MATERIAL SELECTION: WHAT HAVE WE LEARNED FROM BRIDGES?

In the buildings’ construction space, a lot of recent focus has been directed to the new kid on the block – cross laminated timber (CLT). But there’s a story to be learned from the civil construction experience.

Queensland's first State Infrastructure Plan might seem like an out-with-the-old and in-with-the-new project as $300 million is being invested in critical road and rail upgrades. But it’s more than that - it’s a plan that includes the replacement of some of the state’s old, maintenance-intensive timber bridges with more sustainable solutions - durable concrete bridges.

As a proven long-lasting and low maintenance structurally-suitable material for both civil and building construction applications, one wonders why concrete wasn’t used to build the bridges in the first instance. Did the original design teams understand the inherent faults with timber?

WHY NOT CONCRETE?

If design teams had the option in earlier times, they would have surely chosen concrete with its proven performance over hundreds, and even thousands, of years. Take the Colosseum as an example. Or the Pantheon. Or any of the ancient Roman theatres.

At New York’s University of Rochester, Renato Perucchio explains that while Roman concrete is approximately ten times weaker than modern concrete, the mere fact that the buildings in Rome are still standing, is a testament to its “phenomenal resistance over time”.

Therefore, we can only assume that the teams involved with those earlier projects chose the best materials they could at the time of construction, and while they weren’t building iconic buildings, they must have known that these bridges would likely have a short life span and need replacing.

CONCRETE BEATS TIMBER HANDS DOWN

In Queensland, it’s an interesting exercise to research and understand the reason why we timber bridges are being replaced with concrete ones. What benefits are these new projects giving to the community and why are we not replacing timber with timber?

A quick snapshot of some brief research follows:

**Queensland Rail:** “As part of this project, ageing timber bridges will be replaced with steel and concrete structures to improve reliability, operational safety and efficiency of services on the rail corridor.”

**Department of Transport and Main Roads, Queensland:** “Four existing timber bridges at Fiery Creek, Lonely Creek, Boundary Creek and Cut Creek will be replaced with new concrete structures as part of the Peak Downs Highway timber bridges replacement project. The new bridges will improve the safety, capacity and reliability of the Peak Downs Highway particularly for the heavy vehicle and freight industries. Replacing the old timber bridges is the most cost effective long term solution considering ongoing maintenance costs for the timber bridges and the benefits provided by the new concrete structures.”

**Queensland Government, Dept. of State Development:** “Due to the current load limit on the bridges, school buses now travel a further distance to their destination.”

**Australian Federal Government:** “By upgrading these bridges from, for example, by replacing one-lane timber bridges with two-lane concrete bridges, residents will enjoy better and more reliable road access. Freight from farms and local factories will be able to pass safely along quicker routes with greatly improved productivity.”  
“We’ll see significant reductions in road closures due to flooding when this project is complete. This means improved year-round freight access to inland communities and the Townsville Port, as well as safer and better driving conditions for locals.”

**VEC Civil Engineering:** “…allowed a crew of just 7 workers using 2 excavators to remove the old timber rail bridge and replace it with the new bridge or culvert in just 48 hours.”

There are some key themes to take away from the above statements.

Firstly, future generations of Australians, as well as visitors, will be able to use the infrastructure for a significantly longer period of time. The low maintenance, 100-year plus lifespans of the new bridges give precast concrete a big tick for sustainability.

Secondly, the local communities will enjoy a more reliable infrastructure system, with less delays leading to increased productivity (another tick for sustainability) and in some cases, during the wet season, an evacuation route during a flood.

It is safe to assume that anyone would agree that the use of concrete over timber can be justified as a step in the right direction. Reminiscent perhaps of the story of ‘*The three little pigs*’… isn’t the moral of that story to use the strongest material possible to build houses?

IT’S MORE THAN HUFF AND PUFF

Of course, today’s standards demand more than for a structure to simply not blow over. As well as ensuring that both workers and users of a structure are safe, the planning, designing, constructing and commissioning of structures must ensure that:

* in the case of a fire, we won’t be exposed to any harmful chemicals and that the fire rating of the build is as high as possible;
* as payers of rates, strata fees and taxes, we don’t want our authorities purchasing high maintenance structures - structures that not only cost an exponential amount as they get older, but those that are decommissioned after a short period of time, or eaten by termites on the off chance a maintenance inspection wasn’t carried out correctly;
* structures will withstand our unpredictable environment. We want our structures to withstand floods, as recently seen in Brisbane. Would a timber building have survived?
* our buildings are as thermally and therefore energy efficient, as possible;
* they perform well acoustically; and that
* their manufacture and construction supports local economies.

Surely, the Queensland bridge experience can teach us something. Will we learn from it when making material selections in the future?