# Patching of Pavements by Stabilisation using Skidsteer Equipment

## 1 Introduction

The use of a forward profiler style attachment to skidsteer equipment (see Figure 1) was developed and promoted by VicRoads in the early to mid-1990s [White, 1996]. The development was driven by the need to provide a short term, cost effective, timely and quick response solutions to unexpected road failures for small areas.

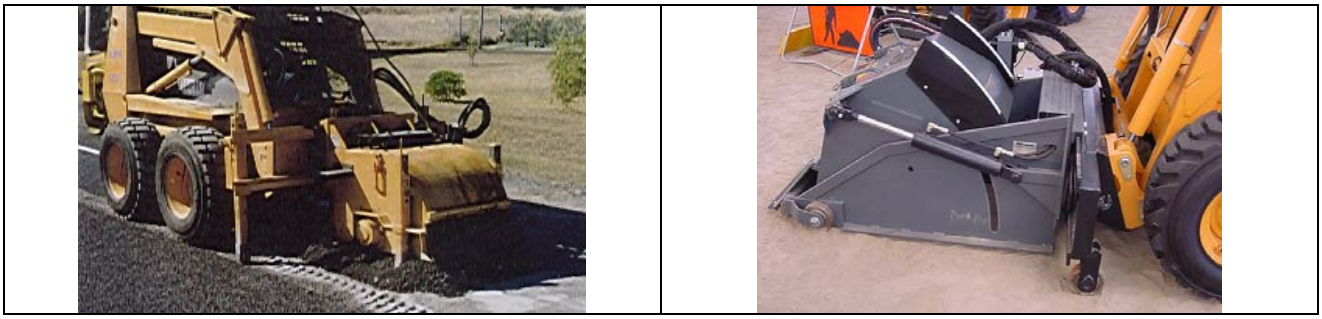

**Figure 1** A view of the skidsteer with the profiler attachment.

The initial development of the process involved:

- Field trials
- Ergonomics and OHS
- Implementation and procedure development
- Plant set selections
- Specification
- Construction procedures
- Costs for various patch sizes

Some of the key findings in the report [White, 1996] on the process were:

- The first trial was conducted in 1993 and lasted at least four years.
- That power of the machine is an important success factor.
- The profiler head was required to have a cutting depth of 250 mm for appropriate mixing to depths of 150 mm.
- A minimum of 3 tonne vibratory roller was required for compaction.
- Maximum lot size was set at 150 m2 to allow sufficient compaction using GP cement
- The specification was an adaptation of VicRoads 307 with 95% modified compaction.

The shortcomings of the process identified in White's Report were:

- Typically no laboratory testing was carried out to ensure the best binder type and quantity was specified.
- Hand raking the binder into position.
- The profiler head did not have a mixing chamber.
- Operators were confused that cutting depth is equal to mixing depth, and the allowance for bulking and sufficient space for mixing the material.
- Sufficient water supply for achieving correct moisture control.
- The profile head was typically 600 mm wide and required many passes when the patch width exceeds 1.2m.
- No site density measurements were taken and therefore, the compaction level could not be verified.

There was no evidence in the study that the binder was effectively mixed with the various profiler attachments. Visual evidence of profilers being used for stabilisation in NSW, WA and Queensland over the last 15 years has shown poor quality mixing [AustStab, 2000a] as shown in Figure 2.

**Figure 2** A profiler incorrectly used for road stabilisation in NSW due to the poor mixing quality.
(Photo taken in March 2000)

Many of these shortcomings of using skidsteer equipment were identified in the AustStab construction tip on patching [AustStab, 2000b] and the following points were listed as the limitation to the process:

- The use of cement bags for spreading is satisfactory for small area patches (i.e. about 20 $m^2$) but as the area increases the uniformity of spreading the binder can decline to unacceptable levels.
- The mixing is not as uniform as that achieved by a stabilisers and reclaimers with dedicated mixing chambers.
- It was always the intention to stabilise up to 150 mm depth and use a 3 tonne roller for compaction.
- Surface finish is a problem and the patch size increases rideability becomes an issue, as this type of work normally does not utilise a grader.
- Short-term solution to maintenance.

## 2 Current Practices

It is known that many regions of Australia use the skidsteer system to patch existing failed roads, and many local government organisations have purchased the attachments. What are rarely identified are the short-term life and the higher risks of using this construction technique.

Patches completed using the skid steer process have a relatively short life and tend to fail in the block cracking mode (see Figure 3).

**Figure 3** A view failed stabilisation patching on the Hamilton Highway at Derrinallum.
(Photo taken in May 2003)

Discussion with AustStab contracting members indicate the following problems with the skidsteer process:

- Lack of testing of pavement material to establish best binder type and content.
- The thickness of stabilised pavements is 150 mm and with too much binder it will crack under loading, especially when the patches are in wheel paths.
- Repairing the subgrade is not carried out with ongoing risks of the pavement cracking.
- The life of repairs treated in this manner has not been well documented, but indications are that it would be less than 1 year if the material were treated as granular[1] (Austroads, 1992).
- Full compaction of the layer is limited by the width of the patch and size of roller. Difficulty in rolling adjacent to the edge of the patch leads to distress along the edge of the patch.
- Whilst 3 tonne rollers were initially recommend it is also becoming clear that heavier rollers are essential on some patches.
- Due to the mixing limitations of the profiling head, the ends of the work are poorly mixed leading to weak zones.
- With no onsite CBR or compaction testing the quality of the work is unknown leading to a variable success factor of the process.
- The lack of opportunity to grade the surface and typically the patches are in wheel paths leads to a rough ride.
- The location of the patch within the pavement can lead to moisture problems if moisture is moving laterally in the pavement.
- In some cases the binder dosage is increased to 'dry' the pavement material leading to low strength stabilised materials.

[1] Figure 8.4 of the Austroads pavement design guide indicates that the minimum thickness of a granular base layer for a design traffic of $10^5$ ESAs with a subgrade CBR of 15% is 150 mm. For typical subgrades around 5%, the traffic life may well be 1,000 ESAs.

- The attachments do not allow individual sprays to be turned off in the overlap mixing region leading to longitudinal cracking or problems with sealing in the overlapped region.
- Applying a geotextile seal over the patch and adjacent roadway may increase the treatment.

Road asset managers and construction supervisors can minimise the risk of this process failing by:

- Limiting maximum patch size to 20 $m^2$ with a maximum width of work of 2 m.
- Carrying out laboratory testing of the pavement materials being processed.
- Limiting depth of stabilised layer limited to 150 mm, and verify stabilised depth in at least two locations per patch.
- At joints, water sprays should be turned off to prevent too much water in overlap area.
- Using vibratory smooth drum rollers with a minimum gross mass of 6 t.
- Use of nuclear density gauges for insitu wet density measurements.

# 3 Conclusions

State Road and Local Government authorities should recognise the limitations of using the attachments on skidsteer equipment. There are some examples of these patches performing beyond 12 months, but many of them are block cracking due to poor construction practices.

Traffic control and road user costs are becoming major cost components in road maintenance activity and it may be appropriate to complete a large patch with specialised equipment rather than a series of small patches with a skid steer process. Finally, using the appropriate construction equipment and skilled operators for road stabilisation provides the best outcome for road maintenance.

# 4 References

Austroads (1992) Pavement Design Guide Sydney, 1992.

AustStab (2000a) *Profilers versus stabilisers* AustStab Construction Tip No.1, Australian Stabilisation Industry Association, Artarmon, NSW, February, 2000.

AustStab (2000b) *Skidsteer stabilisers* AustStab Construction Tip No.2, Australian Stabilisation Industry Association, Artarmon, NSW, February, 2000.

White, GJ (1996) *Small Scale Patrol Patching using the Skidsteer Stabilisation Process* VicRoads South Western Region Technical Report No. GR/97/6 Geelong, Victoria, December, 1996.

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