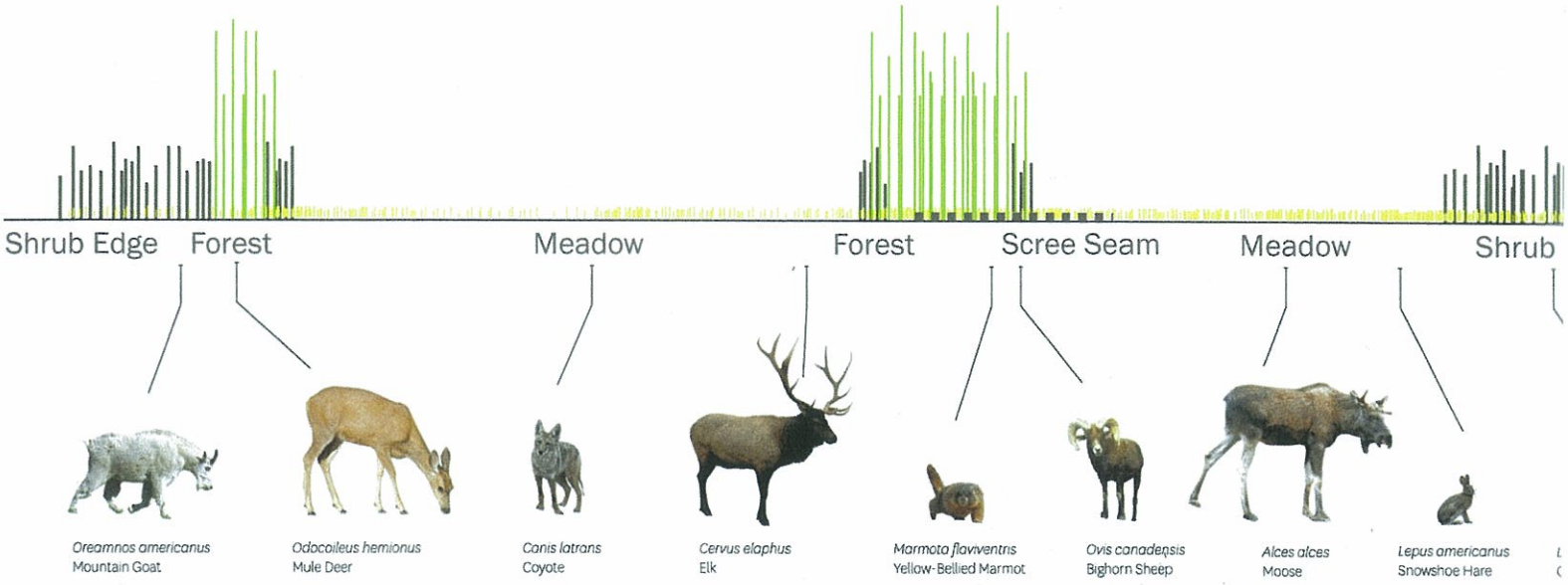
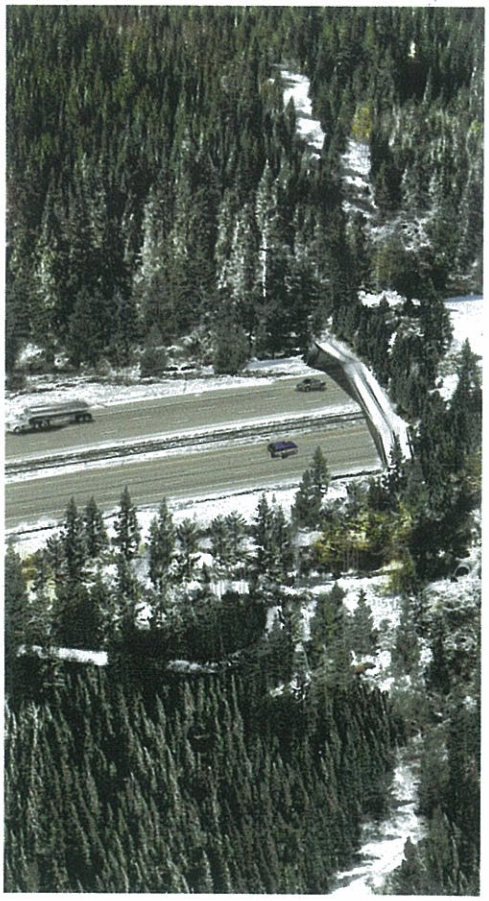
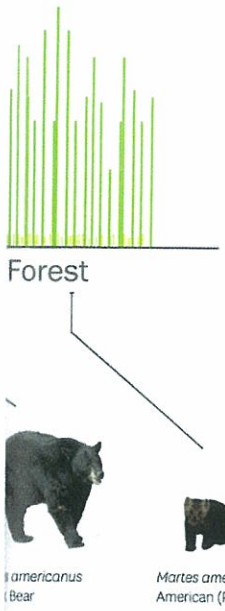


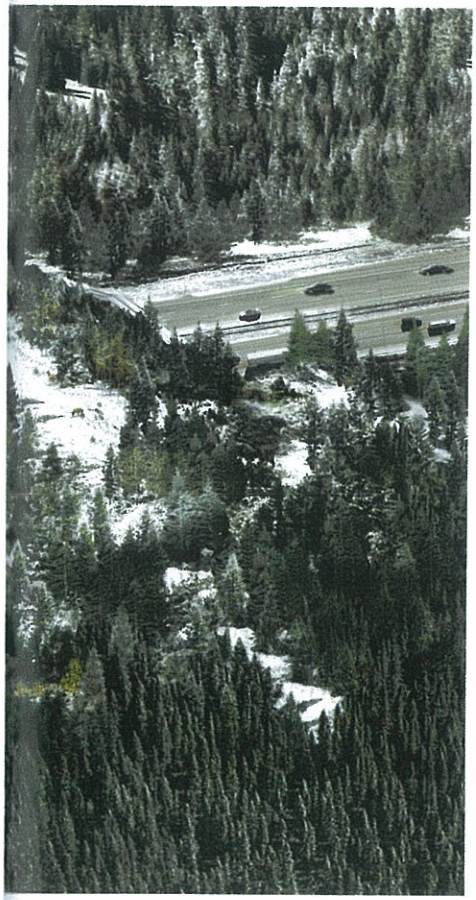


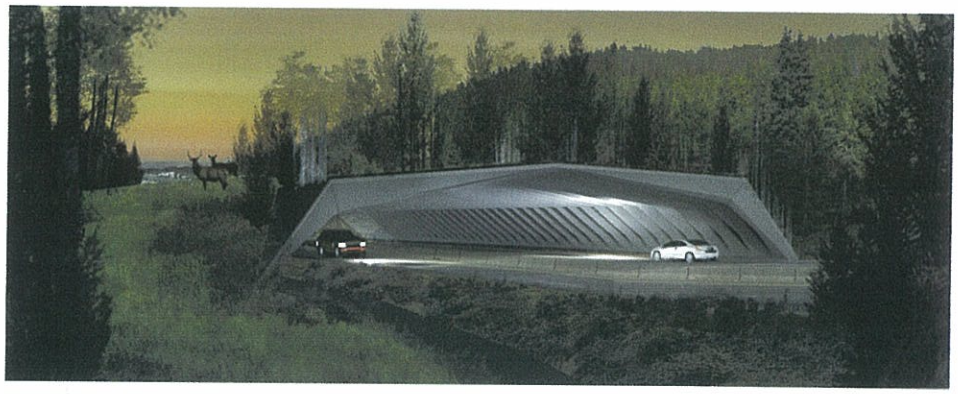
Hypar-Nature, the winning entry by HNTB and MVVA, is based on pre-cast concrete hypar forms. The design is informed by driver experience and animal preferences.



Nina-Marie E. Lister

NEW WILDLIFE CROSSING STRUCTURES





In 2010 an international competition challenged design teams to conceptualise the next generation of wildlife crossing infrastructure for North America's roadways. The project is sited at the Vail Pass on the I-70 highway in Vail, Colorado.

After more than half a century of continuous road building in North America, two phenomena have been recognized. First, growing numbers of wildlife-vehicle collisions are leading to higher levels of personal injury and property damage and to increasing insurance premiums. While human mortality numbers are not large, wildlife-vehicle collisions have increased by 50 percent in the past fifteen years. A U.S. Federal Highway Administration study reports that there are an estimated one to two million collisions between cars and large mammals every year in the US, representing a significant danger to human safety and wildlife populations. Wildlife-vehicle collisions are also increasing as a proportion of the total accidents

on the continent's roads, costing Americans more than eight billion U.S. dollars annually. In addition to obvious concerns for motorist safety, there are serious implications for wildlife in terms of both population viability and habitat connectivity. Road mortality is documented as one of the major threats to the survival of 21 federally listed threatened or endangered species in North America.

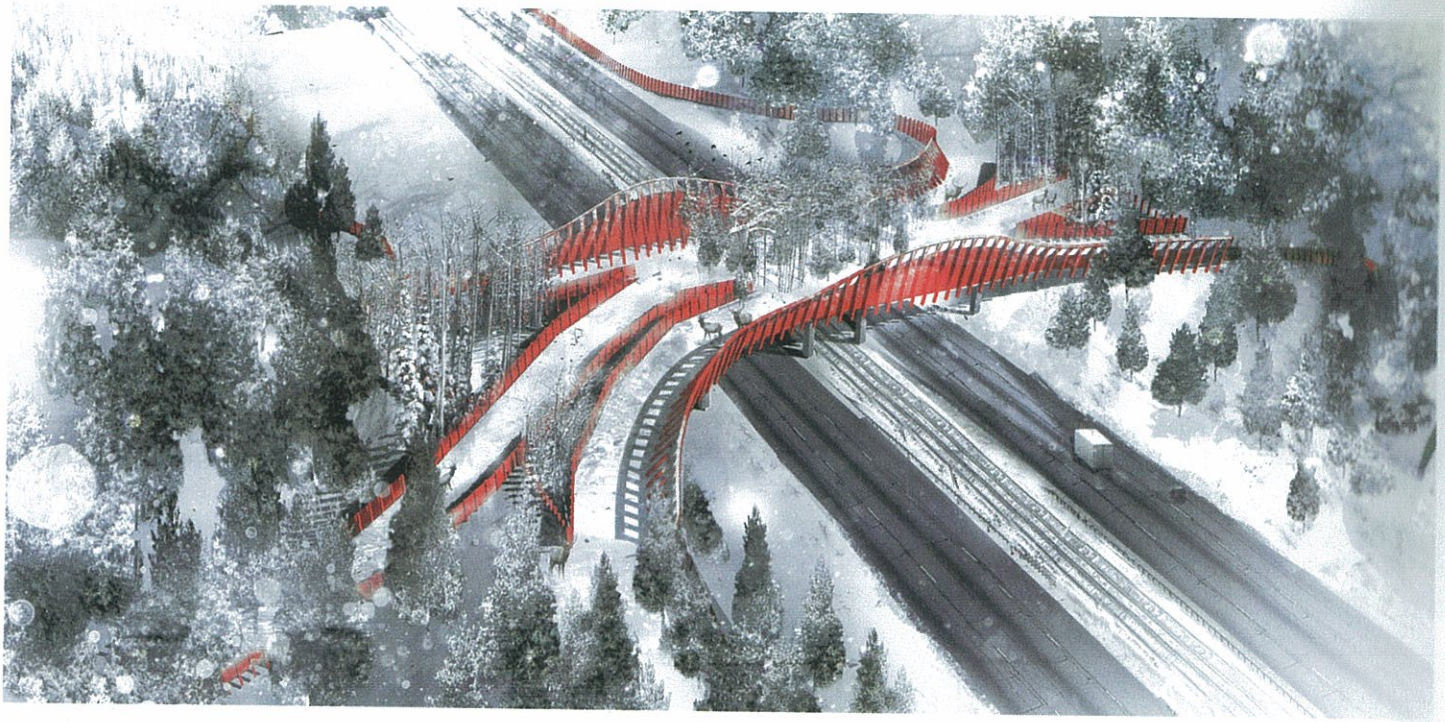
Second, at a much larger scale, the last several decades of road building have resulted in significant habitat losses through the linked processes of habitat fragmentation and (by consequence) habitat restriction as species are limited to increasingly isolated patches in which they can live and move. Subsequent loss of gene pool diversity is a related factor that further exacerbates the problem of habitat fragmentation. More recently, climate disruption portends a new need for wildlife to migrate unimpeded across landscapes in search of new habitats as resources become scarce in their current home ranges and ecosystems.

An emerging priority for both transportation and natural resource agencies is to make highways safer for both drivers and wildlife. One of the proven solutions known to improve safety, reconnect habitats and restore wildlife movement is the provision of wildlife crossing infrastructure at key points along transportation corridors. Throughout Europe, Asia, Australia and in various North American locations, wildlife crossing structures have been deployed with demonstrated success. These structures include both underpasses and overpasses, both of which have been constructed in a variety of sizes and designs. Although wildlife underpasses are less costly structures to build and more commonly used by a diversity of species, wildlife overpasses are preferred by certain wide roaming species-at-risk such as grizzly bears. Overpass structures are also more widely recognised as they are visible and noteworthy to passing motorists. As such, wildlife overpasses present a timely opportunity for the general public to experience – and identify with – engineered landscape designs that create safer roads while protecting wildlife populations and restoring ecosystem function through improved landscape connectivity. Furthermore, lighter, flexible and adaptive infrastructures may offer effective means to facilitate wildlife mobility and population survival under uncertain climate conditions.

The ARC International Wildlife Crossing Infrastructure Design Competition (www.arc-competition.com) was held in 2010 with the goal to engage the most innovative international, interdisciplinary design teams to create the next generation of wildlife crossing infrastructure for North America's roadways. The ARC project derives its mandate from the understanding that today's transportation challenges are exacerbated by three critical factors: 1) an increasing population and expanding suburban and exurban development; 2) an aging, deficient, and outmoded infrastructure and 3) a changing climate. Experts acknowledge that these issues must be addressed comprehensively such that transportation systems are (re)designed to safely meet the needs of contemporary society in a manner that maintains ecosystem integrity and connectivity, reduces the carbon footprint, minimizes consumption of non-renewable materials, recycles resources, extends the life cycle of transportation infrastructure and operates efficiently. As such, the finalist teams were challenged to develop solutions that would be cost efficient, ecologically responsive, safe, flexible and that could be readily adapted for widespread use in other locations as well as offering flexibility for wildlife mobility under dynamic ecosystem conditions, including climate change.

The ARC competitors also faced the unique challenge of designing for two very different clients – humans and wildlife – each with different needs and priorities, yet sharing one problem: the need for safe passage. The design solutions that resulted from the competition are progressive steps in addressing these complex design challenges in the context of road infrastructure for human and wildlife safety and mobility. With these results, the competition capitalizes on a timely window of opportunity to offer new methods, new materials and new thinking for transportation infrastructure that protects humans and wildlife and at the same time, reconnects landscapes and their ecosystems.

In 2009, 25 eligible sites in 16 U.S. states and Canadian provinces were submitted for review by ARC technical advisors. A combination of criteria was used to rank the 25 proposed competition sites. These included ecological importance of the adjacent habitats; number and frequency of wildlife-vehicle collisions; traffic volume; public recognition/visibility of the location; charismatic



RED / Research Evolve Design: The finalist concept design by Janet Rosenberg and Associates' team suggested a multi-stranded bridge structure in wood core fiberglass.

MCS / Modular Crossing System: The finalist concept design by Balmori and Associates' team proposed a freeform structure of reclaimed, laminated timber girders.

nature of the site and its wildlife; priority of the site for the local Department of Transportation (DOT); willingness of the DOT to work with ARC; land tenure arrangements; current and long-range plans for the area and existing plans for a wildlife structure under new infrastructure funding. Using these criteria, the site at West Vail Pass on I-70, managed by the Colorado Department of Transportation (CDOT), was selected as the competition site. The West Vail Pass site is located between the rapidly urbanizing metropolitan area of Denver and the resort communities of Aspen, Vail and Breckenridge, Colorado, at approximately 10,000 feet or 3,000 meters above sea level and 90 miles or 145 kilometers west of Denver along the Interstate Highway 70 (I-70) Mountain Corridor just west of Vail Pass.

The I-70 Mountain Corridor has been extensively studied over the past decade. Located at the core of the 144 mile (232 kilometer) Mountain Corridor that stretches across the central Rocky Mountains of Colorado along I-70 from Glenwood Springs to Denver, the area is considered to be of statewide and national importance. I-70 is the only east-west interstate crossing Colorado and is the only continuous east-west highway in the study area; it serves as the main transportation artery in Colorado. I-70 is also the primary route for access to many of Colorado's recreation and tourism destinations. The portion of I-70 that runs from Glenwood Springs to Denver is particularly congested. For wildlife populations seeking breeding and feeding grounds, the site at West Vail Pass is widely recognized as a critical habitat linkage within the

White River National Forest and several important wilderness areas bisected by the interstate. This region is home to a variety of iconic species such as black bear, cougar, Canada lynx, coyote, elk and American marten. As such, the West Vail Pass site served as an ideal setting for design teams to explore innovative means to safely reconnect a landscape with the wildlife that depend on and define this place.

In this two-phase design competition, five finalist teams were challenged to deliver an innovative concept design for the overpass structure that uses new materials, methods and thinking. Specifically, this required that the design must be: cost effective in terms of materials, construction, and maintenance; ecologically responsive to current and future anticipated conditions; safe for humans and wildlife alike; flexible or modular for possible use in other locations; adaptive to facilitate mobility of wildlife under dynamic ecosystem conditions; sustainable in terms of materials and energy use; responsive to climate change; compatible with plans for the I-70 Mountain Corridor and educational, revelatory and communicative to the public.

Following an open call for Expressions of Interest, five finalist teams were selected to progress to the competition phase. The finalist teams were chosen from 36 qualifying team submissions from 9 countries, representing over 100 firms worldwide. In January 2011, as part of the Transportation Research Board's Annual Conference in Washington DC, it was announced that the scheme by HNTB with Michael Van Valkenburgh Associates, Inc. was unanimously selected.

Wild (X)ing: The finalist concept design by the Olin Studio team relies on a double-curved inverted arc structure overlaid with a lattice of pre-vegetated modules.

HYPAR-NATURE (page 82/83): The project by HNTB with Michael Van Valkenburgh Associates, Inc. (New York) and Applied Ecological Services, Inc. won first prize.
The structure relies on a modular and cost-effective system of thin-shell, pre-cast concrete hypar forms that allow for minimal site disturbance and easy creation, assembly and deployment, given the availability of local pre-casting facilities. The forms can be readily expanded or adapted as wildlife movements and habitats change, or as site specific conditions dictate. The scheme is a landscape and structural collaboration, bridging both under and over the road, layering both driver experience and animal preferences.

RED / RESEARCH EVOLVE DESIGN (page 85): Janet Rosenberg + Associates (Toronto) with Blackwell Bowick Partnership, Dougan & Associates and Eco-Kare International
Using lightweight, resilient wood core fiberglass, the RED structure can be designed in flexible, modular configurations, or "strands" in the landscape, making use of the existing tree canopy as additional habitat between strands. The scheme proposes multiple connections into the site and varied possible routes cross the bridge, based on the travel habits and preferences of each target species. The bridge is intended as an iconic structure for humans, signifying the crossing, the landscape and its non-human inhabitants, but is at once unremarkable to wildlife that cannot see the colour red.

MCS / MODULAR CROSSING SYSTEM (page 86): Balmori Associates, Inc. (New York) with StudioMDA, Knippers Helbig Inc., David Skelly, CITA, Bluegreen, John A. Martin & Associates, Inc. and David Langdon
Designed as a modular and efficient "kit of parts", the MCS is a sustainable freeform structure of laminated timber girders, which can be locally manufactured from pine-beetle killed timber, storing more CO_2 than was used in the manufacturing process. The topography of the local landscape is reflected in the underside contours of the structure, while the surface habitat, with its wide ramps, is designed to blend seamlessly into the surrounding landscape.

WILD X-ING (page 87): The Olin Studio (Philadelphia) with Explorations Architecture (Paris), Buro Happold (London) and Applied Ecological Services
A double-curved inverted arc, the Wild X-ing structure is a steel and Ductal® grid overlaid by a rhomboid micro-grid lattice. The lattice is composed of pre-vegetated lightweight glass-reinforced plastic habitat modules – inserts that can be adapted, replanted, replaced or expanded as conditions dictate. Customized to local habitat conditions, the modules can be planted off-site and easily transported by flatbed trailer to the site for insertion or replacement.

LANDSHAPE (page 88/89): Zwarts & Jansma Architects (Amsterdam) with OKRA Landscape Architects (Utrecht), IV-Infra and Planecologie
This scheme proposes a thin-shell, double-curved concrete pillar-less structure that appears to float across the highway. Using concrete formwork that can be reused for each subsequent crossing, the structure is cost-effective due to the thin layer of concrete required and the intention of repetitive construction. The upper curve of the "landshape" contains the habitat for the crossing, including a system of ponds to serve as a draw for wildlife.

Landshape: The finalist concept design by the Zwarts & Jansma/OKRA team looks for a a double-curved, thin-shell concrete pillar-less structure.

The firm is currently working with ARC stakeholders and representatives to ensure that funding is secured to implement the winning design.

HNTB+MVVA's scheme was identified as the most elegant and compelling solution. The jury observed that this proposal for a pillar-free, modular structure was at once simple and straightforward, while embodying the complexity and contradictions inherent in the competition brief. In particular, the HNTB+MVVA scheme makes use of ordinary materials and technology as well as construction techniques that are well established, and in particular, accessible in many locations across the continent and therefore having the potential to reduce construction costs. The winning proposal combines emphases on wildlife habitat, behavior, and viability with a practical intelligence and concern for long-term sustainability.

Through the implementation of the winning design – a repeatable system of modular components – it is entirely conceivable that wildlife crossing structures may soon become common in the North American landscape. As more crossings are built, continuous learning through on-going monitoring is expected. Based on lessons learned from the data gathered, structural designs can and should be adapted to the site conditions and wildlife dynamics with each successive implementation. As such, it is equally conceivable that more prototypical aspects of the other four finalist's innovations in materiality, technology and ecological approaches will be welcome additions to a promising new typology of infrastructure.