Chairman's Note

It seems that every year gets off to a faster start than the one before. It is hard to believe that it is March already.

It looks like the road sector in New Zealand will continue to change this year. New organisations in Land Transport New Zealand and Transit will be bedding down. We will also see the impacts of both the Local Government and the Land Transport Management Acts become more evident with greater emphasis on integrated planning and solutions and improvements to long term planning respectively. Finally we can all look forward to seeing more work as the industry continues to be better funded than ever before. Over the coming year we will bring you articles on these changes in the newsletters.

Our AGM this year will be at the Beca offices in Auckland at 132 Vincent St, Auckland on Wednesday 27 April. It starts at 12.30pm with lunch, and the AGM itself will be at 1.00pm with a guest speaker to follow 1.30pm. This is the first time we have held the meeting in Auckland so we ask that all you Blues supporters come along.

This year we have a number of committee positions available after the retirement of some committee members. We are looking for enthusiastic supporters from Auckland, the Central North Island and the South Island to join the committee. Please think about this seriously - it will be your chance to help guide the REAAA to achieve what you want.

The Low Volume Roads Workshop is being held in Palmerston North from 3-5 August this year. Please mark it in your diaries now and we look forward to seeing you all there.

Thank you and best wishes for what looks like being an exciting and busy year.

Mike Rudge

Chairman NZ Chapter

REAAA Low Volume Roads workshop

Planning is now well advanced for the 2005 REAAA Low Volume Roads Workshop, to be held in Palmerston North from the 3rd to the 5th of August.

The committee are finalising papers and final costs to attend this event will be available soon. The theme of the workshop is ***Best Practices - Smart Systems - Canny Tools - A Practitioners Approach***. Three overseas speakers will be speaking in key note presentations and they will also participate in a panel discussion on the last afternoon.

It should be noted that REAAA members get a $50 discounted attendance fee for this workshop so members can get a direct return on their member ship fee.

In Brief

Roading New Zealand has launched a website, www.slowdown.co.nz, so motorists can report any roadworks signs they suspect have been forgotten.

The first call for papers has gone out for the 7th Annual Transit NZ/NZIHT Symposium to be held in Christchurch 6-8 November 2005. The theme is Planning for Certainty in Transport. For further details contact The Symposium Co-ordinator, NZ Institute of Highway Technology Ltd, PO Box 4273, New Plymouth. Tel 06 759 7065, Email jo@nziht.co.nz

NZ Chapter's 2005 AGM

This year's AGM will be held on 27 April 2005 in Auckland. The meeting will be at the Auckland offices of Beca at 132 Vincent Street, Auckland, commencing with a light lunch at 12.30pm.

Nomination forms have been sent out and we are looking for interested members from Auckland, the Central North Island and the South Island to join the committee. Please ensure your nominations are in by Thursday 31 March 2005.

Contribution and enquires

This newsletter is published for the benefit of members. Enquires about the chapter and contributions to the newsletter may be directed to:

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REAAA©
Driving Progress

ROAD ENGINEERING ASSOCIATION OF ASIA & AUSTRALASIA (NZ)

NZ Consultants help Sri Lanka recover from the tsunami and develop the Road Network

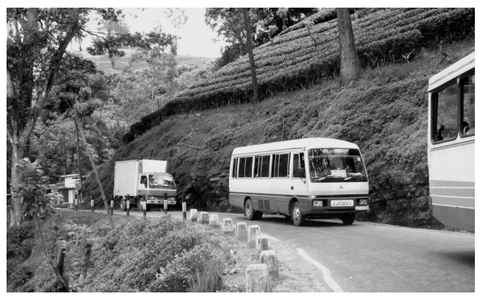
After the devastating tsunami struck Sri Lanka on 26 December 2004, the country was plunged into crisis as it fought to re-establish road links with hard hit coastal towns and cities from Galle in the southwest to Jaffna in the north.

New Zealand had two teams of road engineering consultants on the ground at the time, both engaged on Asian Development Bank (ADB) funded projects. Beca International Consultants Ltd and Opus International joined forces in a voluntary NZ effort to carry out a damage assessment of the main coastal highway from Colombo to Hambantota, and help the Government put together short and medium term plans for restoration and development.

People and property suffered most heavily in the disaster, and was fortunate in terms of relief activities that emergency road links were soon re-established.

The lines of tent cities accommodating the homeless survivors that stretch for miles along the southern coast and the piles of rubble mixed with the remains of peoples' cherished possessions that still line the streets show that it will take a long time for these communities to recover.

Notwithstanding disaster recovery programmes the Government is still pressing ahead with other much needed infrastructure improvement. Beca's project in Sri Lanka for the ADB is to prepare upgrading plans for 500 km of national A and B class highways, selected from a longer list of 1200 km.

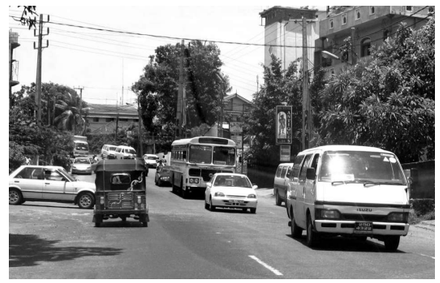


The roads cover a wide range of conditions from high volume heavily congested arterial routes to narrow winding mountain roads through rocky terrain in the high tea growing country of central Sri Lanka.

Improvements focus on widening and pavement reconstruction or rehabilitation, and providing better facilities for non-motorised transport and pedestrians.

The services include HDM-4 modelling of road deterioration and road user costs, economic and financial appraisal, social impact and environmental assessment and resettlement planning for those affected by road widening.

Beca has undertaken a wide range of similar international assignments and Beca's team leader, Ian Bone, has been personally involved in several of these assignments, and he says that New Zealand consultants have some competitive advantages overseas because of the country's reputation for innovative road network management. "New Zealand is recognised as an international leader in its systems of dedicated roads funding, expenditure appraisal, performance reporting and road network management. This is a definite plus when selling engineering and allied services abroad. This cuts both ways - our engineers learn from exposure to the technical methods used internationally, and can then factor this knowledge into the work they do at home."



The project is now 80% complete and due to be reported in April this year. Detailed design will be carried out later in 2005 and a construction start is planned for 2006.

(Institutional Member Article supplied by Richard Steel, Project Director - Infrastructure, Beca)

Deep Soil Mixing - A Slip Repair Technique for Road Maintenance

Introduction

An alternative approach to fixing slow moving underslips

Amongst other things, roading managers are charged with maintaining a smooth and safe pavement surface for the road users. Slips, more properly called land movements, have a habit of interfering with this charge. Slips can be categorised in a number of different ways. They can be under or overslips, shallow or deep seated, catastrophic or slow moving, rotational or translational, creep or settlement, or any combinations of these and some!

This paper is concerned with slow moving underslips. Many roading engineers have significant lengths of road that are affected by these.

The low cost solution of filling the resulting depressions usually only lasts for a short period of time. Some further movement will occur which presents a rough and unsafe surface to road users. In an increasing number of cases the Road Controlling Authority has to introduce temporary speed restrictions until such time as the next solution is applied.

Higher cost, lower risk solutions have traditionally been either some form of deep drainage or the building of a structure downslope of the problem area.

This paper describes an alternative approach to the design of solutions for these problems - ground improvement by deep soil mixing. This is an approach that often deals with both lateral settlement issues that the traditional techniques do not entirely overcome.

The Problem Under The Slip

The source of the problem? Often it's a construction legacy

A lot of today's slip problems are a legacy from the nature of the construction processes that have developed a two lane road with trafficked shoulders from its beginnings as a single lane track.

The original single lane was on cut material, the excavated material being cast over the steep downslope sides as waste. Fill material was often spread directly onto weak materials in gullies. These techniques were adequate for the pavement loadings of the day.

Increasing traffic volumes led to wider roads, the extra width often being founded on the uncompacted cut materials that were cast to waste many years earlier. The downslope is also usually too steep for the low strength of the uncompacted waste.

increased at the same time. The increased pavement loadings on lanes constructed over uncompacted materials could only lead to settlement and sliding problems.

Geotechnical mechanisms

The historic construction described above leaves us with an ongoing problem with pavements that

- Move down vertically because of the settlement and consolidation of the deeper weak materials
- Move laterally because of rotational or translational movements of the overstep and/or uncompacted weak materials
- Are sensitive to storm events and cyclic loading imposed by heavy traffic

Until all of the issues with the weak and steep materials are addressed, the road will continue to go out of shape and present rough unsafe surfaces to the public. A solution that arrests both lateral and vertical movement must be regarded as the ideal.

Basic Repair Approaches

The four basic repair approaches

There are four basic approaches to dealing with land movements caused by weak materials:

- Avoiding the problem area
- Replacing the weak material
- Building some form of retaining structure downslope that attempts to prevent the movement
- Improving the strength of the weak material - ground improvement

Avoid the problem area

The first solution to explore should always be to see if the problem area can be avoided altogether.

Retreating upslope or establishing a new road alignment can be relatively inexpensive in some cases. Investigation needs to confirm that the same, or different problems will not be encountered in the new location.

Replacement of the weak material

In some situations the weak material may be able to be replaced. This will generally be when the material is at shallow depths to allow safe and economic removal followed by the construction of a new stiffer lane.

Building a Retaining Structure

The retaining structure approach involves designing a structure that will restrain all of the material upslope of it from any further lateral movement. Drainage measures are usually associated with these solutions to lighten the load being restrained.

Retaining structures commonly used are;

- Gravity walls such as gabions, rock fill, cribwalls
- Cantilevered walls like H-pile soldier walls, timber pole walls
- Geotechnical Reinforced Structures, geogrid or geotextile wrap around for example

This type of solution does not directly attempt to arrest any vertical movement. If the structure has been built deep enough, the confinement of weak materials behind it may slow and, after a long period of time, stop the settlement

Ground improvement solutions

Ground improvement solutions aim to improve the strength of the weak material.

Ground improvement techniques treat the inherent soil weaknesses in-situ. While there are a large number of techniques available internationally, only two have been used to fix slips in New Zealand:

- Drainage
- Deep soil mixing

Drainage solutions

Drainage solutions, whether they be simple or complex, attempt to increase the material strength by removing water. The success of this is dependent on being able to establish and maintain enough effective drainage channels throughout the affected layers. In low permeability materials this can be nearly impossible. Also, in many materials, this may not be enough as the failure may have reduced the soil strength.

Deep Soil Mixing

Deep soil mixing

Deep soil mixing involves the insitu mixing of a stabilizing agent to increase the strength of weak materials. Common agents are derivatives and/or mixtures of lime or cement. The agents may be added in a dry or wet state, depending on the technology being employed. Most techniques produce vertical columns.

Simple composite material approach to design

Providing the columns are placed sufficiently close to interact, the deep soil mixing solution can be regarded as one that produces a composite material. Where the problems do not warrant detailed geotechnical analysis, the strength and stiffness of the composite material can be regarded as the sum of the proportional strength contributions of the two components, within sensible constraints.

The composite strength block is then analysed using conventional slope stability and settlement techniques.

Complex designs require finite element design

The simple proportional method described above is conservative. The loading that the column takes is understated. The simple technique does not take into account the significant contribution of soil arching between columns. Indications are that the group behaviour of columns can be more than 10% greater than the sum of the individual component columns.

Most road slips involve more complex and/or multiple geotechnical mechanisms than conventional slope stability programs can analyse. These slips require the use of finite element programs.

Deep soil mixing in New Zealand - Colmix

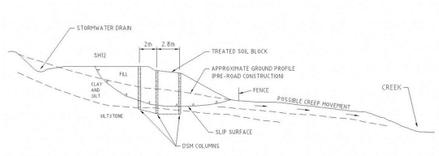
The Colmix deep soil mixing technique was first introduced into New Zealand in 2002. Colmix is a proprietary system developed by Bachy Soletanche in the 80's.

The Colmix equipment used in New Zealand uses twin, overlapping, hollow stemmed augers to mix the slurried stabilizing agent. The grouting and drilling system is computer controlled and monitored to ensure complete quality control of all inputs to the process. Columns of a thickened figure of eight shape are produced - overall dimensions of 600mm x 300mm.

A practitioners understanding

A hands on roading practitioner may find it easy to think of a deep soil mixing solution as producing a beam of strengthened soil. This soil beam has to be strong enough to hold up the road should the soil downslope of the treated zone move.

Figures 2 shows a typical ground improvement solution to a classic rotational



movement problem. A deep soil mixing solution is imposed over the failure mechanism.

Deep soil mixing track record in NZ

Colmix deep soil mixing has been used to repair over 40 slips in NZ. On going monitoring has shown that deep soil mixing has provided satisfactory solutions where previous drainage and smoothing solutions have only had partial success. A number of notable high profile sites with long histories of continual movement have been successfully treated.

All soils are suitable - but not rocks

All types of soils have been successfully treated with deep soil mixing - from marine

muds through clays and silts to sand. The augers will not handle significant quantities of material with particle sizes much greater than 80mm.

Pavement layers are not a problem

Providing the top size is not too large, existing pavement layers are not a problem. Where they include stabilized or very thick bituminous layers, it is often more economic to pre-drill. Pavement layers of up to three metres deep have been encountered where very old slips have been continually topped up with granular and/or bituminous materials.

Traffic and load sensitive areas

Where columns are positioned in traffic wheel paths, construction is carried out early in the day with a lane closure. By the end of the day the tops of the columns will have gained sufficient strength allow the lane to be re-opened to traffic again.

Slips that have a factor of safety close to 1 at the time of construction need to be constructed in a sequence that will minimize movement during construction operations.

Benefits of deep soil mixing

Deep soil mixing can bring the following benefits:

- Cost savings of up to 20% over comparable designs
- Time savings, a 1 month traditional job could be done in a week
- Settlement is addressed, unlike with most other solutions
- Year round construction, no waiting for the right weather
- Lower safety risk during construction

(Article supplied by Lloyd Houghton, Manager, Encore www.encorenz.co.nz Lloyd can be contacted on 09 426 6259 lloyd@encore.co.nz)