DART Expansion Programme

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DART EXPANSION PROGRAMME OPTIONS ASSESSMENT – ADDENDUM REPORT

SYSTRA JACOBS Údarás Náisiúnta Iompair National Transport Authority Iarnród Éireann Irish Rail

DART EXPANSION PROGRAMME

DART EXPANSION PROGRAMME OPTIONS ASSESSMENT

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1. INTRODUCTION

1.1 Overview

1.1.1 This is an Addendum to the **DART Expansion Programme Options Assessment Report** (hereinafter referred to as the *"Main Report"*).

1.1.2 The NTA commissioned SYSTRA to undertake additional strategic modelling, following the publication of the Main Report, to reflect the outcome of an independent Timetable Modelling Assessment of the preferred option (Scheme Bundle 6), that was undertaken by Jacobs Engineers, within a separate DART Expansion work-stream.

1.1.3 This Addendum Report details the outputs of the strategic modelling of the revised service levels arising from that assessment.

1.2 Background

1.2.1 The NTA commissioned SYSTRA and Jacobs to undertake an extensive transport modelling and appraisal of the DART Expansion Programme, which is a key infrastructure measure which forms part of the Government's Project Ireland 2040[1] - National Planning Framework (NPF) and National Development Plan (NDP) 2018-2027 and the National Transport Authority's (NTA) Greater Dublin Area (GDA) Transport Strategy[2].

1.2.2 The project sought to identify a lower cost alternative to the proposed DART underground tunnel component of the DART Expansion Programme. It did this in the context of the importance of the DART Expansion Programme as identified in the GDA Transport Strategy and following on from the NTA recommendations on the deferral of the DART Underground Project in 2015. It also sought to maintain similar transport user benefits as the original DART Underground scheme and to maintain all other elements of the DART Expansion Programme.

1.3 Options Assessment Report

1.3.1 The Main Report recommended that the DART Expansion programme be delivered by enhancing the existing rail network in the short to medium term (Scheme Bundle 6). It further recommended that the DART Underground Project (Scheme Bundle 2) is not required in the short to medium term and that the underground tunnel component of the DART Expansion Programme should be re-designed for implementation in the longer term - subsequent to the implementation of the exiting network improvements (Scheme Bundle 6).

1.3.2 Further details on the DART Expansion Options Assessment and recommendations can be found in the Main Report which should be read alongside this Addendum Report.

[1] Project Ireland 2040 is the Government's overarching planning policy initiative for development up to 2040. It was published along with its associated documents the National Planning Framework to 2040 and the National Development Plan 2018-2027 in February 2018.

[2] The Transport Strategy for the Greater Dublin Area, 2016-2035 was prepared and published by the National Transport Authority in 2016

1.4 Independent Service Plan Review

1.4.1 As outlined above, an independent Timetable Modelling Assessment of the preferred option (Scheme Bundle 6) was undertaken by Jacobs Engineers to understand the feasibility and operational requirements of delivering the proposed service patterns.

1.4.2 Jacobs produced a summary report - ***'Greater Dublin Area Timetable Modelling – Review Paper'*** (included within Appendix B), which provides a capacity analysis and a proposed Train Service Specification (TSS) for the wider rail network across the Greater Dublin Area (GDA), for the Bundle 6 option. Example headway values were calculated by Jacobs using RailSys[3] software and used as a guideline for the timetable modelling.

1.5 Purpose of this Addendum Report

1.5.1 This Addendum Report summarises the outcomes of a strategic modelling assessment of the DART Expansion scheme bundle options based on a set of revised service plans – following the independent capacity analysis review of the rail network in the GDA.

1.5.2 The revised service levels were tested in the NTA East Regional Model (ERM) to understand the impacts on patronage levels, performance and value for money and are in line with the modelling outputs presented in the Main Report.

[3] RailSys is a software package used in the technical and operational planning of railway transport networks.

2. TIMETABLE MODELLING OUTCOMES

2.1 Introduction

2.1.1 The following chapter provides a summary of the key outcomes from the Jacobs Timetable Modelling review described above.

2.2 Revised Train Service Specification

2.2.1 The Train Service Specification (TSS) (for Bundle 6) from the Main Report along with the Jacobs TSS as output from the timetable modelling exercise are shown in Figure 1 and Figure 2 overleaf with the key outcomes of the review detailed below:

- Reduced service levels at the extremities of GDA rail network i.e. to/from Maynooth, Drogheda and Hazelhatch;
  - Kildare line services reduced by 2 TPDPH from Hazelhatch;
  - Services from the Maynooth line are reduced by 7 Trains Per hour per Direction (TPDPH);
    - Replaced mostly from Clonsilla with M3-Parkway services (5-TPDPH) through running onto the Maynooth line;
    - Previously assumed that services from M3-Parkway to Clonsilla would be a 'shuttle' service;
    - all Maynooth Line services terminate at Connolly station.
  - Reduction of 5 TPDPH between Malahide and Drogheda on the Northern line;
    - 4 TPDPH fewer on the Clongriffin to Malahide section;
  - 6 TPDPH fewer to Dun Laoghaire on the South-East line;
    - 3 TPDPH fewer to Bray;

2.2.2 To accommodate the level of services proposed, it was found that trains could not stop at all stations and as such a 'Skip-stopping' pattern is required.

2.2.3 In addition to the above, it was assumed that there will be a balanced distribution of services within the city centre area to/from the Maynooth and Kildare lines, with services allocated equally between Connolly, Docklands and south over the Loop-line Bridge.

Figure 1. Bundle 6 - Main Report - TSS

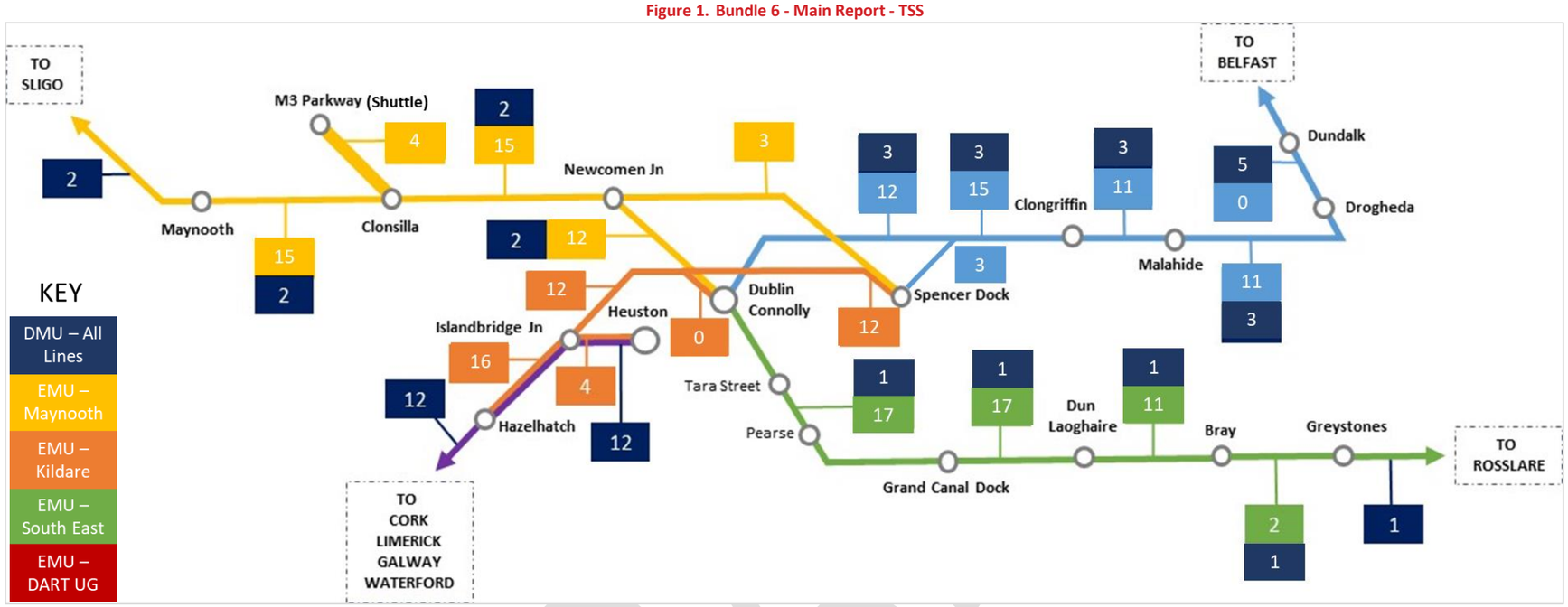
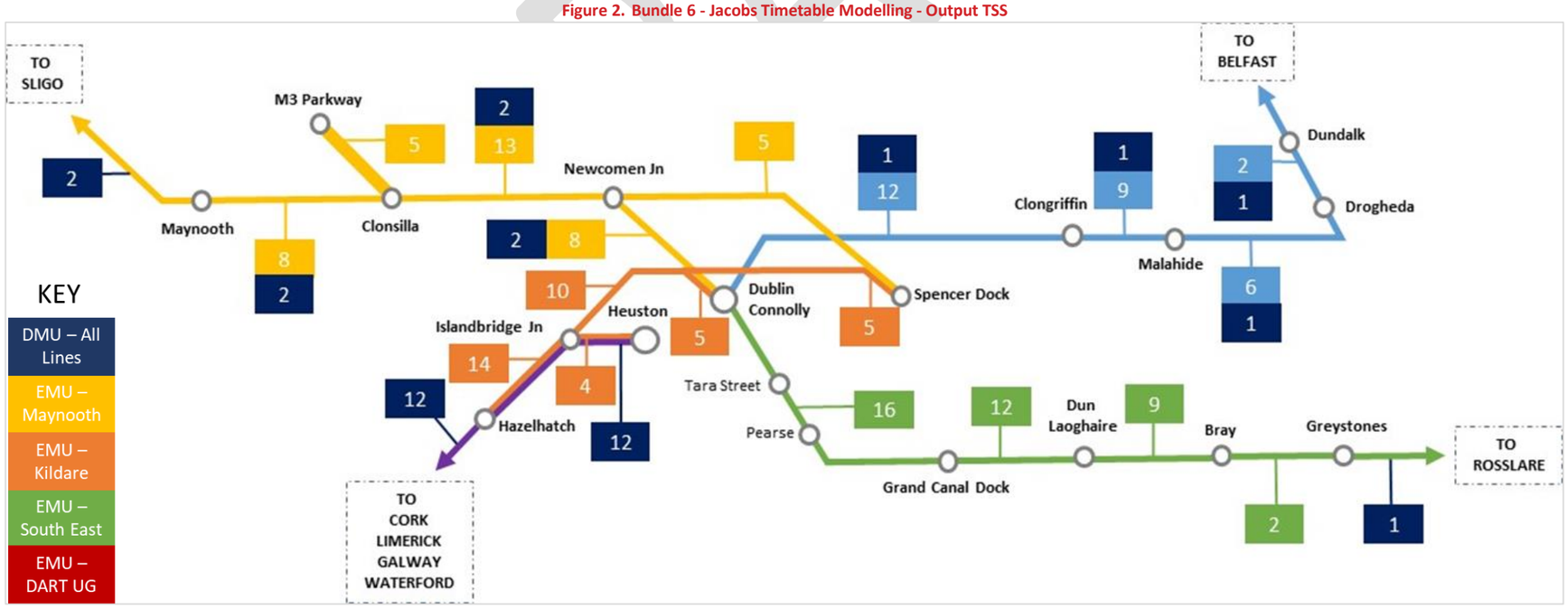


Figure 2. Bundle 6 - Jacobs Timetable Modelling - Output TSS



3. TRAIN SERVICE SPECIFICATION ENHANCEMENTS

3.1 Introduction

3.1.1 The initial train path service plans for each scheme bundle, used in the Main Report modelling assessment were based on service plans provided by Iarnród Éireann (IÉ).

3.1.2 Throughput the project, the service plans were further enhanced and optimised along each corridor using demand outputs from the NTA East Regional Model (ERM) and through consultation with IÉ and NTA – to maximise rail patronage across the DART Expansion options to the greatest extent.

3.1.3 The service plans were also optimised to provide the greatest level of integration with the proposed MetroLink[4] scheme.

3.2 Passenger Demand Sensitivities

3.2.1 As part of the modelling assessment within the Main Report, it was found that overall rail patronage levels were quite sensitive to the terminating location and the distribution of services within the city centre i.e. to what extent services were distributed to terminate at either Connolly or Docklands stations or at stations further south of the Loop-line bridge.

3.2.2 Patronage levels were also found to be quite sensitive to the overall service levels crossing the Loop-line bridge i.e. increased services resulted in higher overall network wide rail patronage levels.

3.2.3 For the above reasons, two alternative options have been developed to deliver the Jacobs Output TSS, that build on the analysis of passenger demand requirements from the Main Report, whilst still working within the upper limit constraints for each line, identified from the Jacobs review i.e. lower service levels.

3.3 Jacobs Output TSS with Enhancements

3.3.1 Further details on the alternative options are provided below, with the TSS for both options displayed in Figure 3 and Figure 4, respectively below.

[4] The MetroLink project is the development of a north-south urban railway service that will run between Swords and Sandyford, connecting key destinations including Dublin Airport and the City Centre along the 26km route.

Bundle 6 - Revised TSS Option 1 – Balanced City Centre Distribution

3.3.2 Option 1 is very similar to the Jacobs Output TSS and retains the balanced city centre service distribution. This option includes the following elements:

- Line capacities limited to Jacobs Output TSS levels outside of city centre;
- Loop-line Bridge capacity increased from 16 to 18 as per service levels in the Main Report;
    - 2 additional TPDPH on Loop-line Bridge to turn-back at Grand Canal Dock;
- No restriction on Maynooth line services proceeding further south beyond Connolly Station;
- 2 TPDPH from Northern Line diverted to Docklands station to provide full movements from each rail corridor (Kildare, Maynooth and Northern lines); and
- It is assumed that all DART services stop at all stations.

Bundle 6 - Revised TSS Option 2 – Optimised City Centre Distribution

3.3.3 Option 2 is similar to Option 1, however the distribution of services within the city centre has been optimised in line with the preferred service plan for Bundle 6 identified within the Main Report.

3.3.4 The service plans proposed provide the highest level of integration with the MetroLink scheme providing for higher levels of interchange at Glasnevin between the two high capacity lines. MetroLink provides the alternative North / South capacity for passengers from the Kildare line rather than the Loop-line bridge.

3.3.5 In summary, the following elements are included in Option 2:

- Kildare / Phoenix Park Tunnel services directed entirely to Docklands station (10 TPDPH);
- No Kildare / Phoenix Park Tunnel services directed to Connolly station;
- No Maynooth or Northern line services to Docklands station; and
- Both Maynooth and Northern line services can access Connolly station **and** can also proceed further south across the Loop-line bridge.

3.3.6 The service plans for each options can be found in Appendix A.

Figure 3. Bundle 6 - Revised TSS Option 1 – Balanced City Centre Distribution

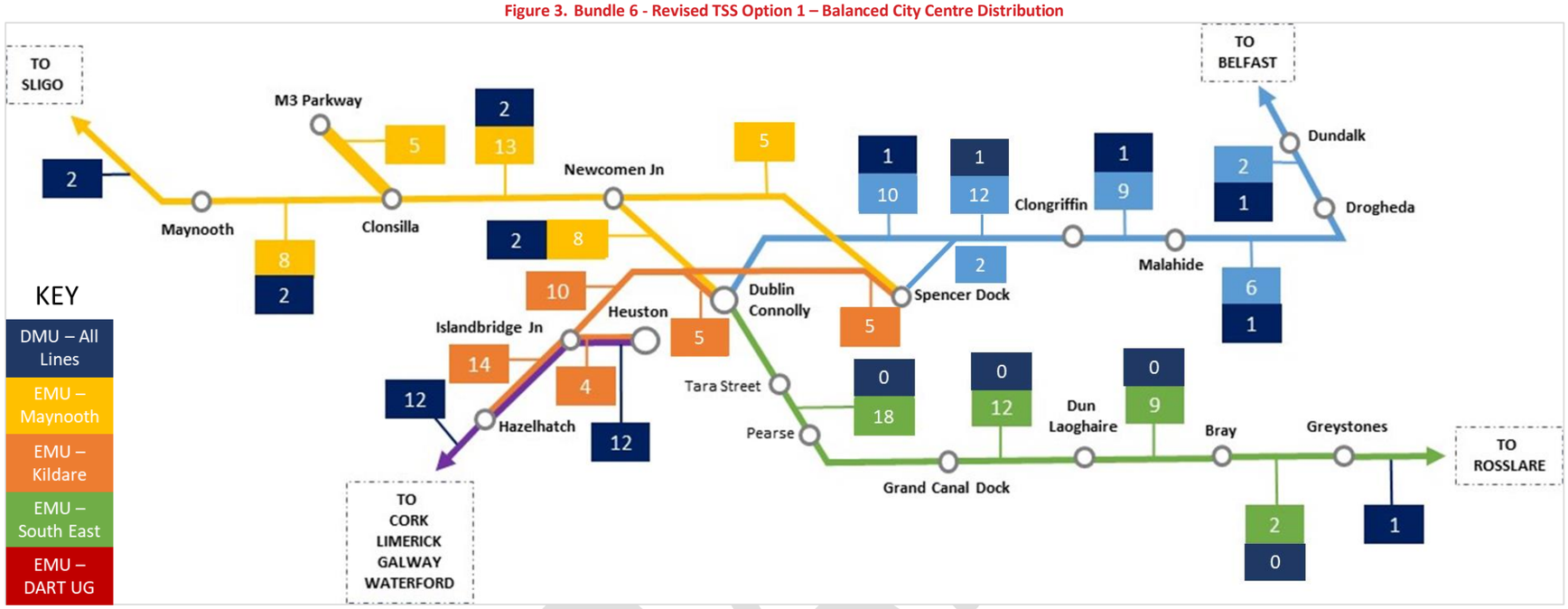
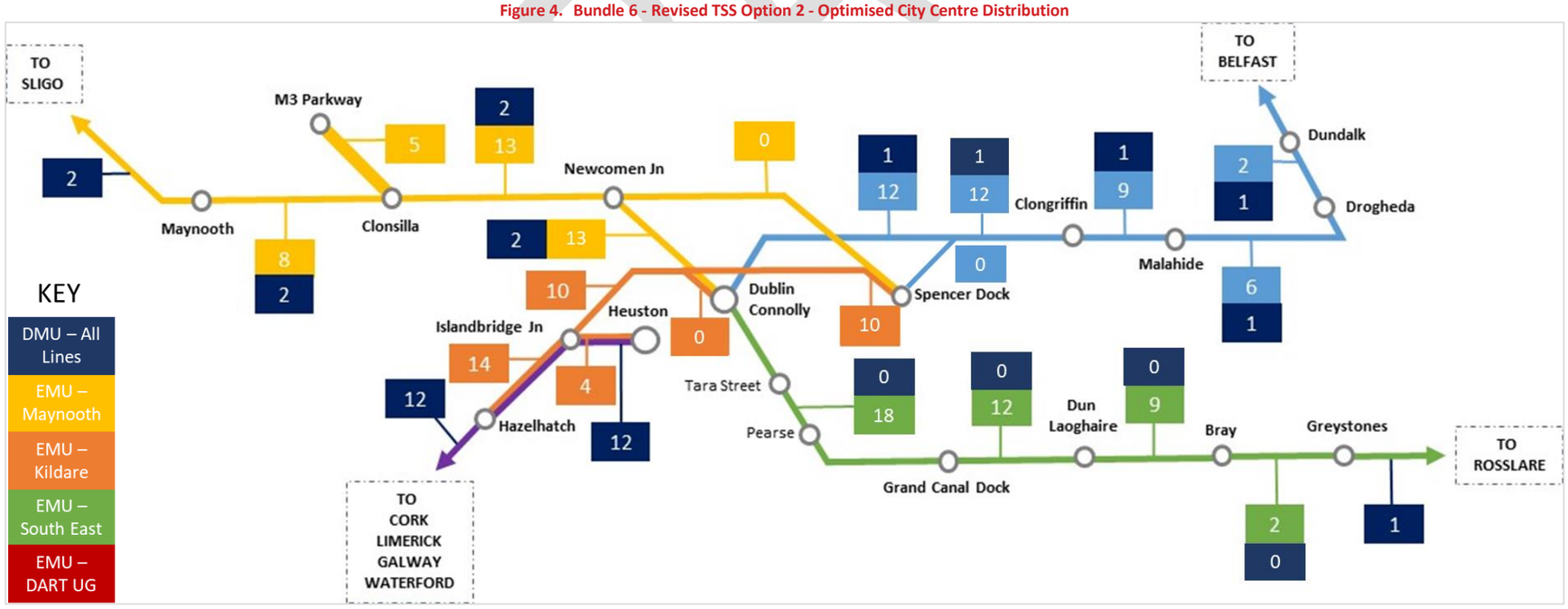


Figure 4. Bundle 6 - Revised TSS Option 2 - Optimised City Centre Distribution



3.4 Scheme Bundle 2 – DART Underground Option

3.4.1 Scheme Bundle 2 includes for the DART Underground tunnel as well as all other DART Expansion Programme elements. This scheme bundle was identified as one of the emerging preferred scheme bundles within the Main Report.

3.4.2 To provide a 'Like-for-Like' comparison with the Bundle 6 options, the Train Service Specification (TSS) for Bundle 2 has also been revised and constrained to the upper limit service levels as per the Jacobs Output TSS levels for Bundle 6.

3.4.3 Figure 5 below shows the Bundle 2 TSS from the Main Report whilst Figure 6 shows the revised Bundle 2 TSS following the adjustments as per the Jacobs Output TSS.

3.4.4 Further detail on the differences between the service plans is provided below:

- Line capacities limited to Jacobs Output TSS;
  - Kildare line services reduced by 2 TPDPH from Hazelhatch;
    - Some Kildare line DART services running to Heuston over-ground station;
    - DART Underground tunnel services limited to 12 TPDPD due to constraints on the Northern Line;
    - 2 additional TPDPD on the Kildare line directed to Heuston over-ground station to maintain 14 TPDPD service level on this line as per the Bundle 6 options.
  - Services from the Maynooth line are reduced by 8 Trains Per hour per Direction (TPDPH);
    - replaced mostly from Clonsilla with M3-Parkway services (5-TPDPH) through running onto the Maynooth line;
    - Previously assumed that services from M3-Parkway to Clonsilla would be a 'shuttle' service;
  - Reduction of 4 TPDPH between Malahide and Drogheda on the Northern line;
    - 1 TPDPH fewer on the Clongriffin to Malahide section;
  - 5 TPDPH fewer to Dun Laoghaire on the South-East line;
    - 5 TPDPH fewer to Bray;

3.4.5 There is no change to the overall pattern of services facilitated by the DART Underground i.e. X (Cross) network configuration retained:

- Maynooth line services connecting to South-east Line via the Loop-line bridge; and
- Kildare line connecting to the Northern Line via the underground tunnel;

Figure 5. Bundle 2 – Main Report Service Plans

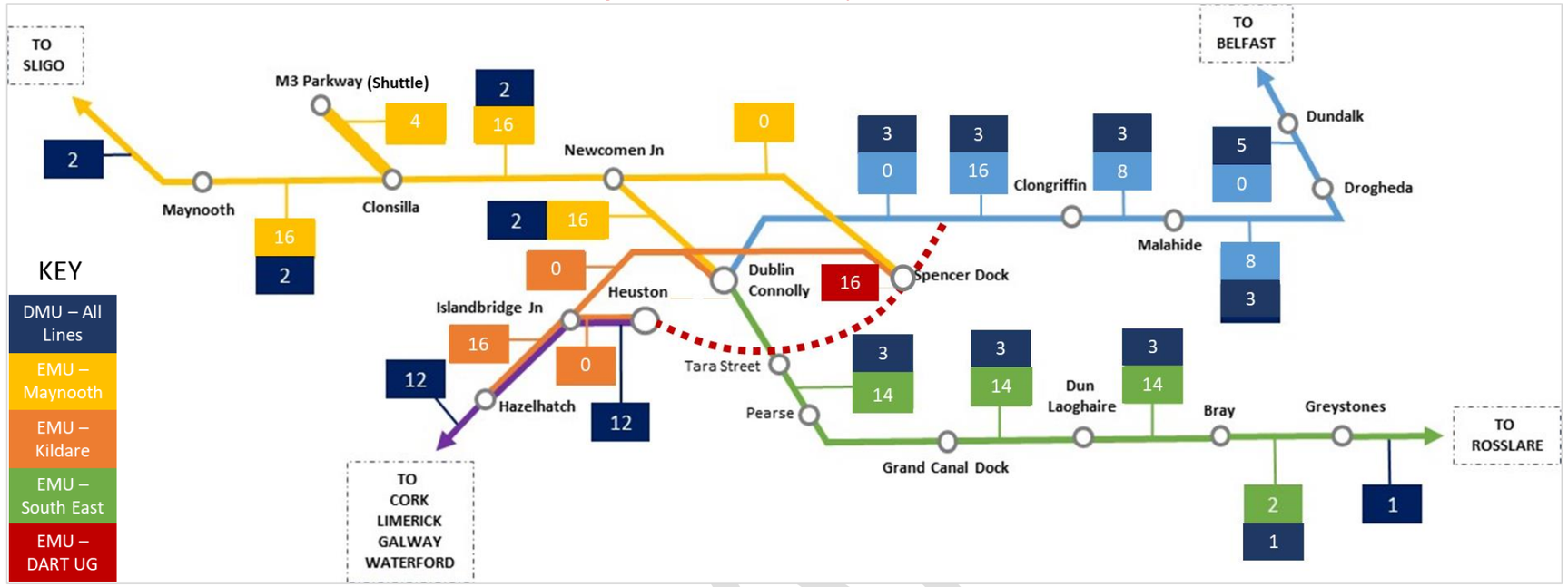


Figure 6. Bundle 2 – Revised TSS

3.5 Modelling Assumptions

3.5.1 The following outlines the key modelling assumptions included in the ERM for this assessment. The assumptions are in line with the modelling assumptions within the Main Report:

- A common appraisal design year of 2035 (representing the GDA Transport Strategy horizon year);
- 5 minute interchange penalty assumed between all public transport sub-modes;
- MetroLink[5] included in all options; and
- No change in station to station journey times for each option from the Main Report assumptions.

3.5.2 Further details on the NTA ERM input assumptions can be found in Chapter 4 of the Main Report. The end-to-end service plans for each option can be found in Appendix A.

3.6 Scheme Bundle Costs

Capital Expenditure (CapEx) Costs

3.6.1 Table 2 below provides a detailed breakdown of the cost estimates for both Scheme Bundles 2 and 6. The table also outlines a breakdown of the costs of the common elements to both scheme bundles. These common elements are essentially the extra infrastructure included in the DART Expansion Programme such as 4-Tracking, electrification and fleet upgrade costs etc.

3.6.2 As can be seen from the table below there is a significant variation in the costs between both scheme bundles with the main cost differential being the underground tunnel element included within Scheme Bundle 2. Scheme Bundle 6 is approximately €1.75 Billion less expensive than Scheme Bundle 2.

3.6.3 For this assessment, it has been assumed that there will be no change to the CapEx costs for each of the Bundle 2 and 6 options.

3.6.4 It is assumed that all infrastructure measures identified within the Main Report will be implemented fully to allow flexibility in service operation as required i.e. Newcomen link to Connolly station, East-wall link from Northern Line to Docklands station etc.

Operational and Maintenance (O&M) Costs

3.6.5 There have, however, been changes applied to the O&M costs to reflect the reduced traction and routine vehicle maintenance costs associated with the operation of lower service levels than previously proposed.

3.6.6 As outlined in Table 1 below, the reduced service levels, particularly at the extremities of the network, results in a 21% and 41% reduction in Bundle 2 and 6 annual O&M costs. The lower

[5] It should be noted that the alignment of MetroLink used within the assessment was the Emerging Preferred Route from the New Metro North Alignment Options Study at the time of modelling (July 2018). This also includes a tie-in with the Luas Green Line and upgrading of Luas Green Line to Metro Standard. This includes a direct interchange with the heavy rail lines at Whitworth Road (proposed new station) and Tara Street.

percentage reduction for Bundle 2 is due to the fact that traction and routine vehicle maintenance costs make up a smaller proportion of overall operational costs, with tunnel maintenance costs remaining unchanged.

3.6.7 It has been assumed that all Bundle 6 options will have the same O&M costs, although it is acknowledged that there would be slight differences between each option due to the minor differences in stopping pattern and distribution within the city centre area.

3.6.8 No account has been taken of any potential cost reductions associated with the 'skip-stopping' pattern inherent within the Jacobs Output TSS Bundle 6 option.

3.6.9 For the purpose of appraisal, the O&M costs detailed in Table 1 are only the costs above the Do Minimum baseline cost levels. The costs shown reflect the lower unit costs associated with electric trains compared to diesel equivalents.

Table 1. O&M Costs – Revised TSS.

SCHEME BUNDLE	O&M COSTS (MAIN REPORT) (€M PER ANNUM)	O&M COSTS (REVISED TSS) (€M PER ANNUM)	% CHANGE
2	85	66	-21%
6	49	29	-41%

Table 2. Cost Breakdown of Scheme Bundles 2 and 6

Scheme Bundle 2 - DART Expansion including DART Underground				Scheme Bundle 6 - DART Expansion with PPT upgrade		
	Scheme Description	Scheme Costs (,000)	Source			
Common Infrastructure	Electrification / Signalling Heuston	€115,612	Irish Rail			
	4-Track Parkwest to Inchicore	€94,526				
	Electrification / Signalling Maynooth	€245,007				
	Electrification / Signalling Northern Line	€210,208				
	Level Crossings - Maynooth Line	€53,286				
	Improved Depot facilities	€164,695				
	Fleet - 296 Electric Multiple Units (EMUs)	€548,000				
	Total Costs - Common Infrastructure	€1,431,334				
Scheme Specific Infrastructure				Scheme Specific Infrastructure		
Work Package	Scheme Costs (,000)	Source		Work Element	Scheme Costs (,000)	Source
• DU - Watling St to East Wall	€1,779,076	Irish Rail		• Newcomen Junction link to Connolly	€33,998	Jacobs Engineering / Irish Rail
• WTI Option from Sarsfield Bridge	€617,914			• Connolly Station Platform Remodelling	€203,860	
• 4-Track Inchicore to Sarsfield	€32,688			• Docklands Station (Spencer Dock)	€164,151	
• Dún Laoghaire Station - Turnback	€49,018			• Tara Street upgrade	€23,458	
• Inchicore works for B4T	€6,333			• Dún Laoghaire Station - Turnback	€49,018	
• FFSS Adjustment	€12,666			• Glasnevin Station	€69,712	
• Parkwest Turnback	€9,047			• Cabra Station	€16,430	
• Kylemore Station	€8,504			• 4-Track Inchicore to OB1	€108,805	
Total Scheme Specific Elements	€2,515,244			• Inchicore works for B4T	€6,333	
Bundle 2 - Total Scheme Cost	€3,946,578			• FFSS Adjustment	€12,666	
				• OB1 Bridge Adjustments	€29,855	
				• Kylemore Station	€8,504	
				• PPT upgrade / Electrification / Signal	€33,473	
				• Electrification OB1 - Heuston	€5,428	
				Total Scheme Specific Elements	€765,691	
				Bundle 6 - Total Scheme Cost	€2,197,025	

4. OUTPUT MODELLING RESULTS FOR REVISED SERVICE LEVELS

4.1 Introduction

4.1.1 This chapter provides a summary of the outputs of the modelling assessment of each of the scheme bundle options described above.

4.1.2 To comparatively assess each scheme bundle option a set of Key Performance Indicators (KPIs) have been extracted from the ERM for each of the options tested and include the following:

- Mode Share (AM peak hour and 24hr);
- Total Boardings (AM peak hour and 24hr);
- Total Boardings by PT Sub-mode (AM peak hour and 24hr);
- Public Transport Transfers (AM);
- Cap Ex Costs (€ millions);
- O&M Costs (€ millions);
- Transport User Benefits (€ millions);
- Present Value of Costs (€ millions); and
- Benefit to Cost Ratio (BCR).

4.2 Bundle 6 Options – Revised TSS Results

4.2.1 Table 3 below provides a summary of the performance of each of the Scheme Bundle 6 options tested.

4.2.2 As can be seen from the results below, there is a reduction in performance for the Bundle 6 – Jacobs Output TSS option. Rail Boardings in the AM peak hour, reduce by approximately, 4,400 – reflecting the reduced service offering and 'skip-stopping pattern'. Overall AM PT Boardings reduce by approximately 2,400 reflecting the transfer to bus and Metro. Transport User Benefits are still relatively high at almost €3.4billion, however this is approximately €1.9billion lower than the Bundle 6 option from the Main Report. The BCR for this option is still very high at 2.33, which reflects the reduced O&M costs associated with this option.

4.2.3 As expected the Bundle 6 – Revised TSS – Option 1 performs better than the Jacobs Output TSS option due to services stopping at all stations. This results in €120m in additional Transport User Benefits with a slight increase in the outcome BCR to 2.41.

4.2.4 The best performing option following the revised TSS – is Option 2. Option 2 provides for direct services from the Kildare line to Docklands Station resulting in higher levels of transfer and integration with MetroLink at Glasnevin. Transport User benefits are approximately €500m higher than the Jacobs Output TSS option with Rail Boardings in the AM peak hour only 2,000 less than the Bundle 6 options from the Main Report. The BCR for this option is 2.68 which represents a very high return on investment.

4.3 Bundle 2 – Revised TSS Results

4.3.1 Table 4 below provides a summary of the performance of Scheme Bundle 2 with the revised service levels constrained to the Jacobs Output TSS levels.

4.3.2 The results demonstrate lower overall Rail Boardings (-2,500 in AM, -25,000 over 24hrs) and a corresponding reduction in Transport User Benefits of approximately €950m resulting in a marginal reduction in the BCR from 2.49 to 2.35.

4.3.3 The reduction in services in the DART Underground tunnel from 16 to 12 TPDPH is not shown to have a substantial negative impact on the overall performance of the scheme bundle, as this level of service is shown to meet the demand reequipments on the line.

4.4 Impact of MetroLink on DART Expansion Options

4.4.1 The modelling assessment contained within the Main Report included MetroLink along with the various DART Expansion measures in all modelling tests. Bundle 6, was accordingly developed based on the potential to maximise the level of interchange with MetroLink at its intersection points with the heavy rail network at Glasnevin and Tara Street stations.

4.4.2 As part of this Addendum report and in addition to the testing of revised service levels for each option, it was also important to understand the performance of each option without the inclusion of MetroLink. This was done to understand if the DART Expansion options would stand on their own merits, without the wider integration benefits from this scheme.

4.4.3 For this reason, Scheme Bundles 2 and 6 have been tested without[6] MetroLink in place. Table 5 below provides a summary of the model results for Bundle 2 and 6 – with and without Metro Link. For this assessment the best performing Scheme Bundle 6 option (Option 2) has been used.

4.4.4 As can be seen in Table 5, the overall performance of the options without MetroLink reduces. The Transport User Benefits for Bundle 2 reduce by €408m (-6%) whilst the Bundle 6 option reduces by €512m (-13%). This highlights that Bundle 6 integrates slightly better with MetroLink releasing approximately €100m more in Transport User Benefits. The exclusion of MetroLink has less of an impact on Bundle 2 due to the higher level of penetration that this scheme provides within the city centre.

4.4.5 The BCR for Scheme Bundle 2 reduces from 2.35 to 2.2 without MetroLink while the equivalent BCR change for Scheme Bundle 6 is 2.68, reducing to 2.32.

4.4.6 The results show that while the inclusion of MetroLink provides benefits for both options, the DART Expansion scheme bundle options provide substantial user benefits in their own right and will provide a very strong return on investment, even without MetroLink.

[6] Note that MetroLink is also removed from the Do Minimum for these tests when calculating Transport User benefits for the 'No MetroLink' options using TUBA software.

Table 3. Bundle 6 - Revised KPI Summary

KPI	BUNDLE 6 – MAIN REPORT	BUNDLE 6 – JACOBS OUTPUT TSS	BUNDLE 6 – REVISED TSS – OPTION 1	BUNDLE 6 – REVISED TSS – OPTION 2
AM Mode Share (PT)	22.1%	21.9%	21.9%	22.2%
24 Hr Mode Share (PT)	12.7%	12.6%	12.6%	12.7%
AM PT Boardings	192,800	190,462	189,800	191,800
Rail	65,800	61,432	63,200	63,900
Bus	68,500	69,861	68,600	69,100
LRT	11,900	11,747	11,500	11,700
Metro	46,600	47,422	46,500	47,400
24 Hr Boardings	1,207,100	1,194,415	1,188,000	1,199,600
Rail	403,500	380,595	384,500	390,000
Bus	416,400	423,593	418,800	420,500
LRT	86,000	84,381	83,500	84,400
Metro	301,200	305,846	301,100	304,800
PT Transfers	43,800	42,700	41,200	43,200
Cap Ex Costs (€ millions)	2,197	2,197	2,197	2,197
O&M Costs (€ millions)	49	29	29	29
Transport User Benefits (€ millions)	5,279	3,387	3,507	3,894
Present Value of Costs (€ millions)	1,680	1,452	1,452	1,452
BCR	3.14	2.33	2.41	2.68

Table 4. Bundle 2 - Revised KPI Summary

KPI	BUNDLE 2 – MAIN REPORT	BUNDLE 2 – REVISED TSS
AM Mode Share (PT)	22.3%	23.4%
24 Hr Mode Share (PT)	13.0%	13.2%
AM PT Boardings	192,600	196,815
Rail	72,800	70,220
Bus	64,500	68,857
LRT	10,600	11,348
Metro	44,700	46,390
24 Hr Boardings	1,212,100	1,222,548
Rail	452,400	427,405
Bus	392,700	413,866
LRT	76,200	79,808
Metro	290,900	301,468
PT Transfers	44,300	45,700
Cap Ex Costs (€ millions)	3,947	3,947
O&M Costs (€ millions)	85	66
Transport User Benefits (€ millions)	7,389	6,442
Present Value of Costs (€ millions)	2,964	2,744
BCR	2.49	2.35

Table 5. KPI Summary – With and Without MetroLink

KPI	BUNDLE 2 – REVISED TSS	BUNDLE 2 – REVISED TSS – WITHOUT METRO	BUNDLE 6 – REVISED TSS – OPTION 2	BUNDLE 6 – REVISED TSS – OPTION 2 – WITHOUT METRO
AM Mode Share (PT)	23.4%	21.4%	22.2%	20.8%
24 Hr Mode Share (PT)	13.2%	12.1%	12.7%	11.8%
AM PT Boardings	196,815	171,200	191,800	167,700
Rail	70,220	70,700	63,900	64,100
Bus	68,857	74,500	69,100	77,400
LRT	11,348	26,100	11,700	26,200
Metro	46,390	-	47,400	-
24 Hr Boardings	1,222,548	1,064,400	1,199,600	1,042,300
Rail	427,405	432,400	390,000	387,600
Bus	413,866	458,100	420,500	477,500
LRT	79,808	173,900	84,400	177,200
Metro	301,468	-	304,800	-
PT Transfers	45,700	35,000	43,200	31,500
Cap Ex Costs (€ millions)	3,947	3,947	2,197	2,197
O&M Costs (€ millions)	66	66	29	29
Transport User Benefits (€ millions)	6,442	6,034	3,894	3,375
Present Value of Costs (€ millions)	2,744	2,744	1,452	1,452
BCR	2.35	2.20	2.68	2.32

5. CONCLUSIONS AND NEXT STEPS

5.1 Assessment Conclusions

5.1.1 This Addendum Report summarises the outcomes of a strategic modelling assessment of the preferred DART Expansion scheme bundle options based on a set of revised service plans – following an independent capacity analysis review of the rail network in the Greater Dublin Area (GDA) .

5.1.2 The revised service levels were tested in the NTA ERM to understand the impacts on passenger demand levels, performance and value for money in comparison to the results from the Main Report.

5.1.3 In summary the modelling assessment has found that:

- There remains a very strong return on investment and a positive business case for the implementation of both Scheme Bundles 2 and 6 with revised (lower) service levels;
- BCRs have reduced as a result of the revised service levels, although remain highly positive.
  - **Bundle 6** - Range of 2.32 to 2.68 with lower service levels (Previously 3.14)
  - **Bundle 2** - Range of 2.20 to 2.35 with lower service levels (Previously 2.49)
- There is a very strong and positive BCR for both scheme bundles, even without MetroLink being in place;
- Direct services from the Phoenix Park Tunnel line to Docklands provides for the greatest transfer levels and best integration with MetroLink; and
- The through running of M3 Parkway services on the Maynooth line performs well, in place of the previously proposed 'shuttle' service from M3 Parkway to Clonsilla.

5.2 Recommendation

Based on the modelling assessment and KPI evaluation, it is recommended that as per the Main Report, Scheme Bundle 6 is the preferred scheme bundle option to deliver DART Expansion. Scheme Bundle 6 still maintains a higher BCR than Scheme Bundle 2 and is €1.75billion cheaper.

5.3 Potential Next Steps

5.3.1 In line with the Public Spending Code and the DTTAS "Common Appraisal Framework for Transport Projects and Programmes 2016" (CAF), government departments are required to submit a Business Case for capital projects greater than €20 million in value.

5.3.2 The Main Report including this Addendum report is considered a Stage 1 - Preliminary Appraisal (as defined in CAF), in that it includes the background, initial specification of the needs and objectives, identification of potential options and a preliminary assessment of the costs and benefits of the options.

5.3.3 The next steps in the project will be to move to the Stage 2 – Detailed Appraisal stage, which will include:

- A full Economic Appraisal;
- Financial Appraisal; and
- Risk Analysis.

5.3.4 This should culminate in the submission of a full Business Case to secure project approvals and funding. In parallel to this, it is recommended that an Implementation and Phasing Strategy is undertaken to understand the incremental benefit of delivering the scheme bundle elements and sequencing of delivery to give the best return on investment.

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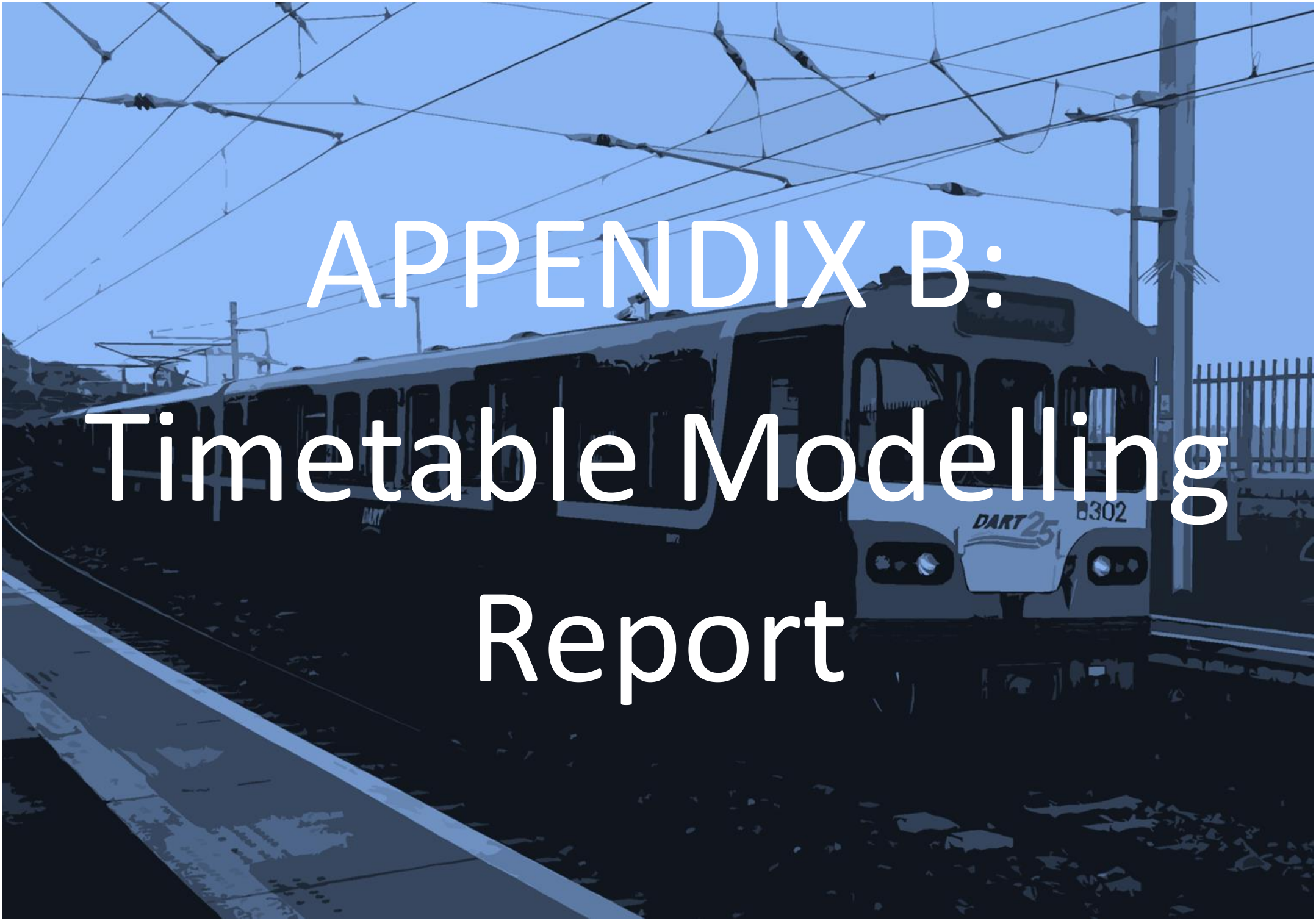
APPENDIX A: Service Patterns

Note: The table below contains a breakdown of the Services modeled as part of the Adddendum Report.

	Bundle 2		Bundle 6			
Route	**Main Report**	**Revised TSS**	**Main Report**	**Jacobs Output - TSS**	**Enhanced TSS - Option 1**	**Enhanced TSS - Option 2**
Northern Line						
Belfast to Connolly (Enterprise)	1	1	1	1	1	1
Connolly to Rosslare Europort (Diesel)	1	1	1			
Greystones to Rosslare Europort (Diesel)				1	1	1
Dundalk to Drogheda [Shuttle]	2		2			
Dundalk to Connolly (Diesel)	2		2			
Dundalk to Bray				2	2	2
Drogheda to Docklands			3		2	
Drogheda to GCD				2	2	4
Drogheda to Connolly			2			
Drogheda to Dún Laoghaire			6			
Drogheda to Bray				2		
Malahide to Greystones				2		
Malahide to Bray				1	3	3
Clongriffin to Dún Laoghaire				1	3	3
Howth to Howth Jn [Shuttle]	6	6	6	6	6	6
Connolly to Bray	3					
Clongriffin to Bray			4	2		
Kildare / Northern Lines						
Drogheda to Hazelhatch	8	4				
Dundalk to Hazelhatch		2				
Clongriffin to Hazelhatch	8	3				
Malahide to Hazelhatch		3				
Maynooth & M3 Parkway						
Sligo to Connolly (Diesel)	2	2	2	2	2	2
Maynooth to Connolly			5	8		2
Maynooth to Docklands			3			
Maynooth to GCD					4	2
Maynooth to Dún Laoghaire		3				
Maynooth to Bray	12	3	5		2	2
Maynooth to Greystones	2	2	2		2	2
M3 Parkway to Clonsilla [Shuttle]	4	4	4			
M3 Parkway to Connolly						5
M3 Parkway to Docklands				5	5	
M3 Parkway to GCD		2				
M3 Parkway to Bray		3				
Kildare Line						
Mainline to Heuston (DMU)	12	12	12	12	12	12
Hazelhatch to Heuston		2	4	4	4	4
Hazelhatch to Docklands			12	5	5	10
Hazelhatch to Connolly				1	5	
Hazelhatch to GCD				2		
Hazelhatch to Dún Laoghaire				2		



APPENDIX B:

Timetable Modelling Report