



# PROJECT CHINA STONE

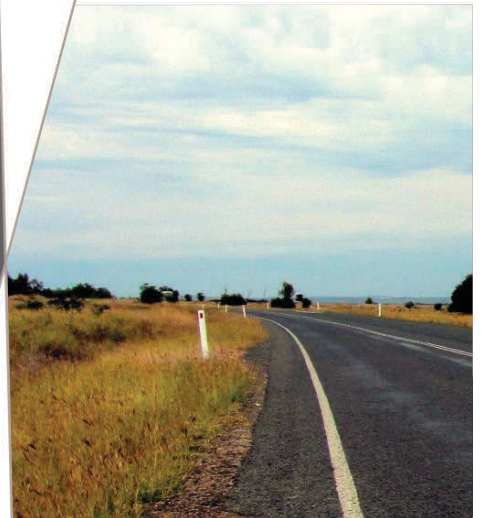
Road Impact  
Assessment Report

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# Road Impact Assessment

for Project China Stone

CEB06482



Prepared for  
Hansen Bailey on behalf of MacMines  
Austasia Pty Ltd (MacMines)

6 July 2015

## Document Information

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## Abbreviations

| Acronym        | Description                                                      |
|----------------|------------------------------------------------------------------|
| AADT           | Annual Average Daily Traffic                                     |
| AEIS           | Additional information to the EIS                                |
| AUL            | Auxiliary Left Turn                                              |
| AUL(S)         | Auxiliary Left Turn (Short)                                      |
| BAL            | Basic Left Turn                                                  |
| BAR            | Basic Right Turn                                                 |
| BC             | Brown Consulting (Qld) Pty Ltd                                   |
| Cardno         | Cardno (Qld) Pty Ltd                                             |
| CCM&RP         | Carmichael Coal Mine and Rail Project                            |
| CHL            | Channelised Left Turn                                            |
| CHR            | Channelised Right Turn                                           |
| CHR(S)         | Channelised Right Turn (Short)                                   |
| CTRC           | Charter Towers Regional Council (Local Government)               |
| DOS            | Degree of Saturation                                             |
| EIS            | Environmental Impact Statement                                   |
| EPC 987        | Exploration Permit for Coal 987                                  |
| ESA            | Equivalent Standard Axle                                         |
| ha             | hectare                                                          |
| Hansen Bailey  | Hansen Bailey Pty Ltd                                            |
| HV             | heavy vehicle                                                    |
| IRC            | Isaac Regional Council (Local Government)                        |
| KL             | kilolitre                                                        |
| km             | kilometre                                                        |
| km/h           | kilometers per hour                                              |
| LGA            | Local Government Area                                            |
| LOS            | Level of Service                                                 |
| MacMines       | MacMines Austasia Pty Ltd                                        |
| m <sup>3</sup> | cubic metres                                                     |
| m              | metres                                                           |
| Mtpa           | Million tonnes per annum                                         |
| NSW            | New South Wales                                                  |
| pa             | per annum                                                        |
| QLD            | Queensland                                                       |
| QTRIP          | Queensland Transport Roads Investment Program 2014-15 to 2016-17 |
| RIA            | Road Impact Assessment                                           |
| RMS            | Roads and Maritime Services (New South Wales State Government)   |
| SHS            | State High School                                                |
| SS             | State School                                                     |

| Acronym     | Description                                                          |
|-------------|----------------------------------------------------------------------|
| t           | tonnes                                                               |
| the project | Project China Stone                                                  |
| TMR         | Department of Transport and Main Roads (Queensland State Government) |
| TTM         | TTM Consulting Pty Ltd                                               |
| veh         | vehicles                                                             |
| vpd         | vehicles per day                                                     |
| vph         | vehicles per hour                                                    |

## Glossary

| Term                                | Definition                                                                                                                                                                                                                                                                   |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 95%ile Queue                        | The length of vehicles in a queue that is exceeded only 5% of the time. A typical design parameter for intersections to estimate turning bay lengths.                                                                                                                        |
| Annual Average Daily Traffic (AADT) | A common measure of traffic volume equivalent to the total volume of traffic passing a particular point over the period of one year, divided by the number of days in the year.                                                                                              |
| Austroroads                         | The association of Australian and New Zealand road transport and traffic authorities that aims to promote improved road transport outcomes and produces nationally accepted guidelines.                                                                                      |
| baseline traffic volumes            | The expected volume of traffic without the addition of the traffic associated with the Project.                                                                                                                                                                              |
| critical delay                      | The highest average traffic delay experienced by any traffic movement at an intersection.                                                                                                                                                                                    |
| Degree of Saturation (DOS)          | The ratio of the number of vehicles arriving at an intersection in a specified period to the capacity during that period.                                                                                                                                                    |
| Equivalent Standard Axles (ESAs)    | A measure defining the cumulative damaging effect to the pavement. It is expressed in terms of the equivalent number of axles passing over the pavement.                                                                                                                     |
| Level of Service (LOS)              | An index of the operational performance of traffic on a given lane, carriageway or road when accommodating various traffic volumes under different combinations of operation conditions. It is usually defined in terms of the convenience of travel and safety performance. |
| priority-controlled intersection    | An intersection where the movement of vehicles is controlled by road rules and traffic control devices as opposed to traffic signals or a roundabout.                                                                                                                        |
| roundabout                          | A channelised intersection at which all traffic moves clockwise around a central traffic island.                                                                                                                                                                             |
| SIDRA Intersection                  | Traffic analysis software developed by SIDRA Solutions which provides estimates of capacity and performance statistics for isolated intersections.                                                                                                                           |
| signalised intersection             | An intersection at which the movement of vehicles and pedestrians is generally controlled by traffic signals.                                                                                                                                                                |

# 1 Introduction

## 1.1 Context

Cardno (Qld) Pty Ltd (Cardno) has been commissioned by Hansen Bailey Pty Ltd (Hansen Bailey) on behalf of MacMines Austasia Pty Ltd (MacMines) to complete a Road Impact Assessment (RIA) as part of the Environmental Impact Statement (EIS) for Project China Stone (the project).

The project involves the construction and operation of a large scale coal mine on a greenfield site in Central Queensland. The project site is remote, being located approximately 270 km south of Townsville and 300 km west of Mackay (Figure A1 in Appendix A). The project site is located at the western limit of the Isaac Regional Council (IRC) Local Government Area (LGA) and adjoins the Charters Towers Regional Council (CTRC) LGA to the west.

The project site is located within the Mackay-Whitsunday Region of the Department of Transport and Main Roads (TMR), with sections of key transport routes servicing the project extending into TMR's North Queensland Region. The project site is defined by the boundary of the project mining lease application areas and covers an area of approximately 20,000 ha.

## 1.2 Government Guidelines

The RIA has been carried out in accordance with TMR's *Guidelines for Assessment of Road Impacts of Development (2006)* which provides the methodology for assessing the potential road impacts of a project.

The objective of the RIA is to identify the potential impacts of the project on the State-controlled and Council-controlled road networks including any potential intersection performance, link performance, pavement condition or road safety impacts and, where appropriate, identify mitigation strategies.

In accordance with TMR's development assessment guideline, potential road performance and safety impacts have been assessed up to the ten-year design horizon following commencement of the project's operations phase. Potential pavement impacts associated with project traffic have been assessed over the project's construction and operations phases.

## 1.3 Assessment Methodology

To identify the potential road impacts of the project and associated mitigation measures, the following tasks were undertaken:

- > Inspection of the public road network between Townsville, Charters Towers and the project site including parts of the Flinders Highway, Gregory Developmental Road, Elgin-Moray Road and Moray-Carmichael Road.
- > Collation of data from road authorities describing the existing road conditions and survey of existing peak hour traffic volumes to supplement the data held by road authorities.
- > Interrogation of crash data for roads in the vicinity of the project site.
- > Review of historic traffic growth patterns and approved projects and developments to inform estimation of the likely traffic volume growth across the road network, excluding traffic generated by the project.
- > Assessment of the additional traffic demands likely to be generated by the activities associated with the project's construction and operations phases.
- > Forecast of future design traffic volumes, both including and excluding the project traffic.
- > Identification of the spatial extents over which traffic associated with the project has the potential to significantly increase existing traffic volumes, referred to as a scoping assessment.
- > Assessment of the future operation of the intersections and the links identified by the scoping assessment as warranting assessment.
- > Identification of the project's potential impact on State-controlled road pavements.
- > Development of strategies to avoid, minimise or mitigate any significant road network performance impacts associated with traffic generated by the project.

## 1.4 Report Structure

This RIA report has been structured as detailed in Table 1-1.

**Table 1-1 Report Structure**

| Section | Description                                                                                                                                                                 |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Identifies relevant guidelines, and the assessment methodology.                                                                                                             |
| 2       | Describes the project including location and access arrangements. Discusses workforce and material estimates that have been utilised throughout the analysis and reporting. |
| 3       | Describes the existing road network including traffic volumes, historic growth rates, crash history and public transport services.                                          |
| 4       | Details future road network improvements planned or conditioned to be delivered by both road authorities and other project proponents.                                      |
| 5       | Outlines the scope of the road network performance assessment including the relevant performance criteria that have been adopted.                                           |
| 6       | Details the assessed traffic volumes including project generated traffic demands.                                                                                           |
| 7       | Presents the assessments undertaken for the key study intersections.                                                                                                        |
| 8       | Presents the assessments undertaken for the key study road links.                                                                                                           |
| 9       | Presents the assessment undertaken for pavement impacts.                                                                                                                    |
| 10      | Documents the assessment conclusions in relation to the potential impacts of the project.                                                                                   |

## 1.5 Limitations

Cardno has undertaken the RIA in accordance with the usual care and thoroughness of the consulting profession. The assessment is based on accepted traffic engineering practices and standards applicable at the time of undertaking the assessment.

The adopted assessment methodology and sources of information utilised by Cardno are outlined in the RIA. Cardno has made no independent verification of the supplied project information or road condition data beyond the agreed scope of works. Within the extent of the assessment scope no indications were found that the supplied project planning information or existing road condition data relied upon in undertaking the assessment were inaccurate.

The traffic engineering analysis informing the assessment was finalised during October 2014 and is based upon the road conditions encountered and project information available at the time. Subsequent to finalising the traffic analysis presented herein, it was requested that the potential influence of a project that was made public following finalisation of the traffic modelling be considered. As part of the June 2015 review, Cardno has established that the reported analysis includes appropriate allowance for the nearby project that has only recently been made public.

## 2 Project Description

### 2.1 Overview

The project involves the construction and operation of a large-scale coal mine on a greenfield site in Central Queensland. The project site (the area that will ultimately form the mining leases for the project) is remote, being located approximately 270 km south of Townsville and 300 km west of Mackay at the northern end of the Galilee Basin (Figure A1). The closest townships are Charters Towers, approximately 285 km by road to the north, and Clermont, approximately 260 km by road to the south-east. The project site comprises approximately 20,000 ha of well vegetated land, with low-lying scrub in the south and east and a densely vegetated ridgeline, known as 'Darkies Range', running north to south through the western portion of the site.

The mine will produce up to approximately 55 million tonnes per annum (Mtpa) of Run of Mine thermal coal. Coal will be mined using both open cut and underground mining methods. Open cut mining operations will involve multiple draglines and tuck and shovel pre-stripping. Underground mining will involve up to three operating longwalls. Coal will be washed and processed on site and product coal will be transported from site by rail. It is anticipated that mine construction will commence in 2016 and the mine life will be in the order of 50 years.

The majority of the mine infrastructure will be located in the eastern portion of the project site. Infrastructure will include coal handling and preparation plants, stockpiles, conveyors, rail loop and train loading facilities, workshops, dams, tailings storage facility and a power station. A workforce accommodation village and private airstrip will also be located in the eastern part of the project site. The large majority of the mine workforce will commute to the site on a Fly-in Fly-Out basis.

The scope of this RIA is limited to the construction and operation of the mine and does not include assessment of the traffic impacts of any infrastructure not located on the proposed mining leases.

### 2.2 Access

Access to the project site will be via a new access road from the Moray–Carmichael Road (Figure A1).

### 2.3 Workforce

Information related to the construction phase and operations phase workforces are detailed in Table 2-1.

Table 2-1 Workforce

| Roster Arrangements | Construction Workforce<br>(prior to airstrip opening) | Peak Operations Workforce               |
|---------------------|-------------------------------------------------------|-----------------------------------------|
| Workforce           | 1,304 persons                                         | 3,391 persons                           |
| Roster              | 7 days on/7 days off                                  | 7 days on/7 days off                    |
| Shifts              | 2 x 12 hour shifts (24 hour operations)               | 2 x 12 hour shifts (24 hour operations) |

Source: MacMines

## 2.4 Materials

Table 2-2 presents the estimated peak annual material requirements during the project's construction phase with further detail included in Table B1 in Appendix B. Table 2-3 presents the estimated annual material requirements during the peak year of operations with further detail included in Table B2 in Appendix B.

**Table 2-2 Peak Annual Construction Activities Material Requirements**

| Material                      | Quantity              | Origin/<br>Destination         | Typical Vehicle    |
|-------------------------------|-----------------------|--------------------------------|--------------------|
| <b>Inputs</b>                 |                       |                                |                    |
| Concrete                      | 47,422 m <sup>3</sup> | Local Quarries / Project Site  | Concrete Mixer     |
| Gravel                        | 663,153 t             | Local Quarries / Project Site  | 6-axle articulated |
| Steel                         | 7,830 t               | Townsville / Project Site      | 6-axle articulated |
|                               | 1,957 t               | Moranbah / Project Site        | 6-axle articulated |
| Oversize Equipment            | 7,290 t               | Townsville / Project Site      | Low Loader         |
|                               | 7,290 t               | Moranbah / Project Site        | Low Loader         |
| Plant and Equipment           | 567 t                 | Townsville / Project Site      | 6-axle articulated |
|                               | 567 t                 | Moranbah / Project Site        | 6-axle articulated |
| Electrical cable              | 161 t                 | Townsville / Project Site      | 6-axle articulated |
|                               | 28 t                  | Moranbah / Project Site        | 6-axle articulated |
| Electrical poles              | 1,859 t               | Townsville / Project Site      | 6-axle articulated |
|                               | 465 t                 | Moranbah / Project Site        | 6-axle articulated |
| Pipe                          | 3,950 t               | Townsville / Project Site      | 6-axle articulated |
|                               | 988 t                 | Moranbah / Project Site        | 6-axle articulated |
| Conveyor belt                 | 292 t                 | Townsville / Project Site      | 4-axle truck       |
|                               | 32 t                  | Moranbah / Project Site        | 4-axle truck       |
| Miscellaneous                 | 737 t                 | Townsville / Project Site      | 6-axle articulated |
| Fuel and Oil                  | 18,500 kL             | Townsville / Project Site      | B-double tanker    |
| Prefab buildings              | 1,417 items           | Townsville / Project Site      | 5-axle articulated |
|                               | 607 Items             | Moranbah / Project Site        | 5-axle articulated |
| Service Providers             | 1,825 veh             | Charters Towers / Project Site | 4-axle truck       |
| <b>Outputs</b>                |                       |                                |                    |
| Scrap metal                   | 189 t                 | Project Site / Townsville      | 6-axle articulated |
| General waste                 | 260 t                 | Project Site / Townsville      | 6-axle articulated |
| Hazardous and regulated waste | 13 kL                 | Project Site / Townsville      | B-double tanker    |
| Waste oil, sludge and grease  | 24 kL                 | Project Site / Townsville      | B-double tanker    |

Source: MacMines

Table 2-3 Peak Annual Operations Activities Material Requirements

| Material                      | Quantity |     | Origin/<br>Destination         | Typical Vehicle    |
|-------------------------------|----------|-----|--------------------------------|--------------------|
| Inputs                        |          |     |                                |                    |
| Concrete                      | 3,044    | m³  | Local Quarries / Project Site  | Concrete Mixer     |
| Gravel                        | 20,398   | t   | Local Quarries / Project Site  | 6-axle articulated |
| Steel                         | 142      | t   | Townsville / Project Site      | 6-axle articulated |
|                               | 36       | t   | Moranbah / Project Site        | 6-axle articulated |
| Pipe                          | 2,510    | t   | Townsville / Project Site      | 6-axle articulated |
| Conveyor belt                 | 253      | t   | Moranbah / Project Site        | 4-axle truck       |
| Explosive                     | 43,500   | t   | Townsville / Project Site      | 4-axle truck       |
| Miscellaneous                 | 15,353   | t   | Townsville / Project Site      | 6-axle articulated |
| Fuel and Oil                  | 106,644  | kL  | Townsville / Project Site      | B-double Tanker    |
| Service Providers             | 1,825    | veh | Charters Towers / Project Site | 4-axle truck       |
| Outputs                       |          |     |                                |                    |
| General waste                 | 1,232    | t   | Project Site / Townsville      | 6-axle articulated |
| Hazardous and regulated waste | 62       | kL  | Project Site / Townsville      | B-double Tanker    |
| Waste oil, sludge and grease  | 5,658    | kL  | Project Site / Townsville      | B-double Tanker    |

Source: MacMines

## 3 Existing Road Network

### 3.1 Road Conditions

The characteristics of the key roads in proximity to the project site are summarised in Table 3-1. The location of these roads is detailed on Figure A1 in Appendix A.

**Table 3-1 Existing Road Network Characteristics**

| Road                       | Authority | Typical Form               | Stock Route | Multi-Combination Vehicle Allowances                     |
|----------------------------|-----------|----------------------------|-------------|----------------------------------------------------------|
| Flinders Highway           | TMR       | 2 lane sealed, undivided   | Partial     | B-triples, Type 1 and 2 Road trains, 23 & 25 m B-doubles |
| Gregory Developmental Road | TMR       | 2 lane sealed, undivided   | Partial     | B-triples, Type 1 and 2 Road trains, 23 & 25 m B-doubles |
| Peak Downs Highway         | TMR       | 2 lane sealed, undivided   | Partial     | B-triples, Type 1 Road trains, 23 & 25 m B-doubles       |
| Moray-Carmichael Road      | IRC/CTRC  | 2 lane unsealed, undivided | Partial     | B-triples, Type 1 and 2 Road trains, 23 & 25 m B-doubles |
| Elgin-Moray Road           | IRC       | 2 lane unsealed, undivided | Partial     | B-triples, Type 1 and 2 Road trains, 23 & 25 m B-doubles |

Source: Qld Government (2013)

### 3.2 Traffic Volumes

Table 3-2 summarises the daily and peak hour traffic volume data utilised to inform the analysis undertaken as part of the RIA assessment. The locations of the permanent traffic counter sites identified in Table 3-2 are graphically summarised on Figure 3-1.

**Table 3-2 Daily Traffic Volumes**

| Road                       | Count Site | Site Reference                                                       | Year | AADT (vpd) | Growth | Period (years) | Source           |
|----------------------------|------------|----------------------------------------------------------------------|------|------------|--------|----------------|------------------|
| Flinders Highway           | 91329      | 300m East of Rainbow Road                                            | 2012 | 2,932      | 3.70%  | 10             | TMR              |
| Gregory Developmental Road | 91701      | Weigh In Motion Site Leyshon                                         | 2012 | 763        | 5.91%  | 5              | TMR              |
|                            | 150016     | Gregory Developmental Road 70m North of Kilcummin-Diamond Downs Road | 2013 | 434        | 6.06%  | 10             |                  |
| Peak Downs Highway         | 150013     | Peak Downs Highway West of Wuthung Turnout                           | 2013 | 650        | 4.53%  | 10             | TMR              |
| Moray-Carmichael Road      | n/a        | n/a                                                                  | 2012 | 20         | -      | -              | Brown Consulting |

Table 3-3 details the peak hour survey data informing the RIA assessment. The data is also graphically summarised on Figure C1 in Appendix C.

**Table 3-3 Peak Hour Traffic Volumes**

| Intersection                                | Time      | Date        | Peak Hour       | Volume | Source     |
|---------------------------------------------|-----------|-------------|-----------------|--------|------------|
| Flinders Highway/Gregory Developmental Road | Morning   | 10 Oct 2013 | 7.00AM – 8.00AM | 174    | Austraffic |
|                                             | Afternoon | 10 Oct 2013 | 3.00PM – 4.00PM | 225    |            |

### 3.3 Crash History

Crash data has been sourced from TMR for the road network surrounding the project site for the following time periods and is classified by crash severity:

- > Fatal crashes: 1 January 2007 - 30 April 2014
- > Hospitalisation crashes: 1 January 2007 - 31 December 2013
- > Medical Treatment, and Minor Injury crashes: 1 January 2007 - 31 December 2011
- > Property Damage crashes: 1 January 2007 - 31 December 2010

The location and severity of the reported crashes is mapped on Figure A2 in Appendix A. The supplied data indicates that a total of 96 crashes were recorded during the time periods along Gregory Developmental Road. Importantly, the reported crash data did not include any crashes within proximity to the proposed project site access location on Moray-Carmichael Road or in the immediate proximity of the point of access to the State-controlled road network. A summary of the related crashes is presented in Table 3-4.

**Table 3-4 Crash Data Summary**

| Crash Severity    | Gregory Developmental Road - North of Elgin-Moray Road | Gregory Developmental Road - South of Elgin-Moray Road | Total |
|-------------------|--------------------------------------------------------|--------------------------------------------------------|-------|
| Fatal             | 4                                                      | 2                                                      | 6     |
| Hospitalisation   | 20                                                     | 17                                                     | 37    |
| Medical Treatment | 13                                                     | 3                                                      | 16    |
| Minor Injury      | 5                                                      | 8                                                      | 13    |
| Property Damage   | 14                                                     | 10                                                     | 24    |
| Total             | 56                                                     | 40                                                     | 96    |

Source: Qld Government (2014)

### 3.4 Public Transport

Table 3-5 details the long distance scheduled public bus routes currently operating in the vicinity of the project site. Services travelling through Charters Towers use the Flinders Highway. The services to/from Emerald travel along the Peak Downs Highway and the Gregory Highway, utilising the Gregory Developmental Road/Peak Downs Highway intersection. It is noted that no services utilise Gregory Developmental Road.

**Table 3-5 Long Distance Scheduled Bus Services**

| Bus Operator           | Frequency           | Route                                    |
|------------------------|---------------------|------------------------------------------|
| Mackay Transit Coaches | Once daily          | Emerald – Clermont - Mackay              |
| Mackay Transit Coaches | Once daily          | Mackay – Clermont - Emerald              |
| Douglas Coaches        | Once daily          | Charters Towers – Townsville             |
| Douglas Coaches        | Once daily          | Townsville – Charters Towers             |
| Greyhound Australia    | Once every two days | Mount Isa – Charters Towers – Townsville |
| Greyhound Australia    | Once every two days | Townsville – Charters Towers – Mount Isa |

Source: Mackay Transit Coaches, Douglas Coaches, Greyhound Australia

Table 3-6 summarises the school bus routes that currently operate along sections of the road network potentially utilised by project traffic.

**Table 3-6 School Bus Services**

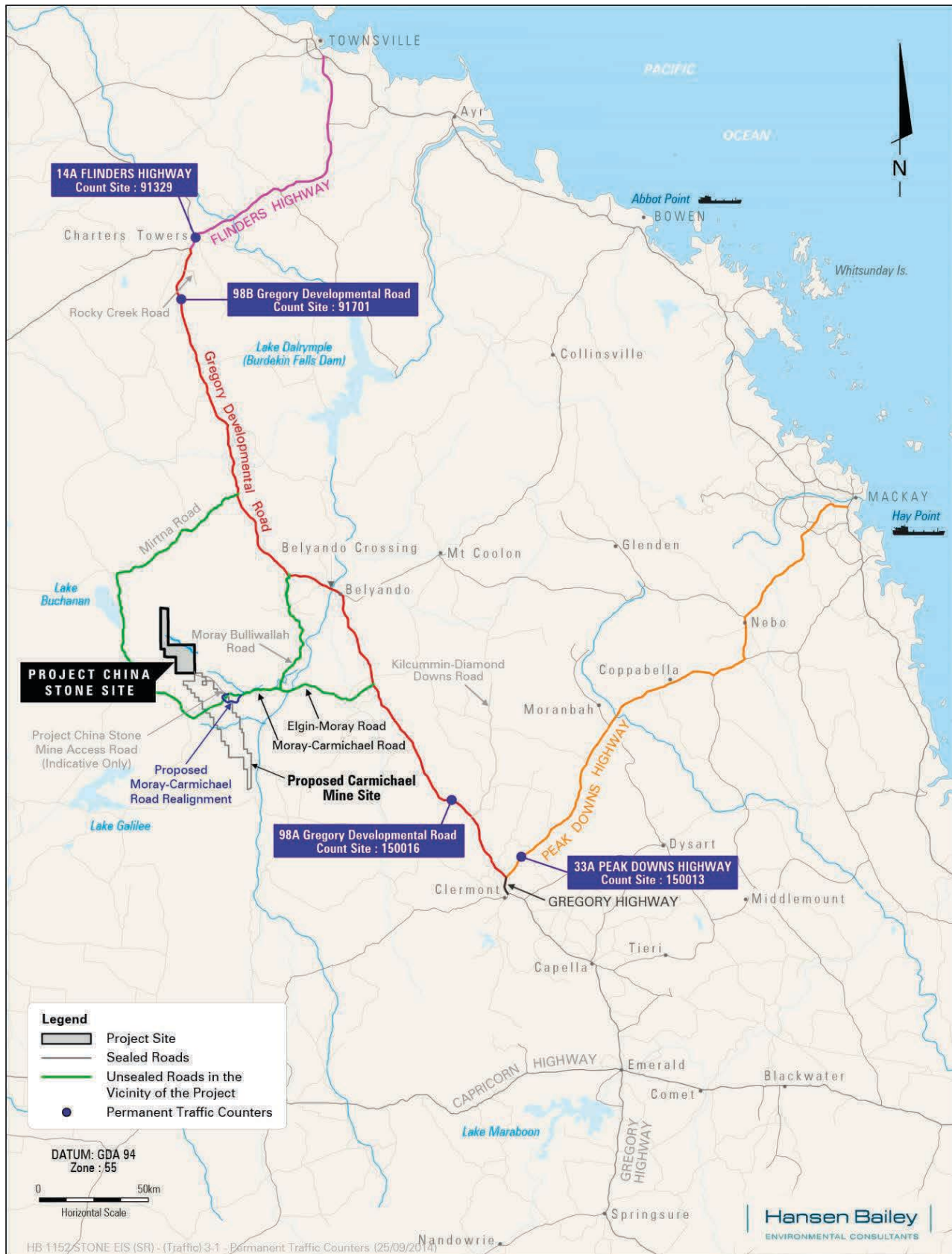
| Route                                                        | Schools                                                         | Roads Travelled                              |
|--------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------|
| Mingela to Richmond Hill State School (SS) (P308)            | Richmond Hill SS, Charters Towers SHS                           | Flinders Highway                             |
| Mt Leyshon to Charters Towers State High School (SHS) (S830) | Charters Towers SHS, Millchester SS, Charters Towers Central SS | Gregory Developmental Road, Rocky Creek Road |
| Kilcummin to Kilcummin SS (P1253)                            | Kilcummin SS                                                    | Kilcummin-Diamond Downs Road                 |
| Gemini Mountains to Clermont SS (P706)                       | Clermont SS, Clermont SHS, St Josephs                           | Peak Downs Highway, Gregory Highway          |

Source: Qld Government (2014)

The identified bus routes operate on the Flinders Highway, Peak Downs Highway and sections of Gregory Developmental Road.

As the public transport services typically operate outside the road network peak hours associated with the start and end of mine shifts, traffic associated with the project is not anticipated to significantly affect the safety or efficiency of these services. No further consideration of the interaction of project traffic and public transport has therefore been made.

Figure 3-1 Permanent Traffic Counters



## 4 Future Road Network Planning

### 4.1 Road Authority Network Planning

TMR's *Queensland Transport and Roads Investment Program 2014-2015 to 2017-2018* (QTRIP) has allocated approximately \$6.4 million to improvements along sections of the Flinders Highway and Peak Downs Highway that may be utilised by traffic associated with the project. These planned works are summarised in Table 4-1.

**Table 4-1 QTRIP Summary**

| Project Name                                             | Location Description        | Indicative Timing | Work Description                           |
|----------------------------------------------------------|-----------------------------|-------------------|--------------------------------------------|
| Flinders Highway<br>(14A: Townsville to Charters Towers) | Southern Port Road          | 2014-15           | Relocate hazardous objects close to road/s |
| Flinders Highway<br>(14A: Townsville to Charters Towers) | Section: 122.00 – 124.80 km | 2014-15           | Rehabilitate pavement                      |
| Flinders Highway<br>(14B: Charters Towers to Hughenden)  | Section: 0 – 139.40 km      | 2014-15           | Relocate hazardous objects close to road/s |
| Peak Downs Highway<br>(33A: Clermont to Nebo)            | Section: 96.00 – 151.00 km  | 2014-15           | Undertake transport project planning       |

Source: TMR (2014)

Table 4-1 identifies that only planning, pavement and safety works are planned to be undertaken on the road network utilised by project traffic. As these works are unlikely to add operational capacity to the road network these improvements have not been specifically considered when assessing the potential impact of project traffic. This approach is considered conservative as the project's impacts have been identified in the absence of these planned network improvements.

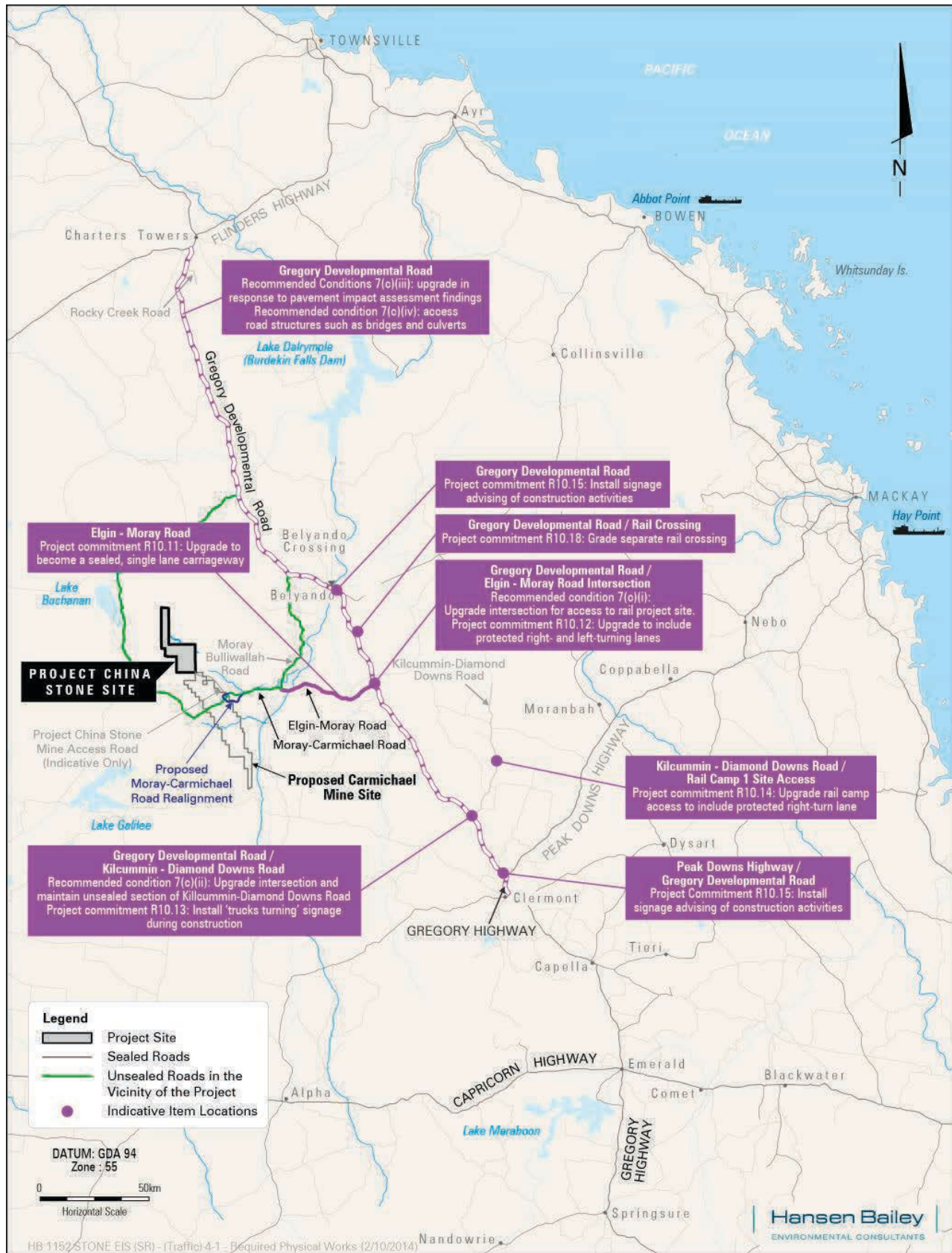
### 4.2 Carmichael Coal Mine and Rail Project Road Network Improvements

The Carmichael Coal Mine and Rail Project (CCM&RP) involves the construction of a 60 Mtpa open-cut and underground greenfield coal mine and a 189 km greenfield rail line connection to the existing Goonyella and Newlands rail system south of Moranbah. The proposed Carmichael Coal Mine adjoins the Project China Stone site to the south. The primary public road access to the proposed Carmichael Coal Mine will be similar to Project China Stone (i.e. via the Gregory Developmental Road, Elgin-Moray Road and Moray-Carmichael Road (Figure A1 in Appendix A)).

The CCM&RP received an EIS Evaluation Report from the Queensland Coordinator-General in May 2014 and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in July 2014. The development of the CCM&RP is therefore likely to precede the development of Project China Stone, as the regulatory approvals for the CCM&RP are at a more advanced stage. This RIA therefore includes assessment of the potential cumulative traffic impacts of the two projects, where relevant, by accounting for the CCM&RP traffic estimates provided in the CCM&RP Additional information to the EIS (AEIS) traffic report.

The CCM&RP EIS Evaluation Report includes recommended approval conditions and commitments from Adani Mining Pty Ltd related to improvements to the road network that will be utilised by traffic associated with Project China Stone as detailed on Figure 4-1. Therefore, when undertaking the RIA for Project China Stone the network improvements associated with the CCM&RP have been taken into account.

Figure 4-1 Carmichael Coal Mine and Rail Project: Required Physical Road Works



### 4.3 Moray Power Project Road Network Improvements

The Moray Power Project involves the construction and operation of a new thermal and diesel power station with a combined generating capacity of 150 Megawatts (MW) gross. TTM Consulting Pty Ltd (TTM) assessed the potential traffic generation and impact of the Moray Power Project on the safety and efficiency of the road network. TTM's assessment is detailed within the report titled *Moray Power Project Traffic Impact Assessment Report* dated 12 November 2014.

The report identified that the Moray Power Project would not require the provision of any developer contributions or road infrastructure beyond the internal access roads directly servicing the project. Therefore whilst the Moray Power Project traffic assessment was prepared and issued after finalisation of the analysis presented herein, the form of the road network assessed herein remains valid as no additional road infrastructure is planned to be delivered as part of the Moray Power Project.

## 5 Assessment Requirements and Thresholds

### 5.1 Spatial Extent of Road Performance Assessment

A road network performance assessment was undertaken to determine the impact of the project generated traffic demands on the performance and safety of the road network. The intent of the assessment was to identify the locations at which traffic associated with the project has the potential to significantly impact the safety or efficiency of the road network and where required, inform mitigation measures.

TMR's *Guidelines for the Assessment of Road Impacts of Development (2006)* states that traffic impacts need to be considered at all accesses to the State-controlled road network. In addition, TMR's guideline stipulates that all State-controlled intersections and links where project traffic demands exceed 5% of existing traffic demands should also be assessed.

The significance of the project's potential traffic volume impacts has therefore been considered for the following intersections and links:

Intersections (refer to Section 7 for detailed assessment)

- > Flinders Highway/Gregory Developmental Road intersection
- > Gregory Developmental Road/Elgin-Moray Road intersection (point of access to State-controlled road network)
- > Proposed Moray-Carmichael Road/Project China Stone Mine Access Road intersection

Links (refer to Section 8 for detailed assessment)

- > 14A Flinders Highway (Charters Towers to Gregory Developmental Road)
- > 98B Gregory Developmental Road (Flinders Highway to Elgin-Moray Road)
- > 98A Gregory Developmental Road (Elgin-Moray Road to Peak Downs Highway)
- > 27C Gregory Highway (Peak Downs Highway to Clermont)
- > 33A Peak Downs Highway (Clermont to Moranbah)

Pavement impacts are scoped and addressed separately in Section 9.

### 5.2 Intersection Thresholds

#### 5.2.1 Performance Criteria

The performance of each study intersection was analysed using SIDRA Intersection 6 (SIDRA). SIDRA is an industry recognised analysis tool that estimates the capacity and performance of intersections based on input parameters, including geometry and traffic volumes, and provides estimates of an intersection's Degree of Saturation (DOS), queues and delays. Simplistically, DOS is a measure of the proportion of traffic entering an intersection relative to the intersection's capacity.

Table 5-1 provides TMR's defined DOS intervention thresholds for intersections.

**Table 5-1 TMR Intervention Thresholds for Intersection Performance**

| Level of Service Description      | DOS Threshold              |
|-----------------------------------|----------------------------|
| Signalised intersections          | less than or equal to 0.90 |
| Roundabouts                       | less than or equal to 0.85 |
| Priority controlled intersections | less than or equal to 0.80 |

Source: TMR *Guidelines for Assessment of Road Impacts of Development (2006)*

The guideline notes that a DOS exceeding the values indicated in Table 5-1 indicates that an intersection is nearing its practical capacity and upgrade works may be required. Above these threshold values, users of the intersection are likely to experience rapidly increasing delays and queuing.

Importantly, it is noted that DOS is not the only performance indicator and that other measures such as critical delay should also be considered when assessing the performance of an intersection. Other authorities

such as the New South Wales Roads and Maritime Services (RMS) recommend the use of the critical movement delay for assessing the performance of priority-controlled intersections.

The RMS *Guide to Traffic Generating Developments (2002)* states that the average delay statistic for the critical movement provides a better indication of intersection performance and safety for priority-controlled intersections than DOS. A summary of the delay thresholds recommended by the RMS is provided in Table 5-2. Although these thresholds are not documented within Queensland guidelines, they are still considered to provide another informative performance indicator and were therefore also considered for this RIA.

**Table 5-2 RMS Level of Service Criteria for Priority Controlled Intersections**

| LOS | Level of Service Description             | Critical Delay per Vehicle (sec/veh) |
|-----|------------------------------------------|--------------------------------------|
| A   | Good operation                           | less than 14 sec                     |
| B   | Acceptable delays and spare capacity     | 15 to 28 sec                         |
| C   | Satisfactory                             | 29 to 42 sec                         |
| D   | Near capacity                            | 43 to 56 sec                         |
| E   | At capacity, requires other control mode | 57 to 70 sec                         |

Source: RMS *Guide to Traffic Generating Developments (2002)*

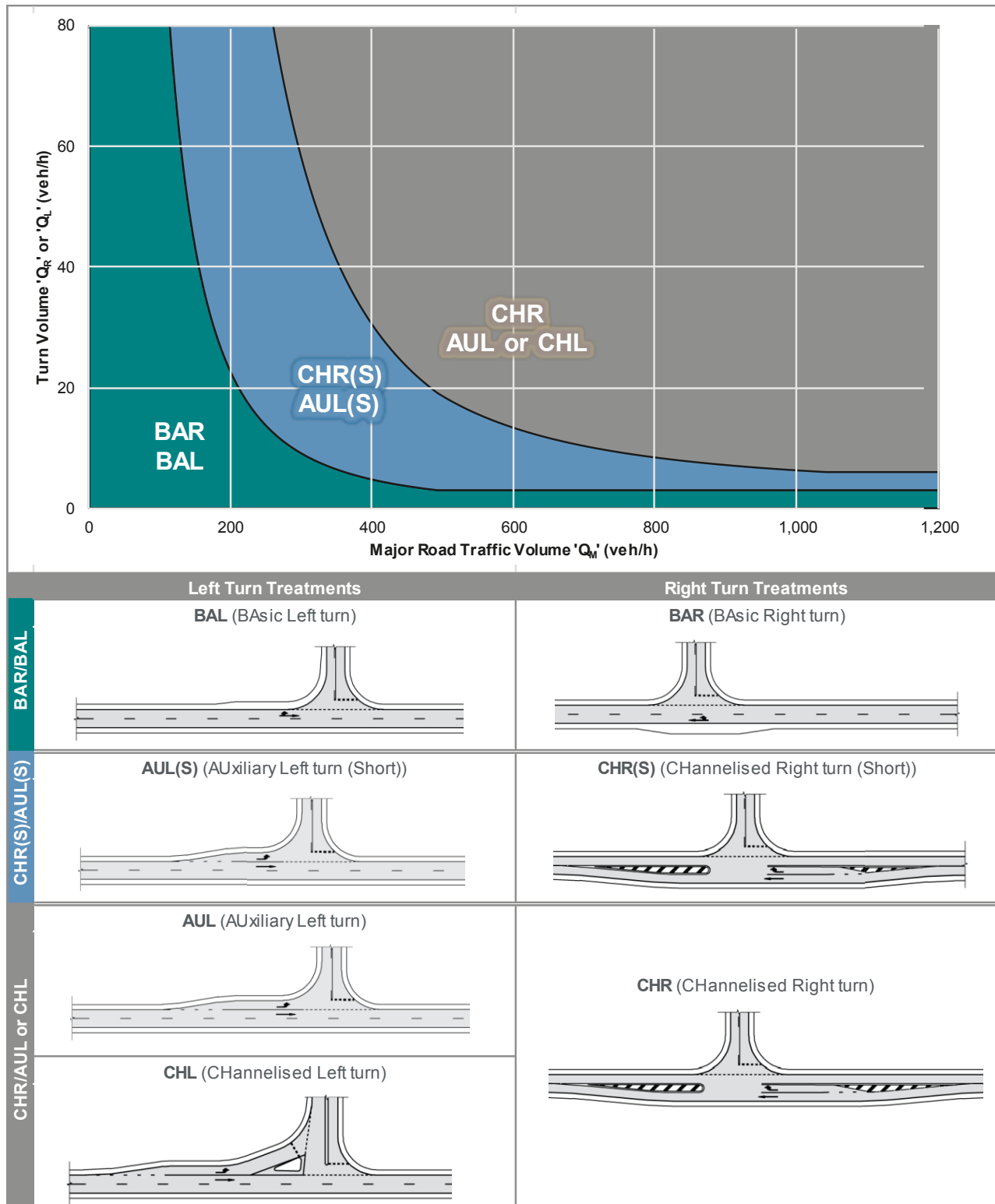
### 5.2.2 Safety Criteria

While the DOS and critical delay statistic provide an indication of the operational performance of an intersection, the Austroads warrants for turn treatments provide an indication of which turn treatments will likely provide an appropriate level of safety.

The warrants provide guidance where deceleration lanes and turning lanes should be used based on traffic volumes. The warrants were developed by Arndt, Troutbeck, Handley and Slattery (2006) and were produced by identifying the location at which the benefits of providing a higher-level treatment (i.e. the reduction in estimated crash costs) are equal to the additional construction costs associated with the treatment. The benefits and costs of a higher-level treatment were compared to the base case (minimum turn treatments) to develop the curves demonstrated on Figure 5-1.

Figure 5-1 reproduces the warrants for turn treatments for rural roads with speeds greater than or equal to 100 km/h. For the purposes of the RIA, the curve developed for high speed environments has been utilised for all intersection assessments to ensure that the safety of all study intersections has been assessed against the most conservative intervention curve. The adopted approach ensures that irrespective of any speed limit changes that may ultimately be implemented the assessed intersections will continue to provide an appropriate level of safety.

Figure 5-1 Warrants for Turn Treatments for Design Speed Greater Than or Equal to 100 km/h



Source: Austroads (2010)

### 5.3 Link Thresholds

Link Level of Service (LOS) relates to the operating conditions encountered by traffic. It is a qualitative measure of such factors as speed, trip time, interruptions, interference, freedom to overtake, ability to manoeuvre, safety, comfort, convenience and vehicle operating costs. TMR's definitions of LOS for uninterrupted flow are defined in terms of traffic flow as detailed in Table 5-3 in addition to indicative photographs.

The performance of the assessed links were analysed including and excluding project traffic using the link LOS methodology detailed in Austroad's *Guide to Traffic Engineering Practice Part 2 Roadway Capacity*. Table 5-4 identifies the level of service thresholds specified for varying K factors which represents the ratio of the design hour volume to the annual average daily traffic.

**Table 5-3 Level of Service Definitions**

| LOS | Level of Service Description                                                                                                      |                                                                                     | LOS | Level of Service Description                                                                                                                |                                                                                       |
|-----|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| A   | Free flow conditions where drivers are unaffected by the presence of others in the traffic stream                                 |    | D   | Close to the limit of stable flow and is approaching unstable flow. Drivers are severely restricted to select their speed and to manoeuvre. |    |
| B   | Stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. |   | E   | Traffic volumes are at or close to capacity and there is virtually no freedom to select desired speeds or to manoeuvre.                     |   |
| C   | Stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre.      |  | F   | Forced flow. Traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs.                       |  |

Source: TMR's Road Planning and Design Manual (2004)

**Table 5-4 Maximum AADT Thresholds for Level Terrain on Two-Lane Two-Way Rural Roads**

| K factor | Level of Service |       |       |        |        |
|----------|------------------|-------|-------|--------|--------|
|          | A                | B     | C     | D      | E      |
| 0.10     | 2,400            | 4,800 | 7,900 | 13,500 | 22,900 |
| 0.11     | 2,200            | 4,400 | 7,200 | 12,200 | 20,800 |
| 0.12     | 2,000            | 4,000 | 6,600 | 11,200 | 19,000 |
| 0.13     | 1,900            | 3,700 | 6,100 | 10,400 | 17,600 |
| 0.14     | 1,700            | 3,400 | 5,700 | 9,600  | 16,300 |
| 0.15     | 1,600            | 3,200 | 5,300 | 9,000  | 15,200 |

Source: Austroads (1988)

## 6 Assessment Traffic Volumes

### 6.1 Assessment Scenarios

The performance of the road network has been considered for the following design years consistent with standard industry practice:

- > 2016 – peak year of the project's construction phase
- > 2018 – first year of the project's operations phase
- > 2028 – ten-year design horizon following commencement of the project's operations phase.

For each of the assessment years documented above the operation of the road network has been considered for two baseline growth scenarios as documented in Section 6.2.

### 6.2 Future Baseline Traffic Volumes

For the purposes of the RIA two baseline traffic growth scenarios (i.e. in the absence of project traffic) have been considered. This includes a scenario in which the adjacent CCM&RP does not proceed and a growth scenario in which the CCM&RP does proceed. This approach has been adopted as the commencement of the CCM&RP has the potential to result in significant increases in traffic volumes in proximity to the project site. The adopted approach ensures that the RIA presents a comprehensive assessment of the potential future operation of the road network.

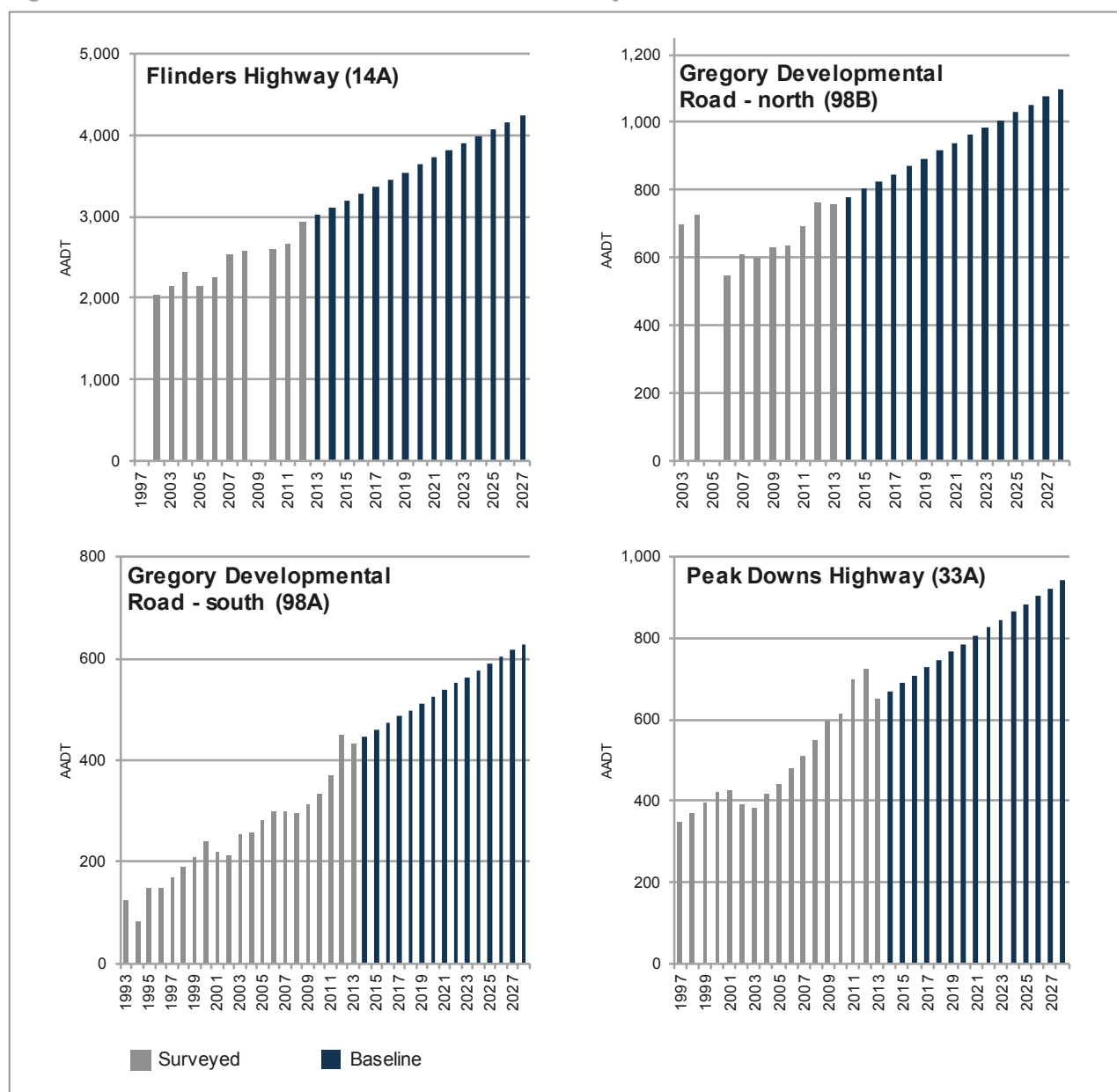
#### 6.2.1 Without Carmichael Coal Mine and Rail Project Growth Scenario

The 'Without CCM&RP' growth scenario assumes a comparable level of traffic demand increase will continue to occur for the foreseeable future to that which has historically occurred. As an example, if traffic demands on a road segment have increased by an average of 20 vehicles per year for the past decade then this adopted approach would assume that the road segment will continue to experience an annual increase of 20 vehicles per year for the foreseeable future. To generally achieve comparable annual traffic volume increases across the extents of the assessed road network a 3% per annum linear global growth rate has been adopted.

The adopted approach is considered conservative (i.e. results in high baseline traffic volume forecasts) as the traffic volumes on the broader road network have been significantly influenced by the mining investment boom over the past decade. It is generally expected that these high historic levels of growth are actually unlikely to be sustained over the longer term. The adopted forecasting approach therefore provides road authorities confidence that a worst-case (i.e. high growth) scenario has been assessed.

Figure 6-1 graphically summarises the profile of future baseline traffic volumes without the CCM&RP. Baseline peak hour traffic volumes at the three assessed design years (as detailed in Section 6.1) are presented on Figures C2 to C4 in Appendix C.

Figure 6-1 Without Carmichael Coal Mine and Rail Project - Growth Scenario



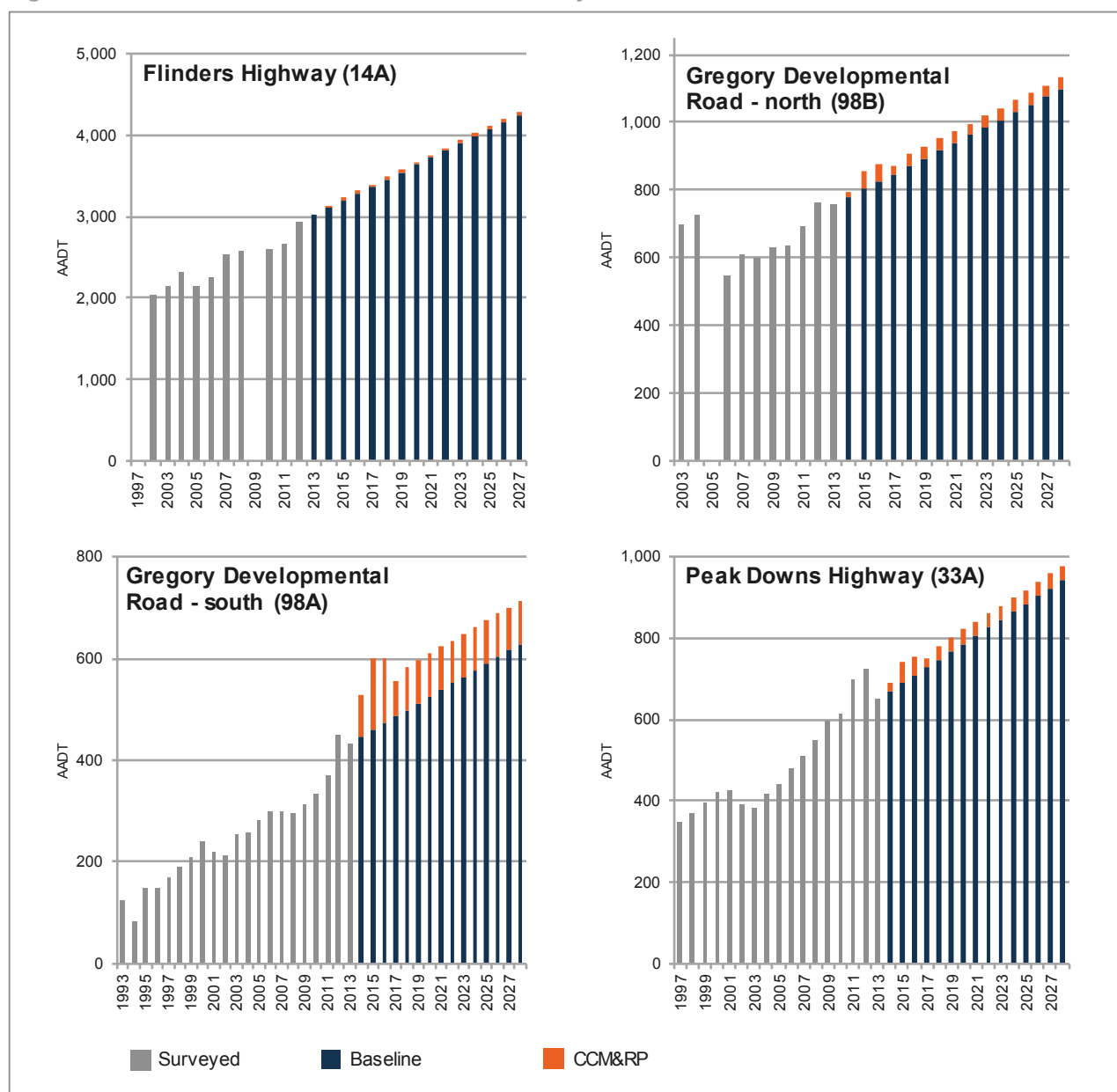
### 6.2.2 With Carmichael Coal Mine and Rail Project Growth Scenario

The 'With CCM&RP' growth scenario assumes that:

- > Existing traffic demands increase at 3% per annum generally consistent with the absolute level of traffic growth experienced over the past decade plus;
- > The traffic volumes reported in the *Carmichael Coal Mine and Rail Project Road Impact Assessment* prepared by Brown Consulting issued on February 2014 are also present on the road network.

Figure 6-2 graphically summarises the resultant profile of future baseline traffic volumes under the 'With CCM&RP' growth scenario. Baseline peak hour traffic volumes at the three assessed design years (as detailed in Section 6.1) are presented on Figures C5 to C7 in Appendix C.

Figure 6-2 With Carmichael Coal Mine and Rail Project - Growth Scenario



### 6.3 Influence of Moray Power Project on Assessed Traffic Volumes

Consistent with standard practice the assessment presented herein includes specific allowance for traffic growth associated with projects that were known at the time of undertaking the analysis and also a generic growth allowance for traffic associated with projects that were unknown at the time of undertaking the analysis.

That is, at the time of undertaking the analysis specific details were known about the likely traffic generating characteristics of the CCM&RP and therefore specific allowance was made for this traffic. An additional global allowance of 3% growth per annum was also made to capture growth potentially associated with other projects that may ultimately eventuate within the design horizon but that were unknown at the time of undertaking the analysis. This allowance was specifically intended to allow for projects such as the Moray Power Project which were unknown at the time of undertaking the analysis.

As part of the June 2015 review Cardno has sought to confirm if the global growth adopted includes an appropriate allowance for the traffic growth that is likely to be generated by the Moray Power Project. Table 6-1 identifies the traffic volumes forecast by TTM as being generated by the Moray Power Project.

**Table 6-1 Moray Power Project – Forecast Daily Traffic Volumes**

| Road                                                               | 2016            |             | 2018            |             | 2028            |             |
|--------------------------------------------------------------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|
|                                                                    | Project Traffic | Increase    | Project Traffic | Increase    | Project Traffic | Increase    |
| Gregory Developmental Road – North of Moray-Carmichael Road (TC02) | 20              | +3.4%       | 10              | +1.7%       | 12              | +2.0%       |
| Gregory Developmental Road – South of Moray-Carmichael Road (TC03) | 6               | +1.1%       | 4               | +0.7%       | 4               | +0.7%       |
| Peak Downs Highway (TC04)                                          | 6               | +0.8% (max) | 4               | +0.5% (max) | 4               | +0.5% (max) |

Source: Moray Power Project: Traffic Impact Assessment Report (2014)

Table 6-1 identifies that for the State-controlled road network, the Moray Power Project will result in a once off worst case increase of 3.4% during 2016 for the Gregory Developmental Road north of Moray Carmichael Road. Other sections of the State-controlled road network are likely to experience a once off increase ranging between 1.1% and 0.5%. The once off increase is low compared to the 45% increase that has been assumed will occur as part of the assessment over the design horizon between the intersection survey year and 2028.

The recent review has confirmed that the adopted global growth includes allowance for the establishment of numerous currently unknown projects with a similar traffic generating potential to the Moray Power Project over the assessed design horizon. Therefore whilst the Moray Power Project traffic assessment was prepared and issued after finalisation of the analysis presented herein, the global growth adopted is considered to remain representative.

Table 6-2 details the traffic growth that has been recently experienced on both the Flinders Highway and the Gregory Developmental Road for which data has become available since preparation of the analysis presented herein.

**Table 6-2 Recent Traffic Growth Trends**

| Road                             | Count Site | Site Reference               | AADT  |       | Growth | Source |
|----------------------------------|------------|------------------------------|-------|-------|--------|--------|
|                                  |            |                              | 2013  | 2014  |        |        |
| Flinders Highway (14A)           | 91329      | 300m East of Rainbow Road    | 2,932 | 2,732 | -6.8%  | TMR    |
| Gregory Developmental Road (98B) | 91701      | Weigh In Motion Site Leyshon | 757   | 673   | -11.1% | TMR    |

Table 6-2 identifies that since 2013, being the year in which the intersection surveys occurred, reported traffic volumes on both the Gregory Developmental Road and Flinders Highway have actually significantly declined by between 6.8% and 11.1%, respectively. Thus the assumption that traffic will continue to grow at 3% per annum is considered to be very conservative (i.e. result in a worst case estimate) even when considered in the context of the recently issued traffic impact assessment for the Moray Power Project.

In summary, allowance has been made for the cumulative impact of projects that were unknown at the time of undertaking the analysis but which may eventuate over the assessment horizon such as the Moray Power Project. Interrogation of the traffic assessment supporting the Moray Power Project indicates that the global growth allowance adopted remains conservative (i.e. likely worst case scenario). This assertion is further supported by the recent decline rather than growth observed on both the Flinders Highway and Gregory Developmental Road.

## 6.4 Project Traffic Generation

The peak hour traffic demands generated during the project's construction and operations phases have been forecast based upon the workforce information detailed in Table 2-1 and the material information presented in Table 2-2 and Table 2-3. The following assumptions were made:

- > All travel associated with the start and end of rosters has been assumed to occur during the road network morning and afternoon peak hours. This assumption is highly conservative as it is likely that start and end of roster movements will actually occur outside the road network peak hours.
- > All material movements have been assumed to occur during the road network morning and afternoon peak hours. This assumption is also highly conservative as typically the majority of material movements occur outside peak hour periods.
- > Five service provider movements are assumed to occur during the road network morning and afternoon peak hours. This allowance significantly overstates the actual number of movements likely to occur during the road peak hours.

These assumptions are likely to overestimate the potential traffic demands generated by the project, therefore adding a level of conservatism to the assessment by providing confidence that a worst case scenario has been assessed.

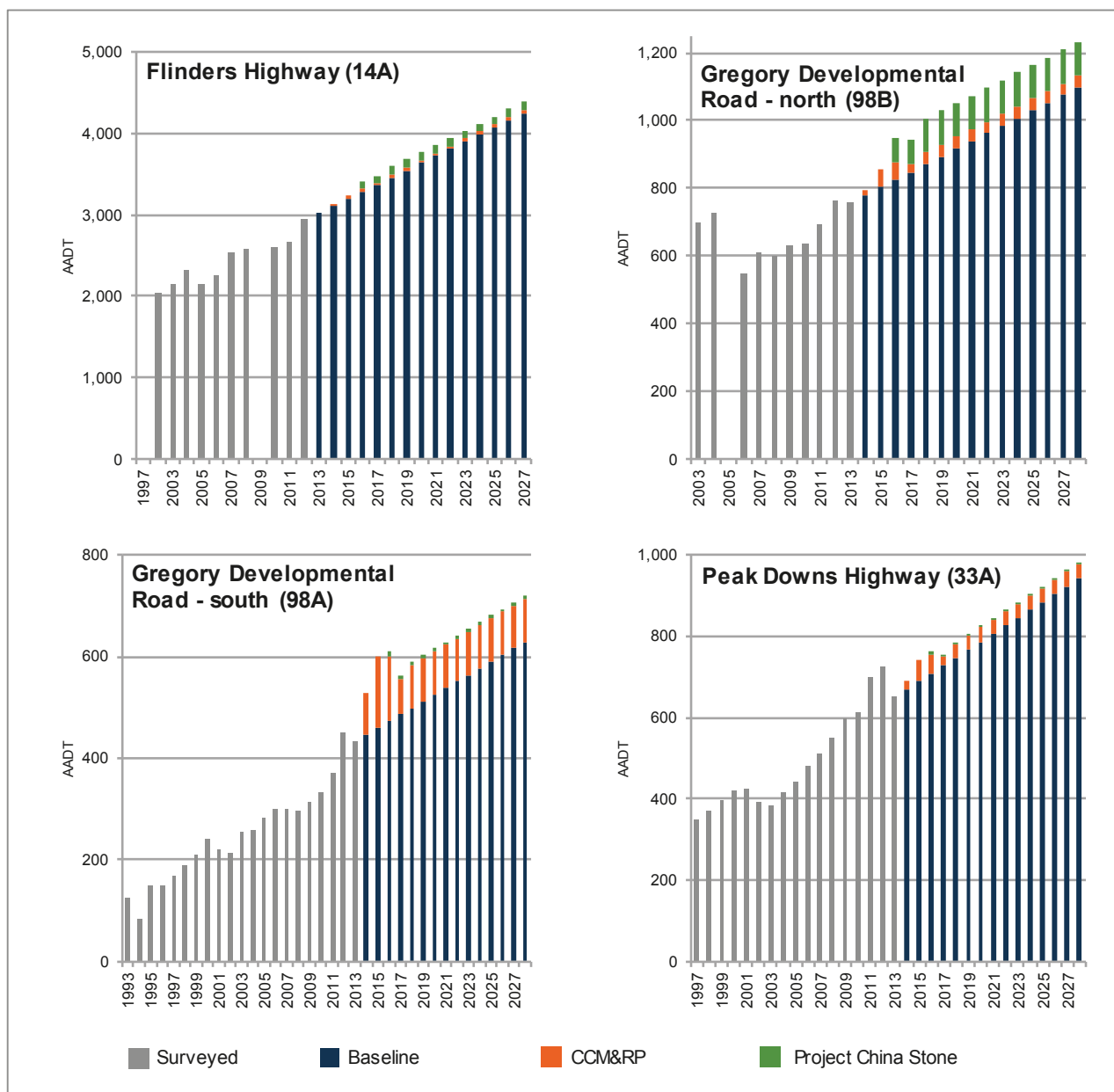
Table 6-3 identifies the daily traffic demands expected to be generated by the project during the construction and operation phase.

**Table 6-3 Project China Stone – Assessed Daily Traffic Demands**

| Road                                     | Construction Phase | Operation Phase |
|------------------------------------------|--------------------|-----------------|
| Flinders Highway (14A)                   | 73                 | 100             |
| Gregory Developmental Road – North (98B) | 73                 | 100             |
| Gregory Developmental Road – South (98A) | 8                  | 6               |
| Peak Downs Highway                       | 5                  | 2               |

Figure 6-3 graphically summarises the resultant profile of future baseline traffic volumes. Figures C8 and C9 in Appendix C detail the assessed peak hour traffic generation during the project's construction and operations phase respectively. Figures C10 to C15 detail the assessed design horizon traffic demands.

Figure 6-3 Project China Stone Assessed Traffic Volumes



## 7 Intersection Assessment

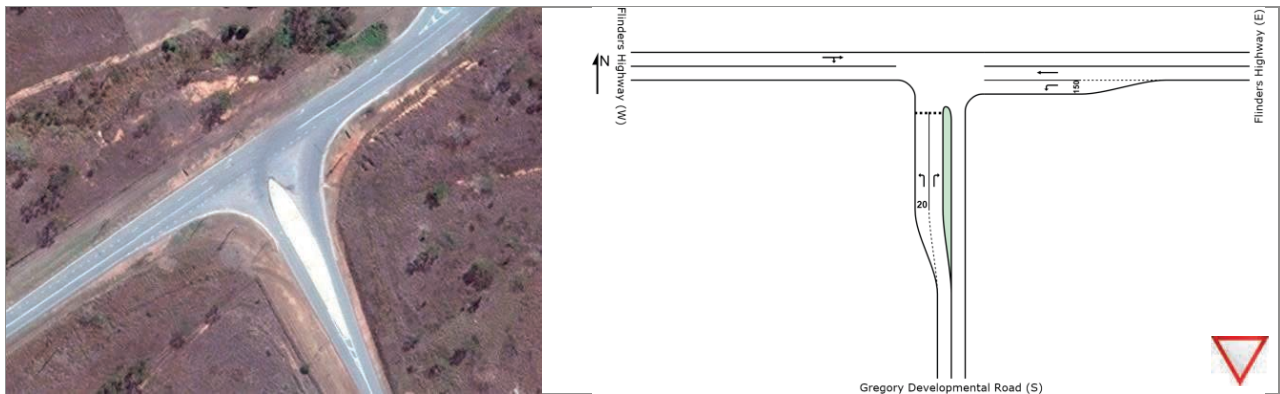
### 7.1 Flinders Highway/Gregory Developmental Road Intersection

#### 7.1.1 Intersection Form

The existing priority-controlled Flinders Highway/Gregory Developmental Road intersection incorporates an AUR right turn treatment on the western Flinders Highway approach and an AUL left turn treatment on the eastern Flinders Highway approach. It is understood that there are no works planned by road authorities or conditioned on other development proponents to be delivered at the intersection and therefore the likely future operation and safety of the existing intersection form has been considered.

Figure 7-1 illustrates the existing and assessed form of the Flinders Highway/Gregory Developmental Road intersection. It is noted that the intersection has conservatively been modelled without the existing turn lane provision on the western approach to ensure a worst-case performance assessment is presented.

**Figure 7-1 Flinders Highway/Gregory Developmental Road Intersection – Assessed Form**



#### 7.1.2 Performance Assessment

Table 7-1 summarises the SIDRA results for the existing priority-controlled Flinders Highway/Gregory Developmental Road intersection.

**Table 7-1 SIDRA Table – Flinders Highway/Gregory Developmental Road Intersection**

| Scenario               | Morning Peak |                |                            | Afternoon Peak |                |                            | Accept-able |
|------------------------|--------------|----------------|----------------------------|----------------|----------------|----------------------------|-------------|
|                        | DOS          | Critical Delay | 95 <sup>th</sup> ile Queue | DOS            | Critical Delay | 95 <sup>th</sup> ile Queue |             |
| Without CCM&RP         |              |                |                            |                |                |                            |             |
| 2016 Baseline          | 0.05         | 8 sec          | 2 m                        | 0.05           | 8 sec          | 2 m                        | ✓           |
| 2016 with Construction | 0.07         | 8 sec          | 2 m                        | 0.07           | 8 sec          | 2 m                        | ✓           |
| 2018 Baseline          | 0.05         | 8 sec          | 2 m                        | 0.05           | 8 sec          | 2 m                        | ✓           |
| 2018 with Operations   | 0.08         | 8 sec          | 2 m                        | 0.08           | 8 sec          | 2 m                        | ✓           |
| 2028 Baseline          | 0.07         | 8 sec          | 2 m                        | 0.07           | 8 sec          | 3 m                        | ✓           |
| 2028 with Operations   | 0.09         | 8 sec          | 3 m                        | 0.09           | 8 sec          | 3 m                        | ✓           |
| With CCM&RP            |              |                |                            |                |                |                            |             |
| 2016 Baseline          | 0.05         | 8 sec          | 2 m                        | 0.05           | 8 sec          | 2 m                        | ✓           |
| 2016 with Construction | 0.07         | 8 sec          | 2 m                        | 0.07           | 8 sec          | 2 m                        | ✓           |
| 2018 Baseline          | 0.05         | 8 sec          | 2 m                        | 0.05           | 8 sec          | 2 m                        | ✓           |
| 2018 with Operations   | 0.08         | 8 sec          | 2 m                        | 0.08           | 8 sec          | 2 m                        | ✓           |
| 2028 Baseline          | 0.07         | 8 sec          | 2 m                        | 0.07           | 8 sec          | 3 m                        | ✓           |
| 2028 with Operations   | 0.10         | 8 sec          | 3 m                        | 0.10           | 8 sec          | 3 m                        | ✓           |

The results presented in Table 7-1 identify that the existing intersection form will operate well within the typically accepted performance thresholds irrespective of the presence of project generated traffic demands (i.e. DOS of less than 0.80 and critical delay of less than 57 seconds). No mitigation works are therefore warranted based upon intersection performance considerations.

### 7.1.3 Safety Assessment

The turn warrants assessment presented on Figures D1 to D3 in Appendix D identifies that a BAR right turn treatment and a BAL left turn treatment would provide an appropriate level of safety. The existing turn treatments exceed these requirements. The existing form of the Flinders Highway/Gregory Developmental Road is therefore appropriate based upon intersection safety considerations.

### 7.1.4 Conclusions

The operational and safety assessment has established that the existing form of the Flinders Highway/Gregory Developmental Road intersection will continue to meet industry standard performance thresholds and will continue to provide an appropriate level of safety irrespective of the presence of project traffic demands. No mitigation works are therefore required at the proposed location to accommodate the traffic demands associated with the project. As a reality check this finding is generally consistent with the finding of the CCM&RP traffic assessment that identified that the subject intersection had sufficient spare capacity to readily accommodate increased traffic demands.

## 7.2 Gregory Developmental Road/Elgin-Moray Road Intersection

### 7.2.1 Intersection Form

The existing priority-controlled Gregory Developmental Road/Elgin-Moray Road intersection incorporates a simple right turn treatment on the northern Gregory Developmental Road approach and a simple left turn treatment on the southern Gregory Developmental Road approach.

It is understood that the existing intersection form will be required to be upgraded to include protected right turn and left turn lanes as part of the CCM&RP. For the purposes of the RIA the operation of the intersection has however been modelled in the absence of these works to ensure a worst-case assessment is presented.

Figure 7-2 illustrates the existing and assessed form of the Gregory Developmental Road/Elgin-Moray Road intersection.

**Figure 7-2 Gregory Developmental Road/Elgin-Moray Road – Assessed Form**



### 7.2.2 Performance Assessment

Table 7-2 summarises the SIDRA results for the assessed priority-controlled Gregory Developmental Road/Elgin-Moray Road intersection form.

**Table 7-2 SIDRA Table – Gregory Developmental Road/Elgin-Moray Road Intersection**

| Scenario               | Morning Peak |                |                            | Afternoon Peak |                |                            | Accept-able |
|------------------------|--------------|----------------|----------------------------|----------------|----------------|----------------------------|-------------|
|                        | DOS          | Critical Delay | 95 <sup>th</sup> ile Queue | DOS            | Critical Delay | 95 <sup>th</sup> ile Queue |             |
| Without CCM&RP         |              |                |                            |                |                |                            |             |
| 2016 Baseline          | 0.02         | 8 sec          | 1 m                        | 0.02           | 8 sec          | 1 m                        | ✓           |
| 2016 with Construction | 0.03         | 8 sec          | 1 m                        | 0.03           | 8 sec          | 1 m                        | ✓           |
| 2018 Baseline          | 0.02         | 8 sec          | 1 m                        | 0.02           | 8 sec          | 1 m                        | ✓           |
| 2018 with Operations   | 0.03         | 8 sec          | 1 m                        | 0.03           | 8 sec          | 1 m                        | ✓           |
| 2028 Baseline          | 0.02         | 8 sec          | 1 m                        | 0.02           | 8 sec          | 1 m                        | ✓           |
| 2028 with Operations   | 0.03         | 8 sec          | 1 m                        | 0.03           | 8 sec          | 1 m                        | ✓           |
| With CCCM&RP           |              |                |                            |                |                |                            |             |
| 2016 Baseline          | 0.04         | 8 sec          | 1 m                        | 0.04           | 8 sec          | 1 m                        | ✓           |
| 2016 with Construction | 0.05         | 8 sec          | 1 m                        | 0.05           | 8 sec          | 1 m                        | ✓           |
| 2018 Baseline          | 0.03         | 8 sec          | 1 m                        | 0.03           | 8 sec          | 1 m                        | ✓           |
| 2018 with Operations   | 0.03         | 8 sec          | 1 m                        | 0.03           | 8 sec          | 1 m                        | ✓           |
| 2028 with Operations   | 0.03         | 8 sec          | 1 m                        | 0.03           | 8 sec          | 1 m                        | ✓           |
| 2028 with Operations   | 0.04         | 8 sec          | 2 m                        | 0.04           | 8 sec          | 2 m                        | ✓           |

The results presented in Table 7-2 identify that the existing intersection form will operate well within the typically accepted performance thresholds irrespective of the presence of project generated traffic demands (i.e. DOS of less than 0.80 and critical delay of less than 57 seconds). No mitigation works are therefore warranted based upon intersection performance considerations.

### 7.2.3 Safety Assessment

The turn warrants assessment presented on Figures D4 to D6 in Appendix D identifies that a BAR right turn treatment and a BAL left turn treatment would provide an appropriate level of safety at the subject intersection. The existing simple turn treatments do not meet these requirements.

While the generic analysis has identified that the provision of basic turn treatments would provide an appropriate level of safety it is instead recommended that a CHR(s) right turn treatment be provided on the northern Gregory Developmental Road approach to mitigate the impact of project traffic demands. This engineering judgement is based upon consideration of the location of the intersection in an isolated high speed rural road environment, the vehicle mix likely to utilise the intersection and also consistency with standard industry practice.

It is noted that upgrade of the intersection to include protected turn lane treatments is required as part of the development of the CCM&RP.

### 7.2.4 Conclusions

The operational assessment has established that the existing form of the Gregory Developmental Road/Elgin-Moray Road intersection will continue to meet industry standard performance thresholds irrespective of the presence of project traffic demands.

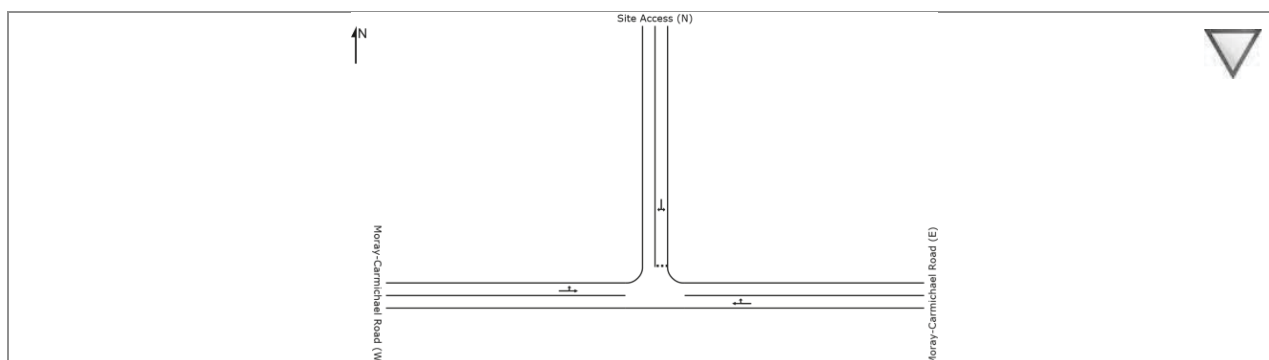
The safety assessment has however established that improved turn treatments should be provided at the intersection to safely accommodate future traffic volumes. It is noted that upgrade of the intersection to include protected turn lane treatments is required as part of the development of the CCM&RP.

## 7.3 Moray-Carmichael Road/Project China Stone Mine Access Road Intersection

### 7.3.1 Intersection Form

The existing priority-controlled Moray-Carmichael Road/Project China Stone Mine Access Road intersection is an informal access intersection. While the existing exploration access intersection may ultimately be relocated to support the project a generic T-intersection form (Figure 7-3) has been considered for the purposes of the RIA. Should an alternative access intersection ultimately be established then the findings of the following operational and safety assessments in relation to an appropriate form for the access intersection would nevertheless remain valid.

**Figure 7-3 Moray-Carmichael Road/Project China Stone Mine Access Road Intersection – Assessed Form**



### 7.3.2 Performance Assessment

Table 7-3 summarises the SIDRA results for the assessed priority-controlled Moray-Carmichael Road/Project China Stone Mine Access Road intersection.

**Table 7-3 SIDRA Table – Moray-Carmichael Road/Project China Stone Mine Access Road**

| Scenario               | Morning Peak |                |                            | Afternoon Peak |                |                            | Acceptable |
|------------------------|--------------|----------------|----------------------------|----------------|----------------|----------------------------|------------|
|                        | DOS          | Critical Delay | 95 <sup>th</sup> ile Queue | DOS            | Critical Delay | 95 <sup>th</sup> ile Queue |            |
| 2016 Baseline          | 0.01         | 6 sec          | 0 m                        | 0.01           | 6 sec          | 0 m                        | ✓          |
| 2016 with Construction | 0.05         | 6 sec          | 2 m                        | 0.01           | 6 sec          | 2 m                        | ✓          |
| 2018 Baseline          | 0.01         | 6 sec          | 0 m                        | 0.01           | 6 sec          | 0 m                        | ✓          |
| 2018 with Operations   | 0.02         | 6 sec          | 1 m                        | 0.02           | 6 sec          | 1 m                        | ✓          |
| 2028 Baseline          | 0.01         | 6 sec          | 0 m                        | 0.01           | 6 sec          | 0 m                        | ✓          |
| 2028 with Operations   | 0.02         | 6 sec          | 1 m                        | 0.02           | 6 sec          | 1 m                        | ✓          |

Note: The With CCM&RP and Without CCM&RP scenarios are the same for the access location.

The results presented in Table 7-3 identify that the generic intersection form assessed will operate well within the typically accepted performance thresholds irrespective of the presence of project generated traffic demands (i.e. DOS of less than 0.80 and critical delay of less than 57 seconds).

### 7.3.3 Safety Assessment

The turn warrants assessment presented on Figures D7 to D9 in Appendix D identifies that a BAR right turn treatment and a BAL left turn treatment would provide an appropriate level of safety. The access intersection form ultimately provided irrespective of location should therefore include a BAR right turn treatment and a BAL left turn treatment to safely accommodate project traffic demands.

#### **7.3.4 Conclusions**

The operational assessment and safety assessment has established that provision of a BAR right turn treatment and a BAL left turn treatment at the access intersection would provide an appropriate level of safety and operational performance. These turn treatments should therefore be provided at the ultimate access intersection.

## 8 Link Assessment

### 8.1 Level of Service

Table 8-1 summarises the properties of the assessed links while Table 8-2 identifies the specific LOS thresholds adopted for the assessed links based upon the existing characteristics of the links. It is noted that the LOS assessment only considers rural road links based on the thresholds identified in Austroads.

**Table 8-1 Assessed Links**

| Road |                            | Section                                  |                            | Adopted K factor |
|------|----------------------------|------------------------------------------|----------------------------|------------------|
| 14A  | Flinders Highway           | Charters Towers                          | Gregory Developmental Road | 0.10             |
| 14B  | Flinders Highway           | <i>Not included (urban road section)</i> |                            |                  |
| 98B  | Gregory Developmental Road | Flinders Highway                         | Elgin-Moray Road           | 0.10             |
| 98A  | Gregory Developmental Road | Elgin-Moray Road                         | Peak Downs Highway         | 0.10             |
| 27C  | Gregory Highway            | Peak Downs Highway                       | Clermont                   | 0.10             |
| 33A  | Peak Downs Highway         | Clermont                                 | Moranbah                   | 0.10             |

**Table 8-2 Applicable LOS Thresholds**

| K factor | Level of Service |           |           |            |            |
|----------|------------------|-----------|-----------|------------|------------|
|          | A                | B         | C         | D          | E          |
| 0.10     | 2,400 vpd        | 4,800 vpd | 7,900 vpd | 13,500 vpd | 22,900 vpd |

Vpd: vehicles per day

Table 8-3 summarises the results of the link LOS assessment based on the different baseline scenarios, compared to the addition of project traffic.

**Table 8-3 Future Link Performance**

| Road | 2016 Baseline                | 2018 Baseline              | 2028 Baseline              | 2016 Baseline (with CCM&RP)                | 2018 Baseline (with CCM&RP)              | 2028 Baseline (with CCM&RP)              |
|------|------------------------------|----------------------------|----------------------------|--------------------------------------------|------------------------------------------|------------------------------------------|
| 14A  | B                            | B                          | B                          | B                                          | B                                        | B                                        |
| 98B  | A                            | A                          | A                          | A                                          | A                                        | A                                        |
| 98A  | A                            | A                          | A                          | A                                          | A                                        | A                                        |
| 27C  | A                            | A                          | A                          | A                                          | A                                        | A                                        |
| 33A  | A                            | A                          | A                          | A                                          | A                                        | A                                        |
| Road | 2016 Baseline + Construction | 2018 Baseline + Operations | 2028 Baseline + Operations | 2016 Baseline (with CCM&RP) + Construction | 2018 Baseline (with CCM&RP) + Operations | 2028 Baseline (with CCM&RP) + Operations |
| 14A  | B                            | B                          | B                          | B                                          | B                                        | B                                        |
| 98B  | A                            | A                          | A                          | A                                          | A                                        | A                                        |
| 98A  | A                            | A                          | A                          | A                                          | A                                        | A                                        |
| 27C  | A                            | A                          | A                          | A                                          | A                                        | A                                        |
| 33A  | A                            | A                          | A                          | A                                          | A                                        | A                                        |

The results presented in Table 8-3 identify that the additional traffic demands associated with the project are not anticipated to significantly impact the operations of any of the assessed links. The analysis identifies that the LOS afforded by the assessed links will be the same irrespective of the presence of traffic demands associated with the project. No upgrades by the proponent are therefore warranted.

## 9 Pavement Assessment

### 9.1 Spatial Extent of Pavement Assessment

The spatial extent of the pavement impact assessment has been defined in accordance with the scoping methodology outlined in TMR's *Guidelines for Assessment of Road Impacts of Development (2006)*. That is, all surrounding State-controlled roads have been considered to identify any road sections where the project is likely to result in an increase of 5% or more beyond existing pavement loadings.

The following roads were considered to determine if the project was likely to have an impact defined as significant:

- > 14A: Flinders Highway (Townsville to Charters Towers)
- > 14B: Flinders Highway (Charters Towers to Gregory Developmental Road)
- > 98B: Gregory Developmental Road (Belyando Crossing to Charters Towers)
- > 98A: Gregory Developmental Road (Clermont to Belyando Crossing)
- > 27C: Gregory Highway (Clermont to Gregory Developmental Road)
- > 33A: Peak Downs Highway (Clermont to Nebo)
- > 841: Townsville Port Road

Figure 9-1 identifies the TMR defined sections of each road, with the baseline traffic volume and Equivalent Standard Axle (ESA) loadings on each section reproduced in Table 9-1. Existing ESA loadings on the pavement have been identified from recent AADT and traffic composition data supplied by TMR. The baseline ESAs have been determined using average ESA/Heavy Vehicle (HV) values for each vehicle type from Austroads (2011) which have been applied to the recorded number of heavy vehicles on each road section. This method ensures that actual ESA/HV factors have been established for each individual section rather than a generic ESA/HV factor being applied to all sections thus resulting in the most representative ESA forecasts.

It is noted that the future baseline pavement loadings considered as part of the pavement assessment have been established based upon the assumption that existing pavement loadings will increase by 3% per annum consistent with typical pavement assessment practice in Queensland. That is, the adopted pavement loading forecasting approach does not include specific allowance for the pavement loading increases associated with the CCM&RP, instead a nominal 3% annual increase has been assumed. Adoption of a 3% growth rate is also consistent with TMR's standard PIA assessment practice.

The adopted approach is conservative as it is anticipated to result in an overestimate of the proportional impact of the pavement loadings associated with Project China Stone. The approach has also been adopted as there was insufficient detail within the CCM&RP road impact assessment report in relation to the precise pavement loadings associated with the project.

Table 9-1 Baseline Traffic Volumes and ESA Calculations (2013)

| TMR Site ID |      |           | Chainage (km) | AADT (vpd) | HV AADT (vpd) | Average (ESA/HV) | Baseline (ESAs) |
|-------------|------|-----------|---------------|------------|---------------|------------------|-----------------|
| Counter     | Road | Direction |               |            |               |                  |                 |
| 92206       | 841  | G         | 0.0 - 7.3     | 995        | 281           | 2.3              | 240,270         |
|             | 841  | A         | 0.0 - 7.3     | 871        | 268           | 2.3              | 232,638         |
| 92192       | 14A  | G         | 0.0 - 2.5     | 717        | 310           | 2.4              | 287,080         |
|             | 14A  | A         | 0.0 - 2.5     | 835        | 340           | 2.4              | 315,207         |
| 90060       | 14A  | G         | 2.5 - 9.4     | 2,602      | 603           | 1.8              | 417,879         |
|             | 14A  | A         | 2.5 - 9.4     | 2,591      | 597           | 1.8              | 410,557         |
| 91389       | 14A  | G         | 9.4 - 122.1   | 1,176      | 213           | 2.1              | 172,093         |
|             | 14A  | A         | 9.4 - 122.1   | 1,149      | 203           | 2.1              | 164,046         |
| 91328       | 14A  | G         | 122.1 - 124.9 | 929        | 206           | 2.2              | 175,382         |
|             | 14A  | A         | 122.1 - 124.9 | 1,010      | 226           | 2.1              | 186,408         |
| 91329       | 14A  | G         | 124.9 - 126.1 | 1,413      | 236           | 2.1              | 189,388         |
|             | 14A  | A         | 124.9 - 126.1 | 1,519      | 239           | 2.1              | 192,560         |
| 91299       | 14B  | G         | 0.0 - 3.5     | 1,536      | 289           | 1.9              | 213,530         |
|             | 14B  | A         | 0.0 - 3.5     | 1,620      | 318           | 1.8              | 227,342         |
| 90020       | 98B  | G         | 0.0 - 142.8   | 219        | 65            | 2.1              | 53,508          |
|             | 98B  | A         | 0.0 - 142.8   | 210        | 55            | 2.4              | 50,297          |
| 91701       | 98B  | G         | 142.8 - 193.2 | 373        | 87            | 2.3              | 74,025          |
|             | 98B  | A         | 142.8 - 193.2 | 384        | 95            | 2.1              | 75,115          |
| 159538      | 98A  | G         | 0.0 - 27.8    | 262        | 79            | 2.3              | 68,498          |
|             | 98A  | A         | 0.0 - 27.8    | 250        | 84            | 2.4              | 75,604          |
| 150016      | 98A  | G         | 27.8 - 101.0  | 213        | 64            | 2.6              | 63,423          |
|             | 98A  | A         | 27.8 - 101.0  | 221        | 71            | 2.6              | 69,551          |
| 150016      | 98A  | G         | 101.0 - 157.9 | 213        | 64            | 2.6              | 63,423          |
|             | 98A  | A         | 101.0 - 157.9 | 221        | 71            | 2.6              | 69,551          |
| 159536      | 27C  | G         | 0.0 - 9.8     | 933        | 214           | 1.9              | 155,794         |
|             | 27C  | A         | 0.0 - 9.8     | 945        | 205           | 2.0              | 153,989         |
| 159640      | 27C  | G         | 9.8 - 14.0    | 719        | 157           | 2.3              | 133,838         |
|             | 27C  | A         | 9.8 - 14.0    | 738        | 179           | 2.3              | 152,899         |
| 150013      | 33A  | G         | 0.0 - 89.1    | 328        | 102           | 2.2              | 84,175          |
|             | 33A  | A         | 0.0 - 89.1    | 322        | 99            | 2.2              | 81,844          |
| 159613      | 33A  | G         | 89.1 - 90.4   | 2,184      | 590           | 2.1              | 476,028         |
|             | 33A  | A         | 89.1 - 90.4   | 2,135      | 576           | 2.2              | 479,599         |

Source: TMR (2014)

The ESA generation of the heavy vehicle movements associated with the project was separately forecast for both the construction and operations phases. Peak construction and operation phase vehicle movements were utilised to identify the worst case impacts for each scenario.

The ESA estimate includes consideration of the vehicle type likely to be associated with each delivery type (e.g. it is anticipated that concrete deliveries will occur via Austroads Class 4). That is, a generic ESA/HV factor was not adopted, but rather loaded and unloaded ESA values were used to reflect the directionality of heavy vehicle movements to and from the project site. This approach is appropriate as it results in the most representative forecasts of the project's ESA generation.

Table 9-2 identifies the project's worst case ESA generation and the associated pavement loading percentage impact on each section.

**Table 9-2 Project ESA and Scoping**

| TMR Site ID |      |           | Chainage (km) | Construction |          | Operations |          |
|-------------|------|-----------|---------------|--------------|----------|------------|----------|
| Counter     | Road | Direction |               | Peak ESA     | % Impact | Peak ESA   | % Impact |
| 92206       | 841  | G         | 0.0 - 7.3     | 3,053        | 1.3%     | 8,624      | 3.6%     |
|             | 841  | A         | 0.0 - 7.3     | 17,118       | 7.4%     | 40,359     | 17.3%    |
| 92192       | 14A  | G         | 0.0 - 2.5     | 17,118       | 6.0%     | 40,359     | 14.1%    |
|             | 14A  | A         | 0.0 - 2.5     | 3,053        | 1.0%     | 8,624      | 2.7%     |
| 90060       | 14A  | G         | 2.5 - 9.4     | 17,118       | 4.1%     | 40,359     | 9.7%     |
|             | 14A  | A         | 2.5 - 9.4     | 3,053        | 0.7%     | 8,624      | 2.1%     |
| 91389       | 14A  | G         | 9.4 - 122.1   | 17,118       | 9.9%     | 40,359     | 23.5%    |
|             | 14A  | A         | 9.4 - 122.1   | 3,053        | 1.9%     | 8,624      | 5.3%     |
| 91328       | 14A  | G         | 122.1 - 124.9 | 17,118       | 9.8%     | 40,359     | 23.0%    |
|             | 14A  | A         | 122.1 - 124.9 | 3,053        | 1.6%     | 8,624      | 4.6%     |
| 91329       | 14A  | G         | 124.9 - 126.1 | 17,118       | 9.0%     | 40,359     | 21.3%    |
|             | 14A  | A         | 124.9 - 126.1 | 3,053        | 1.6%     | 8,624      | 4.5%     |
| 91299       | 14B  | G         | 0.0 - 3.5     | 25,148       | 11.8%    | 48,721     | 22.8%    |
|             | 14B  | A         | 0.0 - 3.5     | 4,845        | 2.1%     | 10,748     | 4.7%     |
| 90020       | 98B  | G         | 0.0 - 142.8   | 4,845        | 9.1%     | 10,748     | 20.1%    |
|             | 98B  | A         | 0.0 - 142.8   | 25,148       | 50.0%    | 48,721     | 96.9%    |
| 91701       | 98B  | G         | 142.8 - 193.2 | 4,845        | 6.5%     | 10,748     | 14.5%    |
|             | 98B  | A         | 142.8 - 193.2 | 25,148       | 33.5%    | 48,721     | 64.9%    |
| 159538      | 98A  | G         | 0.0 - 27.8    | 5,907        | 8.6%     | 434        | 0.6%     |
|             | 98A  | A         | 0.0 - 27.8    | 815          | 1.1%     | 354        | 0.5%     |
| 150016      | 98A  | G         | 27.8 - 101.0  | 5,907        | 9.3%     | 434        | 0.7%     |
|             | 98A  | A         | 27.8 - 101.0  | 815          | 1.2%     | 354        | 0.5%     |
| 150016      | 98A  | G         | 101.0 - 157.9 | 4,845        | 7.6%     | 10,748     | 16.9%    |
|             | 98A  | A         | 101.0 - 157.9 | 25,148       | 36.2%    | 48,721     | 70.1%    |
| 159536      | 27C  | G         | 0.0 - 9.8     | 33           | 0.0%     | 332        | 0.2%     |
|             | 27C  | A         | 0.0 - 9.8     | 33           | 0.0%     | 332        | 0.2%     |
| 159640      | 27C  | G         | 9.8 - 14.0    | 33           | 0.0%     | 332        | 0.2%     |
|             | 27C  | A         | 9.8 - 14.0    | 33           | 0.0%     | 332        | 0.2%     |
| 150013      | 33A  | G         | 0.0 - 89.1    | 782          | 0.9%     | 22         | 0.0%     |
|             | 33A  | A         | 0.0 - 89.1    | 5,874        | 7.2%     | 101        | 0.1%     |
| 159613      | 33A  | G         | 89.1 - 90.4   | 782          | 0.2%     | 22         | 0.0%     |
|             | 33A  | A         | 89.1 - 90.4   | 5,874        | 1.2%     | 101        | 0.0%     |

The scoping identified in Table 9-2 indicates that a detailed pavement assessment is warranted.

## 9.2 Detailed Pavement Impact Assessment Methodology

The detailed pavement impact assessment relies upon:

- > project's heavy vehicle traffic on road links
- > existing pavement roughness
- > constant annual roughness deterioration rate
- > pavement roughness intervention threshold

The detailed pavement impact assessment utilises roughness as the sole measure of pavement distress.

The following values have been assumed for assessment parameters:

- > three counts annual background roughness increase
- > roughness intervention level of 120 counts.

### 9.2.1 Pavement Rehabilitation Impacts

Table 9-3 summarises the reduction in estimated service life of the assessed pavement as a result of the project. The shaded cells represent where material haulage and staff bus movements associated with the project are expected to accelerate pavement failure by more than one year.

In accordance with TMR's guideline, the project is defined as having a significant impact on the timing of pavement rehabilitation only where the acceleration time exceeds one year (i.e. in the shaded cells) and if the mitigation works are required within the 10 year mitigation timeframe. Full pavement rehabilitation assessment details are provided in Appendix E.

As noted previously, the baseline ESA loadings adopted for the pavement impact assessment do not include the ESA loadings from the CCM&RP, the bring forward periods presented in Table 9-3 are therefore anticipated to be conservative (i.e. worst case) impacts.

**Table 9-3 Pavement Rehabilitation Impacts**

| TMR Site ID |      |           | Chainage      | Rehabilitation Year |              | Bring Forward Period (Years) | Within Mitigation Timeframe | Contribution Potentially Warranted |
|-------------|------|-----------|---------------|---------------------|--------------|------------------------------|-----------------------------|------------------------------------|
| Counter     | Road | Direction |               | Excluding Project   | With Project |                              |                             |                                    |
| 92206       | 841  | G         | 0.0 - 7.3     | -                   | -            | -                            | No                          | No                                 |
|             | 841  | A         | 0.0 - 7.3     | 2033.0              | 2031.3       | 1.7                          | No                          | No                                 |
| 92192       | 14A  | G         | 0.0 - 2.5     | 2037.01             | 2035.40      | 1.6                          | No                          | No                                 |
|             | 14A  | A         | 0.0 - 2.5     | -                   | -            | -                            | No                          | No                                 |
| 90060       | 14A  | G         | 2.5 - 9.4     | 2038.59             | 2037.41      | 1.2                          | No                          | No                                 |
|             | 14A  | A         | 2.5 - 9.4     | -                   | -            | -                            | No                          | No                                 |
| 91389       | 14A  | G         | 9.4 - 122.1   | 2036.43             | 2033.91      | 2.5                          | No                          | No                                 |
|             | 14A  | A         | 9.4 - 122.1   | 2036.43             | 2035.82      | 0.6                          | No                          | No                                 |
| 91328       | 14A  | G         | 122.1 - 124.9 | 2024.97             | 2023.66      | 1.3                          | Yes                         | Yes                                |
|             | 14A  | A         | 122.1 - 124.9 | -                   | -            | -                            | No                          | No                                 |
| 91329       | 14A  | G         | 124.9 - 126.1 | 2032.41             | 2030.43      | 2.0                          | No                          | No                                 |
|             | 14A  | A         | 124.9 - 126.1 | -                   | -            | -                            | No                          | No                                 |
| 91299       | 14B  | G         | 0.0 - 3.5     | 2033.64             | 2031.39      | 2.2                          | No                          | No                                 |
|             | 14B  | A         | 0.0 - 3.5     | 2033.64             | 2033.13      | 0.5                          | No                          | No                                 |
| 90020       | 98B  | G         | 0.0 - 142.8   | 2031.9              | 2030.1       | 1.8                          | No                          | No                                 |
|             | 98B  | A         | 0.0 - 142.8   | 2031.9              | 2025.6       | 6.4                          | Yes                         | Yes                                |
| 91701       | 98B  | G         | 142.8 - 193.2 | 2035.7              | 2034.2       | 1.6                          | No                          | No                                 |
|             | 98B  | A         | 142.8 - 193.2 | 2035.7              | 2030.0       | 5.8                          | No                          | No                                 |
| 159538      | 98A  | G         | 0.0 - 27.8    | 2029.7              | 2029.6       | 0.2                          | No                          | No                                 |

| TMR Site ID |      |           | Chainage      | Rehabilitation Year |              | Bring Forward Period (Years) | Within Mitigation Timeframe | Contribution Potentially Warranted |
|-------------|------|-----------|---------------|---------------------|--------------|------------------------------|-----------------------------|------------------------------------|
| Counter     | Road | Direction |               | Excluding Project   | With Project |                              |                             |                                    |
| 150016      | 98A  | A         | 0.0 - 27.8    | -                   | -            | -                            | No                          | No                                 |
|             | 98A  | G         | 27.8 - 101.0  | 2031.8              | 2031.6       | 0.2                          | No                          | No                                 |
|             | 98A  | A         | 27.8 - 101.0  | -                   | -            | -                            | No                          | No                                 |
| 150016      | 98A  | G         | 101.0 - 157.9 | 2034.1              | 2032.4       | 1.7                          | No                          | No                                 |
|             | 98A  | A         | 101.0 - 157.9 | 2034.1              | 2028.4       | 5.7                          | No                          | No                                 |
| 159536      | 27C  | G         | 0.0 - 9.8     | -                   | -            | -                            | No                          | No                                 |
|             | 27C  | A         | 0.0 - 9.8     | -                   | -            | -                            | No                          | No                                 |
| 159640      | 27C  | G         | 9.8 - 14.0    | -                   | -            | -                            | No                          | No                                 |
|             | 27C  | A         | 9.8 - 14.0    | -                   | -            | -                            | No                          | No                                 |
| 150013      | 33A  | G         | 0.0 - 89.1    | -                   | -            | -                            | No                          | No                                 |
|             | 33A  | A         | 0.0 - 89.1    | 2027.9              | 2027.8       | 0.1                          | No                          | No                                 |
| 159613      | 33A  | G         | 89.1 - 90.4   | -                   | -            | -                            | No                          | No                                 |
|             | 33A  | A         | 89.1 - 90.4   | -                   | -            | -                            | No                          | No                                 |

The results presented in Table 9-3 indicate that the project will have an impact, defined as significant, on the timing of the required pavement rehabilitation works (i.e. brings forward by one year or greater) for sections of the Gregory Developmental Road north of the Elgin–Moray Road intersection and a section of the Flinders Highway at Charters Towers (Figure 9-2).

The project's pavement rehabilitation impact should be calculated Post-EIS approval as project planning is further refined and once the likely pavement loadings associated with the CCM&RP have also been refined, this will enable (if appropriate) the identification of a monetary contribution towards pavement rehabilitation activities.

### 9.2.2 Pavement Maintenance Impacts

The impact of project pavement loadings on routine maintenance activity has been identified based on the percentage increase in ESAs on each road segment as a result of the project. Table 9-4 summarises the potential increases in pavement loadings anticipated to be associated with the project. Those items highlighted identify the links where a contribution may be warranted. The corresponding road sections are identified on Figure 9-2. Technical readers should reference the full assessment reproduced in Appendix E.

**Table 9-4 Pavement Maintenance Impacts**

| TMR Site ID |      |           | Chainage      | Scoped | Maximum Increase on Maintenance Cost (in any one year) | Contribution Potentially Warranted |
|-------------|------|-----------|---------------|--------|--------------------------------------------------------|------------------------------------|
| Counter     | Road | Direction |               |        |                                                        |                                    |
| 92206       | 841  | G         | 0.0 - 7.3     | No     | -                                                      | No                                 |
|             | 841  | A         | 0.0 - 7.3     | Yes    | 15%                                                    | Yes                                |
| 92192       | 14A  | G         | 0.0 - 2.5     | Yes    | 13%                                                    | Yes                                |
|             | 14A  | A         | 0.0 - 2.5     | No     | -                                                      | No                                 |
| 90060       | 14A  | G         | 2.5 - 9.4     | Yes    | 9%                                                     | Yes                                |
|             | 14A  | A         | 2.5 - 9.4     | No     | -                                                      | No                                 |
| 91389       | 14A  | G         | 9.4 - 122.1   | Yes    | 21%                                                    | Yes                                |
|             | 14A  | A         | 9.4 - 122.1   | Yes    | 5%                                                     | Yes                                |
| 91328       | 14A  | G         | 122.1 - 124.9 | Yes    | 21%                                                    | Yes                                |
|             | 14A  | A         | 122.1 - 124.9 | No     | -                                                      | No                                 |

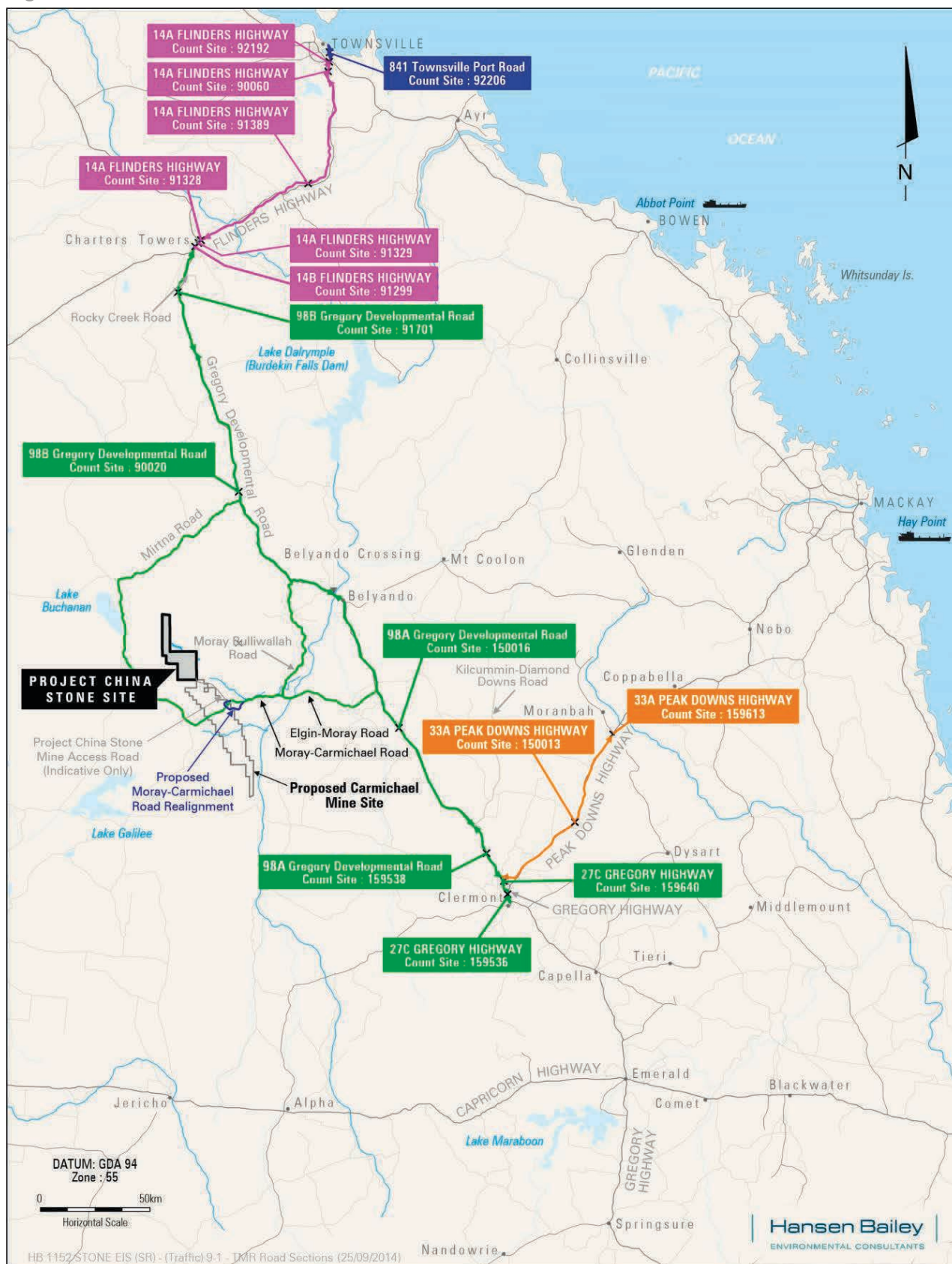
| TMR Site ID |      |           | Chainage      | Scoped | Maximum Increase on<br>Maintenance Cost<br>(in any one year) | Contribution<br>Potentially<br>Warranted |
|-------------|------|-----------|---------------|--------|--------------------------------------------------------------|------------------------------------------|
| Counter     | Road | Direction |               |        |                                                              |                                          |
| 91329       | 14A  | G         | 124.9 - 126.1 | Yes    | 19%                                                          | Yes                                      |
|             | 14A  | A         | 124.9 - 126.1 | No     | -                                                            | No                                       |
| 91299       | 14B  | G         | 0.0 - 3.5     | Yes    | 20%                                                          | Yes                                      |
|             | 14B  | A         | 0.0 - 3.5     | No     | -                                                            | No                                       |
| 90020       | 98B  | G         | 0.0 - 142.8   | Yes    | 18%                                                          | Yes                                      |
|             | 98B  | A         | 0.0 - 142.8   | Yes    | 86%                                                          | Yes                                      |
| 91701       | 98B  | G         | 142.8 - 193.2 | Yes    | 13%                                                          | Yes                                      |
|             | 98B  | A         | 142.8 - 193.2 | Yes    | 58%                                                          | Yes                                      |
| 159538      | 98A  | G         | 0.0 - 27.8    | Yes    | 8%                                                           | Yes                                      |
|             | 98A  | A         | 0.0 - 27.8    | No     | -                                                            | No                                       |
| 150016      | 98A  | G         | 27.8 - 101.0  | Yes    | 9%                                                           | Yes                                      |
|             | 98A  | A         | 27.8 - 101.0  | No     | -                                                            | No                                       |
| 150016      | 98A  | G         | 101.0 - 157.9 | Yes    | 15%                                                          | Yes                                      |
|             | 98A  | A         | 101.0 - 157.9 | Yes    | 63%                                                          | Yes                                      |
| 159536      | 27C  | G         | 0.0 - 9.8     | No     | -                                                            | No                                       |
|             | 27C  | A         | 0.0 - 9.8     | No     | -                                                            | No                                       |
| 159640      | 27C  | G         | 9.8 - 14.0    | No     | -                                                            | No                                       |
|             | 27C  | A         | 9.8 - 14.0    | No     | -                                                            | No                                       |
| 150013      | 33A  | G         | 0.0 - 89.1    | No     | -                                                            | No                                       |
|             | 33A  | A         | 0.0 - 89.1    | Yes    | 7%                                                           | Yes                                      |
| 159613      | 33A  | G         | 89.1 - 90.4   | No     | -                                                            | No                                       |
|             | 33A  | A         | 89.1 - 90.4   | No     | -                                                            | No                                       |

### 9.2.3 Pavement Rehabilitation and Maintenance Contributions

The information presented in Tables 9-3 and 9-4 indicates conservative proportionate contributions for road pavement rehabilitation and maintenance based on the best available information on CCM&RP and project traffic estimates at this point in time.

In order to calculate accurate contributions to TMR for pavement rehabilitation and maintenance it will be necessary to update the calculations presented in Tables 9-3 and 9-4 taking into account the CCM&RP Road Impact Assessment required to be submitted to TMR prior to the commencement of CCM&RP construction and any future refinements to project traffic generation estimates arising from more detailed construction planning.

Figure 9-1 TMR Road Sections



**Legend**

- Project Site
- Sealed Roads
- Unsealed Roads in the Vicinity of the Project

**DATUM: GDA 94  
Zone: 55**

0 50km  
Horizontal Scale

**Map Labels:** TOWNVILLE, 841 Townsville Port Road Maintenance Impact (in one direction), 14A FLINDERS HIGHWAY Rehabilitation Impact (in one direction), 14A FLINDERS HIGHWAY Maintenance Impact (in one direction), Bowen, Abbot Point, Charters Towers, Rocky Creek Road, Lake Dalrymple (Burdekin Falls Dam), 98B Gregory Developmental Road Rehabilitation Impact (in one direction), 98B Gregory Developmental Road Maintenance Impact (in both directions), Murrumbidgee Road, Belyando Crossing, Belyando, Mt Coolon, Glendon, MACKAY, Hay Point, Moray Bulliwallah Road, Project China Stone Mine Access Road (Indicative Only), Proposed Moray-Carmichael Road Realignment, Lake Galilee, Elgin-Moray Road, Moray-Carmichael Road, Proposed Carmichael Mine Site, 98A Gregory Developmental Road Maintenance Impact (in one direction), Kilcummin-Diamond Downs Road, Coppabella, Moranbah, 33A PEAK DOWNS HIGHWAY Maintenance Impact (in one direction), Dysart, Middlemount, Tieri, Capella, GREGORY HIGHWAY, CLERMONT, GREGORY HIGHWAY, Emerald, Comet, Blackwater, SPRINGSURE, GREGORY HIGHWAY, Lake Maraboon, Alpha, CARRICORN HIGHWAY, Nandowrie.

**Hansen Bailey**  
ENVIRONMENTAL CONSULTANTS

23/09/2017

## 10 Conclusion

This RIA has been undertaken in accordance with TMR's *Guidelines for the Assessment of Road Impacts of Development (2006)* to identify if the development and operation of the project has the potential to significantly impact the safety and efficiency of the road network. The assessment has considered the potential for network performance, road safety and pavement impacts.

When undertaking the analysis presented herein allowance has been made for the cumulative impact of projects which may ultimately eventuate by the 2028 design horizon. This includes specific allowance for the CCM&RP and generic allowance for other projects that were unknown at the time of undertaking the analysis. These unknown projects included the Moray Power Project and other projects that remain unknown to this day but for which an allowance has been made to ensure that a worst case scenario assessment is presented herein.

Based on industry standard thresholds, the existing form of the Flinders Highway/Gregory Developmental Road intersection is expected to operate acceptably irrespective of the presence of project generated traffic demands.

Analysis indicates that the Gregory Developmental Road/Elgin-Moray Road intersection will operate acceptably at the assessed design horizons. From a safety perspective, the provision of a CHR(s) right turn treatment on the northern approach and a BAL left turn treatment on the southern approach will ensure an appropriate LOS. It is noted that upgrades of the intersection to include protected turn lane treatments are required as part of the development of the CCM&RP which is anticipated to precede Project China Stone.

With regards to access to the site, the Moray-Carmichael Road/Project China Stone Mine Access Road intersection should include basic turn treatments on both approaches.

No obvious trends were identified in the crash data, reviewed as part of the assessment, which could potentially be exacerbated by the increase in traffic associated with the project. In addition, past crashes were remote from the proposed project site access location and the Gregory Developmental Road/Elgin-Moray Road intersection, being the point of access to the State-controlled road network.

The pavement loadings associated with the project have the potential to influence the extent and timing of future maintenance activities and rehabilitation works. Potential pavement impacts have been identified on the Gregory Developmental Road, Peak Downs Highway, Flinders Highway and the Townsville Port Road. The pavement impact assessment presented in this report will need to be updated prior to the commencement of construction of the project. This update will take into account the traffic information from the pre-construction road impact assessment for the CCM&RP and any refinements to project traffic estimates arising from more detailed construction planning. The updated pavement impact assessment will enable the accurate calculation of appropriate contributions for pavement rehabilitation and maintenance.

Based on the road assessment documented within this report, Project China Stone will have an insignificant impact on the safety and efficiency of the road network provided that the identified intersection improvements are implemented, and that an appropriate contribution is ultimately made towards TMR's pavement activities.

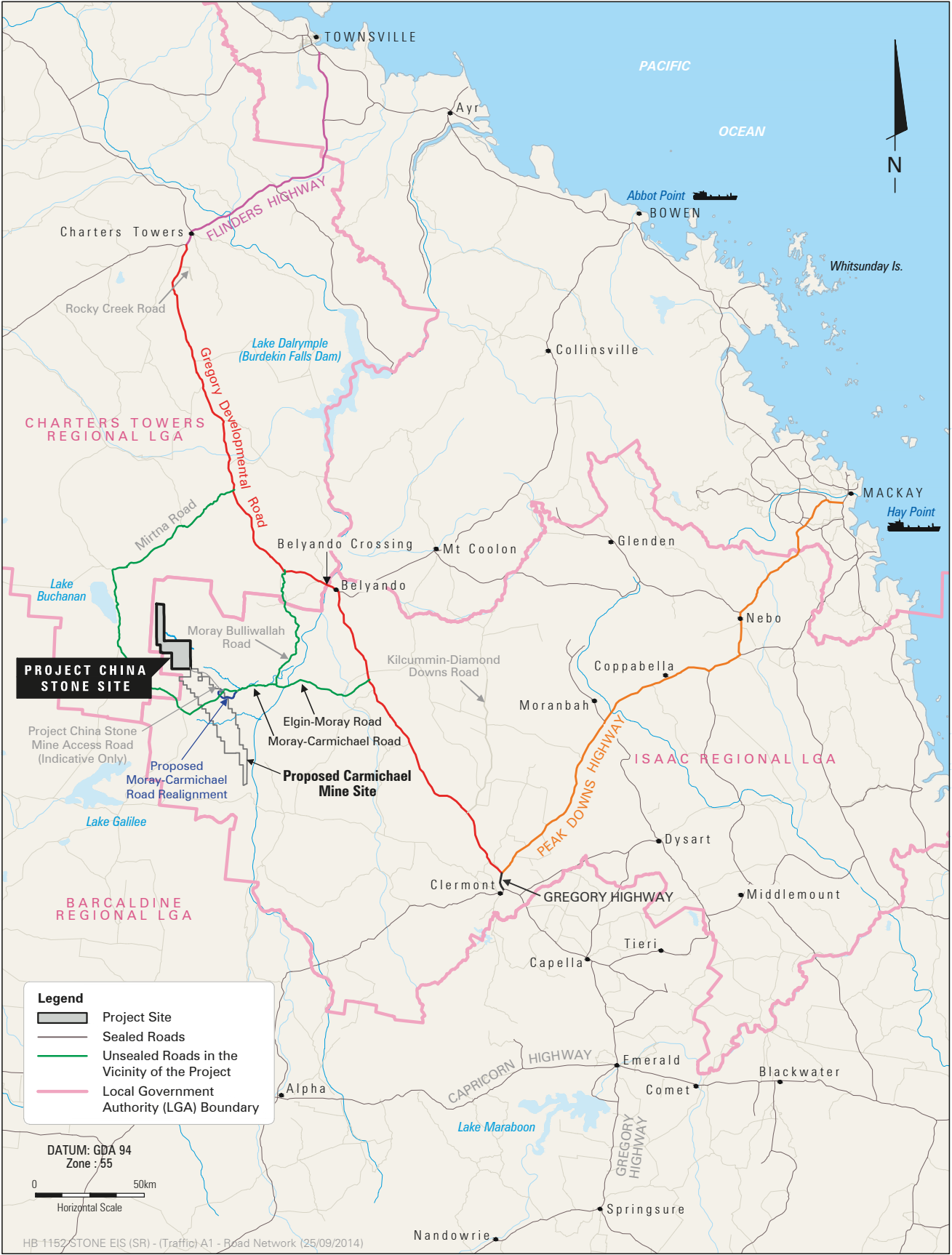
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## Project China Stone

# APPENDIX A

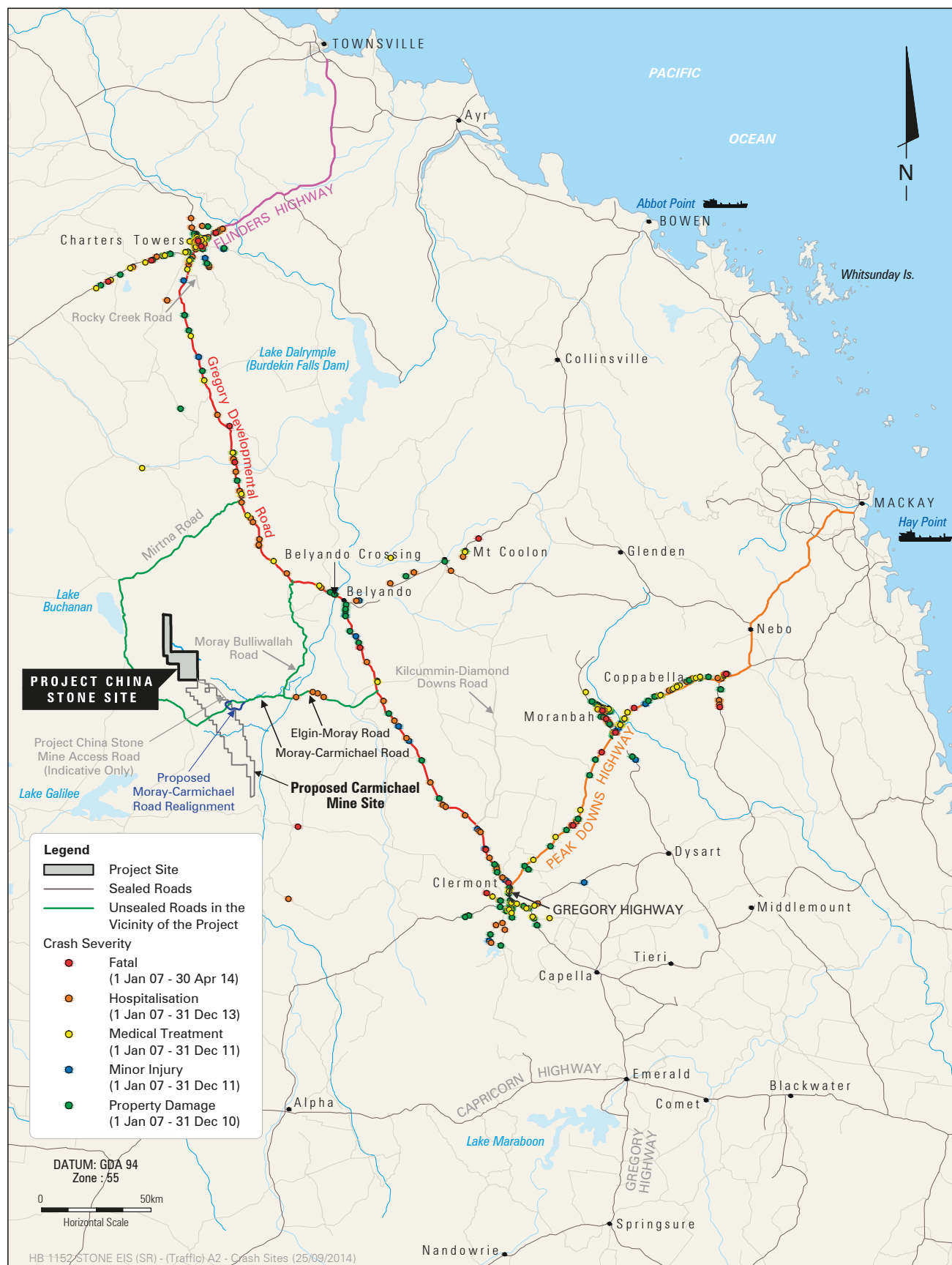
## PROJECT SITE CONTEXT



PROJECT CHINA STONE

Road Network

**FIGURE A1**



PROJECT CHINA STONE

Crash Sites

**FIGURE A2**

Project China Stone

# APPENDIX B

## MATERIAL ESTIMATES

**TABLE B1: CONSTRUCTION MATERIALS ESTIMATES (peak construction year)**

| Material                    | QTY        | Origin              | Destination  | Vehicle Class | Delivery Vehicle                   |
|-----------------------------|------------|---------------------|--------------|---------------|------------------------------------|
| <b>Inputs</b>               |            |                     |              |               |                                    |
| Concrete                    | 47,422 cum | Local               | Project Site | V4            | Concrete Transit Mixer 3 axle 6cum |
| Gravel                      | 663,153 t  | Local               | Project Site | V9            | Six axle articulated 20t           |
| Steel                       | 9,787 t    | Townsville/Moranbah | Project Site | V9            | Six axle articulated 20t           |
| Oversize Equipment          | 14,581 t   | Townsville/Moranbah | Project Site | VX            | Low Loader                         |
| Plant & Equipment           | 1,134 t    | Townsville/Moranbah | Project Site | V9            | Six axle articulated 20t           |
| Elect. cable                | 190 t      | Townsville/Moranbah | Project Site | V9            | Six axle articulated 20t           |
| Elect. poles                | 2,323 t    | Townsville/Moranbah | Project Site | V9            | Six axle articulated 20t           |
| Pipe                        | 4,938 t    | Townsville/Moranbah | Project Site | V9            | Six axle articulated 20t           |
| Conveyor belt               | 324 t      | Townsville/Moranbah | Project Site | V5            | Twin Steer Truck 4 axle 12t        |
| Explosive                   | 0 t        |                     |              | V5            | Twin Steer Truck 4 axle 12t        |
| Misc                        | 737 t      | Townsville          | Project Site | V9            | Six axle articulated 20t           |
| Fuel and Oil                | 18,500 kL  | Townsville          | Project Site | V10           | B Double Tanker                    |
| Prefab buildings            | 2,024      | Townsville/Moranbah | Project Site | V8            | Five axle articulated              |
| Service Providers           |            | Charters Towers     | Project Site | V5            |                                    |
| <b>Outputs</b>              |            |                     |              |               |                                    |
| Scrap metal                 | 189 t      | Project Site        | Townsville   | V9            | Six axle articulated 20t           |
| General waste               | 260 t      | Project Site        | Townsville   | V9            | Six axle articulated 20t           |
| Hazardous & regulated waste | 13 kL      | Project Site        | Townsville   | V10           | B Double Tanker                    |
| Waste oil, sludge & grease  | 24 kL      | Project Site        | Townsville   | V10           | B Double Tanker                    |

## Materials Estimates

### Project China Stone

**TABLE B2: OPERATIONS MATERIALS ESTIMATES (peak operations year)**

| Material                    | QTY        | Origin              | Destination  | Vehicle Class | Delivery Vehicle                   |
|-----------------------------|------------|---------------------|--------------|---------------|------------------------------------|
| <b>Inputs</b>               |            |                     |              |               |                                    |
| Concrete                    | 3,044 cum  | Local               | Project Site | V4            | Concrete Transit Mixer 3 axle 6cum |
| Gravel                      | 20,398 t   | Local               | Project Site | V9            | Six axle articulated 20t           |
| Steel                       | 178 t      | Townsville/Moranbah | Project Site | V9            | Six axle articulated 20t           |
| Oversize Equipment          | 0 t        |                     |              | VX            | Low Loader                         |
| Plant & Equipment           | 0 t        |                     |              | V9            | Six axle articulated 20t           |
| Elect. cable                | 0 t        |                     |              | V9            | Six axle articulated 20t           |
| Elect. poles                | 0 t        |                     |              | V9            | Six axle articulated 20t           |
| Pipe                        | 2,510 t    | Townsville/Moranbah | Project Site | V9            | Six axle articulated 20t           |
| Conveyor belt               | 253 t      | Townsville/Moranbah | Project Site | V5            | Twin Steer Truck 4 axle 12t        |
| Explosive                   | 43,500 t   | Townsville/Moranbah | Project Site | V5            | Twin Steer Truck 4 axle 12t        |
| Misc                        | 15,353 t   | Townsville/Moranbah | Project Site | V9            | Six axle articulated 20t           |
| Fuel and Oil                | 106,644 kL | Townsville          | Project Site | V10           | B Double Tanker                    |
| Prefab buildings            | 0          |                     |              | V8            | Five axle articulated              |
| Service Providers           |            | Charters Towers     | Project Site | V5            |                                    |
| <b>Outputs</b>              |            |                     |              |               |                                    |
| Scrap metal                 | 4 t        | Project Site        | Townsville   | V9            | Six axle articulated 20t           |
| General waste               | 1,232 t    | Project Site        | Townsville   | V9            | Six axle articulated 20t           |
| Hazardous & regulated waste | 62 kL      | Project Site        | Townsville   | V10           | B Double Tanker                    |
| Waste oil, sludge & grease  | 5,658 kL   | Project Site        | Townsville   | V10           | B Double Tanker                    |

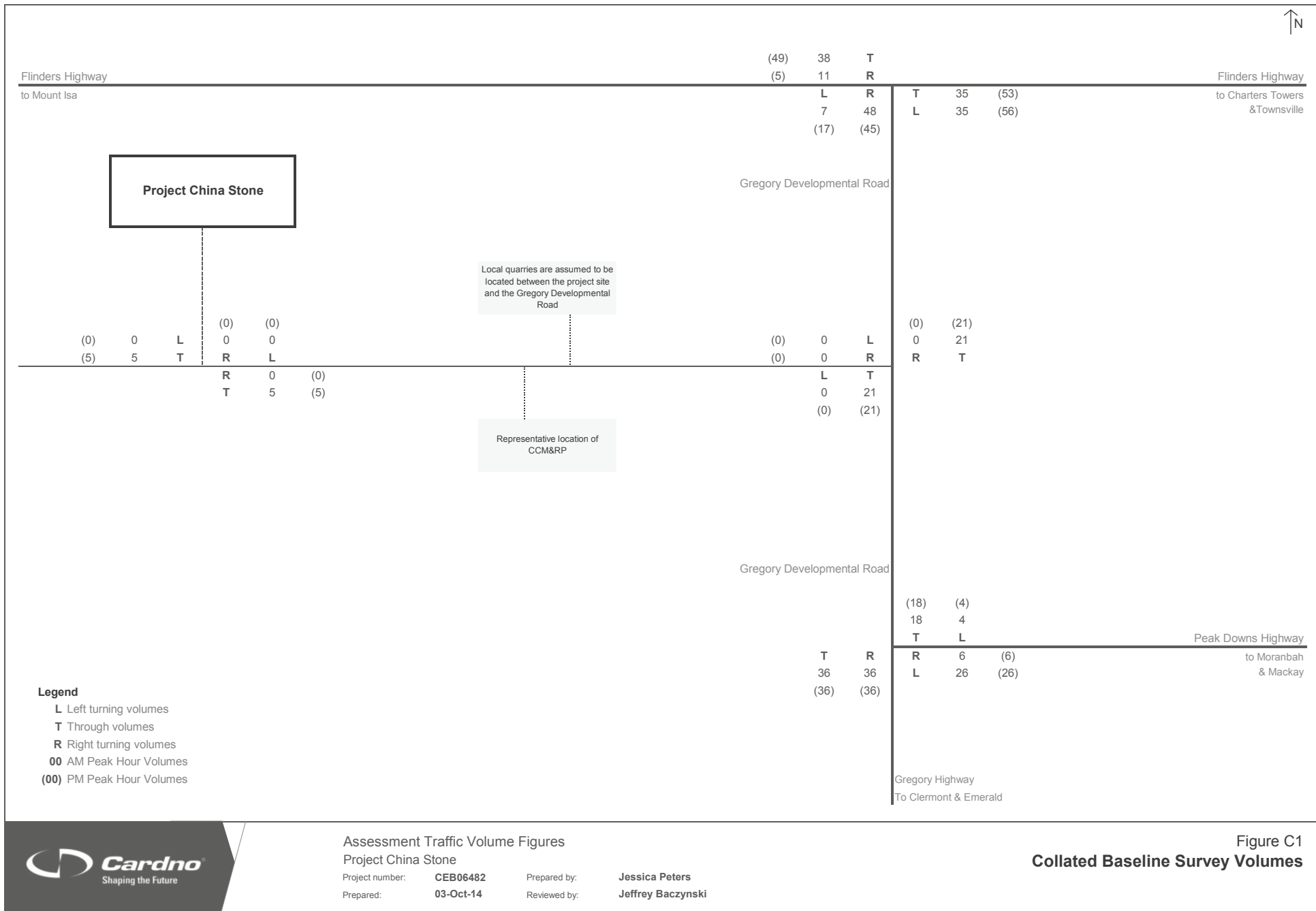
## Materials Estimates

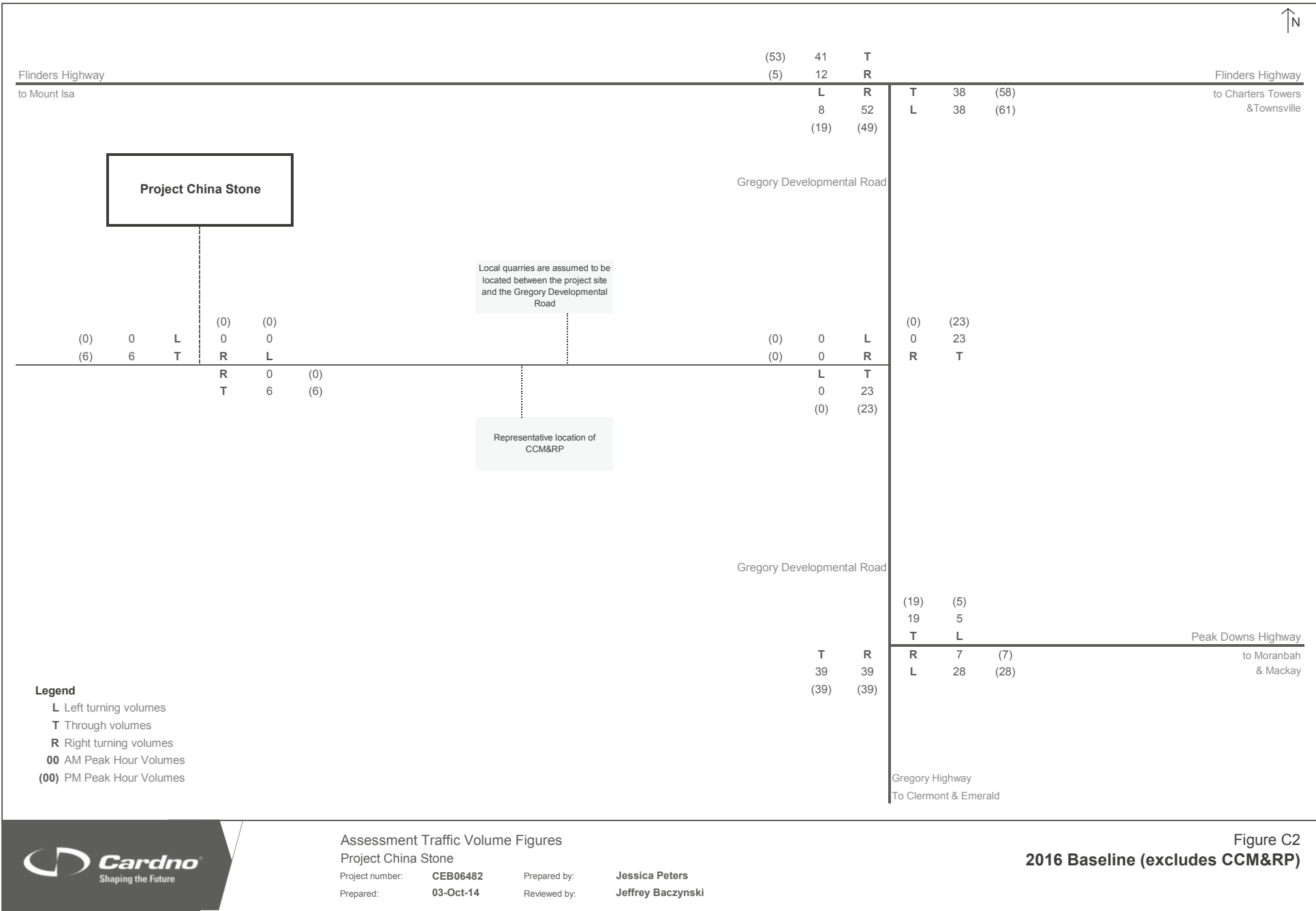
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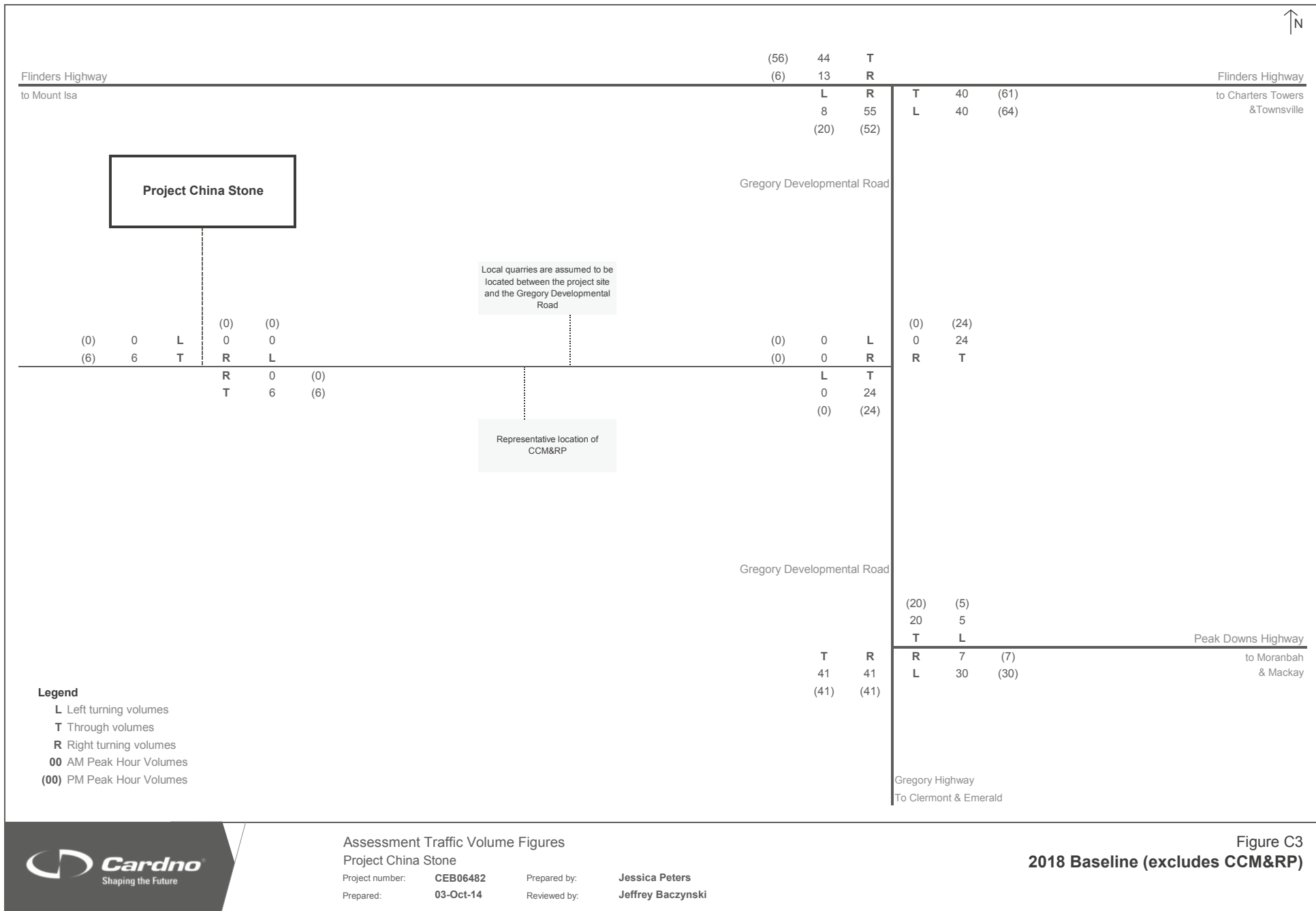
## Project China Stone

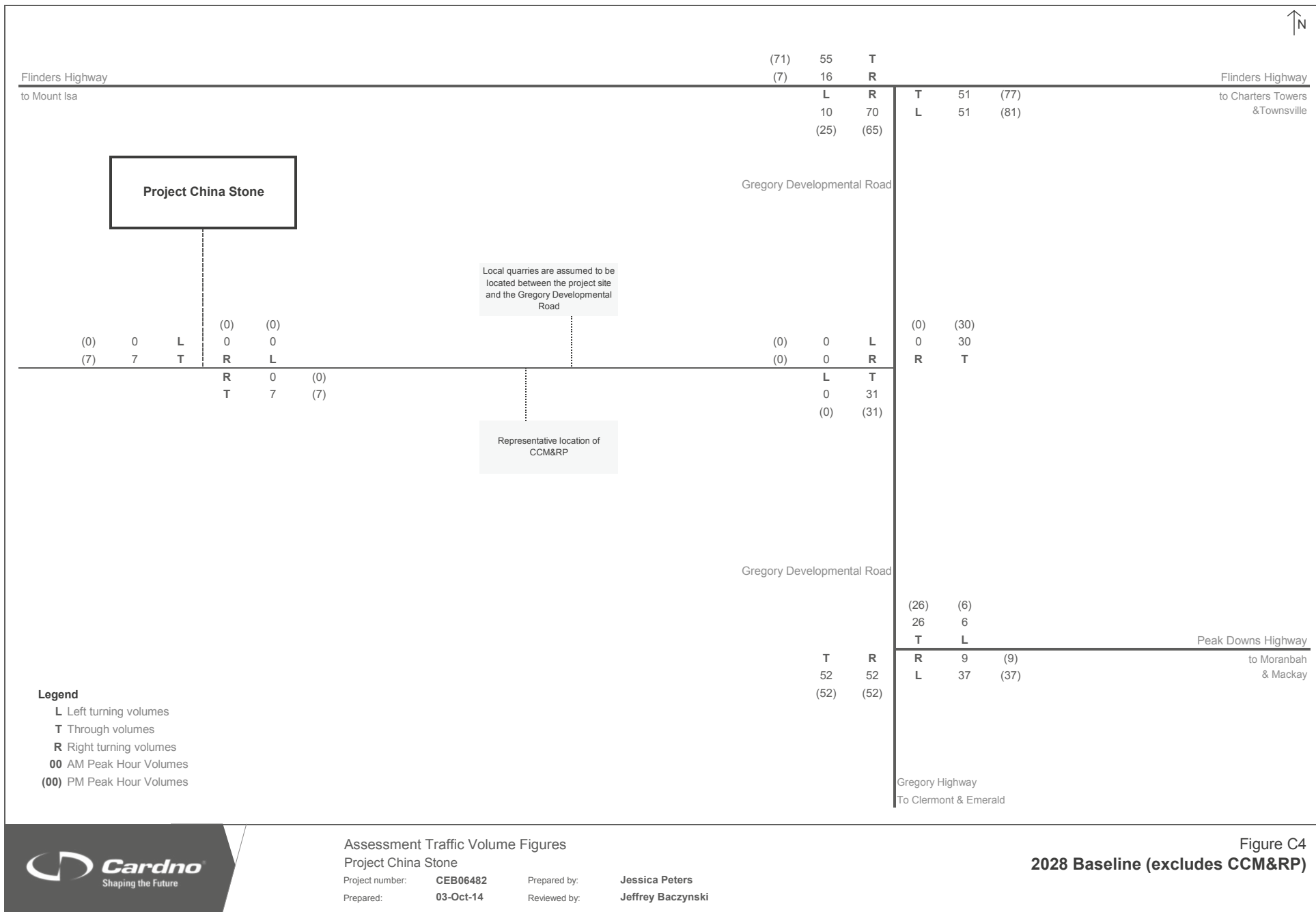
# APPENDIX C

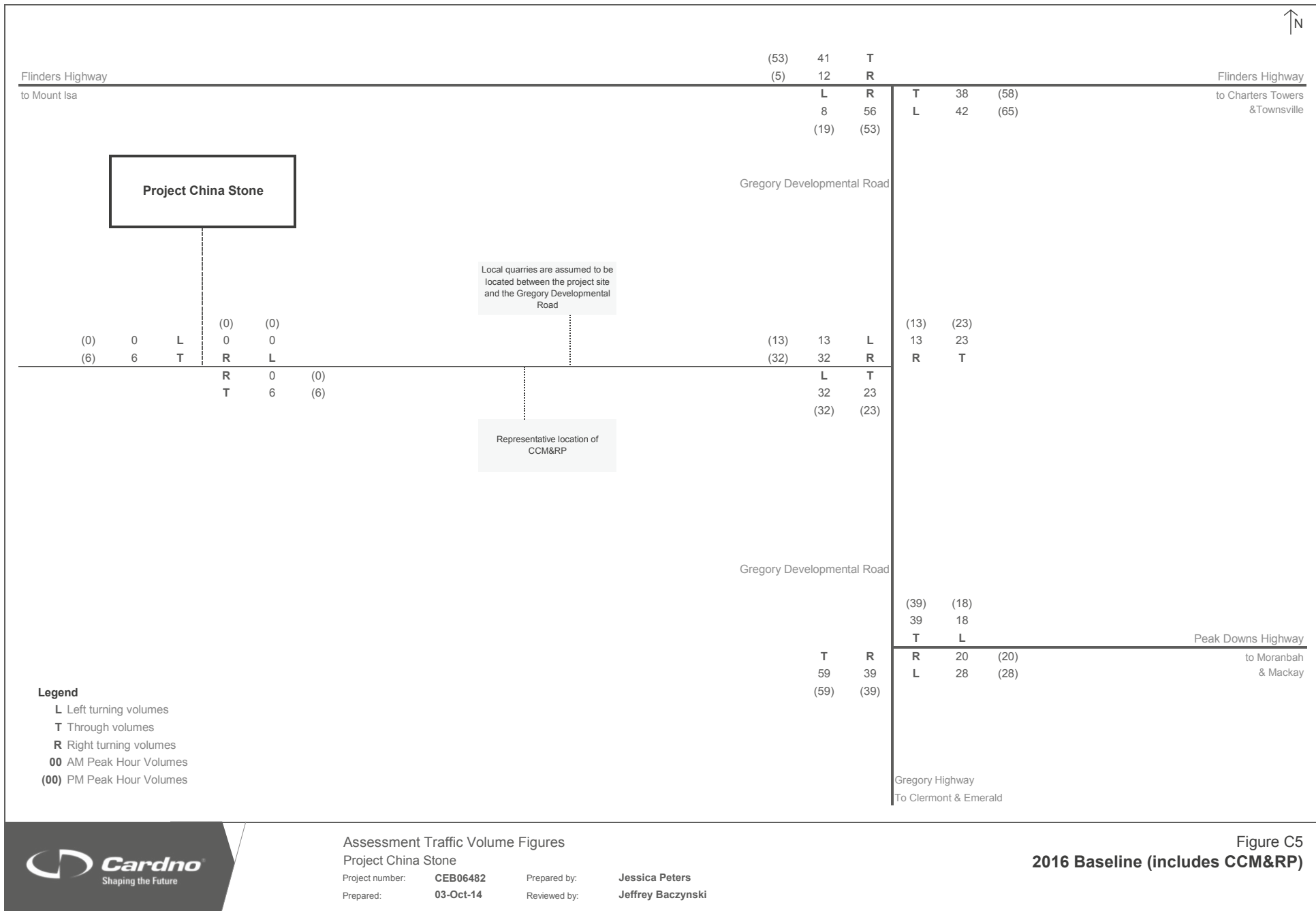
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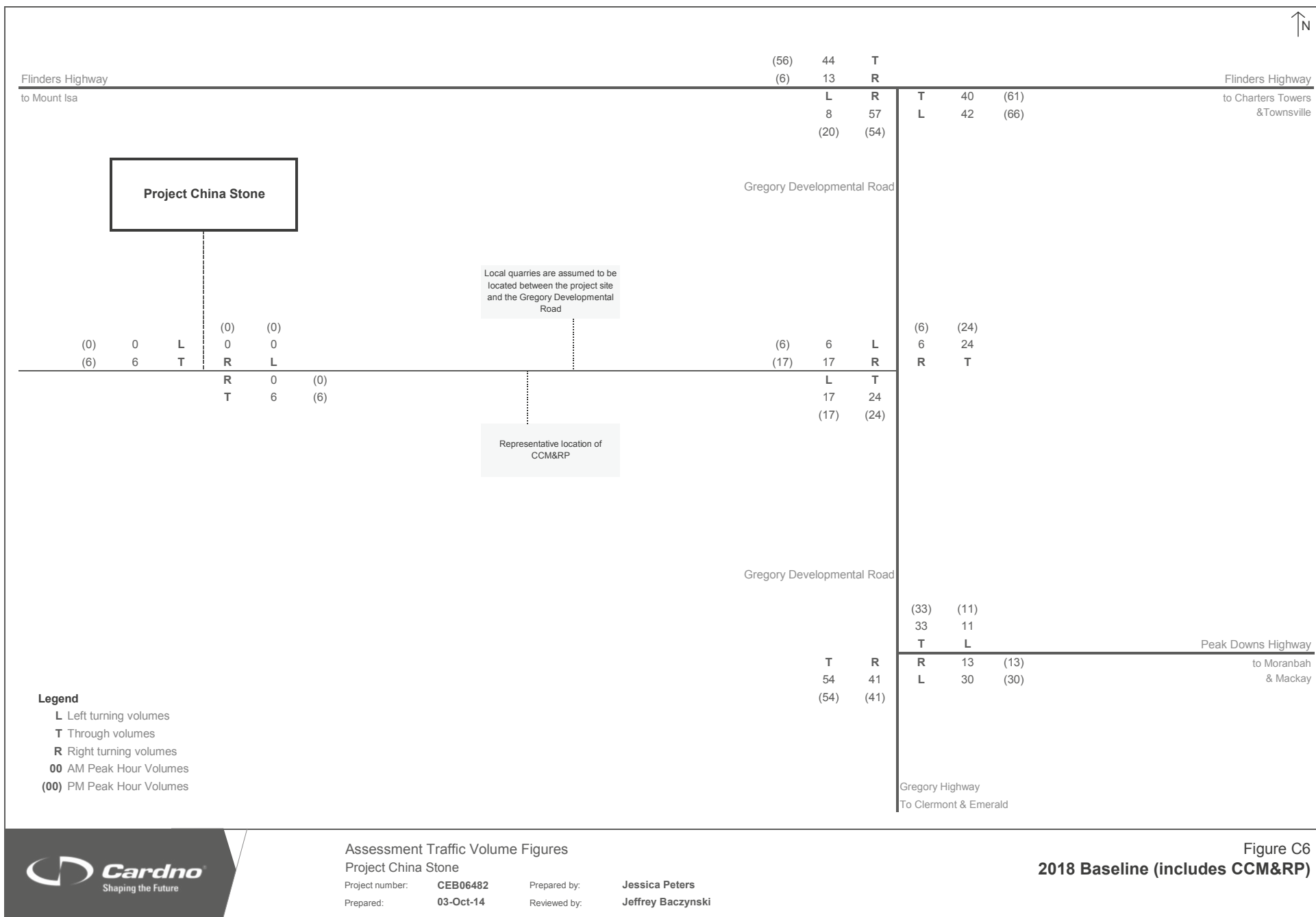


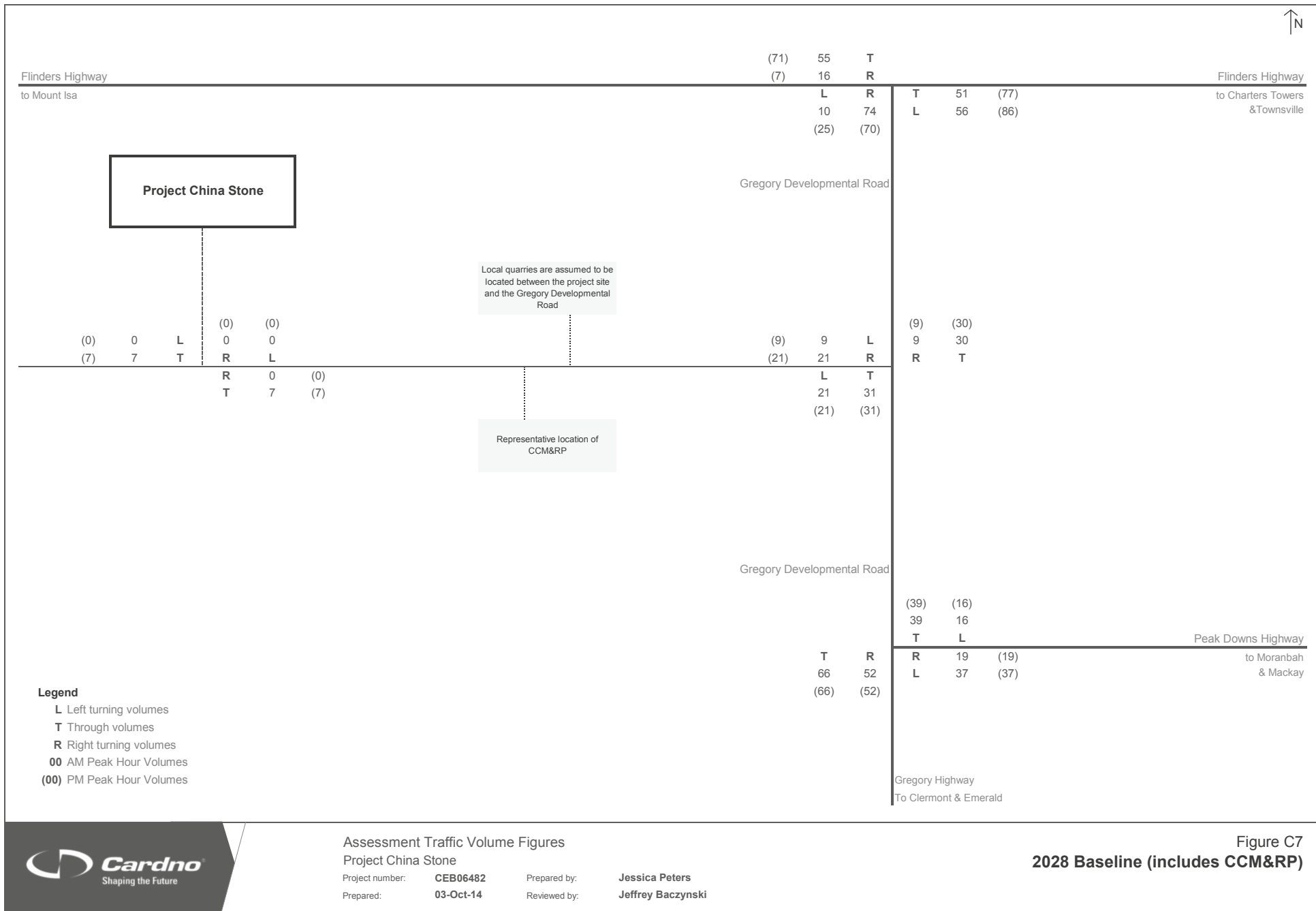


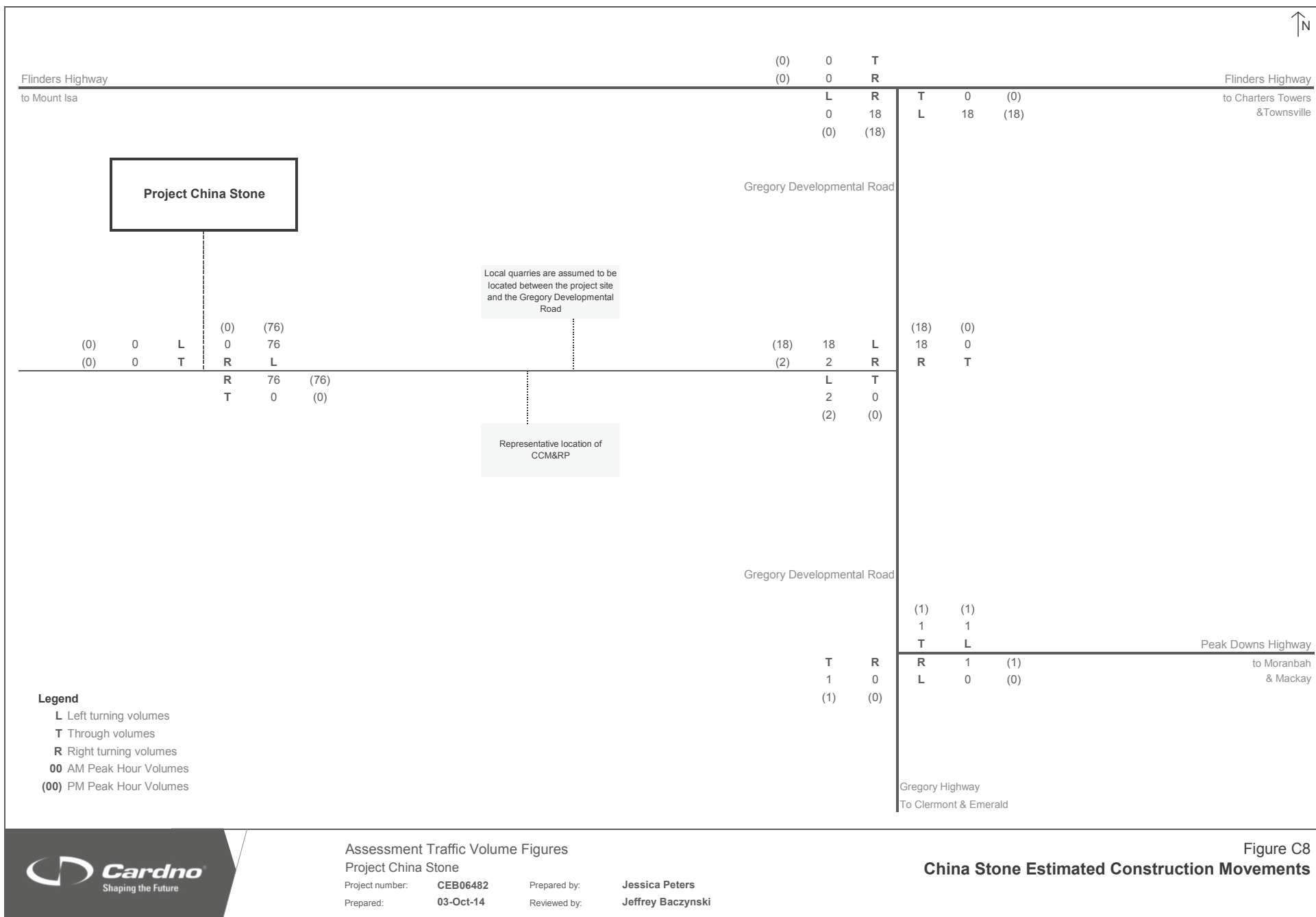


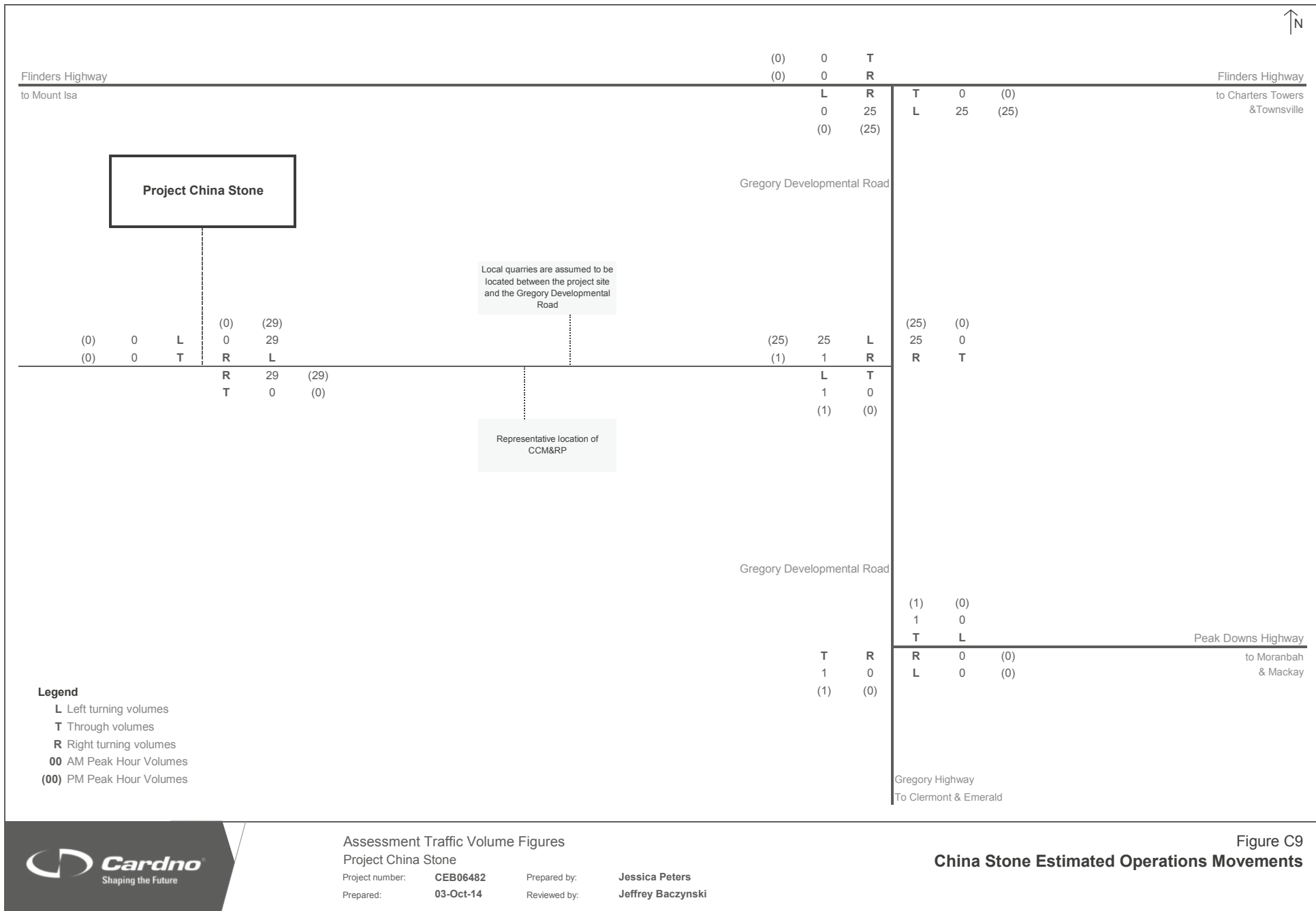


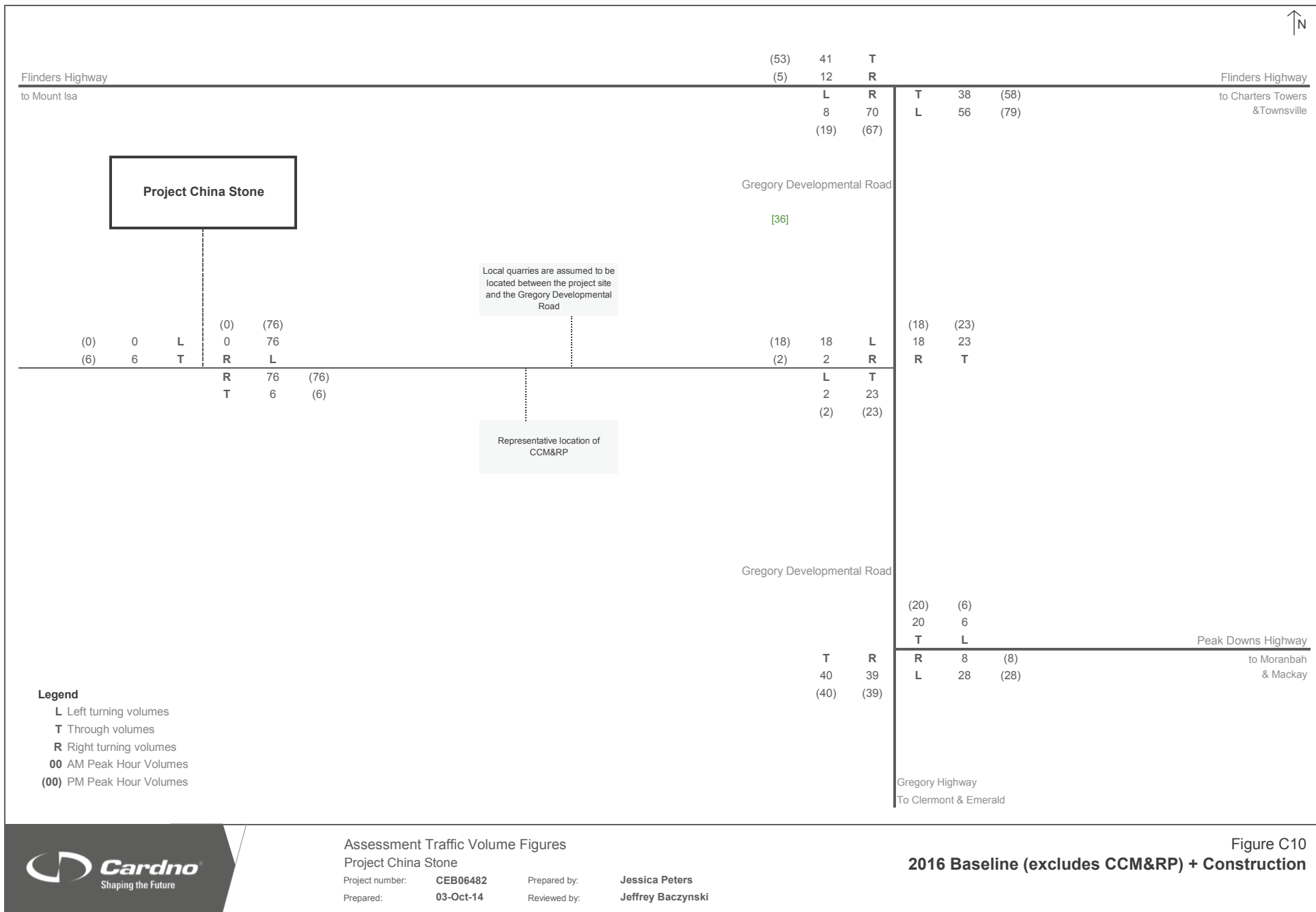


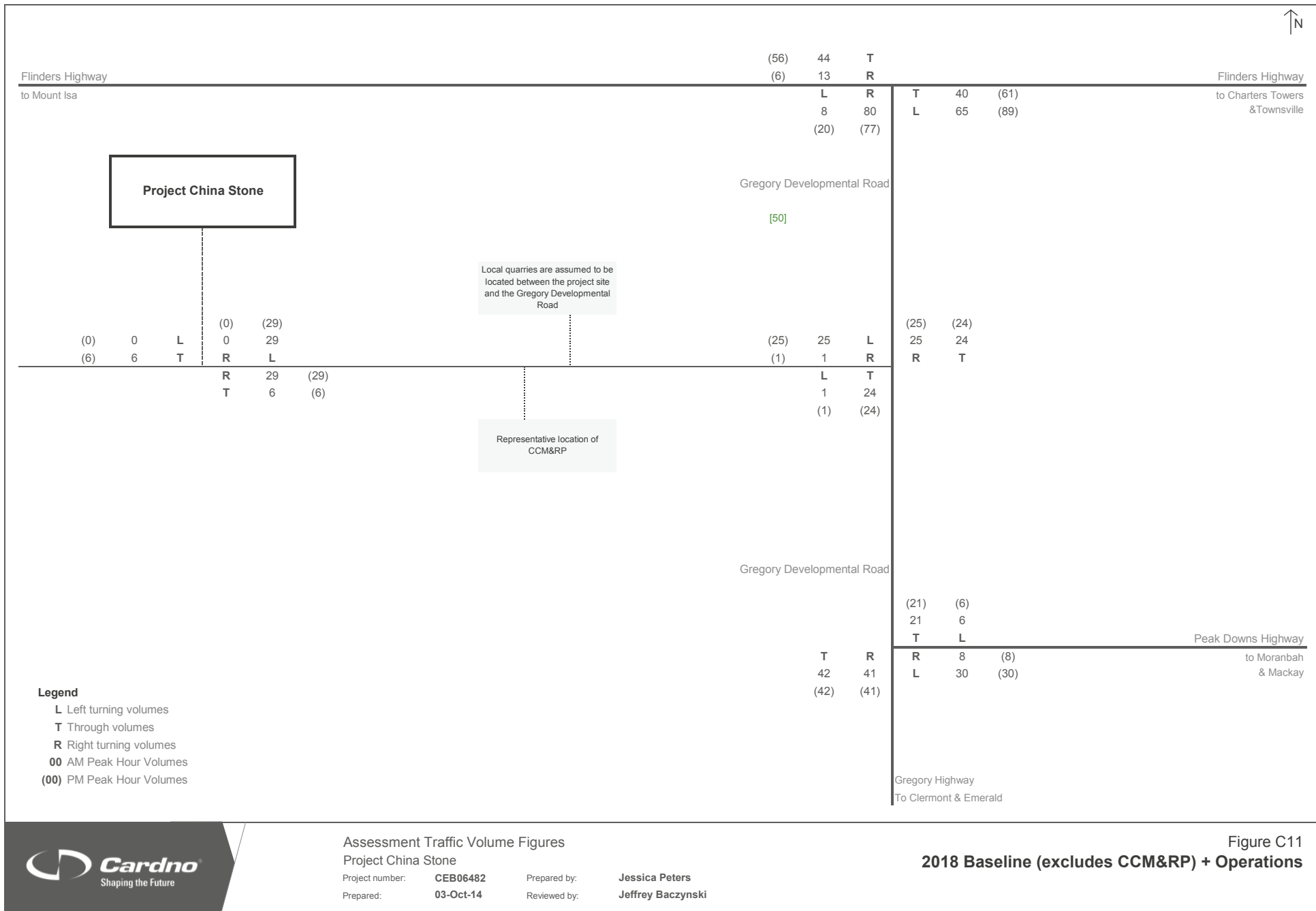


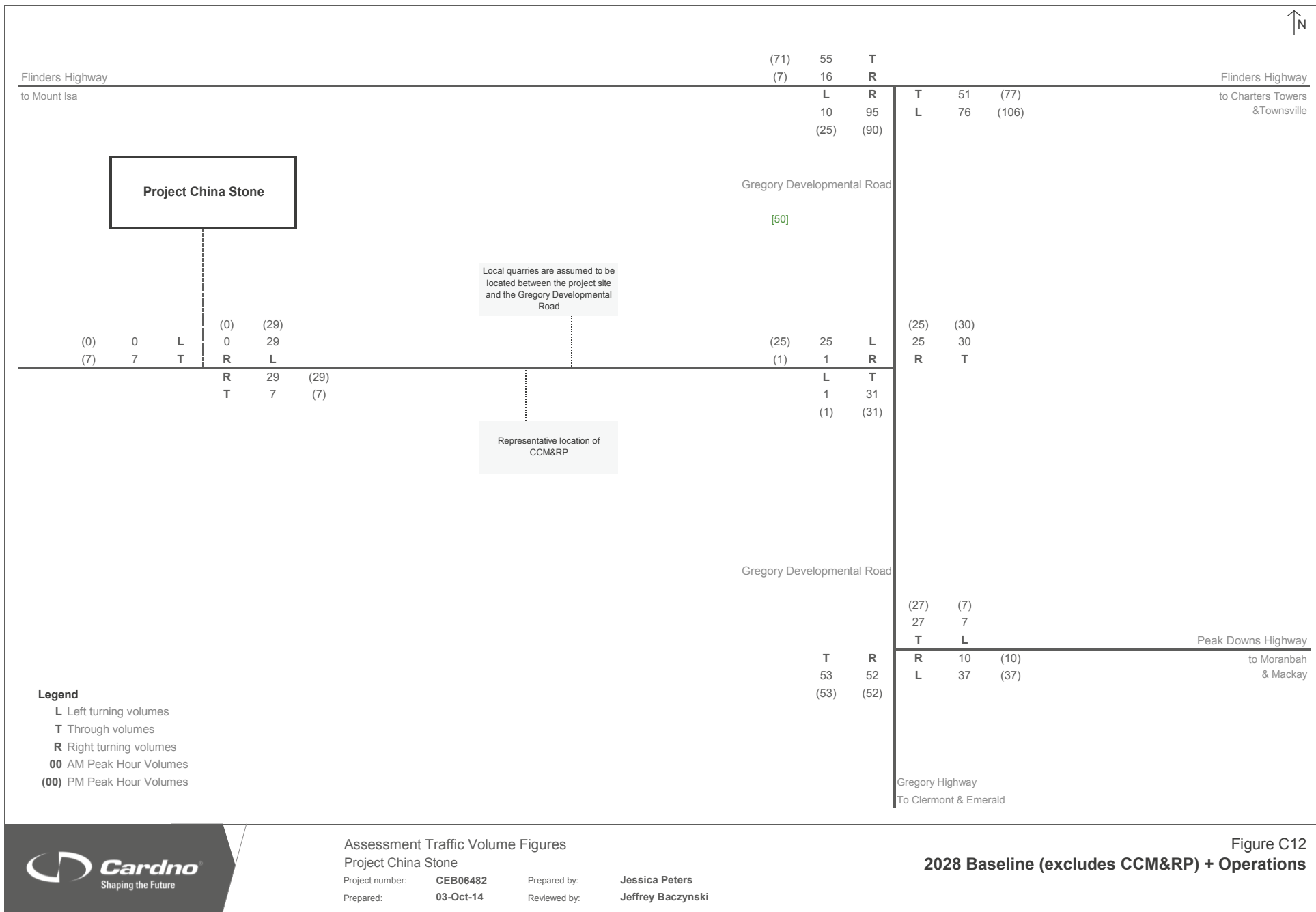


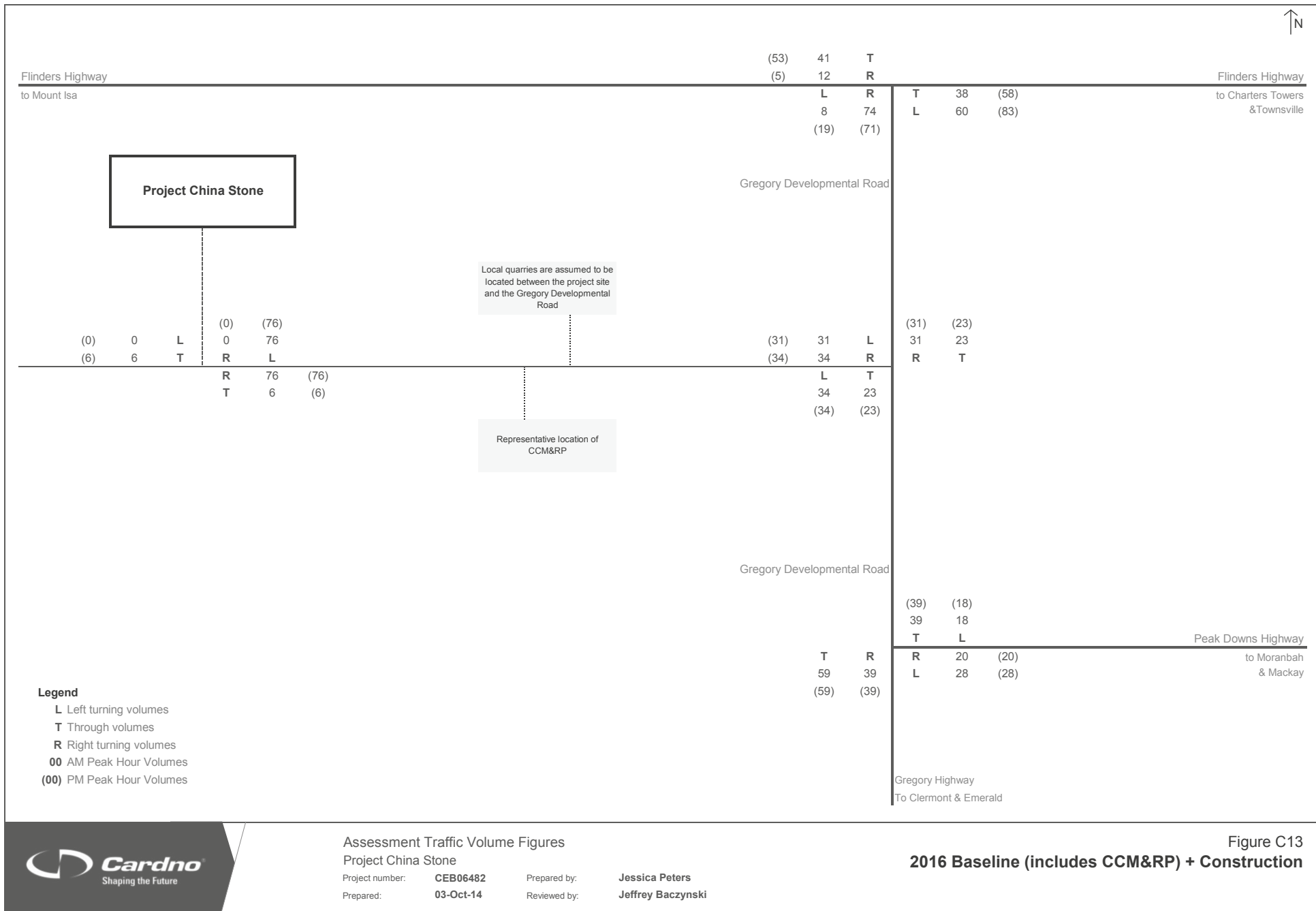


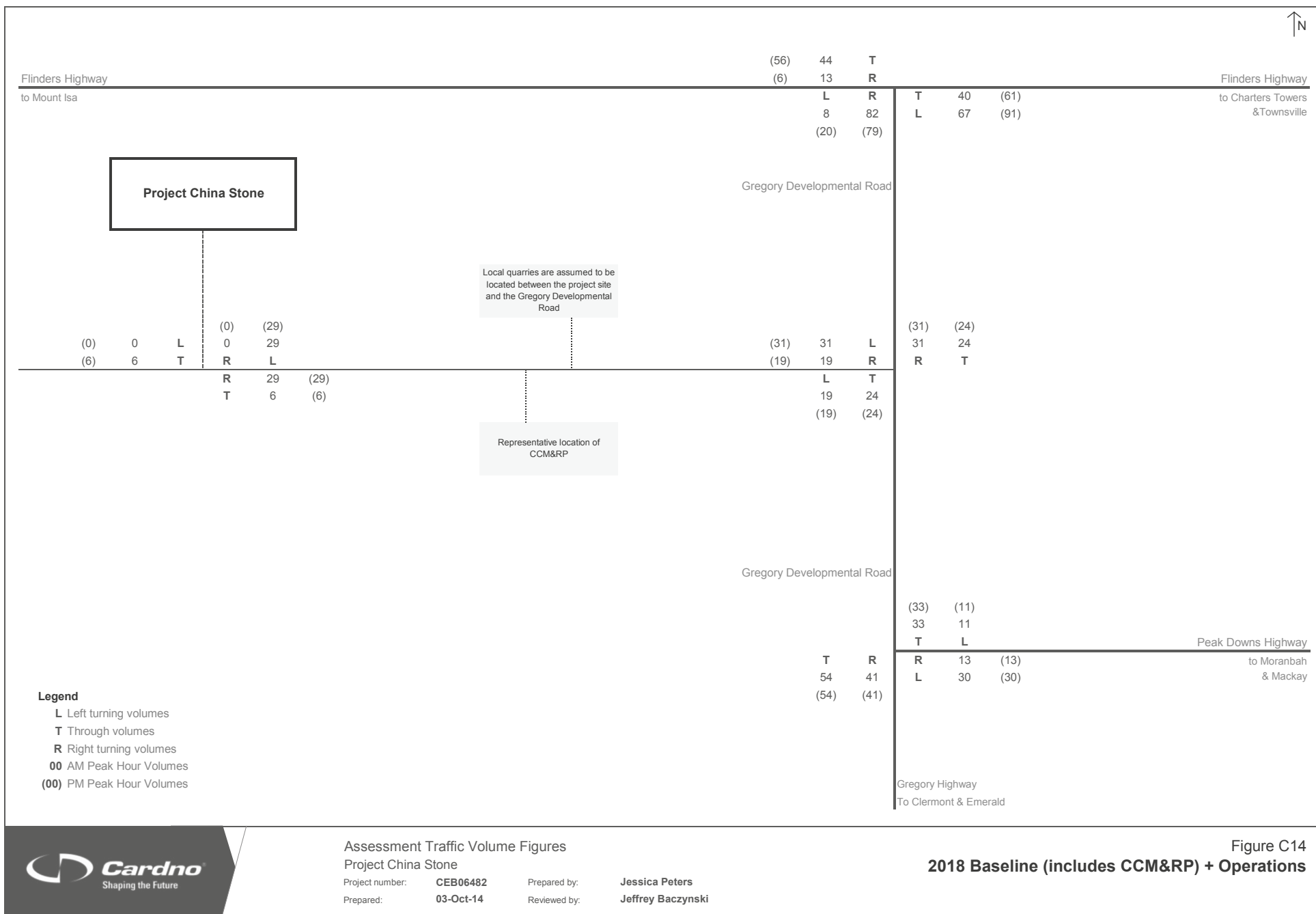


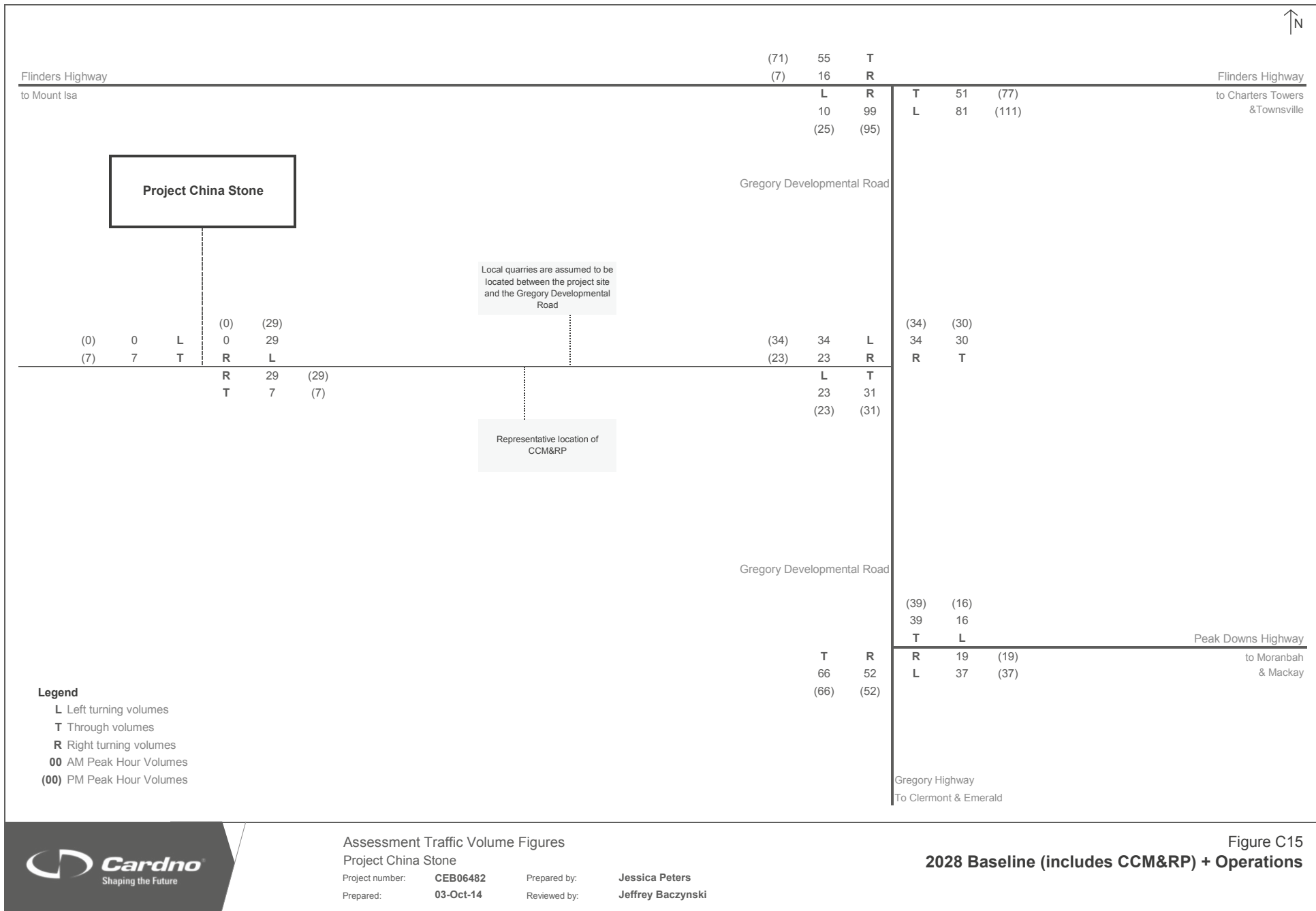










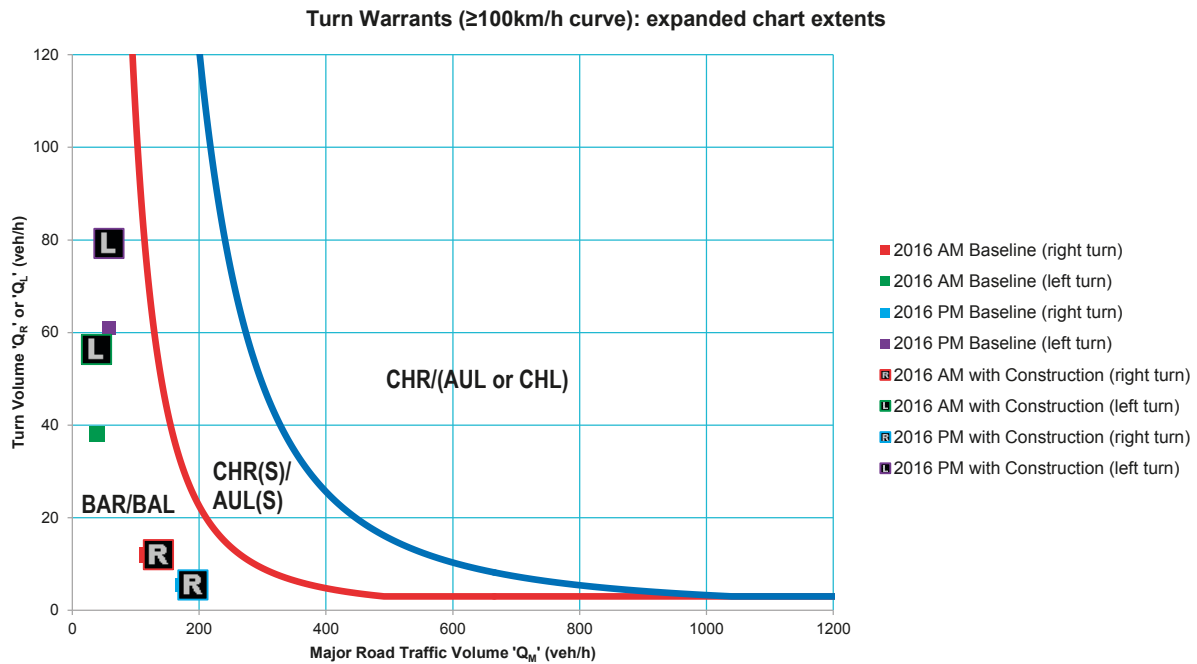


## Project China Stone

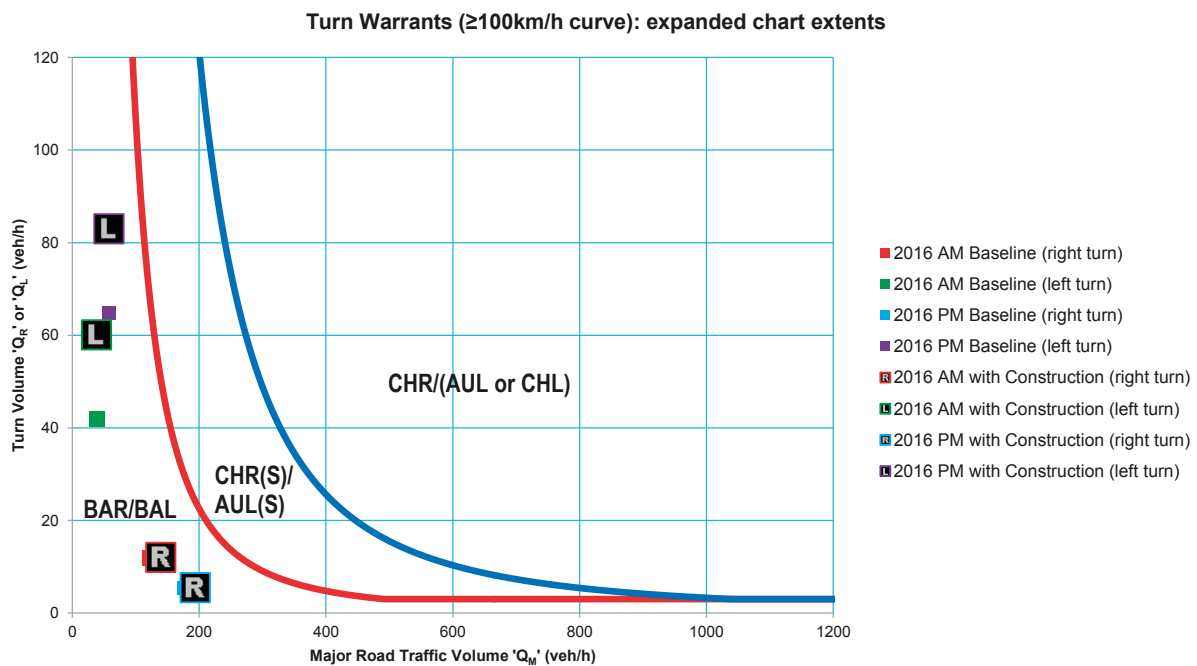
# APPENDIX D

## TURN WARRANTS

## Excluding CCM&amp;RP



## Including CCM&amp;RP



If shown, expanded chart area based on New Warrants for Unsignalised Intersection Turn Treatments (Report Number ID0105 June 2005)

Turn Warrants  
Project China Stone

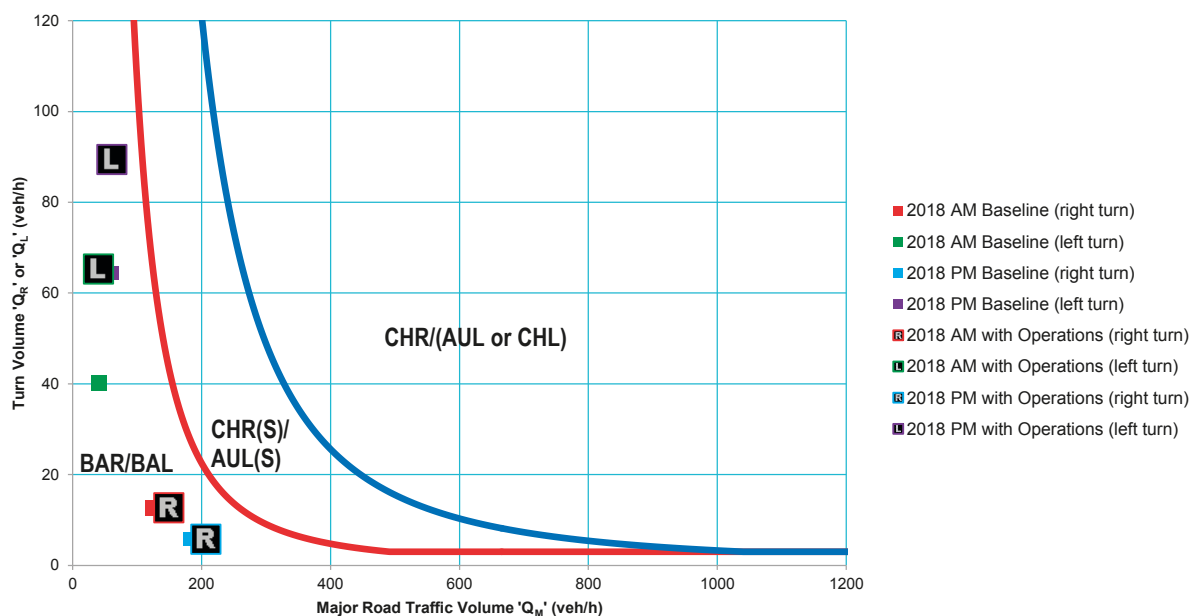
Project number: CEB06482  
Prepared: 10-Sep-14

Prepared by: Jessica Peters  
Reviewed by: Jeffrey Baczynski

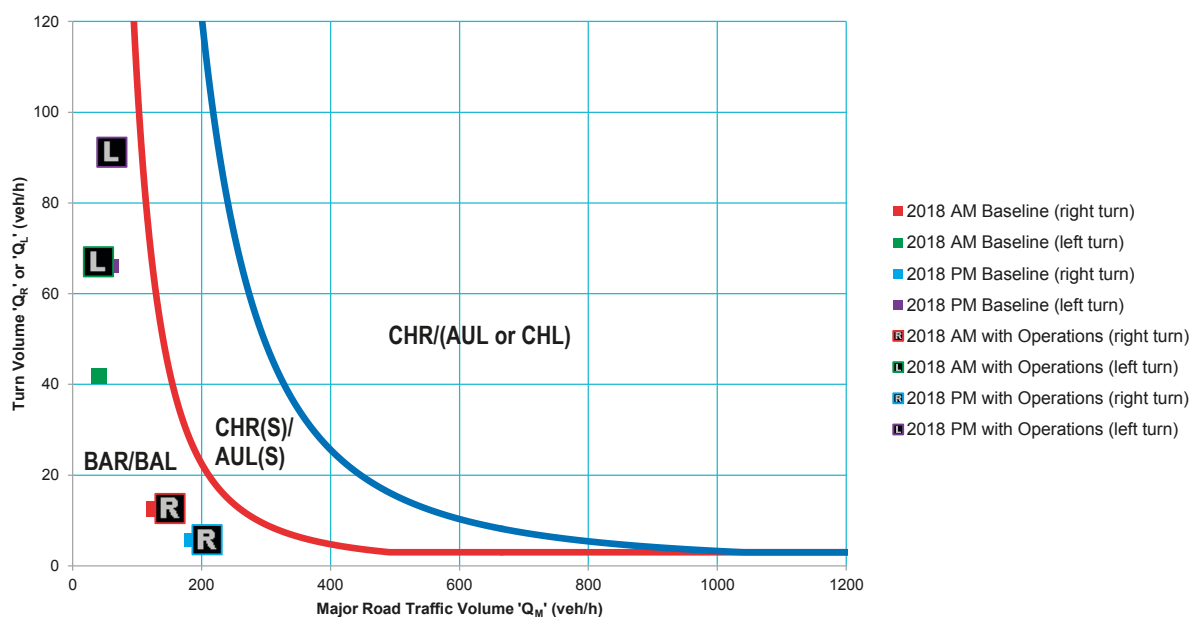
## Legend

BAR Basic Right Turn  
CHR(S) Channelised Right Turn (short)  
CHR Channelised Right Turn  
BAL Basic Left Turn  
AUL(S) Auxiliary Left Turn (short)  
AUL Auxiliary Left Turn

## Excluding CCM&amp;RP

Turn Warrants ( $\geq 100\text{km/h}$  curve): expanded chart extents

## Including CCM&amp;RP

Turn Warrants ( $\geq 100\text{km/h}$  curve): expanded chart extents

If shown, expanded chart area based on New Warrants for Unsignalised Intersection Turn Treatments (Report Number ID0105 June 2005)

### Turn Warrants

#### Project China Stone

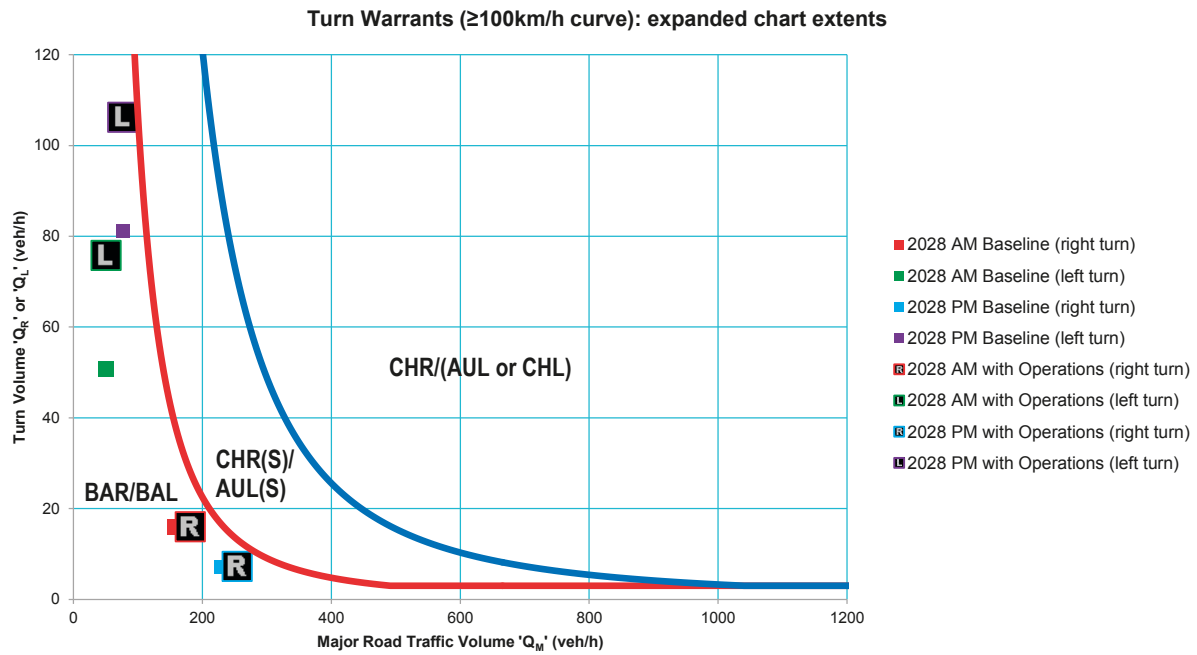
Project number: CEB06482  
Prepared: 10-Sep-14

Prepared by: Jessica Peters  
Reviewed by: Jeffrey Baczynski

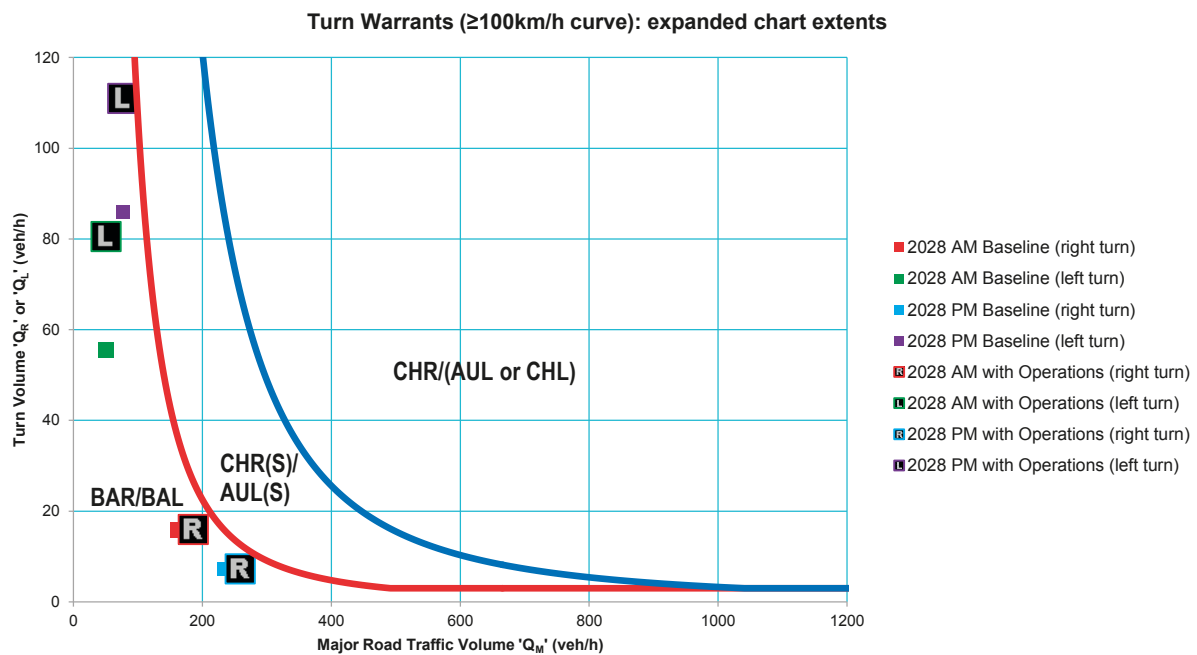
**Legend**

BAR Basic Right Turn  
CHR(S) Channelised Right Turn (short)  
CHR Channelised Right Turn  
BAL Basic Left Turn  
AUL(S) Auxiliary Left Turn (short)  
AUL Auxiliary Left Turn

## Excluding CCM&amp;RP



## Including CCM&amp;RP



If shown, expanded chart area based on New Warrants for Unsignalised Intersection Turn Treatments (Report Number ID0105 June 2005)

### Turn Warrants

#### Project China Stone

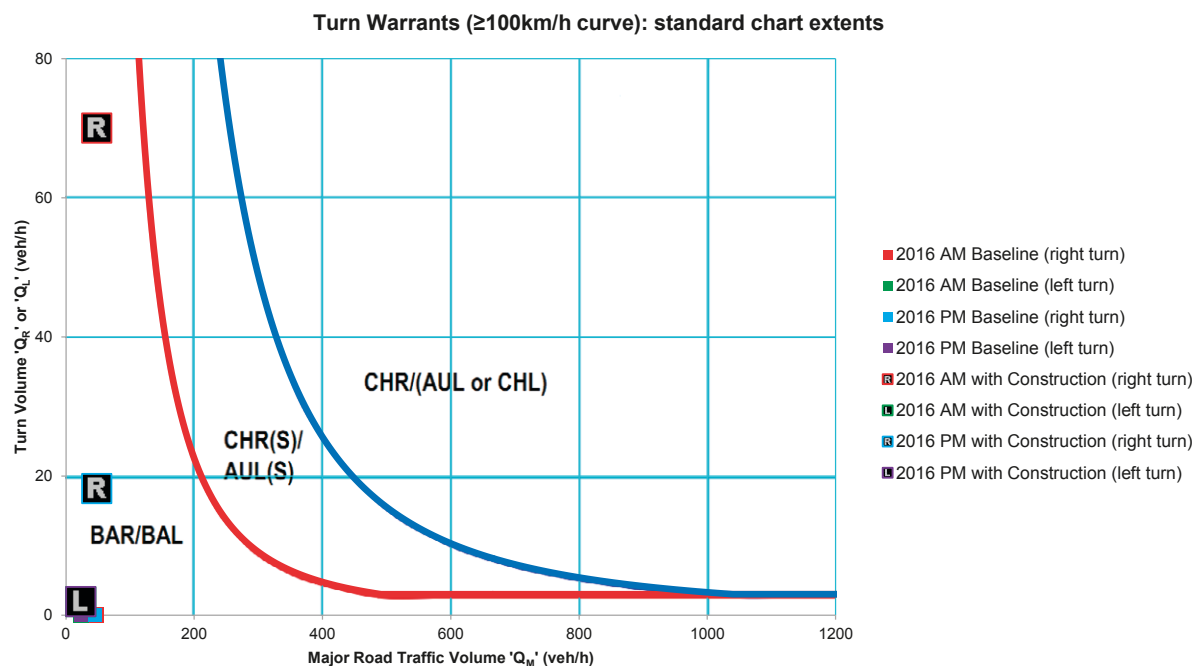
Project number: CEB06482  
Prepared: 10-Sep-14

Prepared by: Jessica Peters  
Reviewed by: Jeffrey Baczynski

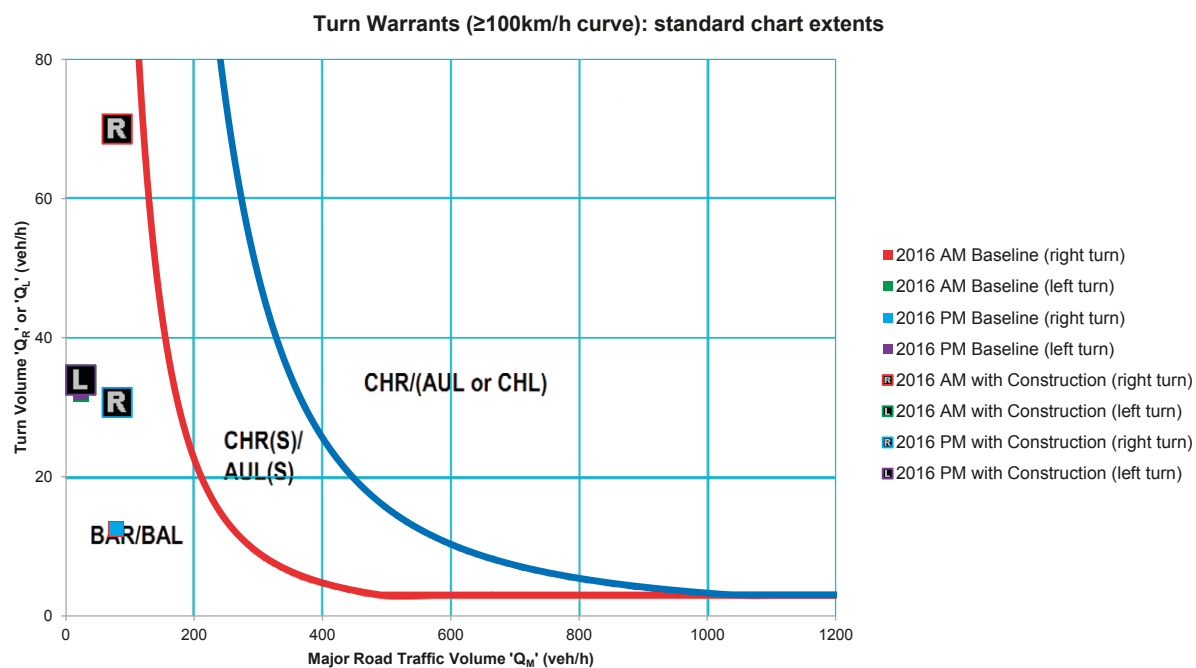
**Legend**

BAR Basic Right Turn  
CHR(S) Channelised Right Turn (short)  
CHR Channelised Right Turn  
BAL Basic Left Turn  
AUL(S) Auxiliary Left Turn (short)  
AUL Auxiliary Left Turn

## Excluding CCM&amp;RP



## Including CCM&amp;RP



If shown, expanded chart area based on New Warrants for Unsignalised Intersection Turn Treatments (Report Number ID0105 June 2005)

### Turn Warrants

#### Project China Stone

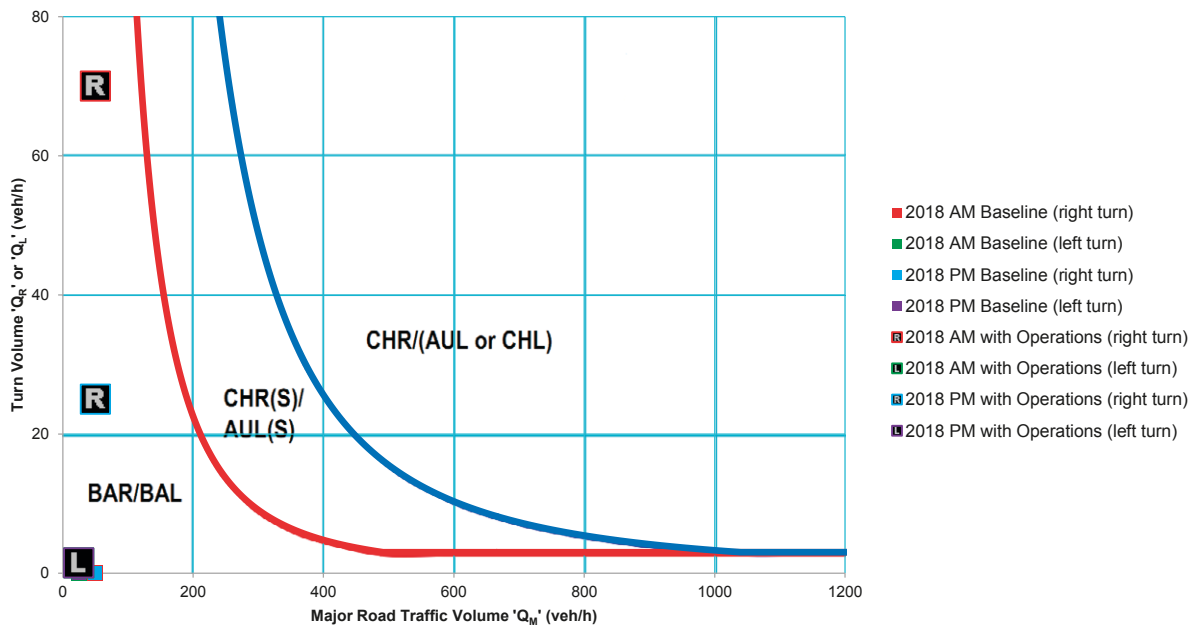
Project number: CEB06482  
Prepared: 10-Sep-14

Prepared by: Jessica Peters  
Reviewed by: Jeffrey Baczynski

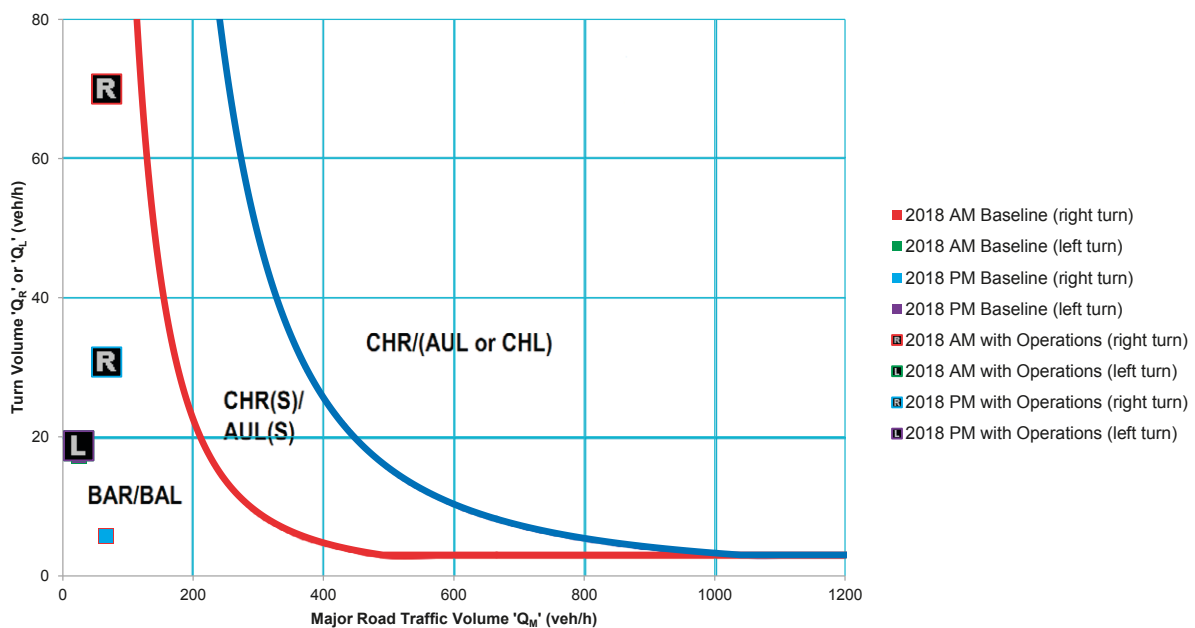
**Legend**

BAR Basic Right Turn  
CHR(S) Channelised Right Turn (short)  
CHR Channelised Right Turn  
BAL Basic Left Turn  
AUL(S) Auxiliary Left Turn (short)  
AUL Auxiliary Left Turn

## Excluding CCM&amp;RP

Turn Warrants ( $\geq 100\text{km/h}$  curve): standard chart extents

## Including CCM&amp;RP

Turn Warrants ( $\geq 100\text{km/h}$  curve): standard chart extents

If shown, expanded chart area based on New Warrants for Unsignalised Intersection Turn Treatments (Report Number ID0105 June 2005)

Turn Warrants  
Project China Stone

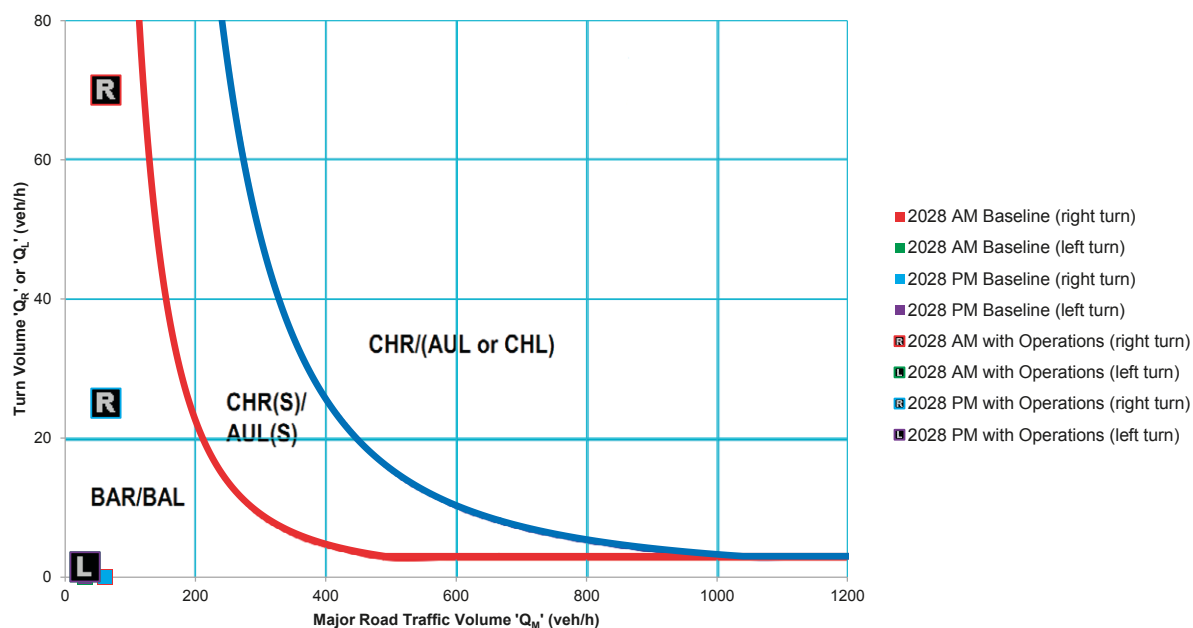
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Prepared: 10-Sep-14

Prepared by: Jessica Peters  
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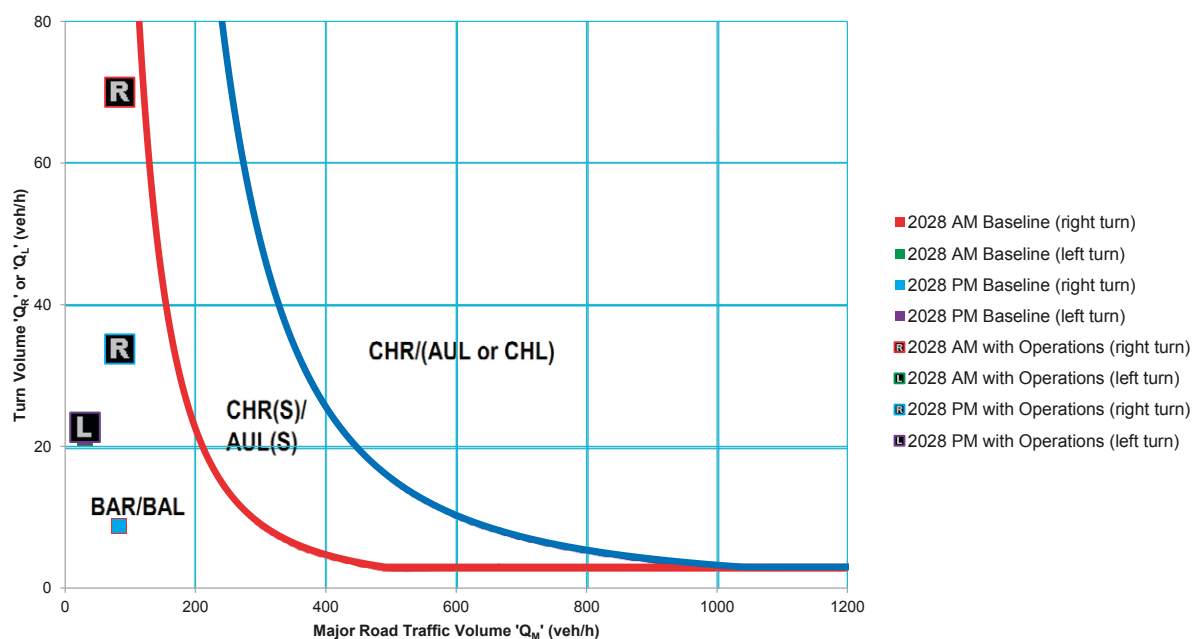
## Legend

|        |                                |
|--------|--------------------------------|
| BAR    | Basic Right Turn               |
| CHR(S) | Channelised Right Turn (short) |
| CHR    | Channelised Right Turn         |
| BAL    | Basic Left Turn                |
| AUL(S) | Auxiliary Left Turn (short)    |
| AUL    | Auxiliary Left Turn            |

## Excluding CCM&amp;RP

Turn Warrants ( $\geq 100\text{km/h}$  curve): standard chart extents

## Including CCM&amp;RP

Turn Warrants ( $\geq 100\text{km/h}$  curve): standard chart extents

If shown, expanded chart area based on New Warrants for Unsignalised Intersection Turn Treatments (Report Number ID0105 June 2005)

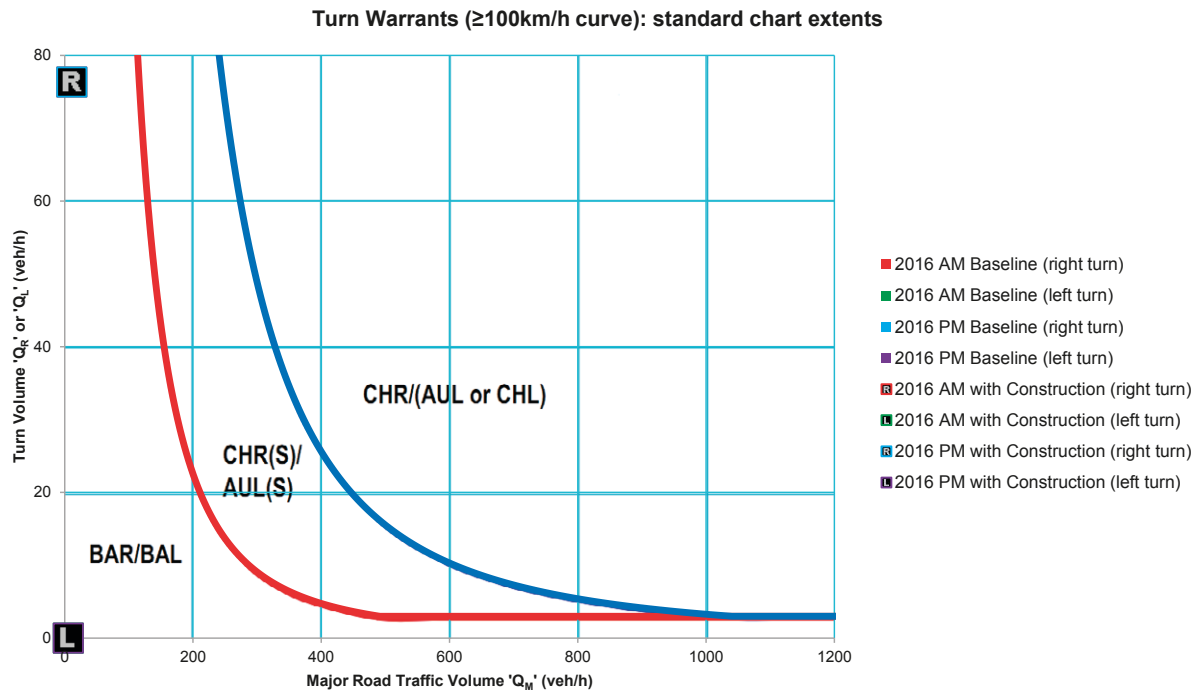
Turn Warrants  
Project China Stone

Project number: CEB06482  
Prepared: 10-Sep-14

Prepared by: Jessica Peters  
Reviewed by: Jeffrey Baczynski

## Legend

BAR Basic Right Turn  
CHR(S) Channelised Right Turn (short)  
CHR Channelised Right Turn  
BAL Basic Left Turn  
AUL(S) Auxiliary Left Turn (short)  
AUL Auxiliary Left Turn



*If shown, expanded chart area based on New Warrants for Unsignalised Intersection Turn Treatments (Report Number ID0105 June 2005)*

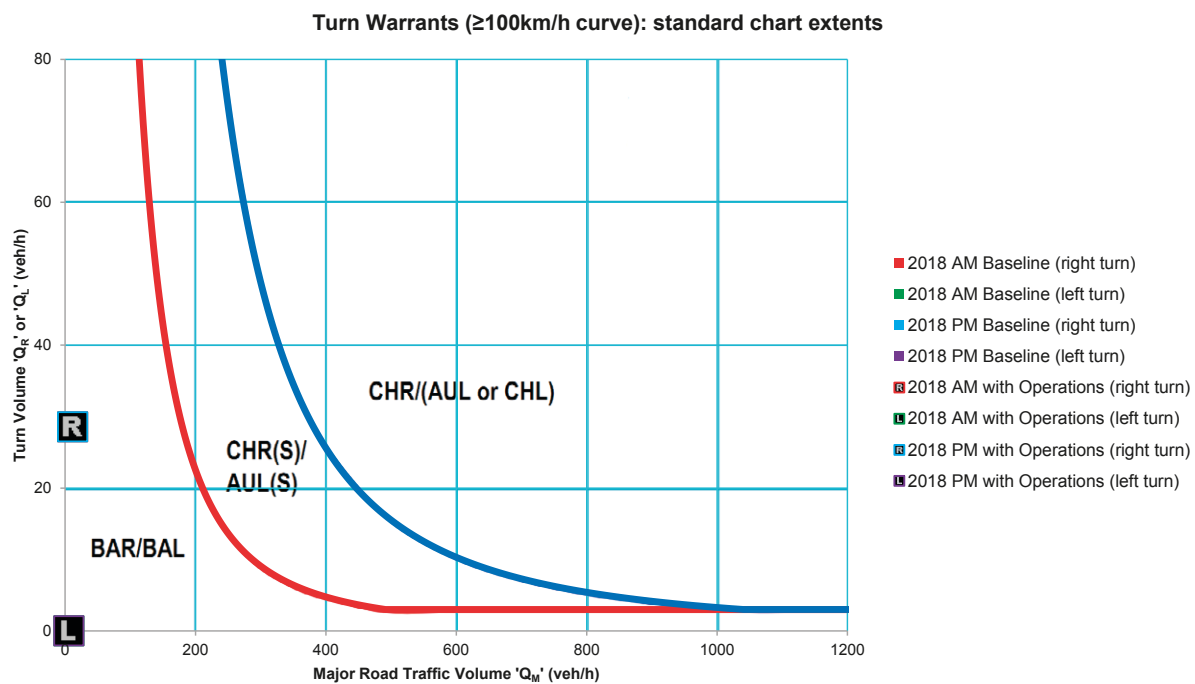
**Turn Warrants**  
**Project China Stone**

Project number: **CEB06482**  
Prepared: **10-Sep-14**

Prepared by: **Jessica Peters**  
Reviewed by: **Jeffrey Baczynski**

**Legend**

BAR Basic Right Turn  
CHR(S) Channelised Right Turn (short)  
CHR Channelised Right Turn  
BAL Basic Left Turn  
AUL(S) Auxiliary Left Turn (short)  
AUL Auxiliary Left Turn



*If shown, expanded chart area based on New Warrants for Unsignalised Intersection Turn Treatments (Report Number ID0105 June 2005)*

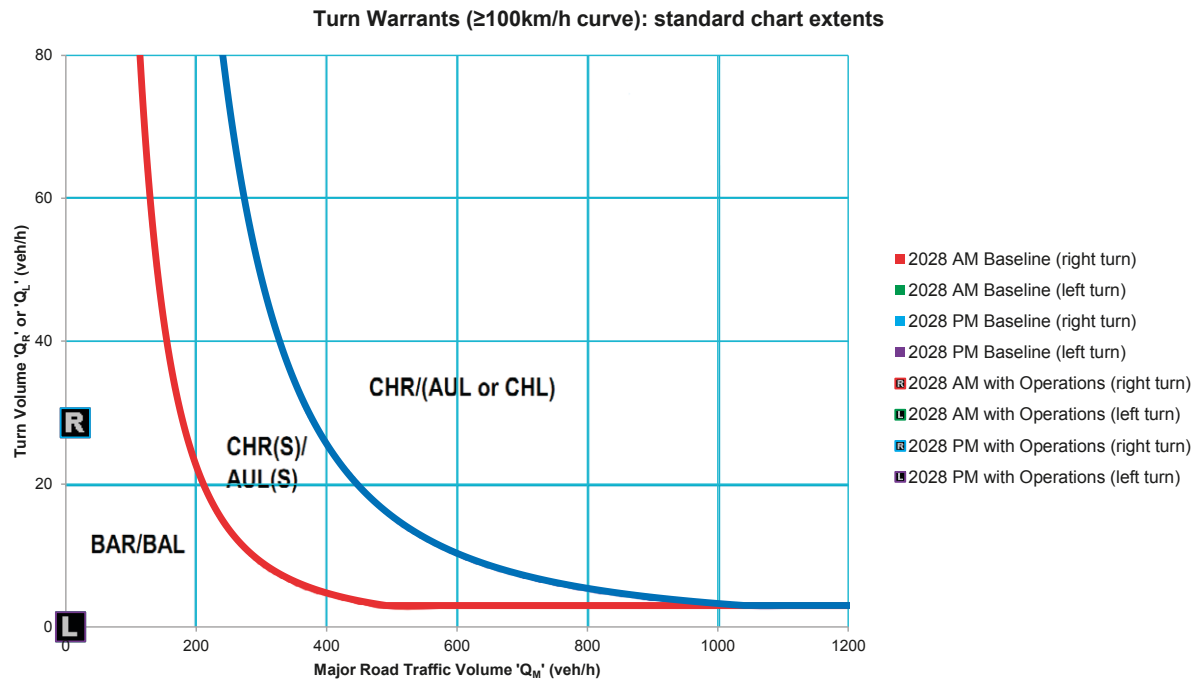
#### Turn Warrants Project China Stone

Project number: **CEB06482**  
Prepared: **10-Sep-14**

Prepared by: **Jessica Peters**  
Reviewed by: **Jeffrey Baczynski**

#### Legend

BAR Basic Right Turn  
CHR(S) Channelised Right Turn (short)  
CHR Channelised Right Turn  
BAL Basic Left Turn  
AUL(S) Auxiliary Left Turn (short)  
AUL Auxiliary Left Turn



With and without CCM&RP is the same

If shown, expanded chart area based on New Warrants for Unsignalised Intersection Turn Treatments (Report Number ID0105 June 2005)

#### Turn Warrants Project China Stone

Project number: **CEB06482**  
Prepared: **10-Sep-14**

Prepared by: **Jessica Peters**  
Reviewed by: **Jeffrey Baczynski**

#### Legend

|        |                                |
|--------|--------------------------------|
| BAR    | Basic Right Turn               |
| CHR(S) | Channelised Right Turn (short) |
| CHR    | Channelised Right Turn         |
| BAL    | Basic Left Turn                |
| AUL(S) | Auxiliary Left Turn (short)    |
| AUL    | Auxiliary Left Turn            |

## Project China Stone

# APPENDIX E

## PAVEMENT IMPACT ASSESSMENT

## ASSESSMENT INPUTS

|                           |                       |
|---------------------------|-----------------------|
| Roughness Increase        | 3 counts/year         |
| Terminal Roughness        | 120 counts            |
| Inflation Rate            | 4.23% p.a. (compound) |
| Discount Rate             | 6.00% p.a. (compound) |
| Heavy Vehicle Growth Rate | 3.00% p.a. (compound) |
| Mitigation Timeframe      | 10 years              |
| Base Year                 | 2014                  |
| Cost Base Year            | 2014                  |

## AVERAGE ESAs

|                               |          |
|-------------------------------|----------|
| 2C: 2-Axle Trucks and Buses   | 0.8 ESAs |
| 2C: 3-Axle Trucks and Buses   | 1.5 ESAs |
| 2E: 4-Axle Trucks             | 1.9 ESAs |
| 2F: 3-Axle Articulated Trucks | 1.8 ESAs |
| 2G: 4-Axle Articulated Trucks | 1.8 ESAs |
| 2H: 5-Axle Articulated Trucks | 2.3 ESAs |
| 2I: 6-Axle Articulated Trucks | 2.7 ESAs |
| 2J: B-Double                  | 3.0 ESAs |
| 2K: Double Road Trains        | 3.4 ESAs |
| 2L: Triple Road Trains        | 3.8 ESAs |

*Establishment of a New Pavement Maintenance Database -  
Stage 1 and 2 Analysis (AP-R394-11)*

## Pavement Impact Assessment Project China Stone

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## Network Assessed

### Directional Sections

| Cardno<br>ID# | Section Details |                   |              |           |
|---------------|-----------------|-------------------|--------------|-----------|
|               | TMR<br>ROAD     | Chainage<br>Start | Chainage End | Direction |
| 1             | 841             | 0.000 km          | 7.336 km     | G         |
| 2             | 841             | 0.000 km          | 7.336 km     | A         |
| 3             | 14A             | 0.000 km          | 2.474 km     | G         |
| 4             | 14A             | 0.000 km          | 2.474 km     | A         |
| 5             | 14A             | 2.474 km          | 9.419 km     | G         |
| 6             | 14A             | 2.474 km          | 9.419 km     | A         |
| 7             | 14A             | 9.419 km          | 122.108 km   | G         |
| 8             | 14A             | 9.419 km          | 122.108 km   | A         |
| 9             | 14A             | 122.108 km        | 124.930 km   | G         |
| 10            | 14A             | 122.108 km        | 124.930 km   | A         |
| 11            | 14A             | 124.930 km        | 126.149 km   | G         |
| 12            | 14A             | 124.930 km        | 126.149 km   | A         |
| 13            | 14B             | 0.000 km          | 3.480 km     | G         |
| 14            | 14B             | 0.000 km          | 3.480 km     | A         |
| 23            | 98B             | 0.000 km          | 142.757 km   | G         |
| 24            | 98B             | 0.000 km          | 142.757 km   | A         |
| 25            | 98B             | 142.757 km        | 193.163 km   | G         |
| 26            | 98B             | 142.757 km        | 193.163 km   | A         |
| 27            | 98A             | 0.000 km          | 27.760 km    | G         |
| 28            | 98A             | 0.000 km          | 27.760 km    | A         |
| 29            | 98A             | 27.760 km         | 101.000 km   | G         |
| 30            | 98A             | 27.760 km         | 101.000 km   | A         |
| 31            | 98A             | 101.000 km        | 157.880 km   | G         |
| 32            | 98A             | 101.000 km        | 157.880 km   | A         |
| 33            | 27C             | 0.000 km          | 9.830 km     | G         |
| 34            | 27C             | 0.000 km          | 9.830 km     | A         |
| 35            | 27C             | 9.830 km          | 14.000 km    | G         |
| 36            | 27C             | 9.830 km          | 14.000 km    | A         |
| 37            | 33A             | 0.000 km          | 89.050 km    | G         |
| 38            | 33A             | 0.000 km          | 89.050 km    | A         |
| 39            | 33A             | 89.050 km         | 90.370 km    | G         |
| 40            | 33A             | 89.050 km         | 90.370 km    | A         |

## Pavement Impact Assessment

### Project China Stone

## Project Loadings

### Equivalent Standard Axles (ESAs) per Year

| Cardno<br>ID# | Section Details |                   |                 |           | 2014 | 2015 | 2016   | 2017   | 2018   | 2019   | 2020   | 2021   | 2022   | 2023   | 2024   | 2025   | 2026   | 2027   | 2028   | 2029   |
|---------------|-----------------|-------------------|-----------------|-----------|------|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|               | TMR<br>ROAD     | Chainage<br>Start | Chainage<br>End | Direction |      |      |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| 1             | 841             | 0.000 km          | 7.336 km        | G         | 0    | 0    | 3,053  | 3,053  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  |
| 2             | 841             | 0.000 km          | 7.336 km        | A         | 0    | 0    | 17,118 | 17,118 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 |
| 3             | 14A             | 0.000 km          | 2.474 km        | G         | 0    | 0    | 17,118 | 17,118 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 |
| 4             | 14A             | 0.000 km          | 2.474 km        | A         | 0    | 0    | 3,053  | 3,053  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  |
| 5             | 14A             | 2.474 km          | 9.419 km        | G         | 0    | 0    | 17,118 | 17,118 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 |
| 6             | 14A             | 2.474 km          | 9.419 km        | A         | 0    | 0    | 3,053  | 3,053  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  |
| 7             | 14A             | 9.419 km          | 122.108 km      | G         | 0    | 0    | 17,118 | 17,118 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 |
| 8             | 14A             | 9.419 km          | 122.108 km      | A         | 0    | 0    | 3,053  | 3,053  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  |
| 9             | 14A             | 122.108 km        | 124.930 km      | G         | 0    | 0    | 17,118 | 17,118 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 |
| 10            | 14A             | 122.108 km        | 124.930 km      | A         | 0    | 0    | 3,053  | 3,053  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  |
| 11            | 14A             | 124.930 km        | 126.149 km      | G         | 0    | 0    | 17,118 | 17,118 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 | 40,359 |
| 12            | 14A             | 124.930 km        | 126.149 km      | A         | 0    | 0    | 3,053  | 3,053  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  | 8,624  |
| 13            | 14B             | 0.000 km          | 3.480 km        | G         | 0    | 0    | 25,148 | 25,148 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 |
| 14            | 14B             | 0.000 km          | 3.480 km        | A         | 0    | 0    | 4,845  | 4,845  | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 |
| 23            | 98B             | 0.000 km          | 142.757 km      | G         | 0    | 0    | 4,845  | 4,845  | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 |
| 24            | 98B             | 0.000 km          | 142.757 km      | A         | 0    | 0    | 25,148 | 25,148 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 |
| 25            | 98B             | 142.757 km        | 193.163 km      | G         | 0    | 0    | 4,845  | 4,845  | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 |
| 26            | 98B             | 142.757 km        | 193.163 km      | A         | 0    | 0    | 25,148 | 25,148 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 |
| 27            | 98A             | 0.000 km          | 27.760 km       | G         | 0    | 0    | 5,907  | 5,907  | 434    | 434    | 434    | 434    | 434    | 434    | 434    | 434    | 434    | 434    | 434    | 434    |
| 28            | 98A             | 0.000 km          | 27.760 km       | A         | 0    | 0    | 815    | 815    | 354    | 354    | 354    | 354    | 354    | 354    | 354    | 354    | 354    | 354    | 354    | 354    |
| 29            | 98A             | 27.760 km         | 101.000 km      | G         | 0    | 0    | 5,907  | 5,907  | 434    | 434    | 434    | 434    | 434    | 434    | 434    | 434    | 434    | 434    | 434    | 434    |
| 30            | 98A             | 27.760 km         | 101.000 km      | A         | 0    | 0    | 815    | 815    | 354    | 354    | 354    | 354    | 354    | 354    | 354    | 354    | 354    | 354    | 354    | 354    |
| 31            | 98A             | 101.000 km        | 157.880 km      | G         | 0    | 0    | 4,845  | 4,845  | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 | 10,748 |
| 32            | 98A             | 101.000 km        | 157.880 km      | A         | 0    | 0    | 25,148 | 25,148 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 | 48,721 |
| 33            | 27C             | 0.000 km          | 9.830 km        | G         | 0    | 0    | 33     | 33     | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    |
| 34            | 27C             | 0.000 km          | 9.830 km        | A         | 0    | 0    | 33     | 33     | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    |
| 35            | 27C             | 9.830 km          | 14.000 km       | G         | 0    | 0    | 33     | 33     | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    |
| 36            | 27C             | 9.830 km          | 14.000 km       | A         | 0    | 0    | 33     | 33     | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    | 332    |
| 37            | 33A             | 0.000 km          | 89.050 km       | G         | 0    | 0    | 782    | 782    | 22     | 22     | 22     | 22     | 22     | 22     | 22     | 22     | 22     | 22     | 22     | 22     |
| 38            | 33A             | 0.000 km          | 89.050 km       | A         | 0    | 0    | 5,874  | 5,874  | 101    | 101    | 101    | 101    | 101    | 101    | 101    | 101    | 101    | 101    | 101    | 101    |
| 39            | 33A             | 89.050 km         | 90.370 km       | G         | 0    | 0    | 782    | 782    | 22     | 22     | 22     | 22     | 22     | 22     | 22     | 22     | 22     | 22     | 22     | 22     |
| 40            | 33A             | 89.050 km         | 90.370 km       | A         | 0    | 0    | 5,874  | 5,874  | 101    | 101    | 101    | 101    | 101    | 101    | 101    | 101    | 101    | 101    | 101    | 101    |

## Pavement Impact Assessment

### Project China Stone

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## Section Properties of Assessed Road Network

## Traffic Volumes and Scoping

| Cardno<br>ID# | Section Details |                   |              |           | Traffic Volumes        |           |        |         |        |                        |              | BASE<br>YEAR ESAs | Scoping Tests         |                                  |                  |                                |                                         | SCOPED |
|---------------|-----------------|-------------------|--------------|-----------|------------------------|-----------|--------|---------|--------|------------------------|--------------|-------------------|-----------------------|----------------------------------|------------------|--------------------------------|-----------------------------------------|--------|
|               | TMR<br>ROAD     | Chainage<br>Start | Chainage End | Direction | AADT<br>Survey<br>Year | AADT      | HV %   | HV AADT | ESA/HV | Survey<br>Year<br>ESAs | HV<br>Growth |                   | Peak<br>Const<br>ESAs | Const %<br>Impact on<br>Baseline | Peak Ops<br>ESAs | Ops %<br>Impact on<br>Baseline | Peak %<br>Impact on<br>Baseline<br>ESAs |        |
| 1             | 841             | 0.000 km          | 7.336 km     | G         | 2013                   | 995 vpd   | 28.24% | 281 vpd | 2.274  | 233,272                | 3.0%         | 240,270           | 3,053                 | 1%                               | 8,624            | 4%                             | 4%                                      | No     |
| 2             | 841             | 0.000 km          | 7.336 km     | A         | 2013                   | 871 vpd   | 30.77% | 268 vpd | 2.309  | 225,862                | 3.0%         | 232,638           | 17,118                | 7%                               | 40,359           | 18%                            | 18%                                     | Yes    |
| 3             | 14A             | 0.000 km          | 2.474 km     | G         | 2012                   | 717 vpd   | 43.24% | 310 vpd | 2.393  | 270,830                | 3.0%         | 287,080           | 17,118                | 6%                               | 40,359           | 15%                            | 15%                                     | Yes    |
| 4             | 14A             | 0.000 km          | 2.474 km     | A         | 2012                   | 835 vpd   | 40.72% | 340 vpd | 2.396  | 297,366                | 3.0%         | 315,207           | 3,053                 | 1%                               | 8,624            | 3%                             | 3%                                      | No     |
| 5             | 14A             | 2.474 km          | 9.419 km     | G         | 2012                   | 2,602 vpd | 23.17% | 603 vpd | 1.792  | 394,225                | 3.0%         | 417,879           | 17,118                | 4%                               | 40,359           | 10%                            | 10%                                     | Yes    |
| 6             | 14A             | 2.474 km          | 9.419 km     | A         | 2012                   | 2,591 vpd | 23.04% | 597 vpd | 1.778  | 387,318                | 3.0%         | 410,557           | 3,053                 | 1%                               | 8,624            | 2%                             | 2%                                      | No     |
| 7             | 14A             | 9.419 km          | 122.108 km   | G         | 2012                   | 1,176 vpd | 18.11% | 213 vpd | 2.089  | 162,352                | 3.0%         | 172,093           | 17,118                | 10%                              | 40,359           | 25%                            | 25%                                     | Yes    |
| 8             | 14A             | 9.419 km          | 122.108 km   | A         | 2012                   | 1,149 vpd | 17.67% | 203 vpd | 2.088  | 154,760                | 3.0%         | 164,046           | 3,053                 | 2%                               | 8,624            | 6%                             | 6%                                      | Yes    |
| 9             | 14A             | 122.108 km        | 124.930 km   | G         | 2012                   | 929 vpd   | 22.17% | 206 vpd | 2.201  | 165,455                | 3.0%         | 175,382           | 17,118                | 10%                              | 40,359           | 24%                            | 24%                                     | Yes    |
| 10            | 14A             | 122.108 km        | 124.930 km   | A         | 2012                   | 1,010 vpd | 22.38% | 226 vpd | 2.132  | 175,857                | 3.0%         | 186,408           | 3,053                 | 2%                               | 8,624            | 5%                             | 5%                                      | No     |
| 11            | 14A             | 124.930 km        | 126.149 km   | G         | 2012                   | 1,413 vpd | 16.70% | 236 vpd | 2.074  | 178,668                | 3.0%         | 189,388           | 17,118                | 9%                               | 40,359           | 23%                            | 23%                                     | Yes    |
| 12            | 14A             | 124.930 km        | 126.149 km   | A         | 2012                   | 1,519 vpd | 15.73% | 239 vpd | 2.083  | 181,661                | 3.0%         | 192,560           | 3,053                 | 2%                               | 8,624            | 5%                             | 5%                                      | No     |
| 13            | 14B             | 0.000 km          | 3.480 km     | G         | 2012                   | 1,536 vpd | 18.82% | 289 vpd | 1.909  | 201,444                | 3.0%         | 213,530           | 25,148                | 12%                              | 48,721           | 24%                            | 24%                                     | Yes    |
| 14            | 14B             | 0.000 km          | 3.480 km     | A         | 2012                   | 1,620 vpd | 19.63% | 318 vpd | 1.848  | 214,474                | 3.0%         | 227,342           | 4,845                 | 2%                               | 10,748           | 5%                             | 5%                                      | Yes    |
| 23            | 98B             | 0.000 km          | 142.757 km   | G         | 2012                   | 219 vpd   | 29.68% | 65 vpd  | 2.128  | 50,480                 | 3.0%         | 53,508            | 4,845                 | 9%                               | 10,748           | 21%                            | 21%                                     | Yes    |
| 24            | 98B             | 0.000 km          | 142.757 km   | A         | 2012                   | 210 vpd   | 26.19% | 55 vpd  | 2.364  | 47,450                 | 3.0%         | 50,297            | 25,148                | 50%                              | 48,721           | 103%                           | 103%                                    | Yes    |
| 25            | 98B             | 142.757 km        | 193.163 km   | G         | 2013                   | 373 vpd   | 23.32% | 87 vpd  | 2.264  | 71,869                 | 3.0%         | 74,025            | 4,845                 | 7%                               | 10,748           | 15%                            | 15%                                     | Yes    |
| 26            | 98B             | 142.757 km        | 193.163 km   | A         | 2013                   | 384 vpd   | 24.74% | 95 vpd  | 2.103  | 72,927                 | 3.0%         | 75,115            | 25,148                | 33%                              | 48,721           | 67%                            | 67%                                     | Yes    |
| 27            | 98A             | 0.000 km          | 27.760 km    | G         | 2013                   | 262 vpd   | 30.15% | 79 vpd  | 2.307  | 66,503                 | 3.0%         | 68,498            | 5,907                 | 9%                               | 434              | 1%                             | 9%                                      | Yes    |
| 28            | 98A             | 0.000 km          | 27.760 km    | A         | 2013                   | 250 vpd   | 33.60% | 84 vpd  | 2.394  | 73,402                 | 3.0%         | 75,604            | 815                   | 1%                               | 354              | 0%                             | 1%                                      | No     |
| 29            | 98A             | 27.760 km         | 101.000 km   | G         | 2013                   | 213 vpd   | 30.05% | 64 vpd  | 2.636  | 61,576                 | 3.0%         | 63,423            | 5,907                 | 9%                               | 434              | 1%                             | 9%                                      | Yes    |
| 30            | 98A             | 27.760 km         | 101.000 km   | A         | 2013                   | 221 vpd   | 32.13% | 71 vpd  | 2.605  | 67,525                 | 3.0%         | 69,551            | 815                   | 1%                               | 354              | 1%                             | 1%                                      | No     |
| 31            | 98A             | 101.000 km        | 157.880 km   | G         | 2013                   | 213 vpd   | 30.05% | 64 vpd  | 2.636  | 61,576                 | 3.0%         | 63,423            | 4,845                 | 8%                               | 10,748           | 17%                            | 17%                                     | Yes    |
| 32            | 98A             | 101.000 km        | 157.880 km   | A         | 2013                   | 221 vpd   | 32.13% | 71 vpd  | 2.605  | 67,525                 | 3.0%         | 69,551            | 25,148                | 36%                              | 48,721           | 72%                            | 72%                                     | Yes    |
| 33            | 27C             | 0.000 km          | 9.830 km     | G         | 2013                   | 933 vpd   | 22.94% | 214 vpd | 1.936  | 151,256                | 3.0%         | 155,794           | 33                    | 0%                               | 332              | 0%                             | 0%                                      | No     |
| 34            | 27C             | 0.000 km          | 9.830 km     | A         | 2013                   | 945 vpd   | 21.69% | 205 vpd | 1.998  | 149,504                | 3.0%         | 153,989           | 33                    | 0%                               | 332              | 0%                             | 0%                                      | No     |
| 35            | 27C             | 9.830 km          | 14.000 km    | G         | 2013                   | 719 vpd   | 21.84% | 157 vpd | 2.267  | 129,940                | 3.0%         | 133,838           | 33                    | 0%                               | 332              | 0%                             | 0%                                      | No     |
| 36            | 27C             | 9.830 km          | 14.000 km    | A         | 2013                   | 738 vpd   | 24.25% | 179 vpd | 2.273  | 148,446                | 3.0%         | 152,899           | 33                    | 0%                               | 332              | 0%                             | 0%                                      | No     |
| 37            | 33A             | 0.000 km          | 89.050 km    | G         | 2013                   | 328 vpd   | 31.10% | 102 vpd | 2.195  | 81,724                 | 3.0%         | 84,175            | 782                   | 1%                               | 22               | 0%                             | 1%                                      | No     |
| 38            | 33A             | 0.000 km          | 89.050 km    | A         | 2013                   | 322 vpd   | 30.75% | 99 vpd  | 2.199  | 79,461                 | 3.0%         | 81,844            | 5,874                 | 7%                               | 101              | 0%                             | 7%                                      | Yes    |
| 39            | 33A             | 89.050 km         | 90.370 km    | G         | 2013                   | 2,184 vpd | 27.01% | 590 vpd | 2.146  | 462,163                | 3.0%         | 476,028           | 782                   | 0%                               | 22               | 0%                             | 0%                                      | No     |
| 40            | 33A             | 89.050 km         | 90.370 km    | A         | 2013                   | 2,135 vpd | 26.98% | 576 vpd | 2.215  | 465,631                | 3.0%         | 479,599           | 5,874                 | 1%                               | 101              | 0%                             | 1%                                      | No     |

## Pavement Impact Assessment

### Project China Stone

## Section Properties of Assessed Road Network

### Constructed and Expenditure Properties

| Cardno<br>ID# | Section Details |                   |              |           | Physical Attributes |            |                            |                  |                          |                      |
|---------------|-----------------|-------------------|--------------|-----------|---------------------|------------|----------------------------|------------------|--------------------------|----------------------|
|               | TMR<br>ROAD     | Chainage<br>Start | Chainage End | Direction | Lanes               | Length     | Total<br>Pavement<br>Width | Section<br>Width | Roughness<br>Survey Year | Average<br>Roughness |
| 1             | 841             | 0.000 km          | 7.336 km     | G         |                     | 7.336 km   | 13.80 m                    | 6.90 m           | 2013                     | 60.00                |
| 2             | 841             | 0.000 km          | 7.336 km     | A         |                     | 7.336 km   | 13.80 m                    | 6.90 m           | 2013                     | 60.00                |
| 3             | 14A             | 0.000 km          | 2.474 km     | G         |                     | 2.474 km   | 14.85 m                    | 7.43 m           | 2013                     | 47.96                |
| 4             | 14A             | 0.000 km          | 2.474 km     | A         |                     | 2.474 km   | 14.85 m                    | 7.43 m           | 2013                     | 47.96                |
| 5             | 14A             | 2.474 km          | 9.419 km     | G         |                     | 6.945 km   | 11.14 m                    | 5.57 m           | 2013                     | 43.23                |
| 6             | 14A             | 2.474 km          | 9.419 km     | A         |                     | 6.945 km   | 11.14 m                    | 5.57 m           | 2013                     | 43.23                |
| 7             | 14A             | 9.419 km          | 122.108 km   | G         |                     | 112.689 km | 9.89 m                     | 4.95 m           | 2013                     | 49.72                |
| 8             | 14A             | 9.419 km          | 122.108 km   | A         |                     | 112.689 km | 9.89 m                     | 4.95 m           | 2013                     | 49.72                |
| 9             | 14A             | 122.108 km        | 124.930 km   | G         |                     | 2.822 km   | 9.47 m                     | 4.74 m           | 2013                     | 84.10                |
| 10            | 14A             | 122.108 km        | 124.930 km   | A         |                     | 2.822 km   | 9.47 m                     | 4.74 m           | 2013                     | 84.10                |
| 11            | 14A             | 124.930 km        | 126.149 km   | G         |                     | 1.219 km   | 10.17 m                    | 5.09 m           | 2013                     | 61.76                |
| 12            | 14A             | 124.930 km        | 126.149 km   | A         |                     | 1.219 km   | 10.17 m                    | 5.09 m           | 2013                     | 61.76                |
| 13            | 14B             | 0.000 km          | 3.480 km     | G         |                     | 3.480 km   | 14.21 m                    | 7.11 m           | 2013                     | 58.09                |
| 14            | 14B             | 0.000 km          | 3.480 km     | A         |                     | 3.480 km   | 14.21 m                    | 7.11 m           | 2013                     | 58.09                |
| 23            | 98B             | 0.000 km          | 142.757 km   | G         |                     | 142.757 km | 7.65 m                     | 3.82 m           | 2013                     | 63.23                |
| 24            | 98B             | 0.000 km          | 142.757 km   | A         |                     | 142.757 km | 7.65 m                     | 3.82 m           | 2013                     | 63.23                |
| 25            | 98B             | 142.757 km        | 193.163 km   | G         |                     | 50.406 km  | 8.60 m                     | 4.30 m           | 2013                     | 51.76                |
| 26            | 98B             | 142.757 km        | 193.163 km   | A         |                     | 50.406 km  | 8.60 m                     | 4.30 m           | 2013                     | 51.76                |
| 27            | 98A             | 0.000 km          | 27.760 km    | G         |                     | 27.760 km  | 7.31 m                     | 3.65 m           | 2013                     | 69.76                |
| 28            | 98A             | 0.000 km          | 27.760 km    | A         |                     | 27.760 km  | 7.31 m                     | 3.65 m           | 2013                     | 69.76                |
| 29            | 98A             | 27.760 km         | 101.000 km   | G         |                     | 73.240 km  | 7.72 m                     | 3.86 m           | 2013                     | 63.53                |
| 30            | 98A             | 27.760 km         | 101.000 km   | A         |                     | 73.240 km  | 7.72 m                     | 3.86 m           | 2013                     | 63.53                |
| 31            | 98A             | 101.000 km        | 157.880 km   | G         |                     | 56.880 km  | 8.48 m                     | 4.24 m           | 2013                     | 56.60                |
| 32            | 98A             | 101.000 km        | 157.880 km   | A         |                     | 56.880 km  | 8.48 m                     | 4.24 m           | 2013                     | 56.60                |
| 33            | 27C             | 0.000 km          | 9.830 km     | G         |                     | 9.830 km   | 9.81 m                     | 4.91 m           | 2013                     | 82.52                |
| 34            | 27C             | 0.000 km          | 9.830 km     | A         |                     | 9.830 km   | 9.81 m                     | 4.91 m           | 2013                     | 82.52                |
| 35            | 27C             | 9.830 km          | 14.000 km    | G         |                     | 4.170 km   | 10.64 m                    | 5.32 m           | 2013                     | 51.43                |
| 36            | 27C             | 9.830 km          | 14.000 km    | A         |                     | 4.170 km   | 10.64 m                    | 5.32 m           | 2013                     | 51.43                |
| 37            | 33A             | 0.000 km          | 89.050 km    | G         |                     | 89.050 km  | 7.58 m                     | 3.79 m           | 2013                     | 75.36                |
| 38            | 33A             | 0.000 km          | 89.050 km    | A         |                     | 89.050 km  | 7.58 m                     | 3.79 m           | 2013                     | 75.36                |
| 39            | 33A             | 89.050 km         | 90.370 km    | G         |                     | 1.320 km   | 15.72 m                    | 7.86 m           | 2013                     | 50.35                |
| 40            | 33A             | 89.050 km         | 90.370 km    | A         |                     | 1.320 km   | 15.72 m                    | 7.86 m           | 2013                     | 50.35                |

## Pavement Impact Assessment

### Project China Stone

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## Potential Rehabilitation Impacts

| Cardno ID# | Section Details |                |              |           | ESA Scoped | Roughness Characteristics |                |                    |                     |                            | Baseline ESAs |                      | With Project ESAs |            |                      | Rehabilitation Scoping Tests |                              |                         |
|------------|-----------------|----------------|--------------|-----------|------------|---------------------------|----------------|--------------------|---------------------|----------------------------|---------------|----------------------|-------------------|------------|----------------------|------------------------------|------------------------------|-------------------------|
|            | TMR ROAD        | Chainage Start | Chainage End | Direction |            | Surveyed Roughness        | Roughness Year | Deterioration Rate | Base Year Roughness | Adopted Terminal Roughness | Rehab Date    | Predicted Breakpoint | Break Year        | Rehab Date | Bring Forward Period | Bring Forward > 1 Year       | Within Mitigation Timeframe? | Contribution Warranted? |
| 1          | 841             | 0.000 km       | 7.336 km     | G         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 2          | 841             | 0.000 km       | 7.336 km     | A         | Yes        | 60.00                     | 2013           | 3.0                | 63.0                | 120.0                      | 2033.00       | 5,978,793            | 2031              | 2031.31    | 1.69                 | Yes                          | No                           | No                      |
| 3          | 14A             | 0.000 km       | 2.474 km     | G         | Yes        | 47.96                     | 2013           | 3.0                | 51.0                | 120.0                      | 2037.01       | 9,273,589            | 2035              | 2035.40    | 1.61                 | Yes                          | No                           | No                      |
| 4          | 14A             | 0.000 km       | 2.474 km     | A         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 5          | 14A             | 2.474 km       | 9.419 km     | G         | Yes        | 43.23                     | 2013           | 3.0                | 46.2                | 120.0                      | 2038.59       | #####                | 2037              | 2037.41    | 1.18                 | Yes                          | No                           | No                      |
| 6          | 14A             | 2.474 km       | 9.419 km     | A         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 7          | 14A             | 9.419 km       | 122.108 km   | G         | Yes        | 49.72                     | 2013           | 3.0                | 52.7                | 120.0                      | 2036.43       | 5,388,649            | 2033              | 2033.91    | 2.52                 | Yes                          | No                           | No                      |
| 8          | 14A             | 9.419 km       | 122.108 km   | A         | Yes        | 49.72                     | 2013           | 3.0                | 52.7                | 120.0                      | 2036.43       | 5,136,662            | 2035              | 2035.82    | 0.61                 | No                           | No                           | No                      |
| 9          | 14A             | 122.108 km     | 124.930 km   | G         | Yes        | 84.10                     | 2013           | 3.0                | 87.1                | 120.0                      | 2024.97       | 2,443,902            | 2023              | 2023.66    | 1.31                 | Yes                          | Yes                          | Yes                     |
| 10         | 14A             | 122.108 km     | 124.930 km   | A         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 11         | 14A             | 124.930 km     | 126.149 km   | G         | Yes        | 61.76                     | 2013           | 3.0                | 64.8                | 120.0                      | 2032.41       | 4,692,451            | 2030              | 2030.43    | 1.98                 | Yes                          | No                           | No                      |
| 12         | 14A             | 124.930 km     | 126.149 km   | A         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 13         | 14B             | 0.000 km       | 3.480 km     | G         | Yes        | 58.09                     | 2013           | 3.0                | 61.1                | 120.0                      | 2033.64       | 5,705,017            | 2031              | 2031.39    | 2.24                 | Yes                          | No                           | No                      |
| 14         | 14B             | 0.000 km       | 3.480 km     | A         | Yes        | 58.09                     | 2013           | 3.0                | 61.1                | 120.0                      | 2033.64       | 6,074,050            | 2033              | 2033.13    | 0.50                 | No                           | No                           | No                      |
| 23         | 98B             | 0.000 km       | 142.757 km   | G         | Yes        | 63.23                     | 2013           | 3.0                | 66.2                | 120.0                      | 2031.92       | 1,284,860            | 2030              | 2030.08    | 1.84                 | Yes                          | No                           | No                      |
| 24         | 98B             | 0.000 km       | 142.757 km   | A         | Yes        | 63.23                     | 2013           | 3.0                | 66.2                | 120.0                      | 2031.92       | 1,207,750            | 2025              | 2025.55    | 6.37                 | Yes                          | Yes                          | Yes                     |
| 25         | 98B             | 142.757 km     | 193.163 km   | G         | Yes        | 51.76                     | 2013           | 3.0                | 54.8                | 120.0                      | 2035.75       | 2,233,244            | 2034              | 2034.15    | 1.59                 | Yes                          | No                           | No                      |
| 26         | 98B             | 142.757 km     | 193.163 km   | A         | Yes        | 51.76                     | 2013           | 3.0                | 54.8                | 120.0                      | 2035.75       | 2,266,135            | 2029              | 2029.99    | 5.75                 | Yes                          | No                           | No                      |
| 27         | 98A             | 0.000 km       | 27.760 km    | G         | Yes        | 69.76                     | 2013           | 3.0                | 72.8                | 120.0                      | 2029.75       | 1,418,303            | 2029              | 2029.58    | 0.17                 | No                           | No                           | No                      |
| 28         | 98A             | 0.000 km       | 27.760 km    | A         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 29         | 98A             | 27.760 km      | 101.000 km   | G         | Yes        | 63.53                     | 2013           | 3.0                | 66.5                | 120.0                      | 2031.82       | 1,513,019            | 2031              | 2031.64    | 0.19                 | No                           | No                           | No                      |
| 30         | 98A             | 27.760 km      | 101.000 km   | A         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 31         | 98A             | 101.000 km     | 157.880 km   | G         | Yes        | 56.60                     | 2013           | 3.0                | 59.6                | 120.0                      | 2034.13       | 1,745,061            | 2032              | 2032.40    | 1.74                 | Yes                          | No                           | No                      |
| 32         | 98A             | 101.000 km     | 157.880 km   | A         | Yes        | 56.60                     | 2013           | 3.0                | 59.6                | 120.0                      | 2034.13       | 1,913,670            | 2028              | 2028.44    | 5.70                 | Yes                          | No                           | No                      |
| 33         | 27C             | 0.000 km       | 9.830 km     | G         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 34         | 27C             | 0.000 km       | 9.830 km     | A         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 35         | 27C             | 9.830 km       | 14.000 km    | G         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 36         | 27C             | 9.830 km       | 14.000 km    | A         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 37         | 33A             | 0.000 km       | 89.050 km    | G         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 38         | 33A             | 0.000 km       | 89.050 km    | A         | Yes        | 75.36                     | 2013           | 3.0                | 78.4                | 120.0                      | 2027.88       | 1,471,445            | 2027              | 2027.77    | 0.11                 | No                           | No                           | No                      |
| 39         | 33A             | 89.050 km      | 90.370 km    | G         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |
| 40         | 33A             | 89.050 km      | 90.370 km    | A         | No         | n/a                       | n/a            | 0.0                | n/a                 | n/a                        | n/a           | n/a                  | n/a               | n/a        | n/a                  | No                           | No                           | No                      |

## Pavement Impact Assessment

### Project China Stone

## Potential Maintenance Impacts

| Cardno<br>ID# | Section Details |                |              |           | ESA Scoped | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|---------------|-----------------|----------------|--------------|-----------|------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|               | TMR<br>ROAD     | Chainage Start | Chainage End | Direction |            |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 1             | 841             | 0.000 km       | 7.336 km     | G         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 2             | 841             | 0.000 km       | 7.336 km     | A         | Yes        | 0%   | 0%   | 7%   | 7%   | 15%  | 15%  | 15%  | 14%  | 14%  | 14%  | 13%  | 13%  | 13%  | 12%  | 12%  | 12%  |
| 3             | 14A             | 0.000 km       | 2.474 km     | G         | Yes        | 0%   | 0%   | 6%   | 5%   | 13%  | 12%  | 12%  | 12%  | 11%  | 11%  | 11%  | 11%  | 10%  | 10%  | 10%  | 10%  |
| 4             | 14A             | 0.000 km       | 2.474 km     | A         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 5             | 14A             | 2.474 km       | 9.419 km     | G         | Yes        | 0%   | 0%   | 4%   | 4%   | 9%   | 8%   | 8%   | 8%   | 8%   | 8%   | 7%   | 7%   | 7%   | 7%   | 7%   | 7%   |
| 6             | 14A             | 2.474 km       | 9.419 km     | A         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 7             | 14A             | 9.419 km       | 122.108 km   | G         | Yes        | 0%   | 0%   | 9%   | 9%   | 21%  | 20%  | 20%  | 19%  | 19%  | 18%  | 18%  | 18%  | 17%  | 17%  | 17%  | 16%  |
| 8             | 14A             | 9.419 km       | 122.108 km   | A         | Yes        | 0%   | 0%   | 2%   | 2%   | 5%   | 5%   | 4%   | 4%   | 4%   | 4%   | 4%   | 4%   | 4%   | 4%   | 4%   | 4%   |
| 9             | 14A             | 122.108 km     | 124.930 km   | G         | Yes        | 0%   | 0%   | 9%   | 9%   | 21%  | 20%  | 20%  | 19%  | 19%  | 18%  | 18%  | 17%  | 17%  | 17%  | 16%  | 16%  |
| 10            | 14A             | 122.108 km     | 124.930 km   | A         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 11            | 14A             | 124.930 km     | 126.149 km   | G         | Yes        | 0%   | 0%   | 9%   | 8%   | 19%  | 19%  | 18%  | 18%  | 17%  | 17%  | 16%  | 16%  | 16%  | 15%  | 15%  | 15%  |
| 12            | 14A             | 124.930 km     | 126.149 km   | A         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 13            | 14B             | 0.000 km       | 3.480 km     | G         | Yes        | 0%   | 0%   | 11%  | 11%  | 20%  | 20%  | 19%  | 19%  | 18%  | 18%  | 18%  | 17%  | 17%  | 16%  | 16%  | 16%  |
| 14            | 14B             | 0.000 km       | 3.480 km     | A         | Yes        | \$0  | \$0  | \$0  | \$0  | \$0  | \$0  | \$0  | \$0  | \$0  | \$0  | \$0  | \$0  | \$0  | \$0  | \$0  | \$0  |
| 23            | 98B             | 0.000 km       | 142.757 km   | G         | Yes        | 0%   | 0%   | 9%   | 8%   | 18%  | 17%  | 17%  | 17%  | 16%  | 16%  | 15%  | 15%  | 15%  | 14%  | 14%  | 14%  |
| 24            | 98B             | 0.000 km       | 142.757 km   | A         | Yes        | 0%   | 0%   | 47%  | 46%  | 86%  | 84%  | 82%  | 80%  | 78%  | 76%  | 75%  | 73%  | 71%  | 70%  | 68%  | 67%  |
| 25            | 98B             | 142.757 km     | 193.163 km   | G         | Yes        | 0%   | 0%   | 6%   | 6%   | 13%  | 13%  | 12%  | 12%  | 12%  | 11%  | 11%  | 11%  | 11%  | 10%  | 10%  | 10%  |
| 26            | 98B             | 142.757 km     | 193.163 km   | A         | Yes        | 0%   | 0%   | 32%  | 31%  | 58%  | 56%  | 55%  | 54%  | 52%  | 51%  | 50%  | 49%  | 48%  | 47%  | 46%  | 45%  |
| 27            | 98A             | 0.000 km       | 27.760 km    | G         | Yes        | 0%   | 0%   | 8%   | 8%   | 1%   | 1%   | 1%   | 1%   | 1%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 28            | 98A             | 0.000 km       | 27.760 km    | A         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 29            | 98A             | 27.760 km      | 101.000 km   | G         | Yes        | 0%   | 0%   | 9%   | 9%   | 1%   | 1%   | 1%   | 1%   | 1%   | 1%   | 1%   | 1%   | 1%   | 0%   | 0%   | 0%   |
| 30            | 98A             | 27.760 km      | 101.000 km   | A         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 31            | 98A             | 101.000 km     | 157.880 km   | G         | Yes        | 0%   | 0%   | 7%   | 7%   | 15%  | 15%  | 14%  | 14%  | 14%  | 13%  | 13%  | 13%  | 12%  | 12%  | 12%  | 12%  |
| 32            | 98A             | 101.000 km     | 157.880 km   | A         | Yes        | 0%   | 0%   | 34%  | 33%  | 63%  | 61%  | 59%  | 58%  | 56%  | 55%  | 54%  | 53%  | 52%  | 50%  | 49%  | 48%  |
| 33            | 27C             | 0.000 km       | 9.830 km     | G         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 34            | 27C             | 0.000 km       | 9.830 km     | A         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 35            | 27C             | 9.830 km       | 14.000 km    | G         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 36            | 27C             | 9.830 km       | 14.000 km    | A         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 37            | 33A             | 0.000 km       | 89.050 km    | G         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 38            | 33A             | 0.000 km       | 89.050 km    | A         | Yes        | 0%   | 0%   | 7%   | 7%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 39            | 33A             | 89.050 km      | 90.370 km    | G         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |
| 40            | 33A             | 89.050 km      | 90.370 km    | A         | No         | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |

## Pavement Impact Assessment Project China Stone

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## Link Summary

| Cardno<br>ID# | Section Details |                |              |           | Is the section<br>used by project<br>traffic? | Is there a >5%<br>impact on<br>Maintenance? | Potential<br>Maintenance<br>Impact | Potential<br>Rehabilitation<br>Impact |
|---------------|-----------------|----------------|--------------|-----------|-----------------------------------------------|---------------------------------------------|------------------------------------|---------------------------------------|
|               | TMR<br>ROAD     | Chainage Start | Chainage End | Direction |                                               |                                             |                                    |                                       |
| 1             | 841             | 0.000 km       | 7.336 km     | G         | Yes                                           | 3.7%                                        | No                                 | No                                    |
| 2             | 841             | 0.000 km       | 7.336 km     | A         | Yes                                           | 17.9%                                       | Yes                                | No                                    |
| 3             | 14A             | 0.000 km       | 2.474 km     | G         | Yes                                           | 14.9%                                       | Yes                                | No                                    |
| 4             | 14A             | 0.000 km       | 2.474 km     | A         | Yes                                           | 2.9%                                        | No                                 | No                                    |
| 5             | 14A             | 2.474 km       | 9.419 km     | G         | Yes                                           | 10.2%                                       | Yes                                | No                                    |
| 6             | 14A             | 2.474 km       | 9.419 km     | A         | Yes                                           | 2.2%                                        | No                                 | No                                    |
| 7             | 14A             | 9.419 km       | 122.108 km   | G         | Yes                                           | 24.9%                                       | Yes                                | No                                    |
| 8             | 14A             | 9.419 km       | 122.108 km   | A         | Yes                                           | 5.6%                                        | Yes                                | No                                    |
| 9             | 14A             | 122.108 km     | 124.930 km   | G         | Yes                                           | 24.4%                                       | Yes                                | Yes                                   |
| 10            | 14A             | 122.108 km     | 124.930 km   | A         | Yes                                           | 4.9%                                        | No                                 | No                                    |
| 11            | 14A             | 124.930 km     | 126.149 km   | G         | Yes                                           | 22.6%                                       | Yes                                | No                                    |
| 12            | 14A             | 124.930 km     | 126.149 km   | A         | Yes                                           | 4.7%                                        | No                                 | No                                    |
| 13            | 14B             | 0.000 km       | 3.480 km     | G         | Yes                                           | 24.2%                                       | Yes                                | No                                    |
| 14            | 14B             | 0.000 km       | 3.480 km     | A         | Yes                                           | 5.0%                                        | Yes                                | No                                    |
| 23            | 98B             | 0.000 km       | 142.757 km   | G         | Yes                                           | 21.3%                                       | Yes                                | No                                    |
| 24            | 98B             | 0.000 km       | 142.757 km   | A         | Yes                                           | 102.7%                                      | Yes                                | Yes                                   |
| 25            | 98B             | 142.757 km     | 193.163 km   | G         | Yes                                           | 15.0%                                       | Yes                                | No                                    |
| 26            | 98B             | 142.757 km     | 193.163 km   | A         | Yes                                           | 66.8%                                       | Yes                                | No                                    |
| 27            | 98A             | 0.000 km       | 27.760 km    | G         | Yes                                           | 8.6%                                        | Yes                                | No                                    |
| 28            | 98A             | 0.000 km       | 27.760 km    | A         | Yes                                           | 1.1%                                        | No                                 | No                                    |
| 29            | 98A             | 27.760 km      | 101.000 km   | G         | Yes                                           | 9.3%                                        | Yes                                | No                                    |
| 30            | 98A             | 27.760 km      | 101.000 km   | A         | Yes                                           | 1.2%                                        | No                                 | No                                    |
| 31            | 98A             | 101.000 km     | 157.880 km   | G         | Yes                                           | 17.5%                                       | Yes                                | No                                    |
| 32            | 98A             | 101.000 km     | 157.880 km   | A         | Yes                                           | 72.2%                                       | Yes                                | No                                    |
| 33            | 27C             | 0.000 km       | 9.830 km     | G         | Yes                                           | 0.2%                                        | No                                 | No                                    |
| 34            | 27C             | 0.000 km       | 9.830 km     | A         | Yes                                           | 0.2%                                        | No                                 | No                                    |
| 35            | 27C             | 9.830 km       | 14.000 km    | G         | Yes                                           | 0.3%                                        | No                                 | No                                    |
| 36            | 27C             | 9.830 km       | 14.000 km    | A         | Yes                                           | 0.2%                                        | No                                 | No                                    |
| 37            | 33A             | 0.000 km       | 89.050 km    | G         | Yes                                           | 0.9%                                        | No                                 | No                                    |
| 38            | 33A             | 0.000 km       | 89.050 km    | A         | Yes                                           | 7.2%                                        | Yes                                | No                                    |
| 39            | 33A             | 89.050 km      | 90.370 km    | G         | Yes                                           | 0.2%                                        | No                                 | No                                    |
| 40            | 33A             | 89.050 km      | 90.370 km    | A         | Yes                                           | 1.2%                                        | No                                 | No                                    |

## Pavement Impact Assessment

### Project China Stone