CASE STUDY

June 2013

M5 Slab Replacement Project

There are numerous concrete slab sections along the M5 motorway which require rehabilitation. As part of the current upgrade, Interlink roads engaged Antoun Civil Engineering in conjunction with Volumetric Concrete Australia to replace a critical slab beneath Moorebank Avenue bridge as the location would have proven difficult to replace due to the nature of its location. The slab was saw cut, demolished, doweled and replaced within a 7 hour closure with an opening strength of 32MPa ready for trafficking.

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INTRODUCTION

The M5 South West Motorway (M5) is the key route between Sydney, its south western suburbs and beyond, connecting motorists to the F5 Freeway, the M5 East Freeway and the Westlink M7.
Whether you're a daily traveler, weekend escaper or occasional tourist, the M5 makes every journey safer, faster and more cost effective.
Since its completion, the M5 and E-way, have saved Sydney motorists countless hours and millions of dollars, reduced air, noise and water pollution and made travelling faster and safer for everyone.

Currently Interlink Roads are upgrading the M5 motorway to widen the carriage way whilst also rehabilitating slab sections which have fallen below substandard conditions due to heavy trafficking.

This particular case study is in reference to a section of pavement with dimensions of approximate length of 11.4m and an overall width of 3.5m. The slab section is located beneath Moorebank Avenue Bridge.

Due to the nature of its location, Interlink Roads have directly engaged Antoun Civil Engineering in conjunction with Volumetric Concrete Australia to rehabilitate this section of pavement to be ready for trafficking at 04:00 EST due to the nature of its location.

THE PROJECT

Requirements/ Specifications

The slab was approximately 11m in length, at a width of 3.5m and an approximate average depth of 200mm. The slab was located in lane 3 (fast lane) directly beneath Moore bank Avenue bridge. The scope of works required us to saw cut, demolish and replace the slab within a seven hour timeframe including all establishment, saw cutting (pre & post installation) and demobilization.

The base beneath the slab also had to be investigated to determine whether it was suitable- if there was crushed rock/ road base beneath the slab, the specification would then call for a 140mm excavation, compaction and a 6-10MPa (compressive in 28 days) lean mix to be installed. If there was an existing slab beneath the slab to be demolished; an emulsion bond breaker was to be installed.

The face of all adjoining slabs are to be doweled using 750mm long 12mm diameter deformed bar chem-set into the surrounding existing slabs at a depth of 250mm. These dowels are to be cogged at 10° down towards the existing base course.

Prior to the setting the dowels into the adjoining slab faces, the centre 100mm of each face had to be scabbled. Scabbling had to be installed at a width of 10mm and a depth of 25mm.

The existing/ installed lean mix was to receive a coat of Cationic Rapid Set (CRS) bituminous emulsion at a rate of $1L/m^2$.

Concrete was then to be installed as per best practice, with no radius on the adjoining edges and a tine finish. Post saw cutting was to commence as soon as practically possible with all joints saw cut and sealed as per detail in *appendix A*.

The works

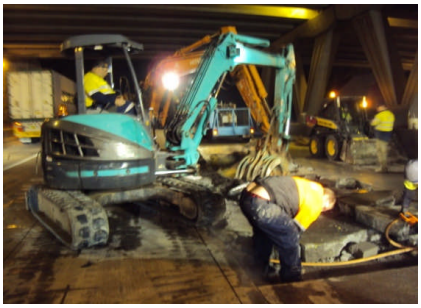
Mobilization onsite was at 21:15 EST with traffic control closing the fast and middle lanes from the three lane carriage way.

The plant and equipment was convoyed strategically due to restrictions in both time and work zone area.

Saw cutting of the slabs commencement immediately around the perimeter and along the P8 joints (refer to *appendix A*). Additional saw cuts were installed at the western end and lifting plates were installed. This was done in an effort to expedite the first panel demolition in order to give sufficient time for managerial staff and the client representative to evaluate the existing base course. Removal of this panel was unsuccessful due to the strong bond between the bottom of the slab and the top of the base course.

Upon completing the saw cutting, slab demolition commenced using a 13t excavator (with jack hammer), skid steer loader and 5t excavator with grabs.

It was discovered that there was exiting lean mix beneath the concrete panel and therefore no excavation and installation of lean mix was required.



Demolition was completed within a 70 minute period due to the bond between the existing slab and lean mix beneath. Also compounding to the problem was the over head bridge imposing a height restriction on the plant required for the task which caused delays during loading of the trucks. Demolition on other projects without these restrictions was completed within a 15-20 minute time frame.

Sweeping of the lean mix was completed while dowel drilling commenced on the eastern face P7d joint using 16mm drill bits on a two gang Minnich drill.

Scabbling then commenced on the eastern P7d joint. The clients representative request that only the P7d joints receive scabbling to the full depth of the adjoining slab, less the top 40mm. There is a total of 7m of P7d joints (eastern and western faces).

Upon completion of the scabbling and drilling to each face of the adjoining slabs (as required) dowels were installed. Unfortunately 16mm deformed bar

was ordered as opposed to a 12mm deformed bar- as per drawings and specifications.

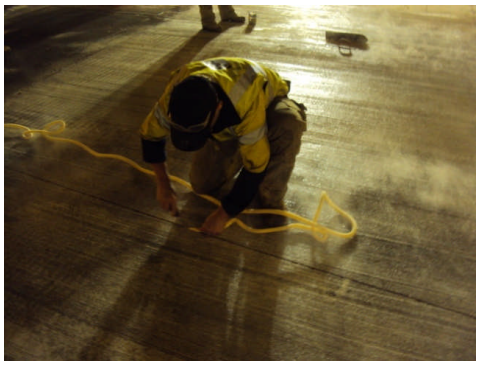
Initially, there was a 22mm drill bit available for a standard hand held hammer drill, and the client representative accepted the holes to be increased in diameter to allow for the 16mm diameter deformed bar, subject to doubling the required chem-set product in each hole. However, this would have increased drilling time which would be insufficient. 12mm deformed bar was acquired from a nearby site, was cut to 750mm lengths, burs grinded and installation completed as per specifications.

The client representative requested that no Cationic Rapid Set (CRS) bituminous emulsion be installed to the top of the existing lean mix.

Demobilization of all plant and equipment occurred during dowel/ scabbling installation. The concrete mixer was then parked in position and a total of 8.12m^3 of concrete was dispensed. Total time for concrete installation was 13 minutes.

Upon finishing of the slab, curing compound, damp hessian (overlapped by 300mm) and 2µm black buildings plastic was laid over the slab completed in order to aid in the curing process.

Once the concrete slab had what we believed to be sufficient curing time, saw cutting commenced. The client representative requested that only detail P8/1 be completed (refer to appendix A).



RESULTS

Ten compressive cylinders samples were taken during concrete installation. Three shrinkage bars and two slump tests were also taken/ conducted. Table 1 below summarizes the results to date.

The results proved to be excellent with an opening strength of 32MPa prior to allowing traffic on the carriage way.

Slump	Opening strength- Compressive	24 hrs- Compressive
170mm	32 MPa	55.5 MPa

Table 1: Test results to date

LIMITATIONS & DISCUSSION

Overall the project was successful. However, there were a few obstacles both Antoun Civil Engineering and Volumetric Concrete Australia had to overcome. These included but were not limited to:

1. No pre-sawcutting the shift before
2. Over head height restrictions during loading
3. Scabbling the of faces of adjacent slabs
4. Incorrect steel ordered and cut for the project

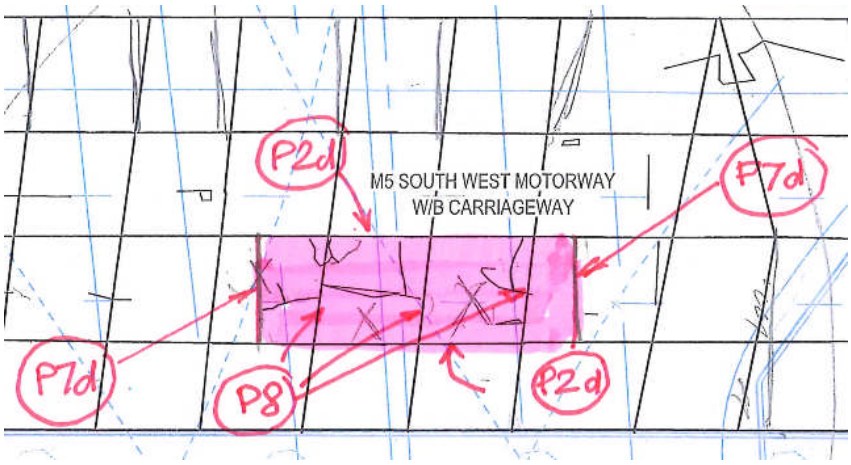
The above points can be mitigated/ eliminated via the following:

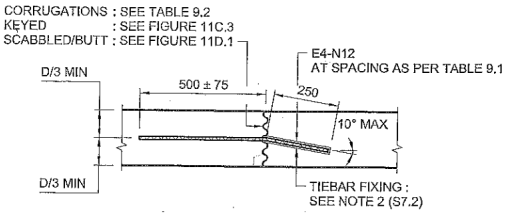
1. Obtain permission from interlink roads to saw cut slabs the previous shift. This will be beneficial as more slab sections can be demolished and replaced in any one shift in comparison with the aforementioned project.
2. This is beyond anyone's control- 2 skid steers to be onsite as opposed to one- subject to work space allocated by client
3. Scabbling gun or the like to be brought to site. Personnel to practice scabbling as specified prior to works commencement.
4. Project Manager to oversee all ordering including drill bits and reinforcement

CONCLUSION

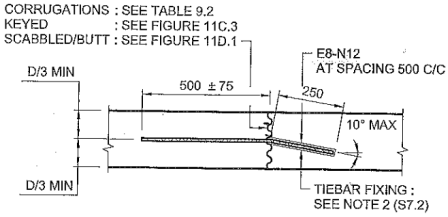
The M5 slab replacement project was without a doubt a great success. The client was impressed with the methodology, trouble shooting and the results obtained on the finished product. The project was completed on time and to budget. This would not have been possible without Volumetric Concrete Australia and the technology and cement implored from CTS Rapid Set Cement.

APPENDIX A- JOINT DETAILS

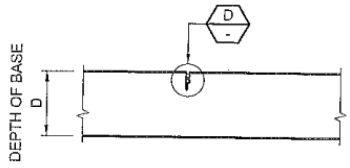




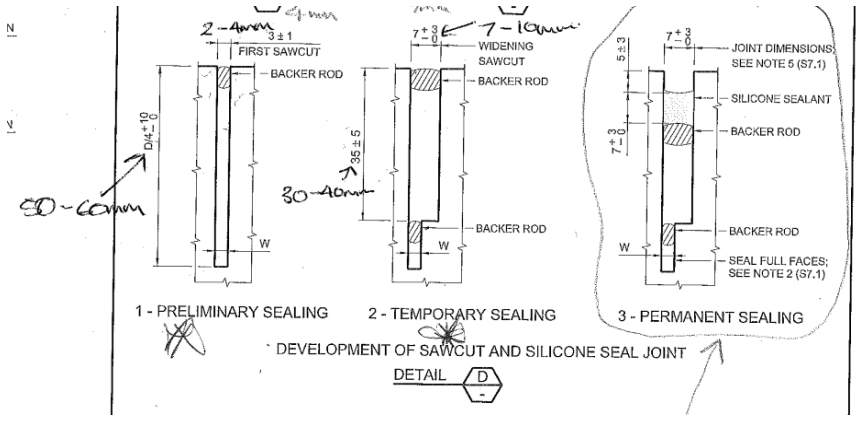
JOINT TYPE (P2d)
LONGITUDINAL;
DRILL-TIED AND FORMED



JOINT TYPE (P7d)
TRANSVERSE CONSTRUCTION;
FORMED AND DRILL-TIED



JOINT TYPE (P8)
TRANSVERSE CONTRACTION;
SAWN (UNDOWELLED)



DEVELOPMENT OF SAWCUT AND SILICONE SEAL JOINT
DETAIL (D)