Connolly Station Enhancement Options Study

National Transport Authority

Staged Approach for Infrastructure - Technical Note

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Contents

1. Introduction

Further to the Options Report for the Connolly Station Enhancement Study submitted by Jacobs to the National Transport Authority (NTA) and Iarnród Éireann (IÉ) on 26th March 2019, the NTA instructed Jacobs to examine a further "Do Minimum" option that could enable an increase in train services into the station without the need for significant civil engineering works.

This report assesses the current station capacity and compares it to the capacity that might be achievable if the track layout was revised as shown on the Per-way Concept drawing in Appendix A.

Our assessment, which has been based on Per-way infrastructure interventions and operational changes only (which, during the next stage, will need to be tested against signaling requirements as well as the required interfaces with other rail infrastructure) indicates that the additional do-minimum option could provide a capacity of 23 trains per hour per direction (tphpd) compared to the current service pattern of 17tphpd (not including the Enterprise service).

It should be noted that the study addresses the increase in train services only and does not take into account the resulting increase in passengers using the platforms, interchanges or gate lines at Connolly Station.

2. Current Capacity

The existing track layout at Connolly Station focuses through Northern Line DART services to and from the Loop Line via Platform 6 (southbound) and Platform 7 (Northbound), as well as Platform 5 intermittently throughout the day. Consequently, whilst some services from the west can merge with Northern Line services to either run through to the Loop Line or terminate in the Train Shed platforms 1 to 4, the conflicting moves required limits the capacity to accommodate services from the west.

Information provided by Iarnród Éireann

The Table below highlights current service levels to and from Connolly in the AM & PM Peak periods, these tables are based on the standard peak hours. The maximum service level achieved in a 60 minute window is 17tph arriving into Connolly Station in the AM Peak with 14 through services and 3 terminating services between 07:44 - 08:44.

Northbound							
Time	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
Terminate	5	2	6	2	4	3	2
Through	7	11	9	12	12	13	11
Total	12	13	15	14	16	16	13

Southbound							
Time	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
Terminate	3	3	3	5	5	4	2
Through	13	13	10	10	8	12	10
Total	16	16	13	15	13	16	12

Jacobs have undertaken a review of the current track layout at Connolly Station, taking into account the scope of works covered under the previously submitted Connolly Station Enhancement Options Study, and believe that the existing layout – assuming that all 16no. Northern Line services (as defined in the project brief) are prioritized for through running at the station, is operating at or close to its maximum capacity. This is due to the conflicts described above and from previous reports prepared by Jacobs.

3. Further Do Minimum Option

3.1 Option Description

This additional do-minimum option aims to increase capacity for services from the west with minimal alterations to the existing infrastructure. It should be noted that whilst the track modifications are tested from a pathing and timetable perspective, the signaling capability, especially the terminating capability in Platform 7 should be tested as a separate exercise. It should also be noted that this assessment makes no comment on whether the existing platforms are able to accommodate the increased number of passengers from the increased train service.

A Per-Way Concept Drawing of the option has been produced, including a Single Line Diagram, and this is included in Appendix A of this report.

The Newcomen Chord will be developed as a single-track line, as illustrated in the drawing in Appendix A. This includes the construction of the drop-lock as detailed in the Connolly Station Main Options Report (32110100-GEN-RP-003).

The Newcomen chord alignment is effectively a concentric arrangement of the existing alignment brought about primarily as a result of the requirement to re-position the rail/canal bridge intersection. This requirement stems from the need to allow a 21m dimension for a narrow boat to sit between North Strand Road bridge and the stop point for the drop lock. This shift eastwards requires the Newcomen chord to be realigned accordingly, shifting the new alignment eastwards respectively and thus, its intersection with the Down Suburban line at the top of the incline, maintaining a similar minimum radius of 182m.

From the Per-Way Concept Drawing it should be noted that one of the two stabling sidings adjacent to the Newcomen Chord will need to be removed to allow space for the tie-in to Platform 7. This may require some civil engineering modifications to the retaining structure at the tie-in.

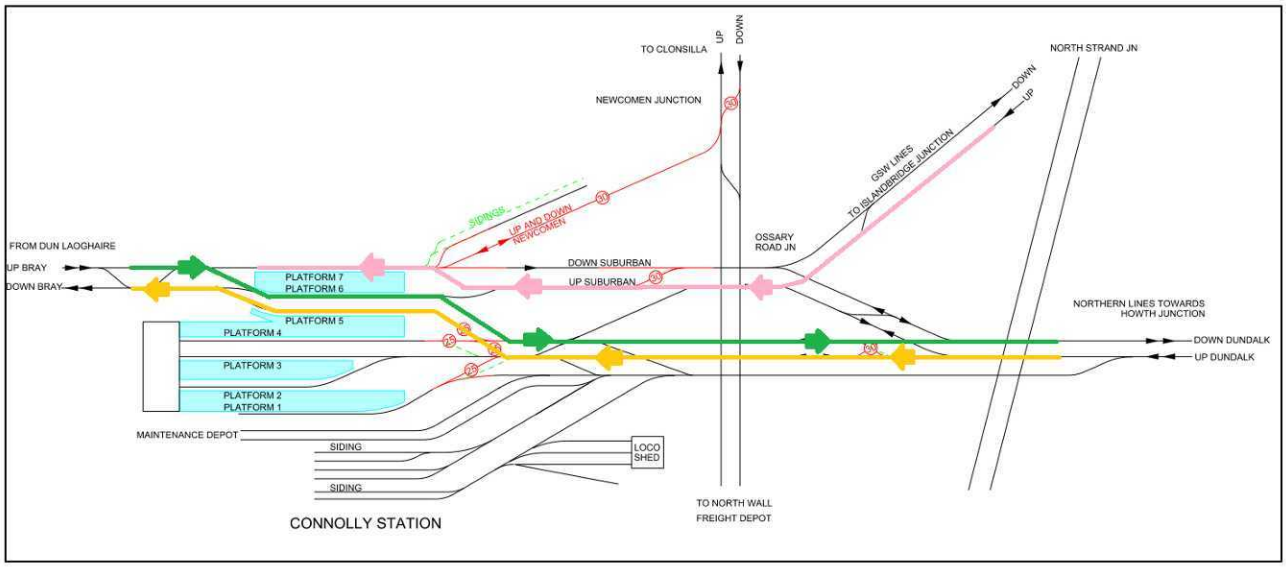
A stabling provision has been maintained but it is only workable to preserve a single siding given the position of the new Newcomen Chord P8 turnout. This toe of the turnout connection into the single siding is located on the same toe position as the existing arrangement, thus maintaining the signalling overlap from platform 7. The addition of a second turnout within this siding to provide a second siding, would present issues in relation to the Clearance Points reducing standage and the inability to accommodate a 4-car train in each siding.

If the removed second stabling siding is still required, then this could possibly be provided by constructing a new siding which would utilize the redundant Newcomen Chord track-bed. However, this would require a significant length of retaining structure to be constructed.

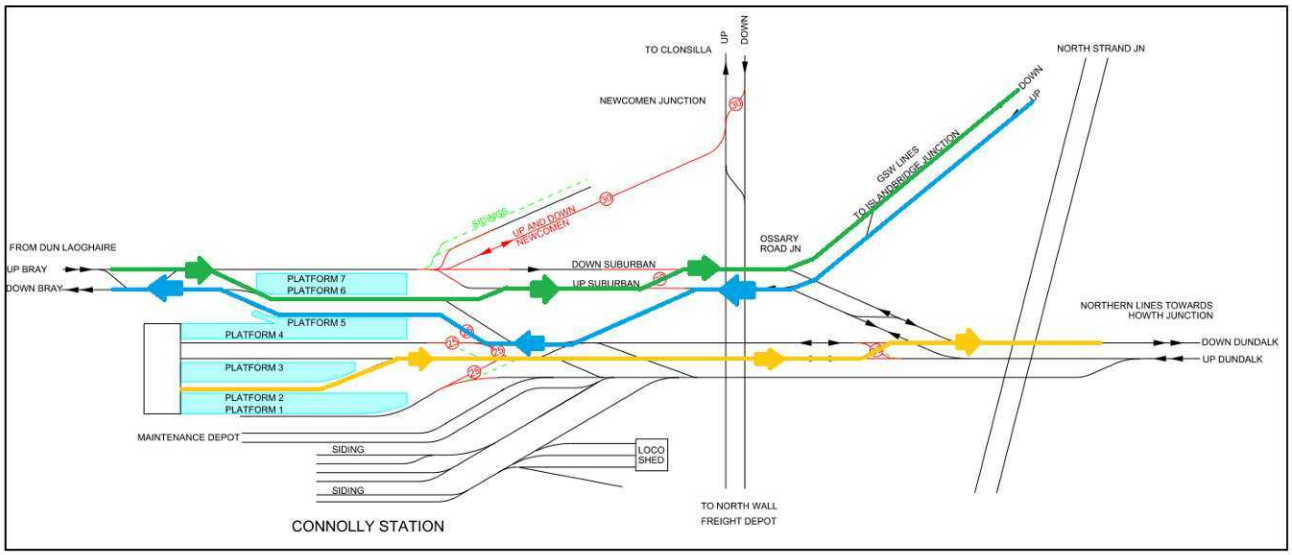
The objective of this option is to allow parallel moves from either the Northern Lines (via the Dundalk Lines) or the GSW Lines (via the Suburban Lines) to the Loop Lines via Platforms 5 and 6, whilst permitting adjacent moves from either Platforms 1 to 4 or Platform 7, thereby maximizing capacity at the station and creating additional terminating capacity for services from the west in Platform 7.

Examples of this include:

Northern Line services to the Loop Line would now run via the Dundalk Lines and the modified infrastructure, directly to Platforms 5 and 6. At the same time, services from either the GSW Lines or the Newcomen Chord can operate to and from Platform 7 (see map below):



Southbound services from Ossary Road Junction would operate *via* the Down Dundalk and the new Double Slip to Platform 5. Northbound services from Platform 6 to Ossary Road Junction would now operate via the Up Suburban as far as the new crossover to gain the Down Suburban prior to Ossary Road Junction. At the same time, Up Northern Line services can access Platforms 1 to 3 via the Up Dundalk. Alternatively, Down services from Platforms 1 to 3 can depart down the Up Dundalk and utilize the new crossover on the Dundalk Lines to gain access to the Down Dundalk (see below):



This therefore means that terminating services from either the GSW or Newcomen Lines can access and Depart Platform 7 without conflicting with Northern Line moves. Services can be operated on an arrival and departure pattern from the same lines, or, if it can deliver more services, it could be possible to arrive from one route and depart to the other.

Platform 4 is difficult to access but could be used for a terminating service from the GSW Lines, at the same time as a terminating service from the Northern Lines to Platforms 1 to 3 (as shown on the diagram above). A departure would need to undertake a parallel movement from the Newcomen Lines if routed to the GSW or Northern Lines, although it would also be possible to operate a departure to the Northern Lines, in parallel with a move from Platform 6 to the GSW Lines.

In summary, this option would increase the capacity of Connolly Station compared to the current layout but will not deliver 30 trains per hour per direction as specified in the original project brief.

3.2 Construction Staging

A potential solution would be a staged approach as outlined below:

1. Installation of the cross-overs on the Dundalk and Suburban lines, plus track works to the approaches to platforms 1-5. The two stabling sidings would be retained at this time. All the works would be within the railway boundary and only impact railway infrastructure. These works could be implemented within a short timeframe because of the limited number of external stakeholders. The first stage of the works could be completed within a series of possessions, each addressing a separate element of the works (Dundalk lines, Suburban lines, platforms 1-5 approaches) and thereby allowing the station to remain largely operational. We acknowledge that some works might need a complete possession of the station but this could be programmed to be limited to normal Engineering hours and/or extended possessions over Christmas/New Year/Easter holidays).

2. Upgrade of the Newcomen Chord, including provision of the Drop-Lock and modification to the pedestrian/cycle bridge and route. At this time there would be a loss of one of the stabling sidings. These works would require a greater level of engagement with external stakeholder (Irish Waterway, Dublin City Council, historic building consents etc.) and would also require a greater capital investment. Currently the Newcomen Chord is utilised on a limited basis so its closure for these works would only have limited operational impact on the railway. The installation of the new tie-ins to the chord would require possessions but these would only significantly impact the approaches to platforms 6/7 and could be programmed to be limited to normal Engineering hours and/or extended possessions over Christmas/New Year/Easter holidays.

This approach would provide an accelerated initial operational benefit, without a very significant initial capital outlay. Followed by the second stage, which with provision of the Newcomen Chord works would provide further operational benefit and can be completed without impact on the works already undertaken.

3.3 Operational Analysis

Section 3.2 describes how the 'Do Minimum Option' works operationally in the Connolly station area. Based on this infrastructure, the maximum service level which has been tested at Connolly is:

- 13 tph Northern Line, 2 tph terminating Connolly (inc. Enterprise)
- 5 tph Phoenix Park via North Strand
- 5 tph Maynooth Line via North Strand
- 16 tph onto Loop Line (11 tph Northern, 5 tph Phoenix Park)
- TOTAL: 23 tph into Connolly

This represents the maximum service level that could reasonably be achieved on the infrastructure at Connolly itself, whilst prioritizing through Northern Line services to the loop line. The balance of the service specification (5 tph from Phoenix Park and 10 tph from the Maynooth line) would therefore need to operate to Docklands.

There are two ways that this could be achieved:

***Via* an upgrade at North Strand Junction**

This option would run up to 15 tph each way *via* North Strand Junction. To deal with this level of traffic would therefore require an upgrade at North Strand Junction.

Routing trains this way would mean that the Newcomen Chord, which is upgraded in the 'Do Minimum Option', is not used. However, the timings at North Strand Junction are constrained by the need for trains to cross movements across Connolly station throat to/from the Loop Line and the need to optimize turn-rounds at Connolly for terminating trains using Platform 7. Combined with the service levels running through North Strand Junction, although this is theoretically achievable it is likely that there will be significant operational constraints and performance issues in practice.

Making use of the Newcomen Chord (as in the 'Do Minimum Option') in addition to a North Strand Junction upgrade would help to alleviate these issues. Routeing terminating (Maynooth) trains via Newcomen Jn in one direction (i.e. requiring Newcomen Chord single line upgrade but not doubling) would mean five fewer trains using North Strand Junction in one direction. This would lower the levels of traffic on the lines approaching North Strand Junction, at the junction itself, and would reduce conflicting movements at the junction. Therefore, use of the Newcomen Chord makes this a much more realistic solution. This option is reflected in Drawing no 32110100-01-ETR-DG-010 Rev P02.

For this option, no upgrade is required at Glasnevin Junction (the Maynooth Connolly trains are optimized to use parallel moves at Glasnevin Junction).

***Via* an upgrade at Glasnevin Junction**

Alternatively, an upgrade at Glasnevin Junction could be provided which would allow trains from the Phoenix Park line access to Docklands (*via* Newcomen Junction rather than North Strand Junction). This would not require the upgrade at North Strand Junction. This would not impact the number of services able to run to Connolly, as the constraints for crossing moves in the station throat and platform use would remain.

With either option, it is possible to make small adjustments to the service levels into Connolly on each line. The number of trains from Maynooth & Phoenix Park to Connolly is constrained by the platform capacity at Connolly and the number of trains that can run onto the Loop line. There is only a single platform 'spare', this has been used to terminate 5 tph which is the maximum that could be sensibly planned. Therefore, running more trains across Connolly onto the Loop Line would mean a proportional number of Northern Line trains terminating.

If it was agreed that four Northern Line services could be terminated at Connolly, then it would be possible to divert more Docklands services to Connolly and route them through to the Loop Line. This would deliver 25tph. However, assuming the balance of the Service Specification is to run to Docklands, this does not change the two options described previously (as the number of trains on the line through North Strand Junction still remains the same).

3.4 Benefits of Newcomen Chord

As described in section 3.3, an upgrade of Newcomen Chord is not absolutely required (in theory) to deliver the Train Service. However, there are a number of operational and performance benefits that it would deliver.

The flows to and from Maynooth could be timetabled to operate into Platform 7 *via* North Strand Junction in one direction and *via* Newcomen Chord in the other. Although the services using the Chord could not call at Drumcondra, this would relieve North Strand Junction, although an upgrade of North Strand Junction would still be required. This would separate service flows and reduce potential conflicting moves at junctions, making timetabling more flexible and providing a performance benefit to the approaches to Connolly.

Moving some Maynooth trains to the Newcomen Chord would also free up capacity that could be used to run services from Phoenix Park to Docklands *via* a connection at North Strand Junction. This would require careful timetabling and consideration of the capacity at Glasnevin Junction. However, Newcomen Chord would also complement an upgrade of Glasnevin Junction by providing more flexibility in routeing.

Finally, during an upgrade on the line *via* North Strand, Newcomen Chord would provide a useful alternative route to minimise disruption during construction work.

3.5 Wider Network Impacts

A timetable change of the magnitude needed to unlock the capacity delivered by the Do Minimum upgrades would need to be part of a wider review of how the railway operates (such as driver diagramming, rolling stock diagramming etc.).

This would include a review of the way trains are planned, such as reviewing current running times and consideration of allowances approaching key junctions (e.g. addition of performance allowance at certain

key locations).

The timetable outside of Connolly itself would need to be capable of supporting this level of service robustly. Further analysis would be needed to optimize this timetable, together with supporting performance modelling to prove that the infrastructure is capable of supporting this service.

4. Conclusion

The proposed layout changes and additional crossovers proposed in the 'Do minimum Option' will provide a capacity of 23 to 25 tphpd into Connolly Station.

The additional crossovers on the Suburban and Dundalk lines are essential to provide parallel moves to/from North Strand Junction. Without them, there would be a considerable capacity impact. The ability to depart a train from Connolly towards Dundalk at the same time as the parallel move above (utilizing the natural gap in traffic it creates) is also required to maintain the number of services terminating from the Northern Line.

In order to increase the capacity of Connolly Station beyond the 23/25 tphpd achieved in the 'Do Minimum Option' then the additional platform detailed in the designs previously developed in the Option Selection Report, in combination with Newcomen doubling or Glasnevin Junction improvements will be required, as this is key to unlocking the extra paths required to achieve greater capacity, without these we believe that 23/25 tphpd is the maximum achievable.

Appendix A. **Further Do Minimum Per- Way Concept Drawing**

TO CONNOLLY
CUT LINE
OSSARY ROAD JN
FROM CLONSILLA
NORTHERN LINE TOWARDS HOWTH JUNCTION
MAYNOOTH LINE TO ISLANDBRIDGE JUNCTION
INSET A
FROM DUN LAOGHAIRE
The prosed siding identifies a possible clash to the retaining wall.
The level difference between the existing siding and the existing Newcomen chord is about 2m (approx.) at this location.
Lifting the ground to match with the existing siding and an earth retaining structure may be required. Civils to identify
PLATFORM 7
PLATFORM 6
PLATFORM 5
PLATFORM 4
PLATFORM 3
PLATFORM 2
PLATFORM 1
CONNOLLY STATION
MAINTENANCE DEPOT
DOWN SUBURBAN
UP SUBURBAN
DOWN DUNDALK
UP DUNDALK
CARRIAGE WASH LINE
TO ISLANDBRIDGE JUNCTION
EXISTING LINE DIAGRAM (NTS)
PROPOSED LINE DIAGRAM (NTS)
PROPOSED ALIGNMENT
EXISTING TO BE REMOVED
SCALE 1:500

DRAFT FOR INFORMATION ONLY

Rev	Date	Description of Revisions	Drawn	Chkd	Appr

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Project

CONNOLLY STATION ENHANCEMENT OPTION STUDY

Drawing Title

CONNOLLY STATION REMODELLING
PERMANENT WAY LAYOUT
OPTION 1 (MINIMUM CHANGES)

Designed: Suresh Pillai	Signed	Date 29/05/2019
Drawn: Suresh Pillai	Signed	Date 29/05/2019
Checked: Chris Bolton	Signed	Date 29/05/2019
Approved: Alex Bradley	Signed	Date 29/05/2019
Scale(s): 1:500	ELR & Mileage	

Alternative Reference

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