

# Assessment of Constraints to Supply of Extractive Materials in Critical Demand Areas

Queensland flood and cyclone damaged road reconstruction  
program (TNRP)



MIP 115/11  
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■ Quarries ■ Resources ■ Solutions

## SITUATIONAL ANALYSIS

In the 2010-11 flood disaster and cyclone-affected regional areas of Queensland, where there is high sustained demand for quarry materials over the next few years (from coal mine, gas and related infrastructure), there are limitations to the quarrying industry's capacity to supply quarry products (roadbases and aggregates) for TNRP and Qld RA road reconstruction works.

These quarry (supply side) constraints include approval and licensing of known extractive resources, existing market commitments, stockpile quantities and space, processing plant capacities, labour shortages (in coal mine/CSG gas development areas) and truck constraints or shortages.

Collectively these constraints have a moderate to high potential to delay the timeframe for completion of TNRP projects in Critical Demand Areas (CDA's), unless remedial solutions to address constraints can be identified and implemented.

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### DISCLAIMER

*This report provides a broad assessment of TMR's and Qld RA's upcoming demand for quarry materials which may or may not eventuate according to the information in this report and organisations should not rely on this information to inform any business decisions they choose to make.*

## ASSESSMENT OF CONSTRAINTS TO SUPPLY OF EXTRACTIVE MATERIALS IN CRITICAL DEMAND AREAS

Queensland flood and cyclone-damaged road reconstruction program (TNRP and Qld Reconstruction Authority)

### EXECUTIVE SUMMARY



FEB 2012  
Ecoroc Pty Ltd

This report provides a summary of the findings of a desktop study, industry consultations and a situational analysis completed over the period December 2011 to February 2012.

A TNRP "All Quarries" database that can be consulted in MapInfo has been developed, with a focus on Queensland's eight (8) most flood-affected regions (referred to as Critical Demand Areas or CDA's). These comprise the DTMR regions of Mackay/Whitsunday, Fitzroy, Central West, North West, Far North, South West, Darling Downs and Wide Bay Burnett.

The "All Quarries" database describes existing and potential hard rock quarry sites. It includes a "point in time" assessment of quarries' capabilities and capacities to supply quarry products to Qld's road reconstruction program. This has been expressed as a theoretical monthly 'discretionary supply' capacity for the 2012-2014 reconstruction period. A worksheet tool has also been developed to assist in ongoing demand ~ supply modelling of quarry materials for road reconstruction planning purposes.

The database identifies a total of 406 hard rock quarries (or potential extractive resources) across Qld, 288 of which are in the eight CDA's. Of these, 80 quarries or (28%) have been characterised as "Strategic Quarries" and 75 (or 26%) as "Quarries of Interest" (155 total). These quarries are expected to provide the 'lion's share' of supply of the Type 2.1 (2.2) roadbase and/or cover aggregates needed for the TNRP and Qld RA road reconstruction effort. Less than 50% of Strategic Quarries have pre-coated aggregate plants and only about 10% have Cement Treated Base (CTB)/pugmill plants.

Only 40% of actual hard rock quarry sites in regional Qld are suitable or able to supply the road reconstruction works. This is mainly because of constraints such as source rock type and technical suitability (geology), but also approvals, licensing restrictions, pre-commitments to supply, product mix,

contestability (eg council pits often not suppliers to the wide market), and capital budgeting issues.

These factors are amongst the "modifying factors" for quarries that drive their commercial and triple-bottom line viability. For the CDA's, the extractive resource, labour and plant/equipment supply-side constraints have been identified, analysed and expressed according to this framework.

Key issues for strategic quarries to overcome supply-side constraints and thus increase their discretionary supply to TNRP, Q Trip and Qld RA projects have been identified. The five (5) dominant supply-side constraint factors and their respective influence on discretionary supply are:

MODIFYING FACTOR (CONSTRAINT)	RELATIVE IMPACT
• Market/Customer/Competitive Choice/Scheduling	55%
• Truck Transport	15%
• Processing plant and stockpiling	10%
• Approvals and licensing	8%
• Resource and extraction constraints	8%

Industry has emphatically reported that the most effective initiative to improve discretionary supply capability over the next 2-3 years is to ensure advanced notice of the need for supply roadbase and pre coat aggregates, is communicated to quarries – 3 months has been suggested as a target in significant shortfall areas (eg MWR, FTR, SWR, DDR).

With forewarning, quarries can plan to mitigate some of the other constraints – For example by arranging for mobile crushing plant, adding a second shift, booking cartage contractors, installing a pre-coat plant, undertaking stripping of overburden, opening up a second face, extending stockpile areas (if room available), and recruiting labour.

Initiatives to streamline approvals and licensing, and assist with productivity and risk management, are also necessary if quarries are to respond to the demands of peak production, and comply with licensing and OH&S provisions and obligations.

## Project Team

### KEY CONTACTS

The authors of this report are:

#### Dugald Gray

Principal, Ecoroc Pty Ltd  
LABRADOR QLD 4215

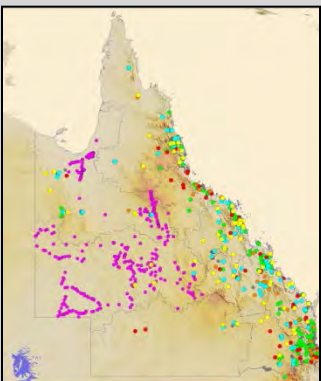
Tel: + 61 7 5574 6666  
dgray@ecoroc.com.au

#### Dr Graham Shorten

Principal, Environmental &  
Community Risk International Pty  
Ltd (ECRI)

HERSTON,  
BRISBANE Q 4006

Tel: +61(0)7 3252 8404  
gshorten@optusnet.com.au



### ECOROC PROJECT TEAM

#### Project Director

**Dugald Gray** *BE Mining (Qld), MBA (Bond)*; Quarrying industry consultant, mining engineer with 30 years professional experience in strategic, general and operational management in the quarrying, construction materials and civil infrastructure development industries.

#### Project Manager

**Dr Graham Shorten** *PhD Civ Eng (Sydney), MSc (Qld), BSc (Qld)*

Geoscientist and international geohazards consultant with 40 years experience in risk assessment of infrastructure and resource assets; Particular expertise in geotechnical assessment of quarries and analysis of geoscience data and information using MapInfo.

#### Database Manager

**Ken Granger** *BSc Applied Geography (CCA), MA (ANU)*  
Risk Scientist and Applied Geographer with 49 years experience in the capture, analysis and application of spatial information to address issues and solve problems in the public safety, emergency risk management and asset management fields.

#### Project Officers – Specific Quarry Investigations

##### Alan Robertson

Principal of quarry/mining engineering consulting firm Ausrocks with 40 years experience in mining, quarrying & tunnelling; Quarry expertise includes operations, resource evaluation, quarry design, material assessment, quarry safety audits and quarry planning.

##### John Siemon

Principal JE Siemon and Associates – Geoscientist and highly experienced in Qld extractive industry resource and reserves investigation and evaluation.

#### Carl Morandy

Consulting mining engineer, Ausrocks - Principal quarry researcher and special projects officer for TNRP project.

#### Mike Cooper

Principal MD Cooper Consulting Pty Ltd – Quarry management, operational and processing plant expert – 30 years industry, management, consulting experience.

#### John (Bronco) Johnston

Quarrying industry consultant, a 50-year veteran of the industry as co-owner and operator of quarries, senior manager, technical expert, superintendent /supervisor of quarry feasibility studies & developments in Australia and South East Asia.

#### Mike O’Sullivan

Extractive industry consultant geologist, Principal of Extractive Industry Services Ltd – highly experienced in the Mackay, Isaac, Central Highlands and Bowen Basin regions.

### Abbreviations or Terms used in this report

CDA	Critical Demand Area
CTB	Cement Treated Base (small % of cement added to roadbase)
DTMR	(QLD) Department of Transport and Main Roads
ktpa	kilotonnes per annum
LGA	Local Government Area
Mt	Million tonnes
Pre Coat	A sized, crushed rock aggregate coated with a bituminous emulsifier prior to use as a road surfacing aggregate
Qld RA	Queensland Reconstruction Authority
tpa	tonnes per annum
SPA	Sustainable Planning Act 2009
TNRP	Transport Network Reconstruction Program
UPM	Unbound Pavement Material

## 1. Purpose and Scope of Study

This report provides a summary of the findings of a study and situational analysis to identify and assess constraints to the supply of quarry materials (crushed rock) in Critical Demand Areas (CDA's) for Queensland's road reconstruction works.

The study has consulted widely with extractive industry and created a TNRP "All Quarries" database for Queensland's eight (8) most critically-affected regions. The database identifies existing or potential hard rock quarry sites by LGA that can/could supply Type 2.1 (2.2) roadbase and/or cover aggregates to TNRP works.

The supply side constraints have been identified and impacts and/or potential supply bottlenecks assessed.

Supply-side constraint issues and suggested remedial measures based on a synthesis of feedback from the quarrying industry and our analyses, are provided to inform policy development.

### PROJECT CONTEXT

#### QUARRY MATERIAL DEMAND FROM ROAD RECONSTRUCTION WORKS 2011-2014

Department of Transport and Main Roads (DTMR) and the Queensland Reconstruction Authority (QldRA) have, across the ten (10) flood and cyclone affected regions of Queensland, estimated the quantity and monthly timing of need for roadbase and coarse aggregate materials for state-controlled and local council road reconstruction projects.

Two quarry material types, Type 2.1 roadbase and cover aggregates, are critical to the road reconstruction program. Total demand forecasts for quarry materials for road reconstruction for the DTMR's Transport Network Reconstruction Program (TNRP) from April 2011 to June 2014 have been estimated by DTMR as:

- i. 14 Mt (million tonnes) of roadbase materials (sometimes referred to generically as 'gravel') and
- ii. 1.5 Mt of aggregate (cover aggregate for road surfacing).

In addition to TNRP demand, Qld RA has estimated demand from local government road reconstruction works across the state at approximately 11.3 Mt (of roadbase materials and aggregates) over the period from November 2011 to June 2014.

The projected quarry material quantities by DTMR region are summarised in Table 1 for the eight (8) most affected regions according to total demand for quarry materials for road reconstruction works. About 85% is roadbase (all types) and 15% is cover aggregate.

**TABLE 1: FORECAST TOTAL DEMAND FOR HARD ROCK QUARRY PRODUCTS IN CDA'S – QLD ROAD RECONSTRUCTION WORKS 2011-2014**

Rank	DTMR region	Total TNRP Demand (Mt)	Qld RA Demand (Mt)	Total Demand TNRP + Qld RA (Mt)
1	Fitzroy	4.30	1.03	5.33
2	Central West	2.60	1.71	4.31
3	Far North	1.90	1.72	3.62
4	Southwest	2.00	0.92	2.92
5	Mackay/Whitsunday	1.70	0.97	2.67
6	Northwest	1.60	1.25	2.85
7	Darling Downs	0.57	1.27	1.84
8	Wide Bay/Burnett	0.46	0.54	1.00
9	North Coast	0.18	0.16	0.34
10	Metropolitan	0.11	0.86	0.97
11	Northern	0.06	0.69	0.75
12	South Coast	0.02	0.13	0.15
	<b>Total</b>	<b>15.5</b>	<b>11.3</b>	<b>26.8</b>

Source: DTMR, Qld RA Dec 2011

#### SUPPLY SIDE CONSTRAINTS FOR ROADBASE AND AGGREGATES IN CRITICAL DEMAND AREAS

Supply constraints have moderate to high potential to impact on the timeframe for completion and cost escalation of TNRP and Qld RA road reconstruction works in Critical Demand Areas.

The risks are especially high in regions where there is coincident and ongoing demand from major projects (eg port, rail, mining, gas related infrastructure). Quarries in these areas have finite resources and a discretionary supply capability. To overcome potential shortfalls in the rate of supply to TNRP projects, either existing quarries need to be encouraged to produce more (and) or new extractive resources need to be brought quickly into production. The latter is by no means easy – it can take several years for a new quarry to be approved under planning law (SPA).

# 1. Purpose and Scope of Study

This report consists of three (3) main sections:

## A. Supply Side Analysis

Update of 'All Quarries' DTMR quarry (hard rock resource) database in the eight (8) CDA's to improve veracity of hard rock quarry material source information, quarry locations & supply capabilities to TNRP projects;

## B. Demand Side Analysis

Overview of projected demand for quarry materials from TNRP (state road reconstruction) works and other projects over the period 2012 to 2014; and

## C. Supply Side Constraints Analysis for CDA's and Remedial Suggestions

Assessment of demand ~ supply imbalances in CDA's; Strategic Quarries and Quarries of Interest; Appraisal and evaluation of discretionary supply and constraints to supply; Recommendations to address or overcome constraints.

## PROJECT DELIVERABLES

For the eight (8) regions of highest quarry material demand for the TNRP:

**1. Create an updated "All Queensland" quarries database** – include identification and mapping using geospatial co-ordinates of existing quarries / extractive resources including quarry name, operating status, source rock type, annual output, product types, approved products to DTMR, quarry description, and discretionary capacity to supply TNRP project work from 2012 to 2014;

**2. Compile and review demand data** for TNRP, Qld RA and Q-Trip; Review effects of major projects including port, rail, mine and gas projects in the Mackay/Whitsunday, Fitzroy, Central West and South West regions;

**3. Identify potential shortfalls between demand and supply in CDA's** and identify 'Strategic Quarries' to the TNRP and 'Quarries of Interest', 'Strategic Quarries' are expected be crucial for the supply of Type 2.1 roadbase and/or cover aggregates for TNRP and Qld RA works – 'Quarries of Interest' may be able to supply.

**4. Advise on industry constraints / supply bottlenecks and provide recommendations for actions to overcome constraints** in CDA's; and if relevant advise on strategies to enable access to additional (potential) extractive resources to ensure the reconstruction timeframe is not constrained by supply shortfalls.



Shepton Quarry, Capella, Basalt, Fitzroy region – A 'STRATEGIC QUARRY'



Broadlea Coal Mine near Moranbah – fresh basalt overburden – A 'QUARRY of INTEREST'

# 1. Purpose and Scope of Study

The project team spent 450 hrs contacting and interviewing quarry industry players across Qld.

Consultations were conducted largely by telephone, with only limited face to face interviews because of time, holiday period and weather constraints.

The TNRP All Quarries database was then compiled using 330 project team hours.



Demand v supply shortfall analyses for CDA's, identification and evaluation of supply-side constraints, and reporting of findings and recommendations required 370 project team hrs.

## STUDY APPROACH

For the eight (8) targeted CDA's, undertake a Dec 11 /Jan 12 survey of hard rock quarries and potential extractive resources, across Regional Queensland, using primary and secondary market research techniques including both quantitative and qualitative data.

## CONSULTATIONS

### 1. QUARRYING COMPANIES

Across the spectrum of size and ownership including quarrying firms that own, produce and sell quarry products eg multi-national, national, privately-owned, council controlled and leasehold. Consultations with individual quarries, sales managers, quarry managers, regional managers, general managers, managing directors.

### 2. CONTRACT CRUSHING FIRMS

Contract crushing firms that undertake 'campaign' or project-specific contract crushing for others including quarries, mines, major projects.

### 3. GOVERNMENT

- DTMR regions incl. project managers
- DEEDI Mineral & Extractive Planning Unit – Annual reported Quarry Production data
- DEEDI NRW Forest Products – Largest quarry land owner in Qld
- DEEDI Mines Inspectorate – Risk management, OH&S perspectives
- Local Government (Councils)

### 4. SUPPLIERS, INDUSTRY ORGANISATIONS, CONSULTANTS

Explosives suppliers, plant/equipment suppliers, Cement, Concrete and Aggregates Australia (CCAA), Institute of Quarrying Australia (IQA), Industry geologists/geoscientists, Quarry consultants/engineers.

## QUANTITATIVE INFORMATION COLLATED

Refer TNRP All Quarries Metadata (Table 3, page 11), showing for example: Quarry type, activity status, name, source rock, production/sales levels, product types, Accredited DTMR supplier status, 'Strategic' or 'Quarry of Interest' Status, Pre-coat plant, CTB/pugmill plant.

Estimate of Monthly discretionary supply for Type 2.1 (2.2) Unbound Pavement Material and Cover (pre-coated cover aggregates).

## QUALITATIVE INFORMATION COLLATED

Includes a description of supply-side constraints or bottlenecks; Reasons given by quarries/ contract crushers for being able/not being able to supply TNRP projects; Reasons for not wanting to increase discretionary supply – eg too hard to get DA amended; short notice and over runs puts everything else under pressure; extra technical, financial risks, additional capital requirements); List and Contact Details for Contract Crushing and Screening Firms and quarry drilling companies (Percussion drilling).

Receive, compile, analyse suggestions (from quarrying industry, suppliers and industry analysts/consultants) on ways to address or overcome constraints to maximising the discretionary supply from quarries of Type 2.1 roadbase and cover aggregates to TNRP and Qld RA road reconstruction works.

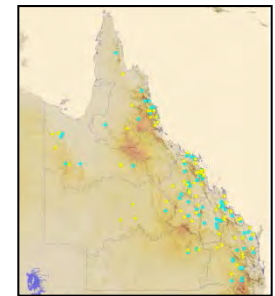
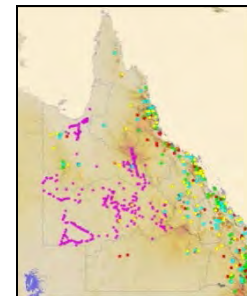
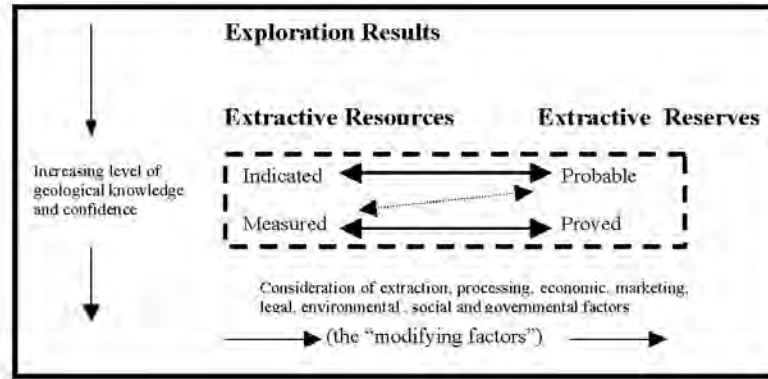


Figure 1 has been adapted from the Mineral Industry's "JORC" Code and shows the relationship between an extractive resource and an extractive reserve of quarryable material.

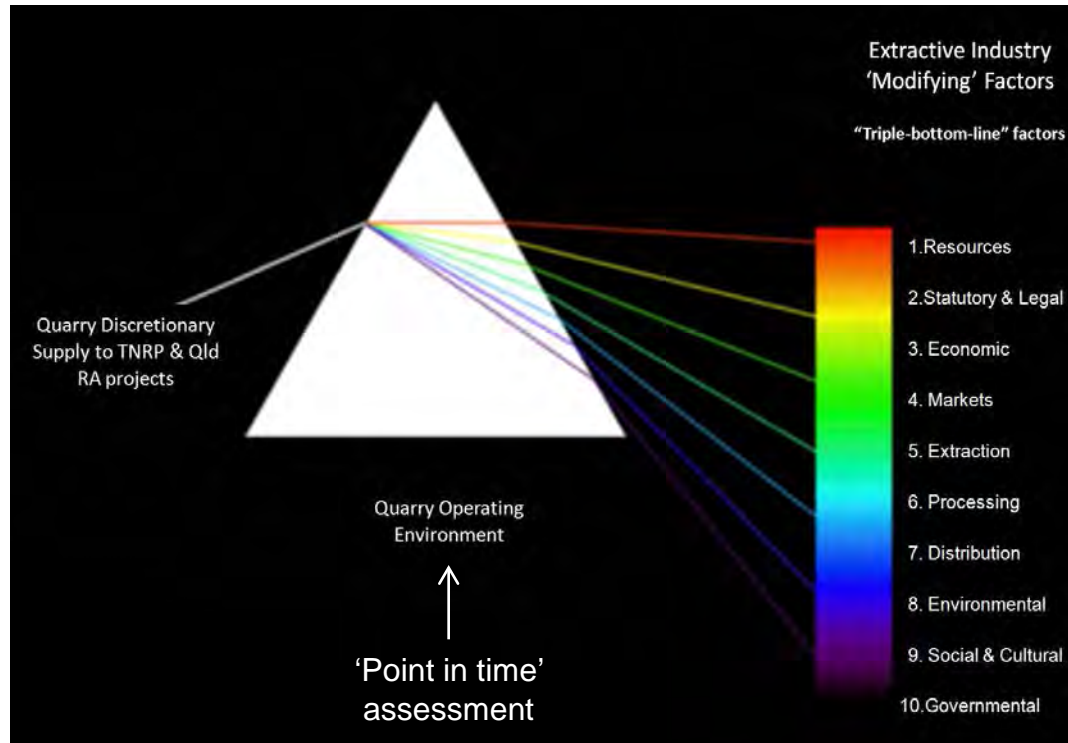
A reserve has been proven to be commercially viable to extract. It has been evaluated by considering the impact and combined effects of the "modifying factors" on commercial performance.

The "Modifying Factors" determine the commercial viability for a quarry. Because it provides a 'quarry-centric view', the factors provide a useful assessment framework for evaluating quarries and extractive resources.

Ecoroc has adapted the framework to produce a Quarry Assessment Framework or EROC (Extractive Resource Opportunities and Constraints) matrix (refer Figure 2).



**FIGURE 1: RELATIONSHIP BETWEEN EXTRACTIVE RESOURCES AND EXTRACTIVE RESERVES** (adapted from the Minerals Industry JORC Code, 2004)



### ASSESSMENT FRAMEWORK FOR CONSTRAINTS STUDY

The "Modifying Factors" represent an industry-centric triple bottom line framework and they determine the commercial viability for a quarry or extractive resource.

They therefore provide a useful guide and risk assessment framework for extractive resource/quarry evaluation, including identifying constraints to the discretionary supply from quarries in Critical Demand Areas.

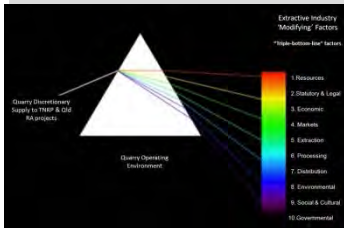
**FIGURE 2: QUARRY ASSESSMENT FRAMEWORK – DISCRETIONARY SUPPLY CAPABILITIES TO TNRP**

**SUPPLY-SIDE CONSTRAINTS ANALYSIS**

Supply-side shortages for quarries have been identified as having materials, labour and plant/equipment dimensions.

TABLE 2 indicates these factors of production and provides a summary description of the constraints, undertaken as part of the study.

The constraints are expressed against the 'modifying factors' for quarries, which helps visualise issues, provides an understanding of the inter-relationship between factors and helps in the identification of remedial solutions to mitigate the effects of supply-side impacts.



**TABLE 2: CONSTRAINT (RISK) FACTORS**

**1. GEOLOGICAL, EXTRACTIVE RESOURCE FACTORS**

Reserves not particularly well-known; Industry has a low degree of exploration expenditure; DTMR specs -variability of source rock quality eg SMC; Efficacy of empirical tests and influence on specs.; Gradings; Poor sampling/testing knowledge in CDA's.

**2. APPROVALS, REGULATORY AND COMPLIANCE FACTORS**

Time & cost for DA's; DERM ERA thresholds – MCU and impact assessable triggers under IDAS/SPA; DA's for accommodation camps; Approval to use mine owned roads and sell quarry materials from mine sites; Extended hours of operation; Traffic restrictions; Access road/entrance infrastructure requirements; Native title requirements and exemptions; Wild Rivers declaration (Coopers Creek) impact on gravel (borrow) pits in Western Qld.

**3. ECONOMIC FACTORS**

Demand from major projects in CDA's – eg coal mines, CS gas and related pipeline, rail and port infrastructure; QldRA LGA road reconstruction program; Labour (skills) shortages; Building & construction activity; Local economic conditions; (eg tourism downturn).

**4. MARKET FACTORS**

Existing customers; Lack of notice of DTMR work; Long term v short term customers; Risk v Return in determining product (sales) mix; Degree of competition and competitive strategy, Degree of contestability in the market to produce Type 2.1 roadbase and cover aggregates.

**5. EXTRACTION and SITE INFRASTRUCTURE FACTORS**

O/B or stripping ratio; Legacy sites requiring re-development; Poor pit planning (eg campaign sites)- DEEDI OH&S requirement for a Quarry Development Plan; Blast logistics.

**6. PROCESSING / MANUFACTURING FACTORS**

Reliance on mobile plant & campaign crushing (cf fixed plant); Capabilities of contract crushing firms (labour; skills; expertise); Less than 50% of key quarries have pre-coat plants and only 10% have CTB/pugmill plants.

**7. HAULAGE AND DISTRIBUTION FACTORS**

Insufficient truck availability during peak demand; Reduce with production and delivery in advance of projects; Cartage price increase during term of supply contracts; Access for road trains; Haulage restrictions (eg Koumala Range); Driver experience / driver fatigue.

**8. ENVIRONMENTAL FACTORS**

Eg. Air, water, noise, blast (vibration) emissions, water quality impacts, remnant vegetation, site rehabilitation.

**9. SOCIAL FACTORS** eg. Community opinion (amenity, external impacts, land values etc); Cultural heritage.

**10. OTHER** Eg. Government attitude; Weather and seasonal effects; Royalty increases; Commercial performance of contract crushing operators.