



On the road to resilience in Ethiopia

It's time to rethink roads. In the vital fields of flood prevention and water supply, they offer incredible potential to enhance and enrich the lives of some of the world's poorest people. Dr Frank van Steenberg is helping to drive this remarkable revolution.

Heading north from Addis Ababa, Ethiopia's capital, you need to travel over 400 miles along Highway 1 to reach Tigray province. Home to some wondrous natural beauty and an intense, often troubled history, poverty is a constant factor here. Over 80 per cent of the population are farmers, cultivating crops and rearing livestock in some of the toughest, most thankless conditions anywhere on Earth, with water a precious resource and climate change set to present severe challenges in the years and decades ahead. Like much of Sub-Saharan Africa, roads are a lifeline in Tigray – arteries of hope and potential prosperity that provide better access to jobs, markets and healthcare and education services. Indeed, across Sub-Saharan Africa as a whole, the building of roads represents one of the biggest public investments and a staggering 5.5 million km have been constructed to date. The paradox is, for

all the many benefits they bring, collateral damage caused by the process can do serious harm to local communities.

“Roads are massive interventions in the local water environment,” says Frank. “They can interfere with the movement and flow of water, aggravating the effects of droughts, while uncontrolled run-off from roads during heavy rain can cause dangerous flash floods that exacerbate soil erosion and sedimentation. It's estimated that there are up to 25 such trouble spots for every 10km stretch of road in Tigray.”

But what if roads were part of the solution rather than the problem? That's the goal of the consortium's programme.

“In Tigray and the neighbouring province of Amhara, we've already proved that, at very low or even no net cost, roads can be designed to help control and harvest water,” says Frank. “Rather than reducing resilience, they can reinforce it and help communities cope with erratic and seasonal rainfall.”

Thinking simple

Working closely with regional government, universities and other organisations as well as local communities themselves, the initiative has focused on delivering flexible ways of turning roads into

water management devices. Overwhelmingly, this has centred on low-tech but highly effective measures to control water and contain it or carry it away – for example, digging ditches, building culverts (tunnels under roads) or using, as reservoirs, so-called ‘borrow’ pits dug nearby to provide rock, earth and stone needed during road construction. Through such methods, water can be channelled to irrigate crops, stored for later use, or allowed to soak into the soil to boost crucial groundwater reserves. Around 1.1m Ethiopians have already benefited, with a 20 per cent rise in income levels recorded in roadside communities.

“Faced with complex challenges such as flood protection and water provision, it can be tempting to look for complicated solutions,” Frank says. “But sometimes the answer is to think simple and harness or adapt something that’s already right in front of your eyes. We estimate that, for every 10km of road in Tigray, typically 4 million m³ of water is harvestable in a year. Initially, road experts were sceptical about our ability to tame and tap into this life-changing resource. Now, seeing the results, they’re our biggest fans!”

The economics are compelling too. Integrating such water management measures adds less than five per cent to standard road-construction costs and is substantially cheaper than building roads to withstand climate-related impacts. This low-cost, big-impact approach – suitable for retrofit as well as for incorporation into new roads – also saves money by making roads less vulnerable to flood- and weather-related damage and disruption. Water causes around 35 per cent of all damage to paved roads in Ethiopia and, with maintenance a perennial drain on budgets, any savings in this respect are extremely welcome.

“Our philosophy is to work with the grain of nature, rather than try and resist it. Integrated thinking on road building and water management really works: for instance, it helped Ethiopia withstand the 2015 drought – one of the worst ever experienced – and the effects of that year’s El Niño.”

Horizons widen

2015 also saw MetaMeta and Mekelle University win a Global Road Achievement Award from the International Road Federation for their work in Tigray. Indeed, success has provided the platform to take the road revolution further afield. As well as targeting the whole of Ethiopia, through guidelines distilling the knowhow and experience developed in the north of the country, roll-out has now also reached Kenya and Uganda.

But the impact isn’t confined to Africa. Bangladesh is beginning to benefit too. With its frequently flooding rivers and vulnerability to rising sea



levels, this is a country that presents very different challenges. Nearly 20 per cent of Bangladesh floods every year, so flood management – especially in rural areas – is at an absolute premium.

The country has thousands of miles of raised embankments, designed to act as barriers to water and (because they often represent the highest points in a locality) used as places of refuge during and after flood events. With roads running along 60 per cent of these earthworks, the consortium is focusing on how such roads can be engineered to strengthen the embankments they form part of, helping to guard against landslips, for example, and maximising the control, protection and sanctuary the embankments afford.

“Water harvesting in dry areas, flood management in wet areas – roads are a versatile tool for blocking water, concentrating it or helping it flow,” Frank concludes. “Our strategic plan is for at least 50 per cent of roads in half of the countries in Africa and a quarter of the countries in Asia to be water-buffered by 2025. We’re hard at work creating the momentum to achieve it – and then to head even further along that road in future.”

Leading water from a road culvert to recharge trenches in Ethiopia.

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The Roads for Water initiative started with a grant from the NERC programme Unlocking the Potential for Groundwater for the Poor (UPGro) supported by NERC, ESRC and DfID and is led by Frank at the Netherlands-based social enterprise MetaMeta together with Tigray’s Mekelle University. The project is now supported by the Global Resilience Partnership.

To see the project progress, follow @grp_resilience and @roadsforwater on Twitter. Contact Frank at fransteenbergen@metameta.nl.