Cement Modification of Low Grade Aggregates for Urban Maintenance

Paul Howard and Phil Pawsey

Introduction

Late 2006 Works had an opportunity to carry out a simple practical trial with cement modified aggregates. The opportunity was recognised due to the innovation partnership with the Dunedin City Council and a prime geographical location to carry out the tests.

The theory was not new but had not been trialled within the Dunedin Urban area and on the typical road constructions found there.

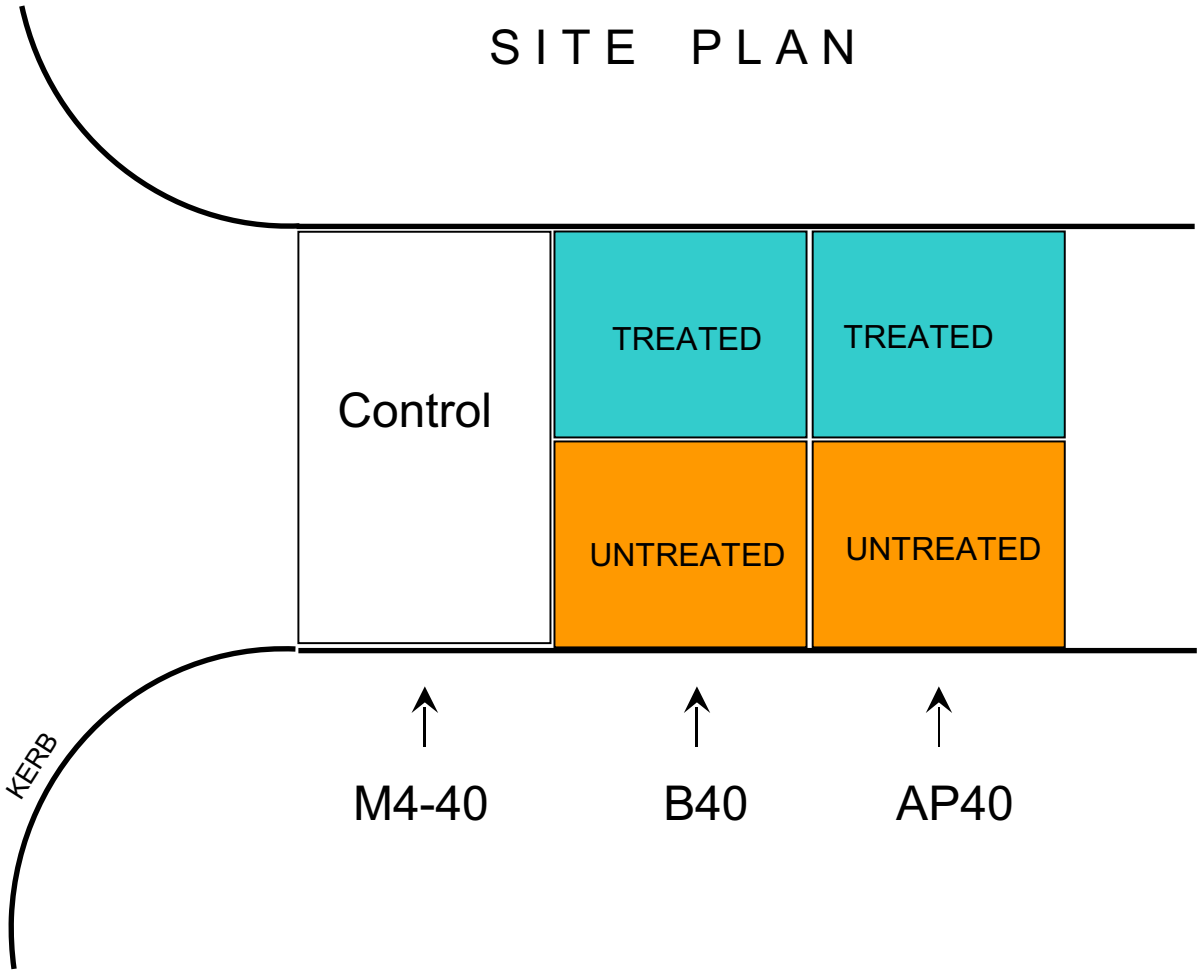
We wanted to test the theory of the materials in actual site conditions and using site construction techniques.

Location is a short urban road with approx 50 vpd and twice weekly visits from large rubbish trucks.

Methodology

- Aggregate selection – M4 AP40 selected as control, a standard AP40 and second grade AP40 (B40).
- Stockpiled aggregates in yard and treated with 2% cement.
- Weathered for 7 days while turning regularly
- Site excavated to 300mm depth, fabric and grid placed, 150mm layer AP65 across entire excavation
- Site divided into sections (half road) and the control, treated and untreated samples placed.
- Compacted in lifts with Bomag BPR55/65 (~480kg) at approximate OMC.
- Surface finished and sealed

Methodology continued



Common local subgrade – blue and yellow pug – very unstable

Site excavated with fabric, grid and AP65 being laid.

Test sections separated by timber edging

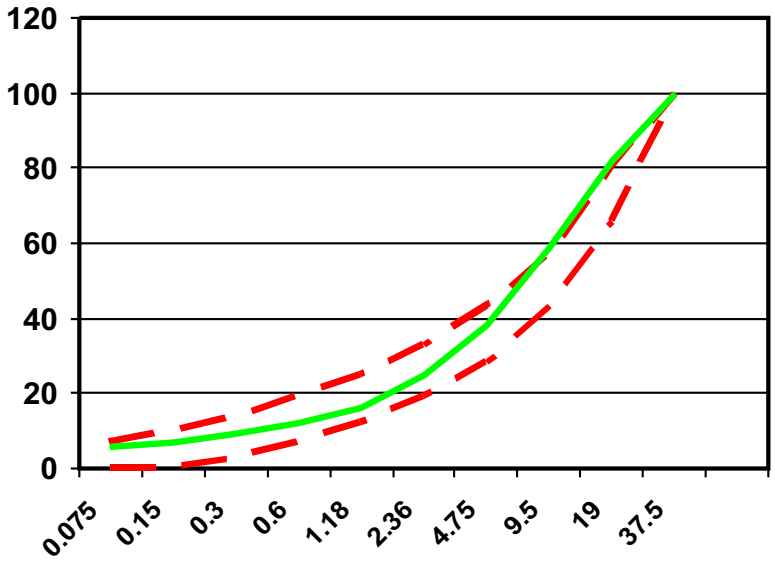
Compacted with 480kg reversible plate

Compacting patch as a single excavation to ensure uniformity

Final wetting and rolling, attempting to reactivate cement

Material Details

Standard AP40

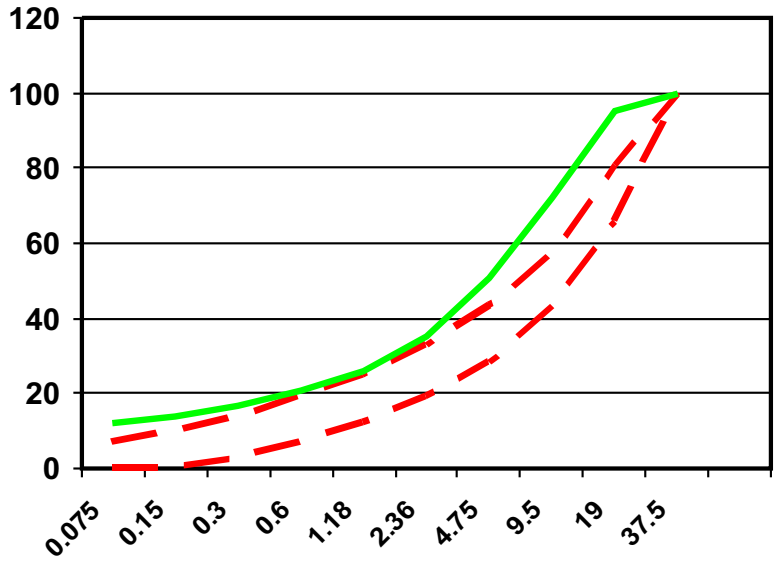


Grading above

SE – 36 (M4 ≥ 40)

PI – 1 (M4 ≤ 5)

Low Grade B40



Grading above

SE – 21 (M4 ≥ 40)

PI – 6 (M4 ≤ 5)

Initial Results

- The final surface was visually good. Ironically there was a problem getting a tight surface on the M4 AP40.
- Compaction of all test samples achieved easily to mosaic surface.
- Comments that the workability of lower quality materials was easier.
- Some visual indication that cement was reactivating.

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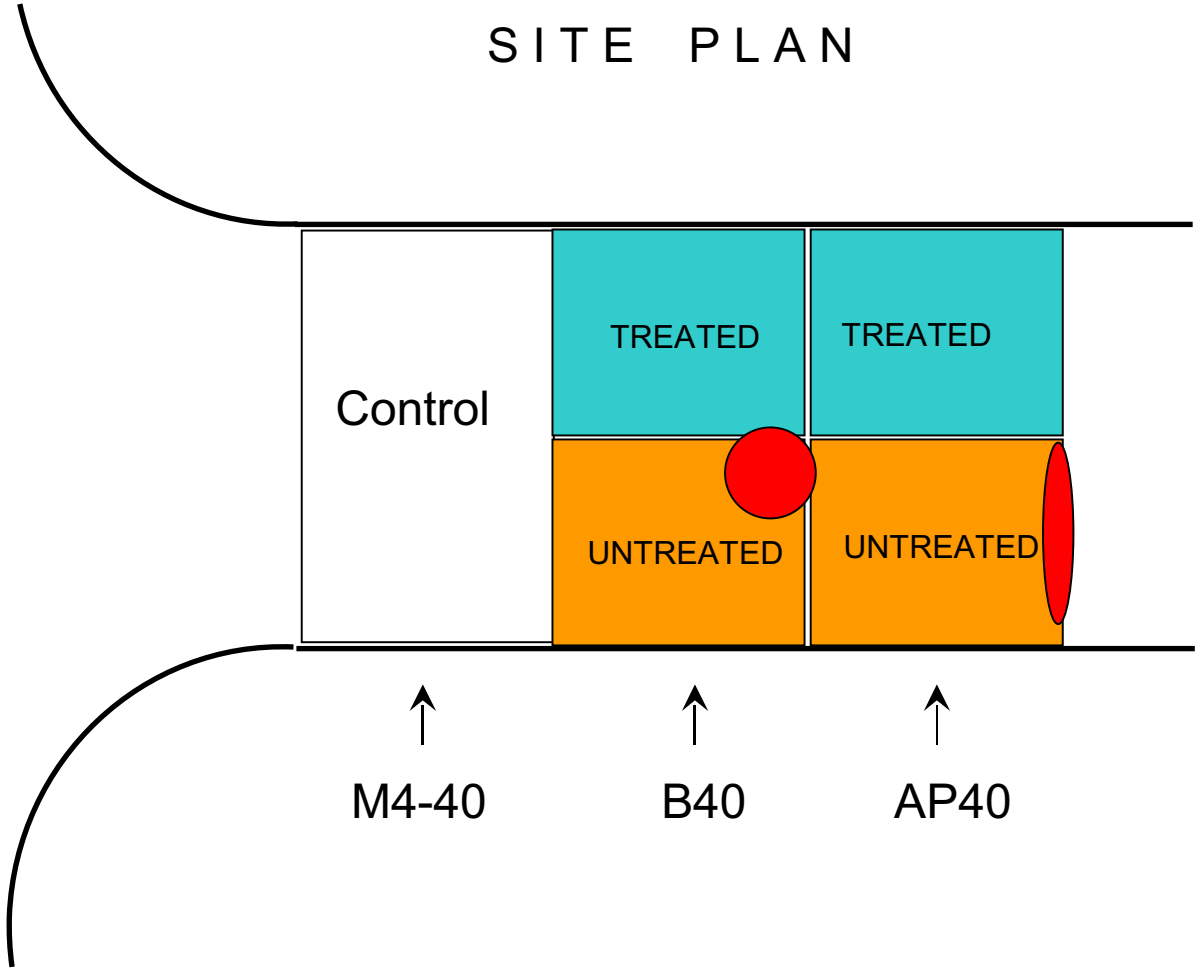
Mid Term Results

- Minor settlement in untreated AP40, approximately 8mm deep along one edge.
- Settlement in the B40 sample that has required remedial work.
- The M4 AP40 (despite the levelling work) looks structurally sound.
- Seal coat intact in all areas (again apart from the M4 problems and untreated B40 repair).

Mid Term results continued



Cost Implications

•<u>M4 AP40</u>	<u>($/m³)</u>	TOTAL COST = $27.00/m³
Purchase cost	$27	
Workability factor	1.0	
<u>AP40 Standard</u>	<u>($/m³)</u>	TOTAL COST = $49.00/m³
Purchase cost	$16	
Plant cost	$17	
Labour cost	$7	
Material cost	$30	
Workability factor	0.7	
•<u>B40</u>	<u>($/m³)</u>	TOTAL COST = $44.00/m³
Purchase cost	$10	
Plant cost	$17	
Labour cost	$7	
Material cost	$30	
Workability factor	0.7	

Conclusions

- Short term/small quantity trial limits conclusions
- Minor failures found only in untreated basecourses possibly indicates cement modification has aided structural integrity
- Aggregate treatment processes need to be efficient and on a large scale to be cost effective
- Cement did reactivate to improve surface condition

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