National Transport Authority

Final Business Case

Next Generation Automatic Vehicle Location System

KPMG

October 2023

NG AVL FBC v13

Glossary

ACER	Average Cost Effectiveness Ratio
AVL	Automatic Vehicle Location
BMO	Bus Market Opening
CBA	Cost-Benefit Analysis
CBO	Commercial Bus Operators
CEA	Cost Effectiveness Analysis
CIO	Chief Information Officer
CMS	Content Management System
CSO	Central Statistics Office
DCC	Dublin City Council
DMS	Data Management System
DPENDR	The Department of Public Expenditure, NDP Delivery and Reform
DRT	Demand Responsive Transport
DTTAS	Department of Transport, Tourism and Sport
EU	European Union
EWT	Estimated Wait Time

FBC	Final Business Case
FMS	Fleet Management System
HICP	Harmonised Index of Consumer Prices
ICT	Information and Communications Technology
IQS	Initial Quality Submission
ISFT	Invitation to Submit Final Tenders
ITN	Invitation to Negotiate
KPI	Key Performance Indicators
MCA	Multi-Criteria Analysis
MORTPI	Multi Operator Real Time Passenger Information
NDFA	National Development Finance Agency
NG AVL	Next Generation Automatic Vehicle Location
NGT	Next Generation Ticketing
NPF	National Planning Framework
NPV	Net Present Value
NTA	National Transport Authority
PAG	Project Approval Guidelines

PBC	Preliminary Business Case
PCI-DSS	Payment Card Industry Data Security Standards
PEP	Project Execution Plan
PI	Performance Indicator
PID	Project Initiation Document
PMR	Private Mobile Radio
PMV	Pole Mounted Validator
PQQ	Pre-Qualification Questionnaire
PRG	Peer Review Group
PSC	Public Spending Code
PSO	Public Service Obligation
QRA	Quantified Risk Analysis
RMP	Risk Management Plan
ROM	Rough Order of Magnitude
RTPI	Real Time Passenger Information
SAR	Strategic Assessment Report
SLA	Service Level Agreement

SPBM	Service Provider Business Model
TAA	Transport and Accessibility Appraisal
TAF	Transport Appraisal Framework
TFI	Transport for Ireland
TIG	Transport Integration Group
TII	Transport Infrastructure Ireland
TISS	Transport Information Systems and Services
TPI	Transport Planning and Investment Department
TT	Transport Technology
VAT	Value-Added Tax

Contents

1 Executive Summary

1.1 Overview

Automatic Vehicle Location (AVL) services have been a part of bus operations for over 30 years. In Ireland, Dublin Bus were the innovators in the 1980s by implementing a very early AVL system. These systems have developed into highly sophisticated tools that have become invaluable in the effective running of bus services across the world and that help to provide real-time information to passengers.

The National Transport Authority (NTA) proposes to continue to provide and improve AVL services under the Next Generation Automatic Vehicle Location project ('NG AVL'). NG AVL is proposed to be a national AVL solution that will provide country-wide opportunities for bus operators, passengers, and the NTA to generate a range of benefits, including:

- More reliable public transport services;
- Better real-time information on bus services with improved information for users;
- Better tools to improve bus services and provide for more efficient use of resources and reduced costs; and
- Improved reporting tools to help improve the network and manage existing services with more efficient use of technical resources across one AVL supplier.

The project aligns with the mission and the strategic objectives of the NTA, to promote public transport under a single brand and to drive customer service standards and innovation.

1.2 Report Purpose

The purpose of this report is to provide a Final Business Case (FBC), in advance of the decision to award the contract.

The FBC involves a complete appraisal based on costs and other information supplied by the NG AVL Preferred Tenderer designate (refer to Section 1.5) at final tender stage.

The FBC has been prepared in accordance with the Public Spending Code (PSC) and Transport Appraisal Framework (TAF) guidelines. It is intended to reassess the **Preliminary Business Case (PBC) from 2021**, in light of final tender submissions and other evolutions and outcomes of the procurement process.

The FBC is based on a comprehensive understanding of up-to-date costs, benefits, risks, deliverability and affordability, providing a basis on which to decide whether to proceed with the Project to deliver NG AVL.

For completeness, the report also describes the programme scope and the procurement process, in order to constitute a single reference document for Decision Gate 3 – Approval to Proceed.

1.3 Strategic Relevance and Project Objectives

Section 3 presents an updated assessment and confirmation of the strategic relevance and objectives for NG AVL.

The reassessment demonstrates that it supports the NTA's rationale for intervention in relation to asset renewal and service improvement of the current AVL systems on Public Service Obligation (PSO) bus services, and potentially some commercial bus services in Ireland, **and** to provide Ireland with an AVL system that is fit for the future**.**

By continuing to provide AVL services through the replacement of AVL systems and by providing customers with access to Real Time Passenger Information (RTPI) through various channels, such as bus stop displays, real-time apps and the National Journey Planner (TFI Live), NG AVL **represents a major commitment to customer experience**, and uses technology and innovation to deepen the integration and accessibility of the national public transport system. The provision of such information is seen as an important factor in encouraging the modal shift away from private transport.

NG AVL will also enable new and future functionality (e.g., passenger counting, preventative maintenance of buses) and will offer cost efficiencies across the whole system (one back office rather than five, and one that can be further expanded with additional Bus Operators).

NG AVL is a **relevant and appropriate investment that furthers the NTA's mission** to connect Ireland's people and places, by providing sustainable transport infrastructure and services.

The overall objectives for NG AVL focus on customer experience, efficiency, and compliance. These objectives have been translated into a set of service, solution, and compliance requirements described in the contract and contract schedules. They provide the basis for NG AVL's design, implementation, and operation; and for tracking and measuring the future value and benefits delivered.

1.4 Updated Detailed Project Brief, Governance and Procurement

Section 4 describes the scope and requirements for NG AVL and sets out the governance framework. It also details the procurement process and key features of the contract that are designed to ensure a high-quality service and to deliver value for money.

Updated Detailed Project Brief and Scope

The overall project scope, objectives and requirements have remained relatively static throughout the procurement process. From the approval of the PBC in April 2021, there have been very few changes in scope or objectives of the Project. NG AVL will, first and foremost, replace the existing bus AVL systems such that RTPI, service control, contract management and bus priority at traffic signals services can be maintained via a single, centralised managed service.

Governance

In the case of NG AVL, the NTA is acting as both the Sponsoring Agency and Approving Authority. In January 2020, the Department of Transport, Tourism and Sport (DTTAS) obtained Government approval that the NTA could take on a dual-governance role, provided there would be a clear separation of the two roles to allow for robust appraisal, scrutiny and oversight. This is described in 'Approving Authority Policy for Projects/ Programmes funded by the NTA Capital Investment Programme where the NTA acts as both Approving Authority and Sponsoring Agency', which outlines how NTA performs both the roles of Approving Authority and Sponsoring Agency.

An Executive Group, a Steering Committee, a Project Implementation Team and an Operations Management Team will be established by the Service Provider and the NTA under the Contractual Agreement in support of the implementation of the services. Both the NTA and the Service Provider shall be represented on each of the Executive Group, Steering Committee and Project Implementation Team.

Risk

As per the requirements of the PSC and TAF, a detailed risk management strategy has been included in the FBC building on the content of PBC, Project Execution Plan (PEP) and the Detailed Project Brief.

The Project team manage risk as per a detailed Risk Management Plan (RMP). The RMP follows a cyclical process of Risk Identification, Risk Assessment, Risk Response Development and Risk Control. At this stage, the RMP and the Risk Log have been updated to ensure any newly identified risks, or changes in the status of existing risks, are captured, and to reflect any change in risk management precipitated.

While individual risks are stated in the Risk Log, the following key risk themes and their mitigation are discussed in detail in Section 4.5.4:

- Installation and integration of new AVL hardware on existing bus fleets;
- Transition and adoption of AVL systems and technology; and
- Costs exceeding budget.

Following a detailed risk assessment, a Quantified Risk Analysis (QRA) has been undertaken to determine the Risk Value, on an expected value basis. The QRA considers the probability and impact range, the stage of the project where the risk would be applicable (i.e., capital expenditure, operating expenditure or both) and the associated cost base. A Monte-Carlo Simulation was then undertaken to determine the risk values at 30%, 50% and 80% confidence levels. The risk values at the 80% confidence interval were deemed the most appropriate to include as part of the overall cost assessment given the stage the Project is currently at. This results in the inclusion of a 23.2% risk adjustment on the capital expenditure base cost and a 5.2% adjustment on the operating expenditure base cost, representing a 12% blended overall risk adjustment to the total Project cost.

Procurement

The NG AVL project is being procured through a Negotiated procedure with prior call for competition[1], which will seek to establish a Single Party Contract for the provision of all the NG AVL elements. This process began with the publishing of the Contract Notice in July 2021 and the pre-qualification in September 2021. Five pre-qualified bidders were selected in Spring 2022, who then received the Invitation to Negotiate in June 2022. Bidders issued their Invitation To Negotiate (ITN) responses in September 2022, which the NTA reviewed to form the basis of agendas for the negotiation meetings, both in terms of quality response and financial. Negotiation meetings were held from late October through to December, with some virtual site visits held with the Bidders' clients in January 2023. The Invitation to Submit Final Tenders (ISFT) document set was issued to the five pre-qualified tenderers in June 2023, and three of the five returned responses, which were received in July 2023. The technical evaluation concluded with agreed scores for each technical criteria in mid-August, and the financial evaluation was concluded in September 2023, which facilitated the

[1] European Union (Award of Contracts by Utility Undertakings) Regulations 2016

identification of Trapeze Group (UK) Ltd as the Preferred Tenderer designate and, subject to the approval of this FBC and the finalisation and signing of a contract, Service Provider.

1.5 Financial Appraisal and Affordability Assessment

Section 6 sets out the approach, analysis, and results of the financial appraisal and affordability assessment.

Trapeze Group (UK) Ltd submitted a tender price of [redacted] million (in real terms, excluding Value-Added Tax (VAT)) as part of their final tender. While this represents the main cost element, the overall FBC Outturn Costs are estimated at c. €156.9 million when accounting for price book items (additional equipment and services the NTA may require over the term of the contract), NTA costs (including resource costs associated with managing the contract with the Service Provider), inflation, VAT, risk adjustment (in the form of a QRA) and contingency.

In line with the contractual terms, a base case of 14 years was determined to be the appropriate project timeline starting from 1 January 2024. This will include two years of development and implementation, eight years of operations and four years of extension (key dates are presented in Section 6.2.2).

[redacted]

Table 1: Total FBC Outturn Costs (nominal)

Amounts in EUR (2023 Base Price)	Capital Expenditure	Operating Expenditure	Total
[redacted]			

[2] HICP is used for inflation forecast.
[3] To be prudent, the FBC assumes 23% VAT on all payments/costs.
[4] QRA adjustment of 23.2% and 5.2% has been assumed for capital expenditure and operating expenditure respectively.
[5] 10% contingency has been deemed sufficient for the FBC in line with other NTA business cases.

As part of the FBC, an updated affordability assessment was completed in order to ensure the Preferred Tenderer designate represents value for money and that sufficient funding is available to meet the Project's full life costs. Table 2 below compares the total FBC Outturn Cost against the updated Do Minimum and PBC Preferred Option Estimate to account for inflation and VAT. The Do Minimum costs assumptions used in the PBC have also been revisited to ensure that changes in the value of money and scope are reflected in the latest costs (refer to Section 6.3).

The analysis demonstrates that the FBC Outturn Costs is similar to the Do Minimum costs with marginal savings of €0.1 million. The FBC Outturn Costs also represent a saving of €11.4 million against the PBC Preferred Option Estimate, thereby reaffirming the affordability of the PBC Preferred Option and providing a strong rationale from a financial perspective to proceed with contract award to Trapeze Group (UK) Ltd.

Table 2: Project Cost Comparisons (nominal terms, incl. VAT)

2023 Base Price	Do Minimum	FBC Outturn Costs	PBC Preferred Option Estimate
Total Cost	**€157,002,830**	**€156,891,562**	**€168,311,411**
vs FBC Outturn Costs	*€111,268*	-	*€11,419,850*

1.6 Economic Appraisal

Section 7 sets out the approach, analysis and results of the economic appraisal.

The appraisal takes the same approached as used in the PBC of a Cost-Effectiveness Analysis (CEA) on the Preferred Tenderer designate and the Do Minimum (renew current contracts).

CEA is used to draw comparison across the two options in terms of value for money. The Average Cost Effectiveness Ratio (ACER) gives the cost per unit of effectiveness, where units are the scores generated through a Multi-Criteria Analysis (MCA). Options can also be evaluated relative to each other, using a percentage of the least cost-effective option. This shows the difference between the most and the least cost-effective options.

Table 3: ACER results

ACER (excluding VAT, contingency, inflation)		Do Minimum	FBC Preferred Tenderer + NTA Costs Option
Cost	Total Cost[6]	€74.9M	€87.5M
	Net Present Value (4% discount rate) **[A]**	€57.8M	€72.5M
	Cost as % of most expensive option, %	80%	100%
	Ranking	**1**	**2**

[6] Figures taken from nominal totals presented in Table 16 (Do Minimum: €92.6 million and FBC Outturn Costs: [redacted] million) adjusted back to real numbers (i.e., in 2023 prices) in line with PSC guidance for economic appraisal

ACER (excluding VAT, contingency, inflation)		Do Minimum	FBC Preferred Tenderer + NTA Costs Option
Effectiveness	MCA Score (out of 700) **[B]**	370	670
	Effectiveness (MCA score) as % of least effective option, %	100%	181%
	Ranking	**2**	**1**
Evaluation	CEA (ACER) **[A/B]**	€156,154	€108,213
	Cost-effectiveness as % of least cost-effective option, %	100%	69%
	Ranking	**2**	**1**

From the ACER analysis, implementing the NG AVL with Trapeze Group (UK) Ltd results in a better economic outcome than the Do Minimum, with the lowest real cost per unit of effectiveness, at €108,213. This shows that it is the most cost-effective option and delivers the most effective solution for the cost. For the FBC Preferred Tenderer + NTA Costs Option each additional score in the MCA cost approximately €108,213 to deliver compared to €156,154 for the Do Minimum.

1.7 Benefits Realisation Plan

Section 8 presents the Benefit Realisation Plan where each of the target benefits are identified and described while an approach to measuring their achievement is outlined. The realisation of these target benefits will be mainly materialised through the performance of the contract between the NTA and the Service Provider. The benefits are categorised as being either passenger (e.g., more reliable public transport services), operator (e.g., more efficient use of resources, through tools to manage vehicles, drivers and energy consumption) or NTA (e.g., improved network to satisfy demand with appropriate supply) driven.

Throughout the term of the contract, the realisation of the target benefits will be measured and monitored at set timelines to ensure the service provides benefits to society and to the taxpayer.

1.8 Evaluation Plan

Section 9 presents the monitoring and evaluation plan for NG AVL to monitor and assess the achievement of objectives, benefits and effectiveness of the Project. It presents a non-exhaustive list of Key Performance Indicators (KPIs) which will be used to measure and monitor the success of the delivery of the Project in relation to the objectives. The Project objectives have been aligned with the Project benefits as outlined in Section 8 so that the success of the Project in meeting its objectives can be reported on in line with the benefits.

The Service Provider will be required to report on all the KPIs and Performance Indicators (PIs) detailed in Schedule 5 of the Contract every contract period, which will form the basis of performance management measures. Benefits outlined in Section 8 will continue to be measured and monitored by the NTA.

In line with PSC requirement, this section also outlines the details of the Ex-Post Review to measure the success of the project at completion including an assessment against Budget, Schedule, Quality and Scope of the project.

1.9 Conclusion

The costs and benefits associated with the project were subject to a detailed financial and economic appraisal, including a review of sensitivities. The result of the appraisal concludes that NG AVL is viable, affordable and represents value for money with the FBC Outturn Cost marginally lower than the Do Minimum by €0.1 million, and lower than the PBC Preferred Option Estimate by €11.4 million. There are also robust risk management, governance, implementation, monitoring and evaluation plans in place in addition to a project management team to oversee the delivery of the project within the time, cost and scope constraints. Based on the analysis undertaken, this FBC re-affirms the NTA's decision to proceed with Option 3 *'Tender for a Single AVL System'* as the Preferred Option given it is the most likely to deliver the most benefits to the NTA at the least cost.

In accordance with the PSC, it is recommended that Decision Gate 3 – Approval to Proceed be sought such that the project can proceed, and the contract can be awarded to the Trapeze Group (UK) Ltd. The contract with Trapeze Group (UK) Ltd will represent one component of the overall FBC outturn cost of €156.9 million which also captures the wider NTA budget to deliver NG AVL, including resourcing, budget for bus and systems upgrades in advance of NG AVL, budget to purchase additional fleet, AVL Lite[7] services and a number of priced options, such as bus lane enforcement cameras.

[7] AVL Lite is a low-cost app-based tracking system, offering similar but more limited functionalities to traditional AVL systems. AVL Lite services will be of use for small operators in more rural areas and will enable distribution of RTPI to passengers. AVL Lite can also be offered to CBOs.

2 Purpose and Methodology

2.1 Purpose of this Report

The purpose of this report is to provide a FBC in relation to the NG AVL procurement to support the decision to award the Contract. The FBC has been prepared in accordance with the PSC and TAF guidelines.

It is intended to reassess the assumptions underpinning the PBC from 2021, in light of final tender submissions, outcomes of the procurement process and other evolutions. It involves a complete appraisal based on costs and other information supplied by the NG AVL Preferred Tenderer designate (refer to Section 1.5) at final tender stage. The business case is based on a comprehensive understanding of up-to-date costs, benefits, risks, deliverability and affordability, providing a basis on which to decide whether to proceed with the project to deliver NG AVL.

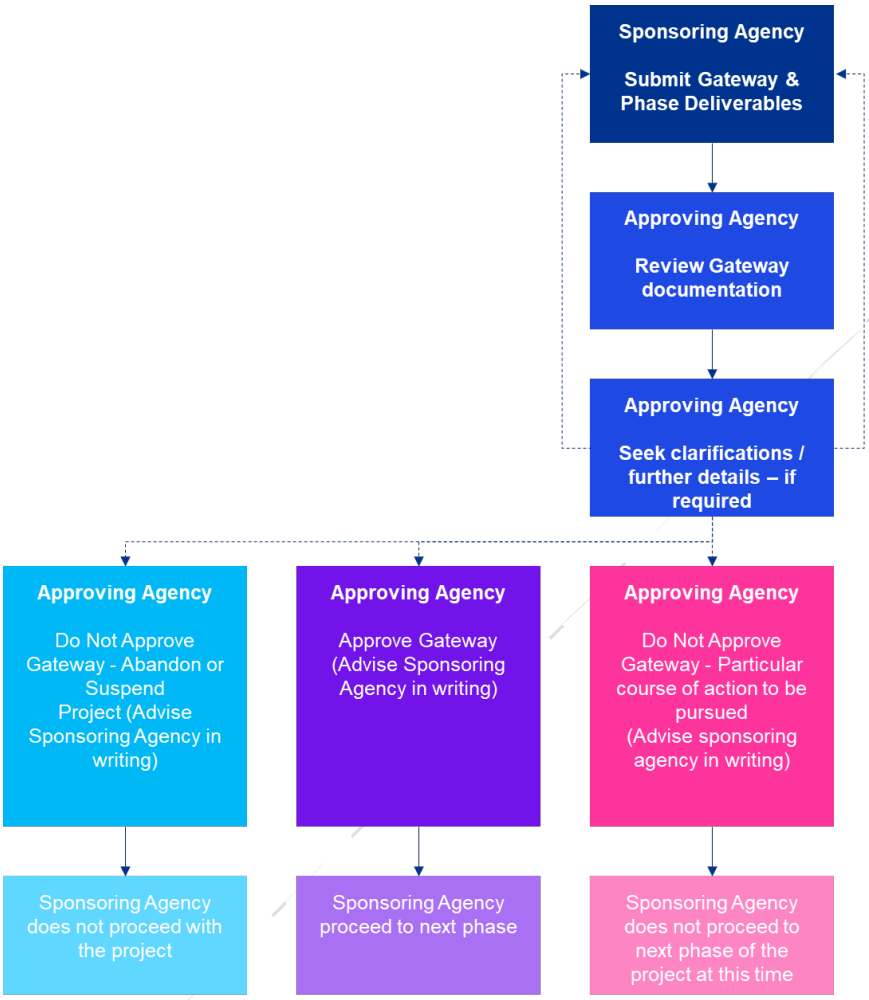
For completeness, the report also describes the programme scope and the procurement process, in order to constitute a single reference document for Decision Gate 3 – Approval to Proceed.

Figure 1, presented below, maps out the PSC Lifecycle Decision Gates and the NTA Project Approval Guidelines (PAG). The FBC is a key deliverable for PSC Decision Gate 3 and NTA PAG Gateway 3b.

Figure 1: PAG and PSC Phases

The PAG outlines a 'Gateway Review' process which will be followed at each phase. This process is outlined below in Figure 2, it shows the interactions between Sponsoring and Approving Agency and the three potential outcomes of the decision-making process.

Figure 2: PAG Gateway Process



2.2 Methodology

The FBC has been prepared in accordance with the requirements set out in the PSC and TAF. It is intended to reassess the assumptions underpinning the PBC and reconsider the emerging findings. There is a greater understanding of a range of critical technical and commercial issues related to the project including costs, benefits, risks, delivery and affordability, which is reflected in the FBC to reassess the ongoing validity of continuing with the investment. Given the passage of time since the financial appraisal and affordability assessment was completed at the PBC stage, the costs for the Do Minimum and the PBC Preferred Option Estimate have been updated to reflect current prices and to include VAT and inflation which were not included in the PBC. This has resulted in a significant increase in these estimates compared to what was presented at PBC stage, however the total FBC Outturn Costs including the Preferred Tenderer designate pricing are lower than the adjusted PBC costs.

As per the PSC and TAF, this FBC is an update and expansion of the earlier project appraisal undertaken at PBC stage, and includes the following elements:

- Strategic relevance;
- Project Objectives;
- Updated Detailed Project Brief;
- Project Governance;
- Procurement;
- Risk Management;
- Financial Appraisal and Affordability Assessment;
- Economic Appraisal;
- Benefits Realisation Plan;
- Monitoring and Evaluation;
- Delivery Schedule.

3 Strategic Relevance and Project Objectives

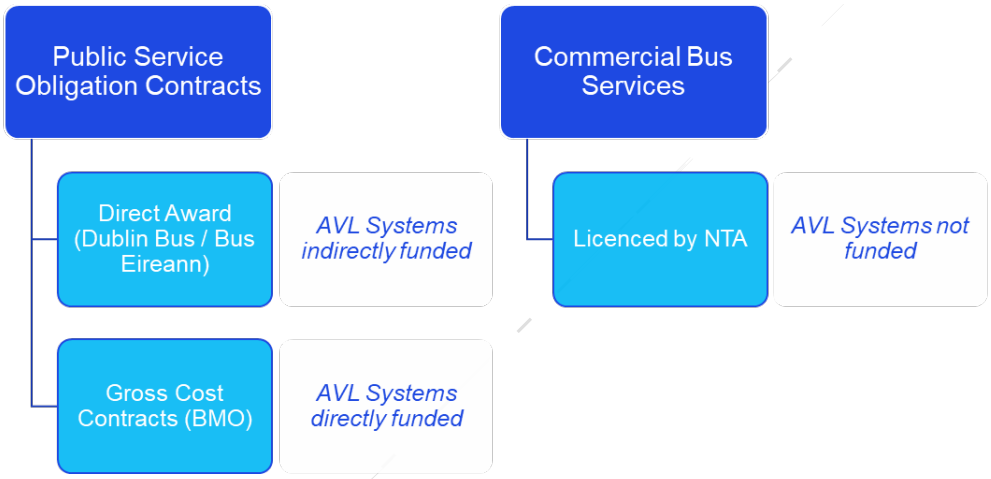
3.1 Strategic Rationale

As outlined in the Strategic Assessment Report (SAR) and the PBC, the strategic rationale for Government intervention is in relation to asset renewal and service improvement of the current AVL systems on PSO bus services and potentially some commercial bus services in Ireland. The strategic rationale has remained relevant since the approval of both the SAR and the PBC. The strategic landscape has not changed. The text below provides a high-level overview of the strategic rationale as outlined in the SAR and the PBC.

3.1.1 RTPI in Ireland

Figure 3, below, illustrates the provision of bus services in Ireland which is undertaken in two main ways:

Figure 3: Bus Services in Ireland



There are currently five AVL systems in Ireland under the remit of the NTA providing essential bus operator service control functionality as well as data to the RTPI systems operated by the NTA. Three systems (associated with the previously initiated Bus Market Opening[8] (BMO) tenders) are owned and managed by the NTA. The Direct Award AVL systems are operator managed but are funded by the NTA through direct award contracts. There are currently AVL systems for commercially operated vehicles in place but are not used to provide RTPI via the NTA's own channels. The current contracts in place between the Bus Operators or the NTA with suppliers of the AVL systems are coming to an end and intervention is required for the future provision of these services and asset renewal. The scope of this project covers PSO bus services (not commercial), to cover both existing and new services. The operational costs of supplying AVL services for new buses have also been included in financial appraisal, the capital element has not been included as this will be included in the procurement of the new buses.

[8] https://www.nationaltransport.ie/transport-technology/bus-market-openings/

3.1.2 Benefits of AVL

3.1.2.1 Benefits to customers

From a customer perspective, the main benefit of the current AVL systems is having access to RTPI through various channels, such as bus stop displays, real-time apps and the National Journey Planner. The provision of such information is seen as an important factor in encouraging the modal shift away from private transport. A recent survey in Ireland of bus users showed that RTPI is at the top of the hierarchy of needs at a bus stop[9], highlighting the importance of RTPI.

Improved levels of accuracy of RTPI information have been proved to generate greater patronage. As stated in the Bus Open Data Implementation Guide, "… *for routes that offered real time service updates, Transport for London reported a two per cent uplift in patronage when compared to routes without real time* information"[10]. This is also supported by Brakewood and Watkins in their literature review of the benefits of RTPI, with studies suggesting patronage increases of 1.7% in Chicago (rail RTPI signage) and 2% in New York (apps)[11]. In addition to the potential of increased coverage of RTPI comes a further opportunity to increase ridership and modal shift away from private transport. In order to help reduce the externalities produced from private transport use, a shift towards greater use of public transport will be assisted by the provision of better RTPI. Research conducted by Transport Focus, the independent passenger watchdog, has found a strong desire amongst bus passengers for more centralised sources of information about bus times, routes and fares[12].

A resulting shift from private to public transport will result in the following benefits for passengers and society:

- a reduction of congestion;
- a reduction of accidents, to drivers, cyclists and pedestrians;
- a reduction of tailpipe emissions, such as particulate matter and nitrous oxides, and the knock-on impact of a reduction in related health issues, such as asthma and some cancers; and
- a reduction in carbon emissions.

3.1.2.2 Benefits to operators

From an operational perspective, an AVL system is core to Bus Operators' operations providing the following benefits:

- An AVL system is essential for Bus Operators to make sure buses run to schedule;
- Allows Bus Operators to ensure that enough buses are in service at the right times;
- Allows Bus Operators to intervene in the event of incidents;
- Provides passenger confidence that scheduled buses will arrive.

[9] Information Hierarchy of Needs at Bus Stops (B&A, 2019) (NTA)
[10] Department for Transport, UK (2019)
[11] C. Brakewood (2018)
[12] Transport Focus (2014)

3.1.2.3 Benefits to the NTA

AVL allows the NTA to provide passengers with RTPI which makes public transport more attractive to passengers due to improved levels of customer experience. This is viewed as one of the key enablers to support the increased demand in public transport projected.

As discussed above in Section 3.1.2.1, recent qualitative research commissioned by the NTA has identified real-time information being at the top of the hierarchy of information needs in relation to public transport[13]. This highlights the importance of an AVL system that provides passengers with RTPI which is needed to support increased patronage and potentially will result in increased fare revenue for the NTA.

An improved AVL system also provides information to the NTA on bus locations, timeliness, delays etc., which in turn can help implement performance improvement and enable fleet optimisation.

The provision of a new Bus Operator contract management system as part of the scope of NG AVL will enable the NTA to continue to manage the performance of contracted Bus Operators. Such tools enable the NTA to measure performance of Bus Operators over given durations and compare it to contracted performance targets, adjusting payment according to the performance of bus operators against these targets. Providing such tools within scope of NG AVL will ensure that such services continue and that there is no need for integration with a separately supplied system, as is the case with the current Bus Operator contract management system.

3.1.3 Next Generation Automatic Vehicle Location

The NTA's proposed solution is to continue to provide and improve AVL services via NG AVL. With improved service control tools, through NG AVL, comes the potential for improved services, and more punctual and reliable services will generate more passengers and revenue. This would be further facilitated through the improvement and introduction of other add-on services, such as improved bus priority at traffic signals, which will help regulate services and improve their reliability, making bus services more attractive.

NG AVL has the potential to be able to assist the Authority to better plan the delivery of its services through an improved understanding of demand and supply. From NG AVL's proposed passenger counting service, a more accurate assessment of numbers of passengers boarding and alighting at each stop on the network will be known, allowing for better decision making around the future of the network. Services that are underused could be re-deployed elsewhere, where the need is greater, or frequencies adjusted to provide the appropriate level of capacity. This enables better use of public funds, whilst providing the socially necessary services to the population of Ireland.

In addition to replacing current systems and maintaining the existing services provided, NG AVL will enable other new functionality that is not currently available with existing AVL systems to be deployed:

- The easy and cost-effective addition of new Bus Operators. to the Irish market;
- Interfacing into fleet management systems (FMS) to enable preventative rather than reactive maintenance, which could save Bus Operators/NTA significant amounts in engineering costs, as well as provide information on driving styles and driver training requirements; and

[13] Qualitative Research – Stop Information Review, B&A, 2019

- More effective management of electric buses and the charging strategy for low emission vehicles. As low emission vehicles become the norm, AVL systems can be used to help manage the range of vehicles in operation and help manage the wider planning of bus deployment, where range is a potential issue.

The implementation of NG AVL will deliver the following passenger benefits:

- Provision of RTPI to more people across Ireland, providing more choice for passengers to plan their travel options, through the delivery of AVL Lite services;
- Increased accuracy of RTPI through the provision of new and improved AVL back office and prediction algorithm;
- A more efficient bus network and service from the use of improved service control tools and using passenger count data to improve the efficiency of the bus network; and
- A reduction in vehicle emissions due to improved network efficiencies and from an increase in the use of bus services thus facilitating modal shift from private vehicle use.

NG AVL will deliver new and better service control tools to Bus Operators, which will result in the following benefits:

- Operational efficiencies due to preventative maintenance capabilities;
- Ability to meet demand more accurately with passenger counting capabilities;
- Improve reputation of Bus Operators due to improved quality of service and more accurate RTPI;
- Reduction in energy consumption from better information on driver styles and more opportunity to re-train drivers to drive more efficiently, which will save on energy costs and reduce emissions from improved driving styles; and
- AVL Lite will meet the needs of small PSO, Local Link and Commercial Bus Operators (CBOs) and allow them to provide RTPI to passengers.

NG AVL will also bring about the following benefits to the NTA:

- Reduced costs, due to the consolidation of five back offices into one, resulting in reduced requirement for financial subsidy;
- Potential for increased fare revenue resulting from improved RTPI quality and greater coverage of RTPI;
- More effective contract compliance services, due to the replacement of the NTA's Data Management System (DMS);
- Efficiencies across the PSO operators, e.g., improvements to schedules reducing the required number of vehicles. For example, if one bus is removed from a route's schedule as a result of the NG AVL system, approximately €200k per year of savings could be made. Multiples of this benefit would be applicable from any improved schedule;
- Ability and ease of adding new operators to a single back office;
- Reputational improvements, though NG AVL helping to increase the attractiveness of public transport; and
- A reduction in the externalities associated with private car use, from a small modal shift away from private car use.

3.2 Project Objectives

The overall objective of NG AVL is to provide Ireland with an AVL system that is fit for the future. It will continue to provide AVL services through the replacement of AVL systems and it will improve and widen current AVL functionality (e.g., better predictions of bus arrivals for RTPI, addition of AVL Lite services). NG AVL will enable new and future functionality (e.g., passenger counting, preventative maintenance of buses) and will offer cost efficiencies across the whole system (one back office rather than five, and one that can be further expanded). The core NG AVL system is defined as Dublin Bus, Bus Éireann and Go Ahead Ireland (the users of the current core AVL systems that NTA pays for or maintains) having NG AVL fully rolled out to all of their depots, which is planned to happen by the end of 2025, based on current estimated timescales. It is also assumed that AVL Lite services may achieve a wider geographical reach from the end of 2025, one year after the initial focus of delivering the core NG AVL system. Some of the objectives will be realised once the core NG AVL system is fully rolled out, some will be enabled once the first bus is delivered and some will take a few years of operation before real benefits are realised.

A defined list of objectives is outlined below:

- To **replace** existing PSO **AVL assets** and **systems** to enable the continuous provision of RTPI, service control and reporting services to passengers, operators and the NTA respectively, by the end of **2025**.
- To facilitate the **expansion** of **RTPI**, **service control** and **reporting services** across Ireland by enabling the **future inclusion** of additional and new transport operators and reduce cost of adding new operators, using both full AVL and AVL Lite, by the end of **2025**.
- To contribute to **improved bus service provision** through the delivery of improved service control tools, by the end **2025**, and with **continuous improvement** throughout the following two years, as Bus Operators improve their use of the service control tools. This will be measured through quality-of-service indicators before, after NG AVL delivery and on an on-going basis.
- To provide tools to **improve operational** and **engineering efficiency**, from the end of **2025**, and with **continuous improvement** throughout the following two years. This will be measured through before and after costs of operational and engineering functions at selected Bus Operators.
- To **reduce** or (at least) **maintain** the current **cost of ownership** of the existing AVL systems (Dublin Bus, Bus Éireann and BMO AVL systems replacements), whilst **increasing functionality** and **compatibility** with other systems, from the end of **2025**.
- To improve the reputation of the NTA and of PSO Bus Operators through **improved accuracy of RTPI**, from the end **2025**, measured by before and after customer satisfaction surveys. Further **improvements** to **NTA's and PSO Bus Operator's reputation** from a widened geographic scope of the provision of RTPI, through AVL Lite services, will be seen from the end of **2025** and will be measured throughout the subsequent two years.
- To **facilitate future functionality** and **policies** through the provision of an AVL system that is fit for the future, from the end of **2025**. This is a challenge to measure, as it is difficult to fully determine what the future will hold, although once NG AVL is fully delivered, by the end of **2025**, this objective would have the potential to be realised.
- To **deliver an AVL system** that makes the **bus network more accessible** through the provision of **more information** to those with additional accessibility requirements.

This will start to deliver benefits as soon as the first bus is included on NG AVL, but more significantly once NG AVL is fully rolled out from the **end of 2025**. This will be measured by customer satisfaction surveys.

– To help **inform the NTA** of the success of the bus network in **satisfying demand**, thus enabling the NTA to deliver the same level of **quality of service** for a lower cost and/or to make improvements such that the bus network is more available to a greater proportion of the Irish population, including contributing towards modal shift. This objective would start to be realised once a few months of historic data is available, from around the **end of 2025**.

3.3 The Strategic Relevance

There are a number of national policy initiatives that should be taken into account when understanding the strategic alignment of any project with Government policy.

3.3.1 National Planning Framework

The National Planning Framework (NPF) is the Government's high-level strategic plan for shaping the future growth and development of Ireland to the year 2040. Contained within the NPF are ten National Strategic Outcomes, of which half could be contributed to by NG AVL. These are:

1 **Compact Growth** – improved public transport through better services and better RTPI will enable better and more public transport use instead of private car use, which would not support compact growth.
2 **Enhanced Regional Accessibility** – NG AVL will contribute to enhanced regional accessibility, through wider coverage of RTPI, enabling a wider use of the National Journey Planner (TFI Live), and less reliance on cars for regional trips.
3 **Strengthened Rural Economies and Communities** – NG AVL can provide low cost AVL solutions through AVL Lite, enabling RTPI, in rural areas, making rural public transport more attractive.
4 **Sustainable Mobility** – NG AVL will support the use of public transport and enable the NTA to better plan and deliver a network of services that meets the needs of demand, be it actual or latent demand. NG AVL will promote the use of public transport over private mobility, which will contribute towards more sustainable forms of mobility.
5 **Transition to a low carbon and climate resilient society** – NG AVL will help facilitate the move towards electric buses through energy management systems via the FMS.

In terms of the Strategic Investment Priorities outlined in the NPF, Housing and Sustainable Urban Development (1), Rural Development (3), Environmentally Sustainable Public Transport (4) and Climate Action (8) are all supported and enhanced through the benefits from NG AVL.

3.3.2 Government's Transport Agenda

The Government's Transport Agenda focuses on sustainable modes of transport, with increased funding allocated to cycling and walking and a big focus on decarbonising of road transport. Improving and encouraging Public Transport is a clear objective for the Government, with plans to improve rural mobility and regional connectivity.

NG AVL will align to the Government's Transport Policy. It will assist with improving information and services such that there is a more integrated national public transport system. NG AVL will also provide greater opportunities for all Bus Operators to generate RTPI across the whole nation, through AVL Lite services.

The Government's Sustainable Mobility Policy (2022) sets out a national framework for active travel and public transport until 2030. Central to this Policy is to make public transport, along with active travel modes, easier for people to use and access. NG AVL will support this focus through the provision of RTPI to passengers via mobile apps and bus stop displays, along with better services from the new service control tools. NG AVL will contribute to making public transport more attractive and encourage a shift away from private car use. This shift will further contribute towards Ireland's targeted 51% emissions reduction by 2030.

3.3.3 NTA Objectives and Transport for Ireland

The vision of the NTA set out in its corporate strategy is 'To provide high quality, accessible, sustainable transport connecting people across Ireland.' This high-level aim is partially achieved through the delivery of AVL information to Transport Operators, to the NTA's internal functions and to the users of its services.

The NTA has a number of statutory functions in the delivery of public transport services nationally. It is involved in the supply of various public transport services in Ireland, such as:

- Client for the PSO contracts with Iarnród Éireann, Dublin Bus, Go-Ahead Ireland, Bus Éireann and a number of other private operators (Iarnród Éireann not within the scope of this PBC);
- Joint client with Transport Infrastructure Ireland (TII) for the provision of the Luas services; and
- The licensing authority in relation to commercial bus services and the small public service vehicle industry – taxis, hackney and limousines.

The Transport for Ireland (TFI) brand was developed by the NTA as the customer facing brand to promote and coordinate the provision of public transport in Ireland. TFI is a "one stop shop" for public transport information, helping public transport customers access information on all aspects of travel by using the following:

- TFI Live Journey Planner – helps people plan their journeys, using public transport, walking or cycling. iPhone App: Appstore Android App: Google Play.
- RTPI – gives people real time service information for train, bus and tram services throughout Ireland. Dublin Bus, Bus Éireann, Go-Ahead Ireland, DART, Iarnród Éireann and Luas real time data are on the App, available on iPhone and Android platforms.
- TFI Leap Card – is a convenient way to pay for public transport in Ireland. It is available in Dublin, Cork, Galway, Limerick, Waterford, Athlone, Sligo, Kilkenny and Wexford.
- TFI website giving information on the above as well as information on taxis, walking and cycling in Ireland.

All functional requirements for an AVL system will contribute to the delivery of the objectives of the NTA and will enable the delivery of information services as required under the TFI brand.

3.3.4 Strategic Alignment with NTA policy

3.3.5 Strategic Alignment with NTA Strategic Objectives

In 2022, the NTA updated its Statement of Strategy to cover 2023 to 2025. Their strategic objectives are centred on eight key themes, and within most there are objectives that NG AVL will contribute to. These specific elements (not all) are covered below[14]:

- **Customer First**:
    - **Continue developing a deep understanding of customer needs to help ensure the infrastructure and services delivered, effectively address those needs** – NG AVL will support this theme through passenger counting services on each bus, providing data on the demand and supply mix of the bus network in Ireland;
    - **Continuously improve transport integration to provide customers with an easy to use public transport network and a seamless end-to-end journey experience** – NG AVL will support this through improved and widened opportunity for RTPI across Ireland;
    - **Ensure an emphasis on accessibility so that infrastructure and services are available to all, including the elderly and people with disabilities** – there are a number of requirements to help those with additional accessibility needs such as identification of wheelchair capacity on a bus;
    - **Prioritise safety on infrastructure and services for customers and staff alike** - NG AVL will help to generate more and accurate RTPI, which will help to enhance safety, particularly for those waiting at bus stops.
- **Climate and Sustainability** – NG AVL will contribute to all of the following objectives through making public transport more attractive to use via improved services and wider available and more accurate RTPI:
    - **Continuously improve organisational sustainability and efficiency, on the journey towards becoming climate neutral**;
    - **Enable a reduction in public transport emissions in collaboration with sector stakeholders**;
    - **Support a modal shift from the private car to more sustainable modes of transport including walking, cycling and public transport**;
    - **Promote sustainable transport in workplaces, campuses, schools and communities**; and
    - **Design and implement effective transport demand management measures** – NG AVL will facilitate the provision of bus priority at traffic signals which will improve the efficiency of moving buses through junctions. Further, NG AVL will enable passenger counting on each bus, which will facilitate demand management opportunities for Bus Operators.

[14] Text in bold is taken directly from the NTA's Statement of Strategy 2023 to 2025

- **Transport Infrastructure**:
    - **Ensure the effective delivery of the Authority's Capital Investment Programme** – NTA will work with the Service Provider to deliver NG AVL efficiently and effectively. It will contribute to BusConnects through the provision of improved bus priority at traffic signals services;
- **Transport Services**:
    - **Continue to develop a PSO framework that sets out the key priorities and provides direction on the future development of the PSO services** – NG AVL's contract and performance management reporting system will enable the NTA to accurate measure Bus Operators' performance.

      Continue to enhance the network of public transport services, responding to customers changing needs – NG AVL will provide Bus Operators and the NTA with a wealth of data to monitor and improve bus services.
    - **Effectively manage the delivery of contracted public transport services, maintaining robust measures to ensure reliability, punctuality and customer service standards are continuously improved** – the provision of new service control and reporting tools will help facilitate more reliable and punctual bus services.
    - **Leverage latest technologies and data insights to continuously enhance services and customer experience** – the vast amount of data captured through NG AVL will be harnessed to develop and deliver continuous improvement initiatives in the delivery of bus services to customers.
- **Transport Regulation**:
    - **Enhance quality consumer services, having due regard to the protection of all users and providers** – NG AVL will contribute to enhancing the TFI services, both in terms of the bus service performance and the quality of RTPI feeding into TFI Live and at bus stop displays
    - **Mature the compliance and enforcement regimes in the SPSV and commercial bus sectors** – NG AVL will provide an opportunity for CBOs to use AVL Lite, thus providing the NTA with a tool to measure CBO performance.
- **People and Organisation**:
    - **Maintain high standards in governance and service delivery** – NG AVL will be managed through strong internal and external governance processes and will be delivered and managed through a well-developed contract using best practice and experience.
    - **Continuously develop and invest in cyber security defences** – The NTA will ensure that the Service Provider will deliver and operate a secure solution.

3.4 NG AVL High Level Scope

NG AVL will, first and foremost, replace existing bus AVL systems such that RTPI, service control, contract management and bus priority at traffic signals services can be maintained via a single, centralised managed service. Through the introduction of a single NG AVL system, there will be the opportunity to improve the quality of these services and increase the scope of the functions on offer.

At a high-level, the scope of NG AVL will involve:

- An AVL system that could be used by any existing Bus Operator in any part of Ireland;
- A replacement of Dublin Bus' current AVL system, provided by Init, which currently services approximately 1,100 buses and has been in operation since 2010. (This will include the use of their existing Private Mobile Radio (PMR) system for voice communication only);
- A replacement of Go Ahead's AVL System, provided by Init (169 buses since 2018) and Trapeze Group (UK) Ltd (41 buses since 2019);
- A replacement of Bus Éireann's BMO AVL systems in Waterford provided by Trapeze Group (UK) Ltd, which services 17 buses and has been in operation since 2019;
- A replacement of Bus Éireann's AVL system, provided by Trapeze Group (UK) Ltd which services approximately 670 buses and has been in operation since 2008;
- A hosted back office to process the information and circulate it to the relevant channels, e.g., the National Journey Planner, RTPI, service control tools, reporting;
- A prediction generator that processes all Bus Operators' AVL data in the most appropriate way;
- A contract management tool, enabling the NTA to effectively manage Bus Operator contracts;
- A method of counting passengers on and off buses, which will assist with capacity planning/management, along with some additional functionality that will help increase accessibility of the bus network, such as a wheelchair space availability sensors;
- The opportunity to purchase a compatible AVL Lite system, for bus services that do not require full AVL. However, there is no definitive number of buses that would be equipped – this is an aspiration for the future and may enable further services to be added relatively inexpensively to RTPI channels in the future. This may also include school bus services in the future; and
- Services that are managed or outsourced in their entirety to the Service Provider, including strong and up-to-date Information and Communications Technology (ICT) Security and ICT Management requirements.

Note - All replacement systems will involve on-bus equipment, interfaces to existing on-bus equipment, service control tools and any other systems and equipment to enable the delivery of the outputs. Further detail on the requirements for NG AVL can be found in Section 4.4.3.

4 Updated Detailed Project Brief and Procurement Update

The Detailed Project Brief is the full and complete statement of the Sponsoring Agency's functional and operational requirements for a project expressed in output requirements. It is updated to reflect the outcomes of the tendering process and is set out in full in this FBC.

4.1 Background

In the course of developing the Project Brief update, the project team has considered the 16 project parameters as well as providing an update of the procurement activity since the NG AVL Project Brief was approved by the NTA Board in July 2021. These parameters, and the appropriate references, are detailed in Table 4 below. Note that not all of these are covered in this section but are included elsewhere in this document, as indicated in the table.

Table 4: Project Brief Parameters

Project Parameter	Reference in this document
1. Objectives	Refer to Section 3.2
2. Purpose	Refer to Section 3.2
3. Scope	Refer to Section 3.4
4. Deliverables/desired outcomes	Refer to Section 3.4
5. Performance	Refer to Section 4.6.6 and 9.4
6. Assumptions	Refer to Appendix E.1.2
7. Governance and Reporting	Refer to Section 4.2
8. Preferred Option	Refer to Section 5
9. Known Risks	Refer to Section 4.5.2 and Appendix E.1.1
10. Value Management Strategies	Refer to Section 4.7
11. Project Execution Plan	Refer to Section 4.6.4
12. Expected Functional Life	Refer to Section 4.3.1 and 4.7
13. Design restrictions/requirements	Refer to Section 4.4.3 and Appendix D.2
14. Location	Not applicable. This is an ICT project and location or site options proposed for the facility does not apply.
15. Budget	Refer to Section 6
16. Constraints	Refer to Appendix E.1.5
17. Procurement Update	Refer to Section 4.3

A separate Project Brief provides some more detail than is given in summary in this section. In addition, further information on those elements outlined in Table 4 can also be found in the PEP. The PEP has been developed to help deliver NG AVL in conjunction with the NG AVL Service Provider and the governance arrangements outlined in this document. Reference will be made to the PEP documents throughout this FBC, in order to avoid significant duplication of content.

4.2 Project Governance

For the purpose of appraising and delivering public investment projects, the PSC defines two primary administrative roles: the Sponsoring Agency and the Approving Authority. Based on

the guidelines set out in the PSC, the Sponsoring Agency "has primary responsibility for evaluating, planning and managing public investment projects", while the Approving Authority "has ultimate responsibility for the project". Per the TAF, the Sponsoring Agency also "must develop and refine the arrangements needed for effective project or programme governance".

In the case of NG AVL, the NTA is acting as both the Sponsoring Agency and Approving Authority. In January 2020, DTTAS obtained Government approval that the NTA could take on a dual-governance role, provided there would be a clear separation of the two roles to allow for robust appraisal, scrutiny and oversight. This is described in 'Approving Authority Policy for Projects/ Programmes funded by the NTA Capital Investment Programme where the NTA acts as both Approving Authority and Sponsoring Agency', which outlines how NTA performs both the roles of Approving Authority and Sponsoring Agency. The key project governance roles are explained below.

An overview of the NG AVL governance structure is set out below in Figure 4

Reference Project Organization and Governance in the PEP (see Appendix H).

4.2.1 Approving Authority

As mentioned above, for public transport projects, the NTA undertakes the role of the Approving Authority. This will be performed by the Transport Planning & Investment Department supported by Department of the Chief Information Officer (CIO). If the Approving Authority is satisfied that the FBC meets the required standards outlined in PSC and TAF, it can approve the project to proceed.

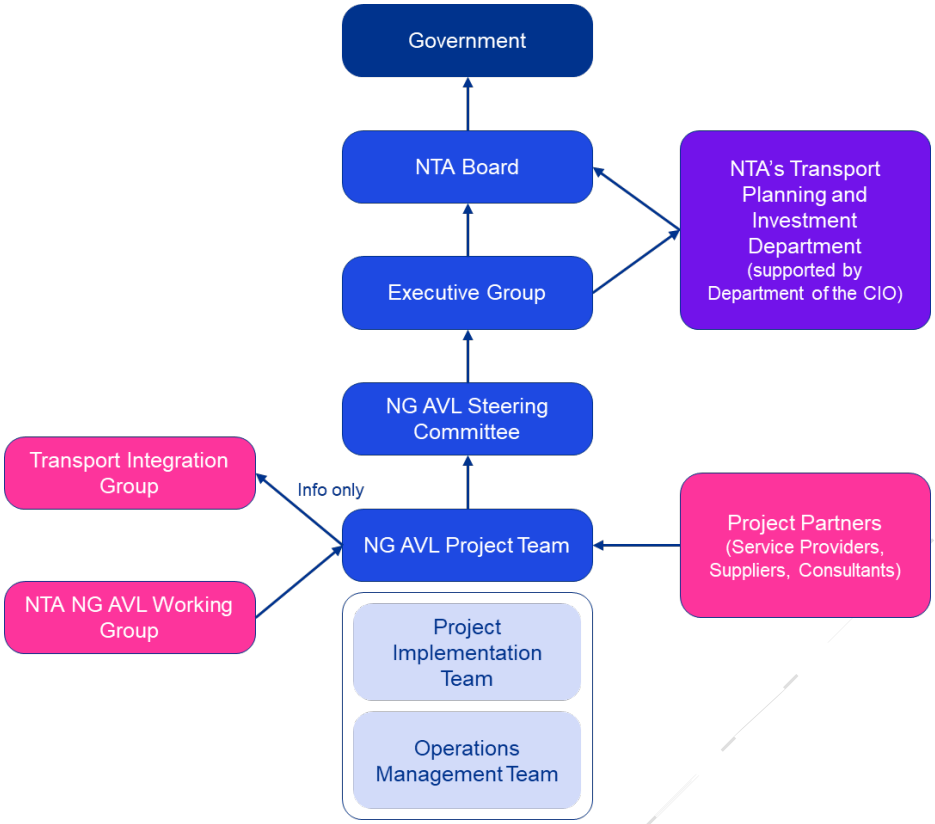
4.2.2 Sponsoring Agency

The Sponsoring Agency role will be undertaken by the Transport Technology (TT) Directorate in the NTA. It will nominate the project team roles (Project Manager, technical roles, etc), plan and manage the project, and be the contracting agency, i.e., responsible for the procurement, the subsequent rollout and operations.

4.2.3 Governance Structure

The updated governance structure for NG AVL project is set out in Figure 4 below, with each of the roles explained in further detail below the graphic. As noted, NTA is acting as both the Sponsoring Agency and Approving Authority. An Executive Group, a Steering Committee, a Project Implementation Team and an Operations Management Team shall be jointly established by the Service Provider and the NTA under the Contractual Agreement in order to ensure appropriate governance and oversight during the implementation and operational phases, with representatives from each organisation on the respective group, committee and teams.

Figure 4: Governance Arrangement for NG AVL



As mentioned previously, NTA is acting as both the Sponsoring Agency and Approving Authority. An Executive Group, a Steering Committee, a Project Implementation Team and an Operations Management Team shall be established by the Service Provider and the NTA under the Contractual Agreement in support of the implementation of the Initial Services, as shown in Figure 5 and Figure 6 below. Both the NTA and the Service Provider shall be represented on each of the Executive Group, Steering Committee and Project Implementation Team.

The specific governance arrangements for the project consists of the following key roles:

- **Government:** The Department of Public Expenditure, NDP Delivery and Reform (DPENDR) and DTTAS will be involved in the approvals process.
- **NTA Board:** NTA Executive Group (the NTA's senior leadership team) reports to the Board and certain matters are reserved for the NTA Board to consider.
- **Executive Group:** The Executive Group's role is to ensure that the delivery of the Services runs smoothly and that the relationship between the NTA and the Service Provider is successfully executed. Any issues that need to be escalated and resolved will be addressed at the Executive Group. The Executive Group will be responsible for strategically leading implementation and performance, and providing guidance to ensure that long-term issues affecting NG AVL are properly considered and, where necessary, resolved. Following commencement of the operational period, the Executive Group will evolve to focus on operational matters. There will be some overlap between implementation activities and operations activities and as such, the role of the Executive Group is interchangeable and largely common across both periods. Any issues that need to be resolved or escalated will be addressed at the Executive Group.

- **Transport Planning & Investment Department:** NTA's Transport Planning & Investment Department supported by Department of the CIO will be the Approving Authority.
- **NG AVL Steering Committee:** Key stakeholders from NTA and the Service Provider(s). The Steering Committee is responsible for strategically leading the delivery of the NG AVL project and for providing guidance to ensure that long term issues are properly considered and resolved. The NG AVL Steering Committee is the point of escalation for the Project Team.
- **Transport Integration Group (TIG):** Forum for NTA CEO, NTA Director(s), and Transport Operator CEOs and their senior staff to meet and discuss strategic programmes and other transport initiatives. Updates on the progress of the NG AVL project will be given by the project sponsor at the TIG.
- **NG AVL Transport Operator Working Group:** The purpose of this working group is to inform all relevant Bus Operators of NG AVL project progress including changes to timescales, project activities, scope etc. and to coordinate updates on the change work packages between the NTA and the Bus Operators. Dublin Bus, Bus Eireann and Go Ahead are represented on this group.
- **Project Implementation Team:** The Project Implementation Team's role is to ensure that the project implementation runs smoothly on a day-to-day basis. The structure of this team is outlined in Figure 5. The Project Implementation Team shall meet every Contract Period unless otherwise agreed by the Steering Committee. Should the need arise, it may meet on an ad-hoc basis.
- **Operations Management Team:** The Operations Management Team role is to ensure that operations run smoothly on a day-to-day basis. The structure of this team is outlined in Figure 6. Operations Management shall meet (at the Operations Management Team Meeting) every Contract Period unless otherwise indicated by Executive Group. However, should the need arise, it may also meet on an ad-hoc basis.

Figure 5: Project Implementation Team

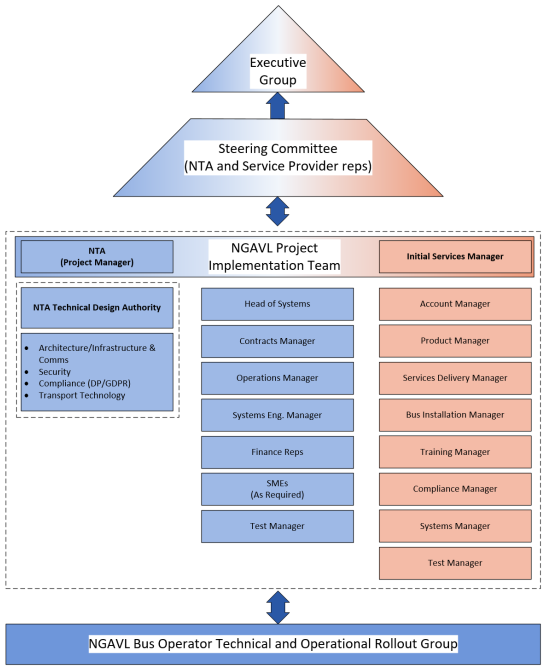
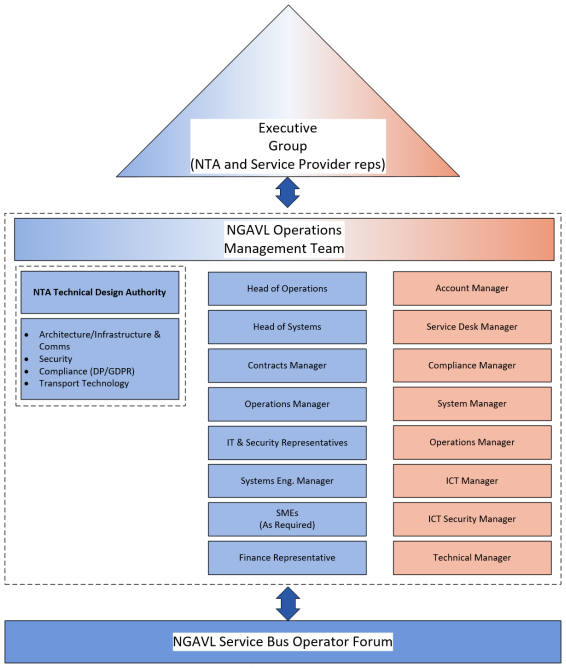


Figure 6: Operations Management Team



The approach outlined will provide an integrated governance framework that emphasises regular involvement of the Steering Committee and other stakeholders to ensure that visibility and oversight is provided to meet the overall service requirements. The benefits of this structure are:

- Strong focus on achieving the objectives and aims for the project;
- Senior management sponsorship and oversight;
- Direct involvement of the Authority for programme oversight;
- Tight control of the project schedule, scope, cost and resourcing;
- Ready access for the project team to decision makers and policy direction;
- Effective identification, management and escalation of project risks; and
- Regular reporting establishing a two-way communication protocol.

4.3 Procurement Process Since July 2021

The governance outlined in Section 4.2 has steered the project through a complex procurement process. This was initiated in July 2021 when the Project Brief was approved by the NTA Board. The following sections provide a summary of that procurement process.

4.3.1 Procurement Strategy

The preferred procurement strategy for NG AVL was agreed in January 2021 as per the Procurement Strategy and is summarised below and set out in Table 5. Since then, there have been no changes to the procurement approach.

Table 5: NG AVL Procurement Approach Overview

Procurement element	Preferred approach
Procurement procedure	Negotiated procedure with prior call for competition
Type of contract	Single supplier contract (without lots)
Length of contract	Approximately two years to deliver (one year set up and one year rollout); Operational contract duration of 8+2+1+1
Number of shortlisted candidates	Maximum of five

This agreed strategy was set out in the Project Brief that was approved by the NTA Board in July 2021. It was also the basis for the activity outlined below in the following sections.

4.3.2 Pre-Qualification Questions and Evaluation

The Pre-Qualification Questionnaire (PQQ) for NG AVL included a series of technical and financial questions that were used to highlight those bidders that would be suitably qualified to deliver a project of the scope and scale of NG AVL. These included some pass/fail criteria as well as some based on experience and judged on a qualitative basis. Any candidate who failed in any of the criterion were excluded from the competition.

Candidates' economic and financial standing over the three previous financial years was assessed across a range of PIs and relative to the estimated total value of the NG AVL contract. Candidates were required to meet a minimum turnover requirement of €10m for each of the three previous financial years. Each candidate self-certified and was awarded a pass or fail as appropriate.

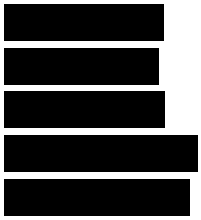
The criterion outlined in the technical questions that was used to select the shortlist of candidates is summarised in Table 6 below. Two case studies were required in response to each criterion, and both provided the client, role of the respondent, number of buses involved and the time of delivery or operations.

Table 6: PQQ High Level Criteria

Criterion (Part 5)	Description	Maximum marks available	Minimum pass mark
5.1	Comparable Engagements to NG AVL	250	100
5.2	Experience of provision of on-bus systems including installation services	250	100
5.3	Experience of provision of Performance Management / Reporting Services	250	100
5.4	Experience of Operations and Maintenance Service	250	100
	TOTAL	**1000**	**400**

The outcome from the pre-qualification process is as follows:

- The following Candidates were eliminated as they failed to achieve the minimum pass mark:



- The following Candidates were not shortlisted:

- The following Candidates were shortlisted:

4.3.3 ITN Draft Schedules

The document templates used for the Transport Information Systems and Services (TISS) Applications Contract were re-used for NG AVL but were heavily amended for specific application to NG AVL. Drafting was undertaken in conjunction with the project team and with the NGT Team, such that alignment across the two procurements could be maintained. Legal support was provided by McCanns Fitzgerald via the NTA's Legal department as and when required.

There was a significant drafting and review effort from Summer 2021 through to May 2022, with the final versions of the ITN schedules issued to the five pre-qualified tenderers in June 2022. The ITN schedules are given in Appendix A1 and are numbered 1 through to 17.

The five prequalified tenderers were issued the ITN document set and asked to respond with a high-level response, specifically to Schedule 4 – Services and the requirements contained within, but also to the draft agreement and to provide comments on any of the Schedules.

4.3.3.1 ITN Technical Assessment Team and Negotiation Meetings

The ITN evaluation team is included in Appendix A2. The Lead Evaluator chaired their respective sections in the ITN negotiation meetings with the tenderers and presented the high-level feedback from the negotiation assessment. These meetings were held in late October and early November 2022.

4.3.3.2 *ITN Financial Negotiation Meetings*

All tenderers were asked to complete Rough Order of Magnitude (ROM) pricing at the ITN stage, which contained high level pricing across capital and operational elements of the project. These were received with the ITN responses and reviewed by the Financial Evaluation Team ([redacted]). The team held meetings with each bidder on specific elements of the outcome of the reviews of the ROM pricing in November and December 2022.

4.3.3.3 *Virtual Site Visits*

Discussions with each of the five tenderers were held in December 2022 and January 2023. These site visits included meetings with both authorities and Bus Operators and included a standard agenda with each. They were:

As an outcome of the virtual site visits, the project team determined that NG AVL requirements were sound and that all five tenderers have built up good working relationships with their suppliers, some for over 20-years. Further, there were some positive discussions on the scope of AVL within these site visits, which generated discussion on validating the scope of NG AVL with respect to passenger counting systems. Further discussion on this subject was held between Toronto Transit Corporation and a number of internal NTA stakeholders.

4.3.4 Invitation to Submit Final Tender Draft Schedules

The ITN schedules were further developed based on the information gleaned throughout the ITN process outlined above. This required significant redrafting, discussion with stakeholders and approvals of documentation from January 2023 to April 2023. Significant changes to those highlighted above are outlined below:

- Agreement – in conjunction with McCann Fitzgerald and the NTA Head of Legal, changes were made following the comments made by tenderers in their ITN submission. Although all comments were reviewed, only minor changes were made and were issued as part of the ISFT process;
- Schedule 3 – Initial Services – improvements were made to the milestone process and associated payment mechanism to incentivise effective delivery (see Schedule 6);
- Schedule 4 – Services – a significant re-write of many requirements was undertaken as part of the ISFT re-draft. Although significant in volume, this was more about adding clarity to existing requirements rather than changing core requirements. Some structural changes were made around architecture and in the ICT sections;
- Schedule 6 – Improvements were made to the payment mechanism around the Initial Services approach to incentivise effective delivery, as well as some changes to the way indexation is calculated;

- All other Schedules – were reviewed again in light of the ITN meetings and submissions resulting in minor changes throughout.

There were two additional schedules added:

- Schedule 18 – Form of Escrow Agreement – this was removed in the ITN stage but re-inserted as a schedule at ISFT on legal advice;
- Schedule 19 - PCI Compliance – this was added to ensure that requirements around PCI compliance, particularly in conjunction with the NGT Project, were made clear.

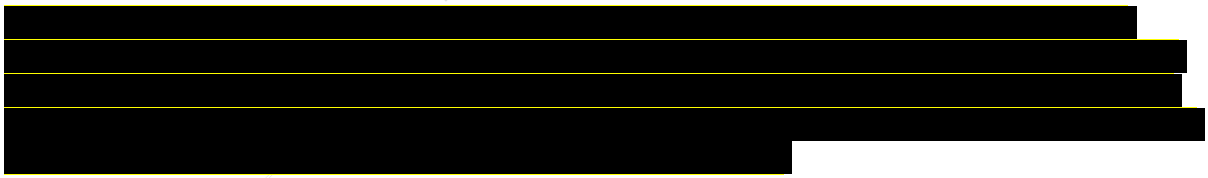
In support of the changes to the Schedules, a number of communication sessions were held with the tenderers between February 2023 and April 2023. These helped to communicate changes that the tenderers could expect in the ISFT pack. The full list of ISFT Schedules is contained in Appendix A1.

4.3.5 Issue of ISFT

The ISFT pack of schedules and supporting documentation was issued to tenderers in late April 2023. A query process began that facilitated tenderers to question elements of the ISFT pack. The majority of the questions were on the technical requirements included in Schedule 4. A full query log was kept throughout this period. Queries closed two weeks before the end of the ISFT submission date.

4.3.6 ISFT Submission and Communication with Tenderers

There were a number of requests for extensions from the tenderers throughout the ISFT process. Three weeks was initially granted as an extension, and a further two weeks was given towards the end of the process, resulting in delays of five weeks in receiving the tender responses.



4.3.7 ISFT Quality Evaluation

The three submitted tender responses were received in June 2023, and were evaluated by the team outlined in Appendix A. The scoring criteria outlined in the ISFT document[15] was used to determine the overall score for each tenderer. Consensus meetings were held throughout July 2023 and August 2023, with an agreed score achieved for all tenderers by the end of August 2023. No clarifications were required to be raised with tenderers at that stage.

4.3.8 ISFT Financial Evaluation

The three tenderers each submitted a completed Service Provider Business Model (SPBM) that was developed by KPMG with the NTA. This provides a financial evaluation price to be

[15] Invitation to Submit Final Tender NG AVL – a document that provided information on such things as the tender process, the contract, the submission and the award criteria for evaluation.

evaluated. The scoring criteria was outlined in the ISFT document. A number of queries related to their submitted pricing were asked of each tenderer. The financial evaluation was closed on 27 September 2023 after receipt of all clarification responses. Further information on the pricing of the Preferred Tenderer designate can be found in Section 6.

4.3.9 ISFT Outcome of Evaluation

The combined scores from the quality and pricing evaluation are contained below in Table 7 Tenderer C scored higher in both the quality and price evaluation. Further information on the detailed outcomes of the evaluation can be found in the Procurement Report.

Table 7: ISFT Evaluation Scores

	Tenderer			
	A	B	C	Max
[redacted]				600
[redacted]				400
[redacted]				**1000**

The outcome of the evaluation has determined that Trapeze Group (UK) Limited is the Preferred Tenderer designate [redacted]

4.4 Project Scope

The project scope, objectives and requirements have remained relatively static throughout the process. From the approval of the PBC in April 2021, there have been very few changes of scope or objectives of the project. These objectives, scope and high-level requirements are all repeated in this section and have remained the focus of the procurement activity outlined in Section 4.3. Although the detailed requirements are not included in this document (See Schedule 4 – Services for a full list), these objectives and high-level functional requirements, whilst being cognisant of the NTA's non-functional requirements for such projects, have driven the requirements capture and negotiations with the tenderers. This provided a solid basis for progression throughout the procurement processes outlined in Section 4.3.

4.4.1 Objectives and High-Level Scope of NG AVL

Both the objectives and the high-level scope of NG AVL are given in Section 3 to help describe the strategic relevance of NG AVL. The Project Objectives are given in Section 3.2 and the High-Level Project Scope is given in Section 3.4.

4.4.1.1 Exclusions from scope

Items deemed not to be in scope for the Procurement phase of the NG AVL are as follows:

- An AVL system for Luas or for Heavy Rail, although NG AVL could be used to manage the contract compliance of both modes, through a replacement for the existing contract management system, the DMS;

- A dynamic Demand Responsive Transport (DRT) system (app based) – there is a separate NTA project looking to procure a Smart DRT application that can be piloted by the NTA;
- Ticket machines and any scope of equipment included within NGT, such as Pole Mounted Validators (PMVs);
- The replacement of existing on-bus next stop displays (other than the provision of new displays for future buses and the potential for displays that could present different information than at present).

At a high level, the scope of NG AVL and its interaction with other NTA systems, is given below in Figure 7.

4.4.2 Functional Requirements for NG AVL

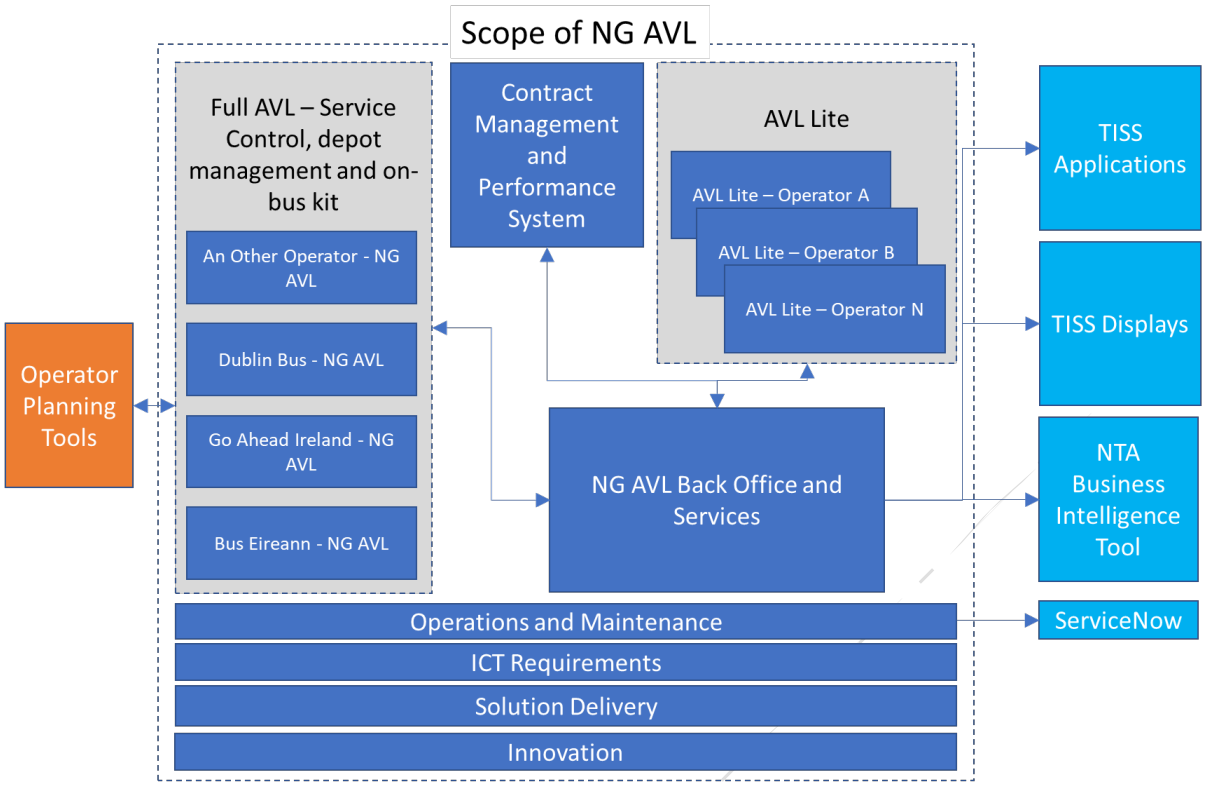
The functional requirements and project objectives have been mapped from NTA policies and business requirements and mapped to benefits for passengers, Bus Operators and to the NTA. The mapping is given in more detail in the Benefits Realisation Plan and in Appendix D. The high level functional requirements and project objectives are also listed in Appendix D.1.

The functional requirements and project objectives are all satisfied through the requirements outlined in the Schedule 4 – Services and were used to develop the general requirements outlined in Section 4.4.3. The mapping of these high level requirements and project objectives back to the expected benefits is given in Appendix D and referred to in Section 8 and in the Benefits Management Tracker in the PEP Document Catalogue (see Appendix H).

4.4.3 General Requirements from Schedule 4 – Services

A high-level summary of the scope of NG AVL is provided as an extract from Schedule 4 – Services within Appendix 2. This is given to provide context to the detailed requirements provided in Section 3 of Schedule 4 – Services. Figure 7 below gives a diagrammatic overview of the scope of NG AVL. These detailed requirements are what the tenderers have based their tender responses on.

Figure 7: NG AVL Scope



4.5 Risk Management Strategy and Risks, Actions, Issues, and Dependencies (RAID)

Risk is an implicit element in the execution of major capital projects like NG AVL. It manifests itself in numerous forms at different stages in the project life cycle. The PSC and TAF require that a detailed risk management strategy be included in the FBC building on the content of the PBC, PEP and the Detailed Project Brief.

At this stage, the risk analysis and risk management strategy has been updated to ensure any newly identified risks or changes in the status of existing ones are captured. This section presents the risk management strategy that was adopted throughout the project's PSC Lifecycle and Decisions Gates in order to address the key risks.

4.5.1 Governance of Risk Management

Figure 8 below, outlines how risk management will be governed in the NG AVL project, with the Project Manager being the first line of defence, followed by the Steering Committee / TIG, and with the NTA Board and Transport Planning & Investment Department (supported by Department of the CIO) as the final line of defence. This structure ensures that all parties have oversight of the risk management procedures in place. Further information on risk management is given in Section 4.5.

Figure 8: Risk Management Processes

4.5.2 The Risk Management Plan and the Risk Log

As discussed above, the NG AVL project team maintains a RMP which:

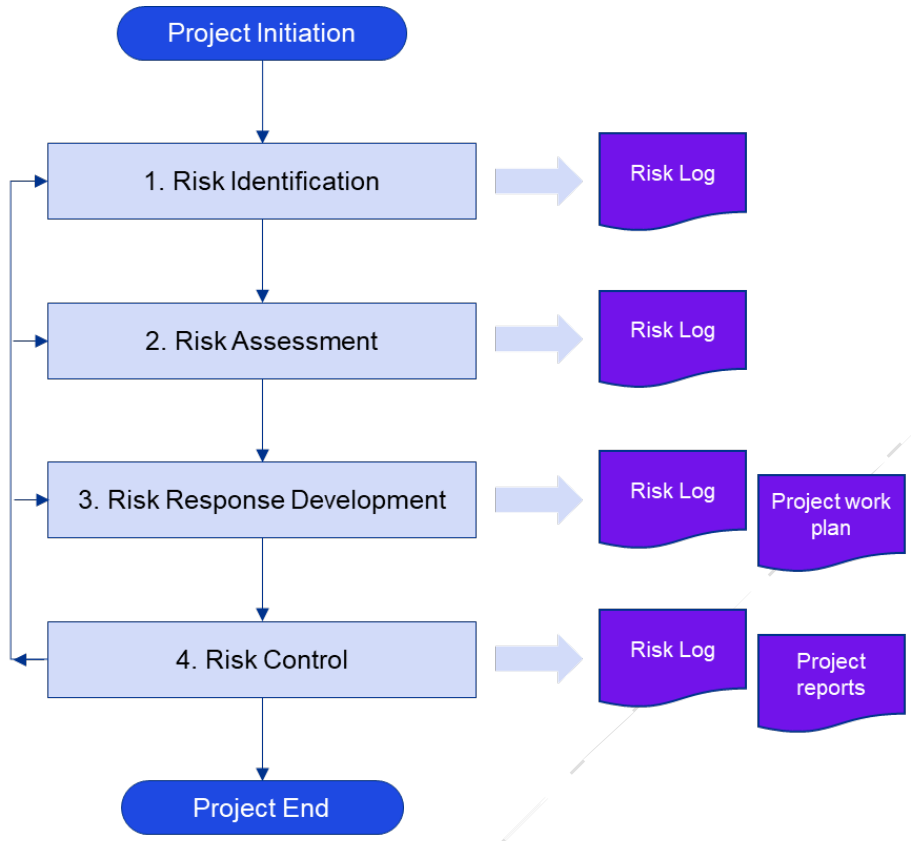
- sets out the risk management objectives and process, identifies the stakeholders involved in the risk management processes and defines their responsibilities;
- Identifies the risk techniques and tools used for risk management covering risk identification, risk assessment, risk response and risk control; and
- defines the risk monitoring and escalation process as well as the structure of the Risk Log which is used to document and communicate the risks and their response actions.

The Project Manager is responsible and accountable for the RMP and oversees the implementation of the Risk Management Process prescribed below.

4.5.3 Risk Management Process

The risk management process for NG AVL is based on the guidance provided in the TAF. The proposed approach to risk management is based on an iterative and ongoing process to identify, assess, prioritise, manage and control risks. Figure 9 illustrates the steps in the risk management process.

Figure 9: Risk Management Processes



4.5.3.1 Risk Identification

A detailed risk identification exercise was undertaken at the PBC and Pre-tender stages to develop a Risk Log. The Risk Log is updated regularly with any new risk(s) identified and reported by the extended project team. It contains the risks identifier, risk name and short description, the risk category and owner, the strategies, actions and timing which will facilitate the mitigation, monitor and control aspects of the project. The Risk Log is updated monthly and at the end of each milestone. An extract of the Risk Log in included in Appendix E. The key risk themes, following the evaluation of the bids received and selection of the Preferred Tenderer designate, are discussed in Section 4.5.4 of this FBC.

4.5.3.2 Risk Assessment

The purpose of this step is to assess the likelihood and impact of the identified risks in terms of their influence to the project objectives. Through such risk assessment, the risk level is determined, which informs the risk prioritisation and planning. The RMP defines the risk evaluation and rating scales, stakeholders' risk appetite and the Probability (Likelihood)/ Consequence (Impact) Matrix.

The Risk Likelihood/Impact Matrix represents the different combinations of likelihood and impact of project risks on a scale from 1 to 5 and defines how the risk levels are determined, to suggest risk response strategies. Every individual risk is assessed as per defined detailed likelihood and impact scales – as a percentage chance of occurrence and percentage of project budget or baseline affected, respectively, and thereupon classified as below.

Figure 10: Risk Likelihood / Impact Matrix

Probability (Likelihood)	Consequence (Impact)				
	1=Very low	2=Low	3=Medium	4=High	5=Very high
5=Very high	5	10	15	20	25
4=High	4	8	12	16	20
3=Medium	3	6	9	12	15
2=Low	2	4	6	8	10
1=Very low	1	2	3	4	5

Legend:

	Low – Risks can be accepted, contingency plans may be developed. Risk that need to be reviewed from time to time.
	Medium – Issues for frequent review
	High – Risks cannot be accepted, a risk response strategy should be developed (avoid, reduce, transfer/ share) – they require constant monitoring.
	Critical - Unacceptable – immediate risk reduction or avoidance response, Issues that require immediate attention of management.
	Risk appetite

Based on such assessment the corresponding risk rating is determined and the individual risks' contribution to the overall risk value is quantified. A similar scale is used for assessing the project opportunities, but its risk value is not carried forward for risk quantification.

4.5.3.3 Risk Response Development

Based on the risk rating determined, the following risk response approaches are determined:

Risk Rating – Scenario	Risk Response Strategy
Very high impact and high / very high likelihood. High / very high impact and very high likelihood.	Avoid **or** implement an immediate reduction mitigation plan.
Very high impact and very low likelihood.	Transfer/Share
All other risk levels.	Reduce
Low or very low likelihood and very low impact or very low likelihood and low impact.	Accept (monitor and plan contingency if deemed necessary)

After the strategy for each risk has been selected, specific actions to implement the strategy are defined, described, scheduled and assigned, and a risk owner assumes the responsibility for its implementation. These are recorded in the Risk Log and incorporated in the PEP.

4.5.3.4 Risk Control

The RMP defines the forums and frequencies at which the Project Manager monitors and controls the implementation of the risk response activities while continuously assessing the project environment for new risks or changes (e.g., probability and/or impact) in the risks already identified. The RMP also prescribes the requirements for escalation or providing visibility of the risks to the Project Steering Committee and other stakeholders based on the risk rating.

4.5.4 Discussion of Key Risk Themes

While the Risk Log (presented in Appendix E) captures the individual itemised risks, the key risk themes are discussed below:

- Installation and integration of new NG AVL hardware on existing bus fleets:
  - There is a risk that the rollout of NG AVL will be delayed due to the compatibility of the new NG AVL system hardware on the buses or due to the lack of availability of the bus fleets for installation. These risks could impact bus service schedules during installation, and/or elongate the overall installation duration of new equipment on buses.
  - To mitigate such risks, a rollout strategy will be developed in combination with the Service Provider and with the Bus Operators, whilst considering other NTA initiatives, such as BusConnects and NGT. Detailed information on each depot has been sought from each Bus Operator, but further discussions must be had once the Service Provider is in place to outline specific space and procedural requirements at each specific depot. The impact of NG AVL on Bus Operator's performance should be noted during the NG AVL rollout, in case this impacts on their ability to deliver bus services to the NTA. The NTA has initiated the Bus Retrofit programme with Bus Operators, to pre-install a demarcation point and associated cabling, in order to reduce the amount of time a bus is off the road for installation, and therefore partially mitigate these rollout risks. Requirements for planning the logistics of the rollout have been included in the contract requirements of the Service Provider i.e., to consider bus availability and space and facilities needed in the depots. The NTA's requirements on the Service Provider have attempted to minimise the duration and frequencies for which access to buses are required. Nevertheless, the Bus Retrofit and subsequent rollout of NG AVL on-bus is a sub-project in itself and close monitoring and management by the project team will be required, both in its planning and throughout its execution
- Transition and adoption of AVL systems and technology:
  - There is a risk that the project cost and timelines will be adversely impacted and intended benefits not fully realised if Bus Operators or the NTA do not progress the pre-requisite interface and integration projects (TISS Applications, VDV[16] configuration, NGT). To facilitate the new AVL system, there is a risk that NG AVL introduces unknown consequences to Bus Operator processes and toolsets, or

[16] VDV (Verband Deutscher Verkehrsunternehmen) means the Association of German Transport Companies

that Bus Operator staff resist or do not fully buy-in to use the NG AVL solution for day-to-day operations.

- To mitigate these risks, a Target Operating Model has been developed and areas of change have been identified early in the project lifecycle. The Project team has achieved significant progress on areas of change in conjunction with the Bus Operators and with the suppliers of other NTA systems, such as TISS Apps and TISS Displays. Bus Operators have been engaged with and informed about the potential impacts and change work packages have been developed for respective Bus Operators to facilitate systems integration and process change. The NG AVL Implementation Team has been strengthened earlier than initially planned to provide more focus on these aspects and risks will continue to be activity managed through detailed planning and engagement with Bus Operators and our existing system suppliers.
- Costs exceeding budget:
  - There is a risk that a higher cost of equipment and/or higher operational/ maintenance costs than what is considered for in the budget, could lead to cost overruns and/or insufficient funding, which may in turn cause the scope to be reduced.
  - To mitigate this risk, a robust financial review of the preferred bidder's submission has been undertaken and suitable provision has been made in the financial, affordability analysis through an appropriate allocation for anticipated Price Book Payments (the purchase of additional ad-hoc items and priced options throughout the term of the Contract) and provisions for inflation have been included in the Contract Agreement.

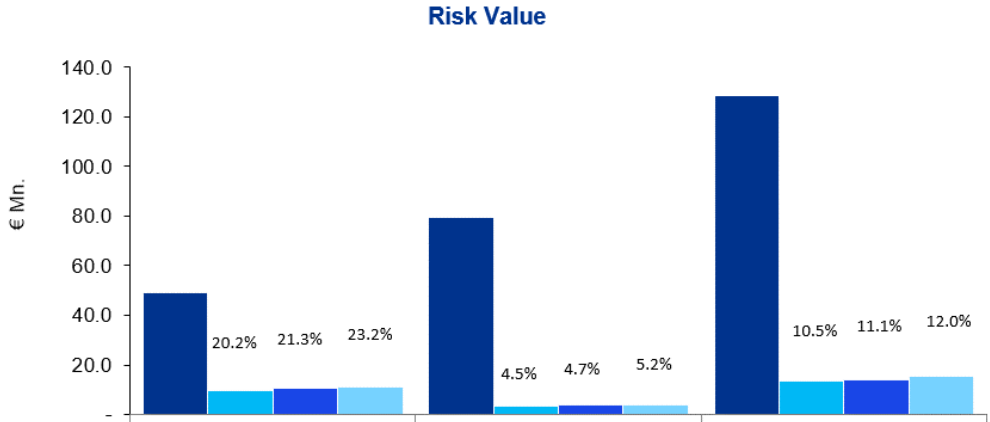
4.5.5 Determining the Risk Value

A detailed QRA was undertaken to determine the Risk Value that would form part of the Total Project Cost. The following methodology was utilised to perform the QRA:

- Inputs to the QRA – the RMP and the updated Risk Log are the primary inputs to perform the QRA. The risks from the Risk Log are classified as occurring either in the implementation phase, the operating phase or throughout the project lifecycle. The capital expenditure and operating expenditure base cost factors in the milestone payments, refresh milestone payments, an appropriate allocation for Price Book payments and anticipated NTA costs. To this sum, an applicable percentage of base cost for every individual risk was assessed by the Project Manager, so that the quantification exercise reflects more accurately the basis for calculating the impact.
- Deriving the Risk Values: The probability range (average) and the impact ranges from the RMP are applied to the individual risks' assessment to determine the range of the Risk exposure. The Risk's exposure and its product with the established capital expenditure and/or operating expenditure base costs, provides the minimum, most likely and maximum Risk Value.
- Deriving the Risk values at specific confidence levels: A Monte Carlo simulation, using @Risk software[17], was performed on this three-point estimate of the Risk Value. This provided the Risk Values at P30, P50 and P80 (confidence level percentiles) for the individual risks. The Risk Values associated with the risks across the entire lifecycle of the project were apportioned to capital expenditure and operating expenditure in direct proportion of their respective contribution to the total project cost. The output of the QRA is presented in Table 8 below:

[17] https://lumivero.com/products/at-risk/

Table 8: QRA Output



	CAPEX € Mn.	OPEX € Mn.	Total Project € Mn.
Base Cost	49.1	79.5	128.5
P30	9.9	3.6	13.5
P50	10.5	3.8	14.2
P80	11.4	4.1	15.5

Base Cost P30 P50 P80

Amounts in €m	Cost Base	% of Total	Risk Value @ P30	% of Cost Base	Risk Value @ P50	% of Cost Base	Risk Value @ P80	% of Cost Base
Capital Expenditure	49.1	38.2%	9.9	20.2%	10.5	21.3%	11.4	23.2%
Operating Expenditure	79.5	61.8%	3.6	4.5%	3.8	4.7%	4.1	5.2%
Total	**128.5**	**100%**	**13.5**	**10.6%**	**14.7**	**11.1%**	**15.5**	**12.0%**

The Risk Value at P80, determined by the project team to be the most appropriate considering the current stage of the decision gate, has been used to determine the Total Project Cost. This results in the inclusion of a 23.2% risk adjustment (€11.4 million) on the capital expenditure base cost and a 5.2% risk adjustment (€4.1 million) on the operating expenditure base cost, representing a 12% blended overall risk adjustment to the total Project cost.

4.6 NG AVL Detailed Delivery Programme

4.6.1 Overview

A high-level timeline plan for the procurement phase of NG AVL is given below in Figure 12. This includes the alignment to future stages of PAG (stage 4 and beyond) and the focus on Phase 0 (the delivery of the core NG AVL product, including pilot testing and initial delivery) and Phase 1, which will include certain requirements that can be tested and delivered later so as to reduce development risk. It also includes external dependencies, such as the

changes required of a number of NTA and Bus Operator systems to interface with NG AVL, such as with TISS Applications, TISS Displays, Dublin City Council's (DCC) Traffic Light Priority system and the Bus Operator's planning tools. Furthermore, it includes the Bus retrofit dependencies, which will be described later in this section.

The NTA has secured a single supplier for the delivery of NG AVL. The single supplier will be responsible for the delivery of the full set of NG AVL requirements, as outlined in various sections of this document. They will work with NTA and Bus Operator staff to design, test, accept and rollout NG AVL to the NTA's Bus Operators and to relevant stakeholders.

Subject to contract award, the next stages of the project will be to plan, document, test and accept the systems and services associated with NG AVL. Operation of services will begin with the successful deployment of the first bus as part of a pilot route or Depot. Rollout of NG AVL will begin once the pilot operations have been accepted fully. The rollout of all core NG AVL bus installations is expected to take less than one year. Operational services will then continue for a total of eight years, with further options to extend by an additional four years in increments of two, one and one further years.

4.6.2 NTA Change Work Packages

A number of work packages were initiated earlier than initially envisaged (these were not included within the PBC estimates) to better prepare for NG AVL. These included the following:

- Planning & Data System Changes – Developing requirements for the changes needed to the Bus Operator planning tools;
- Bus Prerequisites for Rollout – planning for the rollout of NG AVL with the Bus Operators;
- Zero Emission Buses – undertaken preliminary work to ensure that any zero emission bus systems can interface with NG AVL;
- Operator Migration – planning the migration progress with the Bus Operators and feeding this into the NG AVL requirements;
- Network/Technical Integration – developing a baseline for the Bus Operators' networks and any likely interaction with NG AVL;
- Operational Readiness (Internal) – ensuring that the NTA's teams are ready for NG AVL;
- Operational Readiness (External) – ensuring that the Bus Operators are ready for NG AVL;
- Other Projects Integration – planning the alignment with other projects such as NGT; and
- Tait radio changes – planning for the changes to Dublin Bus's Tait Radio system in advance of NG AVL.

These have developed into the work outlined in Figure 12 that will run alongside work with Trapeze Group (UK) Ltd. In other tables in the FBC, the following are referred to as External Dependencies:

- TISS Applications – any changes required of the TISS Applications system to interface with NG AVL. This will be undertaken by the TISS Applications supplier, Trapeze Group (UK) Ltd (also NG AVL Preferred Tenderer designate);

- TISS Displays – any changes required of the TISS Displays system that manages the display of RTPI at all bus stop displays. This will be undertaken by the TISS Displays supplier, Vix;
- Scheme Wide Data Repository – an internal solution to standardise and store data so that systems can work together via real-time interfaces with NG AVL;
- Data Normalisation – a data cleansing activity to improve data quality input to NG AVL from the start, which will help NG AVL achieve RTPI quality improvements;
- Traffic Light Priority – ensuring that Dublin City Council's TLP system can interface with NG AVL;
- Operator Planning Tools – to standardise on the interfaces required for NG AVL. This will be required for each of the three main Bus Operators.

4.6.3 Trapeze Group (UK) Ltd Delivery Programme

Trapeze Group (UK) Ltd's response to the ISFT is based on the NTA's requirements. Trapeze Group (UK) Ltd's high-level timelines and milestones are given below in Figure 11. The timescales align with the NTA's programme as outlined in Figure 12. This assumes contract award in December 2023 and work starting on NG AVL in January 2024. Rollout will complete at the end of 2025, with Milestone 11 accepted in the middle of 2026.

Figure 11: Trapeze Group (UK) Ltd's High-Level Delivery Plan

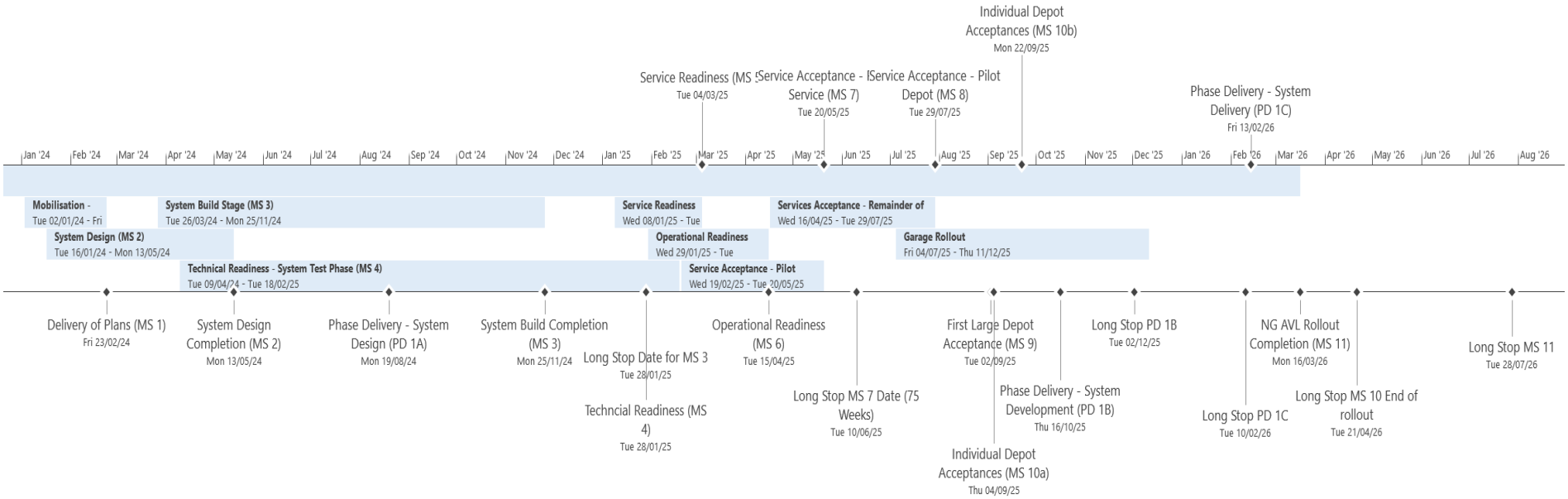
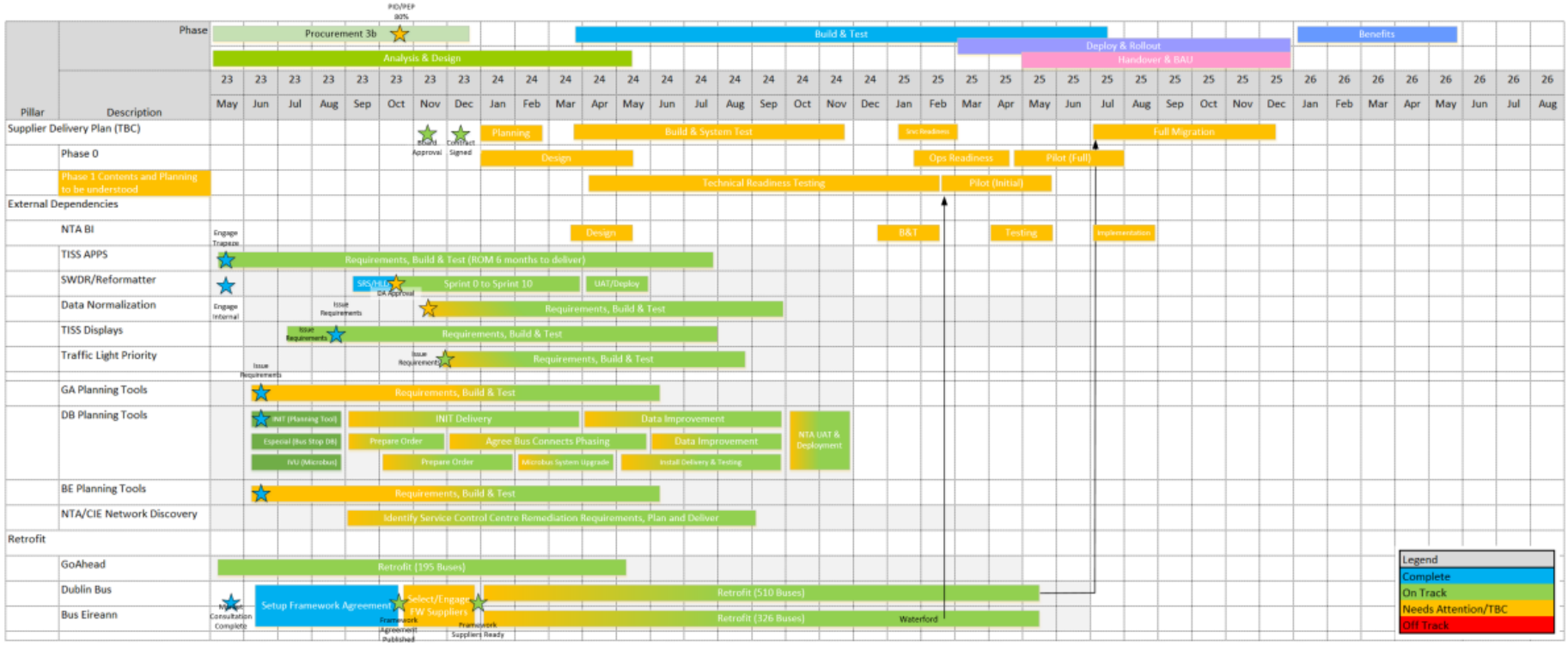


Figure 12: High Level Delivery Plan



4.6.4 Project Deliverables

This section will outline the deliverables expected in each of the phases up to contract award, as well as an indicative view of those required throughout the planning and delivery phases. These phases relate to the PAG and follow those key project deliverables required for a Band 3 ICT Project (over €10m).

Phase 2 and 3 PAG deliverables are given in Appendix B. These have been signed off by the appropriate approver and each PAG phase signed off by the Steering Committee and the PMO.

Full details on the NTA PAG can be found in the PEP Document Catalogue. The PEP document is also found in Appendix H.

The purpose of phase 4 is for the Sponsoring Agency or internal NTA business unit to coordinate the analysis of the project requirements, the architectural and process designs, the approach for delivering the project and the expected costs of the project.

Input from vendors, project managers, project team members and subject matter experts are required in this phase. It is important to agree on timelines and resource demands with vendors at this time so a delivery timeline can be confirmed and aligned with the project plan. Project plan updates may be required based on the outputs of this phase.

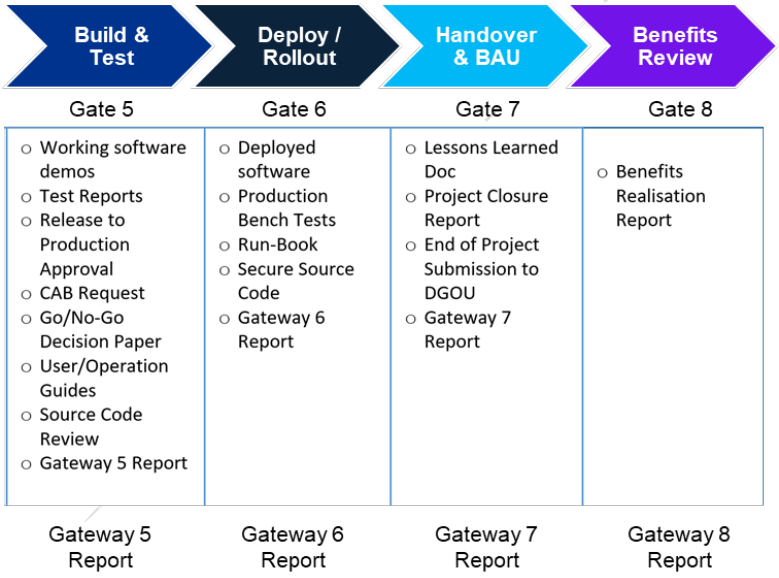
This phase represents progression towards the build, testing and rollout of the solution. The NTA will be consulted on any issues or events that could have an impact on the cost, scope, quality or programme of the project.

The phase 4 deliverables are outlined in Figure 13 below:

Figure 13: PAG Phase 4 Deliverables

The deliverables for the remaining gates are listed in Figure 14 below.

Figure 14: PAG Deliverables Phase 5 Onwards



4.6.5 Project Execution Plan

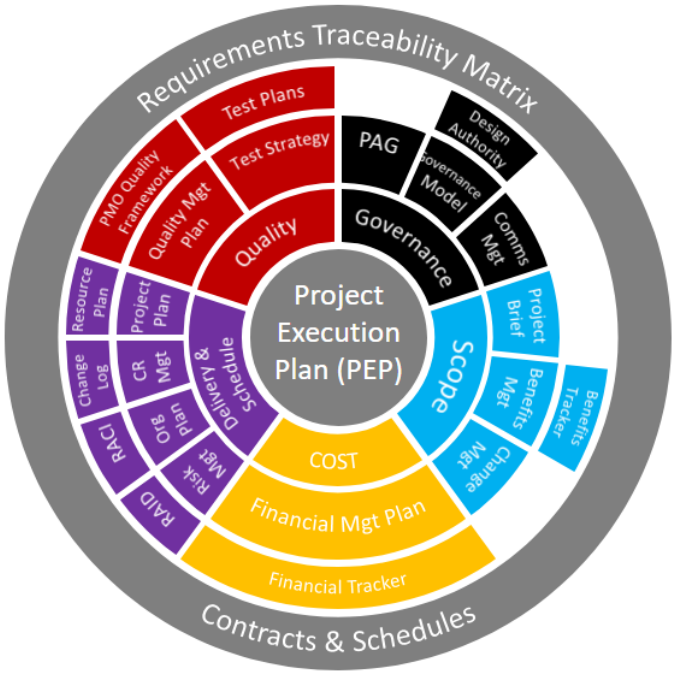
A detailed PEP has been developed for NG AVL and is based on the NG AVL requirements and schedules from developing previous iterations of the Project Initiation Document (PID).

The content of the PEP is outlined in Figure 15: This outlines the basis for the PEP being the NG AVL Contract and Schedules and the requirements traceability matrix. There are a number of artefacts that support the PEP, outlined under five key themes: Governance, scope, cost, delivery schedule and quality. Each one of these artefacts has been produced in advance of the completion of the NG AVL procurement process.

The further sections below outline key elements of the delivery phase, which will be managed through the PEP and its overarching alignment to the NG AVL Contract and Schedules and the requirements contained within.

A copy of the PEP is embedded in Appendix H.

Figure 15: NG AVL PEP



4.6.5.1 *Planning Phase*

There will be a period of time from contract award to the start of the deployment of the system, where the Service Provider and NTA will be able to plan and document the systems and services and agree the timescales for the deployment of their NG AVL offering.

4.6.5.2 *Test Strategy*

A separate Test Strategy for NG AVL has been developed and agreed as part of phase 2 PAG deliverables. The objectives of this strategy are:

- To ensure that it satisfies the NG AVL Business Requirement Specification and NG AVL System Requirement Specifications;
- Provide a process to identify quality issues within a timeframe to resolve or mitigate without impacting wider project timescales;
- Enable key NTA stakeholders' visibility on the quality and progress of the system delivery;
- Ensure that the solution operates end to end with existing systems such as the Transport Information Systems (Apps and Signs);
- To help ensure that milestones are achieved to the satisfaction of the NTA, which will enable progress of the NG AVL System set-up and facilitate milestone payments to the Service Provider in line with the Initial Services Schedule.

4.6.5.3 Milestones

As part of the Initial Services Plan the milestones outlined in Figure 16: and Figure 17: will be used as the core milestones to sequentially manage the deployment of NG AVL. There will be acceptance criteria of each milestone, which has been outlined in Schedule 3 – Initial Services. These milestones will also be used to pay the Service Provider, on acceptance of each milestone. The percentage milestone payments are included in Table 9 are the long stop dates which aim to incentivise effective delivery while also providing protection to the NTA for slow delivery. More detail on how the long stop date process works is given in Schedule 6 – Payments.

Figure 16: Milestones, environments and testing

Delivery of Plans (Milestone 1)	System Design Completion (Milestone 2)	System Build Completion (Milestone 3)	Technical Readiness (Milestone 4)	Service Readiness (Milestone 5)	Operational Readiness (Milestone 6)	Services Acceptance - Pilot Route (Milestone 7)	Services Acceptance - Remainder of Pilot Routes (Milestone 8)	First Large Depot Acceptance (Milestone 9	Depot Group Acceptances (Milestone 10)	Services Rollout Completion (Milestone 11)
N/A	N/A	NGAVL Service Provider Environment	NGAVL Test Environment	NGAVL Test Environment	NGAVL Production Environment	NGAVL Production Environment	NGAVL Production Environment	NGAVL Production Environment	NGAVL Production Environment	NGAVL Production Environment
N/A	Provision of Test Documents • *Test Strategy* • *Test Specification*	Factory Acceptance Testing (FAT)	Site Acceptance Testing (SAT)	System Testing • *Integration Testing with TIS APPS, TIS Displays, DCC* User Acceptance Testing (UAT)	Operational Readiness Testing • *Performance Testing* • *Vulnerability Testing* • *Penetration Testing* • *Disaster Recovery Testing* Acceptance Testing	Pilot Testing • *Evaluate the systems state* • *Test, defect resolutions and configuration changes* • *Test NGAVL fitted buses for acceptance* • *Test NGAVL dispatcher workstations for acceptance*	Pilot Testing • *Evaluate the systems state* • *Test, defect resolutions and configuration changes* • *Test NGAVL fitted buses for acceptance* • *Test NGAVL dispatcher workstations for acceptance*	Depot and Bus Installation Testing • *Test NGAVL network integration at Depot* • *Test NGAVL fitted buses for acceptance* • *Test NGAVL dispatcher workstations for acceptance*	Depot and Bus Installation Testing • *Test NGAVL network integration at Depot* • *Test NGAVL fitted buses for acceptance* • *Test NGAVL dispatcher workstations for acceptance*	Business as Usual Testing • *Testing as required under the change management process*

Figure 17: Phased Delivery Milestones, environments and testing

System Design Completion (Phased Delivery 1A)	System Development Completion (Phased Delivery 1B)			Go Live (Phased Delivery 1C)
	System Build Completion	Technical Readiness	Service Readiness	
N/A	NGAVL Service Provider Environment	NGAVL Test Environment	NGAVL Test Environment	NGAVL Production Environment
Provision of Test Documents • *Test Strategy* • *Test Specification*	Factory Acceptance Testing (FAT)	Site Acceptance Testing (SAT)	System Testing • *Integration Testing with TIS APPS, TIS Displays, DCC* User Acceptance Testing (UAT)	Business as Usual Testing *Testing as required under the change management process*

Table 9: Payment Milestones and Long Stop Dates

Milestone	Description	Milestone Payment	Long Stop Date Week
One	Delivery of plans	5%	
Two	System design completion	10%	
Three	System build completion	10%	56
Four	Technical readiness	3%	
Five	Service readiness	4%	
Six	Operational readiness	3%	
Seven	Services acceptance – Pilot Route	5%	75
Eight	Services acceptance – remainder of Pilot Routes	5%	
Nine	First Large Depot acceptance	5%	
Ten	Depot Group 1 Acceptance Depot Group 2 Acceptance Depot Group 3 Acceptance Depot Group 4 Acceptance Depot Group 5 Acceptance Depot Group 6 Acceptance Depot Group 7 Acceptance Depot Group 8 Acceptance Depot Group 9 Acceptance Depot Group 10 Acceptance Total Depots acceptances	3.5% 3.5% 3.5% 3.5% 3.5% 3.5% 3.5% 3.5% 3.5% 3.5% 35%	 120
Eleven	Services rollout completion	5%	134
PD One A	Phase 1 – System design completion	3%	
PD One B	Phase 1 - System development completion	3%	100
PD One C	Phase 1 Go Live	4%	110

4.6.5.4 Rollout and Migration Planning

The migration approach required of the Service Provider will cover the migration of buses from the existing systems to the new systems, whilst ensuring that the data supply and predictions will support high quality RTPI throughout the migration. There are requirements on the Service Provider to ensure that data from the existing systems and NG AVL are combined to give a consistent view of the network to service controllers and passengers, as far as possible. This will involve data migration as well as bus migration from the existing AVL system to NG AVL. In parallel to the rollout and migration planning, data cleansing activities are underway through the data normalisation work and the development of a Scheme Wide Data Repository, as outlined in Section 4.6.2.

An NG AVL Rollout Strategy will be produced that will determine the order of rollout of the Bus Operators in-scope for NG AVL. The project team has been discussing this with Bus Operators and their engineering staff and have secured information about capacity and constraints at each depot. However, until the Service Provider's specific requirements are fully discussed with the Bus Operators, once the Service Provider is in place, it will not be possible to determine the complete rollout strategy. This will be one of the first tasks for the project team to determine, with meetings required with the Bus Operators and with the Service Provider. Information gathering will be undertaken in parallel with finalising the contract award, such that details on the operational opening hours and any restrictions of all depots, fleet lists per depot are validated, information on the engineering rota is known, the availability of covered space in the depots and space to hold spares and to undertake bench testing are all determined.

Further complications for the rollout order will be the impact of other projects and initiatives, such as BusConnects, the electrification of the bus fleet and depots and NGT. These will be considered when determining a suitable rollout order.

One potential dependency was identified early on through detailed planning activity by the project team and with subsequent negotiation with NG AVL tenderers. In order to speed up the installation activity, it was determined to upgrade all buses to the standard agreed for all new buses since 2021. This involves fitting older buses with some additional cables and a demarcation point, collectively referred to as the Bus Retrofit work. The availability of the demarcation point will ensure a much quicker NG AVL installation by the Service Provider, which will significantly reduce the risk of a bus taking longer than one shift to be installed with NG AVL. This strategy has been taken forward and requires the appointment of suitable Bus Retrofit works partners which is currently the subject of a separate public procurement. Further, it requires the scope of the works required to be fully determined once the Preferred Tenderer designate is determined, as an incumbent service provider may require a reduced bus retrofit than a new supplier to Ireland.

With the Bus Retrofit work assumed to have been completed, all NG AVL bus installation works will be attempted in each depot. If operational or space limitations mean that this is not possible, alternative locations within that Bus Operator will be found. If that is not possible, alternatives will be sourced through other means.

A number of assumptions will be made in the planning for rollout:

- The key priority is for buses to be made available for service in a working order with a working AVL and radio system;
- Installations will take no longer than eight hours per bus (subject to resources allocated by the Service Provider though installation should be shorter in duration);
- Installations will need to take place in the depot, and under cover with sufficient lighting if possible;
- A secure area for stores and offices for bench testing will be required; and

- An area for testing the calibration of the installation (if odometers are included) is required (approximately 100m stretch).

Further work will be undertaken on the overall NG AVL rollout strategy such that the Service Provider's requirements outlined in their tenderer response can be aligned with both the NTA and Bus Operators availability.

4.6.6 Resource Plan

A resource plan for the procurement and phases beyond contract award and into the first year of implementation has been developed and is included within the PEP. This is a living document and will be amended as the project develops. The forecast resources required have been estimated based on experience of similar rollouts and experience of having worked with the NTA, Bus Operators and service providers on AVL systems.

The resources required to supplement the existing operations and support team in the TT department have been determined in conjunction with the operations leads and have been included within the Business Operations Plan and the Target Operating Model for NG AVL.

An overview of the team required within the NTA to deliver NG AVL is given in Appendix C. This aligns with the resource costs outlined in Section 6.

4.6.7 Service Delivery and KPIs

The Successful Tenderer (Service Provider) will provide, operate, maintain and support the NG AVL Systems and Services, as outlined in this section, through the use of ITIL processes or similar. The Successful Tenderer will ensure 24/7 support is provided to the NTA and its Bus Operators such that the AVL service provided serves passengers, Bus Operators and the NTA whenever it is required.

Further information on the KPIs related to the performance of the NG AVL System and Services is given in Section 9.4.

4.7 Value Management Strategies

The approach to value management has been at the forefront of the project activity since its inception.

The long list of options and the options selection process, as part of the SAR and PBC respectively, examined options to reduce the overall cost associated with the provision of AVL services. The preferred option taken forward into the FBC provides a solution with lower operating costs than the Do Minimum Option. An alternative option was to deliver lower cost AVL Lite services across the buses in scope, but it was determined that the objectives of NG AVL would not be as well achieved as the preferred option, despite the lower cost. In discussing the AVL Lite solution with tenderers during the ITN negotiation meetings, this position was validated in that AVL Lite solutions, whist

suitable for a low-cost entry into AVL, are not ready for use in urban environments where highly accurate locations are required.

Another value for money opportunity concerning on-bus equipment was also examined. It was determined that the reuse of existing on-bus equipment, such as next stop displays, will save significant sums. These displays provide a rich and accessible service to passengers and reusing them provides a good value for money option, even if there is some development required of the NG AVL supplier to interface to them. The reuse of existing on-bus peripherals is a principle of NG AVL that will be used wherever possible in order to minimise additional cost and to limit the carbon footprint of the project. This is further possible with Trapeze Group (UK) Ltd's status as the Preferred Tenderer designate as they will be able to reuse some existing on-bus equipment / cabling. The extent of this is yet to be determined but will be a key element of discussion post-contract award, subject to the outcome of this FBC.

There will be provisions included in the contract for NG AVL to ensure efficiencies throughout the contract. It is envisaged that a technology refresh will be avoided, making use of the initial on-bus equipment throughout the contract and avoiding an expensive additional capital investment, which would also require further installations in vehicles. Avoiding a capital refresh will limit costs and risks associated with a second installation process. However, for workstations and AVL Lite on-bus equipment, which is essentially a ruggedised tablet, some refresh will be needed as these devices will not be supported for the full duration of the Term of the Contract.

Opportunities to use the on-bus computer to host other applications could save money in the delivery of future applications, which will be investigated as and when such applications are of use to the NTA, and the market is in a position to provide them.

As an incumbent is the Preferred Tenderer designate, there is the possibility to reduce the scope of the bus retrofit work and therefore to reduce the cost of that preparation installation activity. Further work is required to determine the scope of this change and this will be undertaken in parallel with the completion of this procurement process and is subject to the approval of this FBC.

The drafting of the Contract included the provision of a value for money clause, which will encourage the Service Provider to offer reductions in cost and improvements in scope to the NTA throughout the Term.

4.8 Change Management

Although NG AVL will bring about change across both the NTA and the bus operators organisations, the project is an asset refresh that will be used in similar ways to the existing AVL systems. Further, as Trapeze Group (UK) Ltd is the Preferred Tenderer designate, subject to the approval of this FBC and completion of the contract, there will be some elements of familiarity amongst the users of their tools, systems and services. However, the change and associated communication elements are still critical to the success of the project. Stakeholder analysis has been refreshed and is included in the Communications Strategy. Further a Change Management Strategy that was

developed for earlier stages of the project has been refreshed to focus on the approach to change within both the NTA and bus operators' organisations. Both documents are included within the PEP and will be used by the project team to help focus communications and highlight and plan training requirements to support the delivery of NG AVL, in conjunction with the Service Provider.

5 Short-listed Options

5.1 Long-list of Options – SAR and PBC

The purpose of this section is to outline the process that was undertaken to arrive at the short-listed options at the PBC stage for the financial and economic appraisal. The longlist of options had been developed as part of the SAR. Prior to shortlisting the options, the PBC provided greater detail on the longlist of options.

In line with the PSC and TAF, the counterfactual: 'Do Nothing' and 'Do Minimum' were included in the longlist to act as a benchmark to measure the 'do something' options against. Six 'do something' options were identified:

- Option 1 – Consolidation of Existing AVL Systems;
- Option 2 – Tender to Replace each Existing AVL System;
- Option 3 – Tender for a Single AVL System;
- Option 4 – Mandate Outcomes;
- Option 5 – Mandate Interfaces; and
- Option 6 – AVL Lite Only.

For more information on the long list of options, please refer to Section 5 of the PBC.

5.2 Shortlist – PBC

An MCA was undertaken to arrive at the short-list of options. Please refer to Section 5.3 of the PBC for more details.

The outcome of the MCA was the selection of the following options:

- Option 3: Tender for a Single AVL System;
- Option 4: Mandate Outcomes;
- Option 5: Mandate Interfaces; and
- 'Do Minimum' - Although 'Do Minimum' did not score highly, it has been brought forward for financial and economic appraisal as it acts as the counterfactual for comparison purposes. The 'Do Nothing' option fails to meet the project objectives and so is not considered a suitable counterfactual.

The above options were subject to financial and economic appraisal in the PBC, followed by a CEA.

5.3 Options Included in the FBC

For the purposes of this document, the two options used in subsequent analysis and presentation will be referred to as the:

- Do Minimum Option;
- PBC Preferred Option.

For the purposes of analysing the impact of the Preferred Tenderer's pricing on the financial and economic appraisal, the options will be referred to as the following:

- For the financial appraisal, the **FBC Outturn Costs**. This will refer to the Preferred Tenderer's pricing and the NTA's costs to deliver NG AVL and **include** inflation and VAT;
- For the economic appraisal, the **FBC Option**. This will refer to the Preferred Tenderer's pricing and the NTA's costs to deliver NG AVL but **exclude** inflation and VAT.

6 Financial Appraisal

6.1 Introduction

A financial appraisal is required at FBC stage to evaluate the financial viability of the project in accordance with the PSC and TAF. The financial appraisal assesses the movement in costs from PBC stage against outturn tender costs and assesses the incremental financial impact from the perspective of the NTA. The financial appraisal section is structured as follows:

- Overview of the financial appraisal assumptions (Section 6.2);
- Do Minimum and FBC Outturn Costs (Section 6.3) – details a summary of the updates to the Do Minimum costs since PBC stage. It also includes an overview of the FBC Outturn Costs which includes the tendered costs (in real terms) submitted by the Preferred Tenderer designate and wider NTA costs required to deliver NG AVL;
- Cost comparison analysis (Section 6.4) – details the movement in costs for both the Do Minimum and PBC Preferred Option Estimate (given the passage of time since the financial appraisal was completed at the PBC stage, the costs for the Do Minimum and Preferred Option estimated at PBC stage have been updated for inflation in order to ensure a direct like for like comparison against the outturn tender pricing) and provides a comparison against the FBC Outturn Costs;
- Financial appraisal results (Section 6.5) and sensitivity analysis (Section 6.6); and
- Affordability assessment (Section 6.7).

Overall, the analysis demonstrates that the FBC Outturn Costs represent a saving against the PBC Preferred Option Estimate and is marginally lower than the Do Minimum option cost. This reaffirms the affordability of the PBC Preferred Option and provides a strong rationale from a financial perspective to proceed with contract award to Trapeze Group (UK) Ltd.

6.2 Financial Appraisal Assumptions

Set out below are the assumptions and approach underpinning the financial appraisal and modelling process. These assumptions relate to the key elements of the NG AVL Project.

6.2.1 Sunk Cost

Sunk cost of approximately €3.4m (nominal terms) has been incurred on the project to date largely comprising resource (contracting) costs, legal support, business case and financial evaluation support and providing Bus Operators with resources to support the

project. These are shown below in Table 10. The contractor costs have been split to cover the procurement activity and the advancing of the change work packages (discussed in Section 4.6.2), such as managing the bus retrofit work, and pulling together requirements for changes to the Bus Operators planning tools. In accordance with the PSC requirements, these costs have not been incorporated into the financial appraisal. This is higher than the expected project budget to complete the procurement phase as included in the PBC of approximately €1.5m. In September 2022, the Steering Committee approved an increase in budget to €3.6m to accelerate support for the change work packages and to account for some delays in the procurement process during the ITN drafting process.

Table 10: Procurement Project Cost

Description (Excl. VAT)	Budget	Actuals	Estimate to Completion	Estimate at Completion
Contractors	1,748,400	1,355,754	114,940	1,470,694
Contractors (Change Work Packages)	706,023	487,564	114,940	602,504
Business Case Support and Financial Evaluation	137,072	136,040	15,000	151,040
Legal Support	114,063	85,445	10,000	95,445
Bus Operator Resources	511,680	-	484,881	484,881
Contingency	405,228	37,412	586,514	623,926
Total	**3,622,466**	**2,102,215**	**1,326,275**	**3,428,490**

6.2.2 Project Timeline

In line with the contractual terms, a base case of 14 years was determined to be the appropriate project timeline starting from 1 January 2024. This will include two years of development and implementation, eight years of operations and four years of extension. Key dates are set out below:

- Development and Implementation period: January 2024 to February 2026
- Operations period: January 2025 to December 2032
- Extension period: January 2033 to December 2036

The detailed delivery schedule is presented in Section 4.6.

6.2.3 Project Costs

As part of the tendering process, each tenderer was required to complete a SPBM, developed by KPMG, as part of their pricing submission (details in Appendix F.2). The SPBM was designed to capture tendered payments and costs of implementation and

operation of the NG AVL solution and used for financial evaluations. The SPBM submission by the Preferred Tenderer designate has been used to forecast project costs for the financial appraisal. Additionally, NTA costs have been considered as part of the overall project cost which include project management, administration and other indirect costs related to the implementation and operations of the project. The overall project costs, referred as 'FBC Outturn Costs', are detailed further in Section 6.4.

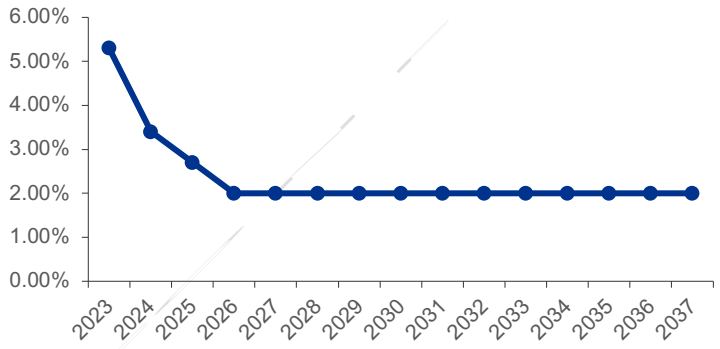
It is best practice that as part of the analysis of capital costs, residual value is given due consideration. In this current case, the AVL equipment is estimated to have no residual value after the duration of the project.

6.2.4 Discount rate and inflation

Discount rate and inflation assumption for capital project appraisal is set by DPENDR in consultation with the National Development Finance Agency (NDFA)[18]. At the time of evaluation, a rate of 3.40% for discounting project cashflows and Harmonised Index of Consumer Prices (HICP) was recommended on DPENDR website (Figure 18).

A number of inflation indices will form part of the Contract (including Industrial Price Index, Labour Cost Index and HICP). However, as HICP is the only forward-looking index available, for the purpose of this FBC only HICP is used for forecasting purposes. The HICP forecasts inflation of over 5% in 2023, then gradually dropping to 2% per annum from 2026 onwards.

Figure 18: Harmonised Index of Consumer Prices (HICP)



6.2.5 Risk and Contingency

A QRA was undertaken to determine the risk value for the project cost. The following risk provisions were deemed appropriate to be applied to the cashflows (see Section 4.5.5 for details):

- Capital expenditure: 23.2%

[18] https://www.gov.ie/en/policy-information/1a0dcb-project-discount-inflation-rates/

- Operating expenditure: 5.2%

A contingency of 15% was applied to both capital expenditure and operating expenditure at PBC stage however this has been reduced to 10% in this FBC in line with other NTA business cases. This is due to the reduced uncertainty and greater knowledge of the project costs through the procurement process.

6.3 Cost Summary

6.3.1 Do Minimum Option Cost Summary

The Do Minimum costs assumptions used in the PBC have been revisited to ensure that changes in the value of money and scope are reflected in the latest costs. Updated information from Dublin Bus and Bus Éireann on the management and support of their own AVL systems were provided, as were the latest NTA AVL support costs. Further, ICT costs were determined by NTA along with the resource costs for any internal NTA support required, across the Bus Operators and the NTA Operations team.

The detail and the assumptions behind the Do Minimum costs are included in Appendix F. Whilst the Do Minimum does not include any costs for procurement activity and assumes that contracts can be extended for the assessment period, assumptions have been made on the refresh of life-expired on-bus equipment, which makes up much of the capital expenditure required to maintain these systems. Some assumptions have also been made on back-office upgrades. Resource costs for the Bus Operators have been include in the costs of maintaining and operating their AVL systems, where specific Bus Operator resources are required to do so. Resource costs for NTA's AVL systems have not been included as these will be used to operate NG AVL and therefore not considered as a saving.

A summary of the Do Minimum cost updates is presented below together with a comparison against the costs for the Do Minimum Option included at PBC stage to illustrate the changes. The costs below exclude inflation and VAT which is included in the cost comparison analysis in Section 6.4. Optimism Bias and Contingency for the updated Do Minimum cost has been kept at the PBC level. The Do Minimum Option assumed an Optimism Bias of 37.5% and 9.6% for capital expenditure and operating expenditure respectively and contingency adjustment of 25% to reflect the level of interface risk and uncertainties in cost assumptions (see PBC Section 6.5.2 for details).

In summary, the Do Minimum costs have increased since PBC reflecting the revisions noted above by the NTA (see Appendix F.1. for further detail on Do Minimum costs).

Table 11: Do Minimum Option Cost Updates (real terms, without VAT)

Cost Categories	PBC Costs 2021	Updated PBC Costs 2023	Difference
Capital Expenditure	€13,016,250	€15,450,459	€2,434,209
Operating Expenditure	€87,245,668	€88,054,794	€809,126
Total	**€100,261,918**	**€103,505,253**	**€3,243,335**

6.3.2 Preferred Tenderer Designate Cost Summary

The proposed payments by the Preferred Tenderer designate as part of this tender submission are summarised in Table 12. The table identifies all payments across the implementation, operations and extension periods under the following categories:

Milestone payments: A series of Milestone Payments have been set out in the Payments Schedule which serve as a means of ensuring that the various tasks that form part of the NG AVL solution are achieved on time. The Milestone Payments are intended to cover the upfront costs of implementation and include payments in respect of delivery of plans and technical readiness.

- **Refresh milestone payments:** As part of the tender submission requirements, Tenderers were required to include specific pricing for workstation equipment refresh milestone payments**.**
- **Price book payments:** This category represents the payments for additional equipment and services the NTA may require over the term of the contract. Tenderers were requested to price for specific price book options as part of their tender submissions.
- **Fixed operating costs**: The NTA will pay the Service Provider operating payments for the delivery of the Services once the solution becomes operational. The operating payments comprise of payments to cover the Service Provider's fixed and operating costs. The fixed operating payments cover payments in respect of: hosting, ICT**,** security, PSO and other costs.
- **Variable operating costs**: Per above, with operating payments covering variable costs in respect of staff, spares and repairs, performance management, PSO and other costs. Variable operating payments are calculated based on the percentage of fleet rollout completed each month from the operational services start date.

All payments presented below in Table 12 are in real terms (i.e., do not include inflation) and are exclusive of VAT (note: VAT is itemised separately in the cost comparison analysis in Section 6.4). The costs are therefore different to what is assessed in Section 6.4 (which include inflation and VAT) however are being presented below to detail exactly what the Preferred Tenderer designate submitted as part of their tender response.

Table 12: Summary of Preferred Tenderer Designate Cost (real terms, without VAT)

Cost Categories	
Preferred Tenderer Costs	
Capital Expenditure (2023 to 2026)	
Total Milestone Payments	[redacted]
Total Refresh Milestone Payments	[redacted]
Operating Expenditure (2023 to 2026)	[redacted]
Total Fixed Operating Payments	[redacted]
Total Variable Operating Payments	[redacted]
Total Preferred Tenderer Designate Costs	[redacted]
Price Book Payments	
Capital Expenditure	[redacted]
Operating Expenditure	[redacted]
Total Price Book Payments	[redacted]
Total Cost	[redacted]

Note on Additional NTA Costs

In addition to the Preferred Tenderer designate costs, the cost analysis also assumes wider NTA specific costs, such as staffing/contactor costs associated with managing the contract with the Preferred Tenderer designate, will be incurred in the set-up of NG AVL. Some of these costs relate to NTA Change Work Packages and are discussed in Section 4.6.2. Table 13 below details these wider NTA costs (between 2024 – 2026). These costs were provided by NTA (in real terms, 2023 prices) and have been inflated in accordance with current HICP indices. The costs are profiled up to and including 2026 only to tie in with the proposed implementation period for the project. Beyond 2026, the only capital costs the NTA will need to monitor are price book items and workstation refreshes, which will all be purchased through the Service Provider via the Contract. These costs have been included in the subsequent analysis below (Section 6.4). The Preferred Tenderer designate option still remains lower relative to the Do Minimum alternative by including these additional costs, further underlining the cost competitiveness of the Preferred Tenderer designate option.

Table 13: Additional NTA Costs with Preferred Tenderer Designate Option (real terms, without VAT)

Cost Categories	2024	2025	2026	Total
External dependencies[19]	€2,700,000	€0	€0	€2,700,000
Retrofit	€2,375,364	€707,788	€0	€3,083,152
Bus Operator resources	€1,680,000	€1,680,000	€0	€3,360,000
Contractor Resource	€1,752,937	€951,185	€94,848	€2,798,970
Total	**€8,508,301**	**€3,338,973**	**€94,848**	**€11,942,122**

6.4 Costs Comparison

This section sets out a detailed review of the movement in costs between the Do Minimum option and the Preferred Tenderer designate option from PBC stage through to tender submission.

The cost movement is itemised under 3 steps as follows:

Step 1: The first table below (Table 14) compares the total cost of the Do Minimum option at PBC stage with the indicative total cost of the Preferred Tenderer designate option estimated at PBC stage. The costs are presented in real terms i.e., in 2021 prices. The table is split between capital expenditure and operating expenditure and separately includes an amount for VAT, optimism bias and contingency for both options. **As noted, the incremental cost of the PBC Preferred Option over the Do Minimum was €4.3m**.

[19] This relates to preparing other NTA systems for interfacing with NG AVL - See Section 4.6.2 for a list of the external dependencies.

Table 14: PBC Do Minimum and PBC Preferred Option Estimates (2021 pricing, real terms)

Cost Categories	2021 Do Minimum	2021 PBC Preferred Option	Incremental Costs
Capital Expenditure			
Service Provider Costs		€22,293,750	
NTA Costs		€2,500,000	
Base cost	**€8,010,000**	**€24,793,750**	**€16,783,750**
VAT (23%)	€1,842,300	€5,702,563	€3,860,263
Base cost (including VAT)	**€9,852,300**	**€30,496,313**	**€20,644,013**
Optimism Bias[20]	€3,694,613	€11,436,117	€7,741,505
Contingency[21]	€2,463,075	€4,574,447	€2,111,372
Total Capital Expenditure	**€16,009,988**	**€46,506,877**	**€30,496,889**
Operating Expenditure			
Base Cost	€64,818,476	€52,898,733	-€11,919,743
VAT (23%)	€14,908,249	€12,166,708	-€2,741,541
Base cost (including VAT)	**€79,726,725**	**€65,065,441**	**-€14,661,284**
Optimism Bias[20]	€7,653,766	€6,272,309	-€1,381,457
Contingency[21]	€19,931,681	€9,759,816	-€10,171,865
Total Operating Expenditure	**€107,312,172**	**€81,097,566**	**-€26,214,606**
Total Cost	**€123,322,159**	**€127,604,442**	**€4,282,283**

Step 2: As the PBC costs are in real terms (2021 pricing), and to reflect the passage of time from 2021, both the Do Minimum and the indicative total cost of the Preferred Option (estimated at the PBC stage) have been: (i) inflated to 2023 pricing[22]; and (ii) a corresponding inflation forecast included for 2024 – 2037. The inflation assumptions are based on HICP indices published by the Central Statistics Office (CSO). As outlined in Section 6.3, updates to the Do Minimum cost assumptions have also been made and are included as part of this step. These updates have been made to ensure a direct like for like comparison of the Do minimum costs against the Preferred Tenderer out turn costs detailed in step 3 below. Further, due diligence has been given to the assumptions and costs of the Do Minimum to account for any changes since the approval of the PBC. The costs are higher than those set out under Step 1, given the costs below account for inflation from 2024 to 2037 as well as an adjustment from a reassessment of the Do Minimum scenario (details for which are highlighted in

[20] Optimism bias of 37.5% and 9.6% was assumed in the PBC for capital expenditure and operating expenditure respectively.
[21] Contingency of 25% and 15% was assumed in the PBC for the 'Do Minimum' and 'Preferred Option'.
[22] An inflation adjustment of 13% has been applied to bring the costs from January 2021 prices to January 2023 prices based on the HICP index.

Appendix F). **By making these updates, the difference in the incremental cost between the Do Minimum and the PBC Preferred Option Estimate has changed, with the Preferred Option higher by c. €11.3m**.

Table: 15 PBC Do Minimum and Preferred Option Estimate (2023 pricing, nominal terms)

Cost Categories	2023 Do Minimum	2023 PBC Preferred Option Estimate	Incremental Costs
Capital Expenditure			
Service Provider Costs		€27,340,689	
NTA Costs		€3,011,977	
Base Capital Expenditure	€11,150,293	€30,352,666	€19,202,374
VAT (23%)	€2,564,567	€6,981,113	€4,416,546
Base Capital Expenditure (including VAT)	**€13,714,860**	**€37,333,780**	**€23,618,920**
Optimism Bias[23]	€5,143,072	€14,000,167	€8,857,095
Contingency[24]	€3,428,715	€5,600,067	€2,171,352
Total Capital Expenditure	**€22,286,647**	**€56,934,014**	**€34,647,367**
Operating Expenditure			
Base Cost	€81,370,989	€72,649,815	-€8,721,174
VAT (23%)	€18,715,328	€16,709,457	-€2,005,870
Base cost (including VAT)	**€100,086,317**	**€89,359,273**	**-€10,727,044**
Optimism Bias[23]	€9,608,286	€8,614,234	-€994,053
Contingency[24]	€25,021,579	€13,403,891	-€11,617,688
Total Operating Expenditure	**€134,716,182**	**€111,377,397**	**-€23,338,785**
Total Cost	**€157,002,830**	**€168,311,411**	**€11,308,582**

Step 3: The final step in updating the cost comparison is to replace the estimated nominal (inflated) Preferred Tenderer costs at PBC stage with actual outturn tender pricing. As discussed previously, each tenderer was required to complete a SPBM as part of their pricing submission. Table 16 below, compares the costs submitted by the Preferred Tender, Price Book Costs and NTA Costs inflated using HICP forecast (referred to as FBC Outturn Cost) against Do Minimum. **Importantly and as shown below, following the competitive procurement process and receipt of tenders, the overall Preferred Tenderer option costs are similar to the Do Minimum option with material operating expenditure savings** in the FBC Outturn Cost. The overall

[23] Optimism bias of 37.5% and 9.6% was assumed in the PBC for capital expenditure and operating expenditure respectively.
[24] Contingency of 25% and 15% was assumed in the PBC for the 'Do Minimum' and 'Preferred Option'.

difference in operating expenditure is mainly driven by the transiting to a single AVL system (as opposed to running multiple systems in parallel, see Section 3.1.1).

Table 16: Final Cost Comparison against Outturn Tender Pricing (2023 pricing, nominal terms)

Cost Categories	Do Minimum	FBC Outturn Cost	Incremental Costs
Capital Expenditure			
Preferred Tenderer Costs		[redacted]	
Price Book Costs		[redacted]	
NTA Costs		[redacted]	
Base cost	[redacted]	[redacted]	[redacted]
VAT (23%)	[redacted]	[redacted]	[redacted]
Base cost (including VAT)	[redacted]	[redacted]	[redacted]
Optimism Bias / Risk Provision[25]	[redacted]	[redacted]	[redacted]
Contingency[26]	[redacted]	[redacted]	[redacted]
Total Capital Expenditure	[redacted]		
Operating Expenditure			[redacted]
Preferred Tenderer Costs		[redacted]	[redacted]
Price Book Costs		[redacted]	[redacted]
Base Cost	[redacted]	[redacted]	[redacted]
VAT (23%)	[redacted]	[redacted]	[redacted]
Base cost (including VAT)	[redacted]	[redacted]	[redacted]
Optimism Bias / Risk Provision[25]	[redacted]	[redacted]	[redacted]
Contingency[26]	[redacted]	[redacted]	[redacted]
Total Operating Expenditure	[redacted]		
Total Cost	**€157,002,830**	**€156,891,562**	**-€111,268**

In summary, the total project cost of €156.9 million is similar to the Do Minimum cost with marginal savings of €0.1 million. It also represents a material saving of €11.4 million against the PBC Preferred Option Estimate, thereby providing a strong rationale from a financial perspective to proceed with the preferred option. Whilst the saving is relatively small over the term of the contract, emphasis should be placed on the risks associated with implementing the do minimum option. As outlined in the PBC, there are

[25] Optimism bias of 37.5% and 9.6% was assumed in the PBC for capital expenditure and operating expenditure respectively and same is used for Do Minimum. QRA adjustment of 23.2% and 5.2% is used for capital expenditure and operational expenditure respectively for FBC Outturn Costs.
[26] Contingency of 25% was assumed in the PBC for the 'Do Minimum' and 10% contingency is assumed for FBC Outturn Costs (as explained in 6.2.5).

significant risks associated with the do minimum, such as interfacing risks with other NTA systems, the risk of updating AVL software and not being able to achieve BusConnects requirements and other NTA initiatives.

Table 17: Project Cost Comparisons (nominal terms)

2023 Base Price	Do Minimum	FBC Outturn Costs	PBC Preferred Option Estimate
Total Cost	**€157,002,830**	**€156,891,562**	**€168,311,411**
vs FBC Outturn Costs	*€111,268*	*-*	*€11,419,850*

6.5 Financial Appraisal Results

The table below shows the Net Present Value (NPV) of the incremental net cashflows over the appraisal period. For NPV calculation, the incremental net cashflows are assumed to be occurring at mid-period and discounted to 1 January 2024 at a rate of 3.4% in accordance with the recommended rate provided by the NDFA. [redacted]. Overall, the absolute incremental net cashflows for FBC Outturn Costs are similar to the Do Minimum option costs. The NPV for the same cashflows shows an incremental spend of €7.7 million, as NPV will assign a lower discount factor to cashflows occurring earlier (i.e., capital costs are assigned a lower discount factor than operating costs).

Table 18: NPV Result

	Amount in €
Total incremental net cashflows	**-€111,268**
Discount Rate @ 3.4%	
Net Present Value	**€7,696,225**

6.6 Sensitivity Analysis

A sensitivity analysis has been performed to illustrate the variability in NPV based on changes in key financial assumptions to test the project affordability under different conditions. A range of sensitivities have been considered against the total incremental project costs, including:

- Capital expenditure: -10% to +10%
- Operating expenditure: -10% to +10%

- Discount rate: -2% to +2%
- Inflation rate: -2% to +2%

The range of sensitivities performed do not alter the results of the NPV analysis. The FBC Outturn Costs continues to show savings in operating expenditure over the do minimum option, with a higher capital expenditure.

Table 19: Sensitivity Analysis Results

Factor	Change	NPV
Base Case		**7,696,225**
Capital and Operating Expenditure	Decrease by 10%	6,926,602
	Decrease by 5%	7,311,414
	Increase by 5%	8,081,036
	Increase by 10%	8,465,847
Discount Rate	Decrease by 2%	3,468,595
	Decrease by 1%	5,700,565
	Increase by 1%	9,481,949
	Increase by 2%	11,080,890
Inflation Rate	Decrease by 2%	10,864,801
	Decrease by 1%	9,385,889
	Increase by 1%	5,774,665
	Increase by 2%	3,598,124

6.7 Affordability Assessment

As part of the FBC, it is necessary to re-assess the affordability of the project in order to ensure the Preferred Tenderer designate represents value for money to the NTA and sufficient funding is available to meet all contractual obligations and additional NTA costs. Table 20 overleaf summarises the projected costs associated with the project throughout the implementation, operation and extension period. The costs are broken down into three categories:

- FBC Outturn Costs submitted by the Preferred Tenderer designate and NTA Costs;
- Risk Provision (QRA) and contingency costs; and
- Additional NTA costs as outlined in Section 6.4 related to the set-up of NG AVL.

All costs are in nominal terms and inclusive of VAT.

NG AVL will be funded out the NTA's overall budget, which is provided for out of an allocation from DTTAS. Within the total costs of NG AVL, the amounts tendered by the Preferred Tenderer designate are the result of an extensive market competition and engagement. Throughout this competition, the NTA constantly looked to secure value for money, whilst meeting programme objectives.

The total FBC Outturn Cost has been compared against the PBC Preferred Option Estimate as this represents the notional project budget to assess and determine affordability. As clearly outlined, the total FBC Outturn Cost is lower than the project estimates at PBC stage thereby re-affirming the affordability of the preferred solution.

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Table 20: Affordability Assessment (nominal values incl. VAT)

€ '000s (nominal values incl. VAT)	Total	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Preferred Tenderer Costs															
Capital Expenditure	[redacted]														
Operating Expenditure	[redacted]														
Total Preferred Tenderer Costs	[redacted]														
NTA Costs	[redacted]														
Preferred Tenderer designate + NTA Costs	[redacted]														
QRA	[redacted]														
Contingency	[redacted]														
Total FBC Outturn Cost	[redacted]														
PBC Cash Outflow (2023 pricing)	[redacted]														
Difference	[redacted]														

6.8 Financial Appraisal Conclusion

In summary, the financial appraisal analysis demonstrates savings from the FBC Outturn Cost against the PBC Preferred Option Estimate and are similar to the Do Minimum option with marginal savings, thereby providing a strong rationale from a financial and affordability perspective to proceed with the preferred option.

6.9 Economic and financial robustness of the Preferred Tenderer

Candidates' economic and financial standing over the three previous financial years were assessed at pre-qualification stage across a range of PIs and relative to the estimated total value of the NG AVL contract. Candidates were also required to meet a minimum turnover requirement of €10m for each of the three previous financial years. As with any procurement, Tenderers are required to continue to demonstrate sufficiently robust economic and financial standing throughout the procurement so as not to pose an unreasonable risk to delivery of the Contract. Upon appointment of the Preferred Tenderer designate, updated financial statements, from those submitted at pre-qualification stage, will be requested and assessed to ensure the Preferred Tenderer designate continues to meet the NTA's economic and financial standing requirements. This assessment will be completed in a separate report prior to contract award. Provisions are also included in the contract in respect of the above to allow the NTA to monitor the economic and financial standing of the Service Provider on an ongoing basis during the life of the Contract.

7 Economic Appraisal

7.1 Introduction

The economic appraisal assesses the desirability of a project from the societal perspective. This form of appraisal differs from financial appraisals as a financial appraisal is undertaken from the perspective of a particular stakeholder e.g., Sponsoring Agency or the Exchequer. The economic appraisal takes a wider view and considers non-market impacts. The options are evaluated on both a quantitative and qualitative basis, paying particular attention to the additional benefits and costs to the greatest degree possible.

In line with PSC and TAF guidelines, an economic appraisal of the Preferred Tenderer designate has been completed as part of the FBC. The results of the economic appraisal along with the results of the financial appraisal are used in either a Cost-Benefit Analysis (CBA) or a CEA to compare the Preferred Tenderer designate against the counterfactual. A CEA is the required method of appraisal used in this section. Further detail is proved on the use of a CEA rather than a CBA.

As part of the TAF, all schemes with an estimated cost in excess of €30m, in addition to a CEA or CBA, are required to include a Transport and Accessibility Appraisal (TAA). This has been included as part of the economic analysis and can be found in Section 7.8.

7.2 Decision on Appraisal Methodology

There are two primary approaches to economic appraisal outlined in the PSC: CBA and CEA. In both methodologies, the objective is to weigh up the economic impacts that are not captured in the financial analysis. CBA is considered the preferred approach according to the PSC, however, is not applicable to all situations.

A CBA requires the monetisation of economic impacts, which is difficult to do in this case due to the nature of benefits, data restrictions, and the proportion of analysis that would be based on assumptions only.

A CEA is regularly applied in the case of government interventions of this nature, to determine which treatment is the most economically efficient to provide. Similar to the CBA approach, we are looking at the average cost-effectiveness of one option, relative to another. Unlike CBA, a CEA does not determine whether the benefits will outweigh the costs in absolute terms.

7.3 Reasoning for a CEA in the Case of NG AVL

The reasoning for using a CEA, as opposed to a CBA, were discussed widely within the project team, the Steering Committee and with external stakeholders, such as the Transport Planning and Investment Department (TPI) and Peer Review Group (PRG). The reasons remain the same and those outlined previously in the PBC are given here below:

- NG AVL is an asset renewal project, therefore a number of the benefits associated with an AVL system (performance improvements from service control; RTPI to bus passengers) are already being realised.
- A benefit of NG AVL is increased passenger journeys due to the provision of RTPI resulting in increased fare revenue. The growth in passenger journeys, outlined in the demand analysis within the PBC, is supported by NG AVL, however the growth is not a direct result of NG AVL and is therefore difficult to isolate and measure as a direct benefit. Rather it is supported by a combination of initiatives aimed at improving customer experience and efficiency of the delivery of public transport, of which AVL is one.
- The additional benefits offered from the Preferred Tenderer designate's solution, compared to the Do Minimum are mostly intangible and generally difficult to monetise, such as: quality of service, integration with other systems and ease of implementation.
- There has been limited research carried out in recent years on the quantitative benefits of AVL systems specifically.
- The purpose of the report is not to decide whether to invest, it is to find the most cost-effective means of intervention.

A comparison of a CEA vs a CBA is supplied in the Appendix G.1.

7.4 Multi Criteria Analysis

As undertaken in the PBC, a detailed MCA has been used to carry out the economic appraisal due to the fact that most of the impacts are unquantifiable. An MCA looks at the qualitative aspects of the options to assess their level of effectiveness in achieving the objectives. For this analysis the following two options identified in the table below have been considered.

Table 21: MCA Option Overview

Options	Description
Do Minimum	**Do Minimum**: All existing contracts would be renewed with existing contract holders, where possible. Equipment would be retained, maintained and renewed when and where necessary
FBC Option	**Preferred Tenderer + NTA Costs (Option 3 in the PBC)**: Replacing the existing AVL systems with a new single-supplied system, with capacity to host the latest software release, which would have enhanced functionality and an opportunity to improve system harmony through the adoption of up-to-date interface standards. Includes NTA costs to deliver NG AVL

As a majority of the criteria used in the MCA cannot be quantified, each impact is scored on a scale of 1 (major or highly negative) to 7 (major or highly positive), with a score of 4 representing neutral or minimal impacts. It was concluded that 1 to 7 was an appropriate scale, as it allows for sufficient differentiation between the options. The integer score to be assigned according to the scale of impacts is as follows:

Table 22: MCA Scoring and Rationale

Score	Description
7	Major or highly positive
6	Moderately positive
5	Minor or slightly positive
4	Not significant or Neutral
3	Minor or slightly negative
2	Moderately negative
1	Major or highly negative

7.4.1 Appraisal Criteria

The appraisal criteria were developed as part of the PBC and has been reviewed in a workshop with NTA and KPMG, which concluded that they are still appropriate for use in the FBC. The criteria themes used in the MCA are as follows; Economic, Integration, Accessibility, Safety / Security, and Others.

Table 23: MCA Criteria

Theme	Criteria	Description
Economy	Quality of Service	The extent to which the quality of service improves for passengers
	Quality of RTPI	To ensure the provision of quality RTPI to encourage patronage
	Bus Fleet Maintenance	The ability to perform preventative maintenance rather than reactive maintenance.
	Bus priority at traffic signals	Improved bus network efficiency through a central bus priority at traffic signals system.
Integration	Other NTA systems	Seamless integration with other NTA systems and overall integration of AVL.
	Future Requirements	The integration of future AVL requirements and variations.
Accessibility	Widen RTPI Coverage	Improve accessibility to RTPI through the ability to widen RTPI coverage across Ireland and for non-urban services.
	Benefits Realisation	Speed of access to upgraded AVL which results in faster benefits realisation.
Safety / Security	Security of information	The extent to which information is secure.
Others	Overall contract management	Overall ease of contract management incl. - Number of contracts, number of back offices, end of contract / exit management
	Acceptance from Operators	Level of acceptance / resistance expected from operators
	Procurement Feasibility	Is procurement of option possible / ease of procurement
	Control	The level of control over suppliers which impacts risk
	Ease of implementation / Time	The level of difficulty associated with implementing the option and the fastest route to roll out.

7.4.2 MCA Scoring

Using the above scoring scale and appraisal criteria is used to compare the FBC Option against the counterfactual (Do Minimum) in their ability to meet the appraisal criteria. These scores and rationale are detailed in the table below. There has been no change in the scoring from the PBC.

Table 24: MCA Scoring and Rationale

Appraisal Criteria	Appraisal Sub-Criteria	Do Minimum		FBC Option	
		Score	Rationale	Score	Rationale
Economy	Quality of Service	4	Under 'Do Minimum', quality of service would remain the same and therefore passenger experience would also remain the same, this option scored 4 under 'Quality of Service'.	6	Under 'FBC Option', quality of service would be enhanced due to increased functionality resulting in improved passenger experience. The provision of single NG AVL provides RTPI to more people across Ireland. This allows for a greater choice for passengers to plan their travel options and easier access to traveling via public transport to different urban centres. This option scored 6 under 'Quality of Service'.
	Quality of RTPI	4	The current provision of RTPI provided by the five AVL systems is not optimum as different systems provide different information on the same bus. This may discourage patronage due to unreliable information. Therefore, this option scored 4 under 'Timeliness of rollout'.	7	Under 'FBC Option', a fully integrated RTPI would be available for customers and would be integrated with other NTA systems to ensure the provision of reliable information. The RTPI will also be coming from one system only ensuring consistency, therefore this option scored 7 under 'Timeliness of RTPI'.
	Bus Fleet Maintenance	2	The current AVL systems in place do not have the functionality to have preventative maintenance in place (operators would continue to use reactive maintenance processes). Therefore, this option scored 2 under 'Maintenance'.	7	'FBC Option' would see the introduction of preventative maintenance, this could reduce operating costs and improve overall system efficiency, therefore this option scored 7 under 'Maintenance'.
	Bus priority at Traffic Signals	4	Under the 'Do Minimum', bus priority at traffic signals is provided, although the current frequency of data provision for bus priority at signals is limited, therefore this option scored 4 under 'Bus Priority'.	7	'FBC Option' scored 7 under 'Bus Priority' as one central AVL system will allow for a centralised data-led approach to Bus Priority at signals which would result in increased bus network efficiency for the Local Authorities consuming the data into their urban traffic control systems, allowing Bus Operators to ensure that the right buses are in service at the right times between public transport facilities. This can be measured as actual bus deployment versus scheduled bus deployment reports between NG AVL and the Operator's Planning tools.

Appraisal Criteria	Appraisal Sub-Criteria	Do Minimum		FBC Option	
		Score	Rationale	Score	Rationale
Integration	Other NTA systems	4	The current AVL systems in place do not have optimum integration with other NTA systems, resulting in different RTPI predictions on different channels for the same buses, for example. Therefore 'Do Minimum' scored 4 under 'Integration with other NTA systems'.	7	The introduction of one central AVL system will facilitate easier integration with other NTA systems and harmony of information. Additionally, NG AVL has the potential to be able to assist the authority to better plan the delivery of its services through an improved understanding of demand and supply Therefore, this option scored 7.
	Future Requirements	4	The current AVL systems in place do not have the functionality to integrate future requirements for NTA policies, therefore 'Do Minimum' scored 4 under 'Integration of future requirements'.	7	Under 'FBC Option', integration of future requirements could be achieved as a new AVL system would be procured that would have the functionality to implement future requirements and as there will only be one system the implementation of future requirements would be easier to manage. Therefore, this option scored 7 under 'Integration of future requirements'.
Accessibility	Widen RTPI Coverage	4	The current AVL system does not have the capabilities for AVL coverage across Ireland. Therefore, accessibility to RTPI is only maintained. 'Do Minimum' scored 4 under 'Widen RTPI Coverage'.	6	Under 'FBC Option', there will be an 'AVL Lite' option available for smaller operators, which will allow RTPI coverage to be widened to country-wide availability. Additionally, this will provide greater choice for passengers to plan their travel options and easier access to traveling via public transport to different urban centres. Therefore, this option scored 6 under 'Widen RTPI coverage'.
	Benefits Realisation	1	Under this criterion, 'Do Minimum' scored 1 as the benefits of a new AVL system will not be realised as the current systems in place would remain.	7	Under 'FBC Option', all the benefits of a new AVL system will greatly enhance all aspects of public transport and commuting. It will mean more reliable public transport services allowing for greater access to country-wide areas, increasing access to jobs. Therefore, this option scored 7 under 'Benefits Realisation'.

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Appraisal Criteria	Appraisal Sub-Criteria	Do Minimum		FBC Option	
		Score	Rationale	Score	Rationale
Safety / Security	Security of information	**4**	Under 'Do Minimum', the current level of security of information will remain. Therefore, this option scored 4 under 'Security of Information'.	**7**	Under 'FBC Option', 'Security of information' will be high as there will only be one system which will be managed by the NTA which reduces the risk associated with information security and ensures NTA policy can be implemented. Additionally, a single NG AVL system allows Bus Operators to intervene in the event of an incident, which can be measured by the number of diversions and curtailments reported by the Operator versus those reported by the NG AVL solution Therefore, this option scored 7.
Others	Overall contract management	**4**	Under 'Do Minimum', the current contract management structure will remain. The current structure is fragmented which reduces the ease of contract management. Therefore, this option scored 4 under 'Contract Management'.	**7**	Under 'FBC Option', contract management will be seamless due to there being only one contract and one back office, this will result in a more efficient AVL system from a resources perspective. Therefore, this option scored 7 under 'Contract Management'.
	Acceptance from Operators	**4**	Under 'Do Minimum' the operators would have to renew existing contracts, due to the limited functionality of the current contracts, Operators may not prefer this option. Therefore, this option scored 4 under 'Acceptance from Operators'.	**6**	Under 'FBC Option', Bus Operators would lose control of the procurement process and the contract management which may be seen as negative by Bus Operators. However, the Bus Operator currently lack such resources to lead the tender and contract management
	Procurement Feasibility	**3**	Under 'Do Minimum' procurement feasibility did not score as highly as the other options as it may not be possible to renew the current contracts that are in place therefore there is a low level of procurement feasibility.	**7**	Under 'FBC Option', there would be one procurement process which would significantly increase procurement feasibility. Therefore, this option scored 7 under 'Procurement Feasibility'.
	Control	**4**	Under 'Do Minimum' the current level of control would remain as there is currently five contracts in place between the operators and their suppliers (as well as with the BMO suppliers). Therefore, this option scored 4 under 'Control'.	**7**	Under 'FBC Option', the NTA would have complete control over AVL for all operators. NTA would experience significant operational efficiencies through centralisation of support either by the NTA or the supplier. Additionally, NTA could provide a more efficient bus network by using supply and demand data from the passenger counter feature of a new AVL system. Therefore, this option scored 7 under 'Control'.
	Ease of implementation	**6**	Under 'Do Minimum', ease of implementation would be higher than the preferred option due to incumbents providing the service and the systems and hardware already being in place. This option scored 6 under 'Ease of Implementation'.	**6**	'FBC Option' scored 6 under 'ease of implementation' as having only one procurement process and dealing with one supplier will be an efficient use of resources.

7.4.3 MCA results

The table below summarises the results of the MCA. The MCA confirms that the FBC Option has the highest level of effectiveness when compared to the counterfactual 'Do Minimum'. The FBC Option has an average level of effectiveness of 'Major or highly positive'.

Table 25: MCA Results

Appraisal Criteria	Appraisal Sub-Criteria	Do Minimum	FBC Option
Economy	Quality of Service	4	6
	Timeliness of RTPI	4	7
	Bus Fleet Maintenance	2	7
	Bus priority at traffic signals	4	7
Integration	Other NTA systems	4	7
	Future Requirements	4	7
Accessibility	Widen RTPI Coverage	4	6
	Benefits Realisation	1	7
Safety / Security	Security of information	4	7
Others	Overall contract management	4	7
	Acceptance from Operators	4	6
	Procurement Feasibility	3	7
	Control	4	7
	Ease of implementation	6	6
Summary Level of Effectiveness		**3.7**	**6.7**

7.5 Cost Effectiveness Analysis

The purpose of this section is to carry out a CEA on the FBC Option and the counterfactual (Do Minimum) based on the financial and economic appraisal MCA. CEA ratios are used to draw comparisons across options in terms of value for money.

The approach used in the PBC compared the additional cost for each option compared to the Do Minimum. This has been expanded on to include an average cost-effectiveness ratio (ACER)[27]. This gives the cost per unit of effectiveness, where units are the scores generated through the MCA. The MCA scores are scaled up to align with the units for costs. In this case, all MCA scores have been multiplied by one hundred to provide a score between 0 and 700. The lower the ACER, the more cost-effective the option is.

[27] This is included within the TAF as a ration between KPI (MCA) and Cost

Formula: **ACER** = **Total Cost** Option n / **MCA Score** Option n

The results of the ACER analysis are shown in the table below.

Table 26: ACER Inputs and Analysis (excluding shadow cost)

ACER (excluding VAT, contingency, inflation)		Do Minimum	FBC Options
Cost	Total Cost[28]	€74.9M	€87.5M
	NPV (4% discount rate) **[A]**	€57.8M	€72.5M
	Cost as % of most expensive option, %	80%	100%
	Ranking	**1**	**2**
Effectiveness	MCA Score (out of 700) **[B]**	370	670
	Effectiveness (MCA score) as % of least effective option, %	100%	181%
	Ranking	**2**	**1**
Evaluation	CEA (ACER) **[A/B]**	€156,154	€108,213
	Cost-effectiveness as % of least cost-effective option, %	100%	69%
	Ranking	**2**	**1**

From the ACER analysis, implementing the FBC Option results in a better economic outcome than the Do Minimum, with the lowest real cost per unit of effectiveness, at €108,213. This shows that it is the most cost-effective option and delivers the most effective solution for the cost. For the FBC Option each additional score in the MCA cost approximately €108,213 to deliver compared to €156,154 for the Do Minimum.

7.6 Shadow Costs

There is a distortionary cost associated with the use of public funds versus private, namely the shadow price of public funds. According to the PSC a 130% premium must be attached to the nominal costs of the proposal in order to make private cash flows commensurate with public cash flows and account for the deadweight loss of taxation.

[28] Figures taken from nominal totals presented in Table 16 (Do Minimum: €92.6 million and FBC Outturn Costs: €104.5 million) adjusted back to real numbers (i.e., in 2023 prices) in line with PSC guidance for economic appraisals.

If public costs and private benefits are treated equally, the NPV of projects will be systematically overestimated. To account for this, the nominal costs, shown in Table 26, are increased to 130% to reflect the true economic cost. The ACER is re-calculated using these costs.

Table 27: ACER including shadow cost

ACER		Do Min	FBC Option
Cost Effectiveness Evaluation	NPV (4% economic discount rate)	€75.1M	€94.3M
	MCA Score (out of 700)	370	670
	CEA (ACER)	**€203,000**	**€140,676**

These results show that under the financial analysis, in both the effectiveness assessment and the average cost-effective ratio, the FBC Option is the preferred option in all analyses. This demonstrates that it performs strongly in terms of cost, the impacts it will deliver and the combined cost effectiveness. From the economic analysis, the FBC Option therefore has the better outcome.

7.7 Sensitivity Analysis

This section analyses a range of scenarios to evaluate the impact of varying our assumptions about each of the main costs discussed in this report.

Sensitivity tests have been carried out to understand the impact changes to key assumptions have on the results. These sensitivity tests help to test the robustness of findings in response to external changes or if outcomes differ to assumptions made. Tests have been conducted with different criteria weighting applied to all themes in the MCA.

7.7.1 MCA Sensitivity

Four different sensitivities that have been applied to the MCA include:

1 **Equal Weighting:** an equal weighting between all criteria. This represents the baseline weightings used for the MCA in Section 7.4.
2 **Economy Impacts Driven**: higher weighting given to the Economy themed criteria.
3 **Integration, Accessibility, Safety and Security driven**: Higher weighting to Integration, Accessibility, Safety and Security themed criteria.
4 **Implementation and Management of AVL**: Higher weighting to the Other themed criteria which includes the implementation and management of AVL.

These four different sensitivity weightings applied to the MCA are shown in the table below.

Table 28: MCA Sensitivity Analysis

Theme	Criteria	Scenarios Weightings			
		Baseline Equal Weighting	Sensitivity 1: Economy Impacts driven	Sensitivity 2: Integration, Accessibility, Safety / Security driven	Sensitivity 3: Implementation / management of AVL driven
Economy	Quality of Service	7.1%	15.0%	4.0%	4.4%
	Quality of RTPI	7.1%	15.0%	4.0%	4.4%
	Bus Fleet Maintenance	7.1%	15.0%	4.0%	4.4%
	Bus priority at Traffic Signals	7.1%	15.0%	4.0%	4.4%
Integration	Other NTA systems	7.1%	4.0%	15.0%	4.4%
	Future Requirements	7.1%	4.0%	15.0%	4.4%
Accessibility	Widen RTPI Coverage	7.1%	4.0%	15.0%	4.4%
	Benefits Realisation	7.1%	4.0%	15.0%	4.4%
Safety / Security	Security of information	7.1%	4.0%	4.0%	4.4%
Others	Overall contract management	7.1%	4.0%	4.0%	12.0%
	Acceptance from Operators	7.1%	4.0%	4.0%	12.0%
	Procurement Feasibility	7.1%	4.0%	4.0%	12.0%
	Control	7.1%	4.0%	4.0%	12.0%
	Ease of implementation	7.1%	4.0%	4.0%	12.0%
Total		**100.0%**	**100.0%**	**100.0%**	**100.0%**

7.7.2 Capital and Operating Costs

A sensitivity analysis was performed on the costs for the Do Minimum and the FBC Option. This includes showing the effects of a 15% increase on the capital costs and separately a 15% increase operating costs.

7.7.3 Discount Rate

Sensitivity analysis on the discount rate has been applied with discount rate of 3% and 5%.

7.7.4 Results from sensitivity testing

The results from the various sensitivity tests are shown in the table below. Across all of sensitivity tests, the FBC Option scores better than the Do Minimum with lower CEA cost (result).

Table 29: Results from Economic Sensitivity Testing

Item	Sensitivity		Do Minimum	FBC Option
Baseline	Baseline with Equal Weighting in the MCA	Costs, €M	74.9	87.5
		Costs NPV 4% Real, €M	57.8	72.5
		Effectiveness (MCA results)	370	670.0
		Evaluation (ACER CEA)	**€156,154**	**€108,213**
MCA	Economy Impacts Driven	Costs, €M	74.9	87.5
		Costs NPV 4% Real, €M	57.8	72.5
		Effectiveness (MCA results)	362	673.0
		Evaluation (ACER CEA)	**€159,605**	**€107,730**
	Integration, Accessibility, Safety / Security driven	Costs, €M	74.9	87.5
		Costs NPV 4% Real, €M	57.8	72.5
		Effectiveness (MCA results)	351	673
		Evaluation (ACER CEA)	**€164,607**	**€107,730**
	Implementation / management of AVL	Costs, €M	74.9	87.5
		Costs NPV 4% Real, €M	57.8	72.5
		Effectiveness (MCA results)	390	667
		Evaluation (ACER CEA)	**€148,230**	**€108,681**
Capital and Operating Costs	Increase in capital costs by 15%	Costs, €M	76.4	89.0
		Costs NPV 4% Real, €M	59.0	77.7
		Effectiveness (MCA results)	370	670
		Evaluation (ACER CEA)	**€159,412**	**€115,953**
	Increase in operating costs by 15%	Costs, €M	84.7	90.8
		Costs NPV 4% Real, €M	65.2	78.2
		Effectiveness (MCA results)	370.0	670.0
		Evaluation (ACER CEA)	**€176,318**	**€116,704**
Discount rate	Discount rate of 3%	Costs, €M	74.9	87.5
		Costs NPV 3% Real, €M	61.5	75.0
		Effectiveness (MCA results)	370.0	670.0
		Evaluation (ACER CEA)	**€166,161**	**€111,887**
	Discount rate of 5%	Costs, €M	74.9	87.5
		Costs NPV 5% Real, €M	54.4	70.2
		Effectiveness (MCA results)	370.0	670.0
		Evaluation (ACER CEA)	**€147,016**	**€104,802**

7.8 Transport and Accessibility Appraisal

As part of the TAF all schemes with an estimated cost in excess of €30m, in addition to a CEA or CBA, are required to include a TAA

The TAA is a supporting system that assesses the impact of a programme across the following six key criteria:

- Accessibility
- Social
- Land Use
- Safety
- Climate Change
- Local Environment

Each criteria has a range of different pre-determined indicators that can be used to assess the relative benefits of the respective options. Only relevant indicators have been considered – i.e., the impacts that may arise as a result of implementing NG AVL and its enabling impact of facilitating customers to access relevant information and improvement of the customer experience.

The TAA is better placed for the assessment of physical infrastructure capital project such as a road, bridge, or cycle lane. Due to the nature of the NG AVL being software based it does not completely align with the TAA and hence these criteria have not been used in the CEA. However, the appraisal is undertaken and provided below.

The FBC Option has been compared against the Do Minimum with the results shown in Table 30 below (a detailed breakdown of the analysis is provided in the Appendix G.2)

Table 30: TAA Results

Criteria	Do Minimum	FBC Option
Accessibility	Neutral	Slight Positive
Social Impacts	Neutral	Slight Positive
Land Use Impact	Neutral	Slight Positive
Safety Impact	Neutral	Slight Positive
Climate Change	Neutral	Slight Positive
Local Environmental Impact	Neutral	Neutral

Across the six key criteria within the TAA reveals that the FBC Option results in a slight positive impact for five out of the six criteria. Whereas the Do Minimum scores a neutral impact across all six criteria.

In relation to the TAA criteria, the main resulting benefit will be an increase in RTPI across Ireland, which has the potential to be wider through the delivery of AVL Lite services. Implementing NG AVL will enhance RTPI through all channels, with greater accuracy of information and increased coverage of services and an enhanced journey experience and increased efficiency. Across the TAA themes there is the following impacts:

- **Accessibility –** A slight positive increase in accessibility through the NG AVL, allowing for a greater choice for passengers to plan their travel options and easier access to traveling via public transport to different urban centres.
- **Social** – A slight positive increase in social impacts from implementing NG AVL. Deprived groups in particular will see the improvement in the bus journey service as they are more likely to use public transport.
- **Safety –** Through implementing NG AVL there is an increased and/or improved information of services through wider and improved RTPI on TFI Live and on bus stop displays, which may lead to a perceived improvement in the perception of safety whilst waiting for buses as the wait time is predicted, although this is difficult to determine. Additionally, the security of information will be improved as there will only be one system which will be managed by the NTA. This reduces the risk associated with information security and ensures NTA policy can be implemented.
- **Climate Change –** It is anticipated that a single NG AVL providing improved RTPI, and a better service will increase the attractiveness of public transport. Additionally, it will assist with modal shift away from private vehicles, which will contribute to reduce the externalities associated with private car use.
- **Local Environment –** A very small improvement of air quality may result from the increase in the attractiveness of public transport resulting in a shift away from private vehicles. This is unlikely to be anything other than a very small change in local air quality. NG AVL is a national scheme, so it would be difficult to measure with regard to local air quality.

7.9 Conclusion

The PBC determined that a CEA was the appropriate appraisal technique for NG AVL, and this remains the case for the FBC. The MCA scoring and rationale was revisited but has remained the same since the PBC. The economic appraisal reveals the difference in CEA ratios between the Do Minimum and that the FBC Option is reflective of the additional benefit received from implementing the FBC Option at a lower cost than the Do Minimum. This shows that the FBC Option is the most cost-effective option and delivers the most effective solution for the cost. Accounting for shadow costs and the application of sensitivity appraisal does not change this economic appraisal outcome.

A TAA has been undertaken, and across the six key criteria (Accessibility, Social, Land Use, Safety, Climate Change, and Local Environment) the FBC Option results in a

slight positive impact for five out of the six criteria, whereas the Do Minimum scores a neutral impact across all six criteria.

8 Benefits Realisation Plan

8.1 Overview

As part of the original SAR, the NTA's business objectives and business requirements were mapped to high level functional requirements and project objectives, which were then mapped through to a set of NG AVL related benefits. This mapping is given in Appendix C. Further, this mapping was included in PAG deliverable for Phase 2, the Benefits Management Strategy, which was signed off by the Steering Committee in December 2021.

8.2 Objectives

The objective of the benefits realisation plan is to determine the benefits that can be quantified, that can be qualitatively assessed and when all of this should be undertaken. It will set out a tracking system to baseline and continuously measure the benefits of NGAVL and regularly report the results as part of NG AVL's governance arrangements.

The long list of benefits outlined in the Benefits Management Strategy are listed below, noting that the numbers relate to the benefits mapping given in Appendix C the tables later in this section:

- **Passenger Benefits**
  - **BEN01** - More reliable public transport services
  - **BEN02** - Complete, consistent and accurate real-time and timetabled information about public transport services
  - **BEN03** - Improved information for users with additional accessibility requirements.
- **Operator Benefits**
  - **BEN04** - More efficient use of resources, through tools to manage vehicles, drivers and energy consumption
  - **BEN05** - Reduced Costs
  - **BEN06** - Increased ridership from improved RTPI.
- **NTA Benefits**
  - **BEN07** - Improved network to satisfy demand with appropriate supply
  - **BEN08** - Reduced Costs (proportionally, i.e., staff to buses ratio)
  - **BEN09** - Better performance from Public Transport Operators
  - **BEN10** - More efficient use of technical resources (Transport Technology) across one supplier
  - **BEN11** - Facilitates future policies, such as BusConnects and NGT
  - **BEN12** - Facilitate the collection of revenue

- **BEN13** - Improve reputation of TFI/NTA
- **BEN14** - Adherence to Legislation and IT Policy
- **BEN15** - Facilitating future standards and applications.

8.3 Indicative Timescales for Rollout

The indicative timescales for NG AVL are as outlined in Figure 12, and as outlined in the PEP.

The main rollout is likely to begin in 2025, with the core Bus Operators likely to take six to eight months to complete rollout. This means that benefits realisation will not begin until at least the pilot is accepted, but more likely when most buses are installed and operational with NG AVL, i.e., towards the end of 2025.

As further work is done to align the Preferred Tenderer designate with the NTA's plans for NG AVL, the timing of the benefits realisation will become more definitive. However, the timings included below will give an aligned estimate of realisation.

8.4 Target Benefits – Qualitative

The long list of potential benefits is outlined above. It should be noted that since this project is an asset refresh and not a first-time introduction of AVL, it will be very difficult (if not impractical) to correctly attribute benefits solely to the replacement of the existing AVL systems with NG AVL systems. For this reason, the PBC and FBC utilised a CEA instead of a traditional CBA (see Section 7). It follows therefore that the benefits of NG AVL may not all be readily quantifiable. Additionally, there will be some benefits that will be difficult to isolate from the impact of NG AVL, such as the improvement of bus services, when other influences exist. In the case of the improvement of bus services, other factors outside of the project, such as the BusConnects network redesign or the price of fuel, for example, will also influence the improvements, or decline, in bus services. This challenge is explored further in Table 31 below.

Table 31: Potential Benefits that are Difficult to Quantify

Number	Potential Benefit	Measurement	Comment
BEN01	More reliable public transport services	Estimated Wait Time (EWT) or schedule adherence across all routes (from NG AVL)	Difficult to accurate attribute to NG AVL alone against the backdrop of significant bus network redesign.
BEN04	More efficient use of resources, through tools to manage vehicles, drivers and energy consumption.	Peak vehicle requirement / total ridership ratio (NTA)	Difficult to accurately attribute to NG AVL alone against the backdrop of significant bus network redesign.
BEN05	Reduced Costs to operators	Cost of operations compared to previous costs (Bus Operator	Internal NTA costs are identifiable. However, may need to base it on

Number	Potential Benefit	Measurement	Comment
		internal costs compared to business case costs)	best estimates of the cost of operating the five separate systems pre-NG AVL.
BEN06	Increased ridership from improved RTPI where RTPI not previously available	% Increase in Patronage levels	Difficult to accurately attribute to NG AVL alone against the backdrop of bus network redesign and other economic factors that may influence patronage, e.g. fares, the economy, etc.
BEN07	Improved network to satisfy demand with appropriate supply	Peak vehicle requirement / total ridership ratio	Difficult to accurately attribute to NG AVL alone against the backdrop of significant bus network redesign.
BEN09	Better performance from Public Transport Operators	EWT or schedule adherence across all routes by operator (from NG AVL data)	Difficult to accurately attribute to NG AVL alone against the backdrop of significant bus network redesign
BEN10	More efficient use of technical resources (within TT Directorate) across one supplier	Reduction in ratio of staff to buses managed (TT internal costs compared to business case costs)	Internal NTA costs are identifiable. However, may need to base it on best estimates of the cost of operating the five separate systems pre-NG AVL
BEN11	Facilitates future policies, such as BusConnects and NGT	Ability to deliver future requirements	Future requirements can be readily identified.
BEN12	Facilitate the collection of revenue	Ability to deliver integration with TGX150 ticket machine	Addition of this feature can be readily identified.
BEN14	Adherence to Legislation and ICT Policy	Ability to adhere to legislation and ICT policy	Compliance should be identifiable.
BEN15	Facilitating future standards and applications	Subject to supplier selected	Compliances should be identifiable.

The benefits in Table 31, rather than be quantified, can be determined as qualitative benefits that will be estimated based on feedback from the NTA or from Bus Operators and other stakeholders.

8.5 Target Benefits – Quantitative

The benefits outlined in Table 32 will involve collecting data from various internal and external stakeholders. These datasets have been identified and data will be collected and baselined, in mid-2024, well before the rollout of NG AVL begins.

Table 32: Realisable Benefits Measurement and Timing

Number	Benefit	Measurement	When From	Monitoring Period
BEN02	Complete, consistent and accurate real-time and timetabled information about public transport services	On-street surveys and Customer Satisfaction scores on RTPI at stops[29]	End of 2025 (end of rollout)	Every 6 months
BEN03	Improved information for users with additional accessibility requirements, such as low floor bus status and wheelchair space availability on a bus	Customer Satisfaction scores on RTPI at stops and focused questionnaires with specific user groups	End of 2025 (end of rollout)	Annual
BEN08	Reduced proportional costs to the NTA	Cost of NG AVL operations (ratio of staff to buses managed) compared to previous costs (TT internal costs compared to business case costs)	From end of 2025 (end of rollout)	Annual
BEN10	More efficient use of technical resources (within TT Directorate) across one supplier	reduction in ratio of staff to buses managed (TT internal costs compared to business case costs)	From end of 2025 (end of rollout)	Annual
BEN11	Facilitates future policies, such as BusConnects and NGT	Ability to deliver future requirements	From end of 2025 (end of rollout)	By Exception
BEN12	Facilitate the collection of revenue	Ability to deliver integration with TGX150 ticket machine	From first bus /pilot	By Exception
BEN14	Adherence to Legislation and ICT Policy	Ability to adhere to legislation and ICT policy	From first bus /pilot	By Exception
BEN15	Facilitating future standards and applications	Subject to supplier selected	From first bus / pilot	By Exception

[29] RTPI quality and completeness could be impacted by misuse of NG AVL by the bus operators and by any processing of the NG AVL-generated predictions by the downstream systems (either TISS Applications or TISS Displays).

8.6 Alignment with PEP

The Benefits Management Plan has been updated and is a core aspect of the PEP. A benefits management tracker has been created to maintain a log of the change in the data for each benefit, so this can be tracked throughout the implementation and operation of NG AVL. The outcomes of these benefits will be presented through various meetings outlined in the Governance section (see Section 4.2).

9 NG AVL Monitoring and Evaluation Plan

9.1 Introduction

This section outlines the monitoring and evaluation plan for NG AVL to monitor and assess the achievement of project objectives, benefits and effectiveness. Both PSC and TAF require that the arrangements to ensure ongoing monitoring, review and ex-post evaluation are presented as part of the FBC.

In this section, the term Project KPI is used to refer to the measures to monitor the success of the delivery of the project or its operations in relation to the Project Objectives. Reference will also be made to the Schedule 5 – Performance KPIs, which contain the KPIs and PIs that will be measured by the Service Provider and reported on every Contract Period. Both are important and used in this section but there needs to be a clear differentiation between the two KPIs.

9.2 NG AVL Project Objectives and KPIs

A set of Project KPIs were defined at the PBC stage using project objectives and benefits realisation plan. A review was carried out at FBC stage to ensure continued relevance and to take into account any changes since the PBC was approved and as a result, many of these have changed. The objectives have been aligned with the project benefits as outlined in Section 8 so that the success of the project in meeting its objectives can be reported on, in line with the benefits. It is suggested that this is undertaken every six months from the completion of NG AVL rollout, noting that some objectives will be achieved much later through the rollout of AVL Lite services, for which its rollout is yet to be defined.

Table 33 presents a non-exhaustive list of Project KPIs that will be used to determine whether the objectives are continuously being met.

Note that the Service Provider will be reporting on all the KPIs, and PIs outlined in Schedule 5 – Performance. All other benefits will be measured and monitored by the NTA in line with Section 8.

Table 33: KPIs for Monitoring and Evaluating NG AVL

Objectives	KPI's
• Replace existing AVL systems to enable the continuous provision of RTPI, service control and reporting services to passengers, NTA and to Bus Operators	• Delivery of NG AVL (Full AVL) by end 2025 • Service Levels outlined in Schedule 5 are met • Customer Satisfaction (BEN02) • Improved bus reliability (BEN09) • Driver Satisfaction (feedback from Bus Ops)
• Facilitate the expansion of RTPI, service control and reporting services across Ireland	• Delivery of NG AVL (full AVL) by end 2025

Objectives	KPI's
by enabling the future inclusion of additional and new transport operators, by the end of 2025.	• AVL Lite rollout to Junior PSO and Local Link fixed routes by end 2026 • CBOs using AVL Lite end 2027 • Improved bus reliability (BEN09)
• To provide tools to improve the use of Bus Operators' resources, such as buses and drivers, and help manage their operational and engineering utilisation	• Driver, engineers, service controller feedback (feedback from Bus Ops) • Improved bus reliability (BEN09)
• To improve the reputation of the NTA through improved accuracy of RTPI	• Service Levels outlined in Schedule 5 are met • Increased ridership in locations that was not previously served with RTPI (BEN06) • Improved RTPI (BEN02) • Customer Satisfaction (BEN02)
• To facilitate future functionality and policies through the provision of an AVL system that is fit for the future	• Service Levels outlined in Schedule 5 are met • Ability to deliver future requirements (BEN11)
• Make the bus network more accessible	• Customer Satisfaction (BEN03) • Delivery of NG AVL (Full AVL) by end 2025 • AVL Lite rollout to Junior PSO and Local Link fixed routes by end 2026 • CBOs using AVL Lite end 2027
• To help inform the NTA of the success of the bus network in satisfying demand	• Customer feedback (BEN02) • Increased ridership in locations that was not previously served with RTPI (BEN06) • Passenger counts on buses (BEN07 using passenger counts from NG AVL)
• To contribute to improved bus service provision through the delivery of improved service control tools	• Feedback from Service Controllers (feedback from Bus Ops) • More reliable public transport services (BEN01)
• To reduce or maintain the current cost of ownership of the core AVL systems, whilst increasing functionality and compatibility with other systems	• Reduced proportional costs to the NTA (BEN08) • More efficient use of technical resources (BEN10)

9.3 Implementation Measures of Success

The following measures of success will be reported on at the project completion (for ex-post analysis) to show the performance of the project:

- Budget – difference from the NTA capital budget allocated to deliver NG AVL. This will include the costs for the NTA project team to deliver and the Contract cost for the Service Provider to deliver.
- Schedule – difference in the time to complete NG AVL rollout (completion of all Full-AVL buses for Dublin Bus, Bus Eireann and Go Ahead Ireland - 2310 buses by end 2025)
- Quality – Use of the requirements verification matrix to determine if all of the NTA's requirements have been delivered as set out in the ISFT. This will refer back to the project objectives as well as the benefits listed in Section 8.
- Scope – A comparison of the scope set out in the initial contract with the Service Provider compared to that required to deliver.

It is expected that these will be reported on when the project is expected to complete, and in conjunction with the end of rollout (end of 2025) and at the acceptance and payment of Milestone 11 (Service Rollout Completion), which is expected in mid-2026.

9.4 NG AVL Contract KPIs

A number of KPIs and performance metrics have been defined in the NG AVL contract (see Schedule 5 - Performance) to ensure that operations are in line with the standards set out in the agreement. These are set out below in Table 34. Note that the target service levels are provided where they are simple to do so. However, most are complicated in their definition and hence more detail can be sourced direct from Schedule 5 - Performance. However, this table is given to provide a sense of the KPIs included in the contract. Beyond the KPIs, there are a number of PIs that will also be measured, although it will only be the KPIs that impact payments to the Service Provider, should target service levels are not met.

Table 34: NG AVL Contract KPIs (from Schedule 5 - Performance)

Reference	Title	Target Service Level
KPI-1	Service Availability	System - production 99.85%
KPI-2	Service Control Availability	99.7%
KPI-3	Real-Time Data Feeds	99.7%
KPI-4	Voice Communications Availability	99.7%
KPI-5	Full AVL Non-real time data availability	97% within 24 hours of the end of service day 100% within 72 hours
KPI-6A	Incident Management	Defined in Schedule 5
KPI-6B	Security Incident Management	Defined in Schedule 5

Reference	Title	Target Service Level
KPI-7	ICT Patch Management	Defined in Schedule 5
KPI-8	Data Backups	Not less than 99.5%
KPI-9	Business Continuity, Disaster Recovery and ICT Service Continuity Management	Defined in Schedule 5
KPI-10	Service Desk request fulfilment Time	Defined in Schedule 5
KPI-11	Continuous Vulnerability Management and Security Testing	Defined in Schedule 5
KPI-12	Anti-Virus Software and Malware Defences	Defined in Schedule 5
KPI-13	Maintaining Key Personnel	Defined in Schedule 5

9.4.1 Reporting

Schedule 5 – Performance details the performance regime for the services provided by the Service Provider and establishes the criteria, processes, and consequences related to the performance of these services.

The Service Provider must track its performance against KPIs & PIs (Table 1 & 2 of the Schedule) and report its results to the NTA within **five** working days after each contract period. This report should include actual service levels, any exceptions and adjustments, the final achieved service level, and calculated performance points as per the payment schedule.

The Service Provider shall develop a Performance Guidebook to detail how it plans to accurately collect and process data for performance measurement against KPIs and PIs. This Guidebook shall be submitted to the NTA for approval **three** Contract Periods prior to the Operational Services Start Date. Any subsequent updates shall be subject to approvals as well.

The performance reports provided to the NTA will form part of the evaluation of the success of the NGAVL project.

Performance of services below the Target Service Levels shall result in accrual of Performance Points. The Target Service Levels in Table 1 & 2 of the Schedule are assigned different categories based on the level of their criticalness, with purple being the most critical followed by red, amber and yellow. Each of these categories has different Performance Points.

This Schedule covers multiple key performance elements including:

- Performance Measurement: Defining and measuring KPIs and PIs for measuring service quality;
- Accountability: Ensuring the service provider is responsible for meeting standards and service levels;
- Continuous Improvement: Encourages the service provider to learn from performance data and take corrective actions to achieve better results;
- Incentives: Incentivizes the service provider to strive for excellence and meet the agreed-upon standards;
- Risk Mitigation: By clearly defining performance expectations and consequences for failure, the document helps mitigate risks associated with service disruptions; and
- Termination Clause: Providing a safeguard for the NTA if performance consistently falls short.

The result of the Performance Report will be reported to various governance meetings outlined in Section 4.2.

A Appendix: Procurement Information

A.1 List of NG AVL Schedules

Schedule / Document	No.	Description
Agreement	-	Main terms of agreement that pulls together all of the schedules
Definitions	1	Defined terms (capitalised terms) used throughout the entire document set
Governance	2	How the agreement between NTA and SP will be governed and organised, and sets out the Delivery Plans
Initial Services	3	Defines the approach to milestones, testing, acceptance and rollout (and links to Delivery Plans in Gov)
Services	4	Includes all the requirements for the system and the services, which will be delivered via the approach outlined in the Initial Services Schedule (solution, ICT, O&M, delivery, Innovation).
Performance	5	Outlines the performance management regime and target levels: KPIs and PIs used to define the performance of the system and services, and is the basis of the approach to judging operational payments.
Payments	6	Defines how the SP will get paid for capital (by milestone acceptance) and for operational activity (KPIs and PIs). Will also include tenderers pricing
Key Sub-Conts	7	List of key sub-contractors to be used by the Service Provider
Key Personnel and Reps	8	List of key reps from both sides – for initial services and for operations
Change Control	9	How both parties use the contract to enable and deliver change
Health and Safety	10	Outlines any H&S regulations and laws applicable to the SP, mainly in the contexts of AVL installations
Exit Management	11	How an exit from the contract will be managed, either before or at the end of the term of the contract
Insurance	12	The insurances required, and their levels, for the Service Provider
Trade Marks and Branding	13	Summary of the trademarks and branding applicable to NG AVL
Form of Parent Co. Guar	14	Form of Parent Company Guarantee
Data Protection	15	How data protection will be ensured and any related requirements
ICT Security	16	ICT Security requirements on the Service Provider
BC/DR	17	Approach to disaster recovery and business continuity for the services and for the users
Form of Escrow Ag'ment	18	Agreement between SP, NTA and a 3rd party software vendor to hold the software code in escrow.
PCI Compliance	19	Outlines the reqs on the SP to be PCI Compliant when dealing with encrypted payment card data (NGT)

A.2 Technical Negotiation Meetings - Agendas

1st Meeting – NTA Offices				
Time	Summary	Detail	Lead	ITN Section
1000 – 1015	Introductions	Intros and objectives for the day	[redacted]	General
1015 – 1030	Summary Feedback	Overview of the responses by review section	[redacted]	All
1030 – 1100	Product Lifecycle Status	Tenderer to summarise the status of the product being offered to the NTA – focus on development and position in lifecycle	[redacted]	All
1100 – 1130	AVL Solution Overview	Questions from the review of the Initial Quality Submission (IQS) with focus on development required	[redacted]	3.1, 3.3

1130 – 1200	On-Bus Systems and Accessibility	Questions from the review of the IQS with focus on the development required	[redacted]	3.2
1200 – 1230	Bus Retrofit Approach	NTA to present a risk mitigation approach to bus installations currently being explored with the Bus Operators	[redacted]	3.9
1230 – 1300	Delivery	Questions from the IQS	[redacted]	3.9
1300 – 1330	Lunch			
1330 – 1400	Operations and Maintenance - Managed Service Overview	NTA to summarise the definition of a Managed Service with respect to NGAVL	[redacted]	3.7
1400 – 1430	Operations and Maintenance	Questions from the review of the IQS	[redacted]	3.7
1430 – 1530	ICT and Security	Questions from the IQS	[redacted]	3.8 / Schedule 16
1530 – 1600	Site Visits and actions summary	Suggestion of site visits for NTA to view before issue of ISFT and meeting close	[redacted]	General
1600-1700	Agenda points from Tenderer	Additional agenda points from Tenderer	[redacted]	General

2nd Meeting – Virtual Meeting				
Time	Summary	Detail	Lead	ITN Section
1000 – 1005	Introductions	Intros and objectives for the day	[redacted]	General
1005 – 1030	AVL Lite	Questions from the IQS	[redacted]	3.5
1030 – 1100	On-Bus Applications Non-AVL – PCI Compliance	NTA to outline summary of PCI compliance requirements and questions from the IQS	[redacted]	3.4
1100 – 1230	System Architecture	Agenda to follow	[redacted]	3.1 and 3.8
1230 – 1300	Service Control	Questions from the IQS	[redacted]	3.3
1300 – 1330	Lunch			
1330 – 1430	Delivery	Feedback on the Bus retrofit discussion (week 1) and questions from the IQS	[redacted]	3.9
1430 – 1500	Electric Buses	NTA to present an overview of some of the potential changes to the requirements due to electric bus management	[redacted]	General

1500 – 1530	Contract and Performance Management Reporting	Questions from the IQS	[redacted]	3.6
1530-1630	Agenda points from Tenderer	Additional agenda points from Tenderer	[redacted]	General
1630 – 1700	Actions Summary	Close meeting and next steps	[redacted]	General

A.3 ITN Evaluators

	Award Criteria	SME -Lead	Evaluation Team			
1	**Solution - Architecture and Design**					
1A	Architecture	[redacted]				
1B	Interfaces and Configuration	[redacted]				
1C	Voice and Data Configuration	[redacted]				
2	**Solution - AVL**	[redacted]				
2A	Service Control	[redacted]				
2B	Service Control Presentation	[redacted]				
2C	Service Control Disruption Mgt	[redacted]				
3	**On-Bus Systems**	[redacted]				
3A	On-Bus Integration	[redacted]				
3B	On-Bus Hardware and Supply	[redacted]				
3C	On-Bus Standards and Applications	[redacted]				
3D	On-Bus Accessibility	[redacted]				
4	**AVL Lite**	[redacted]				
5	**On-Bus Applications (non-AVL)**	[redacted]				
6	**Contract and Performance Mgt**	[redacted]				
6A	Configuration and Application	[redacted]				
6B	Report Generation	[redacted]				
7	**Operational Requirements**	[redacted]				
7A	O&M Requirements	[redacted]				
7B	O&M Plan	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
8	**ICT Requirements**	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
8A	ICT Requirements	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
8B	ICT Security Schedule	[redacted]				
9	**Delivery**	[redacted]				
9A	Initial Services Plan and Delivery Reqs	[redacted]				
9B	Migration Plan and Rollout Plan	[redacted]				

B Appendix: PAG Deliverables

B.1 Phase 2

Document	Phase	Draft/Sign off	Comments
Project Plan	2 / Planning	Microsoft Project Plan and Plan on a Page agreed at Steer Co	Live document
Procurement Plan	2 / Planning		In project plan
PBC	2 / Planning	Signed off by NTA Board	April 2021
Detailed Requirements Specification	2 / Planning	Included in Schedule 4 - Services	
Test Strategy	2 / Planning	Complete	
Risk Management Plan	2 / Planning	Complete	Included in Project Brief
RACI Matrix	2 / Planning	Complete	
Budget	2 / Planning	In place to contract award	
Software Environments Plan	2 / Planning	N/A	Not required for NG AVL until later Phase
Business Operations Plan / Target Operating Model	2 / Planning	Complete	

Document	Phase	Draft/Sign off	Comments
Communications Strategy	2 / Planning	Complete	Issued to PRG
Change Management Strategy	2 / Planning	Complete	Issued to PRG
Benefits Management Strategy	2 / Planning	Complete	
Resource Plan / RACI	2/ Planning	Complete	
Project Implementation Plan	2 / Planning	Complete	Included in Project Brief
Gateway 2 Report	2 / Planning	Complete	

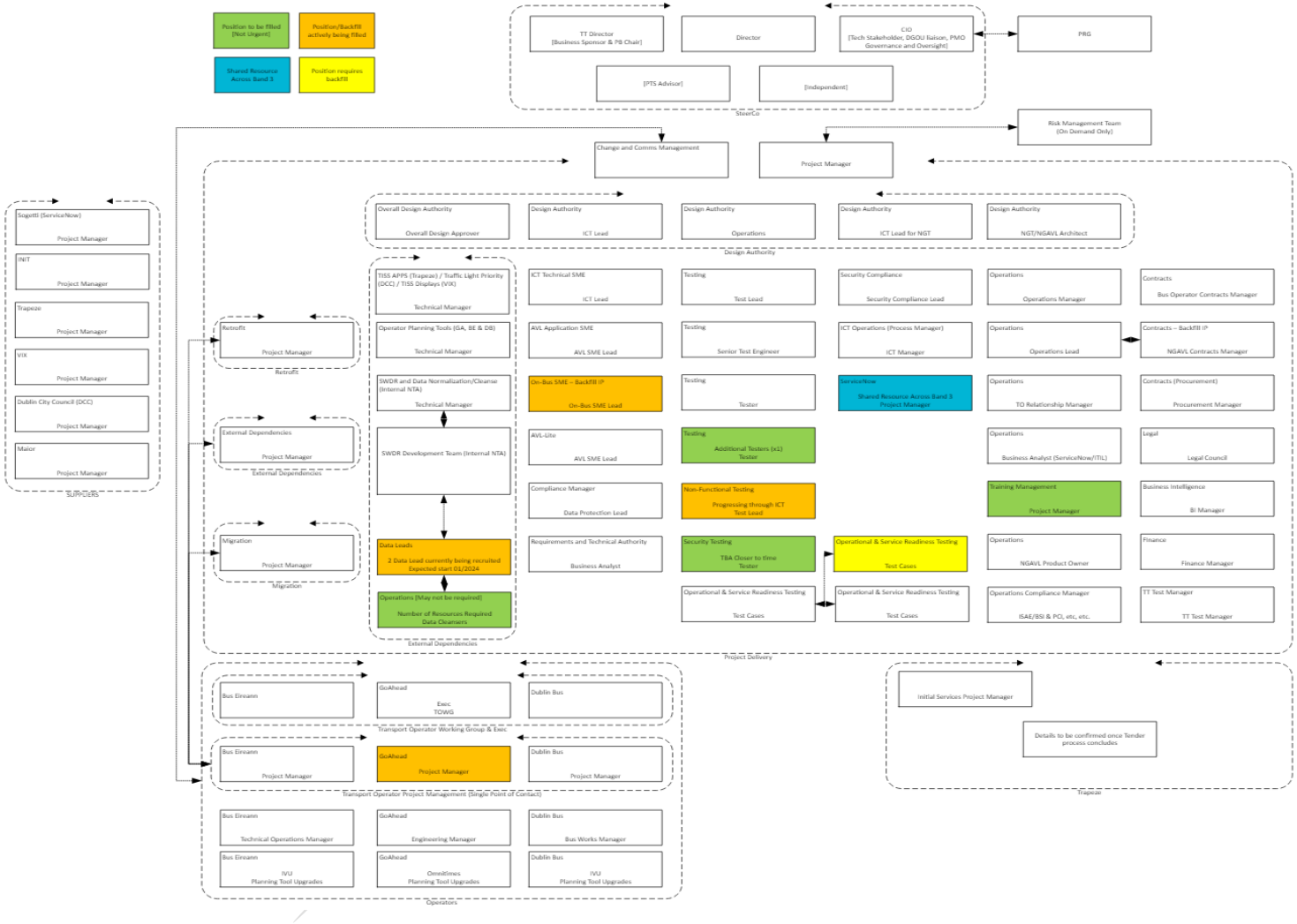
B.2 Phase 3

Document	Phase	Status	Timing/ Comments
PQQ	3 / Procurement	Complete	Issued in September 2021
Tender and Contract Documents with accompanying Peer Review Report	3 / Procurement	Complete	ITN Issued in June 2022 ISFT issued in April 2023
Procurement Governance Document	3 / Procurement	Complete	

Document	Phase	Status	Timing/ Comments
Gateway 3a Report	3 / Procurement	Complete	
Tender Report	3 / Procurement	To be included with the NTA Board pack	October 2023
The post-Tender Total Project Cost with accompanying updated Peer Review Report	3 / Procurement	To be included with the NTA Board pack and in this document	October 2023
FBC	3 / Procurement	This document	
Signed Contract	3 / Procurement	In progress	December 2023 subject to approval of FBC at November NTA Board
Brief for Phase 4, including updated PEP, and accompanying budget plan	3 / Procurement	This section of the FBC plus supplemented by PEP	October 2023
Gateway 3b Report	3 / Procurement	Drafted	December 2023

C Appendix: Resource Overview – NG AVL Implementation

SUBJECT TO CONTRACT / CONTRACT DENIED



D Appendix: Requirement and Benefits Mapping

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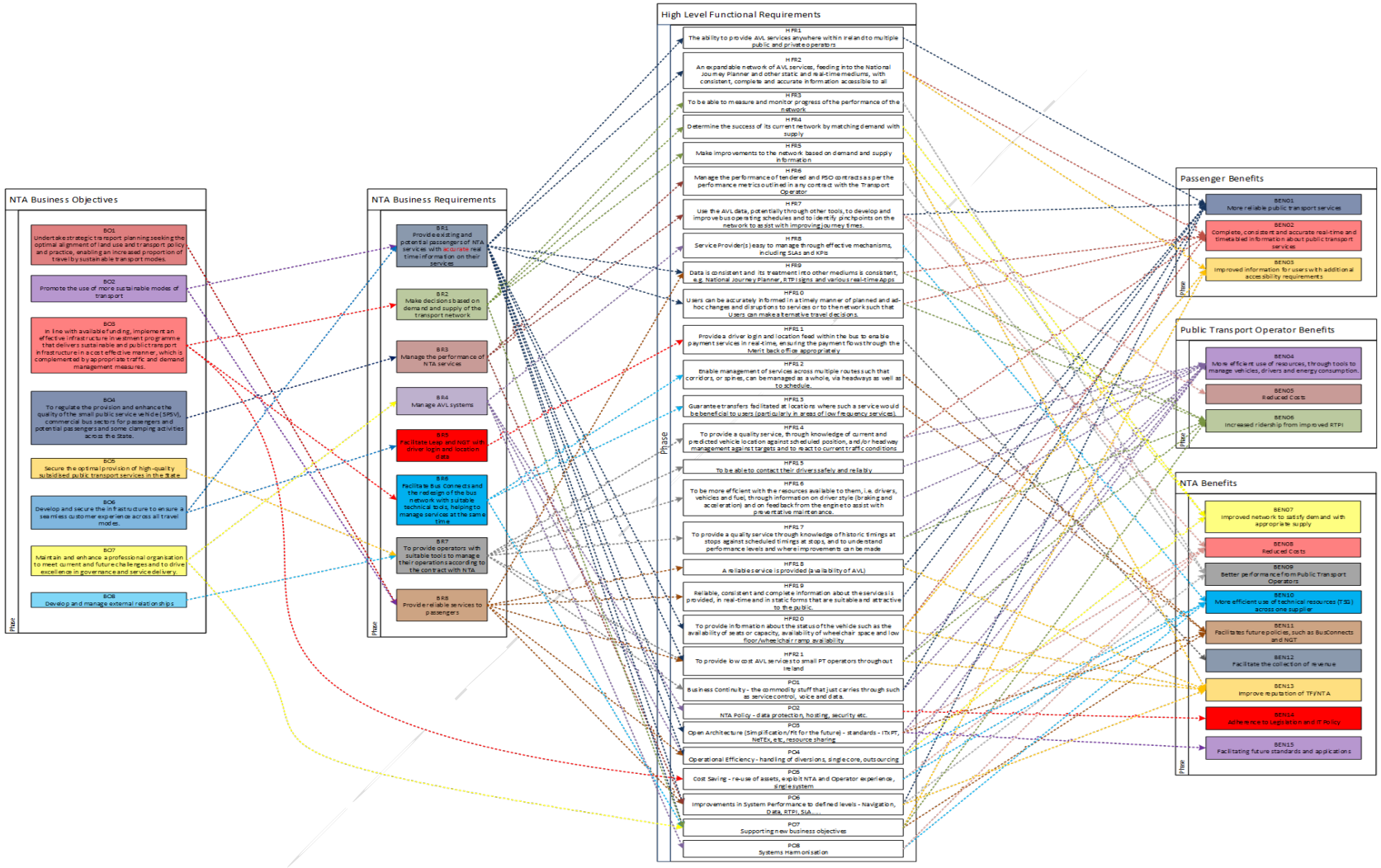


D.1 High Level Requirements and Project Objectives List

- **HFR1** - The ability to provide AVL services anywhere within Ireland to multiple public and private Bus Operators
- **HFR2** - An expandable network of AVL services, feeding into the National Journey Planner/TFI Live and other static and real-time mediums, with consistent, complete and accurate information accessible to all
- **HFR3** – To be able to measure and monitor progress of the performance of the network
- **HFR4** – Determine the success of its current network by matching demand with supply
- **HFR5** – Make improvements to the network based on demand and supply information
- **HFR6** – Manage the performance of tendered and PSO contracts as per the performance metrics outlined in any contract with the Transport Operator
- **HFR7** – Use the AVL data, potentially through other tools, to develop and improve bus operating schedules and to identify pinch-points on the network to assist with improving journey times
- **HFR8** – Service Provider(s) easy to manage through effective mechanisms, including Service Level Agreements (SLAs) and KPIs
- **HFR9** – Data is consistent and its treatment into other mediums is consistent, e.g., National Journey Planner (TFI Live), RTPI signs and various real-time Apps
- **HFR10** - Users can be accurately informed in a timely manner of planned and ad-hoc changes and disruptions to services or to the network such that Users can make alternative travel decisions
- **HFR11** - Provide a driver login and location feed within the bus to enable payment services in real-time, ensuring the payment flows through the ticketing system back office appropriately
- **HFR12** - Enable management of services across multiple routes such that corridors, or spines, can be managed as a whole, via headways (time between buses) as well as to schedule
- **HFR13** - Guarantee transfers from one bus to another facilitated at locations where such a service would be beneficial to users (particularly in areas of low frequency services)
- **HFR14** - To provide a quality service, through knowledge of current and predicted vehicle location against scheduled position, and/or headway management against targets and to react to current traffic conditions
- **HFR15** - To be able to contact drivers safely and reliably
- **HFR16** - To be more efficient with the resources available, i.e., drivers, vehicles and fuel, through information on driver style (braking and acceleration) and on feedback from the engine to assist with preventative maintenance

- **HFR17** - To provide knowledge of historic timings at stops against scheduled timings at stops, and to understand performance levels and where improvements can be made
- **HFR18** - A reliable service is provided (availability of AVL)
- **HFR19** - Reliable, consistent and complete information about the services is provided, in real-time and in static forms that are suitable and attractive to the public
- **HFR20** - To provide information about the status of the vehicle such as the availability of seats or capacity, availability of wheelchair space and low floor/wheelchair ramp availability
- **HFR21** - To provide low cost AVL services to small Bus Operators throughout Ireland
- **PO1** - Business Continuity - the continuation of core services critical for bus operations, such as service control and voice and text communications
- **PO2** - NTA Policy - data protection, hosting, security, etc
- **PO3** - Open Architecture (Simplification/Fit for the future) - standards - ITxPT, NeTEx, etc, resource sharing
- **PO4** - Operational Efficiency - handling of diversions, single core, outsourcing
- **PO5** - Cost Saving - re-use of assets, exploit NTA and Bus Operator experience, single system
- **PO6** - Improvements in System Performance to defined levels - Navigation, Data, RTPI, SLA
- **PO7** - Supporting new business objectives
- **PO8 -** Systems harmonisation.

D.2 General Requirements from Schedule 4 - Services

The following text is an extract from Schedule 4 – Services, Section 3. It provides a high-level summary of the detailed requirements contained within Schedule 4 – Services.

D.2.1 Back Office

The Service Provider will provide, operate, maintain and support:

- A cloud-hosted Back Office including platform, operating system, networking and security;

- All required Back Office applications that shall provide and/or facilitate:

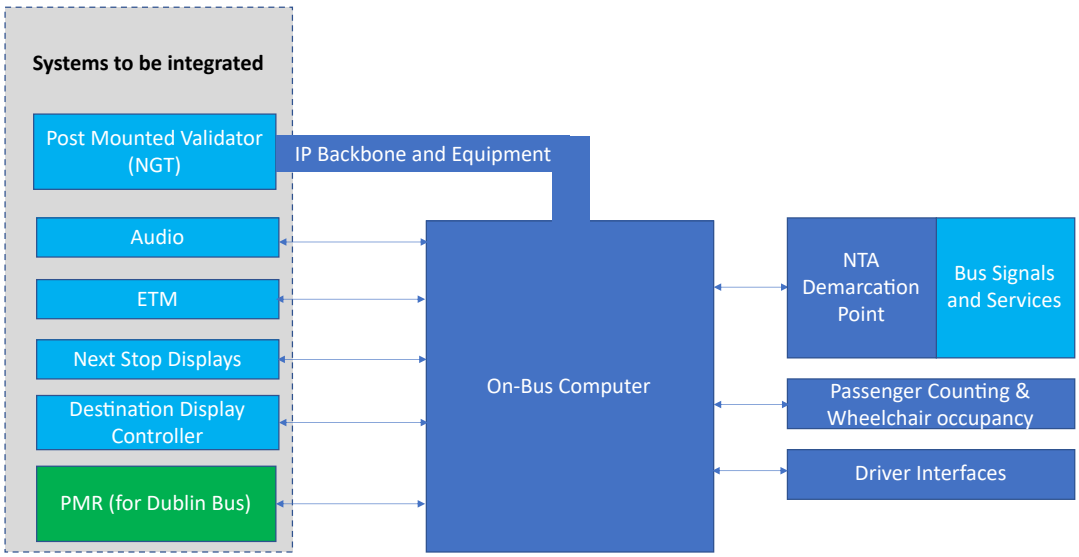
- Communication with NG AVL-installed Buses, in terms of data and voice communications (noting Dublin Bus will continue to use their PMR for voice radio);
- A multi-tenant Back Office providing multiple Bus Operator Service Control Functionality, with each Bus Operator segregated from each other, that can manage real-time disruption information to passengers through the Service Control Functionality;
- Provision of an AVL Lite service to any Bus Operator in Ireland;
- Addition of new Bus Operators with the minimum of effort and cost;
- Support for Traffic Light Priority, providing data to be consumed by various urban traffic control systems across Ireland;
- Contract and performance management functionality to manage and report on various aspects of the System, Route, Driver and Bus performance;
- A prediction generator that makes use of modern machine learning/AI algorithms to make increasingly accurate predictions, taking into account a range of historic and current operational data and third party data sets. For example, weather information, traffic congestion data from mobile phone location data etc.,
- A System that will facilitate the distribution of predictions of Bus arrivals to NTA channels;
- Interfacing with other NTA and Bus Operator systems, such as the TISS Applications (including the National Journey Planner), TISS Displays (RTPI displays) and Bus Operator Planning Tools with appropriate standards;
- The ability to validate any supplied data;
- Supply of test and development environments with functions to promote environments, copy/mirror the live environment and the ability to load test data through the emulation of multiple On-bus Systems;
- The ability to export data to other business intelligence tools;
- Suitable logging and diagnostics to enable fault finding, improvements and operational capabilities; and
- Ability to define geo-trigger points or Trigger Points on the network, to facilitate applications such as Traffic Light Priority.

D.2.2 On-bus Environment

The Service Provider will produce, in conjunction with the Coach Builder, installation designs for each Bus type in advance of the installation, for NTA design approval. This should take into account any equipment and wiring in place (details of which will be supplied by the NTA), re-using where possible. Unless otherwise agreed, only the NG AVL computer and Driver interfaces shall be installed on each vehicle. An estimated installation time for each build will be required. The installation will be proven on a test Bus prior to rollout to confirm the installation and installation time will be established for planning purposes. All On-bus Equipment will be suitable for the environment it will be installed in, i.e., must be resistant to vibration and ingress of dust and water.

Figure 19 below outlines what is in scope (dark blue), to be supplied (light blue) integration between the System and the bus and other systems. The PMR (green) is specific to Dublin Bus only.

Figure 19: On-Bus Scope



The scope of the On-bus requirement shall include the provision, operation, maintenance and support of the following:

- NG AVL computer, with a potential roadmap towards hosting On-bus applications;
- MDT compatible with the NG AVL computer;
- Driver covert alarm;
- Passenger counting capability and an option for a wheelchair sensor;

- Interface with the existing TGX150 Drivers ticket machine, which will remain as the primary method of log in for Drivers until the TGX150 is removed and/or no longer required;
- Integration with future payment systems, including PCI compliance;
- Mechanical fixings for mounting and securing equipment;
- Any necessary additional wiring;
- Equipment installed and tested against an agreed design;
- Configuration of ancillary equipment, if required;
- Removal of existing AVL equipment and associated disposal;
- Making good, including mechanical works for the Driver's cab, blanking old equipment; apertures, removing old cabling etc.; and
- Provision of an FMStoIP service[30] and FMS analysis tools to facilitate preventative maintenance, Driver training and estimates of passengers on board functions, for example.

The following ancillaries will remain in place unless specifically agreed to by the NTA:

- Existing next stop signs (LED, TFT);
- Bus blind controller;
- Audio announcements speakers (for passengers) and speaker for Driver;
- TGX150 Electronic Ticket Machine (ETM);
- Payment validators (pole mounted smart card validators);
- Tait Radio (on Dublin Bus only);
- Antenna; and
- Footswitch and other Driver interfaces (where available).

Note that CCTV will not be integrated into NG AVL although the potential for this to happen in the future will be facilitated through the provision of an open architecture by the Service Provider.

[30] FMStoIP service will allow information from the CAN Bus to be shared to other modules and applications on the IP network.

As part of the NTA Bus Build Specifications, the NTA has a requirement to build all new Buses with a well-defined demarcation between the AVL and Bus systems as well as to install all AVL equipment during the Bus build process. It will be the responsibility of the Service Provider to produce the design documents for approval by the NTA. These shall be sufficiently detailed to give the Coach Builders detailed guidance on the overall design of the Buses and to allow them to undertake all installation work such that NG AVL installations of new Buses are consistent of that of the existing. Testing and acceptance will be the responsibility of the Service Provider.

D.2.3 Service Control

The Service Provider will provide, operate, maintain and support the following (but is not limited to):

- A Service Control tool provided to Bus Operators, such that Service Control can be undertaken at a Depot and remotely through a device agnostic approach;
- A range of tools and views that provide summary and detailed information on the historic and real-time performance and status of a Bus Operator's Buses. This will include, but not be limited to:
    - Route ladder based presentation with icons coloured to show Route service performance variation i.e. headway or timetable etc. It should be possible to show a mix of service performance metrics on the same Service Control screen. All Buses under management of the Service Controller should be visible;
    - Map based presentation where all the Buses are accurately placed in the correct position on the road network, whether on Route or not. It should be possible to zoom in/out, scroll etc. the map;
    - Bus icons should be coloured or highlighted to show:
        - Early, on time and late or headway metrics;
        - In/out of service;
        - Off Route;
        - Non-productive Trips;
        - Curtailed/projected Buses; and
        - On diversion.
    - Provision of Service Controller guidance (through recommended actions), drop down forms and other tools to improve efficiency;

  - High level management summaries of network, Route and Bus performance in near real time and other analysis to help improve the efficiency of Bus services;

- Integration of voice services (Driver communication) within the Service Control tool, with the ability to make group and broadcast calls;
- Ability for a Service Controller to amend or override Driver sign on and Trip selection;
- The management of planned and unplanned disruptions such that information can be provided in near real-time to Drivers and Bus passengers;
- Tools to assist with service optimisation and corridor management;
- The assignment of Routes to a Service Controller, within a Bus Operator, should be flexible and not be tied to location; and
- The ability for Bus Operators to manage zero emission Buses in an efficient manner such that the appropriate Buses are assigned to the right Block or board and that battery status and low battery alarms are visible and provided to Service Controllers.

D.2.4 AVL Lite

The Service Provider will provide, operate, maintain and support the following (but is not limited to):

- A low-cost AVL solution using a mobile device, such as a smart phone or tablet;
- Connection and integration with the single NG AVL Back Office;
- Provision of RTPI information to NTA channels from all AVL Lite Services;
- Provision of Contract and Performance Management Reporting functionality;
- Basic Service Control information provided to Depots or to mobile devices;
- Minimal On-bus integration into the Bus systems, with the device being “stand-alone”. This will simplify installation. However, some interfaces with other On-bus equipment will be expected, such as ticket machines and On-bus displays;
- An option to provide passenger information using an ITxPT based solution; and
- The Back Office architecture designed and built to enable Multi-Tenancy, i.e., use by multiple and many Bus Operators throughout Ireland.

D.2.5 Contract and Performance Management Reporting System

The Service Provider will provide, operate, maintain and support the following (but is not limited to):

- A suite of reporting functions that compare the planned, actual and target scenarios using NG AVL data collected and stored, for up to five years, in the Back Office, for all Bus Operators' Buses fitted with NG AVL equipment (including AVL Lite);
- For the NTA to edit and view Key Performance Indicator (KPI) reports, as used to measure Contract Compliance, relevant to their Bus Operators;
- For the NTA to view and create ad-hoc operational reports, and to be able to interrogate the historic AVL data, to help determine operational improvements or to identify pinch points on the network, for example;
- For any NG AVL Bus Operator to view KPI and edit and view operational reports for their Services only;
- The ability to import third party AVL data, e.g., from Luas or Irish Rail services;
- Flexible data exports or extracts for analysis by other tools;
- For any NG AVL Bus Operator to input Reason Codes for individual Trips or duties that were not operated or that were different to the planned Trip or duty via their NG AVL Service Control tool; and
- For NTA Users to view, edit and validate reports, including the creation of bespoke KPI and operational reports.

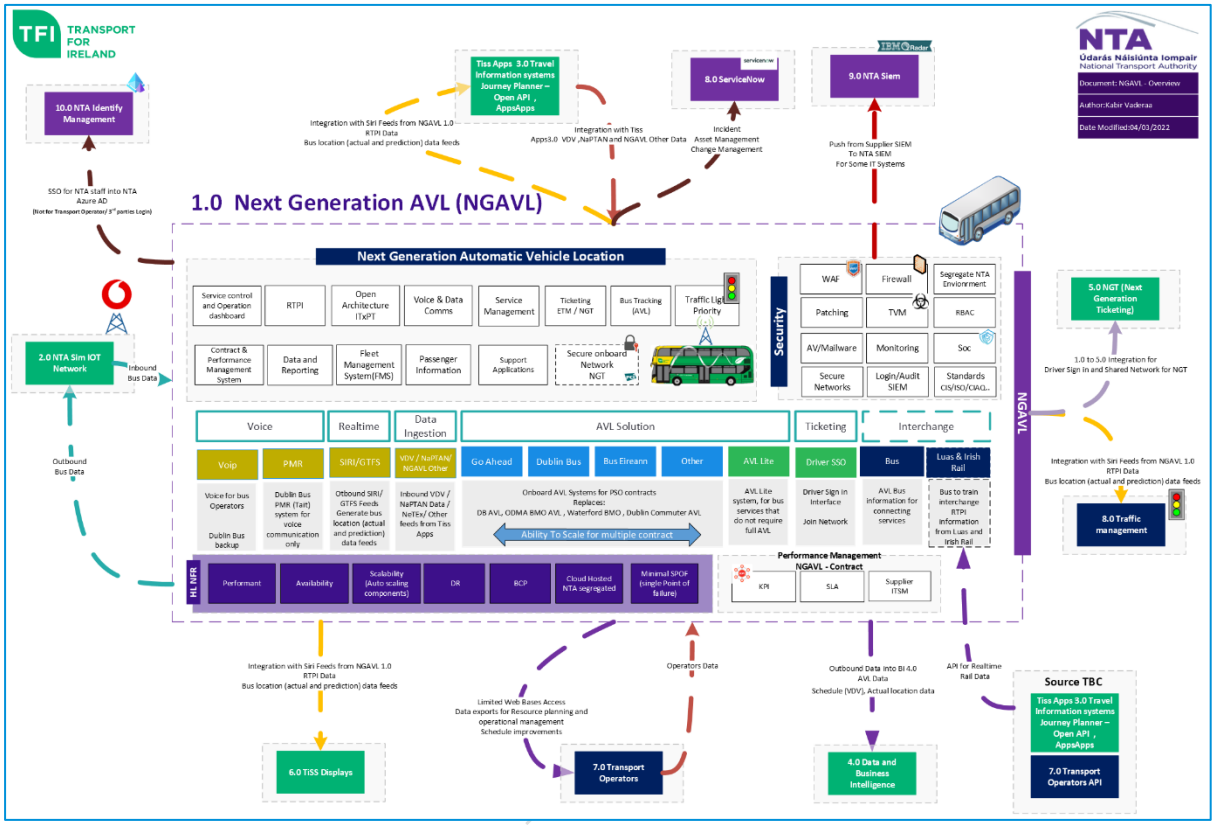
D.2.6 ICT Requirements

The Tenderer's proposed Solution will be a key platform for the NTA, interacting with several other systems throughout the NTA's estate. Critical to the success of the NG AVL is the underlying ICT infrastructure and technology and its ability to integrate with other systems.

It is vital that the System is secure, has High Availability, is resilient, scalable to meet growth and peak demand, and facilitates integrations with other systems. The System must also be performant and readily recoverable in the event of a disaster. It is important that the ICT infrastructure and ICT services are architected, designed, implemented and managed in line with good practice.

Figure 20 places the NG AVL Solution in the context of the other systems, both the NTA's and Bus Operators' and is intended to provide a high-level context to the subsequent requirements.

Figure 20: Conceptual Diagram of NG AVL Solution



D.2.7 Test, Acceptance and Implementation

The Service Provider will be expected to lead the testing, acceptance, migration and rollout processes for NG AVL. These are covered in Schedule 3 – Initial Services Plan and in Solution Delivery Requirements.

The associated acceptance Milestones will be used as payment Milestones which are detailed in Schedule 6 – Payments.

Please see Schedule 8 - Key Personnel and Representatives which details the minimum set of roles the Service Provider should assign to the project.

Schedule 2 Governance details how the NTA and Service Provider will work together.

D.2.8 Operations and Maintenance

The Service Provider will provide, operate, maintain and support NG AVL, via a Managed Service, through the use of ITIL processes or similar.

The Service Provider will ensure 24/7 support is provided to the NTA and its Bus Operators such that the NG AVL serves passengers, Bus Operators and the NTA, according to the performance targets set in Schedule 5 – Performance, whenever it is required.

A payment mechanism that encourages high performance and High Availability is given in Schedule 6 – Payments. KPIs that may be used as part of the payment mechanism are given in Schedule 5 - Performance.

The Service Provider shall carry out all its operations in accordance with applicable law, including but not limited to the requirements of the General Data Protection Regulation.

D.2.9 Exit Management – Contract Termination and Handover

The Service Provider may be needed to provide exit management services at some point during the Contract. The Service Provider will establish an exit management plan as detailed in Schedule 11 – Exit Management.

D.2.10 Miscellaneous

In all phases, the Service Provider shall work with the NTA, other service providers to the NTA and the incumbent AVL suppliers. The Service Provider will also be required to obtain any necessary permission from its 3rd party providers to facilitate the NTA's audit and IT security team to conduct security vulnerability assessments on the website and its interfaces.

Without prejudice to the generality of the obligation to comply with law and to perform the Services to the standard set out in the Contract, Candidates are advised that there are several matters to note in relation to delivery of the Services, including the requirement to comply with relevant General Data Protection Regulation and Data Protection Act 2018 at all times.

D.2.11 Overlap with Next Generation Ticketing (NGT) Project

The NTA has commenced a separate procurement competition referred to as NGT, reference 2020/S 175-423717. The Service Provider shall work with the NTA and the appointed NGT supplier to ensure that NGT ticketing equipment is provided with an On-bus AVL feed and is integrated successfully into the On-bus ITxPT Solution provided by the Service Provider. To that end, the Service Provider may be required to install and configure the NG AVL Solution and On-bus Systems to facilitate NGT ticketing equipment prior to the installation of NGT ticketing equipment. The NGT project shall result in several PMVs being deployed On-bus (which may initially be in parallel with the existing validators but ultimately will replace the existing validators), as well as the eventual removal (and for some Bus Operators, replacement) of the TGX150 Driver ticket machines. The NG AVL Solution may be used as the communications channel for the PMVs, and this would require that such data is

transmitted in compliance with applicable Payment Card Industry Data Security Standards (PCI-DSS).

D.2.12 TISS Applications Summary

The Travel Information System & Services (TISS) Applications includes applications for an NTA Planning tool (in conjunction with their own planning tools) and a new National Journey Planner (NJP). The TISS Applications Contract was awarded in August 2020 to Trapeze. TFI Live has been available for use since February 2023. See also Table 35 below.

The expected interfaces between NG AVL and TISS Applications will be two-fold:

- TISS Applications will store the Route configuration and schedules, including routing, for export to NG AVL; and
- TISS Applications will consume live predictions of Bus arrivals and actual positions of Buses to help plan journeys within the NJP and to information passengers of Bus arrivals, both within the NJP and through a Bus arrivals application.

D.2.13 TISS Displays Summary

The TISS Displays Contract was awarded to Vix Technology UK Limited on 20 May 2020, which includes a new Content Management System (CMS), and on-going support of the existing Multi Operator Real Time Passenger Information (MORTPI) displays. The CMS will consume Bus arrival predictions from NG AVL and present these and scheduled arrival times on the MORTPI displays. At present, the various AVL systems provide these through individual SIRI SM feeds. Through NG AVL, it is expected that there will be one (1) feed of Bus predictions. See also Table 35 below for more details.

Table 35: Summary Reference Information on TISS Contracts

Competition for the Operation, Content Management, Maintenance and Provision of MORTPI Displays	External Reference: 2020-212187 TED Reference: 2020/S 233-576409 https://irl.eu-supply.com/ctm/Publication/Forms/ViewNotice/48151

Provision and Operation of Travel Information Systems and Ancillary Systems and Services	External Reference: 2020-236373 TED Reference: 2020/S 237-586502 https://irl.eu-supply.com/ctm/Publication/Forms/ViewNotice/47299

E Appendix: RAID

E.1.1 Top Project Risks

#	Risk	Factor (likelihood x impact) 1 to 5	Mitigating Action	Risk Owner
R16	There is a risk that NG AVL may introduce unknown consequences to Operator processes and toolsets. Leading to issues with additional cost and impact on project timescales	Inherent: 4x5=20 Residual: 3x5=15	Ongoing engagement with operators ensuring unknowns identified, working through process areas.	[redacted]
R23	There is a risk that the rollout of NG AVL is complex due to bus availability, space availability and contract end dates for existing AVL systems. Leading to delay in rollout, bus non-availability for service and gaps in service for AVL systems and resulting in higher costs and a longer time lapsed before benefits are realised.	Inherent: 4x5=20 Residual: 3x5=15	Framework agreement in progress however cannot reduce until locations agreed/confirmed	[redacted]
R56	IF the quality of the network and timetable data being fed into NGAVL is poor or inconsistent. THEN the accuracy and availability of the current vehicle location, as determined by the NGAVL system, will be poor. This will impact downstream functions reducing the quality and consistency of data for RTPI, NGT and compliance purposes.	Inherent: 4x5=20 Residual: 4x4=16	Focussed attention now on Data Normalisation/Cleansing	[redacted]
R59	IF the Bus Operators/NTA fail to deliver pre-requisite projects for NGAVL. THEN, it could lead to delays in rolling out NG AVL to that or those operators	Inherent: 4x5=20 Residual: 4x5=20	Finalized requirements and submitted to the Bus Operators. Team established and new PM to focus on the pre-requisites. Risks remain until more detailed planning and agreements	[redacted]

R69	Coordinating all the dependant deliverables is extremely complex, specifically around VDV production and use by TO's. Delays due to dependencies (incl. data feeds) not being available in time	Inherent: 4x5=20 Residual: 3x5=15	Review of all external dependencies and identification of all touch points. Additionally putting a dedicated PM onto these related workstreams will ensure focus and deviation from plan/expectations raised early	[redacted]

E.1.2 Project Assumptions

#	Assumption including validation approach	Risk if assumption not validated
1	Any interactions with other systems will be specified such that NG AVL will be compatible and in sync with other NTA systems, such as the National Journey Planner, TGX ticket machine and NGT	Risk is high – being managed as a risk
2	The current project timescales are based on securing approvals (within NTA and from PRG) without significant delay	Risk is medium – and will need to be focused on the PID/PEP progress
3	It is assumed that NGT will deploy any on-bus equipment after NG AVL has been rolled out and that NGAVL will pre-wire the buses as necessary for NGT	NGT will have to interface with existing AVL systems, which will be costly for a short period of time

E.1.3 Project Issues

#	Title	Description	Solution
1	Bus Operator Resource	There is an issue that the Bus Operators do not have enough resource to support NG AVL and the operator impact/involvement leading to delays in decisions and time/cost/quality implications	Bus Operators have recently asked for more resources to deliver a number of NTA projects. Work with the operators to create an SOW and GAF to resource the project
2	VDV standards electric buses	VDV standards in relation to electric buses and charging and the management of duties. Could pose as an issue for NGAVL Init integration.	Specify the standards in the requirements

E.1.4 Project Dependencies

Project	Topic/Subject	Project depending on	Description
NGAVL	TGX	NGT	Requirement for a NGT ticketing driver console which will integrate with AVL or AVL-Lite for rural services. (This does not apply to Dublin City bus services)
NG AVL / TO Planning Systems Upgrades	TO Planning Systems Upgrades	NG AVL Bus Electrification	Transport Operator Planning System Upgrades are required for NG AVL and Bus Electrification.
NG AVL / VDV 452 Consumers	Upgrade VDV 452 & GTFS Consumers to new formats	NG AVL Bus Electrification	VIX and DCC need to upgrade to VDV 452 1.6.1
NGAVL	External dependencies / NTA Systems	TISS Apps TISS Displays DCC Traffic Light Priority	Prepare NTA and other external systems for interfacing with NG AVL.
NGAVL	Service Now	Service Now	Dependent on ServiceNow for processes (but workarounds exist)
NGT	New BMOs and/or Other Project demands	Resource Availability	New or existing projects (e.g., BMO's) may be launched that require both Ops and Project resources. They will need to be impacted to NGT and NG AVL if they occur.

E.1.5 Project Constraints

The following constraints in Table 36 are key, high-level constraints for the NG AVL Project.

Table 36: NG AVL Constraints

#	Constraint
1	The Bus Operators have a resource limitation to work on NG AVL. Any requirement to assist the NG AVL Project Team needs to be cognisant of the other drains on the Bus Operator resources in this area, such as the various Leap Card and NGT ticketing work and getting ready for Bus Connects.
2	The NTA's Procurement Team will guide and lead the Project Team to ensure the Project works within European Union (EU) Procurement Law.
3	The PSC and NTA PAG require certain deliverables and approvals at various project checkpoints (gates).
4	As part of the Digital Government Oversight Unit approvals process, DPENDR will conduct an independent Peer Review on the NG AVL Project, looking at project and procurement documentation and critiquing the FBC
5.	The Approval Process PSC and the NTA's PAG will be followed as required for a project with a capital value of that given in NG AVL Cost Estimates.

6.	Some of the existing AVL equipment is life expired. Rather than the existing suppliers swapping this equipment out with newer versions at the NTA's expense, it would be preferable to swap with a single NG AVL.
7.	The existing contracts with AVL suppliers will end within the next few years.
8.	Bus services must not be impacted by a bus not being available for service due to delayed NG AVL installations. This may require additional bus spares during the installation process to cover for vehicles off the road during the installation process (see Section 4).
9.	NG AVL installations should be undertaken in one visit to the bus only.
10.	Some Depots do not have the space to install NG AVL on their own buses. A Dublin installation centre approach is most likely to be investigated, but this cannot be used for Depots in all locations throughout Ireland.

F Appendix: Cost Assumptions

F.1 Do Minimum Option

F.1.1 Do Minimum BMO Costs

Whilst in the PBC BMO resources were considered in the Do Minimum option, these have been removed as they cannot be considered savings as they will be needed to manage the NG AVL Service Provider. As a result, the cost of the Do Minimum option has reduced with respect to the BMO costs.

However, these have been offset against additional costs such as on-bus works, service costs for DMS and an estimation of an upgrade to all depot Wi-Fi, which has been identified as being required and an estimate of annualised operating expenditure produced. Note that NG AVL will not require depot Wi-Fi as part of its solution.

BMO IT Operating Costs	Annual Cost
[redacted]	[redacted]

[redacted]

BMO AVL Capital Cost Estimates	Capital Cost
[redacted]	

BMO Services Charges Operating Costs	Annual Cost
[redacted]	

Other Operating Costs	Annual Cost
[redacted]	

F.1.2 Do Minimum Operator Costs

As outlined in the PBC, the project team has requested updated values for the Bus Operators AVL costs. These include resources, IT costs and the annual service charge for their AVL provider. Further they have provided a number of planned upgrades, should NG AVL not take place when planned. These are a combination of well-known estimates from Dublin Bus, using quoted estimates from their suppliers and estimates using knowledge of the market, where longer term estimates are required. These will be identified below.

F.1.2.1 Dublin Bus

Operating Costs

[redacted]

[redacted]

AVL Operating Costs	Annual Cost
[redacted]	
[redacted]	
[redacted]	
[redacted]	

As the bus fleet is assumed to increase by 5% every other year, AVL service charges, IT costs and the cost of any non-warranty equipment will also increase by 5%. This is assumed to be in arrears, i.e. the fleet increases in 2026, and the operational costs subsequently increases in 2027. This is simplistic for comparison purposes and would likely be more responsive in reality. These increases are shown in the do-minimum cash flows in section F.1.3.

Capital Costs

[redacted]

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[redacted]

AVL Capital Costs Estimate	Cost
[redacted]	

[redacted]

Project Staff for Upgrades	Daily Rate	Annual Cost
[redacted]		

[redacted]

F.1.2.2 Bus Eireann

[redacted]

Operating Costs

AVL Operating Costs	Annual Cost
[redacted]	

[redacted]

Capital Costs

AVL Capital Costs Estimate	Cost
[redacted]	

The capital cost estimates for Bus Eireann are based on updating their systems to attempt to prolong their use. As highlighted in the PBC, it is assumed that these systems can be extended although there may be time limits to those extensions. However, any procurement costs have been excluded from this option.

Note that any capital costs associated with the cost of AVL equipment for new buses will be covered in the capital cost of the new bus and so are not considered here. This is in line with the assumptions made for the cost of the FBC Option. However, the operational impact of additions to the fleet are considered in the operational costs of the do minimum option, as these are also considered in the FBC Option.

The costs outlined in this section contribute to the do minimum cashflow found in section F.1.3.

F.1.3 Do Minimum Cashflow

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€ '000s	Total	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Capital Expenditure															
System Upgrade	[redacted]									-	-	-	-	-	-
Fleet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Capital Expenditure (real, excl. VAT)	[redacted]									-	-	-	-	-	-
Inflation	[redacted]									-	-	-	-	-	-
VAT	[redacted]									-	-	-	-	-	-
Capital Expenditure (nominal, incl. VAT)	[redacted]									-	-	-	-	-	-
OB	[redacted]									-	-	-	-	-	-
Contingency	[redacted]									-	-	-	-	-	-
Total Capital Expenditure	[redacted]									-	-	-	-	-	-
Operating Expenditure															
Resources	[redacted]														
Service Fees	[redacted]														
IT Costs	[redacted]														
Non-Warranty Equipment	[redacted]														
On-Bus Works	[redacted]														
Licences	[redacted]														
Wi-Fi Upgrade Opex	[redacted]														
Operating Expenditure (real, excl. VAT)	[redacted]														
Inflation	[redacted]														
VAT	[redacted]														
Operating Expenditure (nominal, incl. VAT)	[redacted]														
OB	[redacted]														
Contingency	[redacted]														
Total Operating Expenditure	[redacted]														
Total Do Minimum cashflows	[redacted]														-

F.2 Service Provider Business Model

Embedded below is the SPBM Guidance Manual. This was written by KPMG to provide advice and guidance on the use of the SPBM. Included within this document are many assumptions included within the business model. Those of relevance are included below for information.

ISFT NG AVL SPBM Guidance Manual.p

F.2.1 Milestone Payments

Implementation Milestone Payments

Tenderers shall tender the total amount for all of the below implementation Payment line items for NG AVL. The total amount will be apportioned based on the percentages outlined in Schedule 6 -Payments and in Schedule 3 – Initial Services:

Table 37: Milestone Payments

Milestone Payments		Percentage Allocation
1	Delivery of plans	5%
2	System design completion	10%
3	System development completion	10%
4	Technical readiness	3%
5	Service readiness	4%
6	Operational readiness testing	3%
7	Services acceptance – Pilot Route	5%
8	Services acceptance – remainder of Pilot Routes	5%
9	First Large Depot acceptance	5%
10.1	Depots acceptances (1)	3.5%
10.2	Depots acceptances (2)	3.5%
10.3	Depots acceptances (3)	3.5%
10.4	Depots acceptances (4)	3.5%
10.5	Depots acceptances (5)	3.5%
10.6	Depots acceptances (6)	3.5%

10.7	Depots acceptances (7)	3.5%
10.8	Depots acceptances (8)	3.5%
10.9	Depots acceptances (9)	3.5%
10.10	Depots acceptances (10)	3.5%
11	Services rollout completion	5%
PD1 A	Phased Delivery - Phase 1 – System design completion	3%
PD1 B	Phase 1 – System development completion	3%
PD1 C	Phase 1 Go Live	4%

F.2.2 Refresh milestone payment

Tenderers shall tender an amount for a workstation equipment refresh milestone payment for NG AVL.

F.2.3 Operating Payments

The Authority will pay the Service Provider Operating Payments for the delivery of the Services once the Solution becomes Operational. Operating Payments will be made by the Authority from the Operational Services Start Date and shall be adjusted by the Contract Period Performance Factor. The Contract Period Performance Factor is determined by the total number of Performance Points accrued by the Service Provider in a Contract Period as set out in the Payments Schedule (see Schedule 6, Payments and Schedule 5 - Performance).

Operating Payments shall be paid by the Authority to the Service Provider on a per Contract Period basis in arrears.

The Operating Payments comprise the following:

- Fixed Operating Payments in respect of payments for:
  - Hosting
  - ICT
  - Security
  - Others

Fixed operating payments are paid on a per Contract Period basis from the Operational Services start date.

- Variable Operating Payments in respect of:
  - Staff
  - Spares and repairs
  - Performance Management
  - Others (Tenderers to state)

Variable operating payments are calculated based on the percentage of fleet rollout completed each Contract Period from the Operational Services start date. They are paid on a per Contract Period basis in arrears.

F.2.4 Workstation Rollout

This worksheet provides the Authority with the outputs of each Tenderer's estimated workstation rollout schedule. For the purposes of the SPBM, Workstations must be rolled out a minimum of two Contract Periods before the fleet is rolled out.

Table 38 outlines the number of workstations that are required at each depot.

Table 38: NG AVL Workstations

	Depot	Service Control Workstations
Go Ahead	Ballymount	4
	Naas	2
Dublin Bus		
	Broadstone	25
	Head Office	4
	Disaster Recovery	20
Bus Éireann		
	Busaras	4
	Sligo	1
	Ballina	1
	Stranorlar	1
	Dundalk	1
	Drogheda	1
	Cavan	1
	Broadstone	4
	Galway	5
	Tralee	1
	Limerick	5
	Cork AVL Control Centre	5
	Cork Parnell Place	1
	Cork Depot	1
	Monaghan	1
	Waterford	3
	Wexford	1
	Disaster Recovery Location	4
NTA	NTA Head Office	5
	CCC	1

F.2.5 Fleet Rollout

This worksheet provides the Authority with the outputs of each Tenderer's estimated fleet rollout schedule. Tenderers allocated their fleet rollout in order of the priority listed in groupings 1-10. The Tenderer input their estimated number of buses they expect to rollout by depot at each period. This is then expressed as a percentage of the total. The percentage decides the band the Variable Operational Payment reaches.

Table 39 outlines the number of buses that are to be installed at each depot. Fleet lists with more details, such as single or double deck and bus or coach, have been provided to the tenderers as part of the ISFT pack.

Table 39: Full AVL Buses to be Installed with NG AVL

Groups	Operator	Depots	Total Fleet
Pilot 0	Bus Eireann	Waterford	22
First Large Depot	Go Ahead	Ballymount	169
1	Bus Eireann	Sligo	14
1	Bus Eireann	Ballina	16
2	Dublin Bus	Donnybrook Garage	200
3	Dublin Bus	Harristown	181
4	Dublin Bus	Phisborough	223
5	Dublin Bus	Conyngham Road	92
5	Bus Eireann	Cork Depot	128
6	Go Ahead	Naas	41
6	Bus Eireann	Longford	1
6	Bus Eireann	Stranorlar	10
6	Bus Eireann	Dundalk	79
6	Bus Eireann	Drogheda	20
6	Bus Eireann	Cavan	19
7	Dublin Bus	Ringsend	135
7	Bus Eireann	Athlone	46
7	Bus Eireann	Tralee	41
8	Dublin Bus	Clontarf	67
8	Bus Eireann	Broadstone	112
9	Dublin Bus	Summerhill	122
9	Bus Eireann	Limerick	86
10	Dublin Bus	Broadstone	86
10	Bus Eireann	Galway	78
Factory	Dublin Bus		100
Factory	Bus Eireann		230
No. Buses			**2318**

F.2.6 Price Book

The price book worksheet provides the Authority with the outputs of each Tenderer's additional Equipment and Services items, including the following parts:

A. AVL Equipment
B. Additional Real-Time Feeds or data supply changes
C. Additional reports
D. Additional licenses
E. Additional Depot data networking
F. Additional Bus Operators
G. Additional training courses
H. Additional resources
I. AVL Lite
J. Priced Options

Each has items that the NTA might need to purchase throughout the life of the contract beyond the capital element defined in the Contract. For further details, please refer to the SPBM. An embedded version is included here for information.

G Appendix: Economic Appraisal Additional Detail

G.1 Comparison of a CEA to a CBA

The PSC recommends the use of a CBA or CEA in order to determine the most economically advantageous option for investment. A comparison of undertaking CBA and CEA is shown in Table 40 below.

Table 40: Comparison of a CEA to a CBA (Appendix)

What it does	
Cost benefit analysis	CBA is the ratio of costs to **monetary value** of effects on **all outcomes**: • Can deliver **absolute judgment** on whether a project/programme is worth the investment. • Makes it easier to assess projects/programmes with multiple outcomes. • But **also requires assumptions about the monetary value** of all the different benefits.
Cost effectiveness analysis	Ratio of costs to effect on **outcomes**: • **Summarises complex projects/programmes impacts as simple ratios of costs/effects**, for specific and objective outcomes. • Easily synthesises information from multiple evaluations.
How it is measured and calculated	
Cost benefit analysis	**Costs** and **Benefits** are both monetised (i.e., expressed as a € value): • Net benefit: Measured in ***monetised unit*** at total benefits minus total costs. • ***Cost/Benefit Ratio (C/BR)*** (cost as a ratio of the benefit). • ***Benefit/Cost Ratio (B/CR)*** (benefit as a ratio of the cost).
Cost effectiveness analysis	**Costs** are measured in ***monetary units***, but **Effectiveness Measures** are determined in ***non-monetary units*** and can include final or intermediate outcomes: • ***Cost/Effectiveness Ratio (C/ER)*** (cost as a ratio of the effect/desired outcome). • ***Effectiveness/Cost Ratio (E/CR)*** (effect/desired outcome as a ratio of the cost).
Strength	
Cost benefit analysis	• Units of measure are generally **easily understandable.** • **Prescriptive** - only measurement that shows whether the monetary benefits of an intervention exceed its cost.
Cost effectiveness analysis	• Shows the programmatic results by their impact on users/stakeholders served by the solution. • **Makes results comparable to other interventions/comparators** with same/similar outcome. • More appropriate for public sector programmes/projects where benefits may not easily be monetised.
Challenge	
Cost benefit analysis	• Assumes **all benefits can be monetised**. • Can be **costly** (time consuming, requires key decisions), **complex** to undertake and **accurate information is essential**.
Cost effectiveness analysis	• May exclude other potential benefits or outcomes, but these can be ***"qualitatively"*** documented.

G.2 Transport Appraisal Framework

As part of the TAF all schemes with an estimated cost in excess of €30m, in addition to a CEA or CBA, are required to include a TTA.

The TAA is a supporting system that assesses the impact of a programme across the following six key criteria:

- Accessibility
- Social
- Land Use
- Safety
- Climate Change
- Local Environment

We have compared the FBC Option against the Do Minimum. A detailed breakdown of the analysis is the spreadsheet below:

TAA _NTA NG AVL_FBC FINAL 2023.

H Appendix: Project Execution Plan

Note, due to the PEP's live nature, some of the content in this embedded version may have been updated or superseded since the completion of this FBC.

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