



Australian Government



The new state
of business

An aerial photograph showing a road upgrade project through a dense forest. The road is a light-colored, newly paved or graded path that curves through the trees. There are several construction sites, including areas with dirt, gravel, and some machinery. A large area of trees has been cleared along the road's path. In the background, a road curves through the forest. To the right, a green field is visible, possibly a golf course.

Bonville upgrade

Fauna control measures

Background

The Bonville Pacific Highway upgrade involved building a 9.9 kilometre four lane divided highway, linking the Raleigh Deviation to the south and the Lyons Road to Englands Road upgrade to its north.

The upgrade provides 17.5 kilometres of uninterrupted dual carriageways between Urunga and Coffs Harbour, when combined with the previously completed Raleigh deviation. The project was jointly funded by the Australian and NSW governments.

Front Cover Image
Bonville vegetated median.

Back Cover Image
Construction of Archville Station Road interchange, looking south, with Bongil Bongil National Park in the distance

Protecting the environment

With its moderate to steep slopes, erodible soils and located in one of the State's heaviest rainfall belts with sensitive wetlands and creeks, achieving a high standard of erosion and sediment control for this project was a priority.

A number of innovative and best management practices proved successful in minimising erosion and sedimentation for most rain events.

Work practices included newer innovations such as using mulch from clearing to slow water velocities and catch sediment and other erosion control techniques. This was in addition to a large number of drainage basins, catch drains to divert clean water and diversion drains to reduce water volumes and velocities.

As a result silt loads on the environment were greatly reduced in an area subject to extreme rainfall events. Abigroup and Roads and Maritime won the CCF Earth Awards as well as a merit award from the International Erosion Control Association for this work. The project's numerous environmental measures included:

- About 30 sedimentation basins, some of which will be converted to wetland basins after construction
- Fauna overpass and underpasses
- Noise barriers and treatments of noise-affected homes
- Translocation of rare, threatened and regionally significant flora species.



Landscaping around a water quality basin.

Koala monitoring program

The Bonville area is known for its local koala population. In response to community concerns, Roads and Maritime carried out modifications to the road alignment in the planning stage to avoid key koala habitat within Bongil Bongil National Park.

Koala monitoring measures were in place throughout construction. Local koala experts were involved in capturing koalas and fitting them with radio collars in order to track their movements and to try to reduce koala mortality during construction.

Ten kilometres of temporary fencing was installed and then 15 kilometres of permanent fencing was erected prior to completion of the project. This has helped reduce koala fatalities.



Closeup – A local resident of the Bongil Bongil National Park.

Many design features in the project aimed to protect the environment and native fauna. These features included:

- One fauna overpass spanning both carriageways within the Bongil Bongil National Park area. The overpass is 60 metres wide and provides a vegetated passage for fauna to cross the highway
- A further four dedicated fauna underpasses, plus provision for fauna underpasses at Pine, Reedys and Bonville creeks and under bridges near the Sid Burke rest area, assists with fauna movement
- Fish-friendly culverts with low flow cells to allow fish passage in sensitive creeks and drainage lines
- Increased widths on bridge abutments over creeks to provide access for fauna and the treatment of culverts to assist fauna
- Overall, this project provides significantly better wildlife outcomes than the previous highway.

Key Findings

Monitoring conducted continuously over six years, two years pre-construction, two years during construction and two years post-construction found that:

- Koalas can and do maintain home-ranges right to the edge of the highway
- Highways and other cleared landscape features tend to be used as home-range boundaries by roadside koalas and are rarely crossed by the local residents
- Koala road mortalities are largely concentrated in the coinciding dispersal season (sub-adults) and breeding season (adults), which in northern NSW is August to October
- Other sources of mortality (e.g. chlamydia) can be much higher in roadside koalas than road mortality
- Most Koalas killed by vehicle collisions on the highway are not the local roadside residents but appear to be sub-adults dispersing and perhaps old, weak animals displaced from their former home-ranges away from the highway. Consequently the impact of roadkill affects a wider section of the population
- The genetic variation in roadside Koalas in the Yelgun to Chinderah and Bonville study areas prior to the upgrades was relatively high and had apparently not been impacted by the long existence of the Pacific Highway
- Construction activities in the two study areas directly led to only one known death, suggesting that the direct impacts of clearing and construction are relatively minor at a population scale (when appropriate mitigation strategies are in place)
- Construction activities (in particular, habitat removal) indirectly affected individual Koalas, including the death of at least one animal, the alteration of home ranges and behaviour of others and possibly mortality as a result of home range adjustments
- Vegetation clearing and construction may operate with other factors, including other vegetation clearing or logging, to create cumulative impacts on a koala population
- Scheduling of vegetation clearing to follow the koala breeding season and allow time for the installation of fauna fences before the next season is likely to save individual koalas

- Clearance surveys for koalas prior to and during clearing operations coupled with set protocols for incident management are likely to save individual koalas
- Clear and committed protocols and training procedures for construction workers on how to manage koala incidents on work sites are likely to save individual koalas
- ‘Floppy-top’ fauna exclusion fencing can be very effective at reducing the rate of road killed koalas, but gaps and other weaknesses (including side roads) have to be eliminated, and fences that end at the forest edge are likely to be not as effective as those that extend beyond the forest
- Significant levels of planning and implementation commitment are needed to get temporary fauna exclusion fencing in place and fully operational (ie without gaps) as soon as possible after vegetation clearing is completed and before the next breeding season
- Underpasses (both constructed culverts and ‘natural’ underpasses such as gullies) do work in providing safe dispersal routes for koalas to cross the highway.
- The length of underpasses may be a factor in determining whether Koalas make a successful crossing
- Evidence collected subsequent to this study indicates that Koalas have been present on the Bonville fauna overpass. Koalas may need time to become accustomed to this structure. Provision of vegetation cover may also improve its effectiveness
- Log ‘furniture’ in underpasses was used by a koala but not by most. It may provide an escape route should a predator appear and should be included in future designs
- Temporary movement structures may be useful to divert dispersing koalas safely across the road
- Simple gates placed across the entrances to public side roads (requiring manual opening and closing by drivers) can be very effective at plugging holes in exclusion fencing, provided traffic volumes are low and locals are consulted appropriately.

Translocation success

The endangered Floyd's grass (*Alexfloydia repens*) was successfully translocated as part of the project. This species of grass occurs in the Bonville area, and was found on the banks of the three creeks that the project traverses (Bonville, Reedys and Pine Creek). Further to this, Floyd's grass is the only host plant for the caterpillar of the Knights Grass-dart butterfly (*Ocybadistes knigtorum*) which is also listed as endangered and occurs only in the Bonville region.

During the monitoring program carried out as part of the translocation plan, all 23 patches of Floyds grass planted had rapidly established and spread across the translocation site. After two and a half years the Floyds grass had filled the gaps between patches and covered the whole translocation area. Habitat restoration completed at the site has transformed an initial understory

dominated by exotic Lantana and Broad-leaved Paspalum to a closed stand of Floyds grass. The translocation monitoring report stated that the composition of the translocated Floyds Grass stands appeared to be relatively stable and resistant to invasion of exotic and native species.

In addition to this, monitoring approximately one year after translocation revealed that the Knights Grass Dart butterfly has successfully translocated at the Floyds grass site. This is an exceptional outcome as not only has the extent of this endangered species increased as a direct result of the translocation exercise, it now also helps support another endangered fauna species the Knights Grass-Dart butterfly.



The Black Grass Dart Butterfly.

Fauna Control Measures

Glider crossings and wide vegetated medians

From previous surveys it is known that Gliders can, where suitable trees exist, cross two lane highways with relative ease. When more than doubling this distance with a four lane highway, the chances of successful glider crossing is greatly reduced without specifically designed mitigation measures, such as glider bridges or vegetated medians.

At Bonville wide vegetated medians were incorporated into the design with the remaining vegetation left in-situ to maintain connectivity of habitat for these species without having to wait for planted trees to grow to suitable height. It is important to note that the median width has been significantly increased to allow adequate soil moisture to maintain healthy trees in the median. Where appropriate, the minimum retained width of vegetated median should be metres wide and depending on sight distances (fog lines), batters and verge requirements, the total median width may need to be wider to take these factors into account.

Post construction monitoring revealed use of widened medians by sugar gliders.



Underpass and overpass structures

The design of the bridge at Bonville Creek combined drainage and fauna movement. The wide area underneath the bridge caters for fauna movement. Maintaining minimum span widths between the creek edge and the bridge abutment were a key design constraint put on the construction contractor. The Super-T girder was placed on end spans by a crane and in centre spans by launching truss, in order to reduce the impact to the waterway.

Fauna friendly furniture, specifically designed for koala use, was also installed.

Swamp wallaby and grey kangaroo tracks in the mud are evidence of use of the fauna passage under the Bonville Creek bridge.



Swamp wallaby and grey kangaroo tracks.



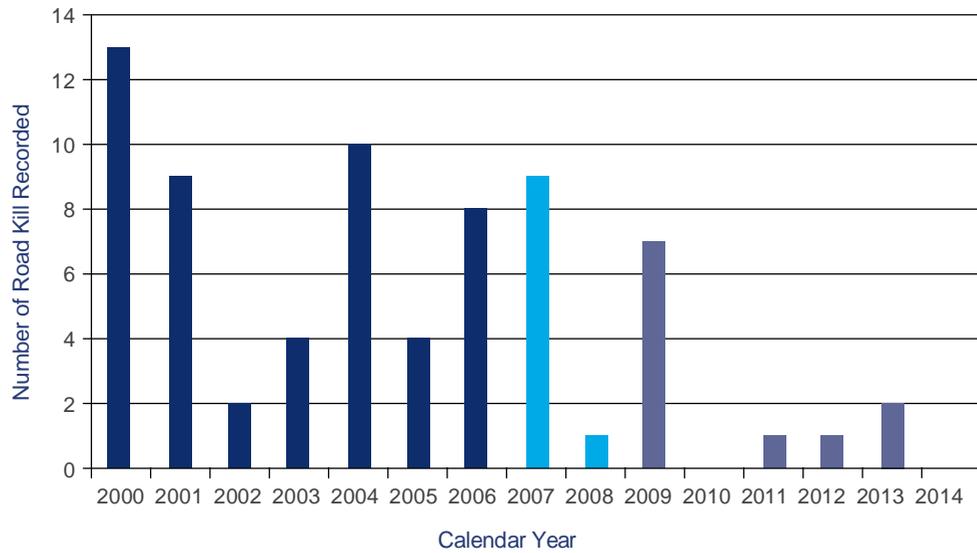
Fauna friendly furniture, specifically designed for koalas.



Fauna friendly furniture, specifically designed for koalas.

Koala Road Kill Data, Bonville Study Area

Substantial construction commenced November 2006. Opened in September 2008.



The piers for the bridge over Pine Creek (previous page) have been constructed outside of the main creek line so that disturbance to riparian vegetation was minimised. This location provides known habitat to the Giant Barred Frog and post construction monitoring shows that their numbers are increasing.

The design of the fauna underpass at Bonville incorporated drainage pipes underneath the structure to ensure dry fauna passage even during episodes of flooding. Post construction monitoring by AMBS have shown koalas using this underpass.

The AMBS koala monitoring of the 80 metre long fauna underpass installed cameras that used motion sensor technology to capture digital images of animals using the structure. The cameras and sensors were solar powered, reducing the need to continually replace batteries and significantly reduce risk of missing the opportunity to record fauna crossing the structure.



Koala recorded using fauna underpass bridge at Bonville shortly after the installation of the infra-red monitoring cameras.

Fauna fencing

Due to the significance of the koala population, history of koala road kills in the area and the fauna movement corridor, the project installed approximately 4 kilometres of temporary fauna fencing prior to clearing activities starting.

Pre-clearing surveys were carried out to ensure that any koalas trapped between the temporary fauna fence and the highway were located and safely located into the adjoining habitat.

The temporary fence was designed so that it was relatively easy and quick to install using chain wire mesh secured to strained wire between star pickets.

The bottom of the temporary fence was pegged down to prevent animals borrowing underneath. The temporary fauna fence design and location was developed after close consultation with the Department of Environment & Climate Change (DECC).

As a result of further koala road kills in the area, additional temporary fauna fencing was installed. This resulted in significantly reducing further road mortalities.

The temporary fencing was left in place throughout the construction process until the permanent fauna fencing was installed.



Temporary fauna fencing being installed on the project.



Temporary fauna fence gate installed on the Bonville Pacific Highway project.



Permanent 'floppy top' fauna fencing.



Temporary fauna fence.



Fauna escape ramp, used in both temporary (left) and permanent fauna fences (above).

Fauna overpasses

A fauna overpass was constructed on the project which also includes glider poles and a rope bridge. This was developed in close consultation with EPA.

The Bonville fauna overpass had solar powered lighting installed on the local

road to increase visibility of fauna crossing for motorists.

Koalas were recorded on top of the overpass approximately 18 months after construction finished.



Revegetation

Post construction revegetation took place across the project.



Fish ramps

The creation of pool and riffle design allows native fish to rest in pools before moving up stream via the riffles. The implementation of this won very high praise from DPI Fisheries.



Decal hawk stickers

Decal stickers on the transparent sections of noise walls, which reflect UV light, are invisible to human eyes but visible to birds.

Monitoring, following their installation, has shown that they have worked well. The decal stickers are narrowly spaced in order to be most effective.





Roads and Maritime Services

20 Prince Street, Grafton NSW 246 | T 1800 653 092 (toll free)
E pacific.highway@rms.nsw.gov.au | rms.nsw.gov.au

July 2014
RMS 14.286