

24. Construction resources

The availability of raw and manufactured materials, and prefabricated components will have a significant impact on the ability to deliver the project. Preliminary estimates of raw materials for construction have been calculated based upon the concept design. These estimates, along with geotechnical site investigations, and research into local aggregate sources have been used to determine the amount and quality of bulk earthwork and pavement materials that will have to be imported, either from existing quarries or borrow pits opened as part of the construction.

Sources for the supply of other raw materials such as cement, bitumen, fuel and water have also been considered. Manufacturers and suppliers of prefabricated components have been contacted to determine their capacity and ability to supply the project.

The impact of the increase in heavy vehicle movements on the local roads surrounding the project in supplying materials had also been considered, with the input of local councils regarding potential haul route suitability.

24.1 Material requirements for the upgrade

24.1.1 Bulk earthworks

The majority of the bulk earthworks will take place on the southern slopes of Dirty Creek Range where the road climbs up through deep cuttings and over fills. There is also a substantial volume of fill required to construct the elevated embankment across the Corindi River floodplain.

Geotechnical investigations indicate that the material generated from the majority of the cuttings over the length of the project will be suitable for general fill, with some material extracted from the lower part of the Dirty Creek Range cuttings suitable for select fill.

Total earthworks volumes have been estimated to be 2.17 million cubic metres of cut and 1.85 million cubic metres of fill, including a topsoil volume of approximately 200,000 cubic metres cut to fill. Geotechnical investigations suggest that in the order of 480,000 cubic metres of cut material from the lower part of the cutting in the Dirty Creek Range could be suitable for select fill. Construction staging is likely to restrict the ability for some material to be won and approximately 25 per cent of the select fill required is expected to have to be imported before any quantity is realised from the cutting.

24.1.2 Pavement material requirements

Material Requirements are shown in Table 24-1.

Select fill requirement is in the order of 200,000 cubic metres. As mentioned earlier the majority will be supplied from the deep cutting in Dirty Creek Range with only 25 per cent or 50,000 cubic metres required to be imported.

Table 24-1 Material requirements

Material types	Cubic metres	tonnes
Total earthworks*		

Cut	2,170,000	
Fill	1,850,000	
– Select fill (imported)		100,000
Pavement materials		
Lean mix concrete	85,000	
Base concrete	117,000	
Asphalt (side roads and ramps)		11,600
Aggregate	106,000	223,000
Sand	70,000	140,000
Cement	27,000	
Bitumen		700

* Note: total earthworks includes approximately 200,000 cubic metres of topsoil cut to fill.

The following assumptions have been made in the development of the quantities listed in the Table above:

- Lean concrete mix ratio: 6 aggregate : 4 sand : 1 cement.
- Base concrete mix ratio: 3 aggregate : 2 sand : 1 cement.
- Asphalt bitumen content: 6 per cent by mass.
- Sand density: 2.0 t/m³.

24.1.3 Prefabricated components

Bridges

There are seven new bridges over the length of the project, six carry the proposed highway over waterways or existing roads and tracks and one carries an existing road, Kangaroo Trail Road, over the proposed route. Concept design for the bridges is generally either prestressed concrete planks or T-ROFFs with in situ concrete decking supported by concrete piers, piles and abutments. The maximum span of the T-ROFF girders required by the concept design is 22 m, however spans of the order of 35m can be accommodated, and for the prestressed concrete planks it is 16 m. The exception to this is the twin bridge structure over the existing highway near Range Road. This bridge spans between two concrete retaining walls either side of the existing highway and its superstructure consists of prestressed concrete girders spanning 15 m with a composite in situ deck 300 mm thick. Rock nailing and reinforced soil walls will also be required for the embankments either side of the existing highway, in both directions, as it approaches the over bridge at this location.

Minor structures and ancillary components

A variety of minor structures usually associated with highway works will be required such as box culverts, pipes, headwalls and other ancillary components.

24.2 Material sources

24.2.1 Stone aggregate quarries

Fourteen quarry sites located in the vicinity of the project were identified in the *Route Option Development – Geotechnical Report (GHD, 2005)*. However, a number of these are no longer in operation. Quarry operators were contacted to provide operational information regarding current operations and reserves. A list of the current operational quarries in the vicinity of the project (as at mid 2007), their current extraction rates and reserves, is presented in Table 24-2.

Table 24-2 Identified quarries, materials and reserves

Quarry name / operator	Materials produces	Extraction rates	Reserves	Comments
Boral, Grafton	20/14 crushed gravel 10/7 crushed gravel Coarse river sand Crusher dust	Max plant output 160 t/hr Allowable extraction rate of 150,000 t/yr	Unlimited, replenished by river Continue extraction until licence removed	Processed river gravel
Jacky's Creek Pit McLennan Earthmoving	Road base Sub-base	Max plant output 2,000 t/day Allowable extraction 60,000 t/yr	Unknown	Ironstone sandstone
Duncan's Pit, Gwydir Highway McLennan Earthmoving	DGB 20 DGF 20 20/14 aggregate 10/7 aggregate	Max plant output 2,000 t/day No maximum limit on extraction	80-hectare site	Granite Argillite
Woolgoolga Quarry Coastal Homesites		Extraction rate of 124,320 t/yr	Up to 5 Mt	
Jungs Quarry T G Jung	Road base Aggregate	Max plant output varies, average of 140t/hr Allowable extraction rate of 285,000 t/yr	Up to 2.5 Mt	
North Boambee Quarry Readymix	Aggregate Road base	100,000 t/yr	Unknown	

The current residual capacity of the quarries could not be ascertained as for commercial reasons operators were reluctant to provide current supply details. However, it is expected that these will change over time and be influenced by other projects and industry demands, and will require reassessment at the time of construction.

Notwithstanding this limitation, the table shows that the quarries to the south have a combined approved extraction rate of approximately 500,000 tonnes per year and total reserves in the order of 10 mega tonnes. McLennan quarries to the west have a combined maximum plant output of 4,000 t/day from the Jacky's Creek Pit and Duncan's Pit operations with a maximum allowable extraction rate of 90,000 tonnes per year from Jacky's Pit and an unlimited extraction rate from Duncan's Pit. There are also substantial reserves at the Duncan's Pit with the majority of the approved 80-hectare area untouched.

The Boral river gravel mining operations has a processing rate of 500 tonnes per day but hopes to increase that rate to 700 tonnes per day within the next two years. They also have a significant allowable extraction rate of 150,000 t/yr and effectively an unlimited resource, although the rate at which the river replenishes the gravel should be considered. It would appear from these figures that if the supply of road base and aggregate material was divided proportionally between the quarries based on their extraction rates, then the project could be supplied with road construction material without significantly impacting on the supply of materials to other projects in the surrounding area and the reserves of the quarries.

In addition to the six current operational quarries, there are three apparently abandoned quarries located in the area surrounding Dirty Creek. One of the quarries is situated to the immediate east of the deep cutting south of Dirty Creek. This quarry is described in a geotechnical assessment as an abandoned conglomerate quarry with sub vertical walls up to 40-50 m and berms less than 5 m wide.

Should it be determined at the time of construction that additional sources of aggregate material are required, further geotechnical investigations will be required at the abandoned quarries to determine the quantity and quality of rock that could be extracted, followed by an economic analysis to determine the feasibility of reopening the quarries.

24.2.2 Other raw materials

Bitumen

Manufacturers of bitumen expressed confidence that the demands could easily be met out of existing refineries. In either case the bitumen will be transported to site by road in heated bitumen trucks.

Cement

Manufacturers of cement advised that the project could be supplied from either Brisbane or Newcastle. Generally distribution would be by road but may consider rail then road. It is likely that temporary storage silos that would be erected on site adjacent to any temporary batching plants. These silos could be replenished overnight, providing such night operations were permitted, and then be full for use the following day.

Water

Water for construction will be required for concrete manufacture, dust suppression (earthworks and materials processing) and compaction.

Clarence Valley Council indicated that water for construction is available at a Department of Commerce reservoir located near Wells Crossing on Parker Road. Coffs Harbour City Council have not responded at the time of this report to requests for information on sources of water.

Extraction of water from the local rivers and streams may be permitted through planning approval but the quality is likely to be suitable for dust suppression and compaction only. Water for the manufacture of concrete will be subject to quality control and approved sources should be established.

Due to the shortage of identified sources of water it is suggested that sources are established sometime prior to the commencement of works. This could be achieved by purchasing or leasing properties with established dams or purchasing properties suitable for the construction of dams.

24.2.3 Prefabricated materials

Larger precast bridge units are likely to be sourced from the larger precast manufacturers. Structural Concrete Industries has a yard south of Newcastle capable of producing prestressed Super T's up to a 40 m span, and BCP has yards in Charmhaven (north of Sydney) and Brisbane capable of supplying the large precast units. Smaller precast units could be sourced from Richmond Valley Council who has beds for prestressed concrete planks conforming to the RTA specifications, along with Super T's and octagonal prestressed concrete piles.

For minor structures and ancillary units such as culverts, headwalls, etc, Humes has manufacturing operations in Kempsey, Tamworth and Sydney. The Kempsey operation produces the small components such as pipes, headwalls and stormwater pits while the Tamworth and Sydney operations produce a full range of precast components. Rocla has manufacturing operations in Sydney and Brisbane and are able to supply box culverts, pipes and other minor structures.

24.3 Environmental approvals

Prior to construction, environmental approval requirements will need to be identified and gained for all material extraction, including aggregate, water, etc. Quarry operators should be required to provide evidence demonstrating environmental approvals to supply the required materials.

Should extraction of water from local streams, dams, or private property be identified as required during construction, these should be identified early as any required environmental approvals may take some time to secure.

This section of the report presents the considerations the impact of additional heavy vehicle movements will have on local roads. Access to the construction site at various key points along the Upgrade alignment has been considered as well as the effect on local roads that will be used as supply routes from quarries and other sources of raw materials.

24.4 Site access and supply routes

For the majority of the length of the project the preferred route alignment either duplicates the existing highway or is realigned close to the east or west therefore access to the construction site will be predominantly from the existing highway. The only significant deviation from the existing highway alignment occurs where the route crosses the Corindi River to the west of the existing crossing and begins its ascent up the southern slopes of the Dirty Creek Range.

Within this section of the project, it is not recommended that Kangaroo Trail Road be used for heavy vehicle access to the cutting under Kangaroo Trail Road and for the construction of the subsequent highway overbridge. Kangaroo Trail Road is an unsealed local road with poor road geometry providing access to residential and rural properties. It is considered unsuitable for sustained heavy vehicle traffic. Nuisance and safety issues for the local residents would also be significant.

The new highway formation could be used for access to the cutting from the existing highway. Earthworks could then extend to the south bank of the Corindi River providing access for the construction of the southern abutment. Alternatively, access to the south abutment would likely have to be by temporary road or access ways to private properties as there are no public roads in the vicinity of the location of the south abutment.

The concept design provides for the construction of an access road that would link the properties on the western side of the proposed highway with the existing highway. It is likely that this road would be constructed early in the project to facilitate access between the existing highway and construction works across the Corindi floodplain.

24.4.1 Supply routes

The majority of the raw and processed materials and prefabricated components for the project are likely to be transported along main roads and highways that are suitable for heavy vehicle use. The only minor roads that may be used for transporting materials are those from material source locations to the main highway, ie local roads from quarries and manufacturing plants to the highway. It is expected that the constructor will develop an access strategy for the project which will identify any local roads expected to be impacted by supply along with appropriate management and maintenance strategies.