GUIDELINES FOR RETRO-FITTING EXISTING ROADS TO OPTIMISE SAFETY BENEFITS.
A Practitioners Experience and Assessment of Options for Improvement.

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The NSW Roads and Traffic Authority is committed to reducing the high number of fatal and serious crashes that occur on the State’s rural road network. However, these improvements must be compatible with a “Safe Systems” approach to road safety.
On existing lower hierarchy rural roads the application of “greenfield” road design standards are usually financially, physically or environmentally unachievable.

Alternative “brownfield” standards need to be determined and incrementally applied.
The NSW Centre for Road Safety research projects.

Broad range of external research.

There is a need to maximise the safety impact that incremental countermeasures will have on the road network while still minimising their cost as well as their physical and/or environmental impact.
Maintaining existing rural roads by only resealing or rehabilitating the pavement without improving the physical characteristics of the formation and alignment won’t make the road safer and may actually make it less safe for some time after.
This may be due to drivers seeing the new pavement as being in better condition and therefore safer to travel at higher speeds. Then when crashes do occur the subsequent outcomes are usually more severe due to the higher speeds.
This indicates that the “do nothing” option of only resealing existing rural roads without addressing the current crash problem will do little to help reduce existing crash rates.

Incremental levels of improvement can be retro-fitted that will greatly improve the safety performance of these roads at a reasonable cost.
The primary countermeasures available for retro-fitting to existing rural roads are:

- Identifying Dangerous Curves
- Shoulder Widening
- Clear Zone Widening
- Wider Centreline
On smaller radius curves there is a greater the chance of crashing. However they do not initiate the most severe crashes. Crash severity increases with vehicle speed through the curve. Speed and the size of the curve is less likely to initiate a crash once the radius becomes greater than 600 metres.
The RTA’s current Road Design Guide has a “grey area” of curve radii - 300m and 440m radius. A Safer Roads Branch study (2007) assessed the crash severity as well as the radius of 7,000 curve crashes on high speed roads. The outcome from this research showed that the “grey area” will need to be expanded to between 200m and 600m to achieve maximum crash severity reduction.
CURVE PRIORITISATION

Crash severity / Curve radii relationship

- Fatal
- Injury
- tow away
Curves can be prioritised into 3 categories.

Priority 1 - 200m to 600m radius curves

Priority 2 - 50m to 200m radius curves

Priority 3 - 600m to 1000m radius curves
CURVES ON THE NSW STATE ROAD NETWORK

Distribution of curves in the NSW Road Geometry Analyst (RGA) network

*Please be aware that radii expressed in RGA are only accurate to +/- 20% (95% confidence)*
Priority 1 curves make up 10% of the total NSW State Road Network. However the majority of fatal and serious injury crashes that occur on bends fall within this range of radii.

The RTA has initiated a separate funding program that will allow engineers to enhance road maintenance projects to reduce an identified crash problem.

All maintenance projects will be evaluated for their safety impact.

The Safer Roads Branch has undertaken research into what crash reduction countermeasures will give the best value to help the engineers achieve this.
PRIORITY 1 CURVES
300m Radius Curve
Priority 2 curves make up even less of the State Road Network (3%) and have the most crashes. However the majority of these result in less severe injuries or towaways.

Smaller curves tend to occur on sections of road through difficult terrain where improvements to the alignment are often difficult to achieve.

Countermeasures to reduce these crashes should concentrate on reducing the occurrence of the crash more than the severity of the crash.
PRIORITY 2 CURVES
70m Radius Curve
Priority 3 curves make up 8% of the State Road Network and should only be considered for treatment when they have either an historically poor safety performance or the road is being upgraded to a higher class level.

Any countermeasure treatments should concentrate on reducing the severity of the crash as these size curves tend not to initiate the crash even though the crash outcome may be severe.
PRIORITY 3 CURVES
850m Radius Curve
Shoulder sealing where none currently exists will have a beneficial effect in reducing off road crashes.

However there is a big difference in the effect they have on reducing crashes depending on whether the crash occurs on a straight or curve.

The types of crashes that occur on straight sections of alignment are often different to curve sections of alignment and the reasons why they occur can also be different.
Crashes are usually related to either distraction or fatigue. An RTA study of stereotypical crashes rates on two lane rural roads showed that:

- No shoulder seal – 42.5 crashes/mvkt
- 0.5m shoulder seal – 31.8 crashes/mvkt (-25%)
- 1.0m shoulder seal – 26.4 crashes/mvkt (-38%)
- 1.5m shoulder seal – 24.5 crashes/mvkt (-42%)

This indicates that although there is a continual reduction in crashes as the seal gets wider, the best value for money when sealing shoulders on straights on rural roads is with a 1.0m width seal.
60% of all off-road crashes on the NSW rural road network occur on curves.

50% of all head-on - not overtaking crashes also occur on curves.

Most loss of control crashes on bends are due to excessive speed for the design of the curve.

There is a 59% difference between off left on curve crashes and off right on curve crashes.
Shoulders on the left hand side (outside) of a right hand curve (both directions) should be widened and sealed to a minimum of 2.5m where possible. This single countermeasure will have an effect in reducing up to 51% of all run off road crashes. The inside shoulder can remain at 1.0m in width.
Clear zones of 10m to 12m are not achievable on most existing rural roads due to terrain or environmental restrictions.

Both the AASHTO Road Design Guide and research undertaken in Safer Roads Branch indicates that good benefits can be gained by installing 5m to 6m wide clear zones where possible on existing rural roads.
CLEAR ZONE WIDTHS
(AASHTO Roadside Design Guide -1996)
The previous slide showed that there is a continuous reduction in crashes up to 10 metres from the edgeline.

Almost 80% of all crashes occur within the first 6 metres.

5 to 6 metre clear zones can be expected to reduce a number of these crashes.

Major benefits are in the reduction of the severity of those crashes that are not stopped.
Current centreline widths leave no room for error.

Fatigue or small lapses in concentration can lead to serious consequences.

The RTA has installed a number of varying width centrelines on the Pacific Highway in NSW.

These range from 0.5m to 2.0m wide and act as a painted median by prohibiting overtaking.
CENTRELINE WIDTHS
PACIFIC HWY, VALLA
A new audio-tactile centreline configuration, up to 1.2 metres wide, is being trialled on the Newell Highway in NSW. This new centreline configuration will permit overtaking where it is considered to be safe and restrict it where it is not. The trial will be undertaken in 2009 along two 5 kilometer sections of the Newell Highway.
To meet the RTA Chief Executive's “Road Safety Challenge” a more efficient method of implementing safety countermeasures needs to be determined and applied to existing rural roads.

The incremental countermeasures described will be part of a new program of works that will target serious crashes on rural roads in NSW.
“Greenfield” design standards are usually not appropriate for retro-fitting road safety countermeasures to existing rural roads. Alternative “brownfield” standards are needed. Applying an incremental safety approach permits practitioners to selectively retro-fit effective interim safety improvements to those sections of the existing road network that are exhibiting the most severe crashes.
CONCLUSIONS

This application of incremental “brownfield” design standards will not only help to make the existing road network safer by providing practitioners with safer but less costly options to retro-fit, they will also allow for more of the network to be upgraded due to a more efficient use of road construction and maintenance funding.
CONCLUSIONS

ANY QUESTIONS?