Geogrid Reinforced Pavements Come Of Age

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Geogrids have been used to stabilise soft roadway subgrades for more than 30 years, but the design is often based on an empirical, rather than a rigorous technical approach. Southern Geosynthetics has introduced new design software that allows simple, effective designs to be generated, increasing options for engineers.

At the new Essendon FC base, "The Hanger" at Tullamarine, designer Aurecon was faced with a real dilemma. The very soft reactive clay subgrade had repeatedly failed proof-rolling. Traditional options of dig-out and replacement with good quality fill, or in-situ cement-stabilisation were not possible due to the presence of a wide shallow service trench along the middle of the roadway alignment. With very little cover over services no further excavation was possible.

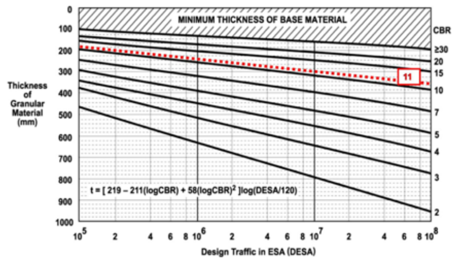

Figure 8.4: Design chart for granular pavements with thin bituminous surfacing

Savings of up to 30% of pavement thickness can be achieved with geogrid reinforcement.

Assuming a design CBR of 1%, and design traffic of 100,000 ESA, the design program solution called for placement of DUX CG30, a 30kN/m biaxial geogrid combined with a non-woven geotextile at subgrade together with a 280mm "stabiliser" layer of crushed rock; this would then provide a working platform with CBR=11% and allow compaction of a second 180mm thick crushed rock pavement layer. The total pavement thickness of 460mm represents a saving of some 200mm, or 30% over traditional design.

Designer Aurecon opted for reduced thickness of 180mm of cement-treated first lift, followed by 200mm of Class 2 FCR and a wearing course of 40mm AC. Upon setting after a few days the cement increases the strength and stiffness of the first stabiliser layer and provides an improved base for compaction of the second lift. But even on initial placement, before the cement "went off", the grid and 180mm layer virtually eliminated rutting under construction truck traffic.

One of the concerns of the contractor was how to achieve satisfactory compaction of pavement layers. Standard road construction practice requires satisfactory "proof-rolling" of the sub grade, with no visible movement or cracking of the subgrade. Any soft, "unsuitable" areas are dug out and replaced with engineered fill to achieve a typical CBR of 15%. However, when building on very soft soils, construction practice must be modified. Roadbase must be placed more carefully, dump trucks should avoid directly trafficking the grid wherever possible. Materials should be spread with light, low ground-pressure, such as the tracked bobcat such used here.

Southern Geosynthetics Supplies (SGS) Design Procedure "RPR 01"

Based on Austroads, SVG and Voss

The procedure is valid for the SGS products DUX GG30, DUX CG30 and DUX CG30L

A. Input parameters

Design traffic (10^5 to 10^8)	DESA	1.00E+05	[-]
CBR of the subgrade (1,5% to 5%)	$CBR_{subgrade}$	1.0	[%]

Note: savings due to reinforcement here for CBR up to 4,9%.

B. Calculation of the thickness of an unreinforced granular bearing layer: t_{AUS}

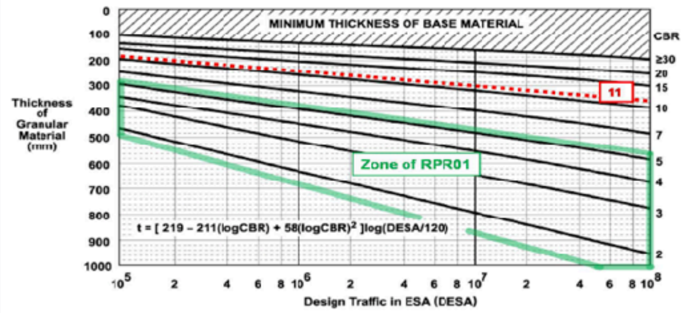

Figure 8.4: Design chart for granular pavements with thin bituminous surfacing (modified)

Required thickness of an unreinforced granular base layer	t_{AUS}	640	[mm]

C. Calculation of the thickness of a reinforced bearing layer: t_{FIN}

C.1 Thickness to achieve a transition from $CBR_{Subgrade}$ to CBR 11%: t_{CBR11}
(dotted red line in Fig. 8.4 modified)

Unreinforced thickness for rounded gravel (Voss)	t_{VOSS}	523	[mm]
Unreinforced thickness for crushed gravel (Voss & SVG)	t_{SVGNI}	419	[mm]
Thickness Reduction Factor (SVG) due to reinforcement	TRF_{SVG1}	0.67	[-]

Required base thickness for reinforced bearing layer to achieve CBR 11%	t_{CBR11}	279	[mm]

C.2 Base thickness (Austroads) based on CBR=11%: t_{AUS11}

Required thickness according to Austroad for CBR =11% instead of $CBR_{Subgrade}$	t_{AUS11}	182	[mm]

C.3 Final total reinforced thickness $t_{FIN} = t_{CBR11} + t_{AUS11}$

Required total reinforced base thickness	t_{FIN}	461	[mm]

C.4 Saving

Saving due to geogrid application	t_{SAVING}	179	[mm]

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This simple yet effective design tool allows design options to be quickly generated

Finished road, no rutting

After achieving greater than required 100% compaction the base is primer-sealed ready for laying asphalt