Category 4: Excellence in Pavement Recycling & Stabilisation in Local Government

Carcuma Road – Pavement Widening and Reconstruction of an Unsealed Section of Road

Damien Edwards
Hiway Stabilizers

HIWAY STABILIZERS

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CARCUMA ROAD
Pavement Widening
and
Unsealed Section Pavement Upgrade
Using Insitu Recycling by Stabilisation

CLIENT

COORONG DISTRICT COUNCIL

HEAD CONTRACTOR

SOUTHERN CONTRACTING

SUB CONTRACTOR

HIWAY STABILIZERS

Damien Edwards – National Technical Manager

Troy Carrigan – Business Manager

Hiway Stabilizers

Overview and Objectives

- Carcuma Road is a class 3 road within the Coorong District Council and is a regionally significant freight link to the Thomas Food International (TFI) Feedlot. The TFI Feedlot is a regionally significant industry generator which requires significant freight movements to operate. Coorong Council engaged Southern Contracting to construct:
  - 14km of pavement widening (trafficable lane widths of 3.5m) including sealed shoulder (0.5m wide) and unsealed shoulder (1.0m wide)
  - Upgrade an existing unsealed section, approximately 1.6km in length to a sealed pavement with the same cross section as the pavement widening.
- Coorong Council and Southern Contracting challenged the standard "remove and replace" methodology, as per the conforming contract design.
- Southern Contracting engaged Hiway Stabilizers, with the blessing of Coorong Council, to offer a pavement design alternative to Coorong Council that provides cost and construction time savings.
- All three organisations worked collaboratively with Hiway Stabilizers taking the lead to investigate and prepare alternative design solutions for consideration. As part of the design process Coorong Council acknowledged additional design costs and delay to the construction start date were a consequence of design optimisation.
- Three alternative pavement design options were offered by Hiway Stabilizers for consideration by Coorong Council.

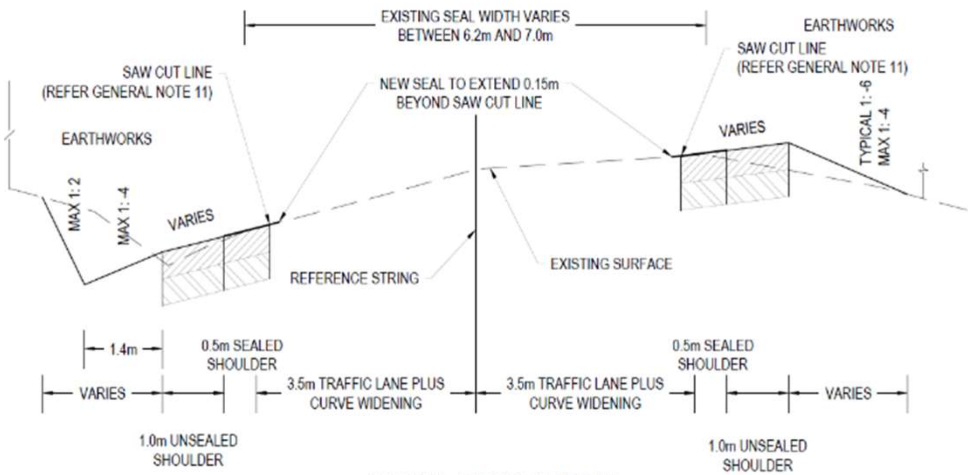
Overview and Objectives

- *The agreed option offered the following benefits above the conforming design:*
  - Condensed overall construction time, even with the additional geotechnical testing and design process.
  - Reduced fossil fuel consumption from construction equipment.
  - Decreased truck movements as a result of less material needing to be transported to and from site.
  - Recycling and reuse of existing pavement material.
  - Minimised impact on high value flora.
  - Construction of all works within the allocated budget – but much faster.
  - Provided a climate resilient pavement.
  - Provided a pavement with improved shear resistance compared to an unmodified granular material.
  - Reduced construction risks:
    - Eliminated the need to expose subgrade during wetter months – there were unusually wetter months during construction.
    - Used a lower quality material more readably available for use in the area.
    - Addressed possible delays in supplying material by reducing demand on quarried material.
    - Easier construction methodology and reduced demand for skilled labour.
    - Public exposure reduced, no boxing out of material which causes a drop off adjacent to the trafficable lane.

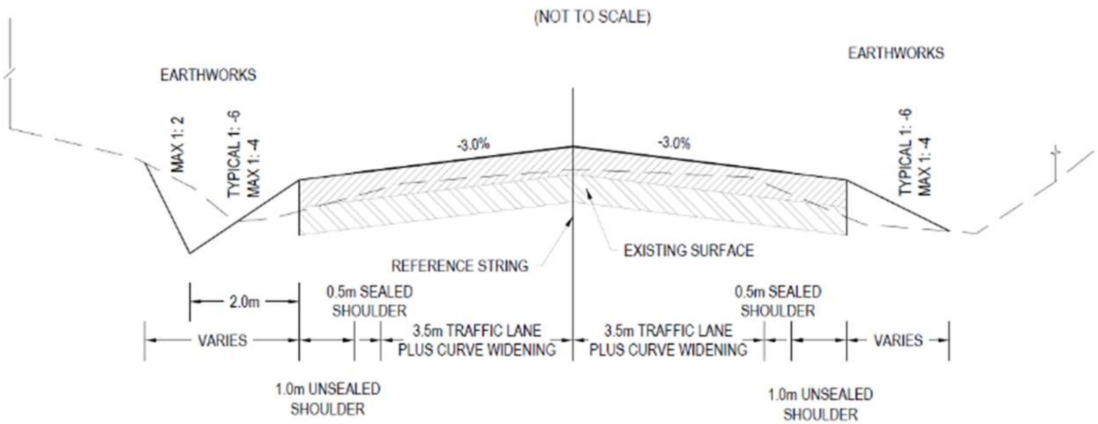
Initiative Undertaken

- Southern Contracting and Coorong Council had been exposed to recycling and stabilisation on a previous project. The initiative undertaken for this project was to reach out and engage Hiway Stabilizers to work collaboratively to prepare a suitable alternative construction methodology, challenging the widely industry accepted model of “remove and replace”.
- Initially the main driver for Council and the Southern Contracting was to reduce construction costs, with both identifying the opportunity to RECYLE and REUSE existing materials.
- Adopting an alternative pavement design approach challenged the historical construction and design methodologies leading to improvements and optimisation of current work processes and practises for the construction of the pavements.
- Adopting a collaborative approach fostered open communication and promoted a proactive approach, creating the opportunity to share ideas. This approach capitalised on the opportunity to recycle and reuse existing materials and reduced the timeline in finalising the contract, where risk was shared and managed for all parties.
- The preferred pavement construction methodology adopted was the LBCM protocol. This option was supported by field and laboratory confirmation of cement reactivity for extremes of insitu and import sampled aggregates and dependable subgrade design CBR’s.

Initiative Undertaken



TYPICAL CROSS SECTION
SHOULDER WIDENING (CH 0 - CH 12810)
(NOT TO SCALE)



TYPICAL CROSS SECTION
FULL DEPTH PAVEMENT CONSTRUCTION
(WHERE DESIGN LEVEL IS LESS THAN 150mm ABOVE EXISTING SURFACE LEVEL)
(CH 12810 - CH 12870 AND CH 14260 - CH 14369.53)
(NOT TO SCALE)

BASE COURSE

SUB-BASE COURSE

PAVEMENT DETAIL

- 14/7 DOUBLE COAT SPRAY SEAL OR 50mm AC14M C320 (REFER PLANS SHEET 02 - 25)
- PRIME
- 150mm PM1/20 QG BASE COURSE
  COMPACTED TO MINIMUM 98% MMDD TO AS 1289.5.2.1
- 150mm SUB-BASE COURSE OF EXISTING ROAD BASE MATERIALS REWORKED
  AND COMPACTED TO MINIMUM 96% MMDD TO AS 1289.5.2.1

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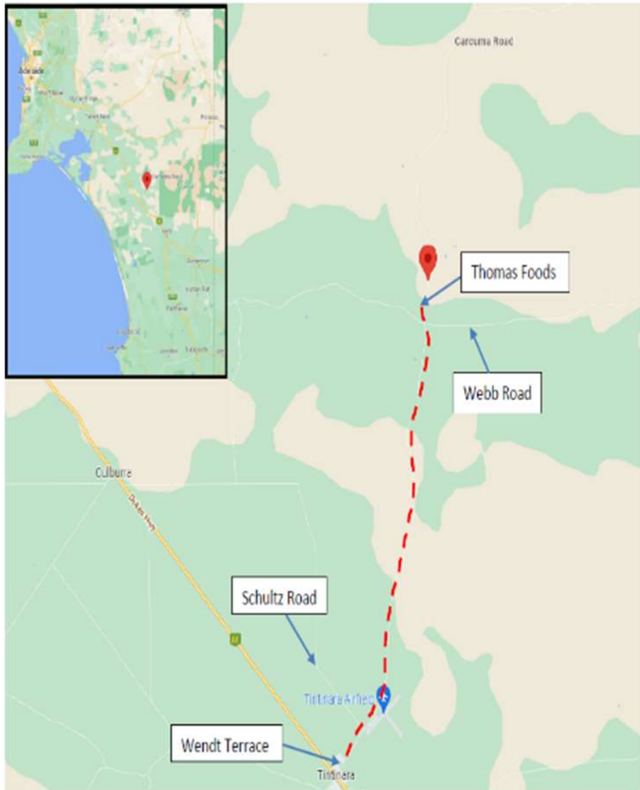
Site Environment and Details Affecting the Project

- Carcuma Road is located in a rural environment, approximately 200km from Adelaide CBD, and due to its remote location and the surrounding geology has limited access to a quarries with high quality material.
- Conforming design contract value using the remove and replace methodology exceeded the allocated budget with no additional funding available.
- Undertaking additional geotechnical testing and additional design efforts delayed the construction commencement date. Council and Southern Contracting supported this work after acknowledging the various benefits including reduced construction time and cost savings.
- Quarried material was readily available, but the material was deemed marginal when assessed against contract specifications. Using suitable binding agent (cement) addressed material deficiencies. This eliminated the need to import higher quality material, thus reducing cost without reducing future performance of the granular material after treatment.
- For the unsealed section, the existing geometric design was altered to maximise the savings of the imported material for the alternative pavement design. The FSL was lowered by 100mm offering a reduction in the batter footprint resulting in reduced vegetation removal.
- Selecting a stabilised granular pavement provided a climate resilient road, with increased shear resistance strength, providing a consistent hard tight surface for sealing. It also reduced the risk of the new seal flushing for the pavement widening in the outer wheel path.



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Implementation Challenges

- Completing the geotechnical investigation and pavement design alternative prior to the commencement of the project was a challenge due to time constraints. The construction program was tight to meet budget requirements.
- Identifying and fencing areas of vegetation, poor subgrades and existing thin pavement material negatively impacted on the alternative pavement design option as it is a time-consuming process.
- Limited geotechnical / laboratory resources at the time of the project led to the Southern Contracting engaging a new NATA geotechnical provider to undertake supplementary geotechnical investigation to confirm subgrade strength, existing granular material thickness and quality and mix design of the LBCM (quantifying the cement content required to achieve a UCS value of between 1.0 – 2.0 MPa - while targeting 1.5MPa).
- Field supervision required to ensure testing was conducted according to the brief and investigation of the pit locations was adjusted to meet site constraints.
- Southern Contracting was under pressure from Council to commence works prior to finalising alternative designs for consideration. Hiway Stabilizers worked closely with the Southern Contracting to identify suitable pavement materials that could be used and organised laboratory testing of the mix design once the material investigation was completed.
- Establishing a relationship between 7-day and 28-day laboratory UCS testing to expedite design, but still ensuring all 28-day UCS testing was concluded.
- Time was of the essence as the project needed to be completed before the end of the financial year and no additional funds could be utilised.
- Minimise potential for construction variations for the Council.

Key Points of Interest

- Council and Southern Contracting challenged the conforming design as they were previously exposed to recycling and reuse through a previous LBCM project successfully undertaken.
- The alternative design addressed the risk of time-over runs, complexity of construction and Council's exposure to latent conditions, e.g. subgrade material being subjected to climatic conditions when granular material was removed. This was achieved by minimising the length of sections requiring box out and replace through the design process.
- Stabilisation increased the performance of the constructed pavements, reducing the risk of premature pavement failure which is possible with typical box out and replace construction.
- For the unsealed section, the design led to a reduction in batter height equating to a decreased batter footprint by lowering the FSL. This reduces the risk of batter scouring during rain events and limits the impact on the high value vegetation.
- The project was completed under budget and within the nominated timeframe.
- Recycling and reuse through stabilisation is becoming Council's preferred construction methodology.
- Council field staff are showing an interest and acceptance of this type of construction and want to see it implemented in their daily work.

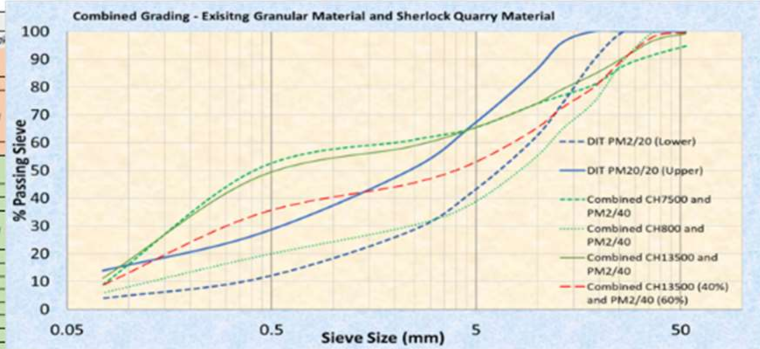
Evidence of Success

- Tangible cost and time savings identified for this project include:
  - Reduced travel kilometres for construction equipment due to a reduction of imported aggregate required
  - Limited area of box out and replace
  - Less reliance on specialised labour
  - Less time onsite due to faster construction process
  - Use of stabilisation to improve material properties resulting in a reduced import of high quality materials from far away locations
  - Project cost savings of 10% per kilometre constructed when measured against the conforming design
- Intangible savings identified for this project include:
  - Reduced impact on the natural environment through minimised vegetation removal and damage, in particular the high value flora
  - Reduced demand on finite aggregate resources
  - Reduced construction traffic loading on the road network from much less import/removal of materials to/from site
  - Reduced disruption to stakeholders including local residents and businesses
  - Minimised construction time resulting in reduced travel time delays for road users
  - Building a stronger relationship between client and contractors
- Implemented the design alternative meeting Councils budget limitations and risk profile.
- Continued to build the knowledge base for the Client, Southern Contracting & community regarding recycling of insitu granular materials.
- Supports the KPIs of Coorong Council to reduce the impact on the environment when constructing infrastructure.

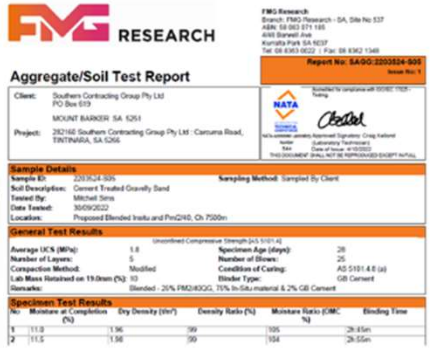
Supporting Data, Design Documentation #1

TP Number as defined onsite	Section	Field Work: Bulk Sample	Field Work: BH (Depth 1.5m)	Field Work: Dip (fill material depth only)	Field Work: DCP	Field Work: Log Sample	Laboratory Work: Grading	Laboratory Work: Atterberg Limits	Laboratory Work: Linear Shrinkage	Laboratory Work: 4 Day Soak
	Section 1 (CH 00 - 1340) Wendt Road - Schultz Road									
BH01	CH300			LHS 3.5m from CL						
TP01	CH800	RHS 3.0m from CL (Sample depth of Fill Material - 00mm-subgrade)			Y	Y	Y	Y	Y	Y
2	CH1100		LHS 3.0m from CL		Y	Y				
	Section 2 (CH 1340 - 12810) Shultz Road - End of Seal									
BH03	CH1340			LHS 3.5m from CL						
BH04	CH1900			RHS 3.5m from CL						
TP02/BH05	CH2500	LHS 3.0m from CL (Sample Depth of Fill Material - 0-150mm)	LHS 3.0m from CL		Y	Y	Y	Y	Y	Y
	CH3000									
BH06	CH3500		RHS 4.0m from CL		Y	Y				
BH07	CH4000			LHS 4.0m from CL		Record Fill Depth				
BH08	CH4500		LHS 4.0m from CL		Y	Y				
BH09	CH5000			RHS 3.5m from CL		Record Fill Depth				
BH10	CH5500		RHS 3.5m from CL		Y	Y				
BH11	CH6000			LHS 4.0m from CL		Record Fill Depth				
BH12	CH6500		LHS 3.5m from CL		Y					
	CH7000									
TP03	CH7500	RHS 3.0m from CL (Sample depth of Fill Material - 00mm-subgrade)			Y	Y	Y	Y	Y	Y
BH13	CH8000			LHS 4.0m from CL						
BH14/15	CH8500		LHS 3.5m from CL	RHS 3.5m from CL	Y (BH only)	Y (for Dip record Fill Depth)				
BH16	CH9000			LHS 4.0m form CL		Record Fill Depth				
BH17	CH9500		RHS 4.0m from CL		Y	Y				
	CH10000									
BH18	CH10500		LHS 3.0m from CL		Y	Y				
BH19	CH11000			RHS 3.5m form CL		Record Fill Depth				
BH20	CH11500		RHS 3.0m from CL		Y	Y				
	CH12000									
TP04	CH12500	LHS 3.0m from CL (Sample Depth of Fill Material - 0-150mm)			Y	Y	Y	Y	Y	Y
	Section 3 (CH 12810 - 14360) End of Seal - Thomas Foods									
BH21	CH13000		0m offset from CL		Y	Y				
TP05	CH13500	0m offset from CL (Sample Depth of Fill Material - 00mm-subgrade)			Y	Y	Y	Y	Y	Y
BH22	CH1400		0m offset from CL		Y	Y				
TP06										
	Total	5	12	10	16		5	5	5	5

1) Testing Requirements to prove LBCM Design



2) Assessment of the insitu and imported granular – blended at proportions predicted



3) Mix Design Results

	Granular overlay/LBCM Treated Base Pavement Designs – Layer Thickness	
	Section 1 and 2 (Pavement Widening)	Section 3 (Unsealed Section)
Wearing Surface (Refer Design Documentation)	10	10
Basecourse (Imported Granular)	50 (min)	50 (min)
Basecourse (Existing Granular Material)	150	150
Subbase (Existing Granular Material)	100	100
LBCM Treatment Depth (mm)	**200**	**200**
Total Pavement Depth (mm)	**310**	**310**

Table 8: Pavement design for nominated subgrade strength

4) Offer Design Options

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Supporting Data, Design Documentation #2

The table below shows a summary of the granular material and construction days saved by adopting the insitu recycling by stabilisation design option as an alternative to full reconstruct (with metrics as supplied by the Southern Contracting)

	Total Length of Section (metres)	Conforming Material Usage PM2/20 (Tonnes)	Alternative Material Usage (PM2/20) (Tonnes)	Material Savings (Tonnes)	Conforming Construction Time (Days)	Alternative Construction Time (Days)	Construction Time Savings (Days)
Pavement Widening	12,800	18,200	4,571	13,629	28	14	**14**
Unsealed Section	1,560	13,000	7,958	5,042	21	14	**7**
Totals	**14,360**			**18,671**			**21**

- There was 18,671 tonnes of imported granular material saved (67% when compared to the conforming design) and 21 days in construction timing.
- The objective of employing this approach is to:
  - Provide a speedy, robust and cost-effective treatment – reducing in construction time noticed by local community
  - Form a robust, moisture resilient substrate for the surfacing
  - Substantially reduce construction time / cut to waste & corresponding import aggregate & cost to Client
- Performance and evaluation to date suggest these objectives have all been achieved

Supporting Images

Typical - Unsealed Shoulder
Pavement widening and
shoulder construction

Typical Section of Carcuma Road

Geotechnical Investigation – Unsealed
Section to be upgraded

Test Pit – Unsealed Section to be Upgraded

Supporting Images

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