configuration values for the first of each fleet type. The contractor shall make provision for attendance of staff to monitor and support the First of Class vehicle until two fault free full days running have been completed.

8.4.3 Following First of Class Acceptance, the contractor shall be responsible for the Configuration Management Database, so that software / hardware and modification status of each product is recorded by serial number with records identifying each supplied item, any changes made shall be authorised by IÉ. The contractor shall also provide details on the change control process for all equipment installed on the vehicle.

8.4.4 Completion of Train Unit – Following First of Class Acceptance, limited proving test is required on each unit when it re-enters service. The train shall be accompanied on two typical Train ID runs, i.e. approx 0.5 day to confirm fault free operation.

8.4.5 Warranty Acceptance – Refer to the Framework Agreement for the supply of the Replacement Passenger Information System.

8.4.6 Completion of Warranty Period – Refer to the Framework Agreement for the supply of the Replacement Passenger Information System.

9. TRAINING

The contractor shall provide suitable training in the programming, operation and maintenance of the PISs for each of the following staff: Project/FTS engineers, Operating staff, and Maintenance staff. In the case of IÉ operating staff, the contractor shall train the IÉ Trainer. Training courses shall assess the competence of the individual trainees and certificates of competency shall be issued to those trainees that have achieved an acceptable level. This training shall be available for entire Warranty period.

For each of the individual training courses detailed below, the contractor shall produce course notes, presentations and handouts, which shall be submitted previously to IÉ for review and approval.

9.1 Ground Systems

Training courses in the use of the ground systems shall be provided following delivery of these systems. This event shall take place at least four weeks before PIS equipped trains are due to enter service to provide sufficient time for data preparation.

9.1.1 Database Editor and Speech Programming

Two training sessions shall be provided for users of the DBE, Speech Editor.

9.1.1.1 An objective of the first training session is that the contractor shall assist in the transfer of existing data (GPS coordinates) and throughout the preparation of the core database. An efficient design of DBE will enable this activity to be undertaken in a short time period. The speech programming system shall be demonstrated.

9.1.1.2 The second training session may be shorter since the core data will have been generated during the first session.

9.1.1.3 IÉ shall be responsible for providing voice recordings.

9.1.1.4 Both sessions shall conclude with training the process of uploading the data on the train.

9.1.2 Communications Scheduler

Training shall be provided on configuration and use of the scheduler.

9.2 Operations

The PIS supplier shall provide training services for IÉ staff, the following training course are envisaged:

9.2.1 Simulator

The contractor shall provide an MMI simulator for training purposes. The simulator may comprise a real Driver MMI that is fully functional or a PC based simulation.

9.2.2 Driver and Train Crew Trainers

The contractor shall provide two separate training courses for the driver and train crew trainers. This training shall be provided in a timely manner so that the train drivers may be fully trained in using the system prior to introduction on the fleet.

9.2.3 Enhanced Logging and Tracking Option

Where the enhanced logging tracking option is provided, a single training session shall be provided for the IÉ IT team to allow set up and access by users throughout IÉ.

9.2.4 RTPI Option

The contractor shall provide two separate training sessions in the operation of RTPI from the control room PC.

9.3 Maintenance

A quantity of five separate depot based training courses to be attended by up to five persons (each course). The course shall be undertaken on each train type serviced by the depot and shall involve hands on learning and use of the download unit/maintenance tools and shall be assessed by simulation of a range of expected failures. In addition, the course shall include testing, fault finding, replacement of LRUs routine maintenance, etc.

9.3.1 Depot Test Wall (one for DMU, one for EMU – locations to be decided)

Prior to the training course, the contractor shall supply, install and document two test walls that replicate the test wall at the PIS supplier premises as described in section 4.10. The test wall shall include DC power supplies (to operate from 230V AC), all necessary cables, connectors and switches / indicators for I/Os. IÉ will provide adequate space and benches, plus PC's required to run any test and simulation software. The contractor shall provide LRU test procedures and training in the test process. The objective of this test facility shall be to replicate the PIS OEM test procedure to avoid returns with 'No Fault Found' NFF.

9.3.2 On–train Fault Finding, Test and Commission

Extensive training shall be provided by the contractor with simulated faults and diagnosis together with changing of LRUs fully demonstrated.

9.3.3 Ground System Maintenance

Fault finding, software installation and other general maintenance shall be demonstrated to IÉ IT department.

10. SPARES

10.1 Spares quantities

The contractor shall recommend an appropriate level of spares for each depot based upon the reliability of the PIS equipment and the time taken to repair failed component at the contractors repair facility. There shall be sufficient spares to ensure the stock levels remain adequate at all times through the life of the systems.

10.2 Spares Prices

Prices shall be quoted with validity from the award of contract until two years following the end of the warranty period. The contractor shall act reasonably in the pricing and availability of spares and shall propose a regime for supporting spares in the future. For example, declaring the price mark up to be used. IÉ acknowledges this may depend on whether the contractor needs to maintain individual components or LRUs in stock or simply acts as a procurement agent for third party materials.

10.3 Warranty Spares

A complete list and pricing of all spare parts shall be provided. The contractor shall make sufficient provision of spares such that the PISs are maintained and available. The contractor shall also provide the MTBF and spares repair turnaround times to support the stated quantities. Shall provide secure storage on depots and an agreed number of man hours for exchange of LRUs during the warranty period. Where reliability does not achieve agreed objectives, the contractor shall be responsible for all costs in increasing the provision of spares and meeting the cost of additional depot resources.

During the warranty period, IÉ depot staff resources may be required for first level support such as changing failed LRUs. The required man hours shall be stated in the bid and the cost of providing this support will be considered during tender evaluation. Where depot support time exceeds 25% of the agreed hours, on average in a given month, the contractor shall either provide their own additional resources on depot or agreed to fund additional IÉ resources.

10.4 Design and Endemic Faults

The contractor shall provide sufficient spares, float stock and on-site support to undertake remedies in case of endemic failures or design faults. Depot labour normally reserved for routine reliability and maintenance issue shall not be used for rectification of such faults. The contractor shall agree modification campaigns with IÉ.

Design changes and modifications shall not be undertaken following FAT acceptance without prior approval from IÉ.

11. STANDARDS AND REFERENCE DOCUMENTS USED

All EU Directives must be complied with. All relevant European Standards and railway industry standards current at time of contract placement shall be met. The following list of standards highlight those frequently considered, it is not an exhaustive list of applicable standards. Note: the following sections are listed in order of precedence, i.e. European Standards are first priority, then Irish Standards, and so on.

11.1 European Standards

Number / Date	Title
2004/108/EC, July 2007	European Union Directive on Electromagnetic Compatibility.
1999/5/EC, March 1999 Note 1	Radio Equipment and Telecommunications Terminal Equipment.
2008/57/EC	Interoperability of the conventional rail system
2008/232/EC Note 2	Technical specification for interoperability relating to the rolling stock sub-system of the trans-Europe high speed rail system referred to in directive 96/48/EC. Note: sections relating to communications & information, PA and passenger alarm are relevant.
2008/164/EC	Technical specification for interoperability for Persons with Reduced Mobility
EN12663-1:2010	Railway applications. Structural requirements of railway vehicle bodies. Locomotives and passenger rolling stock
EN45545 – Note 4	European Standard: Fire Performance category A.
EN50121-3-1: 2006	European Standard: Railway applications - Electromagnetic compatibility - Part 3-1: Rolling stock – Whole vehicle emissions.
EN50121-3-2: 2006	European Standard: Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock – Apparatus.
EN50121-4:2006	European Standard: Railway applications - Electromagnetic compatibility - Part 4: Emissions and Immunity of the Signalling and Telecommunications Apparatus.
EN50124-1	European Standard: Railway applications – Insulation coordination – Part 1: Basic requirements (Creepage and clearance)
EN50124-2:2001	European Standard: Railway applications – Insulation coordination – Part 2: Over voltage and related protection
EN50125-1:1999	European Standard: Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock
EN50126-1	European Standard: Railway applications – Specification and demonstration of Reliability, Availability, Maintainability and safety (RAMS) – Part 1: Basic Requirement and Generic Process.
EN50128:2001	European Standard: Railway applications –

Number / Date	Title
Note 3	Communication, signaling and processing – Software for railway control and protection systems.
EN 50153:2002	European Standard: Railway applications – Rolling Stock. Protective Provisions Relating to Electrical Hazards.
EN50155: 2007	European Standard: Railway applications - Electronic equipment used on rolling stock.
EN50155: 1996 Note 5.	European standard: Railway applications - Electronic equipment used on rolling stock.
EN60077: 2002	European Standard: Railway applications- Electric Equipment for Rolling Stock
EN60529: 1992	Degrees of protection provided by enclosures (IP code).
EN61373: 1999	European Standard: Railway applications - Rolling stock equipment - Shock and vibration tests.
ISO/IEC 8859-15:1999	Information Technology – 8-bit single-byte coded graphic character sets
EN50306:2002	European standard: Railway applications – Rolling Stock cables having a special fire performance
BS857:1967	Safety glass for land transport

Notes:

1. Relevant to application and use of communications technology, e.g. GSM modem, WiFi, etc.
2. TSI for conventional rail does not currently available, applicable requirements of TSI RS HS to be used.
3. Alternative recognised Software Management and Quality Systems will be considered. For reference to EN50128, the PIS shall be deemed to have safety integrity SIL 0.
4. Since Fire standard EN45545 is not currently adopted the fire standard to be agreed between the contractor and IÉ, refer to section 4.3.
5. Several train fleets were designed to this older version of EN50155 which includes provision for harsher transients. The lower source resistance of 5R shall be used on transient waveform D. This requirement may be satisfied by additional external protection on fleets built prior to 1999.

11.2 Irish Standards

Description	Reference
Energy, OHLE Interface for IÉ Rolling Stock	CME-TMS-306
Electromagnetic Compatibility, EMC	CME-TMS-308
Information Technology – Irish 7-bit Coded Character Sets	I.S. 433:1999
Irish Language Regulation	Official languages Act 2003 (Section 9) Regulations 2008

Description	Reference
IÉ Rolling Stock Projects – Approval Process v2.10	CME-TMS-312

11.3 RSSB Standards

Description	Reference
Railway Group Standard: Equi-potential Bonding of Rail Vehicles to Running Rail Potential.	GM/RT2304
Requirements for Driving Cabs of Railway Vehicles	GM/RT2161
Code of Practice for Structural Aspects of Railway Vehicle Interiors	GM/RC2502
Commentary on Structural Requirements for Railway Vehicles	GM/RC2504
Code of Practice – Rail Vehicles – Equi-potential Bonding	GM/RC2514
Electromagnetic compatibility between railway infrastructure and trains	GE/RT8015
Code of practice for EMC between the Railway and its neighbourhood.	GM/RC1500
Guidance on the Application of Selective Door Operation Systems	GE/GN8577
Guidance on the Use of Satellite Navigation	GE/GN8578
Guidance on Digital Wireless Technology for Train Operators	GE/GN8579
Guidance on Train Rooftop Antenna Positioning	GK/GN0602
Vehicle Fire, Safety and Evacuation	GM/RT2130

The standards referenced above are available from www.rgsonline.co.uk

11.4 International Standards

Number / Date	Title
MIL HDBK 217 Issue F (Ground Mobile) DEF STAN 00-41 Issue 3 NPRD - 95	Reliability Prediction of Electronic Equipment

11.5 UIC Standards

Description	Reference
Loudspeaker and telephone systems in RIC coaches. Standard technical characteristics	UIC 568

12. APPENDICES

12.1 Appendix 1 – Sencity Antenna

HUBER+SUHNER®
SENCITY®RAIL ANTENNA
FOR TRAINBORNE WIRELESS COMMUNICATION

SWA 0859/360/4/0/DFRX30

Multiband antenna: GSM 900, GSM 1800, GSM/PCS,1900, UMTS, 2.4, 3.5, 5.3 and 5.8 GHz Bands and GPS/Galileo incl. LNA

Technical Data

Electrical Properties Multiband Antenna

Frequency range (MHz)	870 - 960	1710 - 2170	2400 - 2700	3400 – 3700	5150 - 5875
Impedance	50 Ω				
VSWR*	1.5	1.5	1.5	1.5	2.0
Polarization	linear, vertical				
Gain (using a ø1 m ground plane)	6 dBi	8.5 dBi	9.5 dBi	9.5 dBi	8.5 dBi
Max. power	100 W (CW) at 50°C				

* Note that all VSWR values are guaranteed with and without ground plane.

Electrical Properties GPS/Galileo Antenna

Frequency range	1575.42 ± 1.023 MHz				
Impedance	50 Ω				
VSWR	1.6				
Polarization	circular, right				
Antenna gain (using ø1 m ground plane)	6 dBi (ref. to a circularly polarized isotropic antenna)				
Gain LNA	27 ± 2 dB				
Noise figure	≤ 2.7 dB, typ. 2 dB				
Operating voltage	3.0 to 5.5 VDC feed at centre conductor of GPS antenna				
Current consumption	≤ 25 mA, typ. 20 mA				
Out of band attenuation	> 20 dB at f_0 ± 50 MHz > 40 dB at f_0 ± 100 MHz				
Isolation between ports	> 30 dB	> 40 dB	> 40 dB	> 37 dB	> 28 dB

Mechanical & Environmental Properties

Dimensions	260 x 100 x 90 mm (10.24" x 3.94" x 3.54")
Weight	1.2 kg (2.65 lbs.)
Radome material	high impact acrylic styrene acrylonitrile (HRA150)
Radome colour	RAL 7043 (dark grey)
Back/base plane material	aluminium with polyurethane powder coating
Back/base plane colour	RAL 7043 (dark grey)
Operating temperature range	- 40°C to + 85°C
Storage temperature range	- 40°C to + 85°C

Meets the following requirements:
- Protected against the effects of continuous immersion in water IP68 (only if correctly installed).
- EN 50155, electronic equipment used on rolling stock.
- EN 50124-1, insulation coordination (27.5 kV AC and 3.8 kV DC).
- High voltage and high current protection according to Deutsche Bahn specifications (protection against short circuits of 40 kA).
- EN 50121-3-2, electromagnetic compatibility.

Available Types	**Article no.**	
1399.17.0044	84002818	2 x N female

Mounting Hardware	**Article no.**	
9091.99.0189	84008192	Adapter panel[1]

[1]: Allowing the replacement of the antenna from another antenna manufacturer, without any modifications of the original mounting holes located on the vehicle's roof. Using this interface, the mounting holes dimension for the broadband and GPS connectors have to be 25 ...38 mm and 35 ...38 mm respectively (ref. to mounting instruction). The antenna has to be secured using four M10 screws.

Documents	
01.02.0777	security instruction
Doc.N°. 0000197864	mounting instruction

Material: The antenna is designed according the military standard MIL-F-14072D, which guarantees a long-life without corrosion.
Mounting: On a plane conductive surface clear of paint and other contaminants.
To ensure a correct sealing between the antenna and the roof, the connector mounting hole dimensions have to be 17 ... 38 mm for the broadband antenna and 35 ... 38 mm for GPS antenna. The antenna has to be secured using four M8 screws.
Grounding and high voltage protection: All antenna parts are grounded to protect against lightning and catenary lines according to UIC 533.

12.2 Appendix 2 – VoyagerPlan RPI Long Term Plan Output

Note: the formatting has been preserved as imported from Notepad without adding extra spaces. This .RPI LTP is valid from 09/12/2007 until 13/12/2008 and was produced 7/11/2008 at 10:38:51. 9/12/2007 was a Sunday and the days run are shown from that date.

```
RPI     100     DEC07           IÉ      09-12-2007 00:00:00     13-12-2008 00:00:00
        07-11-2008 10:38:51     0
THD     A       IÉ      A121    99351   0       10-12-2007 00:00:00
        NYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNY
YYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYY
YYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYY
YYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYY
YYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYY
YNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYY
        BFSTC           06:50:00        CNLLY           09:05:00
TDT     A       1       -1                      DD/90
TSP     A       1       BFSTC                   06:50:00                        +00'00
        Y
TMV     A       2       BFSTC           LBURN                   06:50:00        07:01:00
                +00'00  +00'00  +00'00  +00'00
TMV     A       3       LBURN           LURGN                   07:01:00        07:12:00
                +00'00  +00'00  +00'00  +02'00
TMV     A       4       LURGN           PDOWN                   07:12:00        07:17:00
                +00'00  +00'00  +00'00  +00'00
TSP     A       5       PDOWN           07:17:00        07:19:00                +00'00  -02'00
        N       N
TMV     A       6       PDOWN           PPASS                   07:19:00        07:29:30
                +00'00  +00'00  +00'00  +00'00
TMV     A       7       PPASS           NEWRY                   07:29:30        07:39:00
                +00'00  +01'00  +00'00  +00'00
TSP     A       8       NEWRY           07:39:00        07:41:00                +00'00  -02'00
        N       N
TMV     A       9       NEWRY           DDALK                   07:41:00        07:57:00
                +00'00  +01'00  +00'00  +00'00
TSP     A       10      DDALK           07:57:00        07:59:00                +00'00  -02'00
        N       N
TMV     A       11      DDALK           DGHDA                   07:59:00        08:18:30
                +00'00  +00'00  +00'00  +00'00
TSP     A       12      DGHDA           08:18:30        08:20:30                +00'00  -02'00
        N       N
TMV     A       13      DGHDA           MSNEY                   08:20:30        08:29:30
                +00'00  +03'00  +00'00  +00'00
TMV     A       14      MSNEY           BBRGN                   08:29:30        08:33:30
                +00'00  +01'00  +00'00  +00'00
TMV     A       15      BBRGN           SKRES                   08:33:30        08:38:00
                +00'00  +02'00  +00'00  +00'00
TMV     A       16      SKRES           MHIDE                   08:38:00        08:45:00
                +00'00  +00'00  +00'00  +00'00
TMV     A       17      MHIDE           HWTHJ                   08:45:00        08:52:00
                +00'00  +04'00  +00'00  +00'00
TMV     A       18      HWTHJ           CNLLY                   08:52:00        09:05:00
                +03'00  +00'00  +00'00  +03'00
```

```
TSP    A      19     CNLLY        09:05:00      09:05:00              +00'00  +00'00
       N      N
TRF    A      1      -1     ACC   F
TRF    A      1      -1     RES   R
THD    A      IÉ     A122   99352 0      10-12-2007 00:00:00
       NYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNY
YYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYY
YYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYY
YYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYY
YYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYY
YNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYYNYYYYYY
       CNLLY        07:35:00      BFSTC        09:39:00
TDT    A      1      -1                   DD/90
TSP    A      1      CNLLY                07:35:00                    +00'00
       Y
TMV    A      2      CNLLY        HWTHJ                07:35:00      07:43:00
              +00'00 +00'00 +00'00 +00'00
TMV    A      3      HWTHJ        MHIDE                07:43:00      07:46:00
              +00'00 +00'00 +00'00 +00'00
TMV    A      4      MHIDE        SKRES                07:46:00      07:53:00
              +00'00 +00'00 +00'00 +00'00
TMV    A      5      SKRES        BBRGN                07:53:00      07:56:00
              +00'00 +00'00 +00'00 +00'00
TMV    A      6      BBRGN        MSNEY                07:56:00      07:59:00
              +00'00 +00'00 +00'00 +00'00
TMV    A      7      MSNEY        DGHDA                07:59:00      08:05:00
              +00'00 +00'00 +00'00 +00'00
TSP    A      8      DGHDA        08:05:00      08:07:00              +00'00  -02'00
       N      N
TMV    A      9      DGHDA        DDALK                08:07:00      08:30:00
              +00'00 +03'00 +00'00 +00'00
TSP    A      10     DDALK        08:30:00      08:32:00              +00'00  -02'00
       N      N
TMV    A      11     DDALK        NEWRY                08:32:00      08:48:00
              +00'00 +00'00 +00'00 +00'00
TSP    A      12     NEWRY        08:48:00      08:50:00              +00'00  -02'00
       N      N
TMV    A      13     NEWRY        PPASS                08:50:00      08:58:30
              +00'00 +00'30 +00'00 +00'00
TMV    A      14     PPASS        PDOWN                08:58:30      09:09:00
              +00'00 +00'00 +00'00 +00'00
TSP    A      15     PDOWN        09:09:00      09:11:00              +00'00  -02'00
       N      N
TMV    A      16     PDOWN        LURGN                09:11:00      09:19:00
              +00'00 +02'00 +00'00 +00'00
TMV    A      17     LURGN        LBURN                09:19:00      09:28:00
              +00'00 +00'00 +00'00 +00'00
TMV    A      18     LBURN        BFSTC                09:28:00      09:39:00
              +01'00 +00'00 +00'00 +00'00
TSP    A      19     BFSTC        09:39:00      09:39:00              +06'00  +00'00
       N      N
TRF    A      1      -1     ACC   F
TRF    A      1      -1     RES   R
```

VoyagerPlan is a train planning and diagramming tool from Atos Origin currently used by IÉ. It embodies the concepts of the Long Term Plan (LTP) and the Short

Term Plan (STP). The LTP in the case of IÉ is normally valid for six or twelve months. The STP can deal with shorter time domains down to the next day, STP's may include alteration for emergency Engineering work, for example. The STP is overlaid as a modification to the base LTP.

12.2.1 VoyagerPlan Output

The example above provides a small extract of the first two services listed in a VoyagerPlan .RPI extract file. This file embodies critical details relating to the LTP, a similar file is available for the STP. This report will not analyse the detailed properties of exporting from the .RPI file but will provide sufficient discussion to qualify the simplicity of automatically importing this data to a PIS. It would be possible to arrange regular extracts of the LTP (six monthly) and STP (daily) with the files available to the PIS ground system via FTP. The following parameters deserve an explanation:

Data identifier – each new line type is identified by the three characters

Train ID – On IÉ services, train IDs are in the form 'annn', where 'a' is a letter followed by three numbers. The following letters are valid for passenger services:

Code	Train Type
A	Mainline Passenger
B	Mainline Passenger Special
D	Diesel Suburban (Outer Destinations)
E	Electric (EMU)
P	Diesel Suburban (Inner Destination)

IÉ Passenger services Train IDs

The Train IDs are highlighted in bold, A121 and A122 for the two services shown above. The first two examples are Enterprise services but the principles apply to all services including DART. Note: Due to planned expansions on IÉ's network, the Train ID shall have future capability for the form 'annnn'. However, until the time in which a four number Train ID is required, the input of the Train ID shall be in the same manner as it is now, i.e. 'annn', but the number 0 shall be automatically placed right after the letter, e.g. if the driver is setting Train ID A123, it shall be displayed as A0123. The system shall be configurable to support full four numeric entry in the future.

TIPLOC – This is a unique location within the railway, identified by a unique code of five characters, and it may be a station, a junction, a signal box, depot or other defined railway location. By way of an example, the stations (stopping) of Train ID A121 have been highlighted in bold and italics, and their corresponding station names are listed over:

BFSTC	**Belfast Central**
LBURN	Lisburn
LURGN	Lurgan
PDOWN	**Portadown**
PPASS	Poyntzpass
NEWRY	**Newry**
DDALK	**Dundalk**
DGHDA	**Drogheda**
MSNEY	Mosney
BBRGN	Balbriggan
SKRES	Skerries
MHIDE	Malahide
HWTHJ	Howth Junction
CNLLY	**Dublin Connolly**

The stopping stations are shown in bold.

Days run – the day the service runs can be identified from a long sequence of Y and N characters, signifying Yes and No. In the example of A121, this service isn't run on Sundays as determined by the NYYY.. sequence, with Sunday 9th December 2007 as the start of the timetable. The same Train ID may be used with non-overlapping day run, i.e. A121 could have a different stopping pattern on Sundays.

Timings – timing are given for arrivals and departures at stopping station and also given for pass through stations and other timing points identified by TIPLOC codes.

12.2.2 VoyagerPlan Data Application for PIS

The LTP files are large at approx. 20MB each, the data is tab separated and textual. There is significant scope for compression and a basic ZIP compression will reduce the file to 2MB. There is scope for greater compression since many Train IDs will not be relevant to the particular fleets in question so some filtering of the Train IDs should be possible.

12.2.3 Implementation by the PIS supplier

Analysis of the .RPI file with reference to the Working Timetable allows the file format to be understood with little need for other support. Some support from IÉ IT on integration within the corporate IT network may be required.

12.3 Appendix 3 – Train Radio Interface

AEG Mobile Communication ZFM90-IR
Issue of train numbers via RS485 data interface
Supplement to "Data interface for issue of train numbers" specification

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AEG Mobile Communication Document history

Version	Date	Author	Comments
00.01	11.06.01	[redacted]	First draft
00.02	18.06.01		Sec. 4.6
00.03	20.06.01		Sec. 4.2
00.04	26.06.01		Sec. 4.8
00.05	11.07.01		Sec. 4.1
00.06	29.08.01		Sec. 4.5
00.07	12.09.01		Revision of RS485 protocol

1 Introduction

This document is the supplement for the specification mentioned in /1/ for transmission of train numbers via an RS422 data interface. The background is provided by the following changes to be implemented for IR:

• Linking via RS485 bus instead of RS422 point-to-point

• Expansion of the interface protocol with addressing information

• Modification of the interface protocol to support the RS485 bus structure

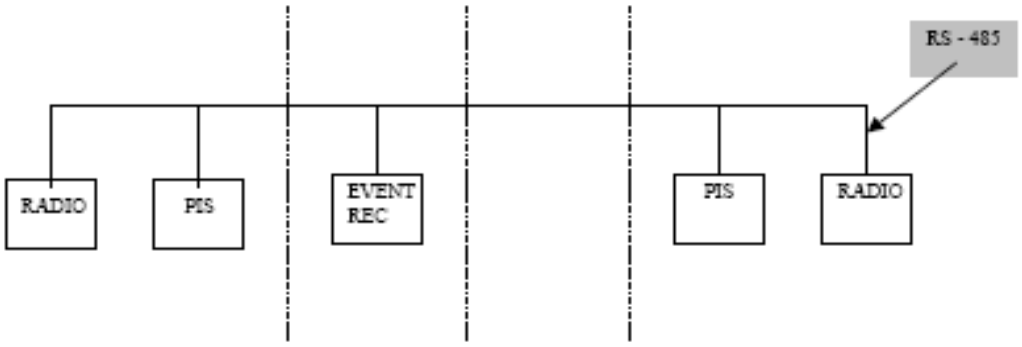
The following diagram illustrates the use of the ZFM90 referred to integration of the RS485 interface.
Only the active users have their own address on the bus. The passive users are, it is true, physically present on the bus, but do not participate in bus communications. The active users are determined by the direction of travel of the train. In a train consist with a number of locomotives > 1, only one locomotive can be active. All other locomotives are passive. The RS485 equipment of the active locomotive is correspondingly also active.
The following users will therefore be active:

1. ZFM90 radio of the active locomotive

2. PIS of the active locomotive

3. The train's event recorder

Where a number of the combinations described in the figure above, consisting of two locomotives with an interpositioned train-section in each case, are used in sequence, only the leading locomotive is active. The subsequent combinations in each case are passive. Both ZFM90s on these RS485 lines, which are in each case independent of one another, are therefore passive. In this case, the PIS of the appurtenant RS485 bus assumes the function of the ZFM90.



in which:
Radio ZFM90
PIS Passenger information system
Event Rec Event recorder

The document describes data transfer via the RS485 interface and the physical circumstances of the interface.

2 References

/1/ Specification for a data interface for issue of train numbers, ZFM90/ABB, V01.03/DE, 27.1.97
/2/ EEFAE-C78.94.112

3 Abbreviations and definitions

3.1 Abbreviations

DPR Dualported RAM
IR Irish Rail
µC µController 80C537 in the control system of the TFZ installation
Loco Locomotive
tbd to be defined
TFZ ZFM motive-power unit system
ZFM90 Mobile train-radio system 90, supply condition as since approx. 1990

3.2 Definitions

4 Properties of the interface

4.1 Physical properties

The interface has the following properties:

• Symmetrical insulated voltage interface in accordance with EIA RS485

• Asynchronous data transmission

• Semi-duplex operation, RS485 two-wire bus

A plug-connector with pin contacts is used as the connection to the ZFM90
Number of poles: 15
Plug type: Sub-D with enhanced number of contacts (VGA socket)
Plug type: female
Plug assignment:

Pin	Signal	Meaning	Level	Direction
1	VCC2	Voltage supply, secondary side	4.5 to 7.5V	Output
2	Y	Output 1 RS485	RS485	Output
3	A_JP	Terminator 120 Ohm for input	-	Output
4	A	Input 1 RS485	RS485	Input
5	GND2	Voltage supply, secondary side, ground	0V	Output
6	Z	Output 2 RS485	RS485	Output
7	Y_JP	Terminator 120 Ohm for output	-	Output
8	B	Input 2 RS485	RS485	Input
9	ADR1a	Input 1 for address bit 1	Max. 20V	Input
10	ADR3a	Input 1 for address bit 3	Max. 20V	Input
11	ADR2a	Input 1 for address bit 2	Max. 20V	Input
12	ADR3b	Input 2 for address bit 3	Max. 20V	Input
13	ADR2b	Input 2 for address bit 2	Max. 20V	Input
14	ADR1b	Input 2 for address bit 1	Max. 20V	Input
15	GND2	Voltage supply, secondary side, ground	0V	Output

The feed voltage necessary for activation of the opto-coupler can be obtained from the interface supply voltage. The wiring in the connecting-cable connector to the RS485 bus has the following appearance referred to the example described:

- Connect Pin 9 (ADR1a) to Pin 1 (VCC2)

- Connect Pin 14 (ADR1b) to Pin 5 or Pin 15 (GND2)

Since the RS485 interface is to be used in a two-wire bus structure, the following pins in the connector on the connecting cable for the RS485 bus must be connected to one another:

- Connect Pin 4 (A) to Pin 2 (Y)

- Connect Pin 8 (B) to Pin 6 (Z)

A jumper should be soldered between Pin 3 (A_JP) and Pin 4 (A) additionally if the bus is to be fitted with a terminator.

4.2 Character format

The following format is used:

- 1 start bit

- 8 information bits, order: LSB first

- Parity: Even

- 1 stop bit

4.3 Control characters used

See /1/ for the control characters used

4.4 Data format

The basic structure corresponds to the data format described in /1/. Address information for the respective user must be transmitted additionally, however, since the interface is operated on an RS485 bus. A telegram is thus composed as follows:

SOH	STX	ADZ	ADQ	6-digit ASCII train number	ETX	LP	EOT

in which:
SOH Start of data block
STX Start of information section
ADZ Target address as ASCII value (30h to 37h for Address 0 to 7)
ADQ Source address as ASCII value (30h to 37h for address 0 to 7)
Train number 6-digit train number, ASCII coded
ETX End of information section
LP Longitudinal parity (values from 00h to FFh)
EOT End of data block

The longitudinal parity is generated as follows:
Exclusive-Or-Link of individual bytes STX, ADZ, ADQ, train number, ETX.
See /1/ for details.

4.5 Telegram types used

Serial No.	Telegram	Meaning
1	**SOH** **STX** **ADZ** **ADQ** **Train number 6-digit ASCII** **ETX** **LP** **EOT**	Transfer of current train number Reply: ACK Acknowledge telegram (Serial No. 2) Possible target addresses (ADZ): 1, 2 Possible source addresses (ADQ): 0 (depending on the connection of the address inputs)
2	**SOH** **ACK** **ADZ** **ADQ** **EOT** in which: ADZ Target address from the viewpoint of the acknowledgement-sending element ADQ Source address of the acknowledgement-sending element	Acknowledgement to telegram Possible target addresses (ADZ): 0 (depending on the connection of the address inputs) Possible source addresses (ADQ): 1, 2

4.6 Issue of addresses on the RS485 bus

The following table is a proposal for the issue of the RS485 bus addresses:

User	Address
ZFM90 active	0
PIS	1
Event recorder	2

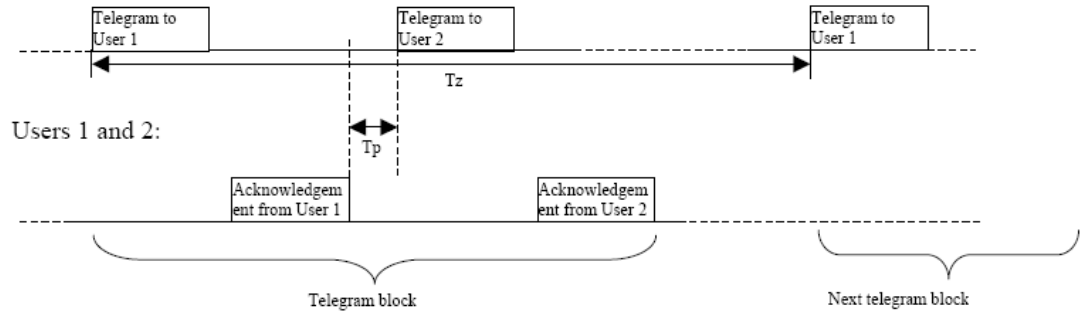
After activation of the interface, the ZFM90 will attempt to transmit the train number currently set in sequence to the users with addresses 1 and 2. The ZFM90 expects from each of the users an ACQ acknowledgement telegram. The ZFM90 will repeat transmission of the train number to any user from whom no valid acknowledgement is received. If transfer of train number fails with not less than one user (no valid ACK acknowledgement received after three attempts one after the other), this is notified to the locomotive driver by a "*" symbol prefixed to the train number. Transfer of the train number is deemed successful after transmission of the train number to both users provided both users have acknowledged the transfer.

4.7 Procedure

The following modifications must be performed vis-à-vis the procedure described in /1/ as a result of the change in the physical configuration to an RS485 bus structure. Firstly, cyclical display of the Readiness-for-reception status by means of XON and XOFF is deleted. Instead, the train-number telegram will be transmitted cyclically with a cycle time Tz to the users with addresses 1 and 2. In this context, a complete data transfer between the ZFM90 and both users, including acknowledge telegrams,

is defined as a telegram block. Cycle time Tz determines the time between the start of a telegram block and the start of the next telegram block.
The following diagram illustrates the procedure in principle:

ZFM90:



in which:
Tz Cycle time
Tp Pause time following end of a valid acknowledgement up to the start of transmission of the train-number telegram to the user with Address 2

Readiness-for-reception status is determined directly by means of reception of a telegram acknowledgement from the bus partners.

In addition, the information for the source and target addresses is inserted into the telegram structure. The cross parity obtained up to now from the individual information bytes STX, train number and ETX is deleted.
The basic functional procedures largely conform with the procedural diagram described in /1/, however. The states described under /1/ will therefore be retained for further explanation of the procedures.
The individual state types are described in detail below.

4.7.1 State 0 – Basic state

The basic state is characterized by the fact that the interface is ready for transmission and for reception. Departure from the basic state occurs in case of the following occurrences:

- Request from ZFM90 for transmission of train number

Return to the basic state occurs as a result of the following occurrences:

- Reception of the ACK telegrams after complete transmission of the data block to users with addresses 1 and 2

- After breakdown of an ACK telegram reception as a result of a transmission error (e.g. timeout, incorrect parity, incorrect telegram structure)

- After n attempts to transmit a telegram: Value for n: n = 3. This means that the telegram to be transmitted to a bus partner will be repeated a maximum of twice following the first failure to receive a telegram acknowledgement. This procedure applies to both the users to be contacted

4.7.2 State 1 – Transmit data block

Transmission of a data block is always performed integrally, starting with the SOH control character. The target address valid from the point of view of the sender and the own source address is inserted into the telegram to be transmitted. The state end with transmission of the final character EOT.

4.7.3 State 2 – Waiting for acknowledgement

In this state, the data terminal device is waiting for the telegram acknowledgement from the other end. Waiting time is: Tq = 50 ms, counting from the end of the transmission of EOT.

The address information is checked after receipt of an acknowledgement:

- Target address in telegram identical to own address

- Source address in telegram identical to target address of the data block to be acknowledged

- Timeout breaktime

Departure from State 2 occurs either if a correct acknowledgement has been received or time Tq has expired. if Tq has expired, a changeover to State 1 occurs for the purpose of repetition of the data block if the maximum number of data blocks to be transmitted has not yet been reached.

4.7.4 State 3 – Receive data block

In State 3, a completely received data block is checked for correctness. Only the acknowledgement to a train-number telegram from the ZFM90 is legal as the reception data block. The check criteria are:

- Correct frame

- Target address in the data block equates to the data terminal device's own address

State 3 occurs after reception of an SOH and departure from it occurs when the following criteria are fulfilled:

- Target address not the same as own address

- Target address same as own address and final byte of a data block received (EOT).

4.7.5 State 5 – Waiting for Readiness-for-reception

Unlike the State 5 described in /1/, Readiness-for-reception of the other end is no longer indicated by means of the two control characters XON and XOFF. Readiness-for-reception by the respective other end can be checked as follows:
Readiness-for-reception on the part of partners with Addresses 1 and 2:
The ZFM90 recognizes Readiness-for-reception by the partners stated solely on the basis of the acknowledgement received in response to a train-number telegram.
Readiness-for-reception on the part of the ZFM90:

The remaining partners recognize the Readiness-for-reception of the ZFM90 on the basis of the train-number telegrams transmitted cyclically.

12.4 Appendix 4 – Irish rail network station names

Existing Network			
English	**Note**	**Irish**	**Note**
Adamstown		Baile Adaim	
Arklow		An tlnbhear Mór	
Ashtown		Baile an Ásaigh	
Athenry		Baile Átha an Rí	
Athlone		Baile Átha Luain	
Athy		Baile Átha Í	
Attymon		Áth Tíomáin	
Bagnalstown		Muine Bheag	
Balbriggan		Baile Bhrigín	
Ballina		Béal an Átha	
Ballinasloe		Béal Átha na Sluaighe	2
Ballybrophy		Baile Uí Bhróithe	
Ballycullane		Baile Uí Choileáin	
Ballyhaunis		Baile Átha hAmhnais	
Ballymote		Baile an Mhóta	
Banteer		Bántír	
Bayside		Cois Bá	
Belfast		Béal Feirste	
Birdhill		Cnocán an Éin Fhinn	2
Blackrock		An Charraig Dhubh	
Booterstown		Baile an Bhóthair	
Boyle		Mainistir an Búille	
Bray		Bré	
Bridgetown		Baile an Droichid	
Broombridge		Droichead na Scuab	
Cahir		An Chathair	
Campile		Ceann Poill	
Carlow		Ceatharlach	
Carrick-on-Shannon		Cora Droma Rúisc	
Carrick-on-Suir		Carraig na Siúire	
Carrigaloe		Carraig an Ló	
Castlebar		Caisleán an Bharraigh	
Castleconnell		Caisleán Uí Chonaill	
Castleknock		Caisleán Cnucha	
Castlerea		An Caisleán Riabhach	
Charleville		An Ráth	
Cherry Orchard		Gort na Silíní	
Clara		Clóirtheach	
Claremorris		Clár Chlainne Mhuiris	
Clondalkin		Cluain Dolcáin	
Clonmel		Cluain Meala	
Clonsilla		Cluain Saileach	
Clontarf Road		Bóthar Cluain Tarbh	
Clonydonnin		Cúil Mhuine	
Cloughjordan		Cloch Shiurdáin	

Cobh		An Cóbh	
Colloney		Cúil Mhuine	
Connolly Station		Stáisiún Uí Chonghaile	2
Coolmine		Cúil Mín	
Cork		Corcaigh	
Dalkey		Deilginis	
Docklands		Dugthailte	
Donabate		Domhnach Bat	
Drogheda		Droichead Átha	
Dromod		Dromad	
Drumcondra		Droim Conrach	
Dún Laoghaire		Dún Laoghaire	
Dundalk		Dún Dealgan	
Edgeworthstown		Meathas Troim	
Enfield		An Bóthar Buí	
Ennis		Inis	
Enniscorthy		Inis Córthaidh	
Farranfore		An Fearann Fuar	
Fota		Fóta	
Galway		Gaillimh	
Glenageary		Gleann na gCaorach	
Glounthaune		An Gleanntán	
Gorey		Guaire	
Gormanston		Baile Mhic Gormáin	
Gort		An Gort	
Grand Canal Dock		Dug na Canálach Móire	
Greystones		Na Clocha Liatha	
Harmonstown		Baile Hearman	
Hazelhatch & Celbridge	1	Collchoill /Cill Droichid	1
Heuston Station		Stáisiún Heuston	
Howth		Binn Éadair	
Howth Junction Donaghmede	2	Gabhal Bhinn Éadair/Domhnach Míde	1
Kilbarrack		Cill Bharróg	
Kilcock		Cill Choca	
Kilcoole		Cill Chomhghaill	
Kildare		Cill Dara	
Kilkeny		Cill Chainnigh	
Killarney		Cill Airne	
Killester		Cill Easra	
Killiney		Cill Iníon Léinín	
Lansdowne Road		Bóthar Lansdún	
Laytown		An Inse	
Leixlip Confey		Léim an Bhradáin Confey	2
Leixlip Louisa Bridge		Léim an Bhradáin Louisa	2
Limerick		Luimneach	
Limerick Junction		Gabhal Luimnigh	
Lisburn		Lisburn	
Littleisland		An tOileán Beag	
Longford		Longfort	
Lurgan		Lurgan	
Malahide		Mullach Íde	
Mallow		Mala	

Manulla Junction		Gabhal Mhaigh Nulla	
Maynooth		Maigh Nuad	
Millstreet		Sráid an Mhuilinn	
Monasterevin		Mainistir Eimhín	
Mosney		Maigh Muirí	
Mullingar		An Muileann gCearr	
Nenagh		An tAonach	
Newbridge		Droichead Nua	
Newry		Newry	
Pearse Station		Stáisiún na bPiarsach	
Phoenix Park		Páirc an Fhionnuisce	
Portadown		Portadown	
Portarlington		Cúil an tSúdaire	
Portlaoise		Port Laoise	
Portmarnock		Port Mearnóg	
Raheny		Ráth Eanaigh	
Rathdrum		Ráth Droma	
Rathmore		An Ráth Mhór	
Roscommon		Ros Comáin	
Roscrea		Ros Cré	
Rosslare Europort		Calafort Rosláir	
Rosslare Strand		Trá Ros Láir	
Rush & Lusk		An Ros & Lusca	
Rushbrooke		Rinn an Chabhlaigh	
Sallins & Naas		Na Solláin & Nás	
Salthill & Monkstown		Cnoc an tSalainn/Baile na Manach	1
Sandycove & Glasthule	1	Cuas an Ghainimh&Glas Tuathail	1
Sandymount		Dumhnach Thrá	
Seapoint		Rinn na Mara	
Shankill		Seanchill	
Skerries		Na Sceirí	
Sligo		Sligeach	
Sutton		Cill Fhionntáin	
Sydney Parade		Paráid Sydney	
Tara street		Sráid na Teamhrach	
Templemore		An Teampall Mór	
Thomastown		Baile Mhic Andáin	
Thurles		Durlas	
Tipperary		Tiobraid Árann	
Tralee		Trá Lí	
Tuam		Tuaim	
Tullamore		Tulach Mhór	
Waterford		Port Láirge	
Wellingtonbridge		Droichead Eoin	
Westport		Cathair na Mart	
Wexford		Loch Garman	
Wicklow		Cill Mhantáin	
Woodlawn		Móta	

Planned Network Extensions for DART

English	Note	Irish	Note
Baldoyle/Clongriffin	1	Baile Dúill/Cluain Grífín	1
Kildare Line			
Kishogue		An Chiseog	
Middleton Line			
Carrigtwohill		Carraig Thuathail	
Middleton			
Western Corridor			
Ardrahan		Ard Raithin	
Craughwell		Creachmhaoil	
Gort		An Gort	
Oranmore		Órán Mór	
Sixmilebridge		Droichead Abhann Ó gCearnaigh	2

Note 1: Station name could be broken down into two lines for the case of FOT1 and FOT2 displays.
Note 2: Possible station abbreviations to be advised by IÉ.

12.5 Appendix 5 – IÉ Approval Process v2.10

IÉ Rolling Stock Projects

Approvals Process

Version: 2.10
Date: 27th April 2009

Revisions

ISSUE	DATE	REVISED SECTIONS	DRAFTED BY	CHECKED BY
2.4	31/7/08		[redacted]	-
2.5	08/8/08		KM	-
2.6	18/8/08		KM	[redacted]
2.7	25/8/08		KM	-
2.8	07/11/08	CHANGE IN TITLE. TYPO RE IA CHANGED - 3.1 (M), (N), (O) & 3.2	KM	-
2.9	17/12/08	CHANGE OF TERM 'VERIFICATION BODY' (VB) TO 'CONTRACTOR COMPLIANCE BODY' (CCB).	KM	-

2.10	**27/4/09**	**ADDITION OF TABLE OF CONTENTS AND DEFINITIONS PAGE.**	**KM**	**-**

Approvals Process

1 General Principle:

1.1 Where TSIs are applicable the approval process shall be a conformity assessment that is performed by the Notified Body (NoBo). The NoBo is appointed by the Contractor.

1.2 Where there are no TSIs the approval process shall be performed by the CCB (appointed by the Contractor), IÉ and the IVB (appointed by IÉ).

1.3 In general terms the Contractor Compliance Body (CCB) shall have a responsibility for ensuring the design and construction of the Units by the Contractor meets the requirements of the technical specification and applicable Standards and Law, whilst IÉ and the IVB will assess the safety management system for the contract, interfaces with IÉ's maintenance and operational activities, IÉ's Operational Safety Case and shall act as a shadow of the RSC, in order to test whether the submissions to the RSC are likely to gain approval.

2 Iarnród Éireann (IÉ):

2.1 IÉ is the owner and operator of the Units which the Contractor shall supply. As the railway operator, it is IÉ's responsibility to ensure that a New Rolling Stock Assessment (NRSA) is submitted to the RSC. The NRSA is to be prepared by the Contractor. IÉ will supply, for inclusion in the NRSA by the Contractor, all the information for which IÉ is responsible.

2.2 IÉ shall appoint a Safety Manager to support the generation of the NRSA by the Contractor and ensure integration of IÉ's submissions into the NRSA. The Safety Manager shall also ascertain if IÉ's Operational Safety Case is affected by the new fleet. If it is found to be affected they shall coordinate all Contractor and IÉ submission deemed necessary by the Safety Manager to facilitate required adjustments to IÉ's Operational Safety Case.

3 Contractor:

3.1 It is an obligation of the Contractor, under the Framework Agreement, to obtain all the approvals, letters and certifications necessary such that the Units can be operated in passenger service. These shall include but not be limited to:

a) An RSC Letter of Acceptance for Detailed Design.

b) An RSC Letter of Acceptance for Testing and Commissioning.

c) An RSC Letter of Acceptance for Passenger Service.

d) All Certificates of Verification from NoBo.
e) 'EC' Declaration of Verification to European Directive 2008/57/EC and any other applicable European Directives for the rolling stock and subsystems.
f) An IVB Letter of Conformance for Vehicle Design.
g) An IVB Letter of Conformance for Vehicle Construction.
h) An IVB Letter of Conformance for Testing and Commissioning.
i) An IVB Letter of Conformance for Passenger Service.
j) An Iarnród Éireann Route Availability Approval (route clearance).
k) An Iarnród Éireann approval for the Operational Safety Case of testing, commissioning and passenger service stages (Company Standard 56).
l) All Independent Professional Review reports such that they are in accordance with Railway Safety Act 2005 (ref. RSC-G-015).
m) An Independent Professional Review Report for Detailed Design.
n) An Independent Professional Review Report for Testing and Commissioning.
o) An Independent Professional Review Report for Passenger Service.

3.2 It is an obligation of the Contractor, under the Framework Agreement, to employ a Notified Body (NoBo) and a Contractor Compliance Body (CCB), as well as Independent Professionals as required under Railway Safety Act 2005 (ref. RSC-G-015). The appointment of the NoBo, CCB and Independent Professionals shall be subject to agreement with IÉ. In addition to its other roles the CCB may also act as the Independent Professional. IÉ must be satisfied that the Independent Professional is suitably qualified and independent. The NoBo must demonstrate to IÉ the requisite knowledge and competence to assess compliance of the Units to the Technical Specification for Interoperability (TSI).

3.3 It is an obligation of the Contractor, under the Framework Agreement, to appoint a Safety Manager who will ensure that the full NRSA is produced in line with all applicable Standards and Law. The Safety Manager will ensure that all the Contractors safety obligations in relation to this project are fulfilled in a timely manner

3.4 The CCB must demonstrate the requisite knowledge and competence to assess the safety management processes applied, the compliance of the Units to all applicable Standards and Law and to assess the safety of the Units for passenger service operation through the compilation of the NRSA. The NoBo and CCB may be the same entity, subject to the demonstration of suitable clarity and definition of roles and appropriate control measures.

3.5 It is an obligation of the Contractor to ensure that the CCB and NoBo carry out any such verification, validation and due diligence reviews, audits, investigations, observations and tests such as will be required to ensure that the Contractor has fully complied with the Technical Specification and the applicable Standards and Law such that successful applications for approvals can be made to the RSC.

3.6 It is an obligation of the Contractor to regularly make submissions to IÉ and its appointed Independent Verification Body (IVB) such as would have to be made to the RSC for safety approvals. These submissions will be

structured as formal submissions such as would be made to the RSC and will be assessed by the IVB as if it were final submissions. No submissions will be made directly to the RSC by the Contractor or any of his sub-contractors without the prior approval of IÉ and the IVB.

3.7 The contractor must identify the Standards and Law that have been applied to the vehicles and must produce a clause by clause statement, along with test procedures, results and other relevant documentation, to show compliance to those Standards and Law in its submissions to the IVB. The Standards and Law must first be selected from the Standards and Law that are listed in the Technical Specification. If the contractor wishes to apply an alternative standard to one in the technical specification he shall apply for a deviation.

3.8 It is an obligation of the Contractor to supply any such required information, drawings, documentation, technical reports, technical descriptions, certifications, test procedures and results or supporting information applicable to the Units as required by the IVB in its role to assess and verify the compliance of the Units to the Standards and Law as defined in the Technical Specification.

3.9 It is an obligation of the Contractor to ensure at all times that any information supplied to and used by the NoBo is also supplied simultaneously to the IVB i.e. the IVB shall be copied on all communications/information going between the NoBo and the Contractor

3.10 It is an obligation of the Contractor, under the Framework Agreement, to ensure that any information and or decisions required from IÉ in order to complete the NRSA is requested at least 28 days prior to when the information is required.

3.11 The IVB shall have 21 days to review the information from the Contractor. The IVB shall consider whether the information that is supplied is adequate and shall respond as follows:

a) If the IVB considers the information is sufficient the response shall confirm this.

b) If the IVB considers the information shows there is a non-compliance with the obligations of the Contractor the response shall indicate the area of the non-compliance and give reasons.

c) If the IVB considers the information is insufficient, the IVB will indicate the nature of additional information that is required and shall give reasons.

d) The Contractor shall submit revised or additional information that address any issues that are raised by the IVB. This will then be reconsidered by the IVB and a further response shall be provided within 21 days.

3.12 It is an obligation of the Contractor, under the Framework Agreement, to ensure that all the IÉ approvals required to support the Operational Safety Case are achieved according to the timelines agreed. These are the CME approvals at each Design review stage and the IÉ safety department stage approvals of design, testing, commissioning and passenger service

4 Notified Body (NoBo):

4.1 The Contractor shall contract a notified body with the obligation to assess the units against all applicable TSIs. The notified body shall issue a Certificate of Verification for the Units and a Technical File. The relevant Directives are transposed into Irish law under SI 61 of 2004, SI 212 of 2006 and SI 61 of 2008.

4.2 Where TSIs refer to Contracting Entity it shall mean IÉ. Where the TSIs refer to the main contractor it shall mean the Contractor. The Contractor shall be considered to be the main contractor that is responsible for the whole project (including in particular responsibility for subsystem integration). The Contractor shall operate a quality management system for manufacture and final product inspection that would be sufficient to allow either module SD or module SH2 of the TSIs to be applied.

4.3 The Contractor shall ensure that the flow of information shall follow Figure 1: EU Route. All information which is required by the NoBo as part of its approval process shall also be supplied to the IVB. All correspondence between the Contractor and NoBo in relation to the approval process must also be distributed through the IVB.

4.4 In accordance with Clause 3.7, the Contractor shall submit any declarations, derogations and supporting documentation to the RSC to gain formal approval for the rolling stock on behalf of IÉ.

4.5 The Contractor shall contract a NoBo with the specific obligation to supply 6-weekly “Approval Progress Reports” containing all the relevant information (as defined by IÉ) on the progress with its approval process to IÉ, the IVB and the CCB. Any approvals that are not progressing to schedule and any elements that are not likely to gain compliance under the NoBo’s remit must be specifically highlighted and identified in such Approval Progress Reports.

5 Contractor Compliance Body (CCB):

5.1 The Contractor shall contract a CCB, that is independent of the Contractor, with the specific obligation to verify that the Units have been designed, built and can be maintained and operated in accordance with the applicable Standards and Law as referenced in the Technical Specification and according to the requirements of the RSC Guidelines.

5.2 The Contractor shall contract a CCB with a specific obligation to compile NRSA submissions to gain Letter of Acceptance for Detailed Design, Letter of Acceptance for Testing and Commissioning and Letter of Acceptance for Passenger Service, and any other approvals required in accordance with the

RSC's Guidelines and such other guidelines that the RSC may issue from time to time. The Contractor, supported by the CCB, shall make full and complete NRSA submissions to IÉ and the IVB prior to making any submissions to the RSC. This shall be conducted in accordance with Figure 2: NRSA Route.

5.3 The Contractor shall contract a CCB with the specific obligation to compile and document a "Rolling Stock Technical File", the format of which will be agreed with IÉ, that will contain all the relevant information on the Units such as drawings, documentation, technical reports, technical descriptions, component and system information, test procedures and results or supporting information and clause by clause as is required by the IVB in its role to assess the compliance of the Units to the Standards and Law as defined in the Technical Specification.

5.4 The CCB shall:

a) Ensure the Units are designed and built in accordance with the technical specification and any Standards and Law that are referred to within the specification.
b) Ensure that there is correct integration of the TSI requirements with the remaining project related safety requirements and that there are no "gaps or contradictions" between these.
c) Ensure the completeness of the overall project related safety requirements.
d) Ensure that the Contractor employs an appropriate quality management system in accordance with the Technical Specification and the Standards and Law called up therein, and that this is complied with throughout the design, build, testing, commissioning and warranty phases of the project.
e) Ensure that maintenance and overhaul manuals are provided that meet the requirements of the technical specification and are sufficient to maintain the units in a safe condition and to ensure the units can meet reliability targets.
f) Ensure that operating manuals are provided that meet the requirements of the technical specification and are sufficient to operate the units safely and reliably.
g) Assess the design and construction of the Units against the requirements of the NRSA.
h) Assess the manuals for the Units against the requirements of the NRSA.

5.5 The CCB shall assess and record all non-compliances, concessions and derogations. This should include the preparation of a comprehensive list of all these deviations. These non-compliances, concessions and derogations shall have been assessed for any impact on safety, maintenance, operations, etc.

5.6 The Contractor shall contract a CCB with the specific obligation to supply 6-weekly "Approval Progress Reports" containing all the relevant information (as defined by IÉ) on the progress with its approval process to IÉ, the IVB and the NoBo. Any approvals that are not progressing to schedule and any elements that are not likely to gain compliance under the CCB's remit must be specifically highlighted and identified in such Approval Progress Reports.

6 Independent Verification Body (IVB):

6.1 IÉ shall appoint an Independent Verification Body (IVB) to independently assess that all the requirements of the NRSA have been met.

6.2 IÉ shall employ an IVB to:

a) Assess the suitability of the Contractors Safety Management System.
b) Assess all required elements of the NoBo and CCB assessments are being adequately performed.
c) Conduct whatever investigations, audits, checks and other such actions required to independently verify that the Contractor is adhering to the quality required in accordance with the Technical Specification.
d) Assess the Contractors and IÉ's safety submissions in the role of an Independent Assessor in accordance with Railway Safety Act 2005 (ref. RSC-G-015) and to submit suitable associated reports to IÉ as required.
e) Assess that where the design responsibility of the supplier interfaces with IÉ's technical requirements, IÉ's maintenance, IÉ's operations and IÉ's Operational Safety Case that IÉ and the Contractor jointly fulfil the project related safety requirements.
f) Assess that when IÉ is taking over the design responsibility from the Contractor, that IÉ fulfils all project safety related requirements.
g) Assess from a higher level perspective "that there are no gaps or contradictions" in the completeness of the overall set of project related safety requirements and associated evidence.

6.3 The IVB shall provide regular reports of compliance (in line with the NRSA stages).

6.4 The IVB shall receive the NRSA submissions from the CCB and IÉ (IÉ Operational Safety Case), and shall take cognisance of the assessments complete or outstanding with the NoBo. The IVB shall undertake a detailed review of the entire project so as to ensure the complete safety approval of the rolling stock.

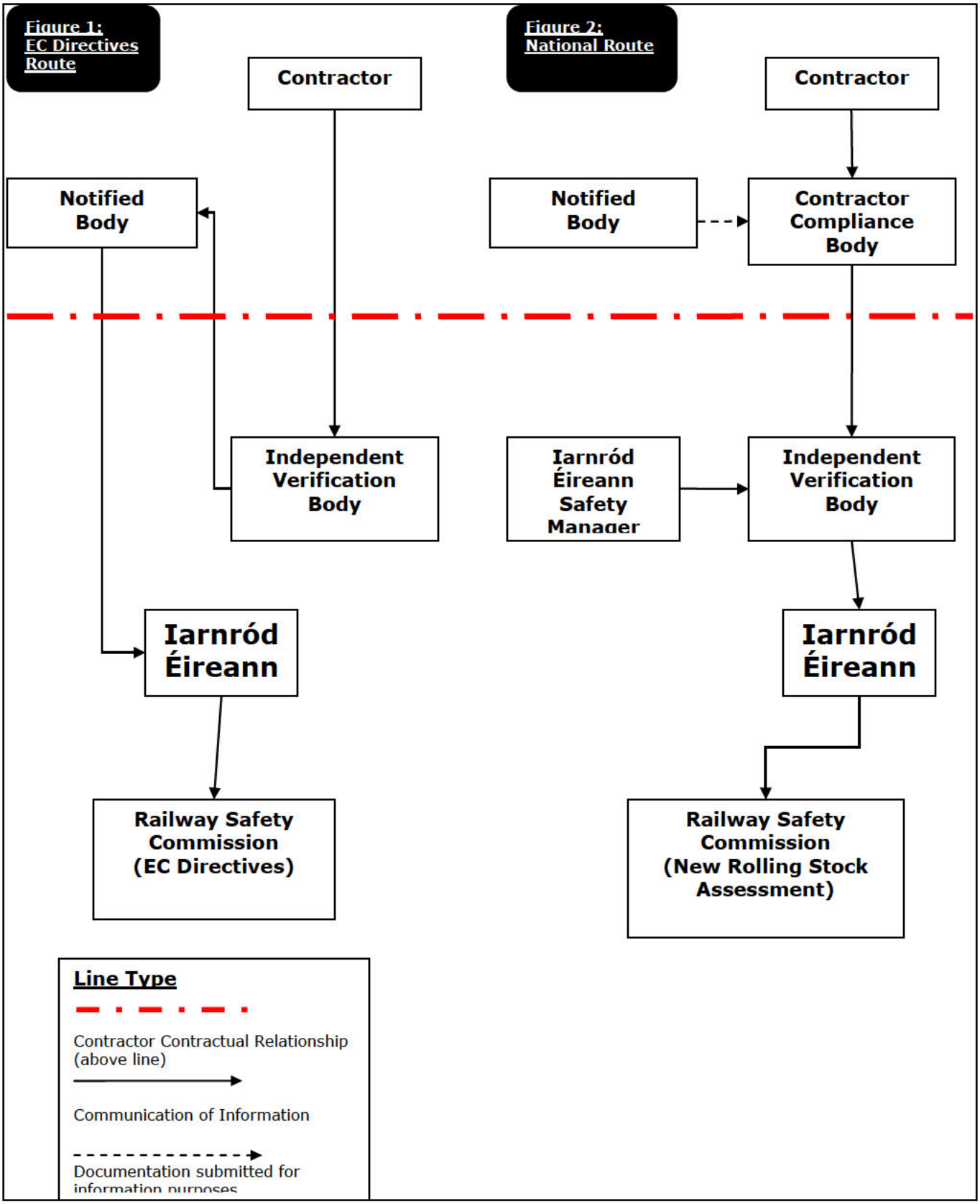
6.5 The IVB shall write a high level verification report after doing both the high and low level verifications in line with Technical Specification and referenced Standards and Law.

6.6 The IVB shall carry out its assessments as if it were acting as the National Safety Authority (RSC) and shall do this in an intrusive way as deemed necessary.

7 Railway Safety Commission (RSC):

The RSC was established under the authority of the Railway Safety Act. 2005 and its role is defined therein and as amended by Irish Statutory Instrument 61 2008. To this end the RSC have produced a number of guidance documents, available at www.rsc.ie , that explain its role and what the Contractor must do in the design and build, and how they are to prove to the RSC's satisfaction that the rolling stock supplied to IÉ are safe to operate in passenger service on the IÉ network.

Process Flow Diagram



12.6 Appendix 6 – IÉ Vehicle Maintenance Instruction (format example)

Iarnród Éireann	**Vehicle Maintenance Examination 8100 EMU Fleet**	Reference No.	ME/TS/ES/81/VMI/Introduction
		Issue No.	1
DART		Revision	0
		Date Issued	September 2008
		Status	Draft
		Prepared By	[redacted]
		Checked By	Name/IÉ
C.M.E. Department		Authorised By	Name/IÉ

Introduction

This Maintenance Instruction is for the Class 8100 Electrical Multiple Units operated by IR. It applies to preventative scheduled maintenance performed on these vehicles

Unit/Vehicle Information

This Schedule applies to the following Iarnród Éireann Class 8100 Electrical Multiple Units:

PC	DT	PC	DT
8101	8301	8121	8321
8102	8302	8122	8322
8103	8303	8123	8323
8104	8304	8124	8324
8105	8305	8125	8325
8106	8306	8126	8326
8107	8307	8127	8327
8108	8308	8128	8328
8109	8309	8129	8329
8110	8310	8130	8330
8111	8311	8131	8331
8112	8312	8132	8332
8113	8313	8133	8333
8114	8314	8134	8334
8115	8315	8135	8335
8116	8316	8136	8336
8117	8317	8137	8337
8118	8318	8138	8338
8119	8319	8139	8339
8120	8320	8140	8340

PC= Power Car, DT = Driving Trailer Car

3. Approved Abbreviations

AEE Axle End Earthing
APC Automatic Power Control
ARL (height) Above Rail Level
ASIC Air Suspension Isolating Cock
ATP Automatic Train Protection
ATPIS Automatic Train Protection Isolation Switch
BCIC Brake Cylinder Isolating Cock
BIC Brake Isolating Cock
BSR Brake Support Relay
BSRIC Brake Supply Reservoir Isolating Cock
CAN Control Area Network
CFA Call For Aid
CGIC Compressor Governor Isolating Cock
COI Component Overhaul Instruction
CPB Couple Push Button
CPU Central Processing Unit
DCS Doors Closed Switch
DLS Doors Locked Switch
DM Driving Motor car
DS Driver's cab / Saloon (vehicle)
DSD Drivers Safety Device
DT Driving Trailer car
DVR Digital Video Recorder
EAD Emergency release/Access
EBR Emergency Brake enable Relay
EBS Emergency Brake Switch
ECU Electronic Control Unit
EIC Emergency coupling point Isolating Cock
EMU Electrical Multiple Unit
EP Electro-Pneumatic
ER Earthing Relay
ERR Earthing Repeater Relay
FI Fault Indication (relay)
GPS Global Positioning System
HSCB High Speed Circuit Breaker
IMS Interface Management System
HVC Horn Valve Isolating Cock
LSR Low Speed Relay
MA Motor Alternator
MCB Main Circuit Breaker
MEMS INS Micro-Electro-Mechanical Inertial Sensor
MMI Man Machine Interface
MRIC Main Reservoir Isolating Cock
MRP Main Reservoir Pipe
MRPCIC Main Reservoir Pipe Coupling Isolating Cock
MS Master Switch
NRV Non-Return Valve
OHLE OverHead Line Equipment
PA Public Address
PAU Passenger Alarm Unit
PIS Passenger Information System
PBC Power/Brake Controller

PBIC Parking Brake Isolating Cock
PEA Passenger Alarm System
PTT Push To Talk
SWSIC Screen Wiper and Washer Supply Isolating Cock
TP Test Point
VCB Vacuum Circuit Breaker
VIS Vigilance Isolation Switch
WSP Wheel Slide Protection

4. Glossary of Terms

ADJUST	Correct to bring a part within defined limits.
CHANGE	Remove the original and fit a new or overhauled part or assembly in its place.
CHECK	To compare against a known parameter.
CLEAN	Remove all dirt and deposits.
DISCARD	To dispose of used materials in a safe and authorised manner.
DISMANTLE	Take to pieces.
EXAMINE	Determine general condition before repair, e.g. wear; cracks; splits; leaks; scoring; corrosion; erosion; breaks; distortion; looseness.
INSPECT	Determine general condition before, during or after repair (e.g. completeness, security, position).
OVERHAUL	Do what is necessary to make an assembly, or sub-assembly reusable, i.e. dismantle, strip, clean, examine, fit new parts, repair, re-assemble, test and inspect.
REASSEMBLE	Put together.
RECORD	Put down in writing a finding from examination, test, inspection, special checks.
RECTIFY	To set right.
REFIT	Put back and reconnect.
REFURBISH	To overhaul and enhance an existing assembly by incorporating design improvements.
REMOVE	Disconnect and take off.
RENEW	Remove and scrap the original part and put a new part in its place.
REPAIR	Restore an original part to the condition by hand-tooling, machining, building-up, welding, patching, bending, setting, heat-treating, re-securing, etc.
STRIP	Remove covering, i.e. paint; polish; fabric etc.
TEST	Prove correct operation by trial.

Iarnród Éireann
Irish Rail

Reference No.	CME-85xx-Spec
Version	FINAL_V2
Operative Date	08-07-2020
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Prepared by	[redacted]
Checked by	[redacted]
Approved by	[redacted]

Technical Specification

Passenger Information System

Upgrade for DART EMU Class 8500/8510/8520 fleets.

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Appendices to Specification:

	Title
A	IÉ Safety Management System RU SMS 014
B	Electrical Schematics
C	Mechanical Drawings

1- Introduction & Current Arrangement

1.2 Iarnród Éireann - Irish Rail (IÉ) procured a fleet of 4 car EMUs from Tokyu Car (Japan) in 2000-2004. These are the Class 8500 series, Class 8510 series and Class 8520 series EMUs. The fleet operates the Dublin DART commuter service powered by overhead 1500v DC.

1.3 Each EMU set is formed of 4 cars permanently coupled. There are 4 x 8500 units, 3 x 8510 units and 10 x 8520 units. Therefore a total of 17 x units from 68 cars.

1.4 All EMUs are based at Fairview EMU depot Dublin for all routine and heavy maintenance.

1.5 The current Passenger Information System (PIS) for the 8500 is supplied by Vemisa, the 8510 is supplied by Vemisa and the 8520 is supplied by Ikusi. A tender for replacement of the PIS system is being sought by IÉ due to the reliability issues of the aforementioned PIS system.

1.6 The purpose of this tender is to source a railway approved PIS system, that are 'fit for purpose', providing accurate and timely information with good visibility/readability (displays) and good intelligibility (audio), consistently and reliably. This specification defines the minimum requirements for the replacement PIS.

1.7 The new PIS equipment will be installed as a standalone system. Please refer to Appendix B for Electrical schematics and Appendix C for the PIS System currently in situ.

2 - Core Requirements

2.1 The core requirement is for the supply of a high quality PIS system. Which can be fitted to the train with minimum interfacing or modification to existing structures. The PIS system shall include as a minimum:

2.1.1 Front Exterior Destination Displays on each driver cab unit.

2.1.2 Internal Displays in each end of the saloon.

2.1.3 Exterior Side Displays on each carriage unit.

2.1.4 Human Machine Interface (HMI) Display on each cab.

2.1.5 Automated Pre-recorded Announcements.

2.1.6 Public Address (PA) System and Passenger Emergency Intercom (PEI).

2.1.7 Database/ Route Editor with a Route Simulator Software.

2.1.8 Remote access to the PIS central unit on the train.

2.2 The new PIS will be required for all 17 units.

2.3 The services to be supplied will include system design, integration, include all equipment necessary to fully integrate it into the existing vehicle and support for safety approvals.

2.4 Additional service shall include:

2.4.1 Mock-up of the system and equipment to be available at the manufacturers site.

2.4.2 System simulator/test wall for demonstrating system/equipment performance and functionality.

2.4.3 First-off installation of the vehicle equipment.

2.4.4 Manufacturers/supplier's equipment and system routine and type testing of the PIS equipment (prior to delivery).

2.4.5 On train type testing of the installed PIS system and all repeat tests in the event of failures.

2.5 Each Passenger Information System shall be controlled through an operator control console in each driving cab. When more than one, four car sets are coupled through automatic couplers, each individual system will be synchronized to work under the control of the lead system controlled by the operator in the leading cab.

2.6 The new PIS main processing unit and HMI units should be able to handle multiple cold reboots without corrupting or damaging the PIS Operating System and the PIS database on the train.

2.7 Minimal future support to be required and 'low maintenance', i.e. simplified database preparation and remote distribution, automated self-diagnostics, fault reporting with event log files that can be accessed and downloaded remotely.

2.8 The PIS shall only display messages sent from authenticated devices, i.e. it must prevent unauthorised messages being displayed

2.9 The new PIS system and installation must comply with both EU and National Legislation including but not limited to the PRM TSI.

3 - Installation

3.1 The supplier will provide a quotation for:

3.1.1 Supplier to install the new PIS to all vehicles.

3.1.1.1. The supplier shall provide all equipment required to complete the installation for each vehicle. The kit shall contain all the parts needed to install the system.

3.1.1.2. The Supplier will install the new PIS system and any associated PIS equipment to the vehicles.

3.1.1.3. The installation work will take place at Irish Rail premises in Dublin (or such other site as agreed) and the contractor to comply with any site-specific requirements required for the site access and undertaking vehicle modifications.

3.1.1.4. The Supplier shall provide installation documentation for the new PIS equipment and any associated PIS equipment mechanically/ electrically which will serve as documentation to be archived by IÉ.

3.1.1.5. The supplier shall provide all software and any special equipment or tooling required to maintain and operate the system.

3.1.1.6. The supplier shall provide training to CME staff to enable them to maintain and operate the system.

4 – Environmental Conditions

4.1. Thermal Range

Powered : -25^{0}C to +55^{0}C external to the equipment, i.e. EN50155, class
Operational : -10^{0}C to +55^{0}C.
Storage : -30^{0}C to +70^{0}C ambient.

4.2. Humidity Range:
95% up to +55^{0}C, to be demonstrated by a damp heat cyclic test including temperature change at 30^{0}C /minute maximum from -25^{0}C to +55^{0}C at maintained relative humidity.

4.3. Contaminants:
Heavy interior use, applicable to rail environment; e.g. dust with oil particles from diesel engines and conductive dust from brake pads. Salt mist – DART services operate along the east coast of Ireland. It is recommended that the supplier access historical data on weather on the Irish East Coast from www.met.ie.

5 - Technical Requirements

5.1 The new PIS system must be a standalone system and should have the following features:

5.2 PIS Distance Measuring System

5.2.1 The system must be designed to ensure accurate and reliable distance measurement and determination of location.

5.2.2 The system should use both GPS and a data recorder or wheel pulse method for measuring and determining the location and distance of the train. The supplier must demonstrate how this will be achieved with the new PIS system.

5.3 Carriage Loading Information System

5.3.1 The system will have a carriage loading information system to indicate passenger loading per carriage. The system will get the data from the data recorder with the source being the brake system suspension pressure input for load weighing the brake cylinder pressure adjustment. That value will then be used to determine or approximate the carriage weight. The information will be displayed in a percentage format using increments of 10%. Supplementary descriptive messages may also be used such as "**Seats Available**", "**Half Full**" and "**Near Full**".

5.3.2 This information should be made available to a wayside customer information system and website/app.

5.4 Audio and PA System

5.4.1 Audio for the Passenger Information System, must comply with TSI-PRM.

5.4.2 An audio speaker system must be in each saloon and drivers cab and be designed to ensure adequate redundancy.

5.4.3 The saloon speaker system should have an ambient noise detection to automatically adjust the speaker volume and ensure the announcement is audible to passengers. The loudness of the speaker should not exceed 80dB and must comply with TSI-PRM.

5.4.4 The PIS controller will make automated announcements in both Irish and English (audio & text).

5.4.5 The driver must also be able to play predefined messages that will override automated audio announcements.

5.4.6 The system shall provide the ability for the driver to locally override automated audio announcements with PA voice announcements.

5.4.7 The system shall provide the ability for the IÉ CTC to remotely override automated audio announcements with PA voice announcements.

5.4.8 PEI device shall replace the current PEI devices, using the same location. The PEI system must comply with TSI-PRM.

5.5 Visual Displays

5.5.1 The Visual Displays shall include internal (saloon), external side and front of train displays and all must comply with TSI-PRM.

5.5.2 Internal TFT displays as opposed to matrix displays are desirable.

5.5.3 Displays shall be capable of displaying messages in both English and Irish languages in multi lines and pictograms.

5.5.4 Displays shall be capable of displaying all the set of characters for the Irish Gaelic Language as established in the Irish Standard Specification for '*Information Technology – Irish 7-bit Coded Character Sets*' (I.S. 433:1999), and in the '*Information Technology – 8-bit single-byte coded graphic character sets*' (ISO/IEC 8859-15:1999).

5.5.5 Displayed characters shall be in a high contrast to their background display with the characters clearly visible.

5.5.6 Front of train displays shall be installed into the location presently occupied by a destination display, i.e. shall replace existing electronic or roller displays. Displayed information must comply with TSI – PRM.

5.5.7 One side display per vehicle side is required. The display shall be secured to the outside of the train and must not infringe the train gauge or the display may be located in a window cartridge mounted in the window frames.

5.5.8 Internal displays shall be installed in each vehicle and will be located at areas where passengers will have good visibility of the information displayed. Double sided ceiling mounted displays near the door areas if possible is preferred. Displayed information must comply with TSI – PRM.

5.6 Timetable

5.6.1 Each system is required to store the DART passenger timetable. The timetable shall relate Train Number to:

5.6.2 Departure and arrival times at all stations.

5.6.3 Day(s) of week when this train runs.

5.6.4 Date of commencement and date of finishing of this timetable.

5.6.5 Any special days e.g. Christmas when this train does not run.

5.6.6 Any special days when this train runs e.g. extra trains only programmed for Christmas period.

5.7 Software

5.7.1 Route Database Editor Software must be provided to IÉ with user manuals, training and should be free from any license cost. The Software provided must be compatible with Windows 7, Windows 8 and Windows 10 and all associated service pack updates. The software package should include the following (but not limited to):

5.7.2 Addition of extra stations names and messages (audio & text) in Irish and English.

5.7.3 Addition of the co-ordinates and distances for the extra stations.

5.7.4 Modification of the co-ordinates and distances for existing stations.

5.7.5 Definition of train numbers using a maximum of three letters and five numbers. Blanks will be permitted at leading and trailing portions to facilitate the current two letter, four number system e.g. "**XXX ####**#", typical current number: "**ZZ 1032**".

5.7.6 Selection of train starting station from a list.

5.7.7 Selection of train destination station from a list.

5.7.8 Selection of train intermediate stations from a list. The order of selection will indicate the order of stopping.

5.7.9 Definition of arrival and departure times for all stopping stations. Non-stop stations shall have the same arrival and departure time. Obviously starting stations only have departure times and destination stations only have arrival times.

5.7.10 Definition of the day(s) of the week when this train runs. This is to be optional, as specials will not use this function.

5.7.11 Definition of any prescribed dates when this trains runs to allow for specials.

5.7.12 Definition of dates when this train does not run, this can either be a list of dates or a range of dates or a combination of ranges and list of dates.

5.7.13 The software shall allow the multiple selection and copying of train details to a new Route I.D. to speed up the timetable generation. There should also be the option for multiple selection and action to allow fast corrections when needed.

5.7.14 Each complete timetable shall have a unique sensible filename and format to be agreed with IÉ.

5.7.15 The software shall allow the importing of existing complete timetables (currently in *.rpi file) to allow easy generation of new timetables.

5.7.16 For particular Route I.D.s, it shall be possible to insert and delete stations.

5.7.17 The software shall provide IÉ with the facility to create edit, modify, or delete any of the audio or visual messages.

5.7.18 It must be possible to remotely push route database updates, including text and audio messages to the train.

5.7.19 The software should be able to run on a basic computer system optimally and error free. Any non-standard software requirements or equipment should be notified and provided for.

5.7.20 The software shall have a route simulator tool that will allow a given route from the database to simulate the external displays, internal displays and automated announcements when the Route I.D. is used on a journey.

5.8 Driver Interface

5.8.1 Route I.D. shall be taken from the drivers input into the train radio.

5.8.2 Driver will have the option to manually input the route I.D. on the PIS for cases where the Route I.D. is not the same as the drivers input on the train radio.

5.8.3 Location selections i.e. override the automatic location data in case of distance measurement system failure.

5.8.4 Next station to always be visible to the driver when a Route I.D. is keyed in.

5.8.5 Driver selection of special messages.

5.8.6 Driver shutdown and restart of the system.

5.8.7 Driver check on current system location.

5.8.8 Driver check on current and next system message.

5.9 Automatic update of system clock in relation to Daylight Savings Time is required.

5.10 Future proofing of equipment and software is required.

6 - Costed Optional Extras

The following option shall be priced as additions to the base offer. Where an option depends upon the adoption of another option there shall be a clear statement to that effect and the total price shall be shown in each case.

6.1 A test rig for the new PIS system shall be provided to facilitate testing, ongoing maintenance, fault finding and operational training purposes.

6.2 Saloon display screens to display information and switch between the following where available. IÉ should be able to remotely edit and configure the displayed:

6.2.1 Display current time, date and weather information.

6.2.2 Display Real time data of current journey such as current location, time remaining to destination, the platform the train will be arriving on and status of stations on the line.

6.2.3 Display IÉ related information which will be the default display when any of the above Real time data are offline or not available.

7 - Maintenance

7.1 The Supplier shall provide all necessary maintenance, overhaul manuals and instructions to enable the PIS and any other equipment supplied to be maintained in the required condition throughout equipment. This includes all necessary documentation, drawings, schematics, instructions, technical manuals and specialized equipment.

7.2 Once installed it shall be possible to easily remove and replace a complete PIS system if replacement or repair is required.

7.3 Validation of maintenance and repair instructions. Include in the Type Test requirements the need for validation of all maintenance and repair instructions. This shall be carried out in the depot environment.

8 - Applicable Standards

8.1 IÉ Safety Management System RU SMS 014. The supplier shall provide IÉ with technical information as necessary to approve the engineering change to the vehicle in accordance with IÉ procedures.

8.2 The Supplier will ensure any proposed internal equipment to be installed will comply (if relevant) with the applicable Fire standards pertaining to the vehicle. All equipment shall have a minimum ingress protection to IP65, or IP66 if floor mounted. To be type tested in accordance with EN60529:1992

8.3 The Supplier will ensure any proposed external equipment to be installed will comply (if relevant) with the applicable Fire standards pertaining to the vehicle.

All equipment shall have a minimum ingress protection to IP66. To be type tested in accordance with EN60529:1992

8.4 The Supplier will ensure where applicable any and all associated electrical and electronic components will be fully EMC compliant and comply with EN 50121-3-2.

8.5 The equipment will meet the requirements of EN 61373 for shock and vibration.

8.6 The equipment will comply with the requirements of EN50155 Electronic equipment for rail vehicles.

8.7 All equipment to be installed on the units shall be CE marked / CE compliant and evidence provided to support this as part of the approvals.

8.8 The Supplier will ensure the equipment installation and mounting arrangement will (where relevant) be fully compliant with EN 15227 structural requirements for rail vehicles.

8.9 The equipment will meet the requirements of EN 50124 clearances and creepage distances for electronic and electrical equipment.

8.10 The Supplier will ensure that all displayed information and audio announcements comply with TSI – PRM.

8.11 The manufacturer shall meet the requirements of all applicable railway engineering Directives, Standards and Codes of Practice applicable to the IÉ rail system.

9 - Type Test

9.1 Typically, type testing is carried out on single unit samples of each LRU, the samples shall be of production standard and to be retained for reference. Some type tests may be repeated on a random basis to ensure production samples do not differ from original design, or in case the design has been modified. Type testing shall comprise the following test parameters, but the list below is not exhaustive:

- Functional
- Vibration
- Bump and Shock
- Dry heat/cold
- Damp/humidity
- EMC
- Surge and transient
- Supply min/max and interruption
- Endurance
- IP rating, dust and water spray

9.2 Type test samples shall be retained as 'glass case' equipment references and shall not be supplied as part of the contract equipment for use on trains. A data pack containing type test results shall be supplied. Reliability and endurance testing to be included where applicable, any failures encountered during burn-in or type

testing shall be logged and recorded. Reliability figures are to be calculated and graphically plotted during the warranty period. The warranty period shall not terminate until reliability is at a stable value better or equal to the values quoted in the bid response.

9.3 In order to demonstrate the system functionality, a 4 car test wall is required. The test wall shall comprise of agreed sub-set of PIS equipment. The test wall details shall be subject to approval by IÉ as part of the type test specification and shall be fully detailed therein.

9.4 The test wall (simulator) is to be available at the suppliers and manufacturers sites. Development and ultimately production equipment shall be integrated into the test wall. A build and testing plan for the test wall shall be included in the bid submission. The objective of the test wall is to:

9.4.1 Demonstrate graphics and gain preliminary acceptance for fonts and PRM visibility.

9.4.2 Validate and gain customer acceptance of the operation of the system

9.4.3 Demonstrate the HMI and gain preliminary acceptance for visibility, operation, including human factors.

9.4.4 Confirm the electrical interfaces and power supply capacity

9.4.5 Customer approvals as detailed in the bid/contract

9.5 Production equipment shall be to the same design standard that was used for type testing, traceable to existing type test reports and certification or to the new tests to be undertaken as part of this project. The 'glass case' type test samples shall be available for inspection and comparison.

9.6 IÉ or its delegates, shall have right of access to attend any development, validation type, or routine test. Prior to undertaking the type test, the contractor shall submit a programme (with at least four weeks' notice), of test procedures and/or method statements for approval by IÉ. If the equipment offered has been previously type tested then the extent and nature of the type test results shall be clearly identified in the offer. IÉ shall reserve the right to request additional or repeated type tests, particularly if the equipment is to be specially modified for use on this project.

Appendix A: IÉ Safety Management System RU SMS 014

RU SMS 014.pdf

Appendix B: ELECTRICAL SCHEMEMATICS

85xx_Electrical_Schemematics

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85xx_Electrical_Schemematics

V.E.M.I.S.A.

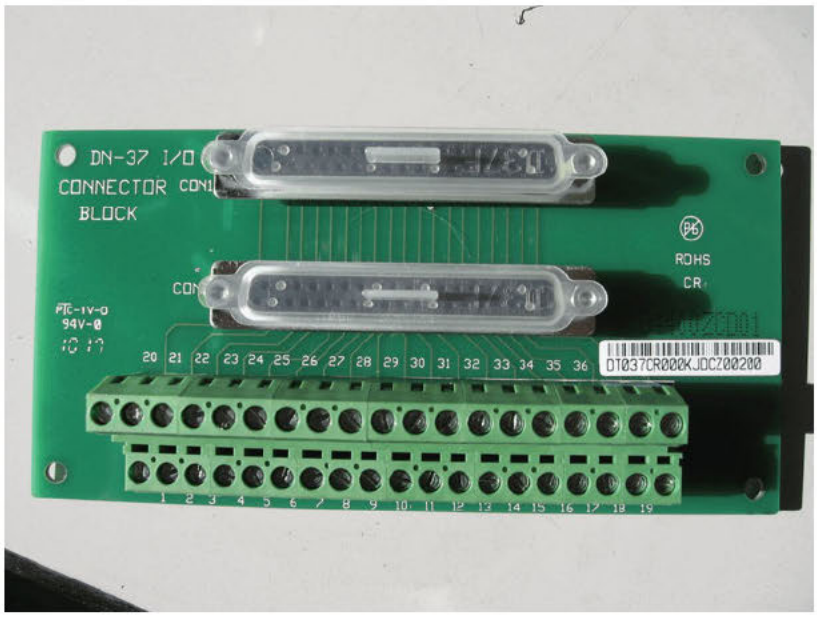
October, 4th, 2010

Dear Sirs,

Following Interfleet recommendations, VEMISA will install an additional connection panel to isolate train signals from the computer.

This connection panel will follow the "*external connection IO board.pdf*" schematic attached. The aim of this new item is to avoid transients and to separate 110Vcc signals.

To adapt to the SUB-D connector in the relay card, this connection panel will look like as follows (connection side only):



Yours faithfully,

VEMISA
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28027 Madrid

A. MARTÍN