

Category 3: Excellence in Sustainability

Great Ocean Road Pavement Rehabilitation

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Downer EDI Works



2021 AustStab Awards of Excellence

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Overview

- Pavement Rehabilitation of 1.9km of Great Ocean Road
- Original Scope → No in situ stabilisation works
- Poor quality lower subgrade material identified
- 2% GB Cement Stabilisation undertaken
- Conforming subgrade compaction results achieved
- Granular Pavement Layers able to be constructed above



Geographic Location of Works

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Overview

- The works were taking place almost directly adjacent to the entrance to the 12 Apostles Visitor Centre
- Original Scope of pavement works required Downer to construct 1.5 x 0.2m widening trenches on both sides of the pavement for the entire length of the road
- The widening trench material and existing subgrade material would all then be mechanically mixed to a depth of 200mm and then regulated to achieve a consistent height of 150mm below FSL
- We mechanically mixed, compacted and shaped the pavement across two days (28th and 29th January), only to return the following week to see the pavement had deteriorated significantly over the weekend whilst it was open to traffic
- Further investigation through the use of DCP testing revealed that the lower subgrade was of a very poor quality and did not possess the strength properties required for us to reach the required compaction
- The proposal Downer then provided to VicRoads was to supply and place a nominal 50mm layer of Class 3 FCR over the existing subgrade material and then stabilise the subgrade with 2% Cement to a depth of 250mm to try and bridge the lower strength lying issues
- The proposal was submitted on Thursday 4th February, approved on Friday 5th February, and works commencing on Monday 8th February

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Pavement Recycling and Stabilisation Association

Outline of Initiative



Pulverize and regulate existing pavement



Mechanically mix in situ material and regulation to 200mm depth



Subgrade compaction results fail



Import 50mm of Class 3 rock



2% cement stabilisation of subgrade and imported Class 3 to a depth of 250mm



Subgrade compaction results pass

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Operating Environment

- Environmentally Sensitive Area
- Culturally Significant Area
- Tourist Hotspot
- Experiences both extremes of weather systems
- Proximity of site to construction resources
- Working under lane closures



Twelve Apostles turn-off 1km
(working in tourist area)

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Operating Environment

- At the commencement of the project, the cultural significance of the area was highlighted by the fact that Downer was required to abide by the Regional Road Victoria Contingency Arrangements for Discovery of Human Skeletal Remains, Historic Heritage or Aboriginal Cultural Heritage
- The contract also required Downer to engage a qualified ecologist to determine the extent of native vegetation to be protected on site
- This required No Go Zone fencing to be installed along the boundary between the road reserve and the native vegetation
- This equated to approximately 4km of No Go Zone fencing
- As works on this project were taking place over the Christmas period, significant restrictions to working hours and length of work sites were enforced
- More than 3 weeks of adverse weather days were incurred on this contract – the consistent presence of rain made it even more crucial that the lower subgrade was exposed for the least amount of time

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Pavement Recycling and Stabilisation Association

Key Challenges

- COVID 19 – Regional border restrictions in Victoria
- Close proximity of waterways
- Presence of native/protected flora & fauna
- Working with live traffic
- Keeping the road open to traffic at all times
- Demonstration of the value of the initiative to client



No Go Zone fencing installed

Key Challenges

- Based on experience of previous contracts delivered in the area, VicRoads do not typically incorporate any form of stabilising in their pavement designs
- The primary concern of VicRoads when introducing stabilising was the potential for fatigue cracking due to having an extremely rigid/bound upper pavement layer sitting on a flexible lower subgrade
- Given the location of the works area, high daily traffic volumes and the social/media interest in the project, VicRoads requested all measures be taken to keep the road open and trafficable

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Points of Interest

- Initial Client position → Subgrade rectification a contractual responsibility of Downer
- Client not traditionally receptive to Pavement Recycling techniques
- Client raised concerns regarding Fatigue Cracking

Initiative Testimonials

“Poor performing lower subgrade results will affect our ability to get compaction and also compromise the integrity of the finished product.”

(Matt Billings, Downer Stabilisation Manager VIC/TAS)

“Big part of the problem will at 600 – 700mm depth, our previous experience suggests this is an issue that will keep reflecting through upper layers of pavement.”

(Tony Egan, Downer Construction Manager VIC/TAS)

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Evidence of Success

Dynamic Cone Penetrometer AS 1289 6.3.2						
Sample Number	12373-35	12373-36	12373-37	12373-38	12373-39	12373-40
Location	DCP-01	DCP-02	DCP-03	DCP-04	DCP-05	DCP-06
Chainage (m)	269.140	269.263	269.460	269.600	270.044	270.268
Location Offset (m)	2.5m Left	1.8m Left	3.0m Right	4.0m Right	0.5m Left	2.0m Left
Offset from	CL	CL	CL	CL	CL	CL
Date Tested	02/02/2021	02/02/2021	02/02/2021	02/02/2021	02/02/2021	02/02/2021
Soil Description	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND
Reduced Level (mm)	N/A	N/A	N/A	N/A	N/A	N/A
Moisture Condition	Moist	Moist	Moist	Moist	Moist	Moist
Start Depth (mm)	-200mm Subbase	-200mm Subbase	-200mm Subbase	-200mm Subbase	0.0	0.0
0-100 blows/100 mm	4	6	2	5	8	4
100-200 blows/100 mm	4	8	4	3	16	11
200-300 blows/100 mm	7	13	9	3	19	15
300-400 blows/100 mm	6	10	7	1	11	13
400-500 blows/100 mm	9	6	4	2	10	5
500-600 blows/100 mm	8	5	7	1	15	8
600-700 blows/100 mm	7	3	3	1	23	5
700-800 blows/100 mm	7	4	2	3	13	4
800-900 blows/100 mm	7	7	2	2	10	3
900-1000 blows/100 mm						
Ground Water Level						
Remarks						

Compaction Control AS 1289 5.2.1 & 5.4.1 & 5.8.1 & 2.1.1						
Sample Number	12373-53	12373-54	12373-55	12373-56	12373-57	12373-58
Date Tested	10/02/2021	10/02/2021	10/02/2021	10/02/2021	10/02/2021	10/02/2021
Time Tested	18:05	17:50	17:41	17:32	17:23	17:15
Test Request #/Location	Great Ocean Road, Princetown	Great Ocean Road, Princetown	Great Ocean Road, Princetown	Great Ocean Road, Princetown	Great Ocean Road, Princetown	Great Ocean Road, Princetown
Chainage (m)	269700.6	269756.0	269811.6	269867.0	269922.6	269978.0
Location Offset (m)	-2.4 from CL	2.4 from CL	1.6 from CL	0.0 from CL	4.0 from CL	3.2 from CL
Elevation (m)	N/A	N/A	N/A	N/A	N/A	N/A
Layer / Reduced Level	Subbase	Subbase	Subbase	Subbase	Subbase	Subbase
Thickness of Layer (mm)	250	250	250	250	250	250
Soil Description	Existing Limestone + CL2, 20mm CR (2% GB Cement)	Existing Limestone + CL2, 20mm CR (2% GB Cement)	Existing Limestone + CL2, 20mm CR (2% GB Cement)	Existing Limestone + CL2, 20mm CR (2% GB Cement)	Existing Limestone + CL2, 20mm CR (2% GB Cement)	Existing Limestone + CL2, 20mm CR (2% GB Cement)
Test Depth (mm)	225	225	225	225	225	225
Fraction Tested (mm)	19.0	19.0	19.0	19.0	19.0	19.0
Field Wet Density t/m ³	2.28	2.26	2.24	2.27	2.13	2.33
Field Moisture Content %	8.1	7.5	8.2	8.2	11.7	9.4
Field Dry Density t/m ³	2.11	2.10	2.07	2.10	1.91	2.13
Maximum Dry Density t/m ³	2.10	2.12	2.03	2.06	1.93	2.16
Adjusted Maximum Dry Density t/m ³	**	**	**	**	**	**
Optimum Moisture Content (OMC) %	9.5	10.5	9.5	9.5	13.0	10.5
Adjusted Optimum Moisture Content (OMC) %	**	**	**	**	**	**
Moisture Variation %	1.0	3.0	1.5	1.5	1.5	1.0
Moisture Ratio %	87.0	71.0	85.5	84.5	88.5	88.5
Density Ratio %	101.0	99.0	102.0	101.5	99.0	99.0
Compaction Method	Modified	Modified	Modified	Modified	Modified	Modified
Density Decay Factor	0.981	0.973	0.973	0.981	0.973	0.973
Density Ratio with factor %	99.0	96.5	99.0	99.5	96.5	96.0
Binding Time (hrs)	13	20	20	14	23	22

Compaction results post stabilisation works demonstrate improved strength of in situ material

DCP results prior to stabilisation works demonstrate poor CBR of in situ material

- The lower subgrade layer was required to comply with Section 304.08 of the VicRoads specifications
- Section 304.08 called for a Characteristic Density Ratio of not less than 97.0% for a max lot size of 4000m²
- Given that the area was stabilised equated to approximately 16000m², there were four 6 Lot Test undertaken
- Each of the compaction results post stabilisation achieved the required Characteristic Density Ratio

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Supporting Data

Cost Analysis

1.0 Stabilisation of In-Situ Material Vs. Remove and Replace Failing Subgrade					
Item	Description of Work	Estimated Quantity	Unit	Rate (\$)	Extended Amount (\$)
1.1	Stabilise the pulverised layer and widening trench material with 2% GB cement to a depth of 250mm and width of 9.4 metres	16,074	m ²	\$8.39	\$134,860.86
1.2	Excavate, remove and dispose failed existing pavement material to a depth of 300mm and supply, place and compact size 20 class 2 FCR.	4823	m ³	\$98.90	\$476,915.58



Time/Production Analysis

1.0 Stabilisation of In-Situ Material Vs. Remove and Replace Failing Subgrade					
Item	Description of Work	Estimated Production	Unit	Actual Area to Treat	Duration of Works
1.1	Stabilise the pulverised layer and widening trench material with 2% GB cement to a depth of 250mm and width of 9.4 metres	4000m ²	Day	16074m ²	4 days
1.2	Excavate, remove and dispose failed existing pavement material to a depth of 300mm and supply, place and compact size 20 class 2 FCR.	320m ³	Day	4823m ³	15 days



- ❖ Cost Analysis highlights saving through Pavement Recycling
- ❖ Clear Value Proposition presented to Client

- ❖ Significant time saving through Pavement Recycling
- ❖ Less disruption to Tourists and Local Residents

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Supporting Data

- As evidenced through the Cost Analysis, the option to stabilise the pavement was more cost effective than removing the existing material and replacing it with virgin material
- The rate of \$98.90 for removal and replacement of unsuitable material was included as a Provisional Quantity Item in the schedule for this contract
- The rate of \$8.39 for Cement Stabilising was provided as a variation on request from VicRoads
- Both of these options were provided to VicRoads for consideration prior to the works being completed
- The productivity of both the stabilising and remove and replace options were calculated based on previous experience when completed similar works
- The combination of the time and cost saving demonstrated a clear value proposition for the initiative
- This allowed VicRoads to approve the works in a timely manner
- This was also a positive from a sustainability perspective as we did not have to replace the existing material with virgin quarry material in order to achieve the desired outcome

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Practical Application

36	Pulverize Existing Seal and Shape Existing (Ch.269000 to Ch.269810)	Wed 27 Jan '21	Thu 28 Jan '21 2 days	37SS,35
37	Rip, Mix & Spread Existing (Ch.269810 to Ch.270710)	Wed 27 Jan '21	Thu 28 Jan '21 2 days	35
38	Earthworks box out (Ch.269000 to Ch.269810 Both Sides)	Fri 29 Jan '21	Mon 1 Feb '21 2 days	36
39	Place Regulating Layer/Shape to 150mm below FSL /Shape to 150mm below FSL (Ch.269000 to Ch.269810)	Tue 2 Feb '21	Fri 5 Feb '21 4 days	38
40	Place 50mm Class 3 Layer for Stabilizing (Ch.269000 to Ch.270710)	Mon 8 Feb '21	Tue 9 Feb '21 2 days	39
41	2% Cement Stabilisation of Subgrade Layer (Ch.269000 to Ch.270710)	Tue 9 Feb '21	Fri 12 Feb '21 4 days	40SS+1 day

Excerpt of Great Ocean Road Construction Program



- ❖ Actual time taken → Aligns with estimate
- ❖ AADT of Great Ocean Rd is 1800 Vehicles
- ❖ No. of Vehicles affected during initiative →
4 days x 1800 Vehicles = 7,200 Vehicles
- ❖ Vehicles affected without Pavement Recycling →
15 days x 1800 Vehicles = 27,000 Vehicles
- ❖ Produced safe trafficable surface
- ❖ No Road Closures or Safety Incidents

- ❖ Princetown Mean Rain Days (Feb) = 9.1 days
- ❖ Princetown Mean Rainfall (Feb) = 40.2mm
- ❖ Time savings through Stabilising initiative →
Less Risk with leaving poor subgrade open to adverse weather



PROJECT NAME: GREAT OCEAN RD, PRINCETOWN - PAVEMENT REHABILITATION							CONTRACT NUMBER: 10132	
EOT CLAIM #	DATE	REASON FOR EXTENSION OF TIME CLAIM	TIME CLAIMED	REPLY DATE	DATE APPROVED	AMMEND CONT COMPLETION DATE	NOTES	
1	11/11/2020	Adverse weather at Great Ocean Rd, Princetown on Wednesday 11 th of November 2020.	0 days		-	10/03/2021	Adverse weather day 1/10	
2	15/01/2021	Adverse weather at Great Ocean Rd, Princetown on Friday 15 th of January 2021.	0 days		-	10/03/2021	Adverse weather day 2/10	
3	29/01/2021	Adverse weather at Great Ocean Rd, Princetown on Friday 29 th of January 2021.	0 days		-	10/03/2021	Adverse weather day 3/10	
4	19/04/2021	Adverse weather at Great Ocean Rd, Princetown on Monday 19 th of April 2021. Works could not continue on preparation of pavement for seal.	0 days		17/05/2021	12/05/2021	Adverse weather day 4/10	
5	20/04/2021	Adverse weather at Great Ocean Rd, Princetown on Tuesday 20 th of April 2021. Works could not continue on preparation of pavement for seal.	0 days		17/05/2021	12/05/2021	Adverse weather day 5/10	

Excerpt of Extension of Time Register

- AADT refers to Annual Average Daily Traffic
- This value is denoted in the VicRoads specification
- Based on actual time taken to complete the stabilising works, approximately 7,200 vehicles were affected during the works
- The fact that the initiative took approximately a third of the time to complete in comparison to the remove and replace option meant that no road closures were required and overall safety of the area was improved

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Supporting Visual Content



DCP testing on lower subgrade layer



Struggling to keep the subgrade trafficable



First run of cement stabilising completed



Compaction effort on treated subgrade layer



Proof roll of subgrade layer and ITP sign-off with VicRoads



The Team delivering a quality result

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