Road Ecology: Wildlife Habitat and Highway Design

LAURA TEPPER SEPTEMBER 2011

The Loing Viaduct, France. [Photo courtesy of Vinci]

High-speed rail may get the flashy headlines, but most U.S. transportation dollars go to building, widening and maintaining roads. President Obama's 2012 budget proposal called for substantially increased spending on rail and public transit, but nonetheless allocates 55 percent of transportation funds to the Federal Highway Administration.[1] The United States adds 32,000 lane miles annually to the 4 million miles of public roads already crisscrossing the country.[2] For more than a century, we have allowed expressways, arterials and rural roads to define our landscapes without seriously considering how we might redefine the road. Engineers have rarely attempted to incorporate ecological functions, let alone artistry, into a design practice historically dominated by concerns for speed and efficiency.

In the last decade, the emerging field of road ecology has galvanized scholars and practitioners eager to address this problem. Road ecologists investigate the complex interactions between roads and the natural environment: how roads act as barriers inhibiting the movement of plants, animals, water and soils; how traffic run-off contaminates surface and underground water; and how particulate emissions and noise pollution affect habitats. They also help develop and test solutions to these pervasive problems.

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The practice of road ecology began in Europe in the 1970s and later spread to the U.S. by way of the annual International Conference on Ecology and Transportation. In 2003, the seminal text *Road Ecology*, written by Richard T.T. Forman and Daniel Sperling along with twelve co-authors, helped to formalize the movement. As Forman explains, the book "pulled the diverse scientific and planning threads of the field together and added distinctive synergisms, resulting in a distinct field which researchers and planners can and do hang their hat on, and push important frontiers." Major research centers now include the Road Ecology Center at UC Davis, the Center for Transportation and the Environment at North Carolina State University, and the Western Transportation Institute's Road Ecology Program at Montana State University. The WTI organized last year's ARC International Wildlife Crossing Infrastructure Design Competition, which brought new momentum and attention to the practice, particularly from architects and landscape architects. In the long term, Forman and many colleagues advocate reducing automobile dependence and removing roads. In the near term, the focus is on innovative design and renovation. As long as we remain politically and financially committed to the highway system, road ecologists say, we must consider not only if, but how we design roads.

Several European countries — notably France, the Netherlands, Switzerland and Germany — mandate an intensive highway design process that integrates environmental factors in the earliest phases of project design and makes extensive use of wildlife crossings and other ecological mitigation infrastructure. The scope of this investment manifests in large-scale systems like the 108 water treatment basins lining France's new "eco-motorway" and the nine ecoducts (Europe's equivalent to wildlife overpasses) currently under construction in the Netherlands as part of a national landscape connectivity initiative working towards the creation of a National Ecological Network.

Wildlife crossing, Banff, Canada. [Photos by Laura Tepper, except as noted]

In North America, such large-scale projects are less common; yet the most iconic works of ecological road infrastructure in the world are the six massive wildlife overpasses lining the Trans-Canada Highway in Banff National Park. The overpasses are part of a larger system of ecological infrastructure that Parks Canada began developing in the early 1980s to address concerns about increased traffic and collisions between vehicles and large mammals. The expansion of the crossing system coincides with the phased "twinning" or widening of the Trans-Canada Highway. Ongoing, year-round monitoring by the Banff Wildlife Crossings Project has proven the crossings' effectiveness at

reducing wildlife mortality, and it is also informing the implementation for future phases of the highway expansion. [3]

Unfortunately, the monumental overpasses come with an outsized price tag. Parks Canada constructed the first two overpasses at Banff in 1997 for roughly $2.5 million USD each, but the cost for the four additional overpasses last year shot up to between $4.5 and $5 million USD each. The high cost has hindered widespread use. Nonetheless, cost-benefit analyses increasingly include potential financial savings from the $8 billion in property damage that, according to the Federal Highway Administration, results annually from animal-vehicle collisions in the U.S. [4]

Banff wildlife ecologist Tony Clevenger sees the high cost of wildlife crossings as a design problem and initiated the ARC Competition as a response. His colleagues at the Western Transportation Institute, together with the Woodcock Foundation, invited interdisciplinary teams to design wildlife overpasses for West Vail Pass, which is along a stretch of I-70 passing through the Rockies 100 miles west of Denver, and to compete for a $40,000 honorarium. The crossings would serve populations of black bear, bighorn sheep, lynx, bobcat, elk, coyote and deer inhabiting the national forests divided by the freeway. Five finalist teams — chosen from a pool of 36 — developed solutions that were not only materially and functionally innovative, but also cost-effective. Finalists included teams led by Balmori Associates, the Olin Studio, Janet Rosenberg & Associates, Zwarts & Jansma Architects; the winner was the team of HNTB and Michael Van Valkenburgh Associates.

The ARC competition generated a store of viable design ideas that add to the substantial body of research the U.S. has already contributed to road ecology; yet Clevenger noted that presently the nation is behind the curve in translating its research into infrastructure, particularly relative to European countries. This photo essay looks at two of the proposals from ARC as well as existing ecological road infrastructure in the U.S. and Europe. The projects, both built and proposed, underscore the promise of road ecology to enhance habitat connectivity and reduce wildlife mortality, and also to ameliorate the broader conflicts between human infrastructure and natural ecosystems.

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Parks Canada initiated the Banff Crossings Project in the mid-1980s to mitigate the effects of a phased Trans-Canada Highway expansion. The *twinning* of the highway through the National Park has resulted in four lanes divided by a wide green median. The green space preserves a park-like appearance, but the design triples the width of the right-of-way, creating a significant wildlife barrier.

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Notes

1. U.S. Department of Transportation, Fiscal Year 2012 Budget Highlights. ↩
2. American Road & Transportation Builders Association, FAQs, accessed June 8, 2011. ↩
3. Wildlife ecologist Tony Clevenger's 14-year study of the project showed that large carnivore mortality rates dropped by more than 80 percent on the 28-mile pilot stretch of the TCH after the crossings were installed. See Clevenger,

A.P., Chruszcz, B., Gunson, K., Wierzchowski, J., 2002, *Conservation Biology* 16:503-514. ↩

4. Federal Highway Administration, Wildlife-Vehicle Collision Reduction Study: Report To Congress, Publication No. FHWA-HRT-08-034, August 2008. ↩

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Laura Tepper explored highway landscapes on a traveling fellowship from UC Berkeley. She practices landscape design in San Francisco.

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