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Timber Pole-Concrete Composite Bridge Deck, Nkenyauna River, Zambia

Tablier de pont en béton et bois sur la rivière Nkenyauna, Zambie

Holz-Beton-Verbundbrücke über den Nkenyaunafluss, Zambia

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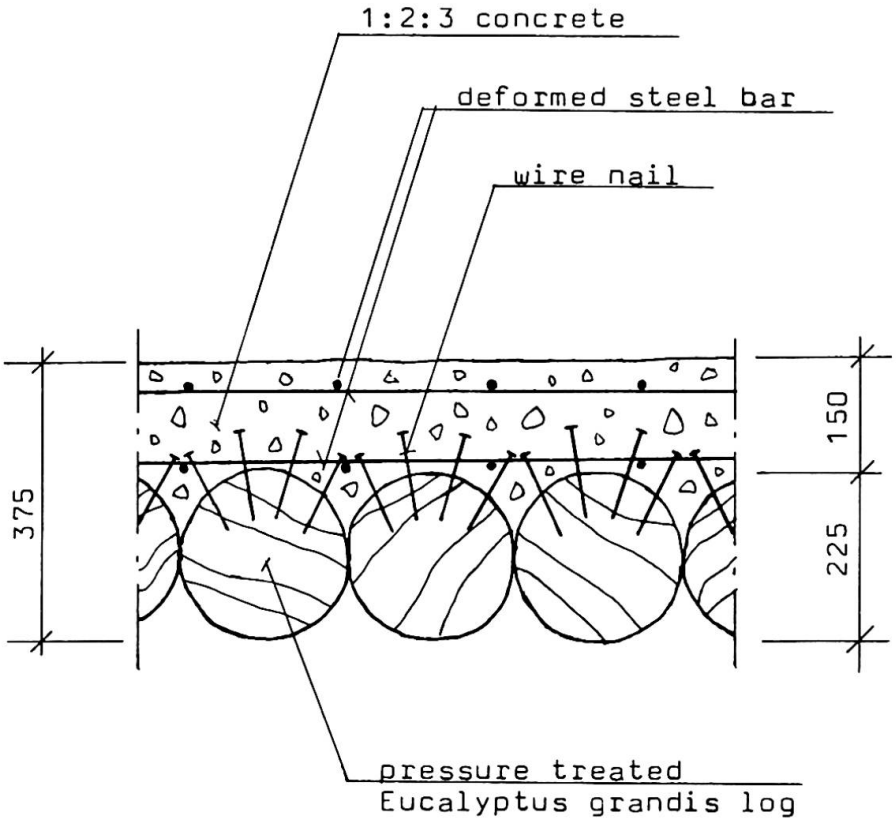
SUMMARY

This poster abstract describes a pilot project, in which a timber pole-concrete composite bridge deck was designed and constructed over Nkenyauna river in Kasempa, Zambia. Design span and load for the bridge were 6.0 m and 90 kN wheel (increased by 25% for impact) respectively, and the total deck depth was 375 mm (span/16). Main advantage of the used technique is claimed to appear at the national economic level in Zambia.



Theoretical cross section at midspan

1. INTRODUCTION

Sponsored by the Finnish International Development Agency (FINNIDA) the Timber Engineering Section of the Zambian Forest Department has studied, among other things, the feasibility of timber-concrete composite structures in Zambian context. At the time of the study, early 1986, significant savings in cost compared to steel reinforcing were only possible by using poles instead of sawn timber in composite slabs. Strength tests suggested that general design principles of timber-concrete composite structures are applicable also when round timber poles are used. Safety factor in tests ranged from 3.2 to 5.9, and the true deflection under design load was less than the calculated one in all test beams I1I.

2. BRIDGE DECK

A pilot project in conjunction with the Zambian Roads Department was implemented in Kasempa, whereby a timber pole-concrete bridge deck was designed and constructed over Nkenyauna river in September -October 1986. Design span and load for the bridge were 6.0 m and 90 kN wheel (increased by 25% for impact) respectively, poles used were out of locally plantation grown, exotic Eucalyptus grandis, (pressure) treated with CCA-salt, and concrete mixture was 1:2:3 (cement:sand:stones). Round wire nails, nailed half way into timber, projecting head sides of nails being finally embedded in the concrete, were used as shear developers. Midspan diameter for the poles was 225 mm, with 150 mm concrete deck on top, bringing the total deck depth to 375 mm (span/16). Light reinforcement of deformed steel bars was used in the concrete to achieve transverse continuity, and to control compression stress and shrinkage cracks.

3. CONCLUSIONS

The material cost of timber pole-concrete bridge deck was calculated to be about 10% less than for steel reinforced concrete deck, but about 30% less when overlong poles are used (to achieve the required midspan diameter), and the salvage value of the removed top end was taken into account. However, the main advantage of this technique appears at the national economic level in Zambia, since the foreign exchange component (of the material cost) of timber pole-concrete composite bridge deck was only about 1/10th of the forex-component in the equivalent steel reinforced one I1I.

It is anticipated that harder and stronger species of timber, that cannot be economically sawn into planks due to excessive wear and tear of sawblades, can be utilized in this type of construction.

Aspects that need attention when considering the use of the technique are stem form of timber species (only relatively straight poles can be used), sugar content of timber (hampers setting of concrete) and protection against decay (weather, fungi, insects).

REFERENCES

1. LAAKKONEN M.O., Timber pole-concrete composite structure - an option for multi-storey low-cost houses. Proceedings of the seminar: Housing for the greatest number (UNESCO, C.E.B.T.P.), Kinshasa, Zaire, 30.11. - 3.12.1987.