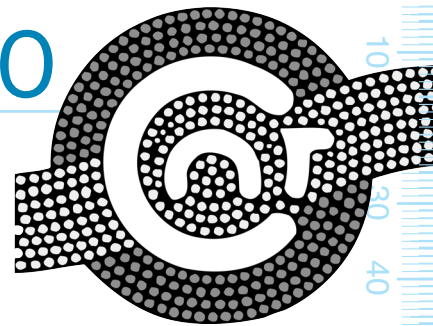


Creek crossings



Background

Remote Australia is proliferated with roads and tracks that cross through creeks and rivers. The majority of the crossings are dry for most of the year, however there are many crossings that cause access problems or delays to travellers and transport for the period that they are wet or flowing.

There are several remote communities throughout the Kimberley Region that become isolated during the wet season. To gather information, CAT have made field visits to some of these communities such as Ngallagunda, Pantijan, Cone Bay, Windjigayre, Imintji, Tirralintji, Yulmbu, Koorabye, Kadjina, Yakanarra, Bidijul, Jarlamadanagah, Kalumburu, MacGowan's Island Beach and Pago.

We talked to people at these communities and looked at their creek crossings along their access roads. We also spoke to people at the Shire of Derby/West Kimberley, Main Roads WA, ATSIK, West Kimberley Fuel Suppliers and the Fire & Emergency Services of Australia (FESA).

What we found

The isolation of communities during the wet season impacts on the cost and supply of medical services, food, energy and people transport, and often means that whole communities of people need to evacuate their communities in advance of the wet season.

- The larger rivers in the Kimberley region, particularly the Fitzroy River, can be non-negotiable for more than six months of the year.
- The Gibb River Road (900 km), which services many communities/outstations, often is officially closed from December until April-May.

Often during the wet season, FESA staff are called in for emergency drops of food and fuel into isolated communities via small helicopter which is load limited and expensive.

We asked questions about what sort of problems there are at creek/river crossings that cause the interruption to travel flow.

Problems revealed

Vehicles can be held up at creek and river crossings for these reasons:

- Loss of wheel traction if the creek bed and/or the entry/exit banks are muddy/boggy
- The depth of water at the crossing is too deep for safe passing. There would be a risk of the vehicle 'inhaling' water into the intake system, or the fan striking the water and damaging the fan and radiator



- The velocity of the water, even if reasonably shallow, can be too fast for safe passing. There is the risk of a vehicle being picked up and washed downstream.

At some creek and small river crossings the water rises and falls quickly, but at others it can take many hours, days or weeks.

During the visits to the many communities, and the local roads departments and experts, we sought local knowledge about the depth of the crossings, and the flow period and velocity of the water. We discussed the types of creek crossings found in the Kimberley, the method of construction, and their advantages and disadvantages.

Types of creek and river crossings

Bridges – are often the best long-term solution for river and creek crossings but are expensive. Often bridges cannot be justified economically.

Culverts (concrete box type) – raise the surface of the vehicle crossing above the water level (mostly), and are cheaper than bridges. The disadvantages are that they are heavy and therefore expensive to transport, and require lifting equipment to load and unload and install. They are difficult to design and construct for one-off big floods. There is evidence of smashed culverts downstream of many crossings.

Culverts (pipes) – as above, and have the advantage of being light weight. The disadvantage is that they do not have the load bearing capacity of concrete box culverts.

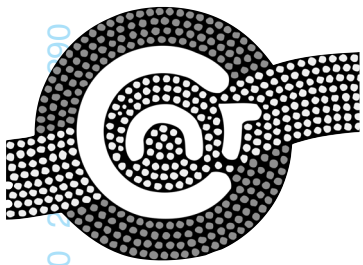
Causeway, raised – (concrete or cement stabilized soil) Causeways can be used in creek crossings or floodways where the water flow is slow but deep, or rises and falls rapidly. A causeway can be raised up to around metre above the floodway or creek bed surface level. This gives vehicles a height advantage when crossing what may otherwise be too deep.

A raised causeway needs to be concrete or cement stabilized soil. Otherwise, it will be rapidly eroded. Because a raised causeway impedes the flow of water over the road, it is necessary to lay gabions (graded rocks in mesh mattresses) or rock beds along the edge of the road pavement across the causeway. This helps to reduce the erosion of the causeway caused by water turbulence. The advantage of this type of causeway is its relatively low cost and simplicity of construction.

Causeway, natural surface level – These crossings need to be of material that does not become soft and boggy when wet, such as cement stabilised soil, or compacted gravel. The water should flow over a causeway without any impediment to flow. These crossings are relatively low cost and simple to construct.

Solutions for creek crossings

Only limited funds are available for roads and creek/river crossings in North West Western Australia, so we need to use these funds wisely and effectively. From our visits, inspections and discussions, CAT has decided to try natural surface level, and raised causeways constructed of gravel and cement stabilized soil over the creeks and floodways. These have been tried on creeks along the new access roads to Yakanarra, Bidijul, Koorabye, and Kadjina, as well as Jarlamadangah and Ngallagunda.



BUSH TECH BRIEF #10

Creek crossings (continued)

How to construct a causeway

CAT staff carefully inspect the creek or river crossing and talk to the local people and authorities about the history of the crossing.

If the water rises and falls quickly, or if the crossing is shallow, we write the scope of works as follows.

- The crossing should be excavated below the natural surface level with a machine to a depth of around one metre, and to a width of one metre wider each side of the road pavement width, and to a length spanning the approach bank, bed and exit bank.
- The excavated section should be back filled with large diameter rock (approximately 400mm diameter), and the rock fill size then gradually reduced back to a smaller diameter; small enough to allow relatively smooth traversing of small vehicles (say 100mm diameter). The rock should be compacted into place. (see figure 1)
- The final finish surface of approximately 150mm depth shall be gravel from the nearest gravel pit, say 25mm diameter.
- The final surface level should be at the same level as the natural surface level of the creek or floodway bed.
- A stockpile of approximately 20 cubic meters of this gravel should be left at a convenient but inconspicuous place near the creek crossing, so that a community or other local loader can use it to backfill any erosion that occurs during the wet period.

If the crossing is deep, but water flow is reasonable slow, we write the scope of works as follows.

- As per the above, the crossing should be excavated with a machine to a depth of around one metre, and to a width of one metre wider each side of the road pavement width, and to a length spanning the approach bank, bed and exit bank.
- The excavated section should be back-filled with large diameter rock (approximately 400mm diameter), and the rock fill size then gradually reduced back to a smaller diameter, small enough to allow relatively smooth traversing of small vehicles

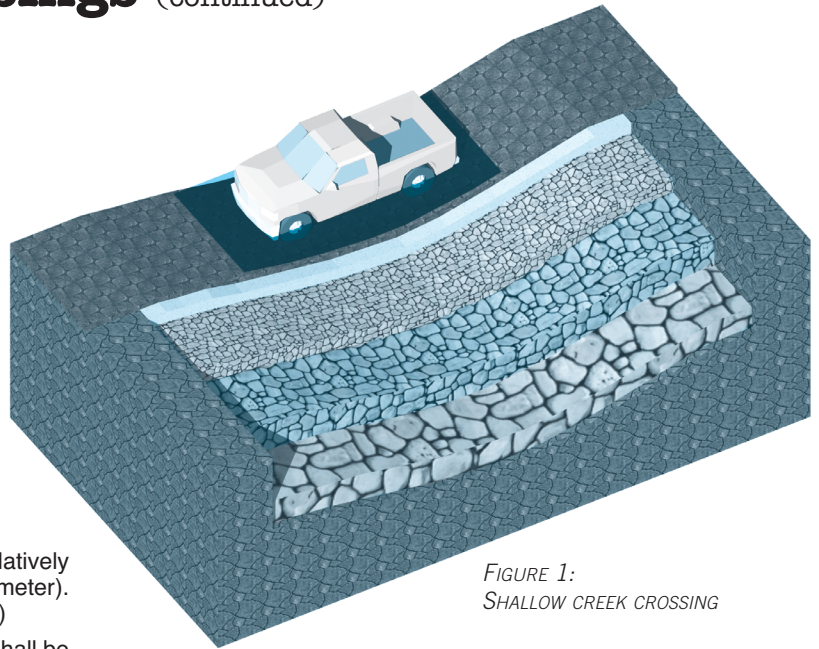


FIGURE 1:
SHALLOW CREEK CROSSING

(say 100mm diameter). The rock should be compacted into place.

- The cement stabilized causeway is to be constructed using a ratio of between 2% to 5% cement, mixed by a grader with water and the natural soil/sand at the crossing. The area/volume to be cement stabilized is that which will be saturated by water from the creek, as well as the approach and exit banks as vehicles drive through carrying or splashing water as they go. The height of the causeway above the creek bed level can be up to a meter.
- Lay gabions (graded rocks in mesh mattresses) or rock beds along the edge of the road pavement across the causeway, from bank to bank. These should be approximately two to three meters wide each side. (see figure 2)

Conclusion

Although it is difficult to design any creek or river crossing to cope with large 'one off' floods, with careful observation and local advice, crossings can be constructed to reduce the problems of lack of traction, and water too deep and too fast for vehicles to traverse.

By using the relatively low cost procedures described above for the construction of surface level crossings, and cement stabilized crossings, there is not a huge loss if a large 'one off' flood does wash the crossing away.

Some of CAT's creek crossings already have withstood a wet season with minimal damage, and members of the Yakanarra and Bidjil Communities have commented that they have had better access to their community during the wet season than in the past.

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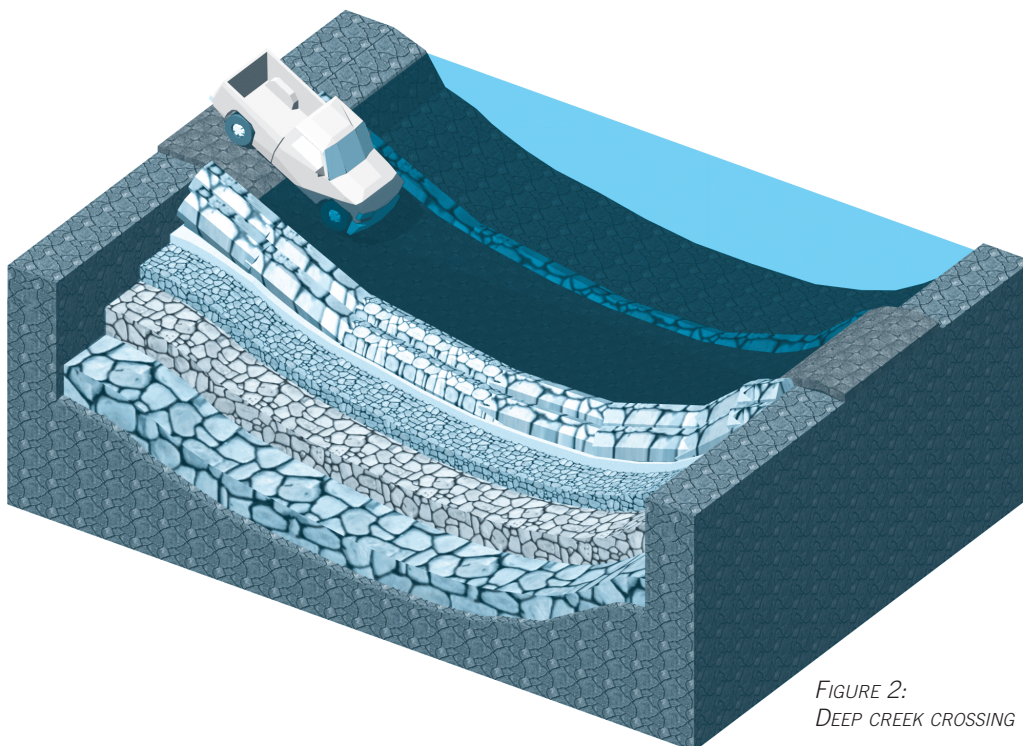


FIGURE 2:
DEEP CREEK CROSSING