From:	Tom K Orr
To:	Sarah T Sanders; CN=Trudy M Whitlow/OU=SouthEast/O=QMR/C=Au@QDOT; Andrew E Armstrong
Cc:	SCR Land Management; TMR MDP
Subject:	Seeking your comments on the Gold Coast Quarry EIS by Friday 31 May 2013
Date:	Wednesday, 24 April 2013 9:19:35 AM
Attachments:	draft DTMR EIS Submission Template inc. examples Oct 12.doc PD&O (SC) comments on Gold Coast quarry project draft EIS Mar 13.doc

Hi Sarah, Trudy and Andrew,

The EIS for the Gold Coast Quarry project will be released this weekend for public comment. Copies of the CD of the EIS are in the internal mail or have already been delivered. It will also likely be available on the Boral website but I do not have the address at this time.

Comments on the EIS should be sent to PPB by cob on Friday 31 May 2013. Please provide comments in the attached submission template and send them to me via email with a cc to mdp@tmr.qld.gov.au. If you have no comments, a short email to that effect would be appreciated.

TMR recently undertook a preliminary review of the RIA in the draft EIS and a copy of the comments are provided below (extract of email and comments table).

- The draft EIS and its included Road Impact Assessment (RIA) appears to include the required elements for an RIA prepared in accordance with the TMR *Guidelines for Assessment of Road Impacts of Development 2006* (GARID). However, the region has noted and is requesting clarification about quite a number of detailed technical matters, including apparent inconsistencies, further explanation of the methodologies used and justification for various assumptions and conclusions.
- A number of included elements appear to be incomplete and/or the detailed information on which the EIS findings are based are only summarised and as a result have not been reviewed by TMR.
- Additional work is required on assessing road safety risk and identifying any required mitigation measures.
- Further information or clarification about the matters detailed in the attached submission is required for TMR to adequately assess the impacts of the proposal and determine the adequacy of the proponent's proposed mitigation measures and the need for any additional mitigation measures.
- The proponents and their consultants are strongly encouraged to discuss these matters with TMR. Details for TMR contact officers are provided in the attachment.
- As previously discussed, TMR would generally only require a Road-use Management Plan (RMP) to be prepared by the proponent and approved by TMR after the granting of project approval but before commencement of project construction. However, it would be appropriate for the EIS to identify any matters likely to be included in an RMP (haul routes, hours of operation, safety initiatives and the like). TMR has a guideline for the preparation of RMPs which is attached.
- Similarly, Traffic Management Plans (TMP) would be a requirement of any TMR approvals for any works or activities in the State-controlled road corridor, and would only be required when these approvals are obtained just prior to the commencement of construction.

If you have any questions in relation to this request, please give me a call.

Cheers

Tom Orr
Principal Planner (Development Outcomes) | Policy and Planning Branch
Policy, Planning and Investment Division | Department of Transport and Main Roads

Floor 12 | Brisbane - Terrica Place | 140 Creek Street | Brisbane Qld 4000
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E: tom.k.orr@tmr.qld.gov.au
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Attachment #
Queensland Department of Transport and Main Roads comment/requirements re:
Draft Environmental Impact Statement (EIS) – xxxxxx xxxxx project

Program Delivery & Operations Division			
Name:	Ms xxxxx xxxxx (Corridor Management & Operations), Program Delivery & Operations Division		
Address:	PO Box xxxx, xxxxx Qld Mail Centre 4xxx	**Contact:**	Mr xxxxx xxxxx, Senior Engineer, (07) xxxx xxxx

Section	Describe the issue [Omission/lack of clarity/incorrectness]	Additional information/ clarification/correction required	Reason for requirement/ other related sections or level of detail required
[The exact reference to text in the EIS which is the issue of concern]	Describe the specific problem or issue. Is the information insufficient, unclear or incorrect? Be specific and concise. State why the issue must be resolved i.e what information is required and why that information is important. Ideally, issues should refer to requirements in the Terms of Reference e.g to provide information/ undertake impact assessment or propose impact mitigation strategies. STOP PRESS: new Notes in black have been added to columns 2 and 3 >> with the change of government and Coordinator-General.	This section should detail the additional information/ clarification/correction required to adequately address the issue you raised. Again, be reasonable & relevant and as specific & concise as possible. (Remember proponents don't actually "correct"/ rewrite EISs, rather undertake additional assessment or provide clarity when preparing their Supplementary EISs). *Note: The EIS document is not formally re-written or updated, rather a Supplementary EIS is generally prepared. Therefore, rather than submitting comments requiring re-wording of sections of the EIS, require the proponent to reflect your EIS comments/ requirements in the S/EIS or any subsequent environmental impact assessment document or analysis/reporting.)*	[This section is optional and should only be used to briefly add additional points to be considered e.g 1) the reason for the requirement, such as the head of power or policy, 2) the level of detail required when providing additional information in the S/EIS, 3) highlighting other sections which should be cross-referenced e.g with inter-related or cumulative impacts or 4) other key issues which should be considered when preparing the S/EIS. (More detailed information can be subsequently raised in consultation with the consultants/ proponents). *Note: latest advice from the new Coordinator-General is (a) there must be closer/ongoing consultation between proponents, CoG project officers and agency internal stakeholders; and (b) CoG wants the focus on 1-2 KEY DELIVERABLES (any potential project "show-stoppers") and expects minor details will be routinely dealt with between agencies & proponents/ consultants.*
Example: Page 17 Section 3 "Potential Impacts and Mitigation Measures" Subsection 3.2 "Transport"	The section in the EIS does not address requirements of section 1.4 of the Terms of Reference for the EIS to assess impacts and estimate costs of alternatives for modifying infrastructure to mitigate impacts on existing infrastructure, particularly at the following locations: the intersection of X and Y Hwys, the rail loading facility and the entrance to the port precinct.	The proponent should detail findings of impact assessment in accordance with DTMR's "Guidelines for Assessing Impacts of Development" 2006.. and provide alternative solutions and broad costings in accordance with DTMR's "Design and Construction manual" 200?	The impact assessment must assess impacts at both the regional and local level, including cumulative impacts and considering inter-modal alternatives. This information is required to ensure the capacity, safety and efficiency of transport corridors is maintained at existing, adequate levels, in accordance with the provisions of the Transport Infrastructure Act 1994

Attachment #
Queensland Department of Transport and Main Roads comment/requirements re:
Draft Environmental Impact Statement (EIS) – xxxxxx xxxxx project

Example: Page xx Section 5.10 Transport Subsection 5.10.2 Transport tasks and routes	This section in the EIS does not sufficiently describe the traffic generation/ background traffic information for the project during construction and operation, in a format that is easily identified by DTMR systems.	For ease of understanding for both background and project-generated traffic, the EIS should provide traffic data in a format similar to ARMIS traffic data that can be provided by Transport and Main Roads. This includes Average Annual Daily Traffic (AADT) total and also provided separately for each direction of traffic flow, and percentage of vehicle by class – light vehicle, heavy vehicle, short vehicle, truck or bus, articulated vehicle and roadtrain and so on in line with the Austroads Vehicle Classes.	In subsequent iterations of the road impact assessment, the proponent is encouraged to provide traffic and other transport data based on the attached proforma (an Excel spreadsheet). This will help ensure all key estimated transport information is consistently provided. This will also allow cumulative impacts of major development projects to be more easily assessed and addressed. (If there is difficulty in opening the spreadsheet, please contact Senior Advisor (Development Outcomes) Planning Mgt Bch, Brisbane ph 3146 1812 who will separately forward it). This information is required for ease of identifying and comparing with our current data.  P:\1 PP&MP\DTMR Traffic generation inf

The department has completed a preliminary review of the draft EIS however given the time constraints, the department has not been able to comment on all the issues or complete a detailed assessment. Therefore the comments below were established based on a preliminary and brief scan of document only. It is anticipated that during the Final EIS assessment the department will complete a full assessment and note all responses to their comments below.

Comments on Pavement Impacts / Report

1) The department requests a pavement impact assessment in accordance with Chapter 5 of GARID. GARID can be located on the TMR website, Business and industry, Technical Standards and publication link, http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Guidelines-for-assessment-of-road-impacts-of-development.aspx.

2) The proposed pavement contribution is $29,000. Please provide justification and reasoning as to how the figure was calculated, this should be included in the pavement impact assessment.

3) The report summary provided Pavement loadings, however the department requires more detail to complete its assessment. Please provide more detail on the development of ESA's, including formulas and computations unloaded and loaded ESA's.

4) There are inconsistencies between Section 4.9.1.7 which states 81 FTE staff but in Table 7.7 staff movements are shown as 62 is vehicle occupancy of 1.3 FTE appropriate, please clarify, which is correct?

5) When Annual tonnage divided by average payload is calculated numbers in tables 7.5 and 7.6 are inconsistent, please clarify and provide a consistent response.

6) Please clarify the reduced efficiency of the payload in Section 7.3.2 and 7.3.3? For example, 75% or 95% payload only in trucks, please clarify why the payload is not calculated at 100%. Furthermore, if 32 tonne capacity has been calculated at 24 tonne payload the department requires a technical justification not a worded response /comment.

7) The tonnage in Table Construction 3a is 4 million tonne. Please confirm that this is this figure correct figure and provide further clarification as to what the timing is and for what stages of the development. For example is it per annum tonnage, construction phase, etc.

8) Section 7.4 indicates that no haulage movements occur between 5:00pm and 6:00pm, however these hours are included in the haulage profile. Please identify that the operating hours align with the haulage hours. These additional ESA's should be redistributed over the actual normalised hours of operation, for example, actual hours of operation will be 6:30 am to 5:00 pm 10.5 hours not 12 hours.

Not Relevant

The department encourages the consultant's traffic engineers to be in contact with the department's engineers if they require clarification on any comments above. Ben Tang (Principal Engineer) and Rob Ebbstein (Senior Designer) are the primary contacts for the above comments; they can be contacted via phone on 5596 9586.

From: Sch 4, Item 6 - Disclosing personal information
To: Sch 4, Item 6 @cardno.com.au
Cc: Sch 4, Item 6 Sarah T Sanders; Sch 4, Item 6
Subject: GCQ - Analysis (STAGE 2) Roundabout and Supporting Calcs (TMR030)
Attachments: TMR030 Analysis (STAGE 2) Roundabout and Supporting Calcs.pdf

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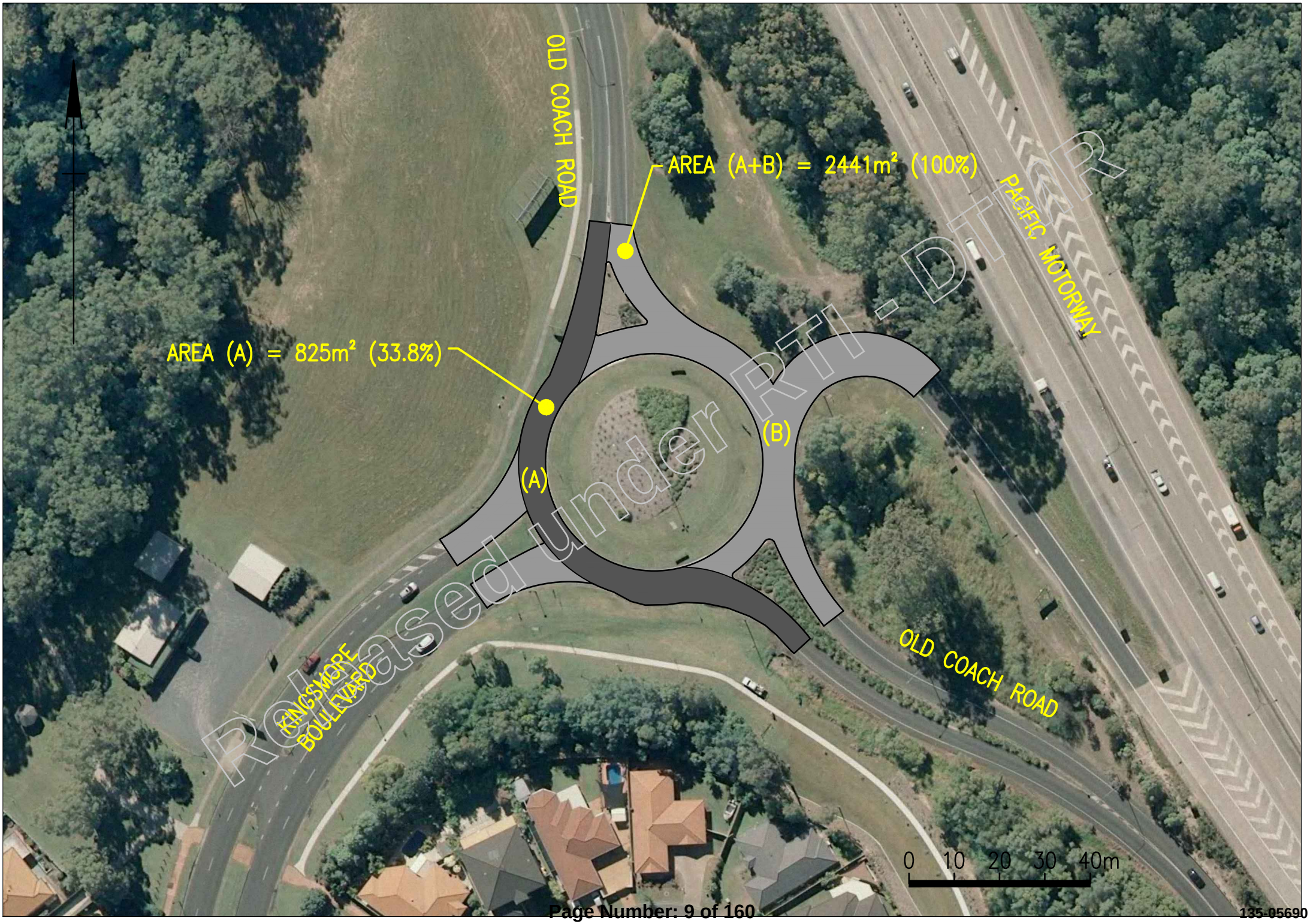
Hell Sch 4, Item 6

As requested in our telephone conversation this morning, **attached** is the supporting information used as INPUT for the round-a-bout ESA calculation comparison provided to Scott via email earlier today.

As discussed, all future requests for information and/or clarification should be made through TMR.

Regards,

Sch 4, Item 6
NEWELL CONSULTING ENGINEERS
Level 4, HQ@Robina Building
58 Riverwalk Avenue, Robina
PO Box 4920, Robina Town Centre Q 4230
T
M Sch 4, Item 6
W: newellconsulting.com.au



Section A (Old Coach Road Roundabout)

Road Section 12A - Pacific Motorway
Site: Round-a-bout Kingsmore Boulevard and Old Coach Road

Design Period	20 years
Current Year AADT (AM Peak x 10)	10990
%HV	3.00%
ESA/HV (Fully loaded Class 2)	3
Compound Growth Rate (PIA adopted value):	3.00%
Days per Year	365

BACKGROUND ESA:

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	TOTAL
Background AADT	12009.07	12369.34	12740.42	13122.63	13516.31	13921.80	14339.46	14769.64	15212.73	15669.11	16139.19	16623.36	17122.06	17635.72	18164.80	18709.74	19271.03	19849.16	20444.64	21057.98	21689.72	
Background ESA	3.94E+05	4.06E+05	4.19E+05	4.31E+05	4.44E+05	4.57E+05	4.71E+05	4.85E+05	5.00E+05	5.15E+05	5.30E+05	5.46E+05	5.62E+05	5.79E+05	5.97E+05	6.15E+05	6.33E+05	6.52E+05	6.72E+05	6.92E+05	7.13E+05	1.13E+07

GCQ TO WBQ:

No. of Days in a Year:	365
Fleet Proportion (Tandem Rear Axle Truck):	0%
Fleet Proportion (Tri Rear Axle Semi):	75%
Fleet Proportion (Tandem Rear Axle Truck and Quad Dog):	25%
Tandem Rear Axle Truck (Theoretical Capacity (t)):	13
Tri Rear Axle Semi (Theoretical Capacity (t)):	25
Tandem Rear Truck and Quad Dog (Theoretical Capacity (t)):	32
Tandem Rear Axle Truck (ESA/HV - Loaded):	3.56
Tri Rear Axle Semi (ESA/HV - Loaded):	4.93
Tandem Rear Truck and Quad Dog (ESA/HV - Loaded):	7.64
Annual Tonnage:	400,000
Split Adjustment Factor Going along Off-ramp:	100%

Development ESA:

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Development ESA (Tandem Rear Axle Truck):	-	-	-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Development ESA (Tri Rear Axle Semi):	-	-	-	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04
Development ESA (Tandem Rear Truck and Quad Dog):	-	-	-	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04
TOTAL Development ESA	-	-	-	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04

CHANGE IN ESA:

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
% ESA	-	-	-	19.26%	18.70%	18.16%	17.63%	17.11%	16.62%	16.13%	15.66%	15.21%	14.76%	14.33%	13.92%	13.51%	13.12%	12.73%	12.36%	12.00%	11.65%

GCQ TO EXTERNAL

No. of Days in a Year:	365
Fleet Proportion (Tandem Rear Axle Truck):	10%
Fleet Proportion (Tri Rear Axle Semi):	5%
Fleet Proportion (Tandem Rear Axle Truck and Quad Dog):	85%
Tandem Rear Axle Truck (Average Capacity (t)):	13
Tri Rear Axle Semi (Average Capacity (t)):	25
Tandem Rear Truck and Quad Dog (Average Capacity (t)):	32
Tandem Rear Axle Truck (ESA/HV - Loaded):	3.56
Tri Rear Axle Semi (ESA/HV - Loaded):	4.93
Tandem Rear Truck and Quad Dog (ESA/HV - Loaded):	7.64
Annual Tonnage:	1600000
Split Adjustment Factor Going along Off-ramp:	100%

Development ESA:

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Development ESA (Tandem Rear Axle Truck):	-	-	-	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04
Development ESA (Tri Rear Axle Semi):	-	-	-	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04
Development ESA (Tandem Rear Truck and Quad Dog):	-	-	-	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05
TOTAL Development ESA	-	-	-	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05

CHANGE IN ESA:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
% ESA	-	-	-	89.15%	86.55%	84.03%	81.58%	79.21%	76.90%	74.66%	72.48%	70.37%	68.32%	66.33%	64.40%	62.53%	60.70%	58.94%	57.22%	55.55%	53.94%

COMBINED GCQ TO WBQ/EXTERNAL

TOTAL DEVELOPMENT/BACKGROUND ESA (2015-2035):

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	TOTAL
ESA:	3.94E+05	4.06E+05	4.19E+05	8.98E+05	9.11E+05	9.25E+05	9.38E+05	9.53E+05	9.67E+05	9.82E+05	9.97E+05	1.01E+06	1.03E+06	1.05E+06	1.06E+06	1.08E+06	1.10E+06	1.12E+06	1.14E+06	1.16E+06	1.18E+06	1.97E+07

COMBINED CHANGE IN ESA:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
% ESA	-	-	-	108.41%	105.25%	102.19%	99.21%	96.32%	93.51%	90.79%	88.15%	85.58%	83.09%	80.67%	78.32%	76.04%	73.82%	71.67%	69.58%	67.56%	65.59%

REHABILITATED PAVEMENT DESIGN LIFE COMPARISON

Pavement Analysis Input	
Existing Pavement Year Constructed	1996
Existing Pavement Design ESA	6.20E+06
Existing Pavement Design Life	20
Existing Pavement Age at 2013	17
Background ESA to 2013	5.27E+06
Residual ESA of Existing Pavement at 2013	9.30E+05
Forecast ESA of Existing Pavement for 2013-2015	1.15E+06
Residual ESA in 2015	-2.19E+05
Total Background ESA 2015 - 2035	1.13E+07
Total Combined ESA 2015 - 2035	1.97E+07

Therefore, pavement life reached during 2015

20 Year Rehabilitation Design Life - Background Only

Residual Capacity of Rehabilitated Pavement (Background ESA):

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Background ESA	1.07E+07	1.03E+07	9.87E+06	9.44E+06	9.00E+06	8.54E+06	8.07E+06	7.59E+06	7.09E+06	6.57E+06	6.04E+06	5.49E+06	4.93E+06	4.35E+06	3.76E+06	3.14E+06	2.51E+06	1.86E+06	1.18E+06	4.93E+05	-2.19E+05

Residual Capacity of Rehabilitated Pavement (With Development ESA):

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Residual ESA	1.07E+07	1.03E+07	9.87E+06	8.98E+06	8.06E+06	7.14E+06	6.20E+06	5.25E+06	4.28E+06	3.30E+06	2.30E+06	1.29E+06	2.59E+05	-7.88E+05	-1.85E+06	-2.93E+06	-4.03E+06	-5.15E+06	-6.29E+06	-7.45E+06	-8.63E+06

20 Year Rehabilitation Design Life - With Development

Residual Capacity of Rehabilitated Pavement (With Development ESA):

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Residual ESA	1.91E+07	1.87E+07	1.83E+07	1.74E+07	1.65E+07	1.56E+07	1.46E+07	1.37E+07	1.27E+07	1.17E+07	1.07E+07	9.70E+06	8.67E+06	7.62E+06	6.56E+06	5.48E+06	4.38E+06	3.26E+06	2.12E+06	9.60E+05	-2.19E+05

COST OF REHABILITATION

Option 1 -Rehabilitation Cost (Area A Only)	
Background Only (20 Year Design Life)	$167,247.63
With Development (20 Year Design Life)	$181,734.38
Difference Between Scenarios	$14,487.50

Option 2 -Rehabilitation Cost (Areas A + B)	
Background Only (20 Year Design Life)	$427,695.13
With Development (20 Year Design Life)	$460,435.88
Difference Between Scenarios	$32,740.75

CIRCLY Version 5.0u (8 April 2013)

Job Title: TMR030 Gold Coast Quarry PIA Review

Damage Factor Calculation

Assumed number of damage pulses per movement:
One pulse per axle (i.e. use NROWS)

Traffic Spectrum Details:

ID: Link X-R Title: Old Coach Rd and Exit 85 Off-Ramp Roundabout

Load No.	Load ID	Movements
1	ESA75-Full	1.13E+07

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA75-Full	SA750-Full	Vertical Force	92.1	0.75	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA75-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA75-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA75-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA75-Full	1	1965.0	0.0	1.00E+00	0.00

Layout of result points on horizontal plane:
Xmin: 0 Xmax: 165 Xdel: 165
Y: 0

Details of Layered System:

ID: Link X-R Title: Old Coach Rd and Exit 85 Off-Ramp Roundabout

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	DG14-A5S-3	Iso.	1.25E+03	0.40			
2	rough	DG20-C320	Iso.	1.84E+03	0.40			
3	rough	Cem500A	Aniso.	5.00E+02	0.35	3.70E+02	2.50E+02	0.35
4	rough	Sub_CBR5	Aniso.	5.00E+01	0.45	3.45E+01	2.50E+01	0.45

Performance Relationships:

Layer No.	Location	Performance ID	Component	Perform. Constant	Perform. Exponent	Traffic Multiplier
1	bottom	DG14-A5S-3	ETH	0.005125	5.000	1.100
2	bottom	DG20-C320	ETH	0.004452	5.000	1.100
4	top	Sub 2004	EZZ	0.009300	7.000	1.600

Reliability Factors:
Project Reliability: Austroads 97.5%

Layer No.	Reliability Factor	Material Type
1	0.67	Asphalt
2	0.67	Asphalt
4	1.00	Subgrade (Austroads 2004)

Results:

Layer No.	Thickness	Material ID	Load ID	Critical Strain	CDF
1	50.00	DG14-A5S-3	ESA75-Full	-2.10E-05	2.16E-05
2	150.00	DG20-C320	ESA75-Full	-1.47E-04	7.36E-01

3	260.00	Cem500A		n/a	n/a
4	0.00	Sub_CBR5	ESA75-Full	4.47E-04	1.07E-02

CIRCLY Version 5.0u (8 April 2013)

Job Title: TMR030 Gold Coast Quarry PIA Review

Damage Factor Calculation

Assumed number of damage pulses per movement:
One pulse per axle (i.e. use NROWS)

Traffic Spectrum Details:

ID: Link X-R Title: Old Coach Rd and Exit 85 Off-Ramp Roundabout

Load No.	Load ID	Movements
1	ESA75-Full	1.97E+07

Details of Load Groups:

Load No.	Load ID	Load Category	Load Type	Radius	Pressure/ Ref. stress	Exponent
1	ESA75-Full	SA750-Full	Vertical Force	92.1	0.75	0.00

Load Locations:

Location No.	Load ID	Gear No.	X	Y	Scaling Factor	Theta
1	ESA75-Full	1	-165.0	0.0	1.00E+00	0.00
2	ESA75-Full	1	165.0	0.0	1.00E+00	0.00
3	ESA75-Full	1	1635.0	0.0	1.00E+00	0.00
4	ESA75-Full	1	1965.0	0.0	1.00E+00	0.00

Layout of result points on horizontal plane:
Xmin: 0 Xmax: 165 Xdel: 165
Y: 0

Details of Layered System:

ID: Link X-R Title: Old Coach Rd and Exit 85 Off-Ramp Roundabout

Layer No.	Lower i/face	Material ID	Isotropy	Modulus (or Ev)	P.Ratio (or vvh)	F	Eh	vh
1	rough	DG14-A5S-3	Iso.	1.25E+03	0.40			
2	rough	DG20-C320	Iso.	1.84E+03	0.40			
3	rough	Cem500A	Aniso.	5.00E+02	0.35	3.70E+02	2.50E+02	0.35
4	rough	Sub_CBR5	Aniso.	5.00E+01	0.45	3.45E+01	2.50E+01	0.45

Performance Relationships:

Layer No.	Location	Performance ID	Component	Perform. Constant	Perform. Exponent	Traffic Multiplier
1	bottom	DG14-A5S-3	ETH	0.005125	5.000	1.100
2	bottom	DG20-C320	ETH	0.004452	5.000	1.100
4	top	Sub_2004	EZZ	0.009300	7.000	1.600

Reliability Factors:
Project Reliability: Austroads 97.5%

Layer No.	Reliability Factor	Material Type
1	0.67	Asphalt
2	0.67	Asphalt
4	1.00	Subgrade (Austroads 2004)

Results:

Layer No.	Thickness	Material ID	Load ID	Critical Strain	CDF
1	50.00	DG14-A5S-3	ESA75-Full	-2.41E-05	7.51E-05
2	170.00	DG20-C320	ESA75-Full	-1.34E-04	8.14E-01
3	260.00	Cem500A		n/a	n/a
4	0.00	Sub_CBR5	ESA75-Full	4.10E-04	1.01E-02

Work Package : New All Items - All Items

Item Number	Description	Unit of Measure	Quantity	Unit Rate ($)	Amount ($)
MRS02 Oct 10					
	PROVISION FOR TRAFFIC				
1201.01	Provision for traffic (MRS02 Oct 10)	lump sum			$25,000
1202.01	Traffic Management Plan (MRS02 Oct 10)	lump sum			$6,500
1203.01	Roadwork signing records (MRS02 Oct 10)	lump sum			$1,500
MRS11 Oct 10					
	SPRAYED BITUMINOUS SURFACING (EXCLUDING EMULSION)				
5141.01	Sprayed bituminous surfacing, including supply of binder, including supply of additives, including supply of cover aggregates, [full-width], refer to Clause 2 of Annexure MRTS11.1 (MRS11 Oct 10)	m2			$6,600.00
MRS28 Jun 09					
	CONTRACTOR'S SITE FACILITIES AND CAMP				
1101.01	Contractor's site facilities (MRS28 Jun 09)	lump sum			$10,000
MRS30 Oct 10					
	PREPARATION OF THE EXISTING SURFACE				
5401.01	Preparation of the existing surface (MRS30 Oct 10)	m2			$825
5404.01	Tack coat [0.2] litres/m2, residual bitumen (MRS30 Oct 10)	litre			$660
9551S	Profile existing pavement (200mm depth)	m2			$12,375
	DENSE GRADED ASPHALT				
5503.01	Dense graded asphalt, DG14 mix (MRS30 Oct 10)	tonne			$26,297
5504.01	Dense graded asphalt, DG20 mix (MRS30 Oct 10)	tonne			$71,156
MRS45 Aug 12					
	LINE MARKING				
6301.01	Spotting only for longitudinal lines (MRS45 Aug 12)	m			$65
6316.01	Lane line, broken, 100 mm wide, [3000] mm line length, [9000] mm gap length, colour [white], material [paint] (MRS45 Aug 12)	m			$0
6319.01	Edge line, 150 mm wide, colour [white], material [paint] (MRS45 Aug 12)	m			$134
6321.01	Continuity line, 200 mm wide, colour [white], material [paint] (MRS45 Aug 12)	m			$27.00
6323.01	Outline, 150 mm wide, colour [colour], material [material] (MRS45 Aug 12)	m			$187.50
6332.01	Transverse lines (diagonal and chevron markings,parking areas and kerb markings), colour [white], material [thermoplastic] (MRS45 Aug 12)	m2			$0.00
	RAISED PAVEMENT MARKERS				
6351.01	Retroreflective raised pavement markers (MRS45 Aug 12)	each			$285.00
6355.01	Removal of existing raised pavement markers, by [method of removal] (MRS45 Aug 12)	each			$135.00
MRS51 Apr 11					
	ENVIRONMENTAL MANAGEMENT				
1331.01	Develop Environmental Management Plan (Construction) (MRS51 Apr 11)	lump sum			$1,500
1332.01	Implement Environmental Management Plan (Construction) (MRS51 Apr 11)	lump sum			$4,000
		Work Package Total :			**$167,247.03**

Work Package : New All Items - All Items

Item Number	Description	Unit of Measure	Quantity	Unit Rate ($)	Amount ($)
MRS02 Oct 10					
	PROVISION FOR TRAFFIC				
1201.01	Provision for traffic (MRS02 Oct 10)	lump sum			$27,500
1202.01	Traffic Management Plan (MRS02 Oct 10)	lump sum			$6,500
1203.01	Roadwork signing records (MRS02 Oct 10)	lump sum			$1,500
MRS11 Oct 10					
	SPRAYED BITUMINOUS SURFACING (EXCLUDING EMULSION)				
5141.01	Sprayed bituminous surfacing, including supply of binder, including supply of additives, including supply of cover aggregates, [full-width], refer to Clause 2 of Annexure MRTS11.1 (MRS11 Oct 10)	m2			$6,600.00
MRS28 Jun 09					
	CONTRACTOR'S SITE FACILITIES AND CAMP				
1101.01	Contractor's site facilities (MRS28 Jun 09)	lump sum			$12,500
MRS30 Oct 10					
	PREPARATION OF THE EXISTING SURFACE				
5401.01	Preparation of the existing surface (MRS30 Oct 10)	m2			$825
5404.01	Tack coat [0.2] litres/m2, residual bitumen (MRS30 Oct 10)	litre			$660
9551S	Profile existing pavement (200mm depth)	m2			$12,375
	DENSE GRADED ASPHALT				
5503.01	Dense graded asphalt, DG14 mix (MRS30 Oct 10)	tonne			$26,297
5504.01	Dense graded asphalt, DG20 mix (MRS30 Oct 10)	tonne			$80,644
MRS45 Aug 12					
	LINE MARKING				
6301.01	Spotting only for longitudinal lines (MRS45 Aug 12)	m			$65
6316.01	Lane line, broken, 100 mm wide, [3000] mm line length, [9000] mm gap length, colour [white], material [paint] (MRS45 Aug 12)	m			$0
6319.01	Edge line, 150 mm wide, colour [white], material [paint] (MRS45 Aug 12)	m			$134
6321.01	Continuity line, 200 mm wide, colour [white], material [paint] (MRS45 Aug 12)	m			$27.00
6323.01	Outline, 150 mm wide, colour [colour], material [material] (MRS45 Aug 12)	m			$187.50
6332.01	Transverse lines (diagonal and chevron markings,parking areas and kerb markings), colour [white], material [thermoplastic] (MRS45 Aug 12)	m2			$0.00
	RAISED PAVEMENT MARKERS				
6351.01	Retroreflective raised pavement markers (MRS45 Aug 12)	each			$285.00
6355.01	Removal of existing raised pavement markers, by [method of removal] (MRS45 Aug 12)	each			$135.00
MRS51 Apr 11					
	ENVIRONMENTAL MANAGEMENT				
1331.01	Develop Environmental Management Plan (Construction) (MRS51 Apr 11)	lump sum		$1,500.00	$1,500
1332.01	Implement Environmental Management Plan (Construction) (MRS51 Apr 11)	lump sum		$4,000.00	$4,000
		Work Package Total :			**$181,734.53**

Work Package : New All Items - All Items

Item Number	Description	Unit of Measure	Quantity	Unit Rate ($)	Amount ($)
MRS02 Oct 10					
	PROVISION FOR TRAFFIC				
1201.01	Provision for traffic (MRS02 Oct 10)	lump sum			$65,000
1202.01	Traffic Management Plan (MRS02 Oct 10)	lump sum			$6,500
1203.01	Roadwork signing records (MRS02 Oct 10)	lump sum			$1,500
MRS11 Oct 10					
	SPRAYED BITUMINOUS SURFACING (EXCLUDING EMULSION)				
5141.01	Sprayed bituminous surfacing, including supply of binder, including supply of additives, including supply of cover aggregates, [full-width], refer to Clause 2 of Annexure MRTS11.1 (MRS11 Oct 10)	m2			$19,528.00
MRS28 Jun 09					
	CONTRACTOR'S SITE FACILITIES AND CAMP				
1101.01	Contractor's site facilities (MRS28 Jun 09)	lump sum			$15,000
MRS30 Oct 10					
	PREPARATION OF THE EXISTING SURFACE				
5401.01	Preparation of the existing surface (MRS30 Oct 10)	m2			$2,441
5404.01	Tack coat [0.2] litres/m2, residual bitumen (MRS30 Oct 10)	litre			$1,953
9551S	Profile existing pavement (200mm depth)	m2			$36,615
	DENSE GRADED ASPHALT				
5503.01	Dense graded asphalt, DG14 mix (MRS30 Oct 10)	tonne			$73,230
5504.01	Dense graded asphalt, DG20 mix (MRS30 Oct 10)	tonne			$196,806
MRS45 Aug 12					
	LINE MARKING				
6301.01	Spotting only for longitudinal lines (MRS45 Aug 12)	m			$194
6316.01	Lane line, broken, 100 mm wide, [3000] mm line length, [9000] mm gap length, colour [white], material [paint] (MRS45 Aug 12)	m			$30
6319.01	Edge line, 150 mm wide, colour [white], material [paint] (MRS45 Aug 12)	m			$385
6321.01	Continuity line, 200 mm wide, colour [white], material [paint] (MRS45 Aug 12)	m			$70.50
6323.01	Outline, 150 mm wide, colour [colour], material [material] (MRS45 Aug 12)	m			$453.00
6332.01	Transverse lines (diagonal and chevron markings,parking areas and kerb markings), colour [white], material [thermoplastic] (MRS45 Aug 12)	m2			$2,070.00
	RAISED PAVEMENT MARKERS				
6351.01	Retroreflective raised pavement markers (MRS45 Aug 12)	each			$285.00
6355.01	Removal of existing raised pavement markers, by [method of removal] (MRS45 Aug 12)	each			$135.00
MRS51 Apr 11					
	ENVIRONMENTAL MANAGEMENT				
1331.01	Develop Environmental Management Plan (Construction) (MRS51 Apr 11)	lump sum		$1,500.00	$1,500
1332.01	Implement Environmental Management Plan (Construction) (MRS51 Apr 11)	lump sum		$4,000.00	$4,000
		Work Package Total :			**$427,695.13**

Work Package : New All Items - All Items

Item Number	Description	Unit of Measure	Quantity	Unit Rate ($)	Amount ($)
MRS02 Oct 10					
	PROVISION FOR TRAFFIC				
1201.01	Provision for traffic (MRS02 Oct 10)	lump sum		$65,000.00	$65,000
1202.01	Traffic Management Plan (MRS02 Oct 10)	lump sum		$6,500.00	$6,500
1203.01	Roadwork signing records (MRS02 Oct 10)	lump sum		$1,500.00	$1,500
MRS11 Oct 10					
	SPRAYED BITUMINOUS SURFACING (EXCLUDING EMULSION)				
5141.01	Sprayed bituminous surfacing, including supply of binder, including supply of additives, including supply of cover aggregates, [full-width], refer to Clause 2 of Annexure MRTS11.1 (MRS11 Oct 10)	m2			$19,528.00
MRS28 Jun 09					
	CONTRACTOR'S SITE FACILITIES AND CAMP				
1101.01	Contractor's site facilities (MRS28 Jun 09)	lump sum		$20,000.00	$20,000
MRS30 Oct 10					
	PREPARATION OF THE EXISTING SURFACE				
5401.01	Preparation of the existing surface (MRS30 Oct 10)	m2			$2,441
5404.01	Tack coat [0.2] litres/m2, residual bitumen (MRS30 Oct 10)	litre			$1,953
9551S	Profile existing pavement (200mm depth)	m2			$36,615
	DENSE GRADED ASPHALT				
5503.01	Dense graded asphalt, DG14 mix (MRS30 Oct 10)	tonne			$73,230
5504.01	Dense graded asphalt, DG20 mix (MRS30 Oct 10)	tonne			$223,046
MRS45 Aug 12					
	LINE MARKING				
6301.01	Spotting only for longitudinal lines (MRS45 Aug 12)	m			$194
6316.01	Lane line, broken, 100 mm wide, [3000] mm line length, [9000] mm gap length, colour [white], material [paint] (MRS45 Aug 12)	m			$30
6319.01	Edge line, 150 mm wide, colour [white], material [paint] (MRS45 Aug 12)	m			$385
6321.01	Continuity line, 200 mm wide, colour [white], material [paint] (MRS45 Aug 12)	m			$70.50
6323.01	Outline, 150 mm wide, colour [colour], material [material] (MRS45 Aug 12)	m			$453.00
6332.01	Transverse lines (diagonal and chevron markings,parking areas and kerb markings), colour [white], material [thermoplastic] (MRS45 Aug 12)	m2			$2,070.00
	RAISED PAVEMENT MARKERS				
6351.01	Retroreflective raised pavement markers (MRS45 Aug 12)	each			$285.00
6355.01	Removal of existing raised pavement markers, by [method of removal] (MRS45 Aug 12)	each			$135.00
MRS51 Apr 11					
	ENVIRONMENTAL MANAGEMENT				
1331.01	Develop Environmental Management Plan (Construction) (MRS51 Apr 11)	lump sum		$2,000.00	$2,000
1332.01	Implement Environmental Management Plan (Construction) (MRS51 Apr 11)	lump sum		$5,000.00	$5,000
		Work Package Total :			**$460,435.88**

From: Sch 4, Item 6
To: Sch 4, Item 6@cardno.com.au
Cc: Sarah T Sanders; Sch 4, Item 6
Subject: RE: GCQ - TMR"s Input to Adopted Roughness Intervention Levels (TMR030)
Attachments: image001.gif

Hello Sch 4, Item 6
As requested Sarah forwarded your below email to me. Can you please also provide:

1. Confirmation that the data is from the 2011-2012 financial year as some of the dates appear to be from 2010?
2. Documentation (i.e. spreadsheet or analysis/summary/calculation process) how your team arrived at the 75% loading from the raw data?
3. Confirm that you have received the ESA calculation information via email?

Regards,

Sch 4, Item 6
NEWELL CONSULTING ENGINEERS
Level 4, HQ@Robina Building
58 Riverwalk Avenue, Robina
PO Box 4920, Robina Town Centre Q 4230
T
M Sch 4, Item 6
W: newellconsulting.com.au

----- Forwarded by Sarah T Sanders/SouthEast/QMR/Au on 20/08/2013 08:34 AM -----

From: Sch 4, Item 6@cardno.com.au>
To: "Sarah.T.Sanders@tmr.qld.gov.au" <Sarah.T.Sanders@tmr.qld.gov.au>
Cc: "alan.j.stone@tmr.qld.gov.au" <alan.j.stone@tmr.qld.gov.au>, Sch 4, Item 6@cardno.com.au>, "Greg.Polkinghorne@coordinatorgeneral.qld.gov.au" <Greg.Polkinghorne@coordinatorgeneral.qld.gov.au>, Sch 4, Item 6" Sch 4, Item 6@cardno.com.au>, "Mick.Lord@coordinatorgeneral.qld.gov.au" <Mick.Lord@coordinatorgeneral.qld.gov.au>, Sch 4, Item 6@boral.com.au>, "Raymond.Barkmeyer@coordinatorgeneral.qld.gov.au" <Raymond.Barkmeyer@coordinatorgeneral.qld.gov.au>, "tom.k.orr@tmr.qld.gov.au" <tom.k.orr@tmr.qld.gov.au>, Sch 4, Item 6 Sch 4, Item 6@cardno.com.au>
Date: 19/08/2013 05:02 PM
Subject: RE: GCQ - TMR's Input to Adopted Roughness Intervention Levels

---

Hi Sarah,

Further to our meeting on Friday and our discussion earlier today, please find attached the West Burleigh Quarry weighbridge docket data for the 2011-2012 financial year. Please note that this information is commercial in confidence and it was utilised by Cardno for the purposes of the assumptions that were detailed in the traffic assessment prepared for the EIS.

It would be much appreciated if you could please forward a copy of the attached file to Sch 4, Item 6 On the basis of the information that has now been provided, can we expect information from Sch 4 6on the ESAs by the close of business tomorrow?

We thank you for your assistance in relation to the above and should you have any further queries please do not hesitate to contact our office.

Regards

Sch 4, Item 6
SENIOR PLANNER
CARDNO HRP

Sch 4, Item 6
Address Suite 15, 3029 The Boulevard, Emerald Lakes, Carrara, QLD 4211 Australia
Postal PO Box 2855, NERANG QLD 4211

Email Sch 4, Item 6 @cardno.com.au Web www.cardno.com/cardnohrp

From: Sch 4, Item 6
To: Sch 4, Item 6
Cc: Sarah T Sanders; Sch 4, Item 6
Subject: RE: GCQ - TMR"s Input to Adopted Roughness Intervention Levels (TMR030)
Attachments: TMR030 Analysis (STAGE 2) Roundabout.pdf
image001.gif

Hello Sch 4, Item 6
ESA calculation summary for the round-a-bout **attached** – this was what was discussed at last Friday's meeting. We will await a response to the other items when it becomes available.
Also, with the advice regarding the calculation of the 75% loading, if you can also confirm the meaning of the codes used in the raw data spreadsheet that would also be helpful.
Regards,

Sch 4, Item 6
NEWELL CONSULTING ENGINEERS
Level 4, HQ@Robina Building
58 Riverwalk Avenue, Robina
PO Box 4920, Robina Town Centre Q 4230
T
M Sch 4, Item 6
W: newellconsulting.com.au

From: Sch 4, Item 6 @cardno.com.au]
Sent: Wednesday, 21 August 2013 8:33 AM
To: Sch 4, Item 6
Cc: Sarah.T.Sanders@tmr.qld.gov.au; Sch 4, Item 6
Subject: RE: GCQ - TMR's Input to Adopted Roughness Intervention Levels (TMR030)

Hi Sch 4, Item 6
I have passed your email on to Cardno and requested that they provide the clarification you are seeking for Items 1 and 2.
With Item 3, I have yet to receive any ESA calculation information via email. If you could please resend the information it would be much appreciated.
Thanks

Sch 4, Item 6
SENIOR PLANNER
CARDNO HRP

Sch 4, Item 6
Address Suite 15, 3029 The Boulevard, Emerald Lakes, Carrara, QLD 4211 Australia
Postal PO Box 2855, NERANG QLD 4211
Email Sch 4, Item 6 @cardno.com.au Web www.cardno.com/cardnohrp

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From: Sch 4, Item 6 @newellconsulting.com.au]
Sent: Tuesday, 20 August 2013 7:04 PM
To: Sch 4, Item 6

Cc: Sarah.T.Sanders@tmr.qld.gov.au; Sch 4, Item 6
Subject: RE: GCQ - TMR's Input to Adopted Roughness Intervention Levels (TMR030)

Hello Sch 4, Item 6

As requested Sarah forwarded your below email to me. Can you please also provide:

1. Confirmation that the data is from the 2011-2012 financial year as some of the dates appear to be from 2010?
2. Documentation (i.e. spreadsheet or analysis/summary/calculation process) how your team arrived at the 75% loading from the raw data?
3. Confirm that you have received the ESA calculation information via email?

Regards,

Sch 4, Item 6
NEWELL CONSULTING ENGINEERS
Level 4, HQ@Robina Building
58 Riverwalk Avenue, Robina
PO Box 4920, Robina Town Centre Q 4230
T
M Sch 4, Item 6
W: newellconsulting.com.au

----- Forwarded by Sarah T Sanders/SouthEast/QMR/Au on 20/08/2013 08:34 AM -----

From: Sch 4, Item 6 @cardno.com.au>
To: "Sarah.T.Sanders@tmr.qld.gov.au" <Sarah.T.Sanders@tmr.qld.gov.au>
Cc: "alan.j.stone@tmr.qld.gov.au" <alan.j.stone@tmr.qld.gov.au>, Sch 4, Item 6 @cardno.com.au>, "Greg.Polkinghorne@coordinatorgeneral.qld.gov.au" <Greg.Polkinghorne@coordinatorgeneral.qld.gov.au>, Sch 4, Item 6 Sch 4, Item 6 @cardno.com.au>, "Mick.Lord@coordinatorgeneral.qld.gov.au" <Mick.Lord@coordinator Sch 4, Item 6 @boral.com.au>, "Raymond.Barkmeyer@coordinatorgeneral.qld.gov.au" <Raymond.Barkmeyer@coordinatorgeneral.qld.gov.au>, "tom.k.orr@tmr.qld.gov.au" <tom.k.orr@tmr.qld.gov.au>, Sch 4, Item 6 Sch 4, Item 6 @cardno.com.au>
Date: 19/08/2013 05:02 PM
Subject: RE: GCQ - TMR's Input to Adopted Roughness Intervention Levels

---

Hi Sarah,

Further to our meeting on Friday and our discussion earlier today, please find attached the West Burleigh Quarry weighbridge docket data for the 2011-2012 financial year. Please note that this information is commercial in confidence and it was utilised by Cardno for the purposes of the assumptions that were detailed in the traffic assessment prepared for the EIS.

It would be much appreciated if you could please forward a copy of the attached file to Sch 4, Item 6 On the basis of the information that has now been provided, can we expect information from Sch 4, 6 on the ESAs by the close of business tomorrow?

We thank you for your assistance in relation to the above and should you have any further queries please do not hesitate to contact our office.

Regards

Sch 4, Item 6
SENIOR PLANNER
CARDNO HRP

Sch 4, Item 6
Address Suite 15, 3029 The Boulevard, Emerald Lakes, Carrara, QLD 4211 Australia
Postal PO Box 2855, NERANG QLD 4211

Email Sch 4, Item 6 @cardno.com.au Web www.cardno.com/cardnohrp

Section A (Old Coach Road Roundabout)

Road Section 12A - Pacific Motorway
Site: Round-a-bout Kingsmore Boulevard and Old Coach Road

Design Period	20 years
Current Year AADT (AM Peak x 10)	10990
%HV	3.00%
ESA/HV (Fully loaded Class 2)	3
Compound Growth Rate (PIA adopted value):	3.00%
Days per Year	365

BACKGROUND ESA:

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	TOTAL
Background AADT	12009.07	12369.34	12740.42	13122.63	13516.31	13921.80	14339.46	14769.64	15212.73	15669.11	16139.19	16623.36	17122.06	17635.72	18164.80	18709.74	19271.03	19849.16	20444.64	21057.98	21689.72	
Background ESA	3.94E+05	4.06E+05	4.19E+05	4.31E+05	4.44E+05	4.57E+05	4.71E+05	4.85E+05	5.00E+05	5.15E+05	5.30E+05	5.46E+05	5.62E+05	5.79E+05	5.97E+05	6.15E+05	6.33E+05	6.52E+05	6.72E+05	6.92E+05	7.13E+05	1.13E+07

GCQ TO WBQ:

No. of Days in a Year:	365
Fleet Proportion (Tandem Rear Axle Truck):	0%
Fleet Proportion (Tri Rear Axle Semi):	75%
Fleet Proportion (Tandem Rear Axle Truck and Quad Dog):	25%
Tandem Rear Axle Truck (Theoretical Capacity (t)):	13
Tri Rear Axle Semi (Theoretical Capacity (t)):	25
Tandem Rear Truck and Quad Dog (Theoretical Capacity (t)):	32
Tandem Rear Axle Truck (ESA/HV - Loaded):	3.56
Tri Rear Axle Semi (ESA/HV - Loaded):	4.93
Tandem Rear Truck and Quad Dog (ESA/HV - Loaded):	7.64
Annual Tonnage:	400,000
Split Adjustment Factor Going along Off-ramp:	100%

Development ESA:

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Development ESA (Tandem Rear Axle Truck):	-	-	-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Development ESA (Tri Rear Axle Semi):	-	-	-	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04	5.92E+04
Development ESA (Tandem Rear Truck and Quad Dog):	-	-	-	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04	2.39E+04
TOTAL Development ESA	-	-	-	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04	8.30E+04

CHANGE IN ESA:

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
% ESA	-	-	-	19.26%	18.70%	18.16%	17.63%	17.11%	16.62%	16.13%	15.66%	15.21%	14.76%	14.33%	13.92%	13.51%	13.12%	12.73%	12.36%	12.00%	11.65%

GCQ TO EXTERNAL

No. of Days in a Year:	365
Fleet Proportion (Tandem Rear Axle Truck):	10%
Fleet Proportion (Tri Rear Axle Semi):	5%
Fleet Proportion (Tandem Rear Axle Truck and Quad Dog):	85%
Tandem Rear Axle Truck (Average Capacity (t)):	13
Tri Rear Axle Semi (Average Capacity (t)):	25
Tandem Rear Truck and Quad Dog (Average Capacity (t)):	32
Tandem Rear Axle Truck (ESA/HV - Loaded):	3.56
Tri Rear Axle Semi (ESA/HV - Loaded):	4.93
Tandem Rear Truck and Quad Dog (ESA/HV - Loaded):	7.64
Annual Tonnage:	1600000
Split Adjustment Factor Going along Off-ramp:	100%

Development ESA:

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Development ESA (Tandem Rear Axle Truck):	-	-	-	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04	4.38E+04
Development ESA (Tri Rear Axle Semi):	-	-	-	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04	1.58E+04
Development ESA (Tandem Rear Truck and Quad Dog):	-	-	-	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05	3.25E+05
TOTAL Development ESA	-	-	-	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05	3.84E+05

CHANGE IN ESA:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
% ESA	-	-	-	89.15%	86.55%	84.03%	81.58%	79.21%	76.90%	74.66%	72.48%	70.37%	68.32%	66.33%	64.40%	62.53%	60.70%	58.94%	57.22%	55.55%	53.94%

COMBINED GCQ TO WBQ/EXTERNAL

TOTAL DEVELOPMENT/BACKGROUND ESA (2015-2035):

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	TOTAL
ESA:	3.94E+05	4.06E+05	4.19E+05	8.98E+05	9.11E+05	9.25E+05	9.38E+05	9.53E+05	9.67E+05	9.82E+05	9.97E+05	1.01E+06	1.03E+06	1.05E+06	1.06E+06	1.08E+06	1.10E+06	1.12E+06	1.14E+06	1.16E+06	1.18E+06	1.97E+07

COMBINED CHANGE IN ESA:

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
% ESA	-	-	-	108.41%	105.25%	102.19%	99.21%	96.32%	93.51%	90.79%	88.15%	85.58%	83.09%	80.67%	78.32%	76.04%	73.82%	71.67%	69.58%	67.56%	65.59%

REHABILITATED PAVEMENT DESIGN LIFE COMPARISON

Pavement Analysis Input	
Existing Pavement Year Constructed	1996
Existing Pavement Design ESA	6.20E+06
Existing Pavement Design Life	20
Existing Pavement Age at 2013	17
Background ESA to 2013	5.27E+06
Residual ESA of Existing Pavement at 2013	9.30E+05
Forecast ESA of Existing Pavement for 2013-2015	1.15E+06
Residual ESA in 2015	-2.19E+05
Total Background ESA 2015 - 2035	1.13E+07
Total Combined ESA 2015 - 2035	1.97E+07

Therefore, pavement life reached during 2015

20 Year Rehabilitation Design Life - Background Only

Residual Capacity of Rehabilitated Pavement (Background ESA):

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Background ESA	1.07E+07	1.03E+07	9.87E+06	9.44E+06	9.00E+06	8.54E+06	8.07E+06	7.59E+06	7.09E+06	6.57E+06	6.04E+06	5.49E+06	4.93E+06	4.35E+06	3.76E+06	3.14E+06	2.51E+06	1.86E+06	1.18E+06	4.93E+05	-2.19E+05

Residual Capacity of Rehabilitated Pavement (With Development ESA):

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Residual ESA	1.07E+07	1.03E+07	9.87E+06	8.98E+06	8.06E+06	7.14E+06	6.20E+06	5.25E+06	4.28E+06	3.30E+06	2.30E+06	1.29E+06	2.59E+05	-7.88E+05	-1.85E+06	-2.93E+06	-4.03E+06	-5.15E+06	-6.29E+06	-7.45E+06	-8.63E+06

20 Year Rehabilitation Design Life - With Development

Residual Capacity of Rehabilitated Pavement (With Development ESA):

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Residual ESA	1.91E+07	1.87E+07	1.83E+07	1.74E+07	1.65E+07	1.56E+07	1.46E+07	1.37E+07	1.27E+07	1.17E+07	1.07E+07	9.70E+06	8.67E+06	7.62E+06	6.56E+06	5.48E+06	4.38E+06	3.26E+06	2.12E+06	9.60E+05	-2.19E+05

COST OF REHABILITATION

Option 1 -Rehabilitation Cost (Area A Only)	
Background Only (20 Year Design Life)	$167,247.03
With Development (20 Year Design Life)	$181,734.53
Difference Between Scenarios	$14,487.50

Option 2 -Rehabilitation Cost (Areas A + B)	
Background Only (20 Year Design Life)	$427,695.13
With Development (20 Year Design Life)	$460,435.88
Difference Between Scenarios	$32,740.75

From: Sch 4, Item 6
To: Sch 4, Item 6
Cc: Sarah T Sanders; Sch 4, Item 6
Subject: RE: GCQ - TMR"s Input to Adopted Roughness Intervention Levels (TMR030)
Attachments: image001.gif

Hello Sch 4, Item 6
Thank you for your email, however following a telephone conversation I had with Sch 4, earlier today and subsequent email sent by myself, all responses will come from TMR moving forward.
Regards,

Sch 4, Item 6
NEWELL CONSULTING ENGINEERS
Level 4, HQ@Robina Building
58 Riverwalk Avenue, Robina
PO Box 4920, Robina Town Centre Q 4230
T
M Sch 4, Item 6
W: newellconsulting.com.au

From: Sch 4, Item 6 @cardno.com.au]
Sent: Wednesday, 21 August 2013 12:15 PM
To: Sch 4, Item 6
Cc: Sarah.T.Sanders@tmr.qld.gov.au; Sch 4, Item 6
Sch 4, Item 6 - Disclosing personal information
Subject: RE: GCQ - TMR's Input to Adopted Roughness Intervention Levels (TMR030)

Hi Sch 4,6
In relation to your queries last night and this morning, please see below the responses that have been provided by Cardno:

Item 1

- The 2011 financial year commenced on the 1 July 2010 and ran through to 30 June 2011 (i.e. not calendar year), data has been supplied for this period
- The 2012 financial year commenced on the 1 July 2011 and ran through to 30 June 2012 (i.e. not calendar year), data has been supplied for this period
- The data can be filtered by the date of sale if TMR needs to interrogate this further.

Item 2

- The haulage fleet profile which Boral has provided for the project indicates that on average, truck capacity is approximately 29.8 tonnes for external sales
- Our assessment assumed 75% loading external client haulage and 95% internal client haulage, which averages to a haulage fleet loading of 79%
- Our estimation of the 75% and 95% loading efficiencies has been based upon engineering judgement from the dataset supplied by Boral for West Burleigh Quarry. The dataset includes detailed information for the almost 50,000 external client transactions that occurred during the 2011 and 2012 financial years. Given the location of the West Burleigh Quarry and the intent that Gold Coast Quarry effectively replaces it we are of the view that the data is highly representative. Key statistics from the data set that have informed our determination of the loading factors are as follows:
  - The average external haulage over the 2011 and 2012 financial years was approximately 22 tonnes per vehicle, which results in a loading of 73% based on the vehicle fleet estimates provided by Boral and adopted for the assessment
  - The 2011 and 2012 FY data indicates that, Quad Dog vehicles were loaded on average 27.9t (87%) and 26.9t (84%) respectively. We suggest that this is an upper bound as Quad Dogs are not typically utilised for part loadings, part loadings are typically more prevalent in the smaller vehicle classes, due to their lower running costs.
  - In the smaller vehicle classes (determined by load) there were a significant proportion of loads that appear to be very low loadings (i.e. under 5t) representing loadings of less than 50%.
  - Based on these various data points our judgement was that 79% weighted for the haulage fleet

was appropriate. This estimate sits mid-way between the 73% calculation for the fleet and the 84%-87% upper bound

- TMR can readily interrogate all these statistics from the data supplied to date.

Item 3

- Receipt of your ESA calculation is confirmed.

Item 4

- QTD = Quad Truck & Dog

Cardno has also requested that you please provide some further clarification in relation to the following matters to assist them with their review of the data you emailed through this morning:

- Can TMR please supply similar ESA calculations for Section B so that Cardno can confirm the identified contribution of $32,740.75; and
- Clarify the mitigation timeframe adopted for the pavement rehabilitation assessment. The standard GARID methodology detailed in Section 9.1 (which we understand South Coast is seeking to apply) stipulates the adoption of a 20 year assessment period but only 10 year mitigation period for pavement works. Cardno just need a little more clarification in relation to the length of the mitigation period adopted in the assessment provided to date as it is unclear. If TMR can confirm the adopted mitigation period then that would be great.

Should you have any further queries please do not hesitate to contact our office.

Regards

Sch 4, Item 6
SENIOR PLANNER
CARDNO HRP

Sch 4, Item 6
Address Suite 15, 3029 The Boulevard, Emerald Lakes, Carrara, QLD 4211 Australia
Postal PO Box 2855, NERANG QLD 4211
Email Sch 4,6 @cardno.com.au Web www.cardno.com/cardnohrp
CARDNO HRP – PLANNING INSTITUTE OF AUSTRALIA PLANNING EXCELLENCE, 2012 QUEENSLAND AWARD WINNER
Cardno operates a quality management system that has been certified to ISO 9001.

From: Sch 4, Item 6 @newellconsulting.com.au]
Sent: Wednesday, 21 August 2013 8:45 AM
To: Sch 4, Item 6
Cc: Sarah.T.Sanders@tmr.qld.gov.au; Sch 4, Item 6
Subject: RE: GCQ - TMR's input to Adopted Roughness Intervention Levels (TMR030)

Hello Sch 4, 6

ESA calculation summary for the round-a-bout **attached** – this was what was discussed at last Friday's meeting. We will await a response to the other items when it becomes available.

Also, with the advice regarding the calculation of the 75% loading, if you can also confirm the meaning of the codes used in the raw data spreadsheet that would also be helpful.

Regards,

Sch 4, Item 6
NEWELL CONSULTING ENGINEERS
Level 4, HQ@Robina Building
58 Riverwalk Avenue, Robina
PO Box 4920, Robina Town Centre Q 4230
T
M Sch 4, Item 6
W: newellconsulting.com.au

From: Sch 4, Item 6 @cardno.com.au]
Sent: Wednesday, 21 August 2013 8:33 AM
To: Sch 4, Item 6
Cc: Sarah.T.Sanders@tmr.qld.gov.au; Sch 4, Item 6
Subject: RE: GCQ - TMR's Input to Adopted Roughness Intervention Levels (TMR030)

Hi Sch 4, Item 6
I have passed your email on to Cardno and requested that they provide the clarification you are seeking for Items 1 and 2.
With Item 3, I have yet to receive any ESA calculation information via email. If you could please resend the information it would be much appreciated.
Thanks

Sch 4, Item 6
SENIOR PLANNER
CARDNO HRP

Sch 4, Item 6
Address Suite 15, 3029 The Boulevard, Emerald Lakes, Carrara, QLD 4211 Australia
Postal PO Box 2855, NERANG QLD 4211
Email Sch 4,6 @cardno.com.au Web www.cardno.com/cardnohrp

From: Sch 4, Item 6 @newellconsulting.com.au]
Sent: Tuesday, 20 August 2013 7:04 PM
To: Sch 4, Item 6
Cc: Sarah.T.Sanders@tmr.qld.gov.au; Sch 4, Item 6
Subject: RE: GCQ - TMR's Input to Adopted Roughness Intervention Levels (TMR030)

Hello Sch 4,6
As requested Sarah forwarded your below email to me. Can you please also provide:

1. Confirmation that the data is from the 2011-2012 financial year as some of the dates appear to be from 2010?
2. Documentation (i.e. spreadsheet or analysis/summary/calculation process) how your team arrived at the 75% loading from the raw data?
3. Confirm that you have received the ESA calculation information via email?

Regards,

Sch 4, Item 6
NEWELL CONSULTING ENGINEERS
Level 4, HQ@Robina Building
58 Riverwalk Avenue, Robina
PO Box 4920, Robina Town Centre Q 4230
T
M Sch 4, Item 6
W: newellconsulting.com.au

email and notify the author immediately

----- Forwarded by Sarah T Sanders/SouthEast/QMR/Au on 20/08/2013 08:34 AM -----

From: Sch 4, Item 6 @cardno.com.au>

To: "Sarah.T.Sanders@tmr.qld.gov.au" <Sarah.T.Sanders@tmr.qld.gov.au>
Cc: "alan.j.stone@tmr.qld.gov.au" <alan.j.stone@tmr.qld.gov.au>, Sch 4, Item 6 @cardno.com.au>, "Greg.Polkinghorne@coordinatorgeneral.qld.gov.au" <Greg.Polkinghorne@coordinatorgeneral.qld.gov.au>, Sch 4, Item 6 Sch 4, Item 6 @cardno.com.au>, "Mick.Lord@coordinatorgeneral.qld.gov.au" <Mick.Lord@coordinatorgeneral.qld.gov.au>, Sch 4, Item 6 @boral.com.au>, "Raymond.Barkmeyer@coordinatorgeneral.qld.gov.au" <Raymond.Barkmeyer@coordinatorgeneral.qld.gov.au>, "tom.k.orr@tmr.qld.gov.au" <tom.k.orr@tmr.qld.gov.au>, Sch 4, Item 6 Sch 4, Item 6 @cardno.com.au>

Date: 19/08/2013 05:02 PM
Subject: RE: GCQ - TMR's Input to Adopted Roughness Intervention Levels

---

Hi Sarah,

Further to our meeting on Friday and our discussion earlier today, please find attached the West Burleigh Quarry weighbridge docket data for the 2011-2012 financial year. Please note that this information is commercial in confidence and it was utilised by Cardno for the purposes of the assumptions that were detailed in the traffic assessment prepared for the EIS.

It would be much appreciated if you could please forward a copy of the attached file to Sch 4, Item 6 On the basis of the information that has now been provided, can we expect information from Sch 4,6 n the ESAs by the close of business tomorrow?

We thank you for your assistance in relation to the above and should you have any further queries please do not hesitate to contact our office.

Regards

Sch 4, Item 6
SENIOR PLANNER
CARDNO HRP

Sch 4, Item 6
Address Suite 15, 3029 The Boulevard, Emerald Lakes, Carrara, QLD 4211 Australia
Postal PO Box 2855, NERANG QLD 4211

Email Sch 4, Item 6 cardno.com.au Web www.cardno.com/cardnohrp

Guidelines for Assessment of Road Impacts of Development

On 3 July 2017 this document was replaced by the *Guide to Traffic Impact Assessment*. Please refer to the *Guide to Traffic Impact Assessment* when preparing traffic impact assessments after this date. A copy of the *Guide to Traffic Impact Assessment* can be obtained from https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Guide-to-Traffic-Impact-Assessment.

Queensland Government
Department of Main Roads

PLEASE NOTE:

These guidelines replace the "Guidelines for Assessment of Road Impacts of Development Proposals" and are effective as of 1st April 2006.

Record of Amendments

No	Date of Amendment	Date Inserted	Inserted by (init.)	No	Date of Amendment	Date Inserted	Inserted by (init.)
1	Add Table C3, pg C9	Feb 08	MN	26			
2	Amend ref. to IDAS referral guide pg C1	June 08	MN	27			
3				28			
4				29			
5				30			
6				31			
7				32			
8				33			
9				34			
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25				50			

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Foreword

Road infrastructure provided by the Department of Main Roads helps to facilitate development, so contributing to Queensland's economic growth and regional development.

As far as is possible, Main Roads seeks to accommodate the road requirements of industry within its forward road investment program. Main Roads has undertaken a number of studies of the road needs of specific industries and consults with industry representatives during forward road planning, including annual development of the rolling, five-year Roads Implementation Program (RIP).

Due to competing demands for available road funds, the scope and timing of delivery of road infrastructure by Main Roads does not always suit the needs of a specific development proposal. Any potential misalignment between the demand for road infrastructure and its supply needs to be properly identified and addressed, given that development can often generate significant changes in the volume and/or mix of vehicle traffic. Proper road impact assessment processes ensure that development projects do not compromise the safety or transport efficiency of Queensland's roads for all users.

The purpose of the Guidelines for Assessment of Road Impacts of Development is to assist industry to assess the road impacts of their development proposals. While use of the guidelines is not mandatory, they provide a basis for open and expeditious dealings between developers and Main Roads on road issues. The guidelines are relevant only where a development proposal has been referred to Main Roads as part of the development approval processes of government. Conditions to address road impacts may be attached to development approvals granted under legislation such as the Integrated Planning Act 1997 and the State Development and Public Works Organisation Act 1971.

The guidelines provide developers with clear, open and accountable advice on the information that Main Roads requires to address road issues. The guidelines also ensure that a consistent approach is adopted across the various Regions / Districts of Main Roads and across the range of development projects.

By using this reference material, developers should gain an improved understanding of issues and requirements important to Main Roads. This should enhance the development approval processes of government and reduce the risk of project delays.

The guidelines provide comprehensive coverage of the issues that may arise for the State-controlled Road Network as a result of development. In practice, there will be very few development proposals where the full breadth of issues covered in the guidelines will occur. In most cases, especially for smaller developments, it will be a matter of selectively applying those chapters of the guidelines that are relevant to the circumstances.

District Offices of Main Roads will be able to advise developers on the extent to which the guidelines are relevant to a specific proposal. Contact details for the offices are contained in Appendix I. Early contact with Main Roads is encouraged as this may enable issues to

be resolved, possibly through minor amendments to the design or proposed operation of the development project, prior to a development application being lodged.

The guidelines are a 'living document'. Any suggestions for their improvement should be directed to the Director (Corridor Land Management), Department of Main Roads, GPO Box 1412, BRISBANE QLD 4001

I encourage development proponents to make use of these guidelines.

Bruce Ollason
General Manager (Corridor Management & Operations)

Table of Contents

Preface

These guidelines have been produced in loose-leaf format so that updated and additional material can readily be included from time to time. The date at the foot of each page indicates when that page was last updated. Please ensure that you are using the latest version before relying on the information in these guidelines. The Checklist of Pages on page iv lists when each page was last updated and the checklist will be updated whenever changes are made to the guidelines. Information about changes to the guidelines will be notified on the Department of Main Roads' website www.mainroads.qld.gov.au

Main Roads recognises that these guidelines will require ongoing refinement as experience is gained in their application. Any suggestions by practitioners on ways to improve the guidelines would be welcome, and should be addressed to:

Director (Corridor Land Management)

Department of Main Roads

GPO Box 1412

BRISBANE QLD 4001

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1.0 Introduction

This chapter outlines the purpose and scope of these guidelines, and provides context and underlying principles adopted by Main Roads in the assessment of road impacts from development.

Note that Appendices C & D provide examples of the application of these guidelines. A list of technical abbreviations and definitions is included in Appendix A.

1.1 Purpose of the guidelines

These guidelines provide information about the steps involved in assessing the road impacts of a proposed development project and identifying measures to mitigate any road impacts the project may have. This will assist developers, Main Roads districts and other State agencies with the development assessment process. The process of compiling and analysing information on the road impacts of specific development proposals is termed Road Impact Assessment (RIA). For some development proposals the process can be complex and require professional analysis and review.

Flexibility and discretion is required to allow for local conditions

The guidelines will assist developers to undertake RIA where required and ensure assessments are in accordance with an agreed methodology. The guidelines provide sufficient flexibility and discretion to development proponents and Main Roads assessment officers so that RIAs reflect the particular local circumstances of a development proposal.

1.2 Applicability

RIA only required for development proposals referred to Main Roads

An RIA is only required where development proposals are referred to Main Roads as part of the development approval processes of government and road impacts are likely to be significant. Many development proposals referred to Main Roads may not require an RIA because the road impacts are not expected to be significant. The guidelines have been framed so that they are relevant to all development activities with the potential for adverse impacts on the State-controlled Road Network, irrespective of the development approval processes that might apply. An outline of government approval processes and legislation relevant to road impact assessment is provided in Chapter 2.

Where a development proponent chooses an alternative approach that departs from the guidelines, the approach must be consistent with the intent of the guidelines.

The development proponent must reach agreement with Main Roads as to the RIA approach, which must be sufficient to enable Main Roads to assess safety and efficiency outcomes. This

ensures that consultations on road issues between the development proponent and Main Roads run smoothly and the risk of project delay is minimised.

Guidelines are for SCRs

While the guidelines do not apply to local government roads, a local government may choose to adopt or use them.

1.3 Context

Sustainable economic growth is essential for Queensland

Sustainable economic growth is essential for Queensland's prosperity and standard of living. Transport infrastructure plays a critical role in the capacity of Queensland's industries to participate and compete in local, national and global economies. The road system helps move people, goods and services to their destinations safely, quickly and reliably.

Main Roads is required to provide a safe and efficient system of road transport

Main Roads legislation requires that the department ensures the safety and efficiency of the road system. Within available funding, Main Roads plans, invests, designs, constructs and operates the State-controlled Road Network in a way that aligns Main Roads' activities with whole-of-government outcomes through:

- safer roads to support safer communities;
- fair access and amenity to support liveable communities;
- efficient and effective transport systems to support industry competitiveness and growth; and
- environmental management to support environmental conservation.

1.3.1 Main Roads planning processes

Main Roads is strengthening its planning processes

Main Roads is placing greater emphasis on road planning. This is reflected by Main Roads' input into Regional Frameworks for Growth Management (RFGMs), Integrated Regional Transport Plans (IRTPs), Integrated Local Transport Plans (ILTPs) and local government planning schemes through Priority Infrastructure Plans (PIPs) and statements of intent (SOIs). PIPs and SOIs should enable better integration of road and transport infrastructure with preferred land use.

To support industry competitiveness and growth, Main Roads makes choices to achieve desired whole-of-government outcomes. The department prioritises road investment to support development in key industrial and urban areas identified in regional planning processes (including IRTPs and RFGMs).

Main Roads takes expected traffic growth into account in its roads planning, investment and roadworks programming. This growth is

based on predictions from past trends and consultation with road users, local governments and other stakeholders.

Main Roads consults widely to determine road planning priorities

The department consults closely with a wide cross-section of the community to understand their needs. State government agencies responsible for planning and development, industry groups and local governments are consulted to ensure that road infrastructure planning and investment is well coordinated and reasonably anticipates industry requirements. This consultation extends from longer-term strategic planning through to the annual development of Main Roads' rolling, five-year Roads Implementation Program (RIP).

It is sometimes difficult for Main Roads to accommodate industry timing requirements for roadworks.

Where industry road needs have been identified and incorporated in formal planning documents endorsed by Main Roads, the department gives a high priority to satisfying those needs through the RIP. This enables Main Roads to provide road infrastructure to service the broader community. However, it is not always possible to provide roadworks as and when required for individual development projects unless there are clear benefits to the broader community. There are two main reasons for this:

- Firstly, available road budgets do not allow all identified roadworks to be provided. This means that roadworks funded through the RIP (for example, new capital works or road maintenance) are subject to a rigorous prioritisation process. This requires balancing a range of factors, including community and industry expectations. For example, it would be unreasonable to expect Main Roads to commit to road funding to support developments if the developer was unable to give a firm commitment to the development going ahead.
- Secondly, despite Main Roads' best endeavours to plan for future growth, it is not possible to anticipate individual projects, especially if a project has a short period between conception and commencement. Main Roads is also unable to plan for project-specific road impacts, such as site access works.

1.3.2 Development impacts on the road network

Some types of development often have road impacts

Some types of land use developments, such as industrial projects and major shopping centres, can have significant impacts on the current or future SCR network as a result of traffic generated during the construction and operational stages, or because of environmental or corridor planning issues. Any adverse road impacts need to be properly assessed and addressed in order to maintain road safety and transport efficiency.

Main Roads may request additional information and if necessary set conditions for approval.

Where the road-related impacts of a proposed development project are likely to be significant, the relevant development application may be referred to Main Roads as part of government approval processes for those projects. If necessary, Main Roads may request the developer to provide additional information on

traffic to be generated by the development, potential road impacts and any ameliorative measures that may be required to address those impacts.

Main Roads may then condition development to ensure the safety and efficiency of the road system.

1.4 Underlying principles

This chapter outlines the underlying principles that guide the assessment of road impacts on the SCR network and the circumstances where a developer will be required to meet conditions and/or contribute to measures to mitigate the road impacts of their development.

Principle 1

Main Roads must ensure a safe and efficient road system

Main Roads' fundamental approach is to serve the needs of industry and the broader community in a way that does not compromise the safety, transport efficiency or future planning of the SCR network.

Main Roads will not approve development unless any road impacts of the proposed development can be managed to maintain a safe and efficient road system for all road users as required by in the *Transport Infrastructure Act 1994*. This approach is supported by the legislative powers of both the *Integrated Planning Act 1997* and the *State Development and Public Works Organisation Act 1971* which enable Main Roads to impose conditions to mitigate the road impacts of proposed developments as part of the development approval process. (Further information on legislative powers that relate to road impact assessment is contained in Chapter 2.)

Principle 2

Main Roads uses its best endeavours to plan and invest in the road network for expected growth

Main Roads uses its best endeavours to accommodate development by planning and investing in the road network for expected growth. Main Roads gives high priority to meeting road needs identified in formal planning documents.

It is obviously in the interests of industry and Main Roads if road requirements for development projects are identified and taken into account as part of forward road planning by the department. To this end, Main Roads has regular consultations with industry representatives through future road planning, including annual development of the rolling, five year RIP. However, some projects cannot be anticipated - because of the size of the proposed project, short lead times or uncertain start times - and are therefore not included in the departments forward planning.

There may already be funds committed as a result of earlier financial planning for the provision for roadworks to accommodate, partly or fully, the road needs of specific development proposals. The prospects of this are enhanced if development proponents consult Main Roads early on their development intentions. However, despite best planning endeavours, Main Roads is not always able to provide roadworks as and when required by a specific development proposal because of available funding and competing roadwork priorities.

If a development is one of many expected traffic generators that all contribute to the need for roadworks (high mix of users / high growth areas) then development contributions are not generally be required. However, if the traffic generated by a development forms a high proportion of total traffic, the development may attract the need for development conditions and/or a contribution for its impacts.

Principle 3

Only significant road impacts are considered.

In general, Main Roads considers a development's road impacts to be insignificant if the development generates an increase in traffic on SCRs of no more than 5% of existing levels. (Traffic is measured by either AADT or ESAs, terms which are defined in Appendix A.) However, there may be circumstances where an increase in traffic of less than five per cent might have significant road impacts (e.g. a road with low levels of ESAs, traffic growth or poor safety record). In other cases, an increase in traffic of more than five per cent might be possible without having a significant impact. Main Roads can advise the development proponent whether their proposals could have a significant impact on the affected road and requires an RIA.

The significance of a development's road impacts depends on the functional hierarchy of the roads involved. For example, planning for AusLink National Roads (formerly National Highways) takes into account their important role in freight transport and long distance travel and therefore assumes traffic will grow (significantly on some road sections). In contrast, local district roads may possibly experience little or no traffic growth. Consequently, AusLink National Roads and state strategic roads are expected to cope with greater increases in AADT and ESAs, except in extraordinary circumstances.

Principle 4

Main Roads only requires development proponents to adopt intervention levels that Main Roads would use.

When determining road impacts, Main Roads requires development proponents to adopt only those intervention levels that it would use for the planning and investment of future roadworks on a particular road link.

For example, because of available funding and competing priorities, Main Roads district adopts a roughness intervention

level of 150 counts for planned pavement rehabilitation works a development proponent is not required to use a different intervention level (say 120 counts), even though it may be specified in some Main Roads technical manuals.

Principle 5

Development that is consistent with Main Roads' plans should not cause significant impacts to the road system. If any mitigation measures required as a result of the development can be accommodated within the first two years of Main Roads' program of roadworks (RIP), then the development is regarded as having no significant adverse impact on the SCR system in terms of roadworks. In this situation, Main Roads can still apply safety or access conditions for access from the development site to the SCR.

Consistent development should not cause significant impacts

Principle 6

In balancing expectations and available budgets, Main Roads may not be able to cater for large individual projects without compromising the safety and efficiency of the road system. Development that is inconsistent with Main Roads' plans is likely to cause significant impacts to the road system. If developments are inconsistent in terms of scale, intensity or timing, then Main Roads might set conditions of development approval for mitigation works or contributions.

Inconsistent development may cause significant impacts and require development conditions

Any development conditions or developer contributions for roadworks are calculated on a transparent, consistent and equitable basis as detailed in later sections of the guidelines.

Principle 7

Main Roads' focus is on safety and efficiency outcomes for the road system. Development road impacts may therefore not require infrastructure solutions. Mitigation measures may range from transport modal choice, traffic management and route selection, through to provision and timing of road infrastructure or staging of the development.

Development impacts may not require infrastructure solutions

Main Roads seeks to work closely with a development proponent so that any road issues related to a specific development project may be resolved in a way which facilitates the project and protects the safety and efficiency of the road system.

Principle 8

While Main Roads provides the major infrastructure elements of the road network, developers are required to provide all roadworks required for a direct connection between the development site and

the SCR network (such as access works) and to address the development's specific road impacts on the SCR network.

Developers will provide all roadworks required to specifically connect to the SCR network.

Developers provide or fund the provision of all roadworks that are required as a direct consequence of their development. These works usually benefit only the development and would not be provided by Main Roads. An example is a road with an expected low volume of heavy vehicle use requires upgrading to accommodate a significant increase in heavy vehicles due to a development proposal.

Principle 9

The bring forward methodology is only a tool to quantify development impacts.

The use of the bring forward methodology (Appendix G) to mitigate development impacts identified in the RIA may be unacceptable to Main Roads. This may be due to funding contingents and competing priorities. In these instances, other assessment methods need to be considered by the proponent to mitigate their development impacts to a level acceptable to Main Roads.

The use of the bring forward methodology is at the sole discretion of Main Roads. It is only a ***tool*** to be used to quantify the developer contributions for road works required to mitigate development impacts beyond the second year of the RIP.

MR will negotiate use of this methodology with the developer.

Main Roads approving use of a bring forward methodology does not commit the department to the provision of specific future roadworks. Main Roads is only agreeing to accept the road network risks associated with the anticipated development impacts identified in the RIA. Main Roads deals with these risks as part of its normal planning and RIP development processes.

Where there are unacceptable risks and Main Roads is unable to fund the required road investment, then developers may have to pay all or part of the required roadworks.

1.5 Scope of a road impact assessment

To ensure the safety and efficiency outcomes from development impacts, the appropriate scope and level of a road impact assessment, Main Roads and the development proponent need to consider a range of issues including:

- impact on the local community;
- road safety considerations;
- extent of potential impacts;
- whole-of-government objectives;

- Main Roads' strategic documents and investment strategies; and
- local government planning schemes and instruments, as well as the land use implications flowing from these schemes and instruments.

1.5.1 Types of impacts

The type of impacts that development projects may have on the SCR network include:

- access to SCRs;
- road safety;
- pavement rehabilitation and maintenance;
- traffic operation;
- environmental (e.g. acoustic, visual, transport corridor preservation);
- hydraulics; and
- public utilities and services.

The first four impacts listed above are the most common issues that usually require detailed assessment. These matters are covered in Chapters 5, 6, 7 and 8.8 of the guidelines. The other impacts are outlined in Chapter 8 which contains a brief overview and references to processes that may need to be followed.

Development-specific and road network impacts are covered by the Guidelines

Once the type of impacts of the development have been determined and agreed, these road impacts can be characterised as either:

- development-specific; or
- affecting the wider road system.

1.5.2 Development–specific impacts

All developers must consider development-specific impacts

The development-specific impacts are those that solely or predominantly benefit a development, such as site access to a SCR or roadworks which Main Roads would not have planned to undertake. These aspects must be discussed with the MR district office and resolved to Main Roads satisfaction.

The spatial extent of RIA depends on the significance of road impacts

In general terms, the spatial extent of any road impact assessment required by Main Roads is usually described by an area in which

road impacts are expected to be significant (see Principal 3 in Chapter 1.3).

The requirements of developers will be no greater than what Main Roads is currently planning or implementing

The guidelines refer to other documents that detail processes, standards and intervention levels to meet whole-of-government outcomes. The requirement that any development conditions be relevant and reasonable should ensure that the standards and intervention levels adopted by the development proponent are those that the MR district office would adopt in its planning and work prioritisation processes.

1.5.3 Wider road system impacts

Impacts that affect the wider road system are those that cause the bringing forward in time of planned or future works or result in increased network operating costs (like accelerated pavement maintenance). In these cases, the development proponent may be required to contribute to the cost of these impacts.

In addition to direct road network impacts, there may be issues relating to sound transport planning practice and corridor preservation that may lead to conditions on development approval being framed for specific developments. MR district offices are able to advise on the extent to which broader network planning considerations are relevant to a specific development proposal.

1.5.4 Legislative environment

Legislative regimes prevail

Care has been taken to achieve consistency between the content of these guidelines and legislation applying to formal development approval processes. In the event of any inconsistency between these guidelines and relevant legislative regimes (e.g. under the *Integrated Planning Act 1997*), then the latter prevails. The guidelines are subject to ongoing review and will be amended, as required, to reflect changes in legislation.

Guidelines focus on Main Roads' responsibilities only

The guidelines focus on issues relevant to the defined responsibilities of Main Roads. In many cases, the implications of development proposals also need to be examined in the context of responsibilities of other State government departments such as Queensland Transport and local government.

It is the responsibility of the development proponent to establish the extent to which other State government departments and local government need to be consulted on development proposals.

Some of the subject matter covered by these guidelines is complex and detailed policy and technical considerations may apply. Rather than complicate the guidelines, references to information sources are provided throughout the guidelines and a reference list is provided in Appendix H. Main Roads can advise

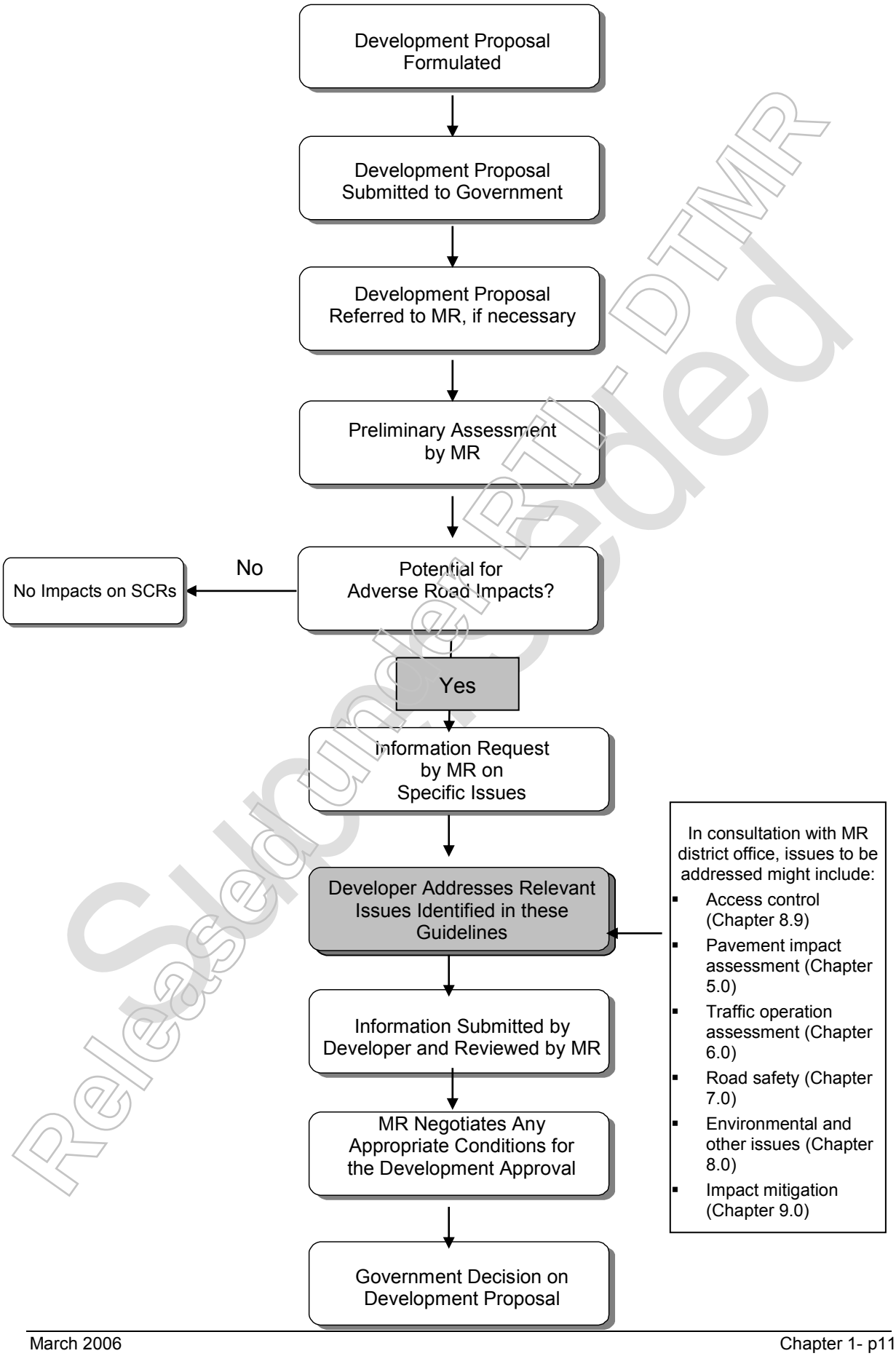
Further information available in cited references

on the extent to which specific departmental policies are relevant to particular development proposals.

It is important to note that while the guidelines have attempted to cover the full range of matters that may be required in an RIA, very few development proposals have to address all of these matters.

Figure 1.1 outlines how the RIA process fits into government processes for assessment of development.

Figure 1.1 Development Assessment and Approval Process



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2.0 Legislation used to assess development impacts on state-controlled roads

2.1 Overview

This chapter outlines legislative processes and powers used by Main Roads to assess impacts of development in Queensland, and identifies how this guideline can be used as part of those processes to assess the impacts of development on state-controlled roads

The legislation listed, provides an indication of the key areas where project approval processes apply and information on road impacts may be required.

2.2 Linkages between the legislation

There are many pieces of legislation which allow State government to assess a range of impacts of different types of development. Main Roads has a level role in the implementation of five of these, which have themes in common. These five Acts fall into two categories:

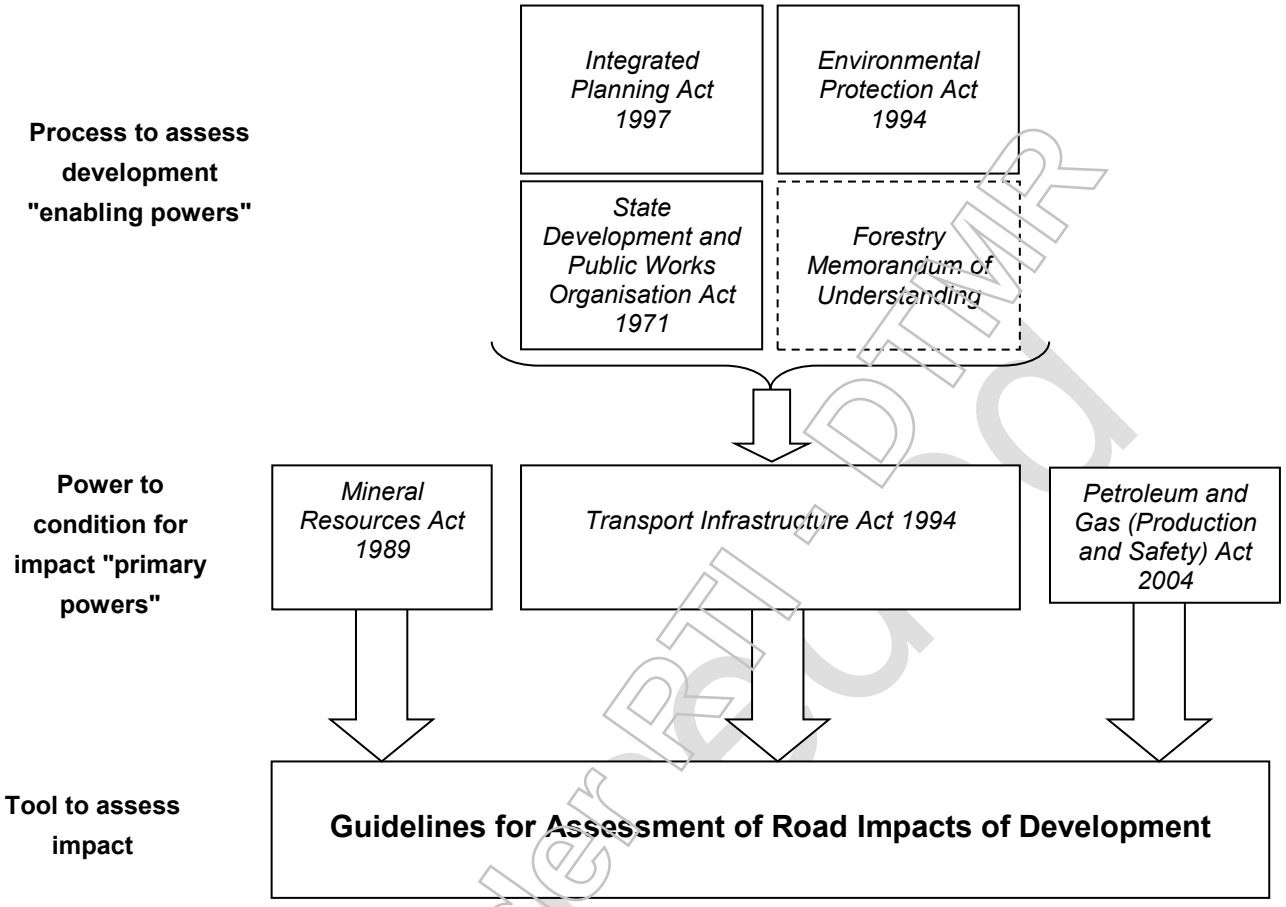
1. **Enabling legislation and agreements**

This legislation sets up regimes to assess development and enables Main Roads to condition for impacts using powers in primary legislation. Legislation that falls into this category is the *Integrated Planning Act 1997*, the *State Development and Public Work Organisation Act 1971,* and the *Environmental Protection Act 1994.* While these Acts give Main Roads power to condition, that power is limited to the powers found in the *Transport infrastructure Act 1994*. The Forestry Memorandum of Understanding also appears in this chapter (see diagram 2.2.1). Although this is technically not legislation, it is an agreement that sets up a process for Main Roads to have input into conditions for certain forestry developments. The power to condition such development is found in the *Transport Infrastructure Act 1994.*

2. Primary legislation

This legislation is termed "primary" legislation, and has a direct power to condition for development, and a process to be followed. The three acts which fall under this category are the *Transport Infrastructure Act 1994* and the *Mineral Resources Act 1989* and the *Petroleum and Gas (Production and Safety) Act 2004*.

Diagram 2.2.1



2.3 Integrated Planning Act 1997

The *Integrated Planning Act 1997* (IPA) is the most often used legislation for development impact assessment in Queensland. It controls development that is prescribed as "development" under the Act and incorporates assessment from both State and local government. Development is defined in a two ways:

- by local governments under a local planning scheme; and-
- by State government departments, including Main Roads, in the Act.

2.3.1 Integrated Development Assessment System (IDAS)

The IPA sets up strict assessment regimes for both local and state government, with timelines and responsibilities for all parties. The assessment process is called the Integrated Development Assessment System (IDAS) and comprises the following stages:

Stage 1. Application stage: Applicants make a development application to the assessment manager (generally their local government).

Stage 2. Information and referral stage: Referral agencies (general state agencies, such as Main Roads) seek information and assess impact of the development. Main Roads may use this guideline to assess the impacts and then condition the development to address these impacts.

Stage 3. Notification stage: Applicants may be required to advise the public of the application and invite submissions.

Stage 4. Decision stage: Applicants are advised if the application is approved and of any conditions attached to the approval, including conditions set by any concurrence agencies in the information and referral stage.

Stage 5. Appeal stage: Applicants may appeal a decision to the Planning and Environment Court.

When an application is referred to Main Roads under Stage Two (information and referral stage), the department may assess the impact of development on any state-controlled road and then condition the development to address those impacts. The IPA states that Main Roads must assess particular types of applications. The jurisdiction to condition those applications comes from the *Transport Infrastructure Act 1994* (TIA). Further, the IPA states that Main Roads' jurisdiction to condition comes from the objectives of the TIA. These refer to the safety and efficiency of the State-controlled Road Network and the subsequent sections of the TIA give Main Roads the power to meet those objectives. Therefore, Main Roads may condition development with conditions that address the impacts on the safety and efficiency of the State-controlled Road Network. This guideline outlines the elements that Main Roads considers when determining the development's impacts on the State-controlled Road Network.

2.3.2 Queensland Transport and the IPA

It should be noted that Queensland Transport also assesses development for impacts referred to it under its IPA referral triggers. These triggers can be found in Schedule Two of the IPA regulations and deal with activities which impact strategic port, land, airports, bus services and rail transport. Any developments which may impact on these areas of interest, or any questions regarding assessment of such activities, should be directed to Queensland Transport.

2.4 State Development Public Works Organisation Act 1971

The *State Development and Public Works Organisation Act 1971* provides a process for dealing with the special requirements of "significant projects". The Coordinator-General determines

whether a project should be declared significant, having regard to criteria in the Act.

The Act provides for the conduct of impact assessment through the preparation of an Environment Impact Statement (EIS) by the proponent. The EIS assesses all impacts of the project, including road impacts. The EIS process includes formal processes for preparation of a terms of reference the EIS and for consultation with government agencies such as Main Roads and the community. The Coordinator-General, through the Department of State Development, has responsibility for the conduct of the EIS.

The Coordinator-General evaluates the adequacy of the EIS and prepares an assessment report. The report may direct that conditions be attached to the development approval.

2.4.1 Interaction with the Integrated Planning Act 1997 (IPA)

If a declared project also requires assessment under the IPA, then it is, in effect, subject to a modified IDAS process. A significant project may start its assessment process as an application under the IPA. If the process under the IPA has begun, once a development is declared significant, the information and referral stage is taken over by the Coordinator-General. Once the Coordinator-General's report is finalised (including any Main Roads conditions), the report is forwarded to the original assessment manager of the IPA process (in most cases the local government). They then must input any conditions from the report into the development approval. As part of the original development process the assessment manager may add to the conditions, however they must not remove, or alter them in any way.

Any suggested conditions forwarded to the Coordinator-General should meet the reasonable and relevance test found within the IPA.

2.4.2 Interaction with the Transport Infrastructure Act 1994 (TIA)

When placing suggested conditions to be included in the Coordinator-General's report, the department must be enabled to suggest such conditions under the TIA. That is, there must be a power in the TIA to condition for that impact.

2.5 Environmental Protection Act 1994

The *Environmental Protection Act 1994* aims to protect Queensland's environment while allowing for development that improves the total quality of life. Chapter 3 of the Act sets out a process called an Environmental Impact Statement (EIS). This requires proponents of development that may affect the

environment (eg environmentally relevant activities, mining activities, and petroleum activities), to assess those effects. This process should not be used for development that is being assessed under the *Integrated Planning Act 1997* as this Act has its own EIS process.

Main Roads may have input into an EIS process at the Terms of Reference (TOR) stage, at the drafting of the EIS, and the publication of the finalised EIS. This may occur in the following ways:

Main Roads can be an "affected person" if the land subject to the development is on or adjacent to a state-controlled road. As an affected person Main Roads is forwarded for comment both the TOR and the EIS.

Main Roads may be referred the EIS or TOR as an interested person if the proponent classifies the Department as an interested person.

The Chief Executive of the EPA may require the proponent to notify and forward a copy of the draft TOR if the Chief Executive believes Main Roads should be forwarded the application.

Public notification stage of EIS allows any persons to make a submission to the Chief Executive of the EPA about an EIS.

During any review of EIS process, Main Roads assesses the impact of the proposed development on affected state-controlled roads using the powers under *Transport Infrastructure Act 1994* and methodology set out in this guideline.

2.6 Mineral Resources Act 1989

The *Mineral Resources Act* 1989 regulates mining development. It does not apply to development carried out under the *State Development and Public Works Organisation Act 1997*. Under the *Mineral Resources Act 1989*, any holder of a mining tenement must notify Main Roads when they are carrying out a notifiable road use. A notifiable road use is when the tenement holder hauls more than 50,000 tonne per year of mineral produced from the tenement.

Upon receiving such notification, Main Roads may give a "road use direction" which can tell the tenement holder how they may use the road for the proposed road use. As part of a "road use direction", Main Roads can request a Road Impact Assessment of the effect of the notifiable road use.

The requirements on this "road use direction" are that it must be reasonable and about preserving the conditions of the road or safety of the road users and other members of the public. In addition to setting conditions, compensation may be payable to mitigate the damage to the road from the proposed haulage.

2.7 Transport Infrastructure Act 1994

The *Transport Infrastructure Act 1994* is Main Roads primary legislation. It sets out the powers the Department has for managing the State-controlled Road Network (SCR). Under Chapter 6 of the Act, the Department has the following powers to assess and condition for the impacts of development:

- Any power a local government has its area is also a power Main Roads has for a state-controlled road in that local government area.
- Works on local roads which have a significant adverse impact on a state-controlled road, or would require road works on a state-controlled road.
- Advertising signs that can be seen from a motorway
- Removal of material from a state-controlled road.
- Damage to roads caused by development other than under the *State Development and Public Works Organisation Act 1971* or the *Integrated Planning Act 1997* and set out in a regulation (at time of writing the regulation has not been written). Under this provision there is also a Memorandum of Understanding between the Department of Main Roads, Department of Primary Industries and the Local Government Association of Queensland to refer forestry activities on State-owned land to Main Roads for assessment of the road impacts from the activity.
- Ancillary works and encroachment by third parties within the state-controlled road reserve.
- Private and commercial access to and from a state-controlled road.

2.8 Petroleum and Gas (Production and Safety) Act 2004

This Act regulates petroleum and gas development and commenced on 1 January, 2005. It does not apply to development carried out under the *State Development and Public Works Organisation Act 1997*. Under this Act, any holder of a petroleum authority must not use a public road for a notifiable road use unless they notify the road authority. A notifiable road use can be:

- The use of public roads in the proponent's area of authority for transport relating to a seismic survey or drilling activity; or,
- The use of a public road to haul greater than 50,000 tonnes per year of petroleum produced or processed in the area, or in the construction of a pipeline.

Upon receiving such notification, Main Roads may give a "road use direction" which can tell the authority holder how they may use the

road for the proposed road use. As part of a road use direction, Main Roads can request an RIA of the effect of the notifiable road use (except where it is for a seismic survey or drilling activity). The requirements on this "road use direction" are that it must be reasonable and about preserving the conditions of the road, or safety of the road users or the public. In addition to setting conditions, compensation may be payable to mitigate the damage to the road from the proposed haulage. This Guideline may be used by the department in this process to determine the impact of the proposed road use.

Petroleum tenures issued prior to the commencement of the *Petroleum and Gas (Production and Safety) Act 2004* may also be subject to a notifiable road use approval. The *Petroleum Act 1923* which applies to petroleum tenures granted before 1 January, 2005 has identical notifiable road use triggers as those mentioned above.

2.9 Transport Operations (Road Use Management – Road Rules) Regulation 1995 (Queensland Road Rules)

The *Transport Operations (Road Use Management – Road Rules) Regulation 1995* (Queensland Road Rules) provides broad powers for signage (Traffic Control Devices) that may be placed on roads.

Sections 103 and 104 of the Queensland Road Rules and section 62D *Transport Operations (Road Use Management) Regulation 1995* allow load limit signs to be placed on a bridge / culvert or a length of road to prohibit access by heavy vehicles weighing above the signed load limits from accessing specific bridges, culverts, roads or areas which may cause safety or infrastructure damage risks. In proposing the application of any official traffic signs other than warning signs, Districts would be required to have processes in place to determine what the safety and infrastructure damage rules were for the relevant vehicle type.

Section 317 of the Queensland Road Rules allows a Traffic Control Device to contain information that can indicate:

- the times, days or circumstances when a sign applies or does not apply;
- the lengths of road or areas where a sign applies or does not apply;
- the persons to whom it applies or does not apply;
- the vehicles to which it applies or does not apply; and
- other information – such as speed limits.

2.10 Other approvals

Proponents of developments should be aware that there may be other legislative requirements which may need to be considered

when carrying out a development, for example, cultural heritage and native title.

There are other arrangements such as the Memorandum of Understanding between Main Roads, the Department of Primary Industries and the Local Government Association of Queensland to help address road impacts from haulage of plantation timber.

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3.0 Road impact assessment (RIA)

This chapter provides an overview of the RIA process and information requirements to enable Main Roads to assess and condition development. Relevant definitions are contained in Appendix A.

The principles (as outlined in Chapter 1.3) that guide RIAs, derive from the legislative basis discussed in Chapter 2, as well as the body of practice that has built up over time.

Level / scope of an RIA will vary

The scope of an RIA depends significantly on the location, type, staging and size of the development and the ability of the road network to handle traffic generated by the development (refer to Chapter 1.4). For example, the scope of an RIA for a small industrial project might focus on SCR access issues. A more detailed RIA is likely to be required for major shopping centres or mining projects that are expected to generate significant heavy commercial vehicle and other traffic during their construction and operational stages.

Consult with Main Roads early

This chapter will assist development proponents to determine those elements of the guidelines that are relevant to their specific development proposal. Main Roads' District Offices will also help to clarify any requirements (a list of district offices is in Appendix I). The Offices hold considerable information on road condition, traffic volumes and future road plans, which can be used by development proponents in preparing RIAs.

It is important that early contact be made with the relevant MR district office during the RIA process. This should commence at the outset and continue as required during the course of RIA preparation. For example, if Main Roads' concerns about access to the SCR network are identified early, this might be able to be addressed through minor amendments to the on-site layout of the development. For larger projects, consultation with Main Roads during development of the initial project concept and consideration of project location and transport options might be appropriate.

3.1 With and without development scenarios

RIA to consider road impacts with and without development

Where the road impacts are unclear, it is usually necessary for an RIA to develop scenarios about what would occur with and without the development. This requires predictions under each scenario of future traffic flows and consequent road needs, as well as an assessment of the nature and timing of mitigation measures to meet those needs. Future traffic growth usually has some allowance for development traffic in background growth.

The process of preparing road impact scenarios with and without a development is not an exact science, but depends heavily on the

assumptions made, methodologies employed and the circumstances of a particular case. A high level of professional knowledge and judgement is required.

In using the with-and/or without development methodology to determine the significance of road impacts from a development, the proponent can expect higher function roads (such as AusLink National Roads, State strategic roads) to be able to accommodate a higher level of traffic growth than could be expected on a lower function road (district roads). Lower function roads receive particular attention as Main Roads normally plans and manages those roads on the basis that there is no exceptional increase in traffic attributable to potential new developments.

A general outline of the stages involved in scenario analysis is set out on the following pages, with more detailed information on specific issues provided later .

Stage 1: Development profile and future traffic volumes

Chapter 4 of this guideline outlines the information required about the development and related traffic volumes. The traffic generated during both the construction and operational stages of the development needs to be considered.

The without-development scenario would normally be based on a trend analysis of traffic volumes. However, more accurate data may be available from relevant traffic studies undertaken by Main Roads or others. Any road planning studies undertaken by Main Roads for the specific road link may already make some allowance for traffic generated by the development.

Stage 2: Scope of assessment and criteria to be adopted

Information from Stage 1 assists in determining the level of detail required in the RIA. In Stage Two, it is important for the development proponent to consult with the MR district office to determine the scope of the RIA and the methodologies and criteria to be adopted in addressing specific issues. These normally reflect documented practices of Main Roads or, in their absence, relevant national guidelines and criteria (such as those produced by Austroads). The relevant practices and documents are referenced in later chapters of these guidelines.

In some cases, it may be appropriate to depart from normal Main Roads practices. An example of this is where there are special local factors in regard to road or traffic conditions or where the scope of analysis needs to be confined to specific mitigation measures due to roads funding constraints or other considerations. Any variation from Main Roads' practices is unlikely to be more onerous than the normal practices.

Because Main Roads will have ultimate ownership of the implemented mitigation measures and will bear all risks associated with that ownership, the methodologies and criteria used in an RIA

for determining the nature and timing of mitigation measures must be acceptable to them

Stage 3: Impact assessment and determination of impact mitigation measures

The RIA is undertaken having regard to the scope and criteria determined in Stage 2. The RIA analysis identifies impact mitigation measures which may include, but are not limited to, the nature and timing of roadworks required to accommodate the traffic generated by the development. The RIA also proposes any future roadworks that would be required under a 'without development' scenario.

The proponent should consult Main Roads' forward planning documents such as the Roads Implementation Program (RIP), Statements of Intent (SOI) or Integrated Regional Transport Plans (IRTP) to determine when Main Roads would have to provide roadworks required by the development. If these documents do not identify these roadworks, it might be necessary to estimate when those works could reasonably be expected to be provided, based on trend projections of future traffic growth and current and future projections of infrastructure condition / capacity to handle that growth.

Stage 4: Determination of development conditions or developer contribution required

Development conditions and/or developer contributions can be determined, following a comparison of the "with" and "without" scenarios.

As discussed in Chapter 9.1, Main Roads is able to give a firm commitment on timing of future roadworks for the first two years of the RIP only. Main Roads' ability to commit to the timing of roadworks in subsequent years is a matter of professional judgement, based on expectations of likely levels of future roads funding and competing roadworks priorities.

If an RIA identifies that additional roadworks are required as part of a development's impact mitigation measures, it is then necessary to determine whether those roadworks can be accommodated within Main Roads' forward program or whether a developer contribution is appropriate.

A developer contribution is calculated to the extent that there is a difference between the nature and/or timing of roadworks necessitated by the development and roadworks scheduled and committed by Main Roads. (See Appendix G for details of the bring forward methodology, and Chapter 9.3 for circumstances when developer contributions may be required).

In cases where development-specific roadworks are required (eg access from a development site to a SCR) or if the roadworks are unlikely to have ever been provided in the absence of the development activity, the development proponent would be

required to meet the full cost of those works. This situation is discussed in more detail in Chapter 9.3 of these guidelines.

3.2 RIA process overview

An RIA report is prepared by the proponent of a development proposal, or by an appropriately qualified person commissioned by the development proponent, to identify and address (to the satisfaction of Main Roads) the implications of the proposed development for state-controlled roads. The detail required in an RIA will depend significantly on:

- the location, type and size of the development; and
- the condition of the road network to handle traffic generated by the development.

The process of conducting an RIA is shown in Figure 3.1. This is an expansion of Figure 1.1.

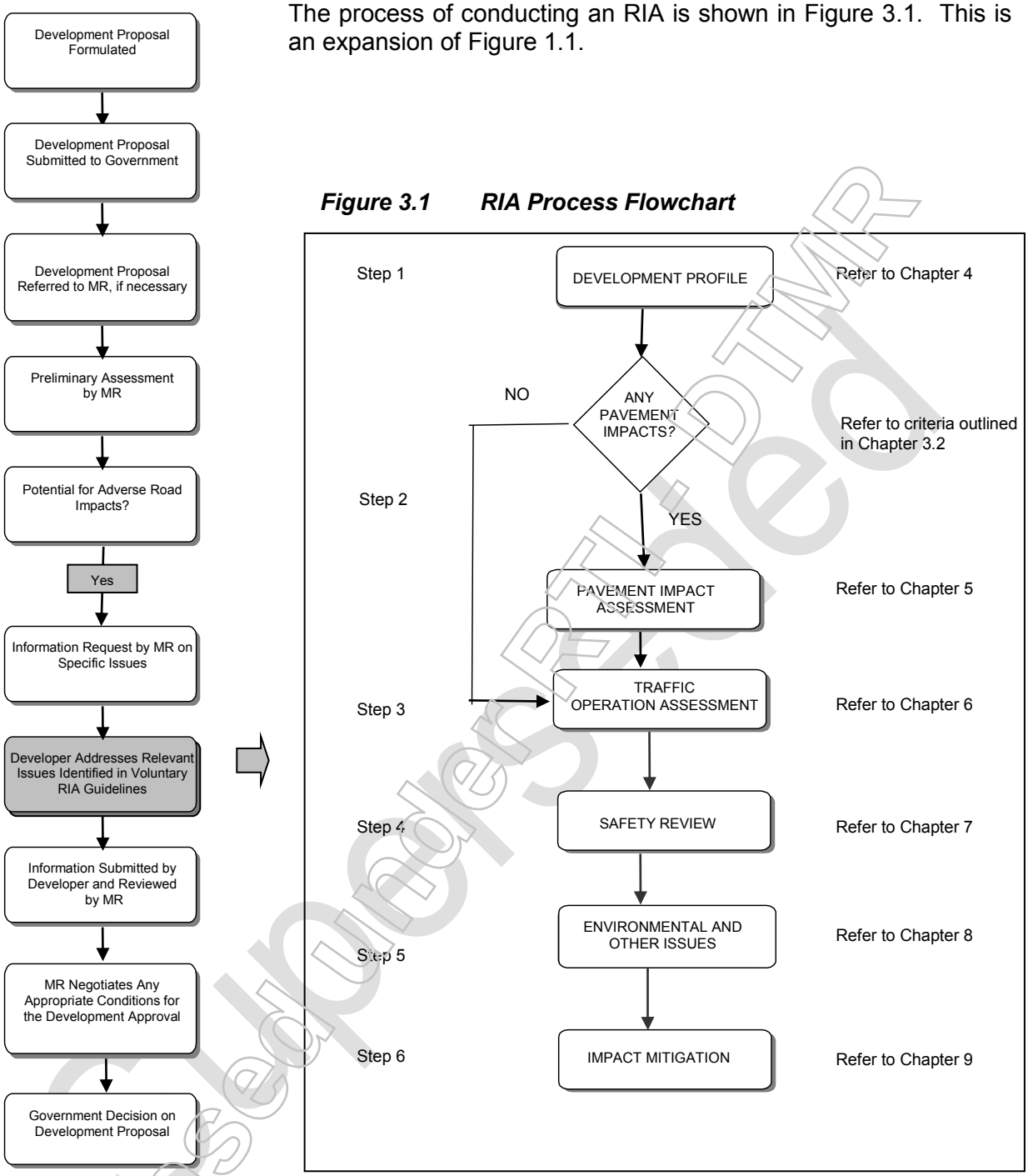

Figure 3.1 RIA Process Flowchart

Step 1 –Development profile

Refer to Chapter 4

Details of the proposed development should be collated and presented. These comprise a description of the characteristics of the proposed development including staging, traffic generation, traffic distribution and surrounding road network. This provides a general profile of the surrounding road network and basic traffic information necessary to assess road impacts.

Step 2 – Pavement impact assessment

Refer to Chapter 5

An assessment is undertaken to determine whether the project, because of its size, location and/or vehicle generation characteristics, is likely to have an impact on the road pavement. In many instances where developments access highly trafficked roads and do not generate a significant heavy commercial vehicle component, there is no requirement to assess pavement impacts.

Where pavement impact assessment is required, "with" and "without" development scenarios will need to be compared to identify any pavement impacts directly attributable to the development.

Step 3 –Traffic operation impacts

Refer to Chapter 6

Impacts of the development on the traffic operation of the surrounding road network are assessed for each stage of development covered by the application for development approval.

Where traffic operation impact assessment is required, with and without development scenarios need to be compared to identify any traffic operation impacts directly attributable to the development.

Step 4 – Safety review

Refer to Chapter 7

Consideration of road safety issues is usually required for all stages of development (including construction).

Step 5 –Environmental and other issues

Refer to Chapter 8

It may be necessary to assess environmental and other issues including noise, visual impacts, parking, transport corridor planning and access control.

Step 6 –Impact mitigation

Refer to Chapter 9

Steps two to five will have identified any mitigation measures required as a consequence of the development including roadworks, changes to the public transport system and possible modifications to the development. The identified mitigation measures are then analysed to determine the extent to which impacts from the development can be accommodated within existing capacities and planned improvements to the road infrastructure. Any mitigation measures that cannot be accommodated should be costed using unit rates applicable to the locality.

This enables the development proponent to identify their contribution towards the cost of any mitigation measures, either by monetary contribution or by undertaking necessary works.

3.3 Spatial extent of assessment

This chapter defines the study area for assessing the potential impacts of a development on the SCR network.

The safety implications of using the SCR network should always be assessed. Appropriate levels of safety at the point of connection to the SCR network and elsewhere on the network must be achieved.

All relevant planning and hydraulic issues associated with a proposal should also be assessed. MR district offices can advise whether such issues are relevant.

Refer to Appendix A for definition of AADT and ESA

The spatial extent to which other issues need to be assessed should be determined according to the following criteria. These are based on a comparison of construction and operational traffic generated by the development project and existing traffic volumes as measured by Annual Average Daily Traffic (AADT) or Equivalent Standard Axles (ESAs). (See Appendix A – Definitions).

Criteria 1: Access to SCRs

Refer to Appendices C and D for sample projects

All points of access between the development and the SCR network need to be considered for both the construction and operational stages. This includes direct access to an adjacent SCR or indirect access via an intersection of a local government access road with a SCR.

Criteria 2: Pavement impact assessment

Generally, pavement impacts need to be considered for any section of a SCR where the construction or operational traffic generated by the development equals or exceeds 5% of the existing ESAs on the road section. The MR district office will advise the development proponent if a percentage other than 5% is to be adopted in determining the development impacts.

Criteria 3: Traffic operation assessment

Traffic operation impacts need to be considered for any section of a SCR where the construction or operational traffic generated by the development equals or exceeds 5% of the existing AADT on the road section, intersection movements or turning movements. The relevant Main Roads district will advise the development proponent if a percentage other than 5% is to be adopted to determine development impacts.

Criteria 4: Heavy commercial vehicle traffic

Because of the impacts of heavy commercial vehicle movements on traffic operations, any haul route must be identified. Traffic operation impacts will need to be addressed for all sections along the haul road where the development traffic equals or exceeds 5%of the existing ESAs.

A traffic operation assessment focusing on overtaking lanes, road width and provision for heavy commercial vehicle movements at intersections will be required, even if an assessment of traffic operations along an identified haul route is not triggered by Criterion Three.

(Appropriate permits are required to use vehicles that exceed the legal load or dimension limits. These permits may be issued subject to conditions) (See Appendix A – Definitions).

Refer to Chapter 6

The spatial extent of assessment identified may be modified with the agreement of the MR district office, and early discussions in this regard are encouraged. (See Appendices C and D for sample projects).

3.4 Design horizons

For **traffic operation assessment** and any necessary **safety review**, the design horizon should be 10 years after the opening of the development. For a staged development this would be 10 years after opening of the final stage. Where assessment of individual stages is undertaken, base flows for successive stages should include the previous stages' traffic generation.

In circumstances where staging is over a period exceeding five years, it would be preferable to have separate development applications for the later stages, which can then be assessed with greater certainty at the appropriate time. It is preferable to avoid extending time horizons beyond 15 years where reliable area-wide future year analysis has not been completed.

For **pavement life assessment**, a horizon longer than ten years is appropriate. Normally a 20 year design horizon is adopted for projects with pavement and maintenance impacts. Mining or other projects with a finite life should be assessed over the expected life of the project.

Although Main Roads carries out strategic road planning up to 20 years in advance, the Roads Implementation Program (RIP) sets

out Main Roads' committed funds only for two years and indicative funding for a further three years. Specific roads projects are usually only identified for up to five years in advance through the annual RIP process.

The IPA requires Main Roads to develop statements of intent (SOI) for the state-controlled roads within priority infrastructure areas (PIA) that will be referenced in the planning schemes for local government areas. These SOIs provide an indication of the State's plans for SCRs and future SCRs out to the planning horizon of the planning scheme (up to 15 years). Main Roads' SOIs incorporate the RIP and other known planning objectives (such as investment strategies) that provides information about the current and future standard and function of individual road links. The development of SOIs provides guidance to development proponents on Main Roads' planning and proposed program of improvements. (Main Roads timeframes are further discussed in Chapter 9.1).

3.5 Structure of an RIA report

The detail required in an RIA report depends upon the type and size of the development, its location in the transport network and its relationship to adjacent land uses.

For projects that are declared to be significant under the *State Development and Public Works Organisation Act* (SDPWO Act), the RIA usually forms part of the EIS for the project and a separate RIA report is not required. Regardless of whether an RIA is presented as a separate report or as part of an EIS, the RIA report should address each of the steps outlined in Chapter 3.1, to the extent they are relevant to the proposal.

3.6 Checklists

To assist in preparation of an RIA report, checklists of matters that may need to be addressed are included in Appendix B.

The IDAS process allows an Information Request to be made by a concurrence agency such as Main Roads. In all cases (either under IDAS or other legislative provisions), it is useful for the scope of the RIA report to be discussed with the MR district office. This provides the opportunity to minimise the work required for the RIA by clarifying issues and possibly reducing the scope.

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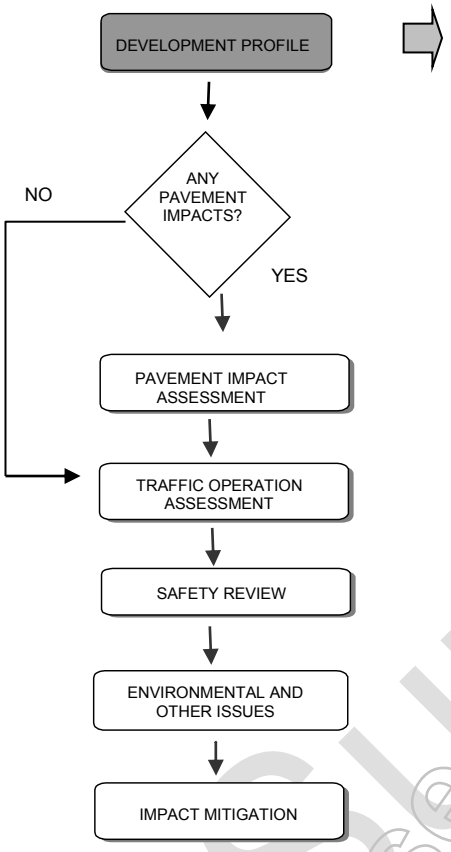
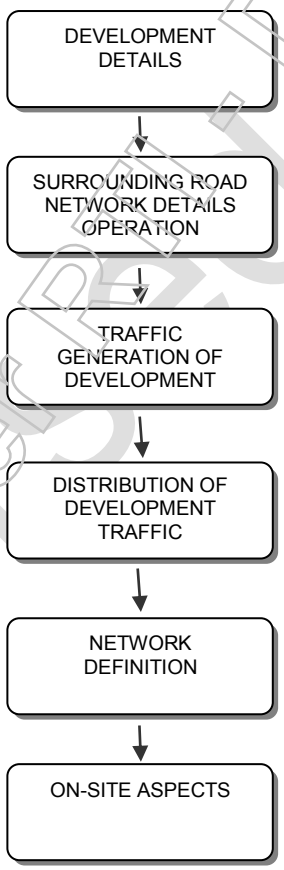
4.0 Development profile

As indicated on the RIA process flowchart in Figure 3.1, the first step is to establish the development profile. The development profile describes the development proposal and its relationship with the surrounding road network. It determines the traffic generated by the proposal and its distribution throughout the SCR network. This provides the traffic information necessary to assess the various road impacts of the proposal. Figure 4.1 illustrates the development profile process.

Figure 4.1 Development profile process





4.1 Development details

The following details should be collated and documented:

- site location;
- current and intended use of the site (Main Roads will normally approve an access only for a specific use. Future changes in use will necessitate a new access approval);

- current and intended use of adjacent land parcels and relationship with proposed development, if any;
- size of development (e.g. floor area, number of dwellings);
- timing of the development, including staging; and
- proposed access location(s) to road network.

For non-residential uses, details of the proposed hours of operation, peak times and, where appropriate, numbers of employees and visitors, should be included. Origins of major project inputs and destinations of outputs are needed where haulage is involved.

4.2 Surrounding road network details

The sections of the SCR network surrounding the development that are likely to be affected by the development are to be identified. The matters to be addressed will depend on the specifics of the development proposal, but could include some (or all) of the following (with maps / diagrams as appropriate):

- road condition, width, alignment and cross-section detail;
- pedestrian, bicycle and public transport routes and facilities;
- intersection configurations, including median breaks and traffic control devices;
- existing daily traffic volumes by vehicle type;
- existing peak periods and associated traffic volumes by vehicle type;
- traffic growth trends and assumptions relied upon to produce the 'without development' traffic volume forecasts for each stage of the development; and
- details of transport corridors or significant road improvements planned by State or local governments.

In some cases this information may be readily available from Main Roads or local government sources, otherwise, it may be necessary to carry out traffic, pedestrian, parking or other types of survey. In some cases this needs to include traffic speed surveys. Any information collected should be relevant to the surrounding network and likely development impacts.

Pedestrian, cyclist, motorcyclist and vehicle safety issues should be considered for all stages of the development.

Details of current Main Roads road projects should be obtained from the published RIP and design or planning layouts prepared by Main Roads. Data availability and requirements should be discussed with the MR district office at the earliest opportunity.

4.3 Traffic generation of development

In order to estimate the change in traffic flow on affected roads, the trips likely to be generated by the development need to be forecast at each stage of the development. This should include vehicle trips by type, public transport trips and pedestrian / cyclist activity.

Peak period traffic volume generation may need to be forecast for the assessment of mid-block and intersection capacity. Traffic generation is normally to be provided for the peak periods of the surrounding road system.

For developments in rural areas or where a high proportion of the generated traffic is heavy, commercial traffic, daily traffic generation may be sufficient.

Refer to Appendix E for discussion of trip generation data

In order to assess requirements for turning circles, bridge strengths, road widths, pavement life and maintenance needs, traffic generation is to be classified by vehicle type. In particular, expected movement of any heavy loads (e.g. construction plant, generators, mining equipment) needs to be identified because such loads can exceed the capacity of pavements and bridges.

Traffic generation can be forecast using trip generation rates established for particular land uses. These are available from a number of sources, including Main Roads and local government. The use of locally derived trip generation rates is preferred to those applicable elsewhere. (See Appendix E for discussion on trip generated data).

In some cases, Main Roads may have made some allowance for traffic generated by the development in its traffic growth forecasts. The MR district office will be able to provide advice on this point.

4.4 Distribution of development traffic

The methodology used to determine the distribution of the generated traffic to the surrounding road network should be identified. The report should, where appropriate, be accompanied by clear diagrams showing the paths of the generated traffic movements through the network.

Origins of major project inputs and destinations of outputs are needed where a haulage component likely to cause significant road impacts is involved.

Distribution should take account of the surrounding land use and travel patterns on the road network. Methods to estimate distribution of traffic range from assessment of existing turning volumes in small catchments to number plate surveys and outcomes from strategic modelling studies for large catchments. Reasonable assumptions about the expected traffic distribution are required.

Assumptions used to determine the proportion of trips assigned to bus and rail trips and to walk/cycle modes should also be presented.

Refer to Appendix F for further discussion on linked trips

In preparing the distribution of traffic, the traffic may need to be divided into separate components to allow for linked trips. These are often referred to as "drop-in" trips and are mostly associated with commercial development. "Drop-in" trips are not a deduction from the site generation, but are already passing the site or are rerouted existing trips from elsewhere on the network. (See Appendix F for discussion on linked trips).

4.5 Network definition

The extent of SCR network included in the RIA needs to be determined. This generally requires preliminary consideration by application of the 5% criteria, and requires existing traffic volume data as well as development traffic generation and distribution forecasts (refer Chapter 4.3 and 4.4).

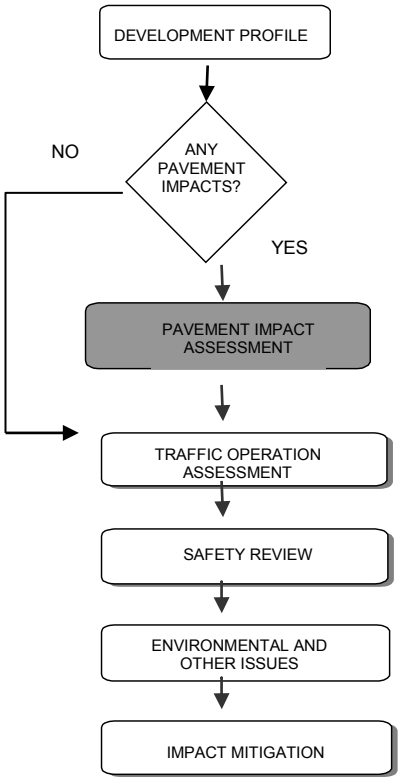
4.6 On-site aspects

Refer to AS 2890 and local government regulations

The RIA needs to address parking demand and servicing requirements to ensure that the on-site layout of the development does not cause queues or conflicts on SCRs. For example, developments should not be reliant on roadside parking as this often has to be removed in future years to enable further road improvements. Local governments have a more detailed interest in on-site aspects. All vehicle servicing movements should take place on-site. The designer of the development should investigate opportunities for joint servicing and/or access with adjacent developments.

Chapter 8.9 for discussion of car parking in greater detail.

5.0 Pavement impact assessment



The general pavement assessment process is outlined below. MR district offices can provide advice on the extent to which this issue needs to be addressed. Depending on the level of information already available to the district office on road conditions and planned future roadworks.

It may be possible, for example, to limit the scope of pavement impact assessment

Chapter 5.1 provides an introduction to pavement management concepts. Principles and issues associated with assessing the pavement impacts of a development are discussed in Chapter 5.2, while Chapter 5.3 outlines the process for assessing pavement impacts.

5.1 Impact on pavement management

Within the constraints of available funding, Main Roads seeks to maintain SCRs so that their whole-of-life performance is maximised, having regard to safety, road user costs, community benefits and financial outlays. Pavements are designed to carry a pre-determined level of traffic (measured in ESAs) over the life of the pavement, after which the pavement will need to be rehabilitated. Pavement design life is usually 20 years. Pavement maintenance is carried out during the design life, primarily to prevent or repair damage caused by heavy commercial vehicle traffic and environmental effects.

Pavement maintenance addresses two broad areas of deficiency: surface condition and structural condition. An assessment of impacts should cover both.

- Surface condition of the road can be assessed visually and should be recorded by video or photograph. Surface defects are usually repaired by routine maintenance such as patching or by programmed maintenance such as resealing. These activities, while preserving the pavement, do not improve it structurally or extend its design life.

- Structural condition can be assessed by estimating the remaining life of the pavement. This is discussed further in Chapter 5.3. A pavement's life can be extended only by pavement rehabilitation, such as an overlay, or by replacement of the pavement.

New developments can generate increases in heavy commercial vehicle traffic which may have adverse impacts on pavements. Typical impacts resulting from an increase in the number and/or size of vehicles using a road include:

- a need for extra pavement width;
- a change in surfacing type or pavement thickness;
- an increase in maintenance; and
- the need to bring forward pavement rehabilitation or works involving new pavement.

5.2 Assessing pavement impacts

Developers are required to address only these pavement impacts directly attributable to their development proposals.

Where a development generates significant increases in heavy commercial vehicle traffic, the additional pavement impacts need to be quantified for each stage of the development. Construction activities often involve intensive, short-term haulage and the road impacts of this haulage over the construction period need to be assessed. A comparison of the nature and timing of roadworks required with and without the development is needed. This comparison requires predictions of pavement maintenance and/or rehabilitation required under each case, based on forecast traffic (measured in ESAs). Similar analysis is required for potential pavement impacts during the operational stage(s) of the development project.

Refer to Pavement Design Manual and Pavement Rehabilitation Manual

Guidance on the nature and timing of pavement works, and the design and construction standards to be achieved, can be obtained from manuals such as the Main Roads Pavement Design Manual and the Main Roads Pavement Rehabilitation Manual. An outline of the assessment procedure is provided in Chapter 5.3. It is important to appreciate that forecasting any required pavement works requires a thorough knowledge of the issues involved and a degree of professional judgement.

The development proponent may be required to meet the costs of any pavement rehabilitation or maintenance works beyond those that Main Roads would normally expect to provide. For example, a developer may be responsible for meeting the cost of bringing forward the need to rehabilitate a pavement earlier than would have been required without the development. The proponent may also be responsible for meeting the cost of any increase in maintenance required as a result of the development.

5.3 Outline of assessment procedure

The following procedure expands on Main Roads' general approach to road impact assessment as outlined in Chapter 1.3.

5.3.1 Development profile and future traffic volumes

Refer to Appendices C and D for sample projects

The traffic volumes and ESAs with and without the development that was determined as part of the development profile in Chapter 4 will usually provide sufficient information for the pavement assessment. The MR district office should be consulted about existing traffic growth rates and predicted traffic growth without the development.

5.3.2 Scope of assessment and criteria to be adopted

The MR district office will be able to confirm the appropriate scope of the pavement assessment. They can also advise if any variation from normal pavement assessment methodologies or criteria is appropriate. Remaining pavement life is normally determined by comparing the traffic on which the pavement design was based with actual traffic that the pavement has carried. Approval should be sought from the District Office before using any alternative method for calculating remaining pavement life (such as roughness trends).

Main Roads holds substantial information on existing pavement condition, expected pavement life and planned maintenance expenditure, which is available for use by development proponents. The following information about current maintenance practice and pavement improvements should usually be sought from Main Roads:

- current pavement design and design life;
- current pavement age;
- date of last programmed maintenance;
- current cost of routine maintenance (including on-costs) in $/km or $/lane km;
- current cost of likely programmed maintenance (including on-costs) in $/m^2;
- current traffic including AADT, percentage of commercial vehicles, growth rate and distribution of vehicles by class (if known) and likely number of ESAs per commercial vehicle;
- any pavement maintenance or rehabilitation planned for the road and its timing; and
- design details of any proposed rehabilitation schemes.

5.3.3 Impact assessment and determination of additional road requirements

The pavement assessment should include consideration of with and without development cases, leading to an estimate of the extent, timing and costs of:

- pavement improvements such as road widening;
- maintenance (including increased maintenance where development-related improvements will change pavement area or type); and
- rehabilitation.

Calculation of the remaining life of the pavement can be conducted as a desktop analysis from records of pavement design, current pavement age and past traffic. The task generally requires a consultant with the necessary skills to interpret information obtained from Main Roads. The remaining life (in ESAs) is the difference between the pavement design life (in ESAs) and cumulative past traffic.

5.3.4 Assessing pavement impacts

The following steps outline the process for assessing the pavement impacts of a development:

- determine the current traffic (number / type / ESAs);
- list the number and types of vehicles that will be generated by the development;
- calculate the total ESAs of commercial vehicles generated by the development;

Refer to Pavement Design Manual, Chapter 7

- calculate the annual ESAs with and without the development, based upon the likely growth rates in both cases to the design horizon; (see Pavement Design Manual, Chapter 7).
- determine the remaining life of the existing pavement in ESAs, based on information obtained from the District Office;

See Pavement Rehabilitation Manual

- predict when the pavement will require rehabilitation with and without the development, based on its remaining life and the forecast traffic (taking into account Main Roads' recent and planned pavement works);
- predict the cost of pavement rehabilitation required at the end of the remaining life of the pavement with the current traffic, and with the current traffic plus the additional traffic generated by the development;
- establish if there is a change in the vehicle mix using the road that may require widening of the pavement or surfacing. This can be done by discussing the vehicle types associated with the development with the MR district office. Where widening is required, estimate the cost of improvement works and the associated increase in maintenance (such as reseals) to the design horizon; and

- predict the total cost of routine and programmed maintenance in each year to the design horizon with the current traffic, and with the current traffic plus the additional traffic generated by the development.

In some cases a pavement may have reached the end of its design life, but it may continue to operate satisfactorily with the current traffic volume. However, an increase in heavy commercial vehicle traffic generated by a development might not be able to be sustained by the pavement. In such cases, a complete pavement evaluation in accordance with the Pavement Rehabilitation Manual may be necessary in order to assess what rehabilitation is required with and without the development.

The above analysis should determine the extent to which any additional pavement works are required to accommodate traffic generated by the development.

5.3.5 Determination of any developer contribution required

The results of the pavement impact assessment are tabulations of rehabilitation and maintenance requirements over the analysis period with and without the development. These tabulations should be accompanied by documentation of the calculation methodology, including all inputs and their source, and any assumptions made during the analysis.

If the pavement works with the development do not align with the works likely to be provided by Main Roads, it may be necessary for Main Roads to seek a developer contribution. Details of the processes involved are contained in Chapter 9. Such a contribution would be based on the bring forward cost methodology shown in Appendix G. In most cases, relevant pavement works would need to be completed prior to the commencement of operations of the development project.

5.4 Impacts on structures

See also Chapter 8.11

Impacts on bridges and other structures within the road reserve need to be considered in cases where the addition of development traffic (especially during construction) exceeds the capacity of existing infrastructure. In particular, expected movement of heavy loads (e.g. construction plant, generators, mining equipment) requires early consultation with Main Roads to determine if movement of the load is possible and, if so, under what conditions.

While structural impacts are unlikely to be an issue in the majority of instances, the MR district office should be consulted to determine whether this issue requires assessment. (see Chapter 8.11)

6.0 Traffic operation assessment

The general traffic operation assessment process is outlined below. The MR district office should be contacted early in the project process to ensure the RIA analyses that part of the road network where Main Roads is aware that significant impacts may eventual from the project proposal.

Main Roads can provide advice on the spatial extent and depth of analysis required and may be able to provide advice on traffic volumes.

Main Roads is responsible for the safety and transport efficiency of the SCR network. Aspects of both safety and efficiency are embodied in the various traffic operation assessment procedures.

Figure 6.1 outlines the traffic operation assessment process. As shown, operating characteristics need to be compared with performance criteria. If performance criteria are compromised as a result of a development, remedial works may be required.

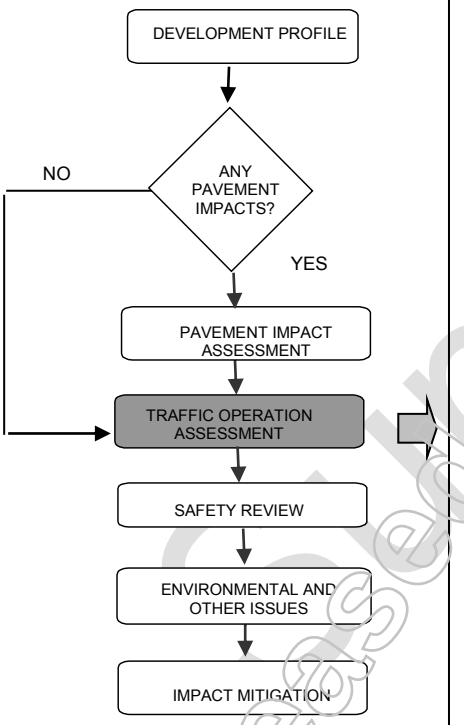
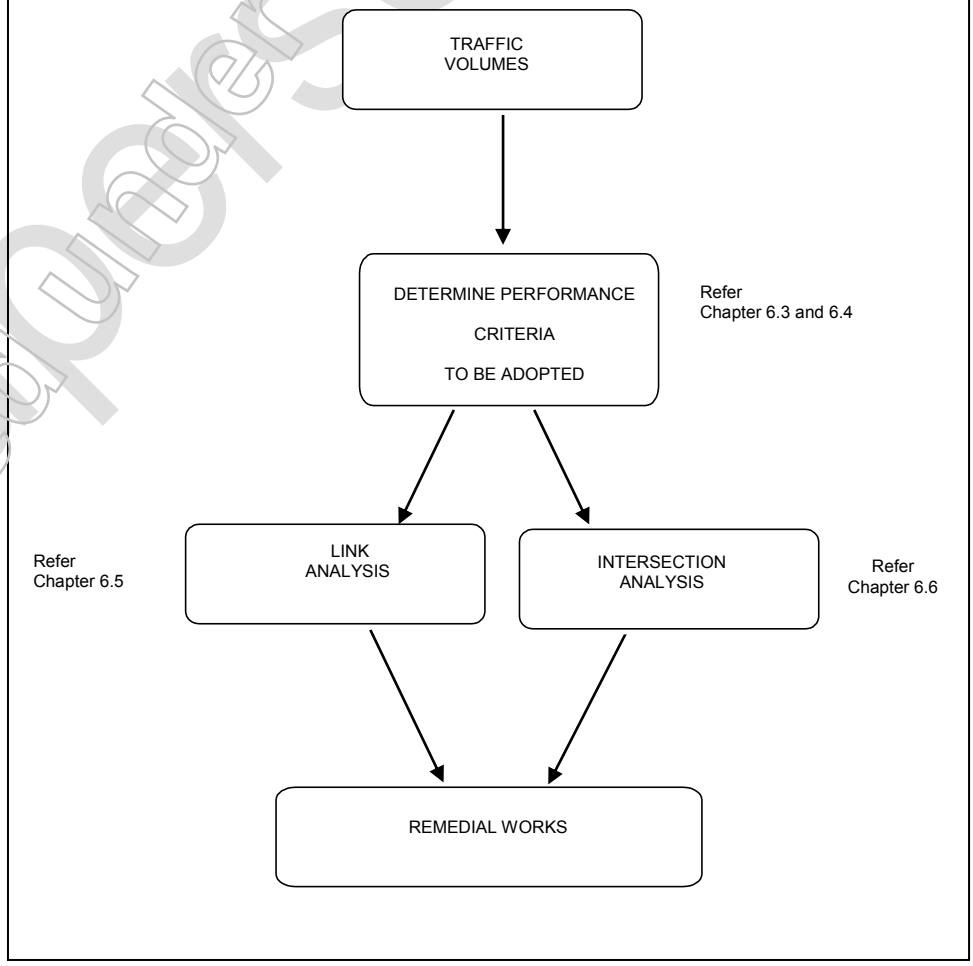


Figure 6.1 Traffic Operation Assessment Process



6.1 Assessing traffic operation impacts

The impact of additional traffic on traffic operations needs to be quantified where a development will generate significant increases in vehicle traffic. A comparison of the nature and timing of road construction and maintenance works required with and without the development will be needed, based on future traffic volumes for each case. The design horizon for a traffic operation assessment should be ten years after opening of the final stage of the development.

Guidance on the road design standards and warrants for various road elements to suit different traffic situations can be obtained from the Main Roads Planning and Design Manual (RPDM) and Austroads Guide to Traffic Engineering Practice (GTEP). An outline of the assessment procedure is provided in Chapter 6.2.

In some cases, Main Roads may agree to the use of criteria different to those that would normally apply. For example, in relation to the vehicle mix, terrain and limited road access, it might be appropriate to deviate from standard criteria and accept a higher than normal traffic volume as the threshold for an additional traffic lane on a road link.

Early contact should be made with the MR district office to determine if any variation to Main Roads' normal criteria could be adopted. It is important to appreciate that determining any required mitigation measures requires a thorough knowledge of the issues involved and a degree of professional judgement.

The development proponent may be required to meet the costs of any mitigation measures beyond those that Main Roads would normally expect to provide. For example, a developer would be responsible for the planning, design and construction of an access from the development site to the road network.

Once the need for mitigation measures has been triggered by a development activity, there may be instances where the optimum solution from the perspective of 'whole of life' management of the road asset exceeds the quantum of mitigation measures necessitated by the development proposal. For example, a development project may require partial road widening and yet Main Roads may decide that when overall future demands on the road are factored in, the most cost-effective solution would be major lane duplication. In such cases, any developer contribution would be based only on the share of the roadworks directly attributable to the development activity.

6.2 Outline of assessment procedure

The following procedure expands on Main Roads' general approach to road impact assessment as outlined in Chapter 3 (refer to Appendix C and D for sample projects).

6.2.1 Development profile and future traffic volumes

The traffic volumes with and without the development that were determined as part of the development profile in Chapter 4 will usually provide sufficient information to carry out the traffic operation assessment. The MR district office should be consulted about existing traffic growth rates and future traffic growth without the development.

6.2.2 Scope of assessment and criteria to be adopted

The MR district office will be able to confirm the scope of the traffic operation assessment. They can also advise if any variation from normal traffic assessment methodologies or criteria is appropriate.

The methodology for assessing the performance of roads and intersections is generally consistent between urban and rural locations, only the performance to be achieved changes. Generally, road users expect a better level of performance in rural conditions as speeds are higher, trip lengths are longer, and volumes are lower. However, for rural roads the maximum capacity of a road will also depend upon the roughness of the pavement surface (see Chapter 6.3 and 6.4 for more detail on performance criteria for road links and intersections).

6.2.3 Impact assessment and determination of additional road requirements

The traffic operation assessment will need to consider the nature and timing of mitigation measures required under both with and without development scenarios. This will require identification of the mitigation measures necessary to achieve relevant road link and intersection performance criteria (determined in Stage Two) for the traffic volumes forecast under each scenario (see Chapter 6.5 and 6.6 for analysis on the impacts of traffic on link and intersection performance).

Having identified the mitigation measures required to accommodate traffic generated by the development, the analysis should then consider the extent to which any mitigation measures required as a result of the development align with roadworks that would be required in the absence of the development.

6.2.4 Determination of any developer contribution required

If the mitigation measures with the development do not align with the works likely to be provided by Main Roads, it may be necessary for Main Roads to seek a developer contribution. Details of the processes involved are contained in Chapter 9. In most cases, mitigation measures would need to be completed prior to the commencement of development operations.

If mitigation measures necessitated by a development are unlikely to have ever been provided by Main Roads, the developer would be required to meet the full cost of the mitigation measures. Roadworks associated with access to the development site are an example of this.

6.3 Road link performance criteria

The developer is required to determine the performance criteria to be adopted. The performance measure for road links is the level of service (LOS), as defined in the RPDM Chapter 5 / GTEP Part 2. LOS is a qualitative measure describing operational conditions within a traffic stream and the perception of these by motorists and/or passengers.

6.3.1 Level of service

The RPDM / GTEP identifies six categories of LOS:

LOS A This, the highest level, is a condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream.

LOS B This level is in the zone of stable flow and drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream.

LOS C Most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream.

LOS D This level is close to the limit of stable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream.

LOS E This occurs when traffic volumes are at or close to capacity and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream may lead to a traffic jam.

LOS F This service level is in the zone of forced flow. Flow breakdowns occur and queuing and delays result.

6.3.2 State-controlled road standards

LOS criteria apply to road sections away from intersections. LOS E should be considered the limit of acceptable urban area operation and remedial works would be needed if LOS F would otherwise result.

In rural areas, change between LOS rankings is also critical. Generally, remedial measures to maintain existing LOS would be sought on rural SCRs. LOS C can be considered the minimum standard, although Main Roads may accept LOS D where weekend peaks are the defining event and occur on recreational routes.

Acceptable volume limits are reached at relatively low volumes on those parts of the rural network where the carriageway is unsealed or narrow. The volume of heavy commercial vehicles is often an issue when determining pavement life, traffic operations and appropriate road width. Road planning for low volume roads is a lengthy process which takes into account a variety of factors including the composition of traffic (commercial vehicles, tourist vehicles etc.), road alignment, soil type, climatic conditions and available funding.

6.3.3 AusLink National Road Network

Higher LOS standards are sought on AusLink National Roads (formerly National Highways), on which LOS B should not be exceeded for more than 100 hours per year for a design life of 20 years. However, funding levels mean that a deficiency LOS C may apply, subject to agreement with the MR district office.

6.4 Intersection performance criteria

The developer is required to determine the performance criteria to be adopted. A similar basic approach to link performance of intersections is adopted. Volumes on particular movements are compared with a calculated capacity for that movement, taking account of competing movements, layout, assigned priorities or signal settings as appropriate.

For signalised intersections, the volume/capacity ratio is expressed as degree of saturation (DOS), the key indicator of operational performance. For unsignalised intersections the key indicator is the utilisation ratio calculated as the volume/capacity ratio for entering movements, also a measure of DOS.

Refer to SIDRA User Guide

For signalised intersections, the analysis technique described in *AARB 1981* is appropriate. The computer application aaSIDRA version 2.1 or later is a computer implementation of this analysis with some additional degree of sophistication and enhanced algorithms. (See SIDRA User's Guide).

For sign-controlled intersections and roundabouts, the key indicator is utilisation ration, calculated as the volume/capacity ration for entering movements. It is also for intersections a measure of DOS. Analysis techniques are outlined in RDPDM Chapter 13 and GTEP Part 5 and for roundabouts in RPDM Chapter 14 and GTEP Part 6. Again, algorithms and analysis techniques have been enhanced in the aaSIDRA application.

Computer-aided analysis of signalised intersections is recommended to facilitate consideration of factors such as:

- pedestrian crossing times;
- effect of shared lanes;
- effect of short lanes; and
- constraints imposed on cycle time, phase sequence and green splits where an intersection operation is coordinated with other intersections.

6.4.1 Limits of acceptable operation

There are various intersection parameters that need to be considered with respect to development impacts. The methodology for determining the limits of operation for the different types of intersections are discussed and specified in the relevant RPDM and GTEP chapters.

The guidance given below does not override the fundamental requirement that development proponents analyse and mitigate their development's impacts to ensure the safety of the intersection. For example, if the analysis of a signalised intersection (including development traffic) determines that the DOS of a particular intersection is 0.88 **but safety is compromised**, then the proponent will be required to mitigate the developments impacts until safety is achieved, even though the DOS is less than 0.9.

In cases where the existing parameters of an intersection are above the limits given below, the development proponent will only be required to ensure that the intersection is no worse than the predevelopment conditions, while ensuring safety of the intersection is maintained.

The RIA needs to address a sense of parameters that are discussed below:

6.4.1.1 Intersection capacity

- **signalised intersections** – the intersection DOS, the proportion of available green time capacity taken up for the critical movement(s), 90% ninety per cent of theoretical capacity and is considered a 'practical capacity' beyond which delays increase substantially for modest increases in volume;
- **roundabouts** – the DOS for any movement should not exceed 0.85; and

- **priority junctions** – the DOS for any movement should not exceed 0.80.

Note: The aaSIDRA default value for saturation flow is 1950 through car units/hour. The performance results obtained from using this value may be conservative in terms of actual impacts.

6.4.1.2 Queuing and queue lengths

For SCRs, 95% confidence limit should generally be used for queue lengths. This is referred to as the 95th percentile queue length. A greater confidence limit may be appropriate where excessive queue length is likely to cause significant problems.

6.4.1.3 Sight distance

Sight distance at intersections should conform to the RPDM Chapter 13 and GTEP Part 5.

6.4.1.4 Intersection layout

For priority junctions (including accesses), the intersection layout should conform to the RPDM Chapter 13 and GTEP Part 5 requirements.

6.5 Road link analysis

The development profile establishes flows on each relevant road link (divided into homogenous sections).

Refer to Appendices C and D for sample projects

LOS may be determined for different terrain types, vehicle mix, and grades, using the service flow rate derivations of the RPDM Chapter 5 and GTEP Part 5.

The longer travel distances involved in rural areas make extended operation at LOS D and E intolerable. At these LOS, travel is usually achieved in platoons of vehicles and overtaking opportunities are severely limited, which in turn introduces unacceptable delays and safety issues. The RPDM / GTEP processes take this into consideration.

Overtaking opportunities are critical to achieving acceptable operation on two-lane rural roads. The effects of unsealed roads or unsealed shoulders on dust and visibility should be considered. Increases in volume can trigger the need for overtaking lanes. An RIA may therefore need to identify the way in which a proposal could influence overtaking opportunities on a road section.

Proposals which would generate significant heavy commercial vehicle movements (e.g. mine haulage, extractive industry sites or sugar cartage) may have an impact on the LOS of road sections where overtaking is limited by alignment or long adverse grades. In some circumstances, it may be necessary to model the operation of the road section to quantify impacts and assist in determining the need for and location of overtaking lanes.

Computer simulation models which represent overtaking manoeuvres may be needed.

Consideration should be given to the safety impacts on the road network, and any necessary changes to the road network as a consequence of the development. The impact on public transport services, changes to bus routes, the need for, and location of, bus stops and the like should be addressed if relevant. The analysis should also examine the impact on amenity, including traffic noise, dust and speed issues. Traffic penetration of adjacent areas (particularly residential areas) should be specifically addressed, although its impact may be more related to local government interests.

6.6 Intersection analysis

A variety of computer analysis packages are available for intersection analysis. The package most widely used in Queensland is aaSIDRA (aaSIDRA version 2.1 or later should be used), which provides analysis of isolated signalised intersections and roundabouts.

Refer to SIDRA User Guide

Where the intersection being considered is adjacent to (within one km of) other signalised intersections, it may be necessary to consider the operation of the intersections as part of a linked traffic signal network. The computer application TRANSYT-7F Release 10 or later should normally be used for this analysis.

Where reassignment of traffic within a network has to be considered, the use of transport modelling packages such as SATURN may be appropriate.

The intersection analysis should consider operation during the road peaks and, for larger developments, during peak generation of the development, or during the combined peaks where relevant.

With signalised intersections, consideration of other operating characteristics aside from DOS is also needed, including queuing and long delay. If excessive, these may generate other problems such as:

- blocking of driveways and side streets;
- overflows of dedicated turn slots;
- additional energy use; and
- interrupted flow conditions.

All assumptions made in the assessment of intersection or network impacts should be clearly stated.

For rural intersections, the warrants for intersection treatments are embodied in the GTEP Part 5 / RPDM Chapter 13.

Accesses to SCRs are to be treated as intersections to a SCR. Requirements could include channelisation, auxiliary lanes, medians, lighting, or development of controlled intersections (signals or roundabouts). As SCRs tend to serve an arterial function, it is preferable to avoid additional turning movements, median breaks and intersections. Only where the overall efficiency of the system is enhanced would such additional facilities be considered for approval.

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7.0 Safety review

This chapter outlines the safety checks to be undertaken as Step 4 of the RIA process shown in Figure 3.1. All RIAs should satisfy the safety checklist included in Appendix B and include an analysis of crash rates, where required by Main Roads.

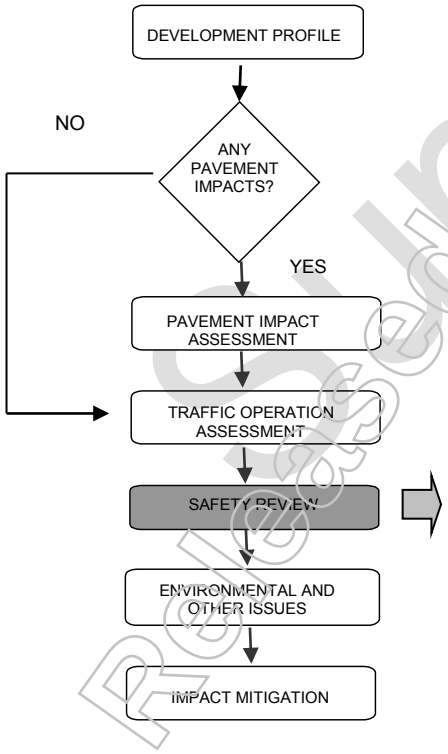
Refer to Austroads and Standards Australia Road Safety Audit

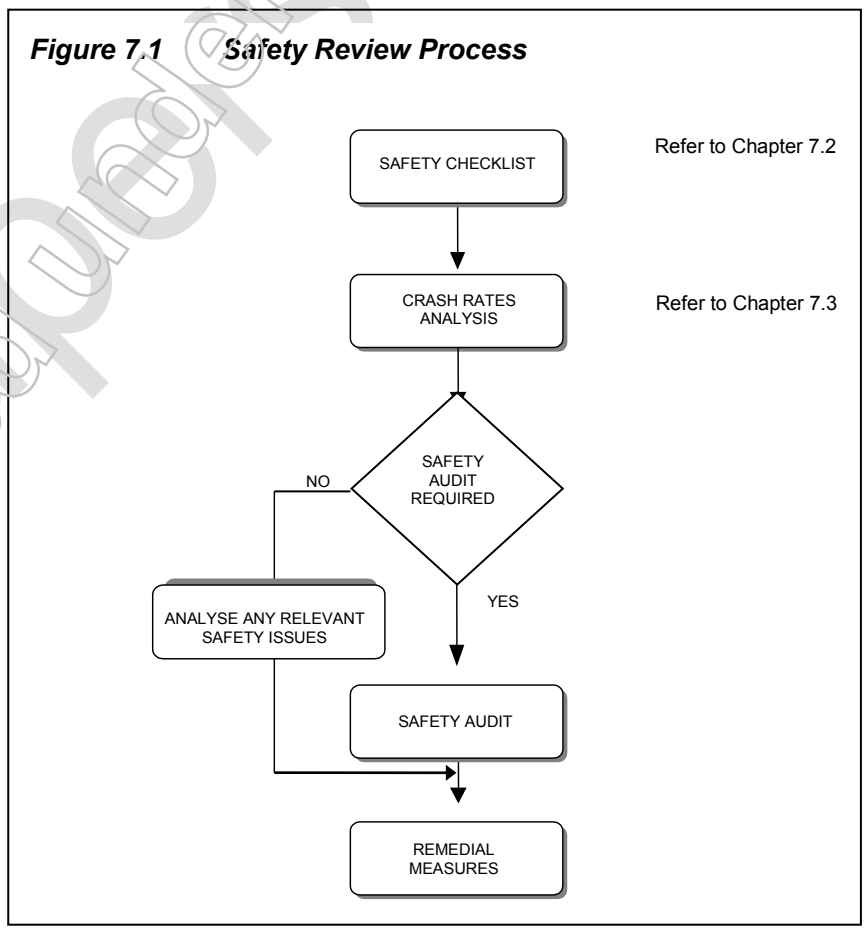
There may be some circumstances involving major works at critical locations where Main Roads may require a safety audit as part of the RIA. These audits follow a prescribed procedure and require trained assessors. Generally, this level of effort is not expected in an RIA unless specifically requested by Main Roads.

Consideration of the road safety impacts for each stage of a development (including construction) will usually be required. The design horizon should be 10 years after opening of the final stage of the development. Ameliorative measures are likely to be required if a development is expected to create a road safety hazard.

Figure 7.1 expands the RIA process flowchart in dealing with safety issues.

Figure 7.1 Safety Review Process





7.1 Relationship between operation and safety

Road safety considerations are embodied in many road design and traffic performance criteria. In many cases, therefore, additional analysis of road safety issues will not be required.

Many safety aspects are implicit within operational performance measures such as intersection capacity. For example, at a give-way controlled intersection, the relevant performance measures are visibility, clear priority measures in place, capacity and delay on the minor approach. Critical values of these performance measures are set to avoid drivers being forced to accept inadequate gaps in the traffic flow.

7.2 Safety checklist

To ensure relevant safety issues are not overlooked, a checklist of matters that may need to be reviewed is provided on Page four of Appendix B. It also provides references to relevant guidelines. The safety issues are grouped under the headings of:

- intersections and access;
- road links;
- pedestrians;
- cyclists; and
- motorcyclists.

As already noted, many safety issues will have been addressed through other parts of the RIA and will not need to be dealt with separately, for example, through the traffic operation assessment. The safety checklist identifies those issues most likely to have been addressed through other parts of the RIA.

Some of the road safety issues will not necessarily apply to every development. For example, safety considerations relating to large pedestrian movements on a SCR are unlikely to be relevant to a development in a remote location. The MR district office will be able to provide advice on where safety issues need to be considered for a specific development.

7.3 Crash rates

If the nature and location of a development is likely to contribute to an increased crash risk, Main Roads may require an analysis of crash rates as they can indicate a potential road safety problem. Where a development is expected to result in an unacceptable crash risk, the proponent will need to assess what can be done to overcome or reduce the risk of crashes occurring (eg by providing a pedestrian crossing or bridge).

Existing crash data for SCRs is held by Main Roads in its road management information system (ARMIS), while Queensland Transport holds crash data for other roads and public places. These agencies can be contacted to obtain crash records. Data should be examined over a five or ten year period to obtain a reasonable trend.

Crash data (by crash type and severity) is generally identified separately for mid-block sections of road and for intersections.

Because crashes are generally related to exposure to potential conflict, crash rates need to be normalised:

- by vehicle–kilometres travelled for mid block sections
- by vehicle throughput for intersections.

The existing crash rates are then compared with a level of crash expectation attributable to the development to determine whether the development will increase the existing crash rate.

Refer to GTEP Part 4, Chapter 4 for calculation of critical crash rates

The expected crash rate with the development is then compared with relevant critical crash rates to determine whether a significant road safety problem exists. Critical crash rates take into account the average crash rate for intersections and links across the network with similar traffic and land use characteristics. Where is it is deemed there is a significant safety problem, further investigation can determine any road safety treatments that would be required. These treatments can include barrier medians, turn lanes, turning prohibitions or a reduction in traffic speed.

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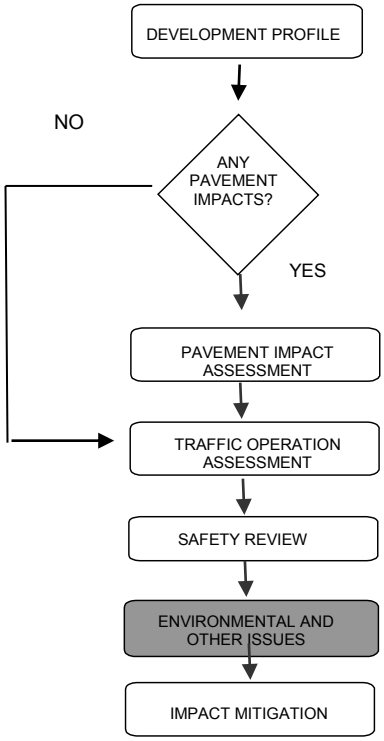
8.0 Environmental and other issues



Other issues, most of which can be categorised as environmental, but also include road use management, transport corridor planning, parking and access control issues may result in adverse impacts on the SCR network and require mitigation. These issues are addressed in Step 5 of the RIA process.

The extent to which these issues will need to be addressed depends on the nature of the impact on the existing SCR. The MR district office can provide advice on the issues that will need to be assessed.

The likelihood of these issues requiring assessment during the RIA process increases with the significance of the impacts on the existing SCR. For instance, a proposal which increases traffic volume but does not necessitate mitigation measures requiring new roadworks is likely to be limited to assessment of road traffic noise and visual impact. However, a proposal which not only increases traffic volume but also necessitates new roadworks either within, or outside of, the existing road formation is likely to require more extensive assessment of environmental issues.

This chapter identifies many of these issues and provides direction on how to address them, including possible mitigation measures.

8.1 Road use management

This chapter applies to operational changes within industry that result in increased heavy vehicle use on state-controlled roads (SCRs).

8.1.1 Road use issues

Operational changes within established industries can cause significant road impacts, particularly where industry rationalisation, expansion or logistical change lead to increased use of SCRs by heavy vehicles. Increased activity could be either permanent, or temporary, where the length of time of operation is uncertain or unknown, and may continue until industry decisions alter transport demand or choices. Examples of significant industry change resulting in sudden increases in heavy vehicle traffic are:

- The sugar industry, as a result of industry rationalisation and regulatory change and;
- The coal industry, as a result of international market expansion driving product demand and short-term transport logistics changes in the supply chain.

Road use issues associated with these industry changes include:

- A decision to shift additional freight onto roads without consultation with Main Roads or local government will result in unplanned increases in heavy vehicle movements on SCRs and Local Government Roads (LGRs);
- Because the increased heavy vehicle activity often affects vulnerable lower order roads, regional alliances with local government should be sought;
- Because the traffic problems could be short-term or seasonal, upgrading the roads may not be a funding priority for government;
- The management of "as of right" heavy vehicles such as semi trailers and heavy vehicles subject to permit conditions or guideline restrictions will need to be reviewed if traffic increases are significant; and
- Solutions are required to address the particular industry's road impact while not penalising, the existing longer-term road users.

8.1.2 Traffic management risks and road impacts

Specific operational impacts and risks need to be considered and addressed in cases where the increased generation of heavy vehicle traffic will have a significant road impact. For example, potential safety risks due to:

- the interaction of heavy vehicles with general traffic and other road users at intersections (chiefly highway entry and exit points);
- Insufficient passing space on LGRs for semi trailers;
- Vulnerable LGRs and SCRs with pavements / bridges or road shoulders not designed for unexpected sudden increases in seasonal heavy vehicle traffic - leading to higher road maintenance costs and funding shortfalls; and
- Immediate amenity impacts causing community complaints to government.

8.1.3 Planning challenges

There are two main types of challenges:

- Immediate problems that must be managed for short-term impacts such as safety and road damage; and
- Longer-term planning challenges that require decisions about likely demand in future years and how to best plan and prioritise road authority responses to that.

Immediate issues cannot wait for analysis of long-term matters and planning decisions. Long-term decisions can be made difficult by a range of uncertainties pertinent to the road impact as well as

uncertainties related to local network planning. For example, industry may make certain choices based on economic considerations that may be either on a trial basis or based on fluid criteria (such as commodity price). This will require decisions as to whether to plan for an ongoing longer-term scenario, treat the short term only, or find some other compromise.

8.1.4 Mitigation options

In addressing the issue of increased seasonal heavy vehicle freight movements on district roads the following approaches may be beneficial and should be considered. They are:

- Freight transport plans / road use management plans
- Designated routes
- Use of official traffic signs

8.1.4.1 Transport plans / road use management plans

- **Freight transport plan**[1] is a planned approach that will ensure the best use of available transport options, including alternative modes, to cater for seasonal freight demands, while taking into account safety, road damage and associated costs, industry viability, community concerns and environmental concerns. For example, a negotiated freight transport plan resulting in investment by sugar mills in the cane rail system as an alternative to haulage of sugar cane by road
- **Road use management plan**[2] is a plan specifically for managing road-related issues and is based on negotiation with industry to best manage current and future increases in district road use/access by specific freight commodities and specific types of heavy vehicles to alleviate and manage adverse traffic management risks and road impacts.

Both can be developed for either short or long-term solutions, separately or in the same document, as appropriate to the circumstances.

Freight Transport Plans / Road Use Management Plans have been applied successfully by Main Roads Districts to address heavy vehicle traffic management risks and road impacts.

If the scenario involves increased heavy vehicle traffic flows that will have adverse impacts, such as significant infrastructure damage across SCRs and LGRs and/or a mix of safety and amenity issues, then the best approach would be for the industry

[1] Haulage compensation agreements, in conjunction with road use management plans, have been successfully used by MR districts / regions to manage increases in bulk road freight movements in certain industries such as minerals and coal. Central Region, with the assistance of Legal and Legislation Branch, has developed a proforma for "Coal Haulage Compensation" which may assist with issues to be addressed in the preparation of a transport plan.

[2] Road Use Management Plans or Traffic Management Plans have been successfully used by Main Roads districts to manage and control bulk road freight movements for "notifiable road use" under the *Mineral Resources Act 1989*. Central Region have developed a proforma for a "Road Use Management Plan"

proponent to consult with relevant State and local governments and negotiate the implementation of a transport plan or a road use management plan. This will facilitate a balanced, measured and co-operative approach to the use of available transport modes by industry and, if increased seasonal use of district roads by industry is unavoidable, can be used to appropriately forward plan and manage the increased heavy vehicle traffic in line with community and road agency expectations.

Consultation at an early stage will help clarify road impact requirements rather than having to risk the application of existing legislative powers to forcibly influence road use.

8.1.4.2 Designated routes

In most cases, seasonal heavy vehicle traffic will have impacts on both LGRs and SCRs. The determination of designated or preferred routes will therefore be subject to consultation between Main Roads, local government and industry and will depend on the current function and capacity of the roads being used / proposed to be used by industry, the types of heavy vehicle to be used and their frequency of use.

As of right, heavy vehicles will need to be considered together with restricted access vehicles such as:

- multi-combination vehicles such as, B-Doubles, B-Triples, road trains;
- over-dimensional & over-mass heavy vehicles; and
- large special purpose vehicles.

Restricted access vehicles are subject to route access guidelines which allow road authorities to approve, disapprove or condition access by these types of heavy vehicles. For example, a B-Double operator must apply for approval to access roads other than approved B-Double routes. Local governments or districts can either reject such an application, approve access or condition access based on time and/or days, vehicle speed limits or on weather conditions.

Details of heavy vehicle guidelines are available on the QT intranet website under "Heavy Vehicles" and provide information bulletins and guidelines on the use of heavy vehicles such as:

- B-Doubles, road trains, B-Triples, AB-Triples;
- agricultural vehicles and agricultural combinations;
- excess dimension and excess mass vehicles carrying indivisible articles;
- livestock loading;
- pilot and escort vehicles and drivers; and
- dangerous goods vehicles.

As of right, vehicles such as semi trailers do not operate subject to route assessment as multi-combination vehicles do, but they can be managed through the use of official traffic signs.

8.1.4.3 Use of official traffic signs

Various powers authorise the use of official traffic signs to restrict or re-direct access to certain roads by certain vehicles or classes of vehicle. They can be used where unplanned industry activity causes safety or infrastructure damage risks. Main Roads may consider installing official traffic signs:

- to warn road users of the risks associated with increased seasonal heavy vehicle activity;
- to regulate and manage heavy vehicle access to local and district roads in certain circumstances, for example:
    - restrict heavy vehicles to specific routes (temporarily or permanently);
    - restrict heavy vehicle movements during certain times of day / days of week;
    - redirect heavy vehicles to alternative routes (temporarily or permanently);
    - engage with enforcement agencies to ensure compliance with conditions; and/or
    - issue exemption permits to heavy vehicle operators who are outside of the targeted seasonal activity.

There are legislative options available to state and local governments to restrict types of heavy vehicle access to specific LGRs and SCRs (refer to Chapter 2). However, solutions based on voluntary negotiation of and compliance with a plan is preferred, as it is likely to result in a better solution and avoid penalising other road users.

8.2 Road traffic noise

Noise mitigation treatments can be incorporated into development proposals by including barriers, setbacks, building orientation, building insulation and/or development layout (eg locate the more noise sensitive components of the development away from the SCR). The effectiveness of barriers is dependent upon issues such as topography, building height, barrier type and location and whether or not the road is limited access. Treatments other than barriers become very important in instances where barriers are less effective (e.g. hilly terrain, multi-storey buildings, roads which are not limited access).

Guidance can be obtained from:

- the *Environmental Protection Act 1994* and the associated Environmental Protection Policy on Noise; and

- Main Roads' Code of Practice for the Management of Road Traffic Noise.

8.3 Visual impacts

8.3.1 Headlight glare

If residential development is placed near a SCR, headlight glare from the traffic stream can impact on amenity / safety, thereby requires mitigation measures such as landscaping or fencing.

A common treatment is the incorporation of landscaped buffers between the SCR and the residential development. Landscaping vegetation can grow to quite high levels and effectively shield buildings several storeys high. The type of vegetation varies dramatically across the State depending on local climatic and other conditions, but the general aim is to adopt low maintenance species.

8.3.2 Distractive lighting

Some developments may have significant on-site activities or lighting (eg golf driving ranges, waterslides and stadiums) which can distract motorists on a SCR and thereby affect safety or efficiency.

Mitigation treatments can include landscaped buffers between the development and the SCR and/or the placement of shields on the lighting to prevent direct light being emitted onto the SCR traffic stream.

8.3.3 Aesthetic appearance of SCRs

The community is now demanding that SCRs present an aesthetically pleasing vista wherever possible. This includes the minimisation of 'hard' surfaces such as concrete and asphalt and the maximisation of 'soft' surfaces such as landscaping.

In some local government areas where visual amenity is given more emphasis (eg tourism destinations), SCRs are often seen as the 'scenic drive' and/or 'entrance statement' to the relevant local government area.

Main Roads' Road Landscape Manual provides guidance on visual amenity, and many local governments have guidelines that suit their local conditions.

8.4 Geotechnical stability

Developments such as quarries and extractive industries located near SCRs have the potential to affect the safety of SCRs due to

blasting (eg flyrock) or undermining (eg a large hole adjacent to and downstream of a SCR in a major river channel).

Mitigation treatments to protect property within the road reserve can include minimum setbacks, blast mattresses and other measures.

Main Roads' Road Drainage Design Manual provides guidance on the management and treatments for erosion and sediment control on SCRs.

8.5 Dust control

8.5.1 Dust-generating developments

Developments such as crushing or screening plants can generate dust which could impact on the safety of SCRs; however, contemporary industry regulations have reduced the incidence of this.

Mitigation treatments could include setbacks and dust control devices.

8.5.2 Locating developments near unsealed roads

If a dust-sensitive development (eg residential dwelling) is located near an unsealed SCR, this can adversely affect the development. The presence of the development can then affect the efficiency or planning of the SCR if Main Roads is forced to reroute or close the road to control the dust nuisance.

Mitigation treatments in these circumstances may range from architectural measures in the dust-sensitive development such as placing windows away from the dust source, to sealing appropriate sections of the state controlled road.

8.6 Hydraulic and hydrological impacts

Existing and future SCRs can be affected by upstream and downstream developments which change the location, level, flow rate and quality of water runoff. These impacts can be in terms of safety (eg damage to road infrastructure or accidents caused by water flowing over the road), efficiency (slowing down of traffic or blocking of roads via flooding), and planning (eg changing the form, cost or effectiveness of future road infrastructure).

Mitigation treatments can include:

- incorporating hydraulic designs into the development such that the location, level, flow rates and quality of water run-off along or across SCRs are not changed (eg retention basins); and

- incorporating additional hydraulic infrastructure in SCRs to accommodate the changes to the location, level, flow rates and quality of water run off (if permitted by Main Roads).

Main Roads' Road Drainage Design Manual provides further guidance on the design of stormwater drainage and on the management and treatments for erosion and sediment control on SCRs.

8.7 Roadworks in the road reserve

If roadworks are proposed outside of the existing road formation that will require earthworks, vegetation removal or infrastructure extension (eg lane widening or bridgeworks), then detailed assessment of the impact of those roadworks may be required.

Main Roads' Road Project Environmental Processes Manual (2004) identifies key responsibilities and processes regarding environmental impact assessment and impact management issues. It describes environmental procedures and techniques for the management of environmental issues that may affect or be affected by road projects.

The proponent should consider the potential and actual environmental impact the development will have on SCRs as part of the environmental impact process that will be undertaken. This process is normally documented in a Review of Environmental Factors or EIS.

Typical issues to be addressed include:

Refer to Road Design Manual

- impact on flora and fauna from any proposed clearing in the road reserve;
- impact of any changes to surface and subsurface drainage, including water quality;
- impact of any land disturbance in the road reserve, including weed infestations, erosion and sedimentation;
- impact on any structures (natural or constructed) in the road reserve;
- native title clearances, if any, that might be required;

Refer to Cultural Heritage Manual

- impact on any items of Indigenous and non-Indigenous cultural heritage. Main Roads' Cultural Heritage Manual facilitates the understanding of, and procedures associated with, the assessment and management of cultural heritage issues associated with road development; and
- impact from any process in the road reserve that may generate regulated waste or other contamination.

The environmental impact assessment should also address mitigation measures to ameliorate the impact of the proposed development.

Main Roads' Roads in Wet Tropics Manual outlines best practice in the management of road development in the Wet Tropics of North Queensland.

Main Roads' Environmental Legislation Register provides an overview of key Commonwealth and State legislation, regulations and policies that affect the planning, design, construction and maintenance of SCRs.

8.8 Transport corridors

Main Roads' planning of SCRs covers the identification of road corridor requirements, including widening existing SCRs and identifying new corridors for future SCRs. The normal practice is to preserve these corridors as development occurs.

Guidance is provided in Main Roads' Road Planning and Design Manual.

8.9 Access control

The safety or efficiency of SCRs can be impacted upon by the level of access between SCRs and adjacent land parcels or roads. The planning of SCRs can also be impacted upon by the level of access permitted because this can influence:

- crash rates;
- the effectiveness of future noise mitigation treatments (eg noise barriers); and
- the form, cost and effectiveness (and hence the safety or efficiency) of existing and future road infrastructure.

Mitigation treatments usually include the minimisation of direct access between SCRs and adjacent land parcels or roads by:

- limiting or prohibiting direct access where this is necessary to allow the SCR to perform satisfactorily the function allocated to it within the road hierarchy;
- prohibiting particular turning movements;
- amalgamating existing accesses or redirecting them via the provision of service roads or local government road links; and
- restricting use of access to particular types of vehicles or times of day.

Main Roads requires approval in all cases where a development seeks direct access to a SCR. A new access approval will be required if any change in use of the site or access subsequently occurs. In certain circumstances, Main Roads may issue a temporary access approval during on-site construction of a project.

8.10 On-site parking requirements

Developments located adjacent to SCRs and on-street delivery of goods can result in roadside parking which may cause adverse safety, traffic efficiency or planning impacts (eg it might compromise future road or transport options).

While Main Roads can overcome these impacts by redesigning, reducing or prohibiting roadside parking, these mitigation treatments can be difficult to implement if the development relies on roadside parking.

Provision for development parking is primarily a local government issue. Main Roads aims to ensure that where developments have the potential to use roadside parking within SCRs, these developments have adequate on-site parking provision. This ensures future removal of any roadside parking does not significantly affect the development's viability. This includes both the correct amount of parking for users and delivery of goods and the correct location within the development such that it is fully used.

8.11 Ancillary works and encroachments

Section 50 of the TiA defines certain things and activities as ancillary works and encroachments which may be constructed or carried out on SCRs with the written approval of Main Roads.

These include such things as overhead conveyors or other structures, tunnels, advertising signs, bikeways, pipes and cables. Activities such as clearing, sporting events, camping and conducting a business are also included. Main Roads needs to approve such things and activities because of their potential to interfere with the planning or operation of SCRs. Such approvals may be subject to conditions, including the payment of fees and other charges.

8.12 Over-dimension vehicles

Vehicles that exceed the legal load and dimension limits can impact road structures such as pavements, bridges or culverts. Legal vehicle dimensions are defined in

- Transport Operations (Road Use Management) Regulation 1995; and
- Various Queensland Transport Performance Guidelines for Special Vehicles in Queensland, for example, Road Trains and B-Doubles.

Excess mass permits must be obtained from Queensland Transport and endorsed by Main Roads before over-dimension or excess mass loads are moved on SCRs.

Where the infrastructure needs to be improved for example, bridge strengthening or widening, these improvements should be estimated and tested.

Queensland Transport's Vehicle Limits Manual provides information about the factors considered in the assessment of an Excess Mass Permit application.

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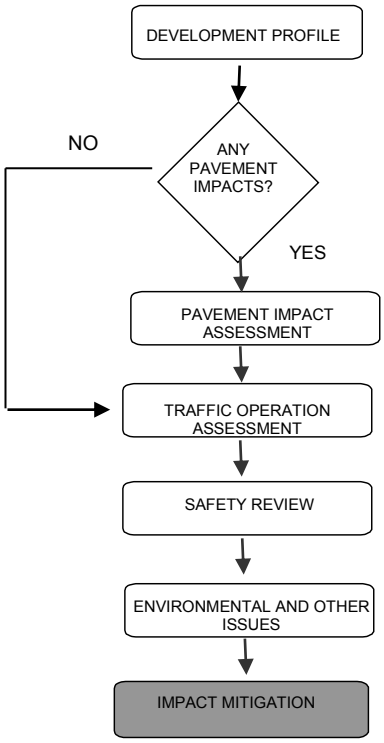
9.0 Impact mitigation



Previous chapters have identified development impacts in terms of traffic operations (Chapter 6), pavements (Chapter 5) and other matters such as drainage and noise (Chapter 8). In determining these impacts the development proponent needs to have considered the safety and efficiency implications of their development on the SCR road network.

This chapter deals with Step 6 of the RIA process, covering the consolidation of identified impacts and determining the types of treatments and/or measures required to address these impacts, including costing of mitigation treatments and funding arrangements.

The main purpose of Chapter 9 is to provide a basis for determining:

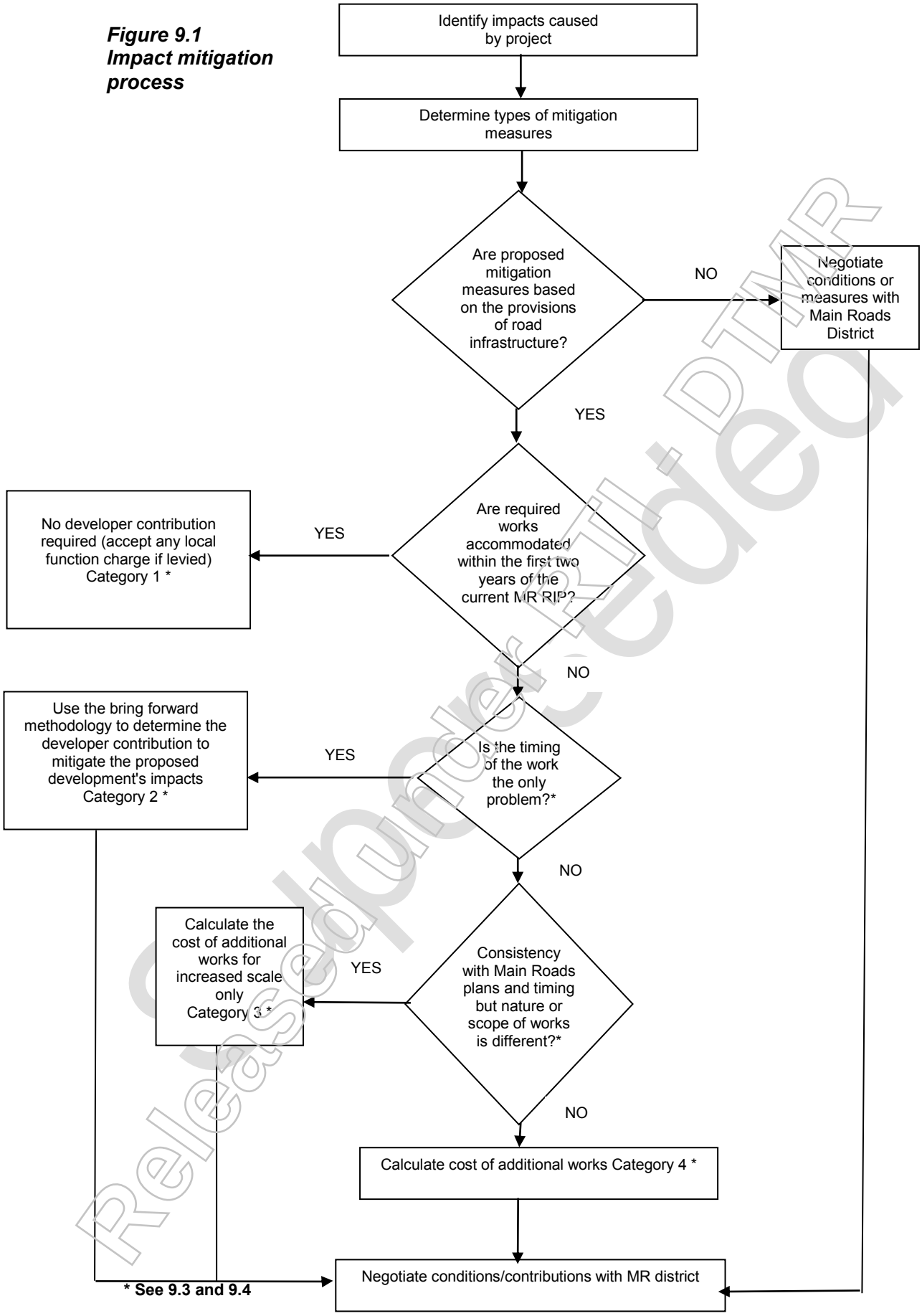
a) what additional roadworks or mitigation measures are required to accommodate the proposed development impacts on the SCR network; and

b) whether Main Roads has the roadworks and associated infrastructure required by the development in the first two years of its program of works (RIP).

However, if no works are programmed, then the proponent will need to propose mitigation treatments that enable Main Roads to meet its legislative obligations (refer Chapter 2 and Principle 1 in Chapter 1.3) whilst allowing the development to proceed. The cost of these works will be at full cost to the developer, irrespective of who else benefits from the infrastructure upgrades.

Figure 9.1 illustrates the impact mitigation process for development proposals.

Figure 9.1
Impact mitigation process



9.1 Mitigation timeframe

Main Roads requires a period of time over which it can adjust its planning, infrastructure investment and program for new transport infrastructure. This is also the time (the mitigation timeframe) when development proponents can mitigate their development impacts.

A 10 year mitigation timeframe should be adopted by development proponents unless advised by the MR district offices due to local circumstances. The mitigation timeframe commences at the start of the use

Development road impacts identified in Chapters 5, 6, 7, and 8 that fall within the mitigation timeframe need to be mitigated by the development proponent. For example, if rehabilitation works were planned to occur in year 14 but, due to development activities, are required in year 8 then the development proponent will be responsible for the mitigation of this impact. However, if the development activities brought requirement for the rehabilitation works to year 11 then the development proponent will not be responsible for this mitigation treatment. Main Roads will accommodate this need in its forward planning and road works programming.

This period allows Main Roads a reasonable planning horizon and sufficient time to program road works to deal with the anticipated road impacts.

NOTE: The mitigation timeframe is not the design horizon or impact assessment period.

9.2 Main Roads planning framework

Main Roads aims to provide an efficient and safe road network which helps to facilitate development across all industry types. To the extent possible, MR's road planning seeks to accommodate local government through the 'Roads Alliance' and industry road needs, within the constraints of other competing road priorities and available funds.

A key focus for Main Roads is to integrate road system planning with other transport modes, broader land-use planning and the general community as outlined in Main Roads primary strategic document *Roads Connecting Queenslanders (RCQ)*.

The RCQ outlines Main Roads' medium-long term intentions, which are subsequently documented in the department's state-wide planning, investment strategies and Statements of Intent (SOI) for each link in the road network. They are then further developed into actual road infrastructure projects during the development of the RIP.

Main Roads' road planning intentions for each SCR link in each local government area are set out in the SOIs. These SOIs are

referenced in the planning scheme developed for each local government area, and provide a qualitative description of specific road links, Main Roads' broad vision over a period of 20 years for the link and its current condition. Due to the uncertainties of future levels of road funding and changing road priorities over time, SOIs are unlikely to provide any indication of the timing for specific roadworks.

The transition of intentions into projects requires Main Roads to consider available funding and competing priorities across the whole road system in Queensland, and its level of certainty increases as it moves from defining its intentions to developing projects.

While Main Road's intentions may be certain in the medium to long term, it may be unable to commit to a particular project because of uncertain funding and project characteristics. As funding certainty is achieved only in the first two years of the RIP, Main Roads has difficulty in committing to projects beyond in this time.

Certainty in terms of road alignment and structure (pavement type, width or depth) increases as Main Roads moves from concept planning through to detailed design.

The most detailed guide to roadworks planned by Main Roads over the next five years is contained in the RIP. The RIP is a rolling, five year program including project description, estimated cost and funding profile. Funding is firm for the first two years (with annual scheduling of work) and indicative for the remaining three years (with no annual schedules). The flexibility beyond year two caters for the dynamics of all transport demand and the uncertainties of future levels of road funding

Mitigation measures requiring roadworks beyond the first two years of the current RIP will require Main Roads professional knowledge and judgement based on expectations of likely levels of future roads funding and competing roadworks priorities. The development proponent will, therefore, need to consult with Main Roads about likely timing for the works.

9.3 Consistency between development impact mitigation measures and Main Roads plans

In order to assess the consistency between the development's impact mitigation measures and Main Roads plans the developer needs to determine which category the development's mitigation measures fall under.

Category 1: Consistent with Main Roads plans

The mitigation measures for the development to proceed now are clearly identifiable in the first two year of the RIP.

Category 2: Consistent with Main Roads plans but not timing

There are two possible scenarios:

- The development's requirements are consistent with the RIP, but the required mitigation measures are not in the first two years of the RIP.

- The development's requirements are beyond year five (that is, not on the RIP), but consistent with Main Roads planning.

In both scenarios the developer, in consultation with Main Roads, needs to determine whether the mitigation measures required by the development will become a Main Roads priority in the development's timeframe. Mitigation measures that fall outside Main Roads priorities will not be programmed within the RIP and have no firm funding allocation. This matter should be discussed with Main Roads at an early stage to determine whether Main Roads is in a position to accept the use of the bring-forward methodology (refer to Appendix G).

Category 3: Consistent with Main Roads plans and timing, but scope or scale of works is different

For example, Main Roads has planned an intersection upgrade including a 75 metre right turn slot, but the traffic operation impact assessment for a proposed development indicates a requirement for a 125 metre right turn slot.

Category 4: Inconsistent with Main Roads plans

The mitigation measure requiring roadworks would never have been anticipated or planned, or are so far into the future (beyond 25 years) that they are regarded as highly speculative and uncertain. For example, as a direct result of the proposed development, a low order road link is expected to cater for B-Doubles which was never envisaged and is inconsistent with the road hierarchy.

In all these categories, where there is a difference between the development requirements and Main Road's likely provision of future roadworks, it will usually be necessary for the developer to resolve with Main Roads how to mitigate road impacts of the development. This is considered in Chapter 9.4 below.

9.4 Determining a development proponent's contribution

Generally, if Main Roads intends to provide roadworks at some future date then the developer can use these roadworks to devise

mitigation measures for their development impacts. For example, if Main Roads' first two years of the RIP show an intersection upgrade at some point in the future, then the developer can include these works in their traffic operation assessment as per Chapter 6.

Chapters 9.3 categorises the consistency between Main Roads plans and the development requirements from 1 to 4. This chapter details the developer's approach to determining their contribution to each category.

Category 1: Consistent with Main Roads plans

The development is regarded as having no significant adverse impact on the SCR network. Therefore, it is unlikely that Main Roads will attach any conditions in the provision of roadworks to the development approval. This does not include site access roadworks and so on, which remain the responsibility of the developer.

Category 2: Consistent with Main Roads plans but not timing

The use of the bring forward methodology (refer Appendix G) maybe an option in either scenario A or B (refer Chapter 9.3). Developers need to discuss with Main Roads whether the development will become a priority. If Main Roads is confident the proposed works will become a Main Roads priority in the time-frame required by the developer, Main Roads may accept a bring forward contribution.

Bring forward is highly unlikely to be acceptable to Main Roads in Scenario B (refer Chapter 9.3) because it is unlikely the proposed roadworks will move into the department's priorities within the timeframe required by the development. Therefore these roadworks will not be funded by Main Roads.

Where Main Roads is unable to accept a bring forward contribution, the developer and Main Roads need to discuss alternative arrangements for dealing with the development's road impacts. Main Roads could, for example, enter into an agreement with the proponent on a financing arrangement and/or a traffic management plan that would achieve the desired objectives of both parties.

Category 3: Consistent with Main Roads plans and timing but nature or scale of works is different

If development impacts require road infrastructure other than that planned or programmed by Main Roads, the developer is required to meet the full capital cost of the inconsistency in the roadworks. For example, if a Main Roads planned intersection upgrade includes a 75 metre right turn slot, but the traffic operation impact assessment for a proposed development indicated a requirement for a 125 metre right turn slot, then the developer is liable for the additional cost of providing the increased 50m length of the right turn slot.

Category 4: Inconsistent with Main Roads plans

If the mitigation measures required by the development include roadworks which are unlikely to have ever been provided in the absence of the development activity, or the estimation of the timing of the roadworks is regarded as too speculative, then the developer is required to meet the full cost of the roadworks. An example is where a road link may never be expected to carry large numbers of heavy vehicles because its position in the overall road network hierarchy. In such instances, the full capital cost and any ongoing maintenance of the works would normally be sought from the proponent as a contribution prior to commencement of the development activity. The proponent will need to calculate the capital cost and maintenance cost of the works (see Chapters 9.5 and 9.6).

A development proponent and Main Roads may enter into an agreement to detail the provision of roadworks or traffic management measure required to mitigate a development's road impacts. Such agreements may cover the standards required, timing of delivery, scale and scope of infrastructure, funding and the obligations of both parties in regard to such matters as cost variations due to unforeseen circumstances.

It is recognised that there may be instances where other road users (current and future) may benefit from roadworks provided on the basis of a contribution from a development proponent. However, it does not necessarily mean that these road users should contribute to the financing of the roadworks, especially if they did not precipitate the timing of provision of those roadworks. There may be instances where planning instruments created under legislation, such as the IPA, allow for the sharing of state-controlled road infrastructure cost by future development within a defined area. In this case, developers may be entitled to seek a refund of their infrastructure cost from subsequent developments as prescribed by the planning instrument.

Where these planning instruments are not adopted by the local government, there may also usually be practical difficulties in assessing and securing appropriate contribution from other road users. When they have 'as of right' access to the affected roads and no effective regime exists for obtaining road user charges on the basis of actual, verifiable road use by specific vehicles.

When determining a development proponent's contribution, consideration needs to be given to any protocols between Main Roads and local governments which outline funding responsibilities in respect of roads and road reserves.

9.5 Construction costs

Main Roads refines cost estimates for its own projects as they progress from design to construction.

Main Roads is principally interested in having the appropriate works completed. Where works are funded in part, or brought

forward in time, proponents have to prepare cost estimates for the works involved.

Cost estimates should be based on reasonable unit rates for works on SCRs in the area of the development. Main Roads may be able to supply this information as well as details of the contract conditions applicable to works carried out on SCRs.

9.6 Maintenance costs

The maintenance of a roadway is an ongoing cost rather than an up-front capital item, and is incurred for pavements, bridges and the other fixtures in the road reserve such as signs, pavement markings, lighting, guardrails, drainage systems, noise barriers and landscaping.

Maintenance costs comprise of fixed costs (e.g. for signs, lighting, etc) and variable costs, which depends on the level of usage (e.g. pavement wear). The fixed cost portion will not be included in considering contributions by developers to road maintenance.

District maintenance expenditure data can be obtained from district offices. An average cost over several years is needed for reliable cost estimation.

9.7 Present values of costs

Refer to Appendix G

For the calculation of developer contributions based on providing roadworks earlier than they would have normally been provided by Main Roads, it is important that the valuation of costs takes into account the time at which the roadworks are likely to be programmed in the first two years of the RIP. This is achieved by discounting costs to a "present value". That is, costs have been discounted to an equivalent amount of today's dollars.

Discounting for time preference is a different concept to that of price inflation. In Queensland, discount rates for public capital investments are periodically reviewed and set by the State Treasury. These rates are obtainable from Main Roads' Cost Benefit Analysis Software.

The calculation of present value costs assumes that the developer will pay the contribution ‘today’. If payment is deferred until works are undertaken in future years, then the contribution will need to be indexed to reflect the future cost of those works.

See Appendix G for details of the bring forward methodology.

9.8 Other fees and charges

Developer contributions do not take into account road user taxes, or charges not directly relevant to the roadworks. For example,

fuel excise and national heavy vehicle charges are paid into general government revenue, are not hypothecated for specific roadworks and are not relevant to roadworks which are unplanned or unfunded by government.

9.9 Presentation of cost calculations

The tables presented in Appendix G may be reproduced and used to present the costs associated with the project.

9.10 Goods and services tax

The effect of the Goods and Services Tax (GST) on developer contributions is complex, especially in relation to the provision of works 'in kind'. Specialist advice should be sought to determine if, and when, GST needs to be paid.

In accordance with a determination by the Commonwealth Treasurer gazetted on 1 July, 2005, it appears that developer contributions (in the form of a monetary payment) obtained under the provisions contained in one or more of the following Acts may not be subject to the GST:

- *Transport Infrastructure Act 1994*
- *Transport Planning and Co-ordination Act 1994*
- *Transport Infrastructure (Roads) Act 1991*
- *Transport (Gladstone East End to Harbour Corridor) Act 1996*
- *Integrated Planning Act 1997*
- *Local Government (Morayfield Shopping Centre Zoning) Act 1996*
- *Local Government (Harbour Town Zoning) Act 1990*
- *Local Government (Capalaba Central Shopping Centre Zoning) Act 1994*
- *Local Government (Robina Central Planning Agreement) Act 1992*
- *Townsville City Council (Douglas Land Development) Act 1993*
- *State Development and Public Works Organisation Act 1971*
- *Integrated Resort Development Act 1987*
- *Aurukun Associates Agreement Act 1975*
- *Queensland Cement and Lime Company Agreement Act 1977*
- *Century Zinc Project Act 1997*
- *Indy Car Grand Prix Act 1990*
- *Mineral Resources Act 1989*
- *Petroleum and Gas (Production and Safety) Act 2004*
- *Petroleum and Gas Act 1923*

If a developer contribution to Main Roads is not provided under the provisions of any of the above Acts, then the normal GST rules will apply and the contribution will need to incorporate a GST component.

Appendix A: Abbreviations & definitions

AADT	Annual Average Daily Traffic. A common measure of traffic volume equivalent to the total volume of traffic passing a roadside observation point over the period of one year, divided by the number of days in the year.
AMCORD	Australian Model Code for Residential Development
ARMIS	A Road Management Information System
ARRB	Australian Road Research Board
Commercial Vehicle	A motor vehicle (excluding any car or motorbike) built to carry goods or tow a trailer. This includes **heavy commercial vehicles** (see below).
Condition	(To set) a condition/s of development approval within MR's jurisdiction under TIA, IPA or other relevant legislation.
CV	Commercial Vehicle
DOS	Degree of Saturation
EIS	Environmental Impact Statement
EP Act	Environmental Planning Act
ESAs	Equivalent Standard Axles is a measure defining the cumulative damaging effect to the pavement of the design traffic. It is expressed in terms of the equivalent number of 80kN axles passing over the pavement up to the design horizon.
GFA	Gross Floor Area
GLA	Gross Lettable Area
GTEP	Guide to Traffic Engineering Practice
GTGD	Guide to Traffic Generating Developments
GVM	Gross Vehicle Mass
Haul Route	Sections of state-controlled road that are used during the construction and/or operational phase of a development for the transport of materials or stock by heavy commercial vehicles and concentrated on one or a small number of origins and/or destinations.
HCV	Heavy Commercial Vehicle. A commercial vehicle (including trailers) with a gross vehicle mass greater than 4.5 tonnes.
IDAS	Integrated Development Assessment System

IPA	Integrated Planning Act 1997
IRTP	Integrated Regional Transport Plan
LGPEA	Local Government (Planning and Environment) Act 1990 (repealed)
LGR	Local Government Road
LGR	Local Government Road. A road controlled by a local government. It includes all roads that are not state-controlled or privately owned (e.g. by mining companies or tollways).
LOS	Level of Service
LUUDT	Land Use and Urban Design Techniques
Maintenance	Management of ongoing performance and condition of the road asset. This can be separated into rehabilitation, programmed maintenance and routine maintenance.
Mitigation Measures	Measures required to mitigate development impacts on the road system. These measures include works (defined below) and non-infrastructure measurers such as traffic management plans, traffic operations plans and so on.
MR	Department of Main Roads
MRA	Mineral Resources Act 1987
MUTCD	Manual of Uniform Traffic Control Devices
PDM	Pavement Design Manual
PIA	Priority Infrastructure Area as per the IPA 1997 and Department of Local Government, Planning, Sport & Recreation guidelines.
PIP	Priority Infrastructure Plan as per the IPA 1997 and Department of Local Government, Planning, Sport and Recreation guidelines.
PRM	Pavement Rehabilitation Manual
Programmed Maintenance	Activities that restore the integrity of the road surface and can be predicted and planned by engineering and pavement techniques. Where roadworks increase the pavement or surfaced area, there will be a corresponding increase in programmed maintenance to resurface this increase. It is only necessary to calculate programmed maintenance impacts where the surfaced area is increased or the type of surfacing is changed as a result of the development, and an increase in the programmed maintenance costs are expected to result.
Qld Streets	Queensland Streets: Design Guidelines for Subdivisional Streetworks. (Revised Version)
Rehabilitation	That group of activities that restores the structural capacity and condition of the carriageway, without altering the geometric

standards, and can normally be predicted and planned by engineering and pavement techniques. This includes the restoration of a bridge to the level of service and load capacity it had when constructed.

Pavements are designed to withstand a number of repeated standard axle loads. Increases in heavy commercial vehicle traffic raise the rate at which the number of these repetitions are applied to the pavement and the design life of the pavement in years is reduced. Once the design life is reached, rehabilitation should occur to extend the operating life of the pavement. Thus, an increase in heavy commercial vehicle traffic causes rehabilitation to be needed earlier and the resultant rehabilitation bring forward cost has an impact on the RIP. The quantification of the bring forward costs should be based on estimating the remaining life of the pavement with and without development. In some instances it may be more cost effective to completely rebuild a pavement.

RIA Road Impact Assessment

RIP Road Implementation Program. A five year program of projects approved by the Minister for Main Roads which includes project description, estimated cost and funding profile by financial year (two years firm, three years indicative).

Road Impacts Road impacts of a development project are defined as the effects on the SCR network (including planning impacts on existing and future SCRs), which result from the presence of the development and/or traffic movements by vehicles, public transport, pedestrians and bicycles to and from the development during the construction and operational phases, and which cause:

- works to be required on a road or within a road reserve;
- shifts in the nature or timing of works from what was planned or might reasonably have been expected in the absence of the development;
- effects upon the safety or efficiency of the road system; and/or
- effects on the planning of the road system.

Impacts are identified by comparing at key milestones during a suitable design horizon, the situations with and without the proposal.

Routine Maintenance Activities that maintain the shape or profile of the pavement and amenity of the road corridor.

Increases in routine maintenance result from increased pavement wear and damage caused by additional heavy vehicle traffic. The additional cost can be calculated by estimating the current pavement-related routine maintenance average cost for a kilometre per ESA. This rate is then applied to the ESAs associated with development over the length of pavement affected.

Pavement-related routine maintenance items include maintenance of the sealed or unsealed roadway including edges, surface,

	pavement, shoulders and overheads. Non-pavement routine maintenance items that are not assessed as attributable to additional traffic include drainage and roadside structures. When estimating pavement impacts of a development, the non-pavement related routine maintenance items are not included in the calculation of average annual cost for a kilometre per ESA. Routine maintenance cost data is stored in the Road Maintenance Performance Contract database, summarised for the current and previous year and available from the MR district office.
RPDM	Road Planning and Design Manual
SCR	State-controlled road**.** A road declared to be controlled by Main Roads, including all AusLink National Roads in Queensland. A tollway is not declared as a SCR while it is controlled by a franchisee. Main Roads can provide advice about SCRs.
SDPWO Act	State Development and Public Works and Organisation Act 1971
SIDRA	Signalised and Unsignalised Intersection Design and Research Aid
SOI	Statements of Intent relating to the future vision for a road link as per the IPA 1997
State Strategic Roads:	The group of SCRs including highways and major developmental roads linking major regions in the state and interstate.
TAG	Transport Assessment Guide
TIA	Transport Infrastructure Act 1994
TO (RUM)	Transport Operations (Road Use Management) Act 1995
TOPTA	Transport Operations (Passenger Transport) Act 1994
Traffic	Traffic includes vehicle, pedestrian and bicycle movements.
Traffic Operation	Traffic operation is defined by way of intersection and road section performance measures. Intersection performance is normally measured in terms of degree of saturation. The performance of road sections between intersections is measured in terms of a volume / capacity ratio or level of service based upon particular deficiency criteria.
VLM	Vehicle Limits Manual
VPD	Vehicles per Day
Works	Works include construction, upgrading, maintenance, pavement reconstruction, surfacing and environmental mitigation works.

Appendix B: Checklists

The checklists on the following pages provide a convenient summary of the issues that may need to be addressed in considering the road impacts of a development project.

Checklists (i) and (ii) indicate issues relating to the development context, development proposal, impact assessment and remedial works that will generally need to be addressed. Checklist (i) relates to developments involving intensive road use, while other developments are covered by checklist (ii).

Checklist 3 lists the various road safety issues that may need to be considered. Many of these issues may already have been addressed through other parts of the RIA (e.g. through a traffic operation assessment) and will not need to be dealt with separately. (The issues most likely to have been addressed through other parts of the RIA are identified in the checklist). Some of the issues in the checklist will not necessarily apply to every development. Main Roads will be able to provide advice on the extent to which safety issues in the checklist need to be considered for a specific development.

1. Issues checklist for intensive road use, such as feedlots or mining / extractive industries

	Generally required	MR discretion
Development context		
site locality	X	
site access (existing use, location and layout)	X	
preferred land use	X	
adjacent land uses / approvals		X
description of road network (function, alignment, grade, lanes, intersections, median breaks, etc)	X	
existing traffic volumes (daily & peak)	X	
traffic growth trends	X	
speed environment / speed surveys		X
existing parking provision	X	
current MR planning and RIP	X	
road hierarchy	X	
public transport network and services (existing and planned)	X	
pedestrian / bicycle facilities		X
crash history		X
flood immunity of access route		X
existing pavement standard / condition	X	
Development proposal		
proposed uses and scale (dwellings, rooms, floor area)	X	
operating hours, peaks	X	
number of employees / visitors	X	
travel demand management policies		X
site layout (including adjoining connections to properties and other roads)	X	
access form and location	X	
development staging	X	
traffic demand (vehicle / pedestrian / bicycle / public transport)	X	
stormwater and drainage works (internal)		X
stormwater and drainage works (external)	X	
construction traffic	X	
service vehicle arrangements (access and on-site manoeuvring areas etc)	X	
proposed parking provision	X	
trip distribution / assignment	X	
haulage routes (including vehicle type and operating times)	X	
Impact assessment and remedial works treatments		
traffic operation (including pedestrian, cycle and public transport)	X	
road safety issues	X	
pavement and bridge impacts	X	
changes to the road network or planning	X	
noise / hydraulic impacts on state-controlled roads		X
visual amenity and other environmental impacts		X

2. Issues checklist for other developments

	Generally required *	MR discretion
Development context		
site locality	X	
site access (existing use, location and layout)	X	
preferred land use	X	
adjacent land uses / approvals		X
description of road network (function, alignment, grade, lanes, intersections, median breaks, etc)	X	
existing traffic volumes (daily & peak)	X	
traffic growth trends	X	
speed environment / speed surveys		X
existing parking provision	X	
current Main Roads planning and RIP	X	
road hierarchy	X	
public transport network and services (existing and planned)	X	
pedestrian / bicycle facilities	X	
crash history		X
flood immunity of access route		X
existing pavement standard / condition		X
Development proposal		
proposed uses and scale (dwellings, rooms, floor area)	X	
operating hours, peaks	X	
number of employees / visitors	X	
travel demand management policies		X
site layout (including adjoining connections to properties and other roads)	X	
access form and location (queuing and storage)	X	
development staging	X	
traffic demand (vehicle / pedestrian / bicycle / public transport)	X	
stormwater and drainage works (internal)		X
stormwater and drainage works (external)	X	
construction traffic	X	
service vehicle arrangements (access and on-site manoeuvring areas etc)	X	
proposed parking provision	X	
trip distribution / assignment	X	
haulage routes (including vehicle type and operating times)		X
Impact assessment and remedial works treatments		
traffic operation (including pedestrian, cycle and public transport)	X	
road safety issues	X	
pavement and bridge impacts		X
changes to the road network or planning	X	
noise / hydraulic impacts on state-controlled roads		X
visual amenity and other environmental impacts	X	

* *Depending upon the size / location of the development proposal, Main Roads may reduce the number of issues to be considered in an RIA.*

3. Safety issues checklist for all developments

	Safety aspect	Reference *
Intersections and access		
#	on and off-site queuing	AS 2890
#	access location and layout / sight distance	GTEP Part 5/ RPDM Ch 4 – Applications of Design Principals and Standards RPDM Ch 13 – Intersections at Grade RPDM Chap 14 - Roundabouts
	bus stops	AMCORD / Qld Streets RPDM Ch 4 – Application of Design Principals and Standards RPDM Ch 5 – Traffic Parameters and Human Factors RPDM Ch 20 – Road Side Amenities
	lighting	GTEP Part 12/ RPDM Ch 17 – Lighting RPDM Ch 18 – Traffic Signals
	pavement marking & signage	MUTCD Guide to Pavement Markings Traffic & Road Use Management Manual
	speed environment	GTEP Part 4/ RPDM Ch 6 – Speed Parameters
#	intersection operation & acceleration / deceleration lane	GTEP Part 5/ RPDM Ch 13 – Intersections at Grade RPDM Ch 14 – Roundabouts
#	auxiliary turn lanes / lengths / weaving	GTEP Part 5/ RPDM Ch 13 – Intersections at Grade RPDM Ch 16 – Interchanges (for weaving and auxiliary lanes on freeways)
#	heavy vehicle and bus turnpaths	AS 2890/ RPDM Ch 5 – Traffic Parameters and Human Factors
	utilities (hardware / services)	MR Policy
	location of poles / traffic signal	RPDM Ch 17 – Lighting RPDM Ch 18 – Traffic Signals RPDM Ch 7 – Cross Section RPDM Ch 8 – Safety Barriers and Road Side Furniture
Road links		
#	road width	RPDM Ch 7 – Cross Sections
#	shoulder seals	Design Manuals
#	vertical / horizontal alignment	RPDM Ch 11 – Horizontal Alignment RPDM Ch 12 – Vertical Alignment
#	bridges and approaches	RPDM Ch 22
#	clearance to obstructions	RPDM Ch 7 – Cross Sections
#	overtaking opportunities	RPDM Ch 15 – Auxiliary Lanes/ GTEP Part 2

Pedestrians	
road crossing facilities	GTEP Part 13/ RPDM Ch 5 – Traffic Parameters and Human Factors
footpaths	GTEP Part 13/ RPDM Ch 5 – Traffic Parameters and Human Factors
disabled provision	RPDM Ch 5 – Traffic Parameters and Human Factors/ GTEP Part 13
Cyclists	
cycle lanes / paths	GTEP Part 14/ RPDM Ch 7 – Cross Section RPDM Ch 5 – Traffic Parameters and Human Factors
road crossing facilities	RPDM Ch 5 – Traffic Parameters and Human Factors/ GTEP Part 14
intersection provision	GTEP Part 14/ RPDM Ch 5 – Traffic Parameters and Human Factors
Motorcyclists	
road surface	Ch 5 – Traffic Parameters and Human Factors/ GTEP Part 15
warning of hazards	Ch 5 – Traffic Parameters and Human Factors/ GTEP Part 15
barrier kerbs	GTEP Part 15/ RPDM Ch 5 – Traffic Parameters and Human Factors
visibility at intersections	GTEP Part 15/ RPDM Ch 13 and 14
drainage pits and culverts	GTEP Part 15/ RPDM Ch 5 – Traffic Parameters and Human Factors

* *Where Austroads guidelines and relevant Main Roads manuals cover the same safety aspect then the Main Roads manual will take precedence.*

\# *Safety issues that are likely to have been addressed through other parts of the RIA.*

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Appendix C: Sample project (rural) – quarry

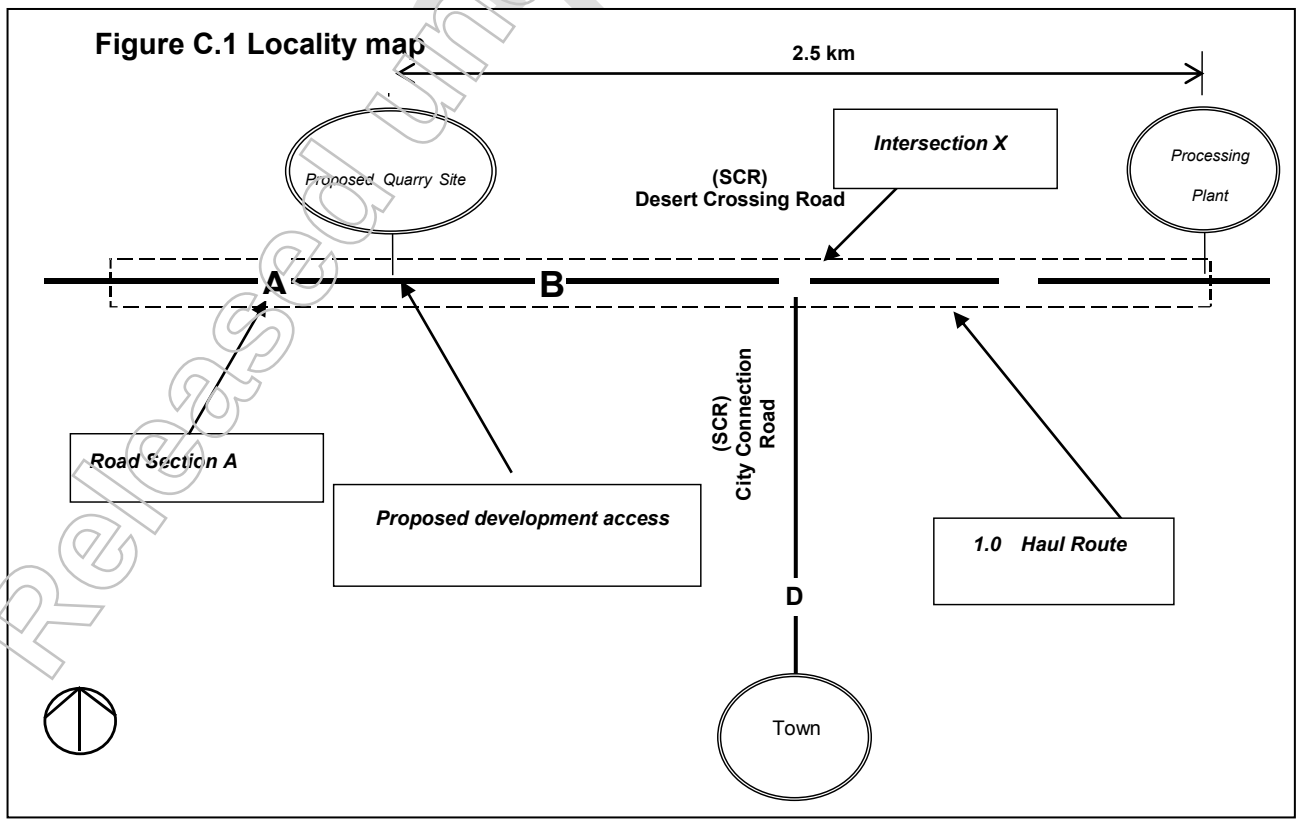
This example is intended to provide an understanding of those issues requiring consideration for rural developments. It is not intended to provide an exhaustive example of traffic analysis, although some analysis is provided for illustrative purposes.

STEP 1: DEVELOPMENT PROFILE (refer Chapter 4)

1.1 Development details (refer Chapter 4.1)

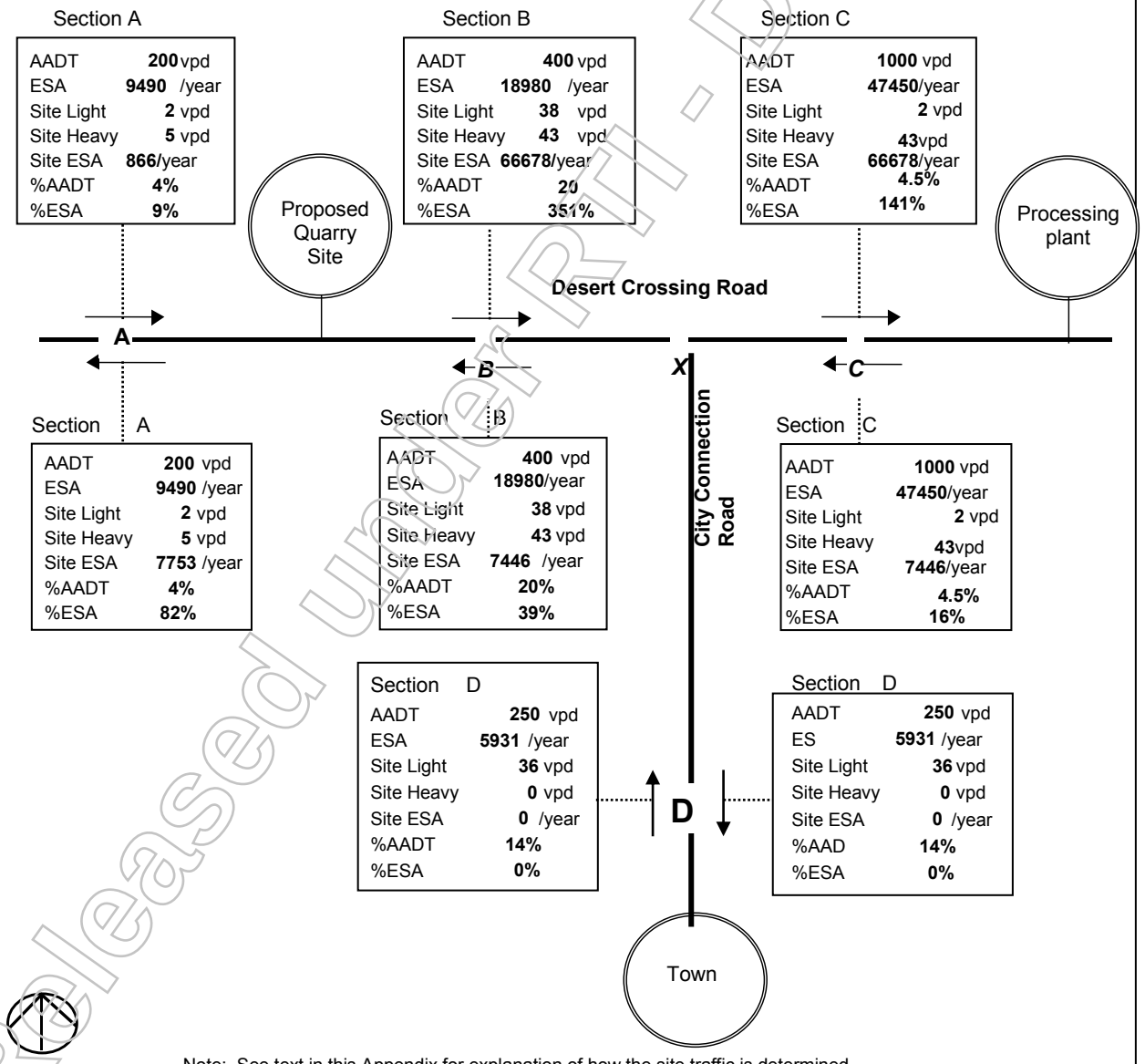
- The proposal is a new quarry to be located outside a large rural town as shown in Figure C.1. An existing processing plant, which will receive the extracted material, is located 2.5 km to the east on the same SCR (Desert Crossing Road).
- The quarry has an estimated output of 200 000 t/year.
- The development application was referred to Main Roads by the local government as the quarry would have direct access to a SCR. The planned size of the quarry exceeds identified referral thresholds. (Referral triggers are documented in Dept Infrastructure & Planning's *Guide 3; Referrals in relation to State-controlled roads*.)
- Currently the site is vacant and there are agricultural land uses adjacent.
- The development is proposed to have a single access onto Desert Crossing Road. The processing plant has an existing access direct to Desert Crossing Road.

Figure C.1 Locality map



- The quarry is proposed to operate in a single 6am to 5pm shift, six days per week, throughout the year (i.e. 312 days / year). Up to 25 staff will be present during a shift.
- Haulage vehicles will be 42.5 t GVM tri-axle semi-tippers with a tare (vehicle) mass of 16 t and net (payload) weight of 26.5 t.
- The proposed development will employ a local workforce, residing primarily in the town.
- The quarry is expected to become fully operational in the year 2007 and has an estimated extraction life of 20 years.

Figure C.2: Traffic volumes



Note: See text in this Appendix for explanation of how the site traffic is determined.

1.2 Surrounding road network details (refer Chapter 4.2)

- Desert Crossing Road is a SCR as is City Connection Road to the town. Both are low volume rural roads.
- Both roads have a 10 m pavement, comprising two 3.5 m lanes and 1.5 m sealed shoulders (the road forms were confirmed by site inspection).
- Existing AADTs provided by the MR district office are shown in Figure C.2. Road sections A, B and C have 10% commercial vehicles while road section D has 5% commercial vehicles.
- The MR district office has advised that the traffic growth rate in the area is of the order of 2% linear per annum.

1.3 Development traffic generation (refer Chapter 4.3)

- The likely traffic profile generated by the proposal was based upon consideration of the operation and its traffic generation characteristics.

Traffic generation – light vehicles

- In this particular example, peak employee traffic has been estimated for a period of one hour. However, this may not be sufficient in some situations and estimates for periods of 15 minutes might be necessary where arrival or departure rates are more pronounced. Visitor movements have also been estimated.
- No reduction in trip making due to potential ride-sharing has been made. Options for operating a shuttle bus have been examined but found to be unviable. Some ride sharing may occur and would be encouraged by the plant operator.
- A survey of a similar development was conducted by means of an automatic traffic counter to identify the traffic profile. Previous surveys of similar developments also support the assumptions adopted.

Traffic generation – light vehicles		
Employees		*25 staff per day x 2 trips/staff/day (1 in/1 out)*
	=	*50 light vehicle trips/day ……..…..…….. (A)*
	or	*25 light vehicle trips/hour (peak)*
		(trips during shifts are unlikely)
Visitors		*average of 15 visitors per day x 2 trips/visitor/day (1 in/1 out)*
	=	*30 light vehicle trips/day……..…… (B)*
		(it is unlikely that any of these trips would occur during the peak period)

Traffic generation – heavy commercial vehicles

- The anticipated annual profile of quarry extraction was examined and the design case identified. For the purposes of traffic operation, the peak operation ('worst case scenario') should be considered, whereas for pavement impacts, the average case should be used. For the purposes of this example, it has been assumed that the peak demand is the same as the average demand.
- The quarry operator has forecast that March will be the peak month. Extraction is expected to be in the order of twice the average.

1.4 Development traffic distribution (refer Chapter 4.4)

- The anticipated distribution of development traffic has been based upon the locations of potential product destinations and staff accommodation. This is shown below in Table C.1.

Component	*Percentage*	*Road Section*	*Volume*
Light Vehicles	90%	D	72
	5%	C	4
	5%	A	4
	100%		***80***
Heavy Commercial Vehicles	90%	B and C	86
	10%	A	10
	100%		***96***

Table C.1 Traffic Distribution

- In accordance with this distribution, the daily site traffic volume is as shown in Figure C.2.

1.5 Study network definition (refer Chapters 3.2, 3.3 and 4.5)

- All haul routes associated with the development will need to be assessed in accordance with Criterion 4 in Chapter 3.2.
- To identify the spatial extent of investigation, information on existing traffic volumes and ESAs was obtained. In most cases, AADT and percentage commercial traffic will be available from the MR district office. Supplementary traffic counts may be required.

1.5.1 Traffic operation

- For traffic operation, assessment is required where the development traffic exceeds the thresholds set by Criteria 3 and 4 in Chapter 3.2.

- This is the case for road section A (Criterion 4), road section B (Criterion 3), road section C (Criterion 4) and road section D (Criterion 4).
- Intersection X also requires assessment (Criteria 3 and 4).

1.5.2. Pavement impacts

- Assessment of pavement impacts is required where development traffic generates an increase in ESAs equal to or greater than 5% (Criterion 2).
- As shown in Figure C.2, the development will generate an increase in ESAs equal to or greater than 5% on road sections A, B and C. Road section A extends for the full distance of the haul route to the west.

Traffic Generation – Heavy commercial vehicles
Average Demand

200 000 t/year ÷ (26.5 t/truck x 312 days/year)
= 24 loaded truck trips/day;
(24 unloaded trips/day to the site/24 loaded trips/day from the site)
= 48 heavy commercial vehicle trips/day

Peak Demand (twice the average extraction)

= 48 loaded truck trips/day;
(48 unloaded trips/day to the site/48 loaded trips/day from the site)
= 96 heavy commercial vehicle trips/day……(C)

Traffic Generation – All Vehicles

= 80 light vehicle trips/day + 96 heavy commercial vehicle trips/day (A+B+C)
= 176 total vehicle trips/day.

Existing ESAs for each road section should be calculated, as shown below, by weighting the AADT in accordance with the proportion of existing commercial traffic.

ESA Calculation (Road Section B)

AADT	=	400 vpd eastbound
Commercial Vehicle (CV) %	=	10%
ESA.CV ratio	=	1.3 *(derived from MR's Pavement Design Manual)*
Existing ESA (Section B)	=	400 vpd x 10% CV x 365 days/year x 1.3 ESA/CV
	=	18 980 ESA/year

1.6 Design horizon

- The design horizon for this project was identified as 2027, as the quarry has an estimated operating life based upon identified yield of 20 years beyond initial opening in 2007.
- For the purposes of traffic operation, it is appropriate to limit the impact assessment to ten years and therefore 2011 has been adopted for traffic operation assessment.

1.7 On-site aspects (refer Chapter 4.6)

- All servicing and parking will take place on site as there is ample space.

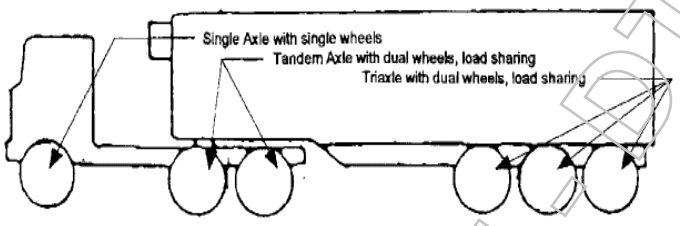
STEP 2: PAVEMENT IMPACT ASSESSMENT (refer Chapter 5)

2.1 Pavement loading

- To calculate development pavement loading, the ESA loading for the quarry tri-axle semi-tipper was calculated as shown.

Figure C.3: Equivalent standard axle example

Tri-axle semi-tipper



Loaded or Unloaded		Single Axle Single Wheels	Tandem Axle Dual Wheels Load Sharing	Tri-axle Dual Wheels Load Sharing	Totals
2.0 Unloaded	Weight (tonnes)	4.5	5.0	6.5	16.0
	2.1 ESAs	**0.5200**	**0.0200**	**0.0150**	**0.5550**
Loaded	Weight (tonnes)	6.0	16.5	20.0	42.5
	ESAs	**1.5200**	**2.0700**	**1.3800**	**4.9700**
Average	**ESAs**	**1.0200**	**1.0450**	**0.6975**	**2.7625**

Source: Department of Main Roads' Pavement Design Manual

The resultant ESA loadings for this vehicle are:

Unloaded - 0.555
Loaded - 4.970

Development ESA (section B - Eastbound)

= 43 loaded trucks x 4.97 ESA x 312 days
= 66 678 ESA/year

Development ESA (section B - Westbound)

= 43 unloaded trucks x 0.555 ESA x 312 days
= 7 446 ESA/year

Section B – Eastbound		
AADT	**400**	vpd
ESA	**18980**	/year
Site Light	**38**	vpd
Site Heavy	**43**	vpd
Site ESA	**66678**	/year
%AADT	**20%**	
%ESA	**351%**	

Section B – Westbound		
AADT	**400**	vpd
ESA	**18980**	/year
Site Light	**38**	vpd
Site Heavy	**43**	vpd
Site ESA	**7446**	/year
%AADT	**20%**	
%ESA	**39%**	

- AADT and ESA calculations for the remaining sections were then completed as is shown in Figure C.2. Assessment summaries of Section B are shown below Figure C.3.

2.2 Pavement impacts

- When addressing pavement impacts, four elements need to be addressed:
  - asset improvement;
  - programmed maintenance;
  - routine maintenance; and
  - rehabilitation.
- Section A was calculated to have some eight years' remaining life with no development. As the development brings forward the need for rehabilitation by less than one year, no contribution was sought from the developer. However, the developer contributed towards the cost of increased routine maintenance brought about by the development.
- Section B was calculated to have no remaining pavement life. However, in the absence of the proposed development, it would have most likely continued to operate effectively with minimal maintenance. The developer accepted responsibility for half the cost of rehabilitating Section B to Main Roads' standards, following consultation with Main Roads.
- Section C was calculated as having a further four years design life (2010) with no development of the quarry site. With development, the need for rehabilitation is accelerated by two years to the year 2008. The current RIP contains funding for rehabilitation that is likely to occur in 2010. Main Roads will need to ensure that funding is available to enable rehabilitation to occur in 2008, if bring forward costs are accepted from the developer.
- In this case, options for ameliorative roadworks were negotiated and agreed. However, the result of such negotiations will vary depending upon the development type and location as well as the standard of existing infrastructure. Other outcomes could include contributions based on an annual payment to cover increased maintenance costs generated as a result of the development or full payment by the developer for rehabilitation with a refund by Main Roads at a later time.
- The costs associated with the pavement impacts should be presented in a tabulated format similar to that shown in Appendix G for each road section.

STEP 3: TRAFFIC OPERATION ASSESSMENT (refer Chapter 6)

Following identification of the traffic profile of the development, discussions with the Main Roads District Office were convened to resolve what traffic operation assessment was required along the haul route on road section A. In this instance, the District Office limited the assessment to road sections B, C and D and intersection X. The analysis process for each is outlined below.

3.1 Road link analysis (refer Chapters 6.3 and 6.5)

- Volumes on all sections of roads are within acceptable limits for the present road forms.
- Existing AADT volumes (2006 base year) were factored by the 2% linear annual growth rate for the 2017 analysis. The forecast link volumes without and with development are shown in Table C.2.
- Volumes on all road sections will continue to be acceptable with the existing road forms at 2017 with the development operational.
- No overtaking lane provision or four lane upgrading will be required within the 2011 design horizon.

Link	Existing AADT (2000)	2007		2017	
		No Dev	With Dev	No Dev	With Dev
Section A	400	408	422	488	502
Section B	800	816	978	976	1038
Section C	2000	2040	2130	2440	2530
Section D	500	510	582	610	682

Table C.2 Forecast link volumes

3.2 Intersection analysis (refer Chapters 6.4 and 6.6)

- To determine the adequacy of intersection X, the site access and the processing plant access, the following have been considered:
  - intersection capacity; and
  - criteria for auxiliary turn lanes.
- Peak hour turning movement volumes with and without the development at the opening year (2007) and design year (2017) were forecast.
- SIDRA analysis for operation of unsignalised intersection X is summarised in Table C.3. Degree of saturation and 95 percentile queue lengths are as shown. The critical degree of saturation for an unsignalised intersection of this form is 80% (refer GTEP Part 5, Section 4).

Design Case	DOS (%)	95%ile Queue (m)	
		Right Turn In	Right Turn Out
2000 No Development	42	10	5
2000 With Development	40	12	8
2010 No Development	75	15	8
2010 With Development	79	19	12

Table C.3 Intersection Operating Characteristics

- Intersection X will continue to operate adequately in its existing unsignalised form to 2017 with the development operational.
- Rural turn lane warrants were checked under projected traffic volumes to determine whether any upgrading to the existing form of intersection X is required. In this instance, the existing Austroads Type B right turn configuration will need to be upgraded to a Type C form on site opening. With no development of the quarry, upgrading would not be required within the 2017 design horizon.
- Traffic operation at the proposed quarry access and the existing processing plant access was also examined using SIDRA. The degrees of saturation at 2017 with the development operational were calculated to be 40 per cent and 50 per cent respectively, which in both cases is acceptable. Rural turn lane warrants were checked for both accesses and Austroads Type A layouts found to be required. The existing processing plant access has already been built to this standard and requires no further work.

STEP 4: SAFETY REVIEW (refer Chapter 7)

- Actual crash rates for road sections B, C and D and critical crash rates for the district were obtained from Main Roads. As the actual crash rates were well below the critical crash rates, no amelioration is necessary.
- The safety issues checklist provided in Appendix B was used to check the safety aspects of the intersections and accesses associated with the proposed development. Pedestrian and cycle facilities are not present or needed on the low volume rural roads assessed.
- Discussions with Main Roads indicated that no safety audit is required.
- No development works are required to ameliorate any existing safety deficiencies.

STEP 5: ENVIRONMENTAL AND OTHER ISSUES (refer Chapter 8)

- No new transport corridors are planned in the vicinity. The existing reserve for Desert Crossing Road is adequate to accommodate four lanes on the southern side if and when necessary.
- The development will not generate significant night traffic and the adjacent agricultural land uses are not sensitive to the noise and vibration created by heavy commercial vehicle traffic that will be generated by day.
- There is no adjacent development that could be affected by headlight glare. On-site lighting will be oriented so as to avoid illuminating Desert Crossing Road.
- Detailed design of the proposed quarry access will need to include landscaping to present well to passing motorists and to replace existing vegetation removed and avoid erosion on Desert Crossing Road.
- Approval for the quarry access onto Desert Crossing Road is being sought as part of this application. The spacing between the proposed access and the nearest adjacent access is approximately 1.25 km. There are few access points along this section of road and it is not anticipated that the proposed access would interfere with others.
- The detailed design of the proposed quarry access and upgrading of Intersection X to Austroads Type C configuration will need to allow for drainage continuity with the existing swale drains along each side of Desert Crossing Road.
- The quarry access will need to be sealed so as not to generate dust across Desert Crossing Road. The on-site design and operational procedures will need to minimise dust generation so as not to impact Desert Crossing Road.
- There is one structure over a creek along the haul route between the site and the processing plant on road section C. Its design has been verified to accommodate the proposed haulage vehicle fleet.
- An Environmental Impact Statement (EIS) is being prepared as part of the development application. This EIS will examine the overall impact of the development.

STEP 6: IMPACT MITIGATION (refer Chapter 9)

6.1 Impacts

The RIA has identified that the following improvements are required as a result of the development:

- Contribution toward increased routine maintenance on section A.
- Rehabilitation of the pavement on section B.
- Rehabilitation of the pavement on section C is brought forward from 2010 to 2008.
- Upgrading of intersection X to Austroads Type C at opening of the development.

- Construction of an Austroads Type A site access intersection to the development.

6.2 Costing / contributions

- Main Roads identified that section A has an annual routine maintenance allowance of $50,000 (2006 $). With development, ESAs will increase by 9%and 82% eastbound and westbound respectively. The development therefore creates a need for a further $22,750 per year (9% x $50 000 / 2 + 82% x $50 000/2) for routine maintenance during its operational life. In this case, Main Roads and the developer agreed that the requirement for additional routine maintenance would be limited to the first ten years of operation of the quarry.
- After discussions with Main Roads, the developer agreed to pay half of the cost of pavement rehabilitation on section B. This section had no remaining pavement life but would have continued to operate effectively with minimal maintenance in the absence of the development. Using Main Roads' unit rates, the full cost of rehabilitating the pavement on section B was estimated at $1.25M (in 2006 $). The developer therefore accepted responsibility for paying $625, 000.
- Main Roads advised that $1.25M (in 2010 $) was expected to be allocated through the RIP for rehabilitating the pavement on road section C in 2010. Using an outturn factor of 1.00/1.12 extracted from the RIP Guidelines, this is converted to $1.12M (in 2006 $). The cost of bringing this improvement forward from 2006 to 2008 is the responsibility of the developer. Main Roads will need to ensure that the capital cost for the rehabilitation is available in 2008.
- The developer paid for the whole cost of upgrading Intersection X to an Austroads Type C form at year 2007 ($475,000 in 2006 $).
- The developer paid for the cost of construction of the Type A access intersection to the quarry ($150,000 in 2006 $).

Scheduled works required to mitigate the quarry development impacts

Summary Table (refer Appendix G)

The development impacts are summarised below for "the with development" and the "without development" cases:

With development

Year	Discount Period	Road Section Expenditure (X)				Intersection Expenditure (Y)				Total Expenditure (Z=X+Y)	Discount Factor (F)	Present Value (2000 $) (Z x F)
		Construction	Rehabilitation	Programmed Maintenance	Routine Maintenance	Construction	Rehabilitation	Programmed Maintenance	Routine Maintenance			
2006	**0**				*$50,000*					*$50,000*	*1.0000*	*$50,000*
2007	**1**		*$1,250,000*		*$72,750*		*$625,000*			*$1, 947,750*	*0.9434*	*$1,837,507*
2008	**2**		*$1,120,000*		*$72,750*					*$1,192,750*	*0.8900*	*$1,061,547*
2009	**3**				*$72,750*					*$72,750*	*0.8396*	*$61,081*
2010	**4**				*$72,750*					*$72,750*	*0.7921*	*$57,625*
2011	**5**				*$72,750*					*$72,750*	*0.7473*	*$54,366*
2012	**6**				*$72,750*					*$72,750*	*0.7050*	*$51,288*
2013	**7**				*$72,750*					*$72,750*	*0.6651*	*$48,386*
2014	**8**				*$72,750*					*$72,750*	*0.6274*	*$45,643*
2015	**9**				*$72,750*					*$72,750*	*0.5919*	*$43,060*
2016	**10**				*$72,750*					*$72,750*	*0.5584*	*$40,624*
TOTALS			**$2,370,000**		**$777,500**		**$625,000**			**$3,772,500**		**$3,351,127 (C)**

Base Year

Opening Year

RIP allocation for rehabilitation of road section C brought forward from 2010 to 2008

Total cost of rehabilitating section B

50% Developer

Increased routine maintenance cost on section A

Cost of rehabilitating intersection X ($475,000) and quarry access intersection ($150,000)

Without development

Year	Discount Period	Road Section Expenditure (X)				Intersection Expenditure (Y)				Total Expenditure (Z=X+Y)	Discount Factor (F)	Present Value (2000 $) (Z x F)
		Construction	Rehabilitation	Programmed Maintenance	Routine Maintenance	Construction	Rehabilitation	Programmed Maintenance	Routine Maintenance			
2006	0				*$50,000*					*$50,000*	*1.0000*	*$50,000*
2007	1				*$50,000*					*$50,000*	*0.9434*	*$47,170*
2008	2				*$50,000*					*$50,000*	*0.8900*	*$44,500*
2009	3				*$50,000*					*$50,000*	*0.8396*	*$41,980*
2010	4		*$1,120,000*		*$50,000*					*$1,170,000*	*0.7921*	*$926,757*
2011	5				*$50,000*					*$50,000*	*0.7473*	*$37,365*
2012	6				*$50,000*					*$50,000*	*0.7050*	*$35,250*
2013	7				*$50,000*					*$50,000*	*0.6651*	*$33,255*
2014	8				*$50,000*					*$50,000*	*0.6274*	*$31,370*
2015	9				*$50,000*					*$50,000*	*0.5919*	*$29,595*
2016	10				*$50,000*					*$50,000*	*0.5584*	*$27,920*
TOTALS			**$1,120,000**		**$550,000**					**$1,670,000**		**$1,305,162 (D)**

Base Year

Limit of current

RIP allocation for rehabilitation of Section C

Routine maintenance cost on Section A

Developer Contribution in Year 2006 = *$C-D*

= *$3,351,127 - $1,305,162*

= *$2,045,965*

*Less MR contribution** - *$625,000*

* *50% of the cost of rehabilitating road section B*

Total Contribution = *$1*

With Development

Appendix D: Sample project (urban) – commercial / industrial project

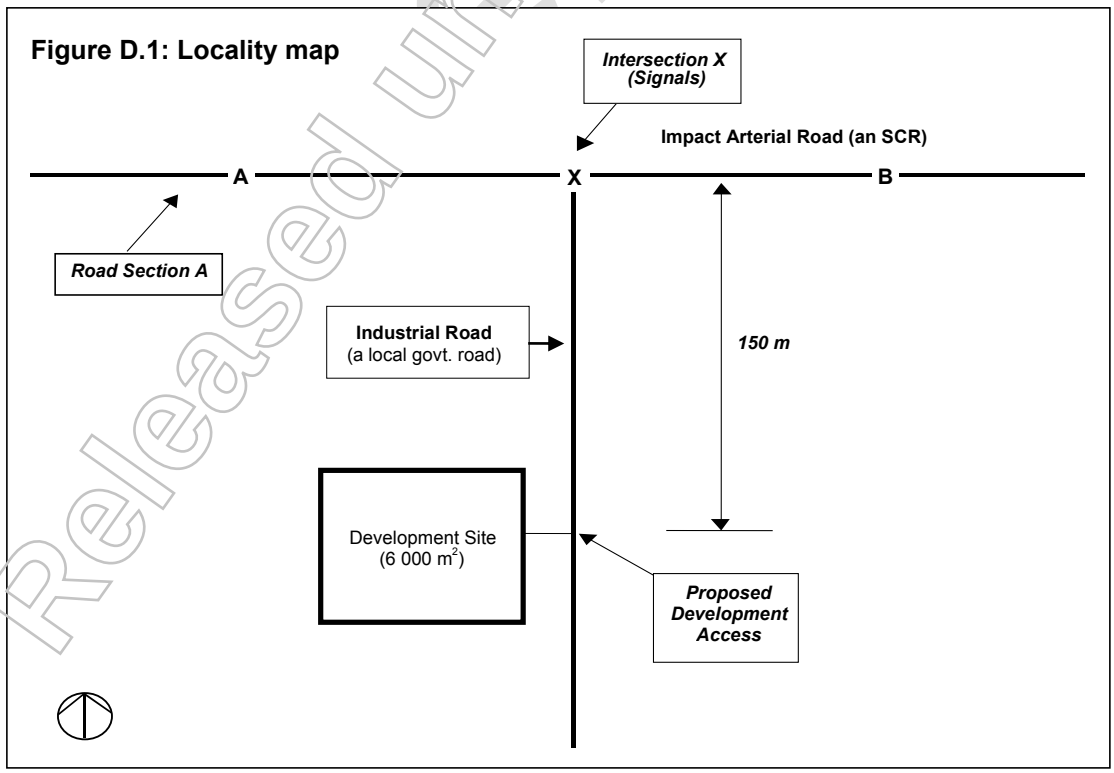
The following example is intended to provide an understanding of those aspects requiring consideration for urban development types. It is not intended to provide an exhaustive example of traffic analysis, although some analysis is provided for illustrative purposes.

STEP 1: DEVELOPMENT PROFILE (refer Chapter 4)

1.1 Development details (refer Chapter 4.1)

- The proposal is for a light industry / office development within an urban environment on the fringe of a major city. A locality map is shown in Figure D.1.
- The proposed development is to have a Gross Floor Area of 6 000 m^2.
- It is anticipated that staff will work a single shift between 6.30am and 4.00pm daily. The typical attendance will be 50 employees.
- The application was referred to Main Roads by the local government as the planned development would access a local government road that intersects with a SCR within 200 metres.
- Currently, the site is vacant and is used by adjacent industrial uses for parking.
- The development proposal is planned to be opened in 2007.
- Access to the development will be obtained via an all movements access to Industrial Road.

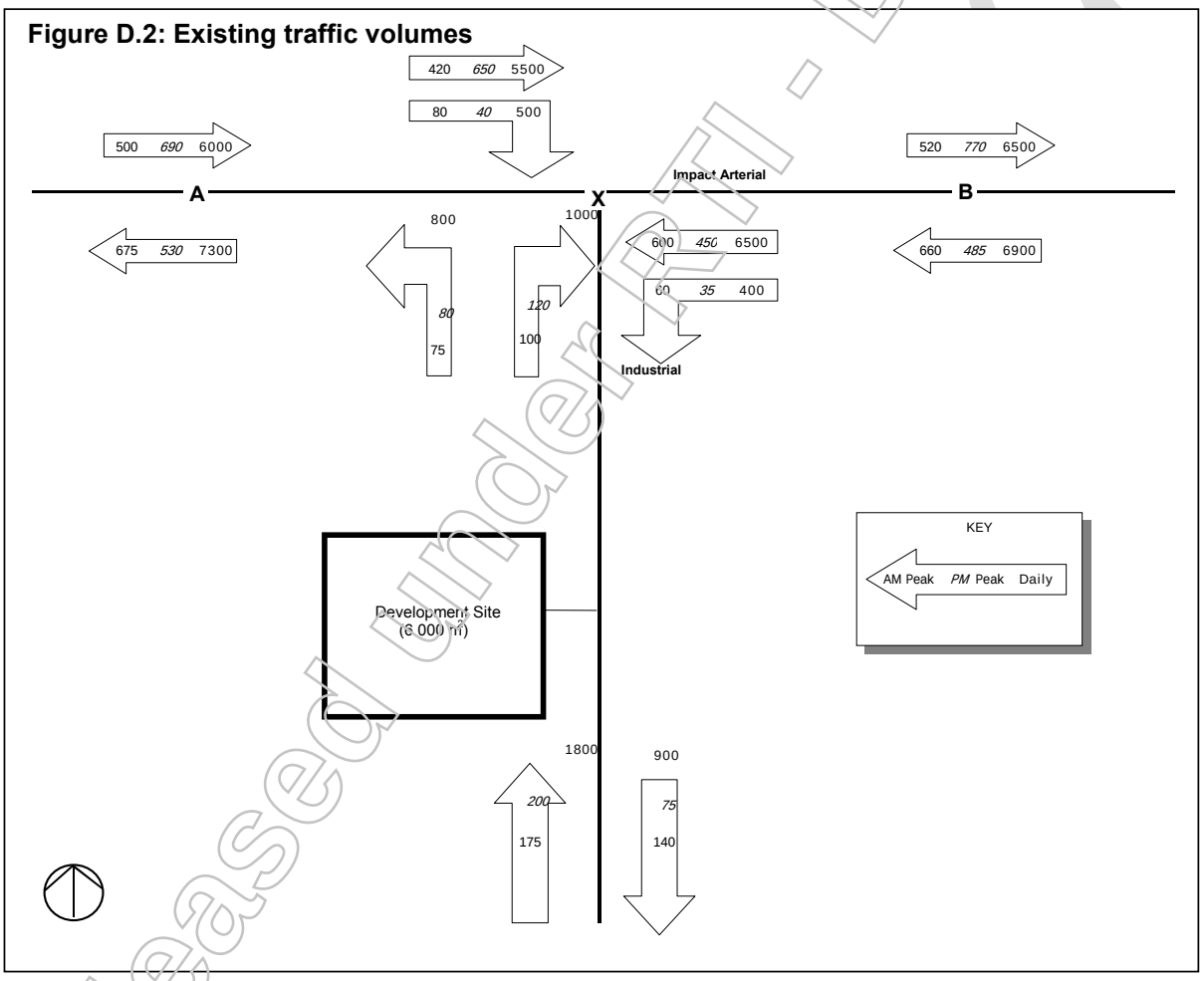
Figure D.1: Locality map



1.2 Surrounding road network details (refer Chapter 4.2)

- The site is located adjacent to a major local government road (Industrial Road) that intersects a SCR (Impact Arterial) approximately 150 m away.
- The intersection of Industrial Road and Impact Arterial is currently signalised.
- Traffic counts were conducted at the intersection to ascertain the existing peak hour and daily demand. The surveyed turning movements at the intersection are shown in Figure D.2.
- Historic traffic counts were reviewed to determine the profile of traffic growth. Growth assumptions were confirmed and agreed with Main Roads District officers prior to usage.
- Base year and 10 year horizon traffic volumes at the intersection were generated for the scenario without the proposed development.

Figure D.2: Existing traffic volumes



1.3 Development traffic generation (refer Chapter 4.3)

- Likely traffic volumes generated by the proposal were estimated using unit traffic generation rates extracted from surveys of similar developments. The source of any such traffic generation information utilised should be documented.
- Table D.1 shows the traffic generation based upon a peak rate of 1 trip end per 100 m^2 and a daily rate of ten trip ends per 100 m^2.

- In this case, trip generation estimates based upon Gross Floor Area provide a reasonable estimate of development traffic.

Traffic Generation Characteristic	In	Out	Total
Daily trip ends	300	300	600
AM peak hour trip ends	45	15	60
PM peak hour trip ends	15	45	60

Table D.1 Traffic generation (Light Industrial – 6 000 m^2)

Traffic generation calculation

Daily Trips *=6 000 m^2 x 10 trip ends/100 m^2*
=600 trip ends per day
Peak Hour Trips *=6 000 m^2 x 1 trip end/100 m^2*
=60 trip ends per hour

(A direction distribution of 50% in /50% out was assumed for daily trips on the basis of similar surveys. For the peak hour generation, a directional distribution of 75 per cent in /25 per cent out was utilised for the AM peak and reverse for the PM peak.)

1.4 Development traffic distribution (refer Chapter 4.4)

- Traffic generated by the proposed development was distributed in accordance with existing turning movement patterns at the intersection and residential development within the anticipated catchment (see Table D.2 Traffic distribution).

Direction (to/from)	Percentage	Daily		AM Peak		PM Peak	
		In	Out	In	Out	In	Out
South	20%	60	60	9	3	3	9
East	35%	105	105	16	5	5	16
West	45%	135	135	20	7	7	20
TOTAL	100%	300	300	45	15	15	45

Table D.2 Traffic Distribution

Development-generated traffic is shown in Figure D.3.

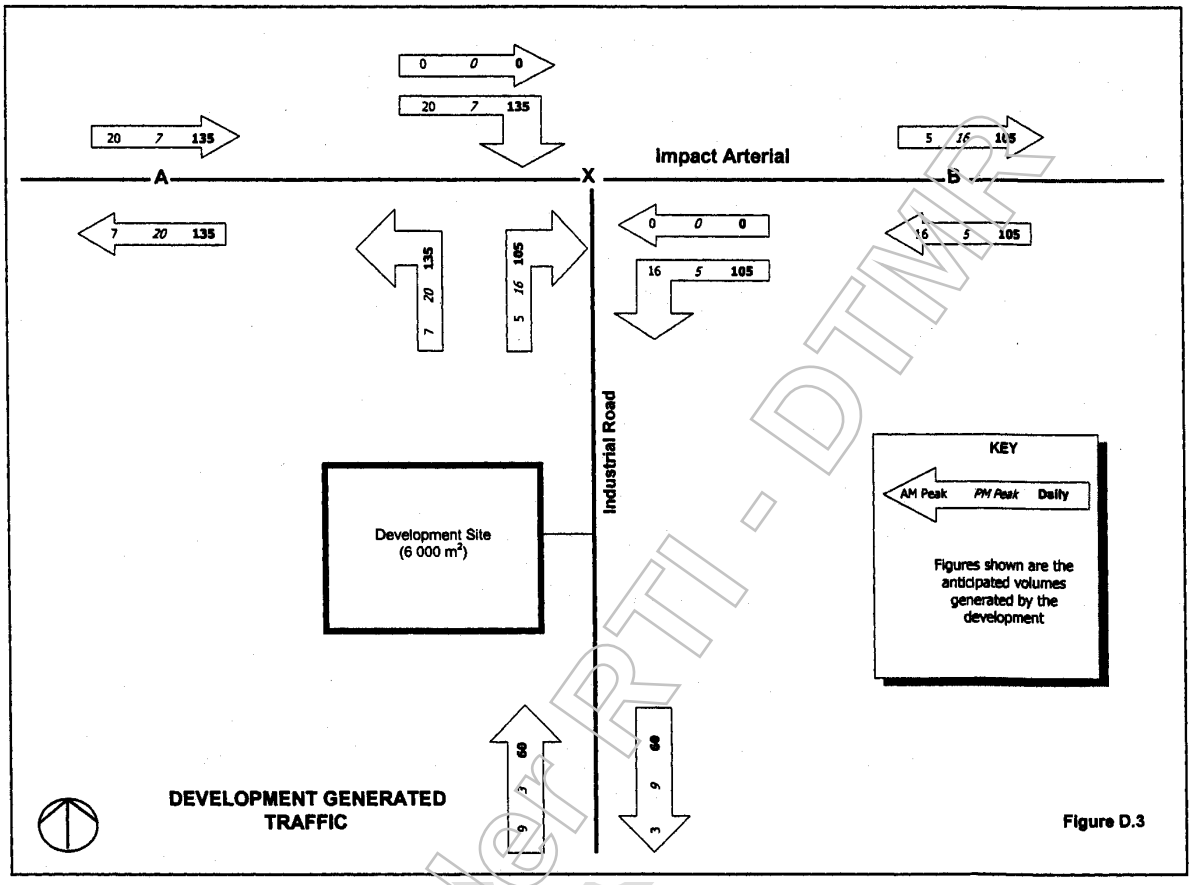


Figure D.3

1.5 Study network definition (refer Chapters 3.2, 3.3 and 4.5)

1.5.1 Traffic operation

- The scope of investigation in this instance was limited to the intersection of the local government road and the SCR (Impact Arterial Road / Industrial Road).
- Figure D.4 shows the development traffic as percentages of existing turning movements. In all cases, the percentage is greater than 5 per cent and assessment of the intersection is therefore required (see Criterion 3 in Section 3.2).
- With respect to road link volumes, development traffic on Impact Arterial Road east and west of Industrial Road is less than 5% of the existing flows and therefore assessment is not necessary.

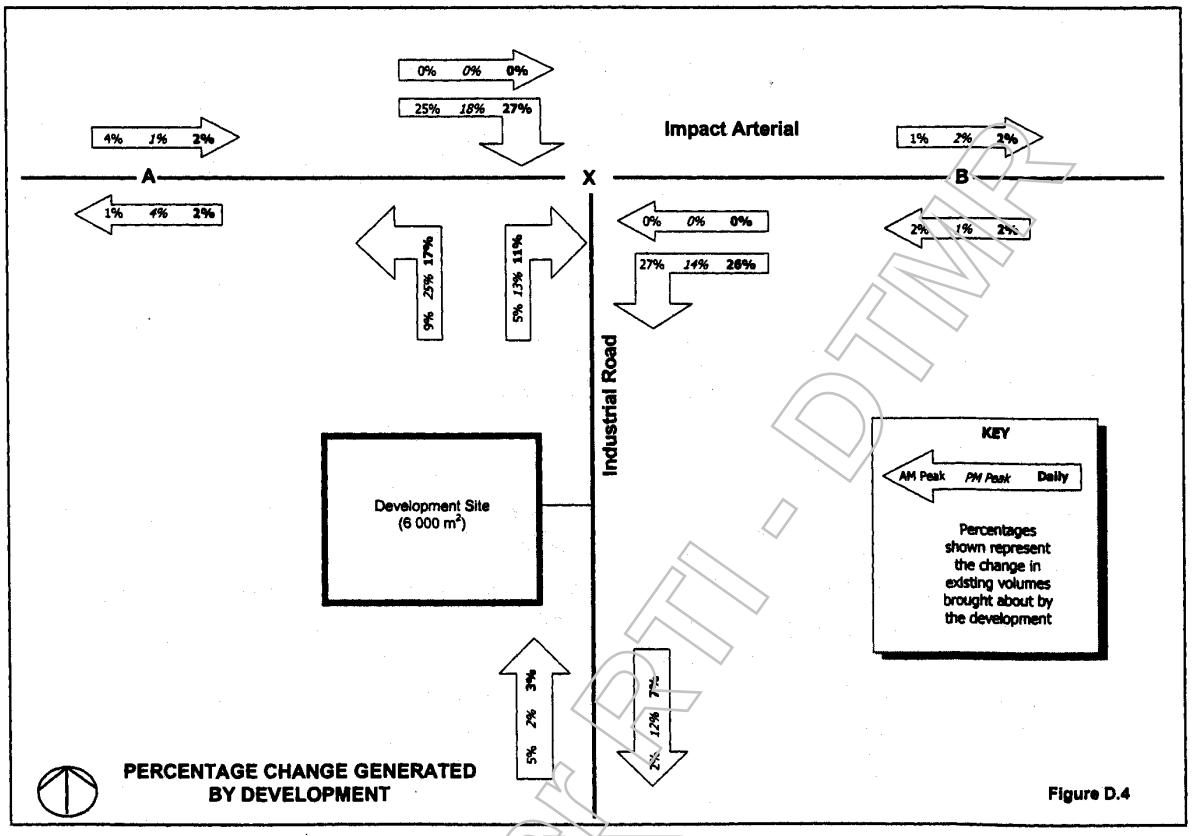


Figure D.4

1.6 Pavement impacts

- Site-generated ESAs associated with heavy commercial vehicles were calculated to be less than 5 per cent of the existing use on the SCR and therefore no assessment of pavement impacts was required.

1.7 Design horizon

- The development is anticipated to be completed and open by 2007. The horizon year is therefore 2017 (ten years following opening).

1.8 On-site aspects (refer Chapter 4.6)

- In this case Main Roads is not interested in on-site aspects as they are not expected to affect operation of the remote intersection.
- On-site aspects will need to be covered for the local government assessment.

STEP 3: TRAFFIC OPERATION ASSESSMENT (refer Chapter 6)

- The traffic operation assessment prepared as part of the RIA needs to address operation of the intersection of the local government road with the SCR (Impact Arterial Road / Industrial Road). The local government would also require an assessment of the operation of the points of access from the development to its road. This would generally be covered in the one assessment.
- No assessment of road link operation was required for this project as the threshold set by Criterion 3 in Section 3.2 was not exceeded for Impact Arterial Road.

3.1 Intersection Analysis (refer Chapters 6.4 and 6.6)

- Development traffic volumes at the Impact Arterial Road / Industrial Road intersection were produced by considering increases generated by the development using the assumptions regarding traffic generation and distribution discussed above.
- Intersection operation was tested using SIDRA.
- Analysis revealed that the intersection is currently operating at levels outside desirable limits of capacity during peak periods. With development, operation is marginally worse.

STEP 4: SAFETY REVIEW (refer Chapter 7)

- A review of safety issues was undertaken including crash history at the intersection. No concerns were identified.
- Safety was not considered to be a major concern given that the types of vehicles generated by the proposal were not inconsistent with those currently using the intersection.

STEP 5: ENVIRONMENTAL AND OTHER ISSUES (refer Chapter 8)

- No other issues were determined to be relevant to the affected SCR or intersection.

STEP 6: IMPACT MITIGATION (refer Chapter 9)

- It was identified that RIP funding has been committed for some minor intersection improvements.
- The development, in this instance, brought forward the timing for the intersection improvements by less than one year. As a result, capacity impacts were viewed as insignificant and no contribution sought.

Appendix E: Trip generation data

Trip generation data for a variety of land uses is available from a number of sources including:

- *Guide to Traffic Generating Developments* prepared by the Roads and Traffic Authority of NSW (may need to be modified for particular uses to suit the local situation);
- *Trip Generation* by the Institute of Transportation Engineers (ITE) (United States data – may need to be modified to suit Australian conditions);
- Main Roads' and local governments' databases; and
- Traffic / transport consultants' and surveyors' databases.

The level of detail provided in these sources varies from raw data, relationships between amount of traffic generated and size of land use, to rates only. Some contain parking demand data and/or rates as well as data collection and use methodologies.

It may be possible to collect data from other similar developments and to extrapolate the required data when attributes such as size and location differ between the surveyed and the proposed developments. It is recommended that an experienced practitioner perform such analysis.

It is noted that the most reliable source of trip generation data will be survey data from the actual development or a similar one in a similar location – preferably in close proximity. An increased level of judgement is generally required when using regional, statewide, national or international information.

Table E.1 is a sample of the format for traffic generation data that can be collected to obtain rates for a proposed development. Raw data is provided together with a description to allow appropriate use of the information.

Table E.1 Development traffic generation data

Use: *Shopping Centre*
Location: *Shopping Central - Queen Street, Carina*
Description of Development: *GFA* 65 000 m^2
GLA 60 000 m^2
Description of Surrounds: *CBD*
Day of Survey: *Friday, 3 October 1998*

CENTRAL SHOPPING CENTRE - TRAFFIC GENERATION

TIME (1/4hr commencing	15 MINUTE GENERATION		TOTAL	HOURLY GENERATION	PARKED VEHICLES	OCCUPANCY
	IN	OUT				
700	35	37	72		30	2%
715	41	29	70		42	2%
730	61	10	71		93	5%
745	102	32	134	347	163	8%
800	94	39	133	408	218	11%
815	118	36	154	492	300	15%
830	156	47	203	624	409	20%
845	206	41	247	737	574	29%
900	175	59	234	838	690	35%
915	198	62	260	944	826	41%
930	231	78	309	1050	979	49%
945	225	101	326	1129	1103	55%
1000	215	127	342	1237	1191	60%
1015	174	105	279	1256	1260	63%
1030	201	134	335	1282	1327	66%
1045	176	136	312	1268	1367	68%
1100	122	125	247	1173	1364	68%
1115	229	171	400	1294	1422	71%
1130	175	153	328	1287	1444	72%
1145	225	172	397	1372	1497	75%
1200	241	261	502	1627	1477	74%
1215	166	167	333	1560	1476	74%
1230	180	178	358	1590	1478	74%
1245	197	214	411	1604	1461	73%
1300	176	224	400	1502	1413	71%
1315	128	174	302	1471	1367	68%
1330	176	198	374	1487	1345	67%
1345	174	185	359	1435	1334	67%
1400	153	250	403	1438	1237	62%
1415	169	209	378	1514	1197	60%
1430	169	204	373	1513	1162	58%
1445	154	162	316	1470	1154	58%
1500	153	232	385	1452	1075	54%
1515	106	185	291	1365	996	50%
1530	131	160	291	1283	967	48%
1545	131	165	296	1263	933	47%
1600	131	148	279	1157	916	46%
1615	159	200	359	1225	875	44%
1630	125	204	329	1263	796	40%
1645	110	196	306	1273	710	36%
1700	118	187	305	1299	641	32%
1715	102	199	301	1241	544	27%
1730	126	175	301	1213	495	25%
1745	116	180	296	1203	431	22%
TOTAL	**6750**	**6351**	**13101**			
PEAK PARKING ACCUMULATION					**1497**	**75%**
PEAK HOUR TRAFFIC GENERATION				**1627**		
TOTAL SPACES AVAILABLE						**2000**
AVERAGE OCCUPANCY						**47%**

Information supplied by: *Eppell Olsen & Partners*

Appendix F: Linked trips

Traffic generation data for movements in and out of certain development types is readily available. However, there is a need to understand how much of the generated traffic is new and how much is already on the road network prior to opening of the development.

Historically, traffic impact assessments conservatively assumed that all generated traffic was new. More recently, 'discounts' have been applied to generated traffic to account for the 'drop in' component, which is not new traffic to the network.

Research undertaken on this subject has concluded that it is appropriate to make adjustments to generated traffic due to linked trips.

Trips can be broadly categorised into the following types:

Linked Trip A journey where there is a chain of stops from origin to ultimate destination. A trip from home to work with stops at school and the post office comprises three linked trips:

- home to school;
- school to post office; and
- post office to work.

Unlinked Trip A journey with no intermediate stops (generally referred to as New Trips in the RIA)

For the purposes of an RIA, the following three types of trips are commonly used:

New Trip In traffic impact studies, unlinked trips are generally referred to as new trips. These are trips attracted to the development and without the development would not have been made – hence a new trip.

Diverted Drop In Trips A linked trip from an origin to a destination that has made a significant network diversion to use the new development.

Undiverted Drop In Trips A linked trip from an origin to a destination that previously passed the development site. This is also referred to as a 'pass by' trip and the new development is an intermediate stop on a trip that is made from an origin to a destination.

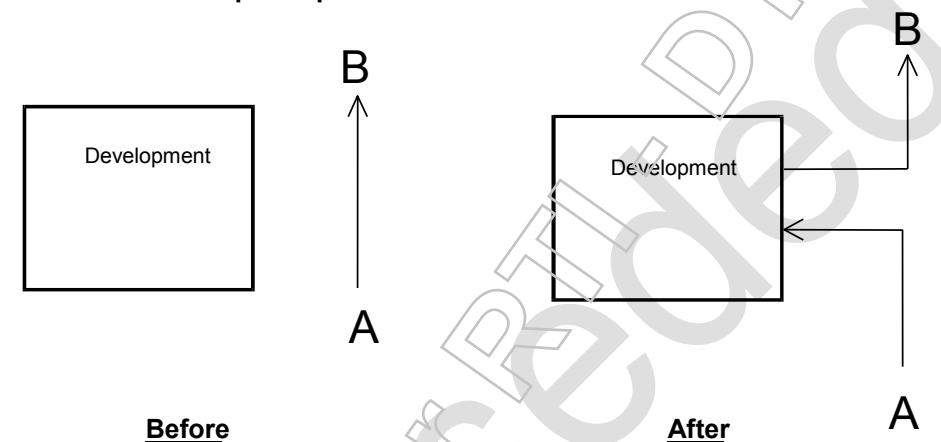
The diverted and undiverted drop-in trips are considered to be trips that are already part of the existing flows on the road network.

The treatment of the different trip types varies with the level of assessment. Hallam (1988) provides a reasoned basis for separating assessment into three levels:

- Regional Assessment – consideration of the impact of a development in the context of the total urban area;
- Local Assessment – consideration of the effect of a development over a substantial area focussed on the development; and
- Access Level – micro level assessment.

At the regional level, insertion of a new development could be considered to only increase travel by the new trips proportion of generation. Diverted and undiverted drop in trips would already be on the network.

Figure: F.1 : Undiverted drop in trips



Before
Trip passes development site on route from A to B.

After
Trip which was previously passing the site drops in to development on route from A to B

Note: One original pass by trip becomes 2 drop in trips (1 in and 1 out)

An RIA is usually conducted over a limited part of the network. At a local level, both the new trips and diverted drop-in trips are introduced into the area and represent additional trips on the local network. This local network may contain roads of regional significance. The undiverted drop-in trips to developments on roads of regional significance can be regarded as already on the local network. It is important that these trips are considered. They must be rerouted from movements past the development to movements into and out of the development. For every two development trips assigned as undiverted drop-in trips (one in / one out), one through trip should be removed from passing traffic.

In 1995, Eppell Olsen & Partners carried out surveys for Main Roads to segment traffic generation for specific developments. The results of these surveys are documented in the report, *Development Traffic Surveys: Linked / Unlinked Trips*.

The segmentation of traffic generation for shopping centres and fast food outlets is shown below:

Table F.1

Development	Trip Segmentation		
	New (%)	Diverted Drop In (%)	Undiverted Drop In (%)
Shopping Centres >20 000 m^2	63	18	19
Shopping Centre 3 000 m^2 – 20 000 m^2	50	22	28
Shopping Centres <3 000 m^2	50	32	18
Fast Food Outlets	40	25	35

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Appendix G: Bring forward methodology

Bring forward methodology may be used by development proponents to mitigate their development's road network impacts. Subject to the provisions of the IPA, Main Roads has sole discretion in whether to accept the bring forward methodology as a means of mitigating a development road network impacts

The bring forward methodology determines the quantum of the difference between the discounted present value of the cost of construction of works as programmed or expected by Main Roads and the discounted present value of the cost of construction of the same works, required to mitigate a developments impacts, at an earlier time. In order to quantify costs of a development's mitigation measure it is necessary to determine when the roadworks are required by the development and when those roadworks would normally have been provided by Main Roads.

Main Roads will consider future commitments in the RIP before deciding to accept the use of the bring forward methodology. Funds are committed **only** in the first two years of the RIP. Where the works under consideration are substantial, it may not be feasible for Main Roads to accept bring forward cost arrangements and other funding arrangements may be necessary. The bring forward methodology is available only where Main Roads can accommodate any of the necessary changes required to future budgets and works arrangements. .

Present value is calculated using present day construction costs and the discount rates established by State Treasury. The discount rate is a 'time preference' discount rate, which is net of any allowance for inflation.

The RIP presents construction costs in 'out-turn' prices (i.e. the predicted cost in future dollar terms). An allowance for inflation is made using factors that are released each year in the RIP guidelines. As a result, future year construction costs in the RIP have to be deflated by these factors to obtain present day construction costs.

Example

Intersection works are shown on the RIP for 2010. The construction cost in 2010$ was 'deflated' to give a cost of $870 000 in current dollars (2006$). Development causes the works to be needed in 2008. The Treasury time preference discount rate is 6%.

Discount Factor (2010 – 2006)	$= (1.06)^{-(2010-2006)}$
	= 0.7921
Present value of works in 2010	= $870 000 x 0.7921
	= $689 127
Discount Factor (2008 – 2006)	$= (1.06)^{-(2008-2006)}$
	= 0.8900
Present value of works in 2008	= $870 000 x 0.8900
	= $774 300
Therefore bring forward cost	= $774 300 - $689 127
	= $85 173

DISCOUNT FACTORS (F)

Treasury time preference discount rate		1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
Discount Period (years)	1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091
	2	0.9803	0.9612	0.9426	0.9246	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264
	3	0.9706	0.9423	0.9151	0.8890	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513
	4	0.9610	0.9238	0.8885	0.8548	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830
	5	0.9515	0.9057	0.8626	0.8219	0.7835	0.7473	0.7130	0.6806	0.6499	0.6209
	6	0.9420	0.8880	0.8375	0.7903	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645
	7	0.9327	0.8706	0.8131	0.7599	0.7107	0.6651	0.6227	0.5835	0.5470	0.5132
	8	0.9235	0.8535	0.7894	0.7307	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665
	9	0.9143	0.8368	0.7664	0.7026	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241
	10	0.9053	0.8203	0.7441	0.6756	0.6139	0.5584	0.5083	0.4632	0.4224	0.3855
	11	0.8963	0.8043	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505
	12	0.8874	0.7885	0.7014	0.6246	0.5568	0.4970	0.4440	0.3971	0.3555	0.3186
	13	0.8787	0.7730	0.6810	0.6006	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897
	14	0.8700	0.7579	0.6611	0.5775	0.5051	0.4423	0.3878	0.3405	0.2992	0.2633
	15	0.8613	0.7430	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394
	16	0.8528	0.7284	0.6232	0.5339	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176
	17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978
	18	0.8360	0.7002	0.5874	0.4936	0.4155	0.3503	0.2959	0.2502	0.2120	0.1799
	19	0.8277	0.6864	0.5703	0.4746	0.3957	0.3305	0.2765	0.2317	0.1945	0.1635
	20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486
	21	0.8114	0.6598	0.5375	0.4388	0.3589	0.2942	0.2415	0.1987	0.1637	0.1351
	22	0.8034	0.6468	0.5219	0.4220	0.3418	0.2775	0.2257	0.1839	0.1502	0.1228
	23	0.7954	0.6342	0.5067	0.4057	0.3256	0.2618	0.2109	0.1703	0.1378	0.1117
	24	0.7876	0.6217	0.4919	0.3901	0.3101	0.2470	0.1971	0.1577	0.1264	0.1015
	25	0.7798	0.6095	0.4776	0.3751	0.2953	0.2330	0.1842	0.1460	0.1160	0.0923

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Appendix I: Department of Main Roads district offices *(superceded June 08)*

District	*Phone*	*Address*
Border (Warwick)	*07 4661 6333*	*306 Wood Street Locked Bag 1, Warwick, Q, 4370*
Central (Rockhampton)	*07 4931 1500*	*31 Knight Street PO Box 5096, Nth Rockhampton MC, Q, 4700*
Central Highlands (Emerald)	*07 4983 8700*	*83 Esmond Street PO Box 1787, Emerald, Q, 4720*
Central Western (Barcaldine)	*07 4651 2777*	*69 Ash Street PO Box 3, Barcaldine, Q, 4725*
Mackay	*07 4951 8555*	*46 Gordon Street PO Box 62, Mackay, Q, 4740*
Metropolitan (Brisbane)	*07 3834 8344*	*183 Wharf Street PO Box 70, Spring Hill, Q, 4004*
North Coast Hinterland (Gympie)	*07 5482 0333*	*50 River Road PO Box 183, Gympie, Q, 4570*
North Western (Cloncurry)	*07 4769 3200*	*16-22 Ramsay Street PO Box 338, Cloncurry, Q, 4824*
Northern (Townsville)	*07 4720 7200*	*146 Wills Street PO Box 1089, Townsville, Q, 4810*
Peninsula (Cairns)	*07 4050 5444*	*15 Lake Street PO Box 6185, Cairns, Q, 4870*
South Coast Hinterland (Nerang)	*07 5596 9500*	*36-38 Cotton Street PO Box 442, Nerang, Q, 4211*
South Western (Roma)	*07 4622 9511*	*Cnr Gregory & McDowall Streets PO Box 126, Roma, Q, 4455*
Southern (Toowoomba)	*07 4639 0752*	*Cnr Phillip & Clopton Streets PO Box 645, Toowoomba, Q, 4350*
Wide Bay (Bundaberg)	*07 4154 0200*	*23 Quay Street Locked Bag 486, Bundaberg DC, Q, 4670*

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