Case Study: Highlands Highway, Papua New Guinea




The Highlands Highway is the main highway in Papua New Guinea (PNG). It is a vital link between PNG's second largest city, Lae, and the populous Highlands region for both transportation of goods and people. For most of its length the Highlands Highway is no more than a single carriageway two-lane road which is often hindered by potholes and poor riding quality.

The two key structural layers, being the base and sub-base, are extremely variable. A consistent pavement layer design would have been applied, however it can be seen that there was little adherence to the pavement layer design during construction. Total thickness of the pavement layer design varies from 360 to 720 mm. This implies that the pavement layer design for the same road difference by 100% in some location. These differences in pavement layer thickness represent a difference in the roads ability to resist repetitive loading.

Given the high importance of the road to the region and to PNG, there is likely to be a higher Equivalent Standard Axle Load (ESAL) than would be expected for a road of this classification in other regions. Further, with the mixed traffic use (mining vehicle, trucks, buses, cars, etc.) the road will need to accommodate both heavy axle loads and growth in the future. There is no formal traffic data for the road. Given the importance of the road, the traffic load on the roads in this area is expected to be approximately 25 million Design ESALs.

A pavement design based on rehabilitating the existing pavement structures by use of a soil recycler is recommended. The proposed design takes into account the need for rapid reconstruction, the variable nature of the existing material types and thicknesses, and the observations that were documented during various site visits by AnyWay staff members:

- 5 cm Asphalt wearing course (minimum double chip seal quality)
- 20 cm Local in-situ base, stabilized with 4% ANSS, compacted to max 98% of Mod. AASHTO to reach a minimal CBR value of 100%.
- 20 cm Local in-situ soil sub-base/base blend compacted to max 95% of Mod. AASHTO

The use of alluvial aggregate throughout PNG is commonplace. The rounded nature of the aggregates used in the base will need to be addressed using the rehabilitation intervention. To this end, a recycler will be employed in the stabilization construction process. Such a machine will allow for milling of the upper pavement layer, including the wearing course where it is present, to break up the rounded aggregates and provide angularity. Such angularity provides much better resistance to repetitive loading. An added benefit to the recycler is that the depth can be accurately controlled, which will produce a uniform rehabilitated base layer along the project site. The main lane is designed to be of 8 m width with shoulders on both sides at various widths subject to the space available on site.

Results from samples taken from the Highlands Highway between Togoba and Kagul River

Location	MDD kg/m^3	OMC %	PI	Dosage (%)	CBR
CH: 1.6 + 3.7	2240	9.0	NP	2	180
				4	130
				6	110
CH: 4.5 + 6.7	2230	9.0	NP	2	150
				4	140
				6	110
CH: 9.4 + 11.1	2220	7.6	NP	2	130
				4	120
				6	110
CH: 14.4 + 16.3	2240	9.0	NP	2	132
				4	93
				6	80
CH: 20.3 + 23.0	2210	9.0	NP	2	160
				4	130
				6	110

Savings using stabilization over alternative design

- Overall cost saving of 50%
- Time saving of 50% compared to previously used methods.
- Further time saving on project by all-weather trafficability.
- Using stabilization design, NO exchange of pavement materials was required

Environmental savings

- 116,000 m3 less soil spoiled to landfill site
- 116,000 m3 less selected aggregate imported from quarries.
- 12,760 X 20-ton truck journeys through existing residential area avoided, saving road wear and traffic congestion.
- CO2 emissions saved (global environmental impact).