

Zeitschrift: IABSE congress report = Rapport du congrès AIPC = IVBH
Kongressbericht

Band: 13 (1988)

Artikel: Timber pole-concrete composite bridge deck, Nkenyauna river, Zambia

Autor: Laakkonen, Mauri

DOI: <https://doi.org/10.5169/seals-13129>

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

Download PDF: 17.01.2026

ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>

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

Mauri LAAKKONEN

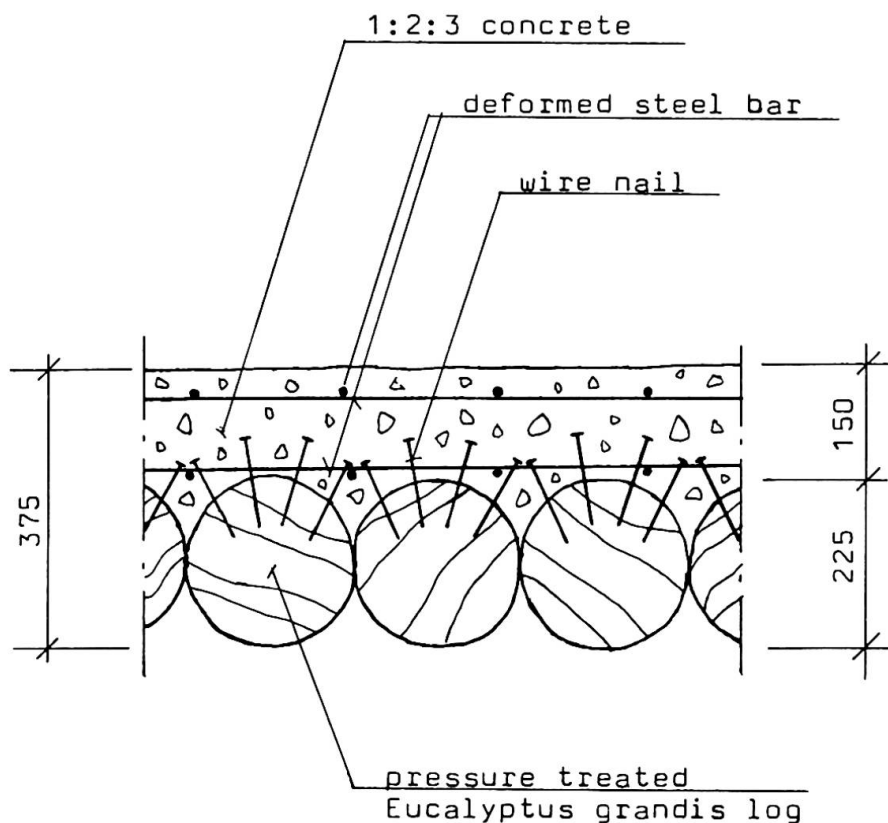
City Engineer

City of Hanko

Hanko, Finland

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.