

Appendix F1

Construction methodology:

Construction method statements – major structures

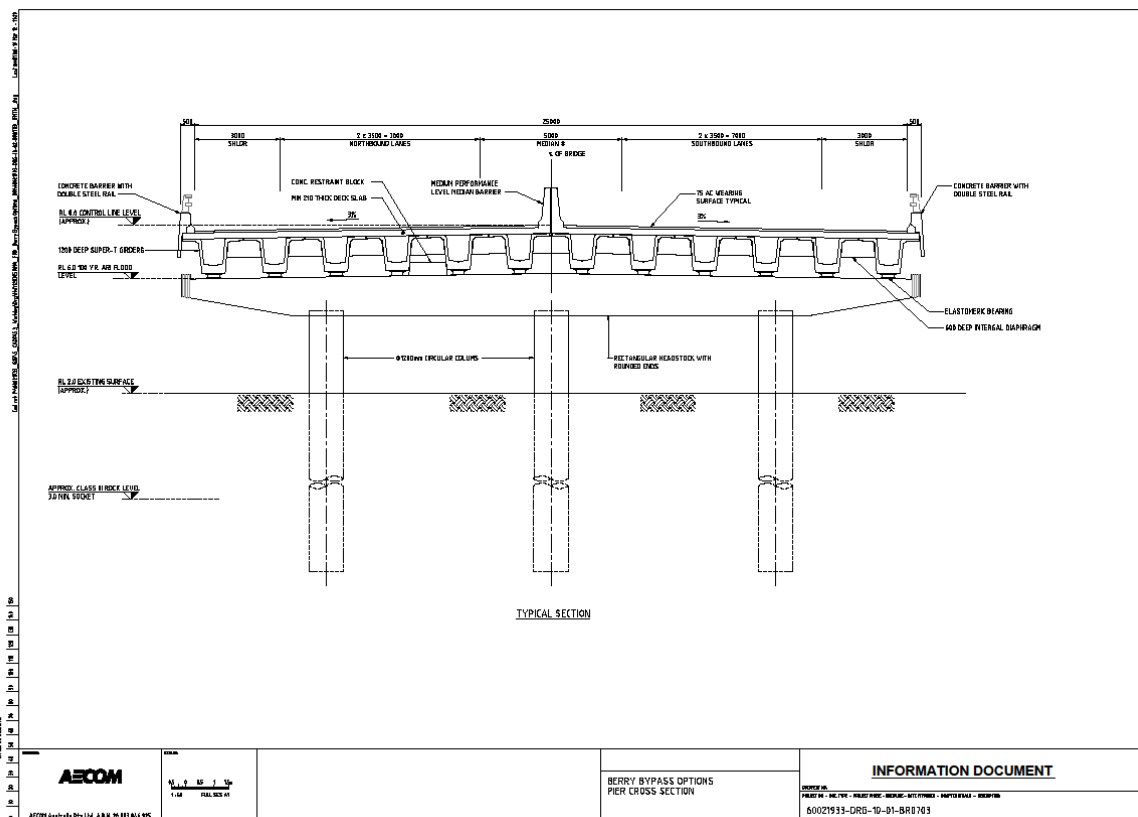


CONSTRUCTION METHOD STATEMENT

10910 Main Berry Bridge

Northern Route

(The general approach to the construction of the main bridge is similar for the Southern Suggestion. An appendix indicates variations to the method required for the Southern Suggestion)



Scope:

This CMS covers key aspects of construction of the main bridge from piles up.

Key elements addressed include:

- Pile installation
- Pile cap construction
- Pier construction
- Headstock construction



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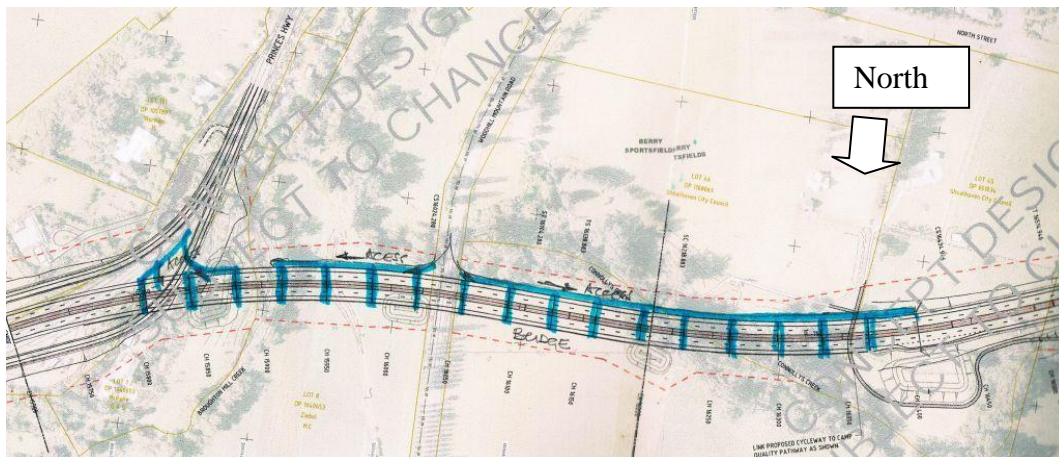
- Super T beam erection
- Deck, diaphragms, link slabs and precast parapets

Construction Method:

Basics:

Assumptions are as follows:

- Hard surface access is available to all pile caps. Main access point from Woodhill Mountain Road with auxiliary access from Princes Highway at Northern Interchange to reach structure for first two spans.



- The piles are already in place having been driven from GL. The upper section will project sufficient to allow the clamping of the pier formwork
- Creek diversions or alternatives are in place to ensure construction is in the dry (although pumping may be required to keep the excavation dry)
- 3 no 1200diam circular piers (uniform shape from bottom to top) extend upwards from 3 no 1200 diam piles
- No pile caps are anticipated at time of writing but MS included should design change.
- Super tee Beams are 32.250m span and 1.5m deep weighing approximately 55t.
- Assume 20 spans at approx. 30m = 607.5m



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- Assume 6 Super tees per carriageway (therefore 240 beams)
- Number of headstocks: 19
- Number of piers/columns 3 per headstock (57 no)

Method - Bored piles

Scope

Please note this activity is normally subcontracted.

This method statement applies to the installation of bored piers required as foundations for bridge, walls and miscellaneous structures on the Project.

Access

Clear access will be provided to the location of the bored piers. Embankments will be built where required prior to the commencement of drilling. The piers will be installed from a ground pad at the toe/top of embankments as appropriate.

Anticipated Resources to carryout Construction Stage:

- Pile Driving Rig
- Drilling Rig
- Bob Cat (Loader)
- Truck
- 25tonne Support Crane for trammie pipe and placing reo cage

Survey

Centres of piers shall be marked with a peg and offset pegs shall also be installed. A reference distance to design toe and the pier diameter shall be marked on an offset peg. The pre-bored hole will be checked for positional tolerance at regular intervals during pre-boring before insertion of the steel liner.



Driving of Steel Liners

If required, steel liners will be driven using the pile driving rig set up over the pier set centre peg. Liners will be pitched and driven to the founding level given on the drawings. Where required the liner will be driven progressively with excavation and removal of material from within to facilitate driving. Where ground conditions permit, predrilling of holes marginally larger than the pile shoe outer diameter will be carried out prior to insertion of the liner.

Drilling/Excavated Material Removal

The drilling rig fitted with the correct sized auger will be set up over the driven steel liner or pier centre peg and drilling commenced.

Excavated material will be spun off the auger as it is withdrawn from the hole. This material will be removed by the small loader either into stockpile for later removal or directly into a truck for progressive disposal to spoil. Drilling will proceed to the required founding level. If this is into rock, a special rock cutting auger will be fitted to the Kelly bar of the drilling rig to enable penetration to the required depth. Alternatively a rock chopper may be used.

Steel Reinforcing Cage

After the founding condition in the pier has been accepted by the Engineer, any temporary protective liner shall be withdrawn. The socket will then be cleaned using a cleaning bucket and a pre-made steel reinforcing cage will be lowered into and suitably secured in the bored pier.

Concrete Placement

The bored pier will then be filled with the appropriate grade of concrete using a suitable tremmie pipe or concrete pump with the finished surface being brought to the appropriate R.L.

Anticipated Production Rates:



- *Allowance for approximately 5m/hour in other than rock material.*

Method - Pile Caps (if required)

- Pile caps are excavated to the required level with 20t excavator. The excavation will allow a 1m wide strip all around to provide space to erect the pile cap formwork. The excavation slopes will be at say 1:1. Some hand excavation will be required around piles. A sump will be provided and a pump used to keep the excavation dry if necessary. Spoil is side cast. Perhaps later used to landscape over cap.
- Piles will be trimmed back to the required level exposing the reinforcement. Excavator fitting with crushing tool may be required if concrete in pile is cast too high.
- A 50mm concrete blinding will be placed over the underside of the pile cap as a working platform.
- Pile cap formwork (proprietary type) can be erected, reinforcement cage placed or fixed insitu and the pile cap poured. Concrete poured directly from ready mix truck. May occasions where crane is required.

Anticipated Resources to carryout Construction Stage:

20 t excavator
Subcontract the FRP base

Anticipated Production Rates:

Allow 5 days/pile cap (Note: Two no per location as there are two parallel bridges one for each carriageway)

Method - Piers

- Piers are generally about 6m high rising at the northern end to ~12m high (depending on the final alignment).
- Piers are assumed to be uniform shape from bottom to top





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- A purpose made steel form made up in modules to suit the height will be used. Make up pieces may be required for odd heights and this would be placed at the bottom section.
- The reinforcement cage would be prefabricated and hoisted into place with a 20t crane.
- Once the reo is in place one half of the form can be erected, plumbed and fixed, followed by the second half. The two halves are joined together working from the scaffold.
- Concrete may be placed by crane and skip into the form and vibrated
- The pier form will remain in place till the initial curing period is over say 5 days.

Anticipated Resources to carryout Construction Stage:

- Access at each pier being constructed.
- Purpose made steel forms (capable of doing 3 no 1200 diam piers simultaneously)
- 20t R.T. crane
- Concrete Skip
- Hiab truck

Anticipated Production Rates:

Allow 5 day cycle /6m pier form:

	M	T	W	T	F	S	S	M
Prefab reo cage								
Erect cage								
Erect form								
Concrete								
Cure								
Strip Form								

Allow 3 forms (19 uses each)

Programme for piers would be 19 weeks.

Method - Headstocks (insitu)



If cast insitu the approach would be:

- Simple falsework system to support formwork for then insitu cast headstock
- The same crane that erects the pier forms and places pier reo will have the right capacity to construct the headstocks.
- The prefabricated reinforcement cage is placed using crane and spreader bar.
- Cage is tied into the pier starter bars and then the headstock is concreted either by pump or crane and skip



Anticipated Resources to carryout Construction Stage:

- Access tower at each pier remains in place.
- Walkways on the headstock
- 20t Tonne crane
- Concrete pump

Anticipated Production Rates:

- The rates of installing the falsework and concreting the headstocks is expected to be one every two weeks allowing for 7 days curing before stripping the falsework

Precast Headstock option

If precast 'bathtub' forms were manufactured and placed the approach would be:

- To avoid costly falsework to support an insitu headstock a precast trough/bath option is considered viable.





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- The same crane that erects the super tees as it will have the right capacity to also place this precast trough.
- Note all walkways are pre attached before lifting.
- Starter bars protruding from the piers pass through holes in the soffit of the headstock.
- The reinforcement cage is placed and tied into the starter bars and then the rest of the headstock is concreted.

Anticipated Resources to carryout Construction Stage:

- Access tower at each pier remains in place.
- Walkways on the headstock
- 200tonne Tonne crane

Super T Manufacture

Whilst there are commercial sources for Super-T beams the cost of transport and storage may make 'on site' casting viable, particularly as there are a large number of beams to be manufactured. The viability of an 'on site' facility will depend on the quantity of beams and market conditions.



Method - Super tee Erection

Super tee beams may be procured from industry suppliers experienced at producing such beams. Factories in the Central Coast and Macksville in NSW as well as precasters in Victoria could be possible sources.

If there is sufficient quantity and a precasting site available the





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contractor may elect to manufacture "on site" to save transport costs. The proposed site for the truck rest stop may well be suitable to accommodate the manufacturing facilities as well the beam storage area. Adequate services would be required and this will need to be checked for suitability.

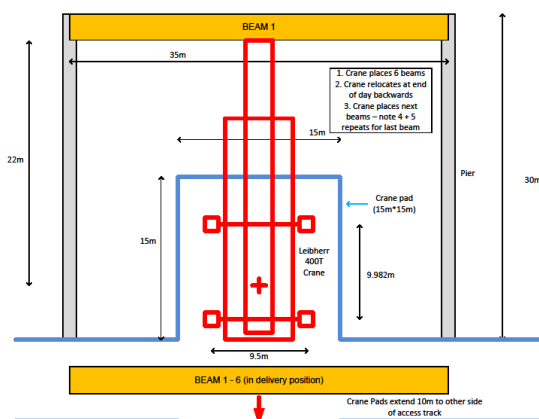


Beams will be loaded onto a horse and jinker haulage unit and brought to the site for erection.

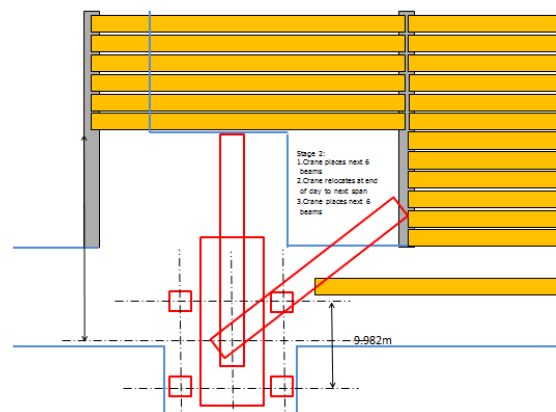
The beam will be brought alongside the piers where the beam is to be erected.

Depending on the peculiarities of each location the crane required may vary. For instance on the flood plain the crane can be placed close to the beam both during lifting off the transport and placing on the headstocks.

A suitable crane would be a 400tonne which will lift the 55tonne super tee at a 20m radius with a 30m boom (see table). Crane pad layout shown and layout for first six beams:

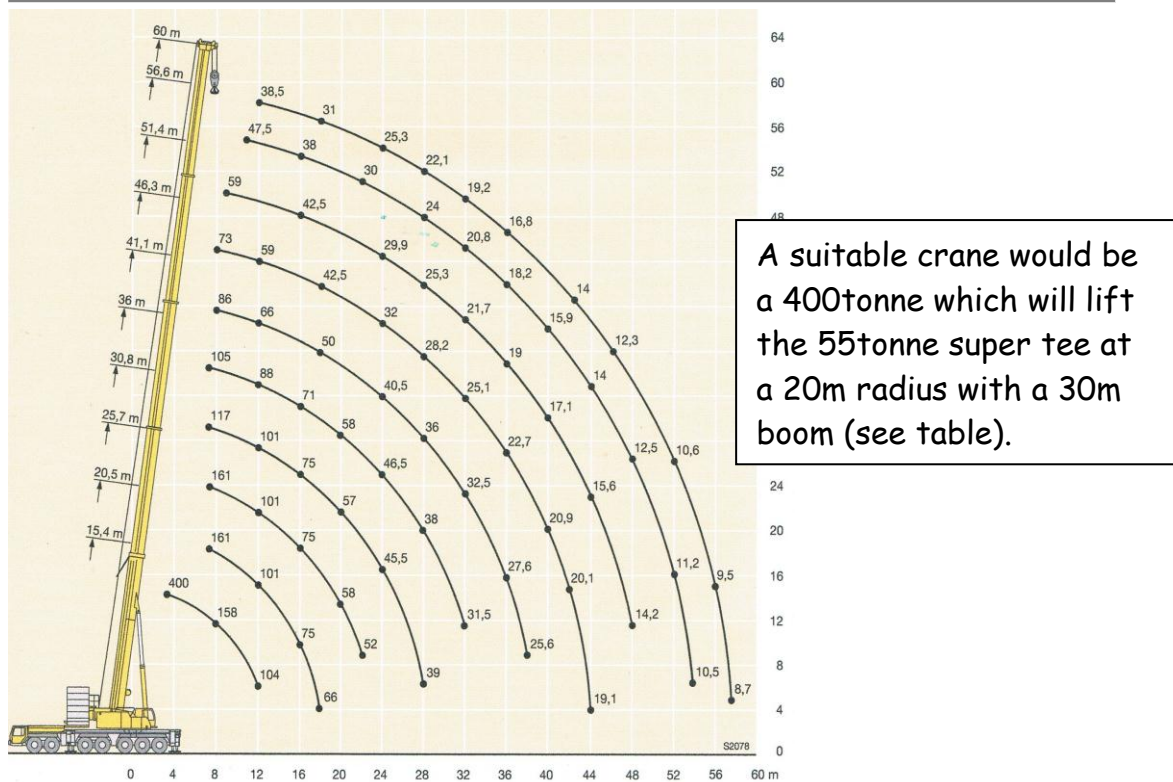


Layout for second 6 beams:





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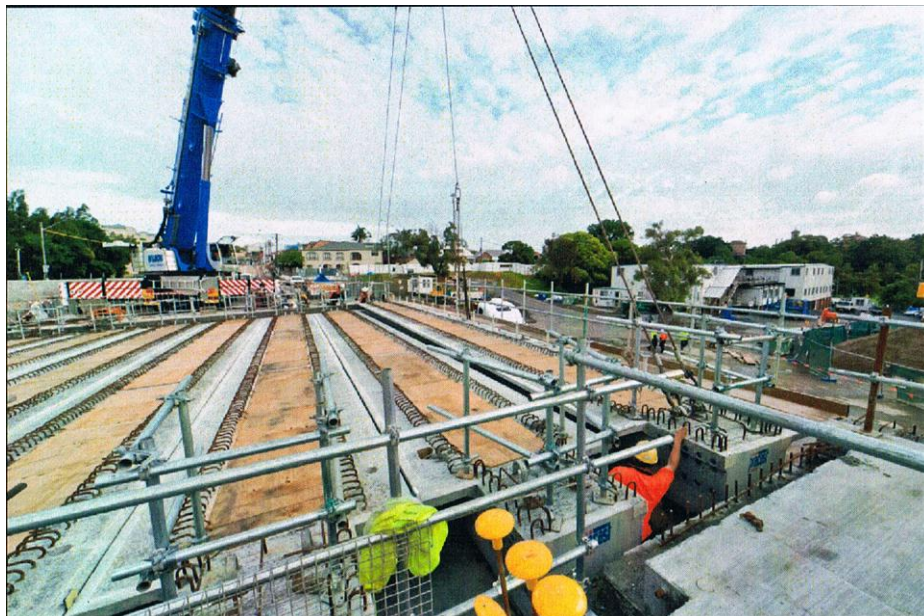
At the Northern end of the bridge access restrictions may require a dual lift operation to erect the beams. This needs further investigation.



Picture from Minnamurra bridge

Method - Deck construction

Once the supers are in position formwork is placed between the beam flanges and for the end diaphragms. A 50tonne rough terrain crane is used to handle the reinforcement onto the deck where is fixed in position. Once the reinforcement is placed and the screed rails established the concrete poured using a concrete pump at approximately 30 m³/hour.





Precast parapet shells are manufactured either off site or on site (depending on whether an 'on site' precasting facility is provided for the manufacture of bridge beams). These are made in 6m lengths and craned onto the bridge where they are either bolted to the deck or cast in-situ with the deck kerb.



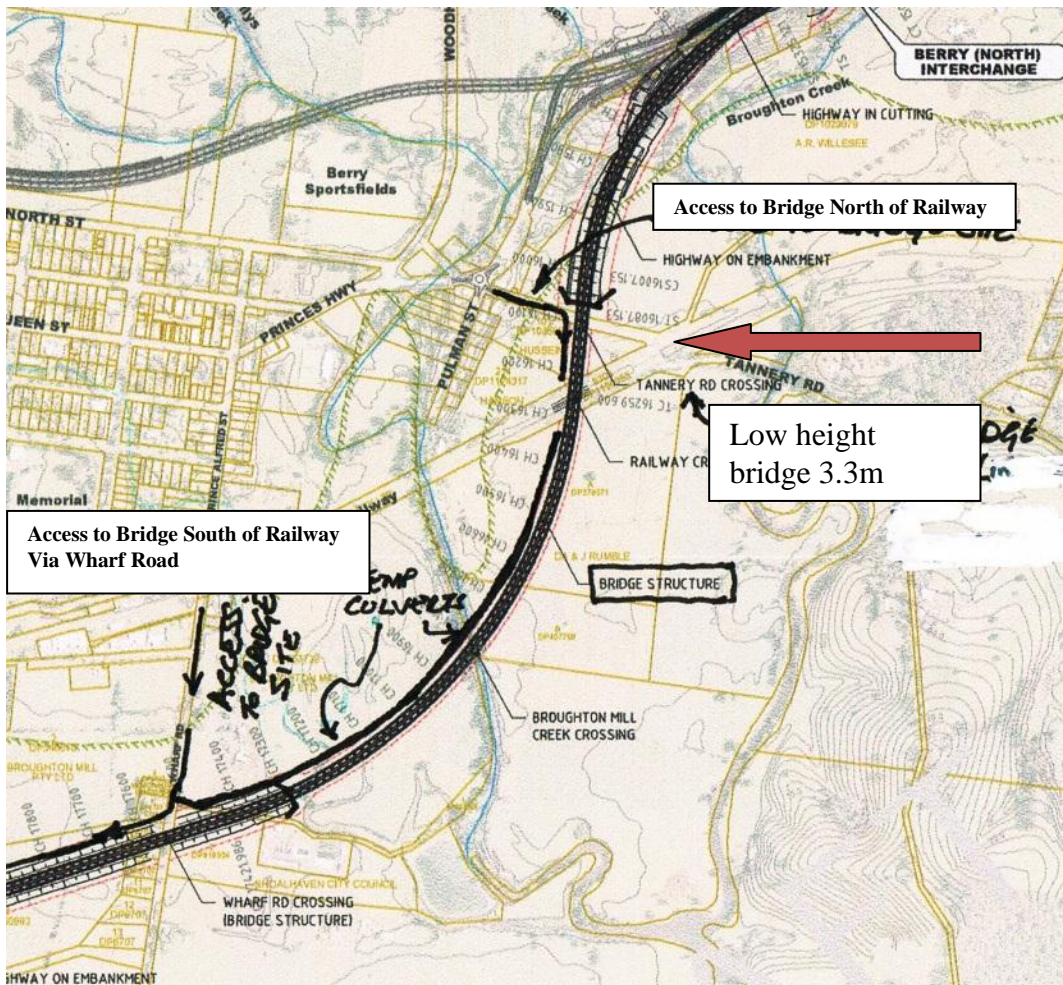
Completion of the bridge involves conventional traffic barriers, handrailing, expansion joints, asphaltting, line marking & signs.



Appendix: Southern Berry Bridge

The above method statement for the Northern Concept Design is applicable to the Southern Suggestion as the same approach would be adopted to constructing the bridge. Obvious differences are:

1. The access to the bridge site. This is depicted below:



Appendix F2

Construction methodology:

Construction method statements – bulk earthworks



CONSTRUCTION METHOD STATEMENT

10630 Bulk Earthworks

Northern Route

Scope:

This MS describes the approach to the bulk earthworks for the Northern Route. The Southern suggestion is basically similar and any changes are noted in the appendix. Major cut is in Latite and other cuts in sandstone and stiff silty clays.

Earthworks

Mass Haul Analysis

Purpose

Earthworks are one of the most significant costs in a major road project. A mass haul analysis aims at finding the most economic approach to construction of the earthworks. This is best achieved by minimizing haul distances and the quantity of imported fill (if required)

Approach

From the design long and cross sections the volumes of earthworks are determined. These are either cuts (Excavated material) or fills (embankments). The amount of topsoil is determined and this is generally stockpiled for later reuse in landscaping the embankment batters. Then the amount of unsuitable material is assessed from knowledge of the geotechnical conditions along the route and experience. The final mass haul then takes these factors into account in determining the earthworks balance (where the amount of cut equals the amount of fill consistent with the minimum of haul distance)

Constraints

Mass haul analysis takes into account material properties but also:



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1. Geological properties of the excavated material and its suitability for its intended use
2. Special issues such as the presence of soft soils, potential acid sulfate soils and embankment stability all impact on the mass haul
3. Material bulking and compaction factors
4. Obstacles such as major rivers, roads, railways which intercept the mass haul and hence impact the analysis
5. Accommodation of existing traffic by means of staging or traffic switching
6. Need to sequence work to optimize usage of plant and to achieve the shortest possible programme

Reference Documents

- AECOM Concept Design Drawings dated 30 June 2011
- Geotechnical reports as follows:
 - Concept Design Report - Foxground and Berry Bypass. Appendix A - geotechnical Report prepared by AECOM Jan 2011
 - HWI - Princes Highway: proposed cutting Foxground: Geotechnical Investigation - Overview Report prepared by Southern Geotechnical Services, Wollongong Nov 2011
 - Geotechnical Interpretive Report for Concept Design prepared by Coffey Geotechnics May 2010
- Raw mass haul for main alignment showing accumulated earthworks volumes. The earthworks volumes on the raw diagram exclude pavement layers, topsoil removal, rock ripping, unsuitable material and bulking factors.

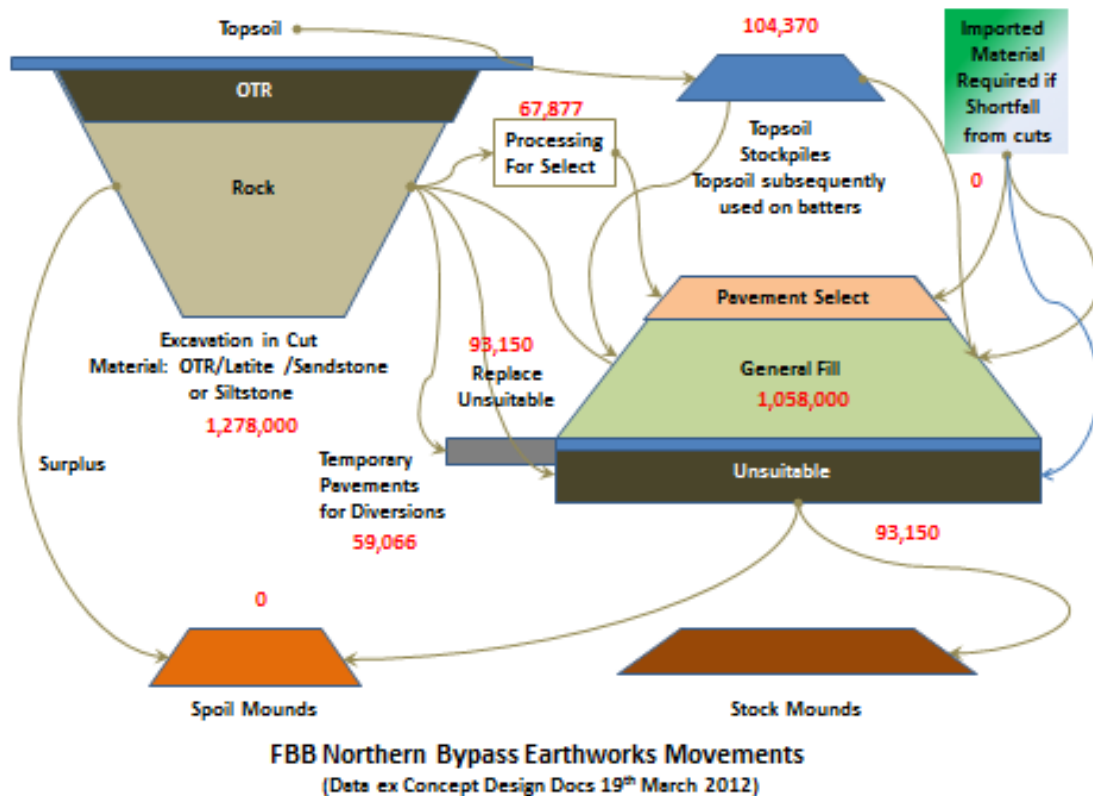
Construction Method:

Basics:



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The overall earthworks movements are best represented by Figure 1N below:



1. The major cut (407861m³) is in Latite whilst the balance of cuts are substantially in sandstone material. Latite is similar to basalt and will need to be drilled and blasted. The sandstone cuts may be won by ripping.
2. The latite is only suitable for general fill and not select material.
3. All latite and sandstone cut batters will be presplit.
4. Geotechnical report indicates the following bulking factors which affects the amount of material that has to be hauled:
 - Residual soils and stiff alluvial soils 0.9 - 1.0
 - Highly weathered sandstones, siltstones and latite: 1.1 - 1.2.
 - Slightly weathered to fresh sandstones and latite: 1.3 - 1.4
 - **Allowed 1.1 for OTR and 1.3 major cuts**
5. Haul distances average out at approx.. 885m. Assumptions have been made for haulage of unsuitable material and its replacement material as the quantity & location are not yet determined.



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6. Short hauls say under 1.5km are generally handled with motorised scrapers provided the material is not too abrasive. Latite is abrasive and generally unsuitable for scraper work.
7. As the latite is quite abrasive the rock is loaded into haul trucks and transported to the embankment fills. Off highway trucks are used where possible eg on 'greenfield' sites and in the first stage of the staged works.
8. Highway trucks have to be used where material is required to be transported on public roads and this also applies to the second stage of the staged works.
9. Where staged works are necessary in order to accommodate the existing traffic flows on the Princes highway it has been assumed that 60% of the works can be executed in the first stage and 40% in the second stage.
10. In order to accommodate construction the existing highway will require a number of temporary diversions and cross over points.
11. Cross over points would be located at Chainages 11950, 13800, 14250 & 15400
12. Some material, mainly sandstone, is suitable for pavement material in the Select Material Zone. Provided this material is not required in embankments it will be hauled to the proposed site of the truck rest stop and processed there for use as select material.

References (approximate):

Cut / Fill reference	Start Chainage	Finish Chainage
C1	7600	7600
F3	7600	8000
C2	8000	8400
F4 side	8400	8470
C3	8470	9380
F5 side	9000	9100
F6a	9380	9910
Broughton Ck Bridge 1	9910	10030
F6b	10030	10060
F7	10060	10670
Broughton Ck Bridge 2	10670	10760
F7b	10760	11120
Broughton Ck Bridge 3	11120	11320
F7c	11320	11360



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C4	10670	11700
F8	11700	11920
C5	11920	12160
F9 side	12160	12340
C6	12340	12590
F10	12590	12920
C7	12920	13260
F11	13260	13800
C8	13800	14120
F12 side	14120	14160
C9	14160	14370
F13	14370	14490
C10 side	14490	14520
F14	14520	14650
C11	14650	14990
F15	14990	15300
C12	15300	15800
F16 side	15800	15810
Berry Bridge	15810	16410
F17	16410	17200
C13 side	17200	17340
F18	17340	17510
C14	17510	17760
F19	17760	18250
C15	18250	18430
F20	18430	18890
C16	18890	19160
F21	19160	19500
C17	19500	19560
F22	19560	20000
C18	20000	20300
F23	20300	20400

Breakdown:

The earthworks item will be broken down into the following plant fleets for estimating the costs:

1. Unsuitable and spoil OTR
2. Latite material from Cut 3
3. Sandstone cuts C4 to C11 plus initial stages of staged construction



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4. Sandstone cuts C4 to C11 plus final stages of staged construction
5. Sandstone cuts C12 to C13
6. OTR and Siltstone cuttings C14 to C18 plus initial stages of staged construction
7. OTR and Siltstone cuttings C14 to C18 plus final stages of staged construction
8. Ripping base of cuts
9. Construction of diversions/temporary roads
10. Zone diagram showing possible contracting approach
11. Traffic Sequencing for Staged Construction

1: Unsuitable and spoil OTR

The quantity is assumed at this stage and the assumption is made that unsuitable will occur under embankment fills, in gullies and flood plains. Issue is whether material can be modified to be useable or whether it has to be disposed of. Typically this would be removed by scraper fleet as per above, however depends on location of spoil dump and haul route and distance. Assumed haul by truck and dog as need to haul over public roads.

- Excavate with CAT E35 excavator
- Haul with truck and dog(6 no)
- CAT D6H Dozer
- Truck Water cart 30kL
- Spotter

Anticipated Production Rates:

- Production 230m³/hr
- 50% allowed in stock bunds with nominal compaction
50% to stockpile with no compaction
- Stockpile/Bund fleet:
- CAT D6S Dozer
 - Spotter
 - CAT E35 Excavator
 - Truck Water cart 30kL



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2: Latite material from Cut 3 ROCK

Drill & Blast will be undertaken by a specialist subcontractor. Drill patterns, spacing of holes, charges etc. to be provided by s/c. Batters have to be presplit.

Anticipated Resources to carryout Construction Stage:

Subcontractor

Anticipated Production Rates:

Assume blasting 10,000m³/blast

No of blasts: ~40 with a blast every 3 days

Cut would take 40*3=120 days (say 6 months)

Anticipated Resources to carryout Construction Stage:

Load dump trucks with Komatsu PC1000 excavator or equivalent
6 number CAT 773 50tonne rear dump trucks.

Anticipated Production Rates:

R50 Dump Trucks 21.8m³ to match PC1000 output of 4500m³/day

Haul	Travel time	Fixed Time	Total time	Cycles/ 50min hour	Volume/ hour/truck	Trucks required	Bm ³ /hr total
m	min	min	min	no	Bm ³ /hr/truck	no	Bm ³ /hr
500	1.35	3.45	4.8	10	227	1.9	436
750	2.05	3.45	5.5	9	199	2.2	436
1000	2.7	3.45	6.15	8	177	2.5	436
1500	4.05	3.45	7.5	7	145	3	436
2000	5.4	3.45	8.85	6	123	3.5	436
2500	6.75	3.45	10.2	5	107	4.1	436

Additional plant:

- Grader CAT 14G
- Truck Water cart 30kL
- Spotter



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Compaction of fills:

Anticipated Production Rates:

MODEL AND MACHINE PASSES	AVERAGE SPEED		COMPACTED LIFT THICKNESS								
	km/h	MPH	100 mm m ³ /h	4 in yd ³ /hr	150 mm m ³ /h	6 in yd ³ /hr	200 mm m ³ /h	8 in yd ³ /hr	250 mm m ³ /h	10 in yd ³ /hr	
815B	3	6.5	4	419	548	628	822	837	1095	—	—
		9.5	6	628	822	942	1232	1256	1643	—	—
		13.0	8	837	1095	1256	1643	1675	2191	—	—
	4	6.5	4	314	411	471	616	628	822	—	—
		9.5	6	471	616	706	924	942	1232	—	—
		13.0	8	628	822	942	1232	1256	1643	—	—
	5	6.5	4	251	329	377	493	502	657	—	—
		9.5	6	377	493	565	739	754	986	—	—
		13.0	8	502	657	754	986	1005	1314	—	—
	6	6.5	4	286	274	314	411	419	548	—	—
		9.5	6	314	411	471	616	628	822	—	—
		13.0	8	419	548	628	822	837	1095	—	—
825C	3	6.5	4	488	642	731	962	975	1283	1219	1604
		9.5	6	713	962	1069	1444	1425	1925	1781	2406
		13.0	8	975	1283	1463	1925	1950	2566	2438	3208
	4	6.5	4	366	481	534	722	731	962	914	1203
		9.5	6	534	722	802	1083	1069	1444	1336	1804
		13.0	8	731	962	1097	1444	1463	1925	1828	2406
	5	6.5	4	293	385	439	577	585	770	731	962
		9.5	6	428	577	641	866	855	1155	1069	1444
		13.0	8	585	770	878	1155	1170	1540	1463	1925
	6	6.5	4	244	321	366	481	488	642	609	802
		9.5	6	356	481	534	722	713	962	891	1203
		13.0	8	488	642	731	962	975	1283	1219	1604

The number of machine passes required is dependent on soil type, moisture content, desired compaction and machine weight.

e.g. General Fill: Assume 6 passes of an 825 travelling at 6.5kph on layers 200mm thick: 488 compacted m³/hour*50/60=400ccm/hour

Anticipated Resources to carryout Construction Stage:

- CAT 825C (2no)
- CA51 Smooth Drum Roller
- Grader CAT 14G
- Truck Water cart 30KL 50%
- Spotter

Anticipated Production Rates:

Production 365m³/hr



3: Sandstone cuts C4 to C11 plus initial stages of staged construction

Expect to be able to rip the sandstone to win the material for general fill and also for select material

Anticipated Resources to carryout Construction Stage:

- CAT E65 Excavator
- CAT D10R ripping
- CAT 773 Dry (5 no)
- Grader CAT 14G
- Truck Water cart 30kL 50%
- Spotter

Same compaction fleet as above

Anticipated Production Rates:

Production 365m³/hr

4: Sandstone cuts C4 to C11 plus final stages of staged construction

Same fleet as for initial stage but with smaller water cart
Same compaction fleet as above

Anticipated Production Rates:

Production 230m³/hr

5: Sandstone cuts C12 to C13 to Bridge Embankment

Expect to be able to rip the sandstone to win the material for general fill and also for select material

Anticipated Resources to carryout Construction Stage:

- CAT E65 Excavator
- CAT D10R ripping
- CAT 773 Dry (8 no)
- Grader CAT 14G
- Truck Water cart 30kL 50%
- Spotter

Same compaction fleet as above



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Anticipated Production Rates:

Production 365m³/hr

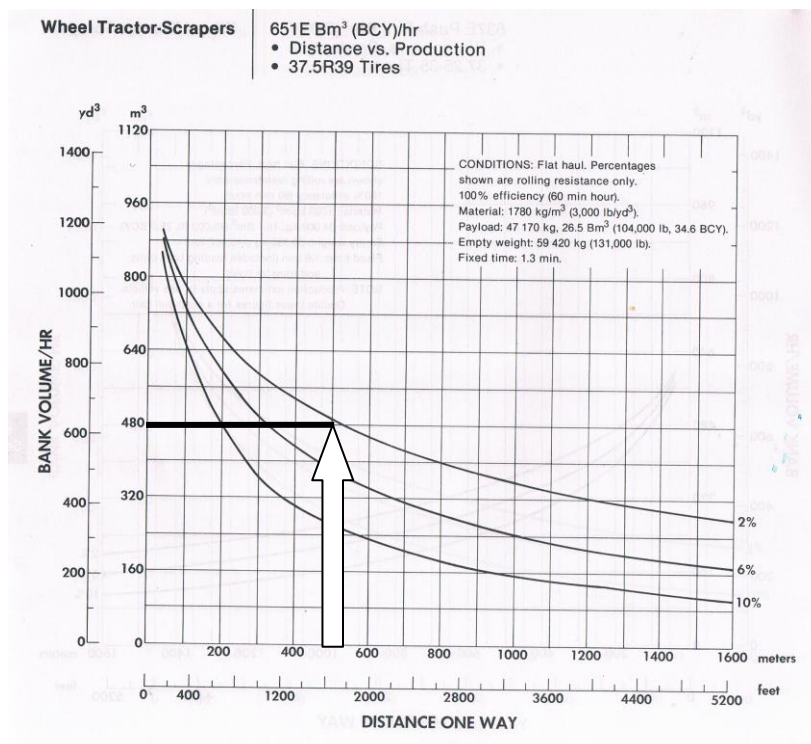
6: OTR and Siltstone cuttings C14 to C18 plus initial stages of staged construction

Anticipated Resources to carryout Construction Stage:

- CAT 651 Scraper (3 no)
- CAT D11D11R ripping
- Grader CAT 14G
- Truck Water cart 30kL 50%
- Spotter

Same compaction fleet as above

Anticipated Production Rates:



E.g. for 500m haul expected output per scraper is
 $480 \times 95\% \text{ efficiency} = 450 \text{bcm/hr}$.

3 scrapers would output 1350 bcm/hr

Adopt Production 450m³/hr



7: OTR and Siltstone cuttings C14 to C18 plus final stages of staged construction

Anticipated Resources to carryout Construction Stage:

- Excavate with CAT E35 excavator
- CAT D10R Dozer ripping
- Haul with truck and dog(4 no)
- Truck Water cart 15kL 50%
- Spotter

Same compaction fleet as above

Anticipated Production Rates:

- Production 230m³/hr

8: Ripping of cutting floors

Anticipated Resources to carryout Construction Stage:

- CAT D10R Dozer ripping
- Truck Water cart 30kL 50%
- Spotter

Anticipated Production Rates:

- Production 300m²/hr for a 300mm depth

9: Temporary Diversions

Construction of side tracks:

The tracks are to be designed to the construction travel speed horizontally and vertically. Normally at the start of project we have an 80km/hr standard and can go down to 40km/hr. This is project specific the appropriate radii should be adopted.

The overall cross section width of 10m should be sufficient 1.5m shoulders and two 3.5m lanes.

Pavement specifications - a typical pavement for the side track (used on the Conjola Mountain project on the Princes Highway) was:

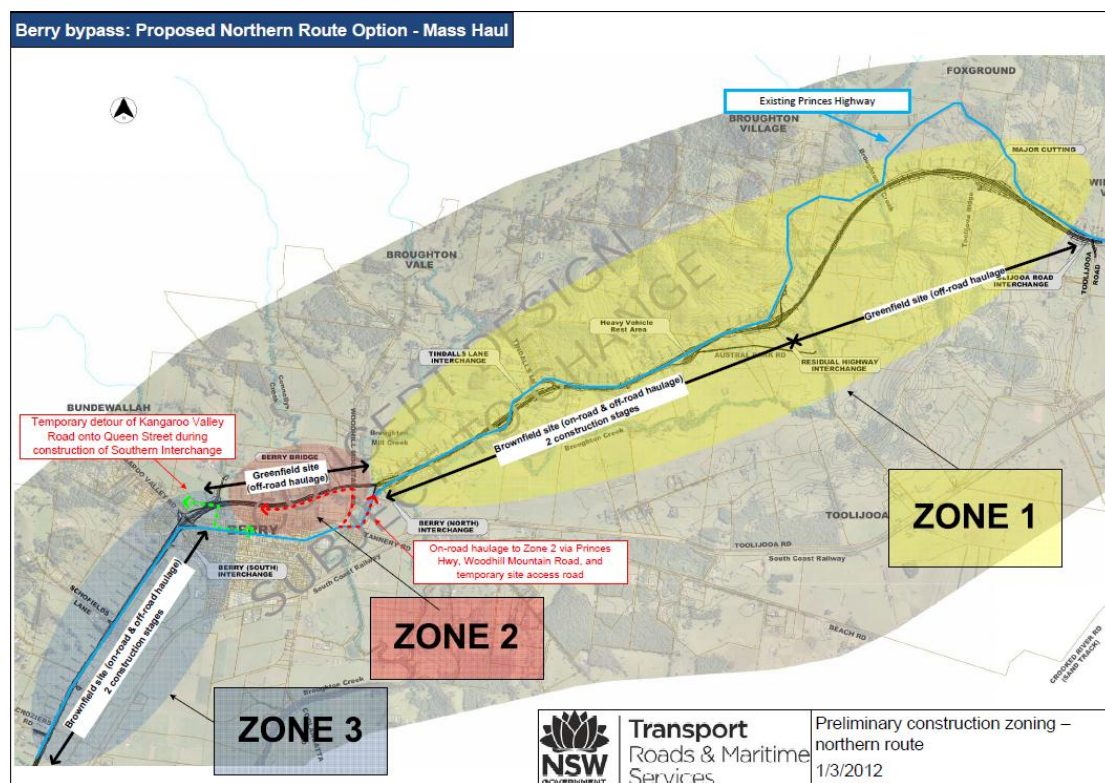


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- Select material 300mm (150mm lime stabilised 3% - 150mm min CBR 15%)
- DGB 20 200mm
- 10mm sprayed seal
- 50mm Asphalt

10. Zone diagram showing contracting approach

This zone diagram indicates a generalised contracting approach to the project:



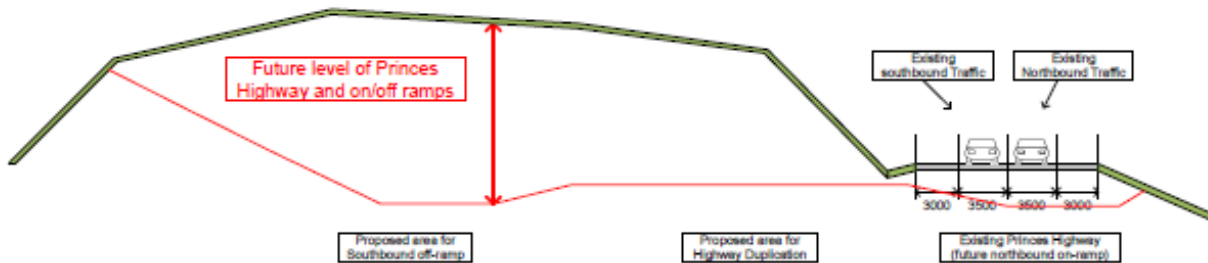
11. Traffic Sequencing for Staged Construction

The following diagrams indicate the sequencing to accommodate the traffic on the princes Highway north whilst maximising the construction site.

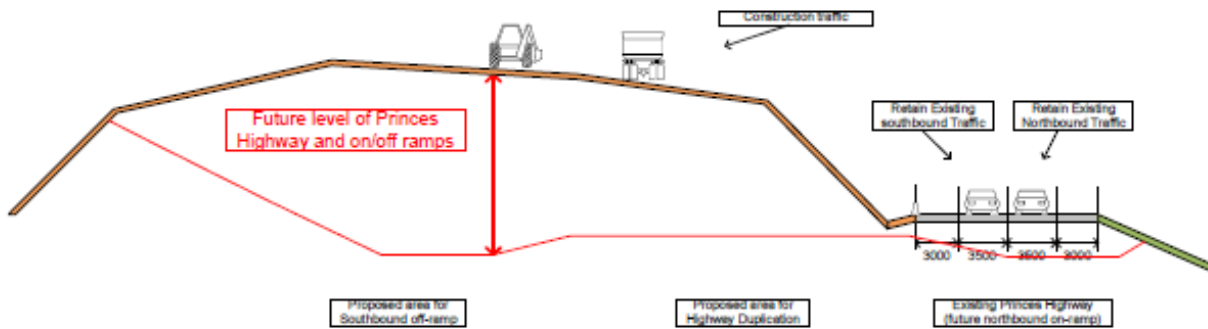


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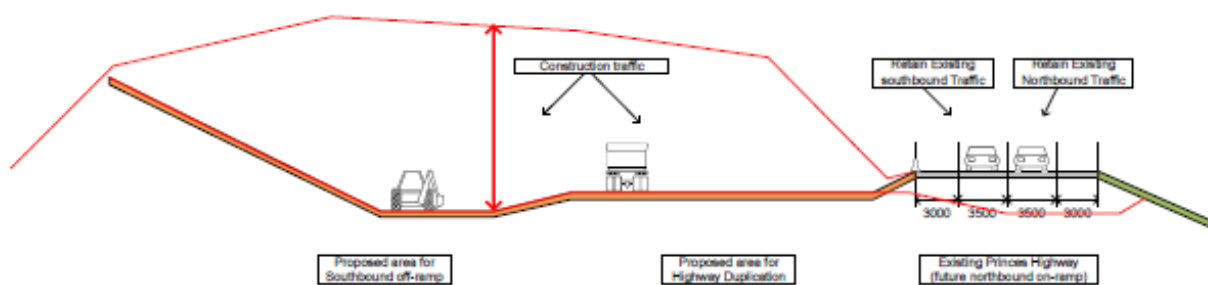
BEFORE CONSTRUCTION – NORTHERN INTERCHANGE CH16800



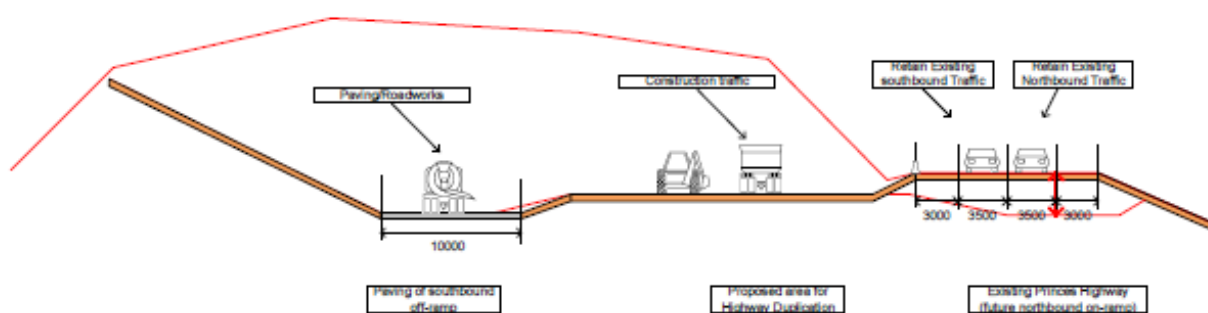
CONSTRUCTION STAGE 1 – NORTHERN INTERCHANGE



CONSTRUCTION STAGE 2 – NORTHERN INTERCHANGE



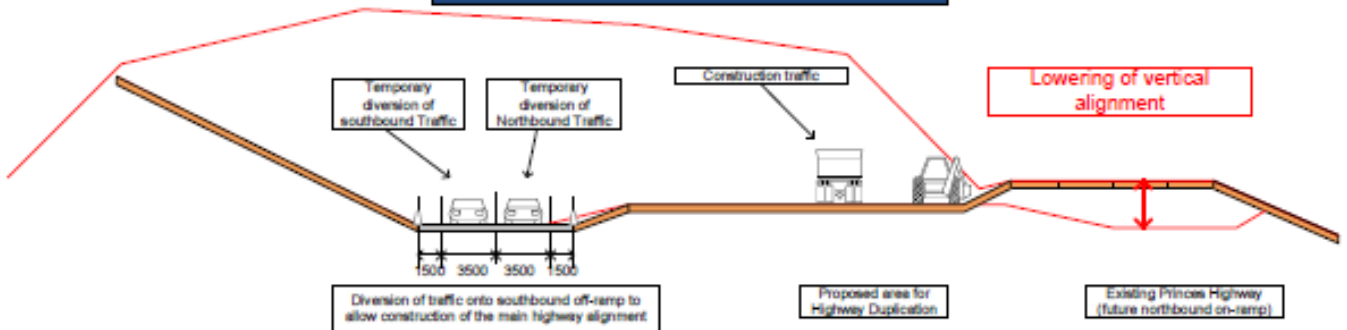
CONSTRUCTION STAGE 3 – NORTHERN INTERCHANGE



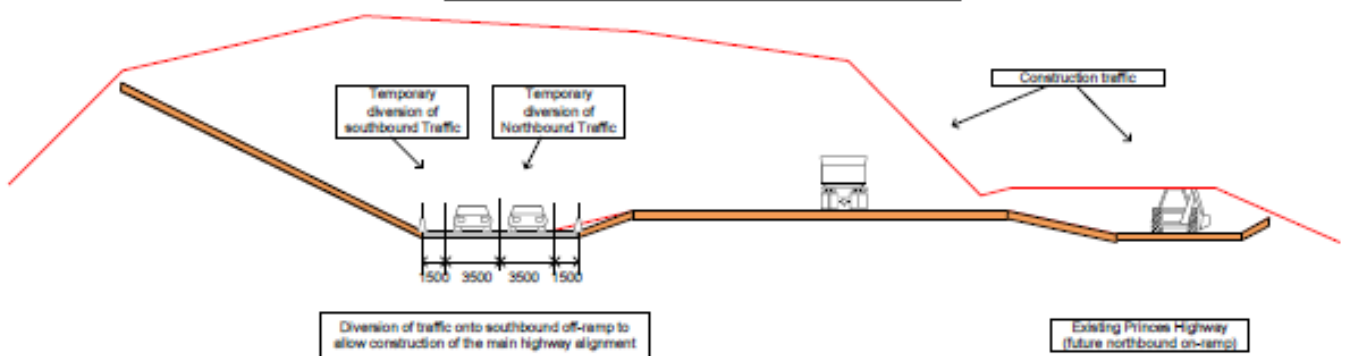


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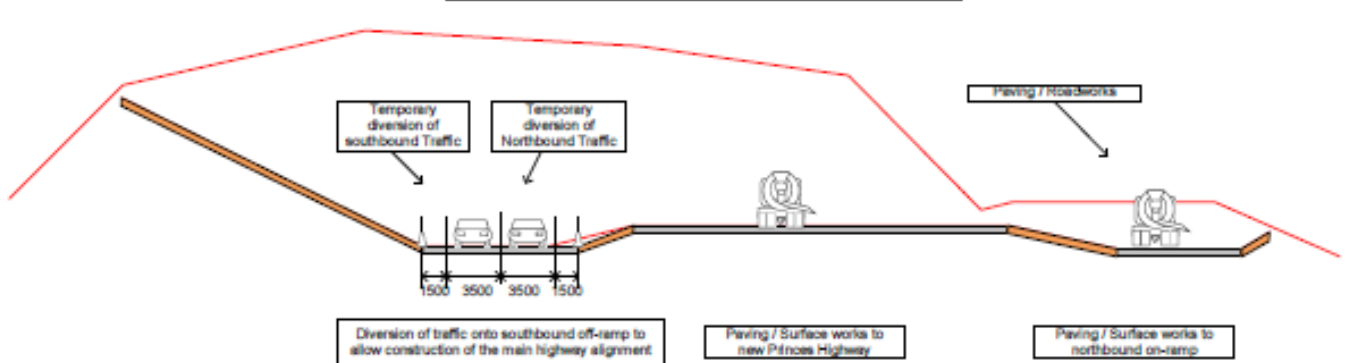
CONSTRUCTION STAGE 4 – NORTHERN INTERCHANGE Traffic switched to modified South bound off ramp



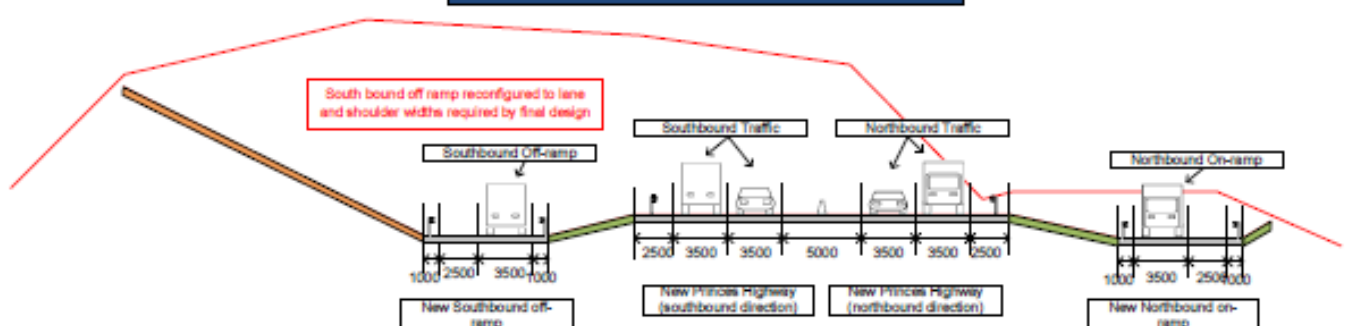
CONSTRUCTION STAGE 5 – NORTHERN INTERCHANGE



CONSTRUCTION STAGE 6 – NORTHERN INTERCHANGE



CONSTRUCTION STAGE 7 – NORTHERN INTERCHANGE Traffic switched to final alignment

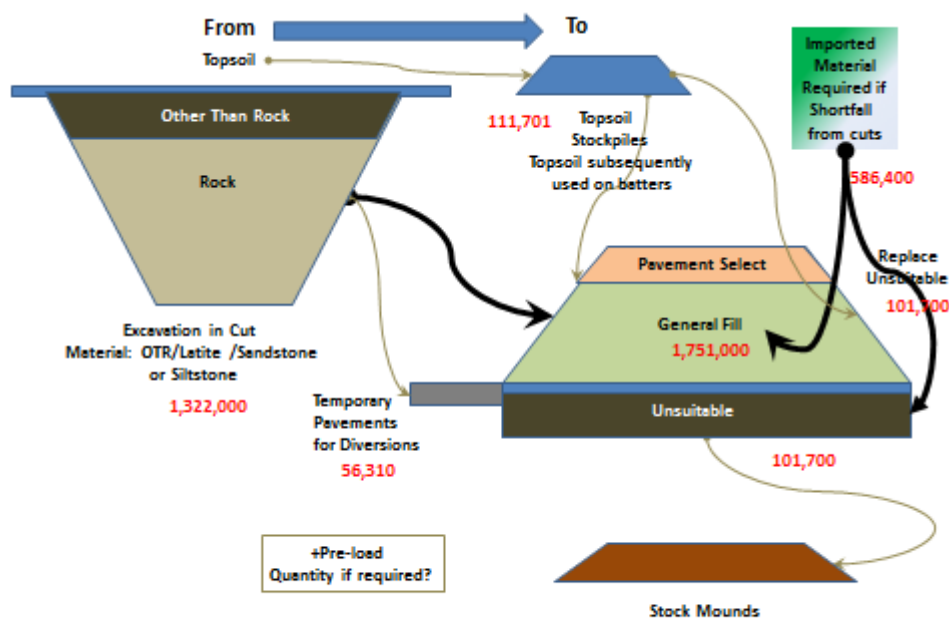




Appendix for Southern Suggestion Base Case Option

In general the above approach and plant fleets apply to the Southern suggestion. The earthworks from chainage 7600 to 14500 remains the same as for the Northern Concept Design. Thereafter the alignment changes which impacts the mass haul. The following are the aspects that change:

- The level of documentation is not as detailed as the concept design as it is being developed for this process. Documents adopted for the earthworks mass haul include:
 - a. AECOM General Arrangement drawing SK001
 - b. AECOM Drawings Long sections (SK004) and cross sections March 2012
 - c. Raw Mass Haul ex AECOM 8th March 2012
 - d. Geotechnical info pending Site Investigation interpretation results
- The earthworks movements for the base case are best represented by Figure 1S below:



FBB Southern Route Earthworks Movements
(AECOM drawings dated 6 March 2012)

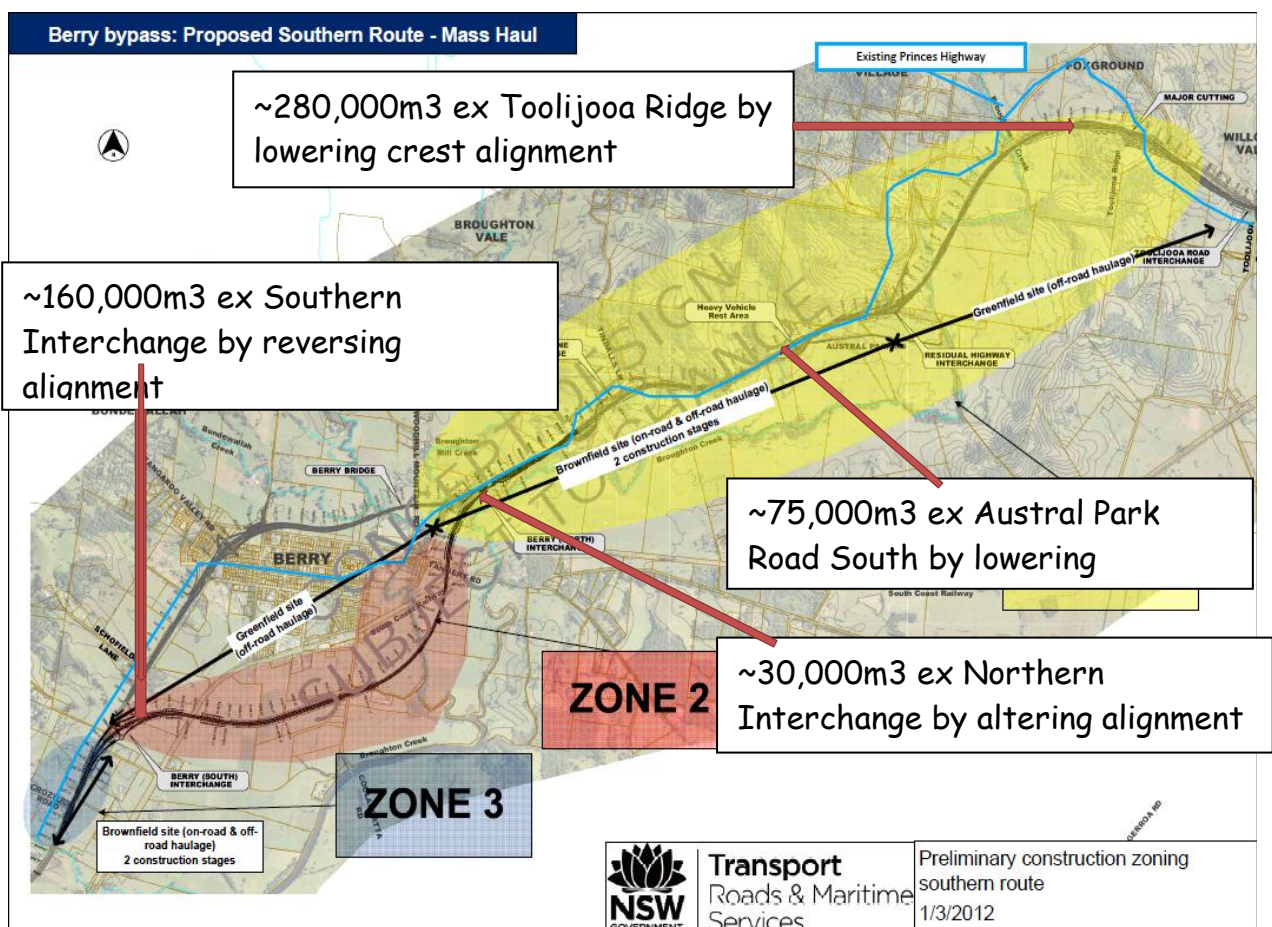
- Significant allowance will need to be made either for material required to overcome settlement issues or stabilisation measures to strengthen the subgrade.
- Assumptions have been made for haulage of unsuitable material and its replacement material as the quantity & location are not yet determined.



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Assumptions have also been made in regard to the source of the approx. 600,000m³ of fill required to make up the shortfall required for the Southern Suggestion. Initially imported material sources were not identified for the base case and the assumption is that material should be available from a 10km radius.

- Further analysis by the TIG after doing some major realignment changes (Toolijooa Ridge; Austral Park Road South, Northern Interchange and Southern Interchange) to win material from the project brought the mass haul roughly into balance.

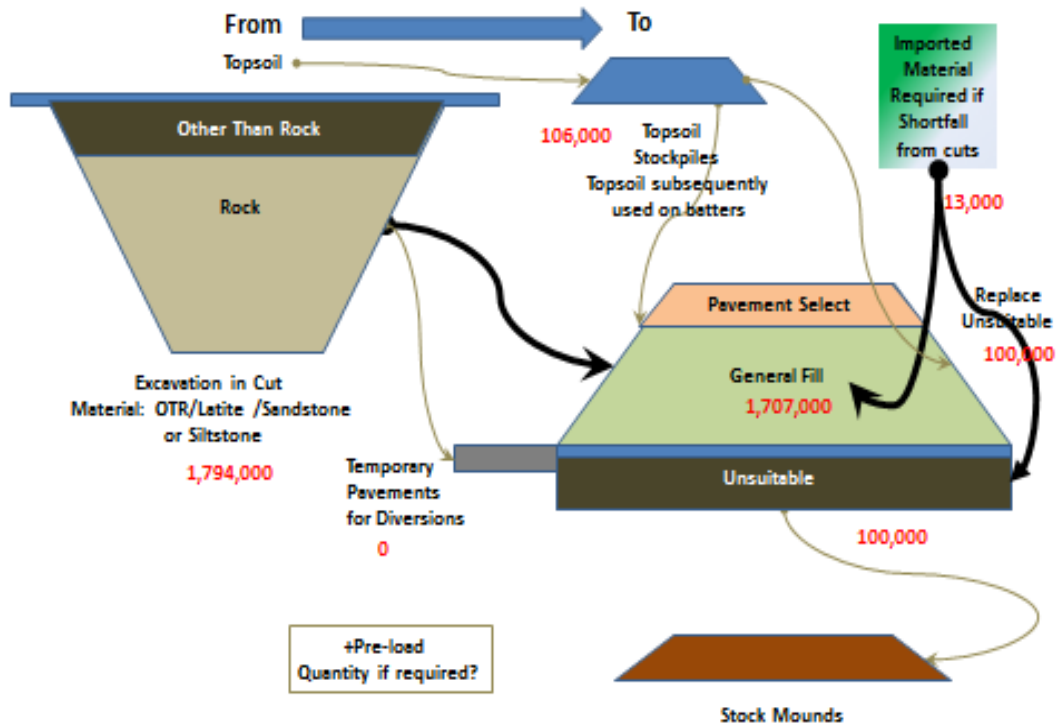


Any further alignment changes such as the route south of the sewage treatment plant or the introduction of an island embankment will upset this balance and require fill material to be imported.

See Southern Route Earthworks Movement Diagram which includes subsequent realignments up to May 2012.



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FBB Southern Route Earthworks Movements

(AECOM drawings dated 6 March 2012 plus subsequent realignments up to 4 May 2012)

Summary: The southern route base case with some re-alignments as at May 2012 (excluding the island embankment) is roughly balanced.

However:

- There are significant areas and quantities of soft soils requiring treatment. Preloading may be required which will impact material handling and timing
- There is evidence of PASS on the southern route and this material is not available for use in embankments. This material is subject to a specific Materials Management Plan



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- A number of possible variations to the southern suggestion base case have been identified and these are captured as Provisional Items and addressed elsewhere in the report.
- This zone diagram indicates a generalised contracting approach to the project:

