

Business Case

Main Roads Western Australia

Armadale Road – Construct dual carriageway from Anstey Road to Tapper Road



Department of
Transport



mainroads
WESTERN AUSTRALIA



Public Transport
Authority

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Business Case approval

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Executive summary

Armadale Road is a strategic freight route connecting the South West and the South East corridors. It serves as one of the main east-west links within the Perth metropolitan transport network connecting the Armadale Sub-regional centre and Albany Highway west to the Kwinana Freeway, forming part of the route to the Fremantle Port. The link passes through industrial areas, rural subdivisions and recently developed residential subdivisions, and borders various environmentally sensitive reserves.

This business case recommends the State Government construct a two lane second carriageway for 6.96 km between Anstey Road and Tapper Road and associated works at an estimated project cost of \$145.4 million at [REDACTED]. Funding to the [REDACTED] project cost level (\$145.4 million) has been considered adequate for the proposed project scope, given the current competitive nature of the road construction market and the downturn in construction activities in Western Australia.

This section of Armadale Road is experiencing increasing volumes of traffic and associated congestion, delay and safety issues attributable to the increasing number of residential developments in the area and industrial developments at Forrestdale.

The 6.96 kilometre section of Armadale Road between Anstey Road and Tapper Road is deficient in catering for increasing volumes of traffic. The recommended capacity for single lane roads is 8,000 vehicles per day. Traffic volumes on this section currently varies from 17,895 vehicles per day between Anstey Rd and Warton Rd to 27,500 vehicles per day between Warton Rd and Tapper Rd. Traffic volumes are expected to grow to 29,000 vehicles per day between Anstey Road and Warton Road 40,000 vehicles per day between Warton Road and Tapper Road by 2021, an annual growth rate of 5 per cent. This will place increasing pressure on the route, reducing service standards and compounding delays for commercial vehicles and commuters.

Three options were evaluated to address the efficiency and safety issues on Armadale Road:

- Base Case – continue with the current ongoing maintenance schedule. This option will cost the community through traffic delays, vehicle operating expenses and crash related costs.
- Option 1 – address the congestion issues by diverting traffic to alternative routes, providing road safety barriers, road treatments or grade separating intersections. This option is a short-term solution to address safety issues with limited capacity benefits and efficiency gains.
- Option 2 – construct a 6 lane dual carriageway from Anstey Road to Tapper Road. This is the ultimate configuration for the Armadale Road, but is not recommended at this time as it is anticipated a 4 lane dual carriageway for the project length will be fit for purpose.
- Option 3 (Recommended) – construct a dual carriageway along the deficient section of Armadale Road. The south metropolitan area will continue to be the focus of urban developments to support increasing population and economic growth in Perth. The delivery of this road upgrade will supply additional traffic lanes and help to ease congestion and safety issues along this section of road. This option is estimated to cost \$145.4 million with additional maintenance funding of \$110,000 per annum

required from 2018-19 onwards and is expected to create economic benefits to the order of \$940 million for road users discounted over 30 years.

The recommended option involves construction of a second carriageway between Anstey Road and Tapper Road; various upgrade works at 4 intersections; construction of Principal Shared Path; street lighting and drainage; provision of two metre sealed shoulders; and significant service relocations. The project is expected to yield private and commercial travel time savings of \$637 million, vehicle operating cost savings of \$268 million and crash cost savings of \$35 million. A preliminary benefit cost ratio of 6.07 has been calculated based on a 7% discount rate.

This project contributes to the State Government's moving freight strategies by providing infrastructure that supports economic development within the south west and south east corridors of the Metropolitan area, especially industrial areas at Jandakot and Forrestdale by improving a strategic link in the freight route.

Tenders for the project delivery could be awarded in 2018, with completion in 2019-20.

Main Roads Western Australia and the Transport Portfolio have prioritised this proposal for investment and recommends that the Department of Treasury endorse this proposal for funding in the 2016-17 State Budget.

1 Problem/Opportunity Definition

Armadale Road is a strategic freight route connecting the South West and the South East corridors. It serves as one of the main east-west links within the Perth metropolitan transport network connecting the Armadale Sub-regional centre and Albany Highway west to the Kwinana Freeway, forming part of the route to the Fremantle Port. The link passes through industrial areas, rural subdivisions and recently developed residential subdivisions, and borders various environmentally sensitive reserves.

Urban developments are currently happening adjacent to this road in Banjup, Piara Waters and Forrestdale. Further planned expansions include urban developments in Byford and Mundijong, as well as industrial developments in Forrestdale.

Cockburn Central is located on western end of the project area and is a new town centre with a vibrant mix of residential, retail and commercial properties. Significant developments have taken place over the last ten years, including the construction and opening of Cockburn Gateway shopping centre, eight new residential buildings providing 466 dwellings, and a doubling of carpark bays in the area.

There is also current and future land planning for the Cockburn area and further south, which will increase commercial and recreational activity around the area. These developments include:

- Cockburn Central Transit Oriented Development adjacent to Cockburn Train Station currently under development.
- Jandakot Industrial Area commercial development on the east side of Kwinana Freeway.
- Expansion of Cockburn Gateway shopping centre from 33,000 m² to 55,000 m² occurred in 2014 and further expansion to 100,000 m² of floor space with a doubling of current employment from 1,500 to 3,000 by 2018-19 (Gateways Precinct Local Structure Plan, TPG, 2010).

As a result, increasing volumes of traffic are being experienced on the link, along with associated congestion, delays and safety issues.

Current traffic volumes are such that demand is not being met and road users are being delayed. Service is inadequate with bottlenecks being experienced leading to queues.

Prior to 2003, Armadale Road was a single carriageway from Lake Road, east of the present Tonkin Highway, to Solomon Road near the Kwinana Freeway. During the construction of the Tonkin Highway in 2003 to 2005, the section of Armadale Road between Lake Road and Anstey Road was upgraded to a dual-carriageway as part of the works. This was done in recognition of the expected growth of traffic that would result from the construction of the Tonkin Highway. This leaves the 6.96 km Anstey Road / Tapper Road section of Armadale Road as the only single carriageway section in the 15.9 km between the Kwinana Freeway and Armadale.

Road users are currently unable to access industrial and residential developments in a timely manner due to this remaining section of single carriageway.

2 Evidence of the Problem/Opportunity

The current traffic volumes are approximately 27,500 vehicles per day between Warton Road and Tapper Road and 17,900 vehicles per day between Anstey Road and Warton Road.

The recommended capacity for single lane roads is 8,000 vehicles per day, and this section is well in excess of this amount, leading to high levels of congestion particularly during peak hours. This section remains the only single carriageway section on Armadale Road between the Kwinana Freeway and Armadale. Total crashes for the period between 2010 and 2014 are 438 of which 57% of crashes were rear end crashes. International studies over the past decade have found a direct link between rear end crashes and increased traffic congestion. The crash rate is 171 per 100MVKT for this section of road which is higher than the Metropolitan average annual crash rate of 134 per 100MVKT for highways and freeways. The summary of crash data over the last 10 year periods are given below.

Period	Crashes					
	Fatal	Hospital	Medical	PDO Major	PDO Minor	TOTAL
2005 to 2009	2	17	39	128	34	220
2010 to 2014	0	20	91	228	99	438

The current Level of Service (LoS) experienced on this section of Armadale Road is Level E, which is characterised by intense bunching of traffic, significant lowering of speeds and unstable operating conditions.

3 Objectives and Outcomes

The recommended option will provide a range of benefits including:

- Improved road network connectivity and efficiency;
- Provide infrastructure that supports economic development within the south west and south east corridors of the Metropolitan area, especially industrial areas at Jandakot and Forrestdale by improving a strategic link in the freight route;
- Reduced travel times;
- Improved level of service at intersections; and
- A reduction in the risk of rear end crashes.

This project will assist in upgrading a road that was designed and is suitable for a semi-rural environment, to an urban road able to service the increasing developments in the area.

3.1 Urgency

Project completion is required now to cater for existing traffic and to align with planned expansions included in the Metropolitan Region Scheme.

The future structure planning shows that significant traffic growth in this area will occur due to ongoing residential and commercial development along the northern side of Armadale Road, the Transport Orientated District (TOD) on the northwest corner and Gateway shopping

centre expansion on the south west corner of Armadale Road and Kwinana Freeway interchange.

Increasing congestion in the Cockburn Central precinct has been highlighted by stakeholders (City of Armadale and City of Cockburn) seeking that improvements are made, suggesting that another Kwinana Freeway crossing as an extension of North Lake Rd is undertaken. Network Definition work has clarified that by 2031 both the North Lake Road crossing over Kwinana Freeway and upgrading of Armadale Rd will be required.

Urban development will create ongoing traffic growth of approximately 5% per year on Armadale Road as one of the main links in the network. By 2021, traffic volumes are expected to grow to 29,000 vehicles per day between Anstey Road and Warton Road and 40,000 vehicles per day between Warton Road and Tapper Road, adding to the congestions and safety issues

If this project is not undertaken, it is anticipated that the LoS would drop to Level F or worse by 2021, which represents heavily congested flow with traffic demand exceeding capacity.

If the second carriageway is constructed, the LoS in 2021 is expected to be improved to a Level C or D, which is a significant enhancement.

4 Strategic Alignment

Directions 2031 is the Metropolitan planning strategy for Perth and Peel. The strategy recognises the benefits of a more consolidated city and strongly supports the development of a number of key strategic activity centres that are well connected to public transport. This proposal is aligned to Directions 2031, through providing increased accessibility to Cockburn Train Station and through promotion of the Cockburn Central activity centre and improving access to the strategic metropolitan and industrial areas of Armadale and Forrestdale.

This project aligns with the Towards Zero strategy by contributing to the provision of safer roads and roadsides through improved infrastructure , thus reducing the number of fatal and serious crashes attributable to these factors

The Main Roads' Strategic Asset Plan outlines the organisation's approach to long term asset investment requirements. The Plan identifies various elements that are targeted to deliver outcomes in alignment with government goals. This proposal specifically addresses Network Configuration and Condition in terms of easing congestion.

5 Recommended Option

5.1 Works in Scope

This project involves the construction of a four lane dual carriageway between Anstey Road and Tapper Road, a length of 6.96km. The project also involves:

- Provision of dedicated left and right turn lanes and installation of new traffic signals at 2 intersections (Liddelow Road and Taylor Road / Wright Road);
- Provision of dedicated left and right turn lanes and upgrade of existing intersection layout and traffic signals at Nicholson Road intersection;
- Modification of the Fraser Road intersection; and
- Provision of road safety barriers in the median and verge.
- Provision of 2m sealed shoulders on left side of the carriageway.
- Installation of street lighting for the full length of the project.
- Eastbound carriageway northern side and intersection areas will be kerbed and pipe drainage will be provided, and the other areas will be open drain.
- Provision of a PSP on northern side of the Armadale Rd.
- Significant service relocations will be required.

Planning works identified additional land requirements outside of the MRS and an amendment to the MRS has been initiated. Land resumption will be required as part of the project.

The link borders various environmentally sensitive reserves but a Preliminary Environmental Impact assessment (PEIA) has already been completed and the next stages of project development will further examine environmental matters associated with wetland areas at the western end of the project section.

Other project development works are well advanced and there are no achievability issues anticipated.

5.2 Interfaces with other Projects or Works

The proposed North Lake Road Bridge over the Kwinana Freeway (connecting North Lake Road and Armadale Road) will complement this section of Armadale Road and benefit from additional traffic lanes on Armadale Road. The new overpass will be located between the existing Armadale Road / Kwinana Freeway interchange and the Berrigan Drive / Kwinana Freeway interchange. The proposed overpass would complement the dualling of Armadale Road by improving the traffic flow through the Kwinana Freeway / Armadale Road interchange.

Widening of the existing Armadale Road Bridge over the Kwinana Freeway is also planned to happen at the same time as this dual carriageway project. Therefore, this project should or could be delivered in parallel to the Kwinana Freeway- Armadale Road Interchange Bridge widening to provide greatest benefits as well as construction efficiencies.

5.3 Works out of Scope

- Upgrading of local roads
- Kerbing will be limited Eastbound carriageway Left Hand Side and intersection area only

6 Option Evaluation

6.1 Decision Criteria

Economic

- Increase private and commercial travel time savings
- Improvement in transport efficiency

Social

- Amenity
- Improve Safety

Environmental

- Reduction in emissions

6.2 Options Analysis

Base Case

Continue with current ongoing maintenance schedule, no construction of additional lanes or changes to road conditions.

If the status quo is maintained the result will be further delays caused by congestion, as well as an increasing crash rate as the volume of traffic increasingly exceeds capacity.

This Option will incur no additional capital cost.

Option 1

To address the problems of high traffic volumes and high crash rates, some possible options include encouraging/forcing traffic to use alternative routes, providing road safety barriers or road treatments or grade separating intersections along the route to improve traffic flow.

Grade separating the intersections are not practical due to high construction cost.

There is no obvious alternative route, the most likely being via Ranford Road, Nicholson Road and Roe Highway, approximately an additional 13km in length. This route would also put increasing pressure on the Kwinana Freeway which already experiences capacity issues. There would also be more pressure on the local roads which have not been designed as distributor roads.

Due to the significant additional length of the detour, it is not likely that reduced speeds along Armadale Road (either due to congestion or a reduction in the posted speed limit) will encourage road users to take the alternative route.

These measures may provide some relief in the short term, but will serve as interim solutions only, will not be readily accepted by industry and the community, and will not support the economic development of the southern metropolitan area. Promoting use of an alternative route will present a significant detour on already congested roads.

Option 2

Build a 6 lane dual carriageway from Anstey Road to Tapper Road.

This provides additional capacity before it is required and has a much higher construction cost.

Option 3 (recommended)

Build a 4 lane dual carriageway from Anstey Road to Tapper Road.

The recommended Option has been chosen as based on predicted traffic volumes, a 4 lane dual carriageway for the full length of the project section will be fit for purpose until 2031, therefore there is no reason to build the 6 lane dual carriageway as an initial option. Further, there are unresolved planning issues regarding the future cross section of Armadale Road between Kwinana Freeway and Tapper Road. These issues are associated with the future planning of the Kwinana Freeway / North Lake Road interchange connection to Armadale Road. If there are any funding constrains, then this option could be staged as follows:

Stage 1 – Dual the Armadale Road from Rossiter Avenue (SLK 10.47) to Warton Road (SLK 12.00) length -1.53 km

A new subdivision development is in progress on the north east corner of Armadale Road / Wright Road intersection. Due to this development the traffic volume on Wright Road will increase significantly and the existing Armadale Road / Wright Road intersection will not operate at an acceptable Level of Service and create more safety issues. As part of this subdivision development approval there is requirement to upgrade the Armadale Road/Wright Road intersection by the developer.

The developer contribution of approximately \$6M is available to upgrade the Wright Road intersection. If the developer upgrades this intersection then there will be short length of single carriageway between Warton Road and Wright Road and may require reconstructing the Wright Road intersection as part of the dual carriageway project. There may be an opportunity to have the developer to pre-fund this work and the State to contribute the additional \$35 M.

Stage 2 – Dual the Armadale Road from Warton Road (SLK12.00) to Tapper Road (SLK 14.95) length – 2.95 km

This section of Armadale Road carries higher traffic volumes than the section from Anstey Road to Warton Road.

Stage 3 – Dual the Armadale Road from Anstey Road (SLK 7.99) to Rossiter Avenue (SLK 10.47) length – 2.48 km

6.3 Decision Matrix

Decision category	Decision criteria	Base case	Option 1	Option 2	Option 3 (recommended)
Economic	Increase private and commercial travel time savings	x	x	✓	✓
Economic	Improvement in transport efficiency	x	x	✓	✓
Social	Amenity	x	x	✓	✓
Social	Improve Safety	x	✓	✓	✓
Environmental	Reduction in emissions	x	x	✓	✓
Reason/s for acceptance/rejection of option		Status quo is not acceptable to road users affected by higher delays and higher crash rate. Reduced safety for all road users.	Provide some short term relief, interim solutions only, not be readily accepted, not support the economic development.	Improved safety and efficiency. Reduced travel time and freight cost. Stimulate economy. Higher cost than fit for purpose Option.	Improved safety and efficiency. Reduced travel time and freight cost. Stimulate economy. Fit for purpose until 2031.

7 Financial and Economic Analysis

7.1 Cost Estimates

A probabilistic risk adjusted estimate has been developed based on a concept design developed for the project option. The estimated outturn capital requirement is:

- \$145.4 million over four years [REDACTED]
- [REDACTED]

Outturn costs are based on a concept design estimate in [REDACTED] escalated using Main Roads standard escalation rates for construction over the four year period 2016-17 to 2019-20.

Additional maintenance funding of \$110,000 per annum will be required from 2020/21 onwards as a result of this project. A further requirement for \$10 million in 2034/35 will be required for resurfacing.

Additional depreciation funding of \$3.8m per annum will be required from 2019/20 onwards as a result of this project.

Below outlines the cost components the project at the P50 confidence level.

Contractor Costs	[REDACTED]
MRWA Management Allowances	[REDACTED]
Land	[REDACTED]
<i>Subtotal</i>	[REDACTED]
Contingencies	[REDACTED]
<i>Subtotal</i>	[REDACTED]
Cost Escalation	[REDACTED]
Total	145.4

Financial Analysis and Funding/Financing

Impact on State Finances	2016/17 \$'000	2017/18 \$'000	2018/19 \$'000	2019/20 \$'000	2020/21 \$'000
Adjustment to Approved Expense Limit	0	0	0	0	0
General Government Net Operating Balance	0	0	0	0	0
Asset Investment Program	21,000	25,000	56,500	42,900	0
Total Public Sector Net Debt	21,000	46,000	102,500	145,500	145,400
Additional FTEs	0	0	0	0	0
Source of Funding					
Cash at Bank	0	0	0	0	0
Other -	0	0	0	0	0
Additional Appropriation	21,000	25,000	56,500	42,900	0
<p>(a) Own source revenue or other surplus cash balances should be considered as a funding source prior to a request for additional appropriation funding.</p> <p>Main Roads includes in its budget expense limit capital spending which is capitalised as part of the State's infrastructure program. However, Main Roads also reverses this as an extraordinary item in its Income Statement. Therefore, although there is an expense limit impact for the agency, there is no change to general government expenses.</p> <p style="text-align: right;">.....</p> <p style="text-align: right;">P. Woronzow Executive Director Finance & Commercial Services Main Roads WA</p>					

7.2 Economic Analysis

A Benefit Cost Ratio (BCR) of 6.07 has been calculated based on a 7% discount rate. Unescalated P90 costs have been used in the below Cost Benefit Analysis. The BCR is calculated using ROM24, Main Roads' traffic modelling software. ROM24 utilises endorsed land use planning data sets that have been agreed on by Western Australia Planning Commission and Main Roads.

Benefits/Costs	Discount Rate 7%
Private Travel Time savings	\$540.9m
Commercial Travel Time savings	\$96.2m
Vehicle Operating Cost savings	\$267.8m
Crash savings	\$34.8m
Environmental savings	-\$0.2m
Total Benefits	\$939.5m
Maintenance Cost	\$5.0m
Capital Cost	\$154.0m
BCR [(Benefits – Maintenance Cost) / Capital Cost]	6.07

8 Risk Analysis

8.1 Risk Matrix

The comprehensive risk management strategy has not been developed, however, the primary risks have been identified and mitigation activities noted. If the proposed dual carriageway is supported a specialist consultant will be engaged to undertake a formal risk identification and assessment workshop as part of the detailed design development stage.

A summary of the potential risks associated with the project is provided in the table below. The information and the risks shown are based on the current information available regarding the project.

Potential Risk	Likelihood (L)	Consequence (C)	Risk Rating (LxC)	Mitigation Strategy	Rating of residual risk
Cost - Cost exceeds budget	3	4	High	Review	Moderate
Heritage and environment - Disturbance of European or Indigenous heritage sites	3	4	Moderate	Surveys and assessments	Low
- Destruction of protected environment and rare flora	1	4	Moderate		Low
- Delays due to environmental assessment process	2	3	Moderate		Low
Services located in the vicinity of the works - Services requiring relocation - Delays associated with service	5	4	Very high	Liaise	Moderate

Potential Risk	Likelihood (L)	Consequence (C)	Risk Rating (LxC)	Mitigation Strategy	Rating of residual risk
relocation	4	4	High		Moderate
- Increased cost	4	3	High		Moderate
Design and Safety Review					
- Alteration of design with increased amount of work	3	3	Moderate	Compare	Low
Additional land requirement outside of MRS					
- Potential delays to the delivery of the project	3	4	High	Identify	Moderate
Secondary impacts					
- Including noise and visual intrusion possible for some residential areas, creating local opposition to the project.	2	4	Moderate	Consultation	Moderate
Excessive traffic					
- Implementation of the dual carriageway attracts significantly higher than expected levels of traffic immediately after construction.	2	4	Moderate	Modelling	Low

8.2 Risk Management Strategy

The mitigation strategies proposed to address the risks identified above are described in the table below.

Risk	Mitigation Strategy	Status
Cost	Ensure estimates are reviewed and kept current with scope of works	In place
Heritage and environment	Conduct desktop study. Archaeological and ethnographic survey of the area prior to construction. Undertake environmental assessment in advance of project construction.	In place In place Planned
Services located in the vicinity of the works	Services Relocation Plan. Check with service providers of location of existing services and prepare Organise service relocation if necessary.	In place Planned
Design and safety review	Compare revised design costs to budget.	Planned
Additional land requirement outside of MRS	Identify additional land requirements and initiate MRS amendment and acquisition process.	In place

Secondary impacts	Community Engagement Strategy (Consultation and engagement with local residents).	Planned
Excessive traffic	Traffic Management Plan - Traffic modelling. Complementary road / public transport upgrades	In place

9 Stakeholder Analysis

Key Stakeholders	Interest/Context	Position
EXTERNAL STAKEHOLDERS		
Hon. Dean Nalder MLA (Minister for Transport)	Project funding and approval.	Support
Hon. Ken Travers MLC (Shadow Minister for Transport)		Support
Department of Transport	Regional transport planning.	Support
Local Government – City of Armadale, City of Cockburn	Managing local roads – traffic, amenities, tourism.	Support
Public Utilities – Western Power, Water Corp, Telstra, Alinta Gas	Providing utilities to public and businesses. Check for potential conflict with existing services within the area.	Support
Fire and Emergency Services (FESA)	Providing emergency services. Advise of potential delays and traffic management plans during project construction.	Support
Department for Environment and Conservation (DEC)	Environmental issues and clearances. Rare and priority flora & Threatened Ecological Communities.	Support
WAPC & Department of Planning	Planning of the metropolitan region and sub-divisions. MRS, land use planning.	Support
Landowners	Purchase of land.	Majority support. May be a few in opposition due to not wanting to sell – require negotiations.
Residents	Road nearer the fence line. Noise.	Majority support May be a few in opposition due to noise.
INTERNAL STAKEHOLDERS		
Road Network Services (Manager Traffic)	Network operations.	Support

Key Stakeholders	Interest/Context	Position
Operations and Services, Director Heavy Vehicle Operations)	Heavy vehicle operations.	
Planning and Technical Services (Manager Road and Traffic Engineering, Senior Engineer Structures, Manager Road Planning, Manager Materials Engineering)	Road standards/guidelines. Structures standards/guidelines. Planning considerations. Pavement and surfacing standards/guidelines.	Support
Supply and Transport	Procurement and finance requirements.	Support
Environment Branch	Environmental, landscaping and sustainability requirements.	Support
Metropolitan Region	Asset management.	Support
Infrastructure Delivery Services	Delivery planning, resource planning, technical support services and contract documentation.	Support

10 Summary and Recommendation

This Business Case recommends that the section of Armadale Road between Anstey Road and Tapper Road be upgraded from a 2 lane single carriageway to a 4 lane dual carriageway.

The recommended option will provide a range of benefits including:

- improved road network connectivity and efficiency
- reduced travel times
- improved level of service at intersections
- a reduction in the risk of rear end crashes

The predicted monetary benefits are private travel time savings of \$540.9 million, commercial time savings of \$96.2 million, vehicle operating cost savings of \$267.8 million, and crash savings (safety benefits) of \$34.8 million.

Other options, such as the status quo (base case) and demand management option (option 1) would avoid the capital costs associated with the upgrade. However, they will not address the issues regarding travel delays, road network performance and road safety.

The alternative construction option (option 2) will address all of the above issues, but for a much higher cost, and to a standard not required until 2031.

Additional capital funding of \$145.4 million is required over the four year period from 2016/17 to 2019/20 to undertake this project.

Additional maintenance funding of \$110,000 per annum will be required from 2020-21 onwards as a result of this project. There is also a resurfacing requirement after 15 years of operation which will incur a cost of \$10 million.

Additional depreciation funding of \$3.8m per annum will be required from 2019-20 onwards as a result of this project.

APPENDIX A Delivery Summary

A.1. Recommended Delivery Method

The predicted project cost is in the order of \$145 million and is considered to be a low risk project. The delivery mechanism recommended at this stage is either via a Design and Construct (D&C) contract or via separate design and construction contracts.

Because of the size of the project a Cat 2 contract is not supported (too large for this type of contract).

The Region will meet with IDD once funding is committed to workshop and confirm the most appropriate delivery method.

A.2. Procurement strategy

The project procurement strategy is yet to be formulated and shall be in accordance with the State Supply Policies. The recommended delivery method will be determined in terms of MRWA procurement criteria.

A.3. Governance

In the event that this project is funded an appropriate structure to manage the project will be developed consistent with the delivery model chosen.

A.4. Resourcing strategy

Main Roads has the capacity to deliver the project management requirements. It is anticipated that the delivery will be managed by the Infrastructure Delivery Directorate.

The private sector currently has the capacity to deliver the project. There is a possibility that private sector services could become scarce in upcoming years as a result of continued growth in the resources and energy sectors.

A.5. Communication strategy

As part of the final development stages and the preconstruction stage further public consultation will be undertaken, as well as providing notices to residents and major stakeholders.

A.6. Schedule

Subject to funding, the proposed timescale for delivery of this project is as follows:

2016/17	Commence preconstruction activities. Complete design.
2017/18	Purchase Land, Invite tenders for project delivery.
2018/19	Award Contract & Project Delivery
2019/20	Project Delivery
2020/21	Close out

A.7. Project performance measurement and Benefits Realisation

As part of the development stage, further investigation would be completed to confirm the appropriate project performance measures. This will include the identification of Key Performance Indicators (KPI). Suggested performance measures are outlined in the table below.

Success criteria	Responsibility
Milestones	Project Manager
Budget	Project Manager
Safety	Project Manager
Disruption to road network	Project Manager
Environmental and amenity impacts (noise, dust emissions, vibration)	Project Manager

The benefits realisation is the outcomes of the project and should be measured to evaluate the success of the project throughout its use. This requires assessing if the community needs over the short, medium and longer terms of the life of the proposed upgrade has been met. The primary performance measurements for the delivery of the project will be:

- Network performance
- Reduction of crashes
- Capital replacement and/or maintenance
- Community support and approval

The Metropolitan Region will be responsible for the delivery of the abovementioned measurements.

Specific KPI's will be identified for the project during the next phase of the project.

APPENDIX B Detailed Cost Estimate

B.1. Design Standards

Applicable standards, procedures and guidelines for the design and delivery of the project are stated on Main Roads website.

Road Asset Details:

Pavement Width	Design Life	Surface Width	Design Life
11.0m (Eastbound Carriageway) due to kerbing on LHS 12.0m (Westbound Carriageway)	40 years	10.0m	15 years
Sealed Lanes	Sealed Shoulders	Unsealed Lanes	Unsealed Shoulders
2 x 3.5m	2 x 2.0m, 2 x 1.0m	0	2 x 0.5 m (Median) 1 x 1.0 m (Westbound carriageway LHS)

Geometry Design Speed:

Vertical	Horizontal
90km/h	90km/h

B.2. Estimate Details

Only the recommended Option 1 was costed as funding was not available to undertake a concept design and concept cost estimate for the other options.

A P50 probabilistic cost estimate as the budgetary figure has been undertaken based on the concept design of Option 1 developed by Main Roads.

PROJECT COST ESTIMATE SUMMARY
(Probabilistic Risk Approach)

Description	Base Estimate (\$)		
<i>Contractor's Costs</i>			
General Conditions of Contract	\$		
Series 100 - General Requirements	\$		
Series 200 - Management Requirements	\$		
Design Costs	\$		
Series 300 - Earthworks	\$		
Series 400 - Drainage	\$		
Series 500 - Pavements	\$		
Series 600 - Traffic Facilities	\$		
Series 700 - Electrical and Lighting	\$		
Series 800 - Structures	\$		
Series 900 - Miscellaneous	\$		
Provisional Sums	\$		
	\$		
Subtotal (Construction Costs)	\$		
Add for Contractors Margin and Overheads			
Subtotal (Construction Costs plus OH&P)	\$		
<i>Client Management Estimated Costs</i>			
Client Planning Design and Documentation	\$		
Client Contract Management	\$		
Client Project Management	\$		
Principal Controlled Insurances	\$		
Site Investigation & Project Studies (inc geotech)	\$		
Ethnographic Surveys & Clearances	\$		
Land Costs	\$		
Environmental Offsets	\$		
Other	\$		
Subtotal (Owners Cost)	\$		
Base Estimate (Construction Costs + Owners Costs)	\$		
<i>Contingency</i>			
Total Risk			P50 P90
Base Estimate + Contingency	\$		
<i>Escalation</i>			
Escalation to Date of Tender / RFP	\$		
Sub-total	\$		
Rise & Fall during the Contract (PS)	\$		
TOTAL OUTTURN COSTS (EXCL GST)	\$		
Sunk Costs	\$		
TOTAL OUTTURN COSTS PLUS SUNK COSTS (EXCL GST)	\$	\$AUD Millions	
PREDICTED CONTRACTORS TENDER SUM			

APPENDIX C Detailed Financial Analysis

Maintenance/Operations

- \$110,000 per annum (13.8 lane kilometres @ \$8,000 per km)
- \$10m resurfacing requirement after 15 years of operation

Depreciation

Additional depreciation funding of \$3.8m per annum will be required from 2020/21 onwards as a result of this project. This is based on a depreciation rate of 40 years for pavement, drainage and seal in the Metropolitan environment.

APPENDIX D Detailed Economic Analysis

Economic Analysis was conducted on the recommended option for this proposal using a Benefit Cost Ratio. The BCR is calculated using Main Roads' traffic modelling software ROM 24. The model utilises endorsed land use planning data sets that have been agreed on by Western Australia Planning Commission and Main Roads. Qualitative factors have also been considered in the options analysis, including social amenity and safety for pedestrians and cyclists.

Below provides a summary of the Benefit Cost Analysis for the recommended option with P50 unescalated costs, using sensitivity of 4%, 7% and 10% discount rates.

Benefits/Costs	Discount Rate		
	4%	7%	10%
Private Travel Time Savings	\$836.7m	\$540.9m	\$373.1m
Commercial Travel Time Savings	\$145.6m	\$96.2m	\$67.8m
Vehicle Operating Cost Savings	\$407.7m	\$267.8m	\$187.7m
Crash Savings	\$51.1m	\$34.8m	\$25.3m
Environmental Savings	-\$0.5m	-\$0.2m	-\$0.1m
Total Benefits	\$1,440.6m	\$939.5m	\$653.8m
Maintenance Cost	\$7.5m	\$5.0m	\$3.4m
Capital Cost	\$149.2m	\$154.0m	\$159.0m
BCR [(Benefits – Maintenance Cost) / Capital Cost]	9.61	6.07	4.09

APPENDIX E Environment and Sustainability

A desktop assessment of environmental constraints in the project area has been undertaken by MRWA's Environment Branch by viewing ArcGIS shapefiles and reviewing government agency managed databases where necessary. This assessment covers Armadale Rd from the project site all the way east to Nicholson Rd and extending for a 2 km radius locus. Their draft report can be found at D15#212500.

The above report also assessed heritage constraints for the same road section extending for a 500 m radius locus.

E.1 Environmental Standards

Australian Standards are followed in the design and delivery of Main Roads projects. These include:

- AS/NZS ISO 14001: Environmental Management Systems – Specifications with Guidance for Use
- AS4970: Tree protection on development sites;
- AS3480.4: Methods for Sampling and Analysis of Ambient Air
- AS1940: The Storage and Handling of Flammable and Combustible Liquids
- AS2436: Guide to Noise Control on Construction, Maintenance and Demolition Sites.
- AS/NZS ISO 31000: Risk Management – Principles and Guidelines

Main Roads refers to AS/NZS ISO 14001 which is an independently certified system that underpins risk management, sound environmental practice and successful delivery of works programs. Main Roads will refer to AS/NZS ISO 14001 through the various RO&DS phases of this proposal to assist with the following –

- pursue continuous improvements in environmental performance;
- minimise risks of environmental non-compliance;
- implement best practice environmental management;
- increase awareness of environmental issues; and
- provide a consistent, transparent and systematic approach to environmental management.

E.2 Environmental Risks

One item of flora of interest has been recorded in the vicinity of the project. There is the possibility several threatened Fauna may be present in the area.

The project site resides in the Perth Groundwater Area and the east side coincides with the Jandakot Public Drinking Water Source Area.

The project therefore may require referral to the Environmental Protection Authority (EPA). If not assessed by the EPA the project may still require a permit to clear native vegetation either through Main Roads State-wide clearing permit CPS 818, or a project specific clearing permit.

In terms of the timeframes required for approval it will be dependent on site assessments and on-ground investigations. If referral to the Commonwealth is required, due to the possible presence of breeding trees, suitable habitat for Black Cockatoos or declared rare flora, it may take approximately 12 to 15 months for approval including surveys.

The project will involve pavement construction in close proximity to over infrastructure whereby the contractor will need to undertake building condition surveys before and after the construction works.

A desktop assessment for the project area and the potential constraints of the proposal were undertaken by viewing ArcGIS shapefiles and reviewing government agency managed databases where necessary. The environmental constraints study area is confined to 2 km radius and heritage constraints is confined to 500 m radius.

The DotE protected matters search tool was used to determine whether the project will impact upon matters of national significance. The results of the protected matters search are provided further below.

Aspect	Evaluation of Project Area
Aboriginal Heritage	Forrest Road (Site ID 3423– Mythological; Stored Data/ Not a Site)
Contamination	Though there are several contaminated sites with the search area, indications these are more than one km from the project site.
Environmentally Sensitive Areas	There is one sensitive area in the north west corner of the project site and one adjacent to the site.
Groundwater	Project area is located within the Perth Groundwater Area.
Heritage (non-indigenous)	A search of ArcGIS shapefiles and Heritage Council and the State Heritage Office’s database indicates no sites of heritage significance within the study area. It is unlikely that this project will impact any heritage sites.
Noise/ Vibration	Works are close to sensitive receptors and will require consultation with nearby residents.
Surface Water/Rivers	The project is located on a Public Drinking Water Surface Area, the Jandakot Underground Water Pollution Control Area.
Wetlands	There are six Multiple Use and three Resource Enhancement wetlands that occur within the study area. The study area also intercepts a Conservation wetland, and one Resource Enhancement wetland.
Reserves / Conservation areas/	The study area intersects a Bush Forever site.

Aspect	Evaluation of Project Area
Fauna	<p>ArcGIS shapefiles identified multiple records of 9 conservation significant fauna within the study area, including:</p> <ul style="list-style-type: none"> • Carnaby's Black Cockatoo - Threatened • Numbat - Threatened • Rainbow Bee-Eater - Protected Under International Agreement • Southern Brown Bandicoot
Flora	<p>There is one Declared Rare Flora within the study area: <i>Caladenia huegelii</i>, located within the construction area.</p>
Ecological Communities	<p>The study area intersects the buffer of one record of Threatened and Priority Ecological Communities (TEC/PECs), which is:</p> <ul style="list-style-type: none"> • Banksia ilicifolia woodlands (Priority 3)
Matters of National Environmental Significance	<p>A search of the DoE Protected Matters Search Tool identified:</p> <ul style="list-style-type: none"> • 2 Nationally Important Wetlands: • 23 listed threatened fauna species, including: <ul style="list-style-type: none"> - Forest Red-tailed Black-Cockatoo - Baudin's Black-Cockatoo - Carnaby's Black-Cockatoo - Chuditch, Western Quoll - Western Ringtail Possum - 10 flora species

Environment studies or assessments required of the project:

- Noise impact review
- Building condition surveys, pre and post construction
- Fauna survey
- Black Cockatoo Habitat Assessment
- Flora assessment
- Vegetation assessment
- Consultation with Department of Water regarding potential impacts to wetlands, lakes and surface water, and the site being located within a Public Drinking Water Source Area (PDWSA).

Weeds of National Significance are known to occur around the project site and the soil is capable of sustaining dieback. Care is to be taken to minimise spread of weeds and pathogens.

E.3 Climate Change

The impacts of climate change relate mainly to the detail design of the structure and road pavement with respect to higher temperatures. These impacts will be considered in the detailed design of the project, should it proceed.

APPENDIX F Reference Reports

The following documents have been used to prepare this business case.

Records Ref	Report / Drawings
D15#412865	Economic Benefit (BCR Analysis)
1532-0112/00 to 1532-0113/00 1532-0114/00 D15#291383 D14#138864 D15#291375	Design Ultimate design Preferred Stage 1 design Safety Barrier Assessment Report Pavement Design Report by Aurecon Pavement Design by Materials Engineering Branch of MRWA
D15#439976 & D15#440003 D15#439913	Cost Estimate Land Cost Cost estimate for Preferred Option
D15#212500 D15#257996 D11#205612	Environmental & Heritage Desktop study by Environment Branch Desktop study by AECOM Supplementary to AECOM Report
D15# 307778, D15#307784 & D15#307787	Land requirements Land Requirement Plans

APPENDIX G Definitions

AM – ante meridiem, before midday.

AM peak – morning 60 minute period of maximum vehicle activity.

BCR – Benefit Cost Ratio.

CPS – Clearing Permit System

EPA – Environmental Protection Authority

FTE – Full Time Employee

ITS - Intelligent Transport Systems

KPI – Key Performance Indicator

LOS – Level of Service

PDWSA – Public Drinking Water Source Area

PM – post meridiem, after midday.

PM peak – afternoon 60 minute period of maximum vehicle activity.

PSP – Principle Shared Path. Combined cyclist and pedestrian facility.

PTA – Public Transport Authority

ROM24 – Regional Operations Model, 24 hour.

RAV- Restricted Access Vehicles

SCATS – Sydney Coordinated Adaptive Traffic System.

SIDRA- Signalised & unsignalised Intersection Design & Research Aid

APPENDIX H Maps, Plans or Photos

