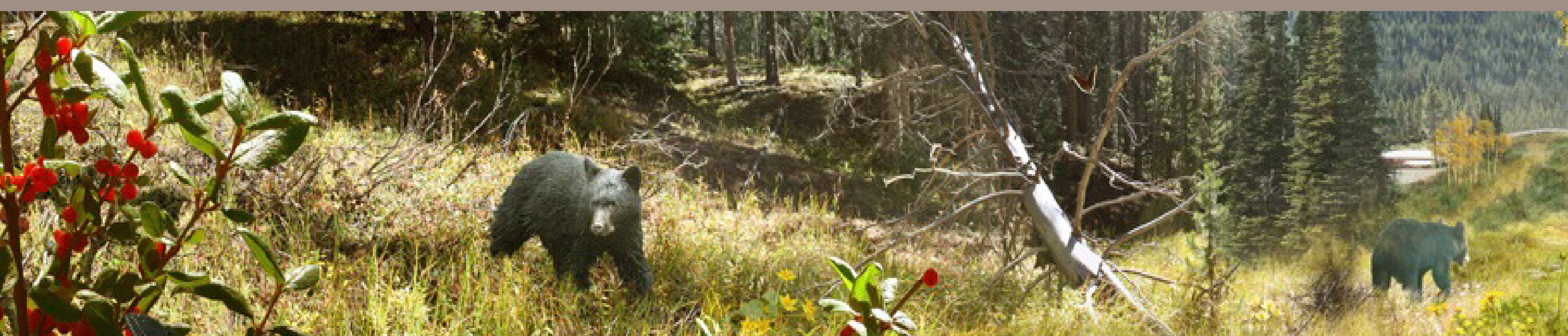
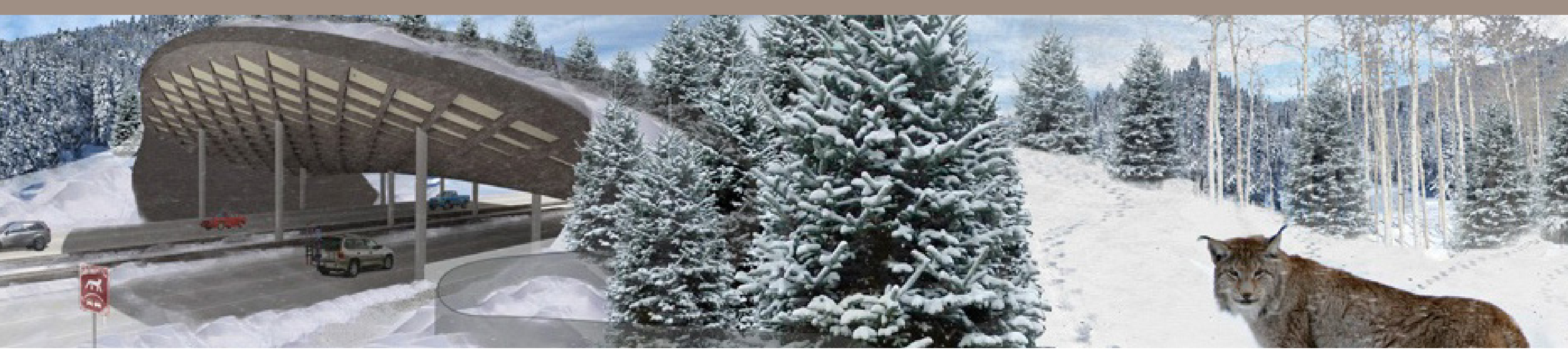
SAFE PASSAGE

COLAB PRIMER

INTEGRATED DESIGN FOR LANDSCAPE CONNECTIVITY





ECO/
LOGICAL
DESIGN
LAB

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SSHRC PDG Partners and CoLab Cohosts: National Wildlife Federation, The City of Edmonton, Perkins + Will, Toronto and Region Conservation Authority, Liberty Wildlife Corridor Partners, Western Transportation Institute, DIALOG Studio, Evergreen Brick Works, City of Toronto

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The Ecological Design Lab directed by Professor Nina-Marie Lister at Toronto Metropolitan University's School of Urban and Regional Planning tests strategies, develops evidence-based next-generation practices, and develops tangible solutions for sustainability and resilience. As we rethink and renew our relationship to nature in the city, we need creative thinking, community-collaborative planning and informed, inspired design. Through collaboration and co-creation with our community partners we are developing integrated evidence-based design solutions to complex socio-ecological problems.

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The Safe Passage CoLab reports were revised, reformatted, and prepared for publication by Sabrina Careri (EDL Lab Manager) in 2024.

TABLE OF CONTENTS:

INTRODUCTION

It is indisputable that landscape fragmentation, caused by road and other infrastructural developments, results in barriers to the safe movement of humans and animals alike. Growing urban regions and road networks are associated with increases in wildlife-vehicle collisions, and in the long term, landscape fragmentation results in habitat degradation and a decline in biodiversity.

There is strong evidence that wildlife crossing infrastructure can dramatically reduce the risk of collisions and mediate negative environmental impacts. However, where the construction of wildlife crossing infrastructure has emerged, it has been slow and piecemeal, characterized by limitations in a shared vision and consensus between disciplinary, political, economic, and cultural frameworks. This is due to the fact that landscape connectivity restoration is an interdisciplinary complex socio-ecological planning and design challenge, that is not under the mandate of a single practice or agency. Although the infrastructural design solutions aimed at reducing fragmentation are known to work, there is an urgent and growing need for a coordinated integrated approach to planning and design for widespread sustainable implementation. This challenge cuts across scales and jurisdictions, and solving these issues is not solely a technical or research challenge; it is about working collaboratively and building consensus beyond disciplinary boundaries to develop holistic evidence-based solutions.

By engaging with these issues in a unique interdisciplinary and experiential learning format - one that links landscape design and road ecology, with evidence-based policy and urban environmental planning - the CoLaboratory creates new opportunities for advanced research, open exploration, and civic engagement.

WHAT ARE COLABORATORIES?

CoLaboratories (CoLabs) are community-expert collaborative forums for hands-on design and planning, intended to address problems that are complex, multi-sectoral and interdisciplinary. It is an experiential, practice-oriented intensive multi-day workshop, during which invited experts from different relevant disciplines and / or local community members, work together to develop a shared vision and design practical feasible solutions to a given problem.

Methodological components of the CoLab can include:

- Performing preliminary site and policy context research;
- Compiling and analyzing technical data;
- Mapping and visualization;
- Cataloging existing and case-precedent decision-making strategies;
- Analyzing policy options and planning tools for each site;
- Soft-systems mapping of policy contexts and planning tools (including overlaps, boundaries and constraints);
- Developing preliminary design solutions and implementation strategies;
- Ideation, programming, and exhibit development for public engagement.

PRECEDENTS

The Studio Model and Design Charrette

Derived from the 19th century Beaux-Arts movement, the studio is an established model for cultivating the pedagogy and practice of collaborative design. By employing creative hands-on and experiential practice, the studio serves as a bottom up approach to learning. This model has long been a valued foundation of professional architectural, landscape, urban design, and urban planning education (Balassiano & West, 2012).

In a similar manner, the design charrette also serves as an intensive method for design development, and can occur through several forms. Underlying the charrette process is design thinking as a mode of knowledge production, which has been honed over a century, through the studio model. Historically, the charrette represents the culmination of a longer period of an individual's / group's professional design activity (Karwoski-Magee & Ruben, 2010). More recently, aspects of the charrette tradition have been incorporated into community-engagement activities, where a multi-day community design workshop intended for neighborhood residents of a given community, is facilitated by professional planners, designers and municipal decision-makers (Lennertz, 2003). In this way, the charrette may also function as a reward at the end of a longer process of discussions and negotiations. Regardless of its form, continuous exchange created in the charrette process is key for co-producing formal knowledge that is also practicable and relevant to broader stakeholders (Nassauer and Opdam, 2008). The design charrette is therefore not a self-contained activity, but is instead grounded in a longer series of reflections.

Engaging in strategic design management or the strategic design method, offers valuable insights in applying design thinking to process development, and in making design thinking and design techniques accessible to non-designers. Many landscape-based transdisciplinary research projects have proven successful in facilitating collaborative knowledge production across academic disciplines, and with non-academic practitioners, local actors, and governing bodies. Design-thinking research is ultimately a problem-solving framework, and is part of systems-based research and practice approaches, (Checkland, 1981; Checkland & Scholes, 1990) centered on principles of experiential learning-by-doing (Lee, 1993). Realized through multiple modes of communication and expression, design thinking research is a more highly visual, spatial and analytical method of exploring solutions to complex problems (Deming & Swaffield, 2011; Razzouk & Shute, 2012; Tufte, 2006).

Other names: pressure cooker, hack-a-thon, charrette, rapid prototyping

OBJECTIVES

The CoLaboratory puts the designer, professionals, and stakeholders involved in a project together, to problem-solve and work towards the following objectives:

Build Bridges Between Institutional Silos

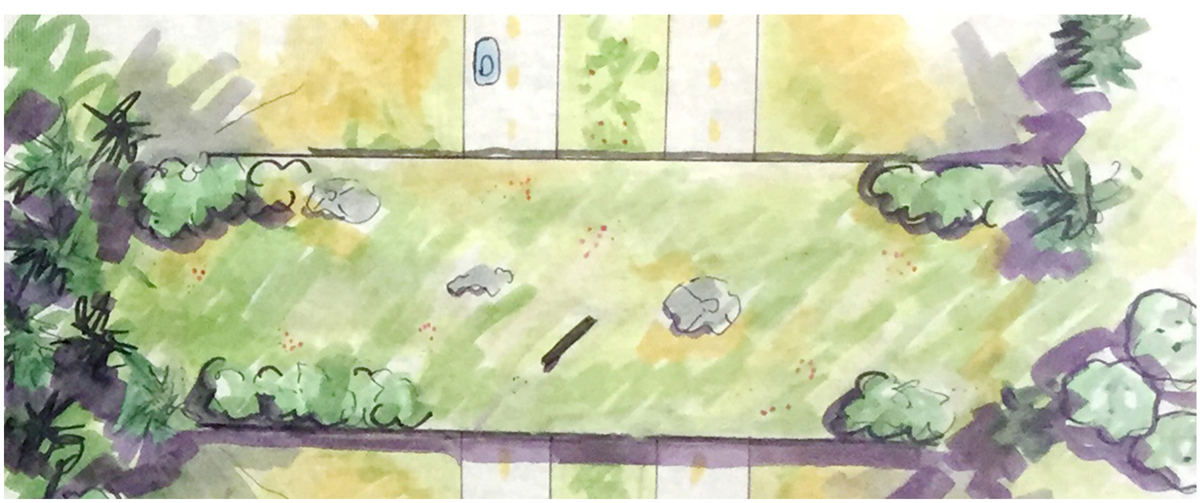
Institutional frameworks affect the integration of expertise at each stage of project development. The CoLab method invites participants to step out of their conventional silos, to facilitate and engage in knowledge production across disciplines, developing co-created design resolutions, which may not have existed otherwise within their familiar methods of practice.

Create Common Language

Departments, agencies, and fields of practice, often operate using a distinct set of professional terms and lingo. This inhibits knowledge transfer and collaboration with those from outside of the sphere. The CoLab method encourages effective communication through idea exchange and engagement in dialogue, developing common accessible vocabularies without disciplinary barriers.

Think Outside of Constraints

Design projects are guided - and often limited - by design standards, as well as financial limitations, as well as time and regulatory constraints. The CoLab method invites participants to blue-sky and envision possibilities that are more flexible, finding innovative opportunities to overcome typically imposed restrictions, and developing new creative solutions.



Change Objectives: From “Fail Safe” to "Safe-to-Fail"

Traditional models of design delivery have emphasized control and static outcomes, to prevent possible errors. This leaves little room to adapt to changing conditions over time. The CoLab method places greater emphasis on learning outcomes, developing ideas that are resilient and adaptable, and embracing the possibility of error or failure in design.

Increase Confidence in New Designs and Approaches

Publicly funded projects are often limited in their ability to implement innovative solutions (i.e., are precluded by restrictions in the pursuit of the lowest-cost-bid or value-engineering). The CoLab presents opportunities to demonstrate the art of the possible, by illustrating external proofs-of-concept, generated via prototyping efforts. Thus, establishing credibility, validation, and support for more diverse design approaches by a larger group of stakeholders.

CoLab participants begin with a set of ground rules to guide production and co-creation:

Do:

- Speculate, create, and explore; take liberties, jump fences, blue-sky, imagine!
- Develop design concepts in the absence of perfect information
- Pursue common understanding, and bridge gaps between professional disciplines and areas of expertise
- Iterate, iterate, iterate, and develop several concepts
- Allow for tangents, emergent possibilities, new directions
- Keep track of questions that arise
- Embrace the possibility of failure, note barriers, as well as opportunities
- SHOW: draw, sketch, diagram, map, make lists, engage hands-on

Don’t:

- Avoid untested or different ideas and strategies simply because they are new to you
- Constrain ideas to those that are readily realizable
- Force immediate conclusions
- Get fixated on the cheapest, fastest option (although DO note these)
- Be dominated by one discipline or professional voice
- Don’t get hung up on imperfect data
- Wait for a single best design resolution
- TELL: avoid a lack of engagement by providing information through words alone


Topographic Map for Site B


WESTERN GATEWAY
EDUCATION ZONE
ISSUES
OPPORTUNITIES
TAYLOR CREEK
VICTORIA PARK AVE
New LRT along Eglinton
Cycling facilities at an LRT station
Bike share station!
Outdoor gym!
Gateway to be enhanced with designed gardens, framing the beginning of t trail with lookout points
The proximity of existing wetland habitats provide educational opportunities to learn about different wildlife ecosystems and changes in the natural landscape
WESTERN GATEWAY
EMERGING VISION
The Bermondsey-Western Gateway will utilize a variety of planting including gardens to emphasize the entrance to The

FACILITATION

Though CoLab outcomes are participant led, facilitation is needed to introduce the method, define the scope of inquiry, and ensure that groups remain on task throughout the workshop. CoLab facilitators are encouraged to:

Act as a Neutral Party

Be engaged from outside of the participating organizations, and try not to be embedded in existing hierarchies and default (disciplinary) working relationships.

Practice Progressive Inquiry

Progressive inquiry is a cyclical process that involves defining and questioning existing assumptions, to more deeply understand the interacting variables involved in complex problems. Developing a holistic understanding is the outcome of this model, developed through iterative shared expertise on scientific and technical information, and prevailing theories.

Translate Descriptions to Visuals

Participants that have not been formally trained in design professions, often are wary or lack confidence in drawing and diagramming abilities. Though list-making and SWOT analysis are a valuable component of concept development and problem definition, participants should be encouraged to translate their observations and ideas spatially.

INFRASTRUCTURE AND DESIGN CONSIDERATIONS

Wildlife crossings must be designed for the safe passage of both people and wildlife. Some considerations in the design of the structure, to be explored during the CoLab, include:

Structural Type:

- Overpasses - those that take the landscape over a roadway in the form of a bridge designed to convey wildlife
- Underpasses - those that take wildlife under a road through culvert, tunnel, and open span bridge (wherein traffic passes overhead)
- Multi-use / at-grade crossing - those that reconcile the needs of people and wildlife mobility by separating pathways, or time of use, etc.

Treatment:

- Surface materials
- Vegetation and plant selection
- Substrates
- Climate
- Topography
- Water management
- Maintenance and management
- Contextual conditions, including history, political climates, social and cultural, economics, etc.

SITE	ROAD	CLIMATE	ECOLOGY	POLICY
• Topography • Slope • Aspect • Geomorphology • Presence of existing structure potential for adaptive reuse • Substrate type, composition • Geophysical conditions soil composition, texture, drainage	• Span / number of lanes present and planned • Traffic volume • Collision statistics • Surface material • Speed limit • Visibility • Construction constraints road closing, temporary traffic control	• Local weather patterns • Elevation • Snow load • Precipitation • Humidity • Freeze / thaw cycles	• Target species and associated habitat requirements • Diversity and abundance • Migration patterns • Local and regional vegetation • Canopy cover • Soil quality and depth • Surface water availability quality, quantity, location	• Land tenure • Easement • Ownership • Present and future plans, zoning and other regulations • Stakeholder interests • Public support and awareness

TIMING THE COLABORATORY

Speculative

The Speculative CoLab is not tied to an in-progress on the ground project. Appropriate goals at this stage include exploration, iteration, opening new avenues for inquiry, transferring knowledge from a developed field to a new application, and building a case for future research. Difficulties associated with this approach include a lack of background data for participants to build on and difficulty ground-truthing concepts.

Proposal

A CoLab associated with a project that is in the Proposal Stage allows for the inclusion of broader criteria, for instance considerations around siting and location of the structure, as well as contextual circumstances within the broader landscape connectivity network. Furthermore, there are greater opportunities during this stage to propose / integrate innovative design elements, use unconventional materials, and create a framework for ongoing collaboration throughout the project's implementation. However, there are also inherent risks associated with a CoLab at this stage, which are primarily characterized by the potential of ineffective or wasted use of resources (i.e., participant time, funding, materials, etc.) This is because some projects may see an eventual failure to move towards development for a variety of reasons (i.e., lack of funding, political misalignment, institutional constraints, increased costs, regulatory or quality issues, etc.).

Early Design (< 30% complete)

A CoLab that evaluates early versions of a design offers the opportunity to identify preliminary issues, evaluate progress, and facilitate iteration for continuous improvement to better ensure regulatory compliance and quality standards will be met. This is best done for projects that have institutional momentum and will proceed to construction. CoLab materials at this stage will be more refined, and this can also be used to develop public communications strategies that can enable further fundraising and build community support for further phases of the project.

Mid-to-Final Design / Early Construction

A CoLab at the mid-to-final stage of design development, or one that is in the early stages of construction, can be effective in ensuring that progress continues to align with the project goals (established early on in project development). Likewise, the CoLab can be used to assess and propose improved details in aesthetics and functionality to the overall design, and finalize ideas to prepare for implementation. The most noteworthy risk associated with the CoLab for a design at this phase, is project delay attributed to major changes. This intern, will impact project timeline, necessary studies, cost effectiveness and optimization for all stakeholders. Instead, minor alterations to plans and efforts to minimize unforeseen or associated costs to changes, are appropriate targets for a CoLab project at this stage.

Post-Implementation

CoLabs for projects that are complete, can help to advance public education and develop communications strategies. Goals for a CoLab project at this stage can include assessment of success against the project goals, and the development of key takeaways by identifying issues or shortcomings and assessing overall operational effectiveness. The CoLab can also be applied to plan for related future projects, or seek to study a larger issue more generally, through which the design hoped to address (e.g., landscape connectivity or wildlife mobility). Additionally, design development to retrofit existing structures and the adaptation of a structure to improve effectiveness, ease of maintenance, or longevity can also be addressed.

WHO SHOULD BE INVOLVED?

The translation of research to practice is facilitated through interaction between researchers in academia and practitioners integrating and applying the latest findings to design and management frameworks. A combination of participants from academic and agency / practitioner spheres is recommended, including but not limited to:

- Structural engineers
- Civil engineers
- Landscape architects
- Wildlife / road ecologists
- Private developer / consultants
- Industry representatives
- Environmental NGOs
- Municipal policy makers
- Provincial transportation agency staff
- Indigenous representatives
- Urban planners
- Community members
- Maintenance staff

Group Assignment

A single task and scope can be assigned across all groups to generate contrast and nuance in outcomes or to validate common outcomes that result from groups working on the same challenge. Alternatively, groups can be differentiated along a number of axes to generate a broader range of design concepts and strategies. Different sites are likely to present a range of topographies, road spans, target species that will necessitate different solutions. Groups can also be assigned a different set of objectives.

To enable collaboration and in-depth discussion, participant group size should not exceed 6-8 people. If the participant group is small, the CoLaboratory can be undertaken as a single group. If there are additional participants, sub-groups that contain representation from across disciplines.

COLABORATORY APPLICATIONS

New Materials

Opportunities:

Feasibility - Conventional wildlife crossing designs have largely been adopted from designs intended for vehicular traffic. Purpose-built structures which account directly for the variation in requirements for wildlife crossings provide opportunities to streamline designs (reduce load bearing requirements, decrease fill) and use lighter materials resulting in an overall lower cost.

Deployability - Road closures and speed of installation are critical factors affecting the cost of infrastructure implementation. Minimizing disruption to traffic created by the construction of a structure is a critical consideration for agencies and saves significant cost.

Maintenance: The current estimated lifespan of a wildlife crossing built using conventional materials is approximately 75 years. Reducing required maintenance over the life of a structure or designing structures whose lifespan exceeds the current average range can lower long-term costs of implementation.

Adaptability - Habitats change over time as does the migration routes and movement patterns of wildlife. Structures that can be adapted to suit changes in local vegetation or can be moved from one location to another will be more effective than static solutions.

ADVANCING DESIGN EXCELLENCE

Opportunities

Integrate outside expertise - Only a small number of public agencies have experience constructing and maintaining wildlife crossing structures across North America. Where new structures are planned, agencies are eager to engage practitioners that have been engaged on existing projects.

Continuous collaboration and advisory involvement - Ongoing engagement with external experts is essential for the successful design and implementation of the wildlife crossing project. A Request for Proposals (RFP) should be issued to bring in consultants who can address challenges identified by the project team and CoLab participants. Additionally, establishing an advisory committee will provide continuous peer review and support throughout the process. To ensure Indigenous perspectives and knowledge are fully integrated, the role of Indigenous representatives should be formalized at every stage of the project's development.

Design innovation - The proven effectiveness of wildlife crossing structure in restoring connectivity and preventing wildlife vehicle collisions remains poorly understood relative to the widespread nature of the problem it resolves. As such, there is a need for projects to represent a high level of excellence in efficacy and demonstrable benefits to society to build and maintain confidence and increase the visibility of crossings as a viable and necessary solution.


NOT A
THROUGH
STREET

Future Directions

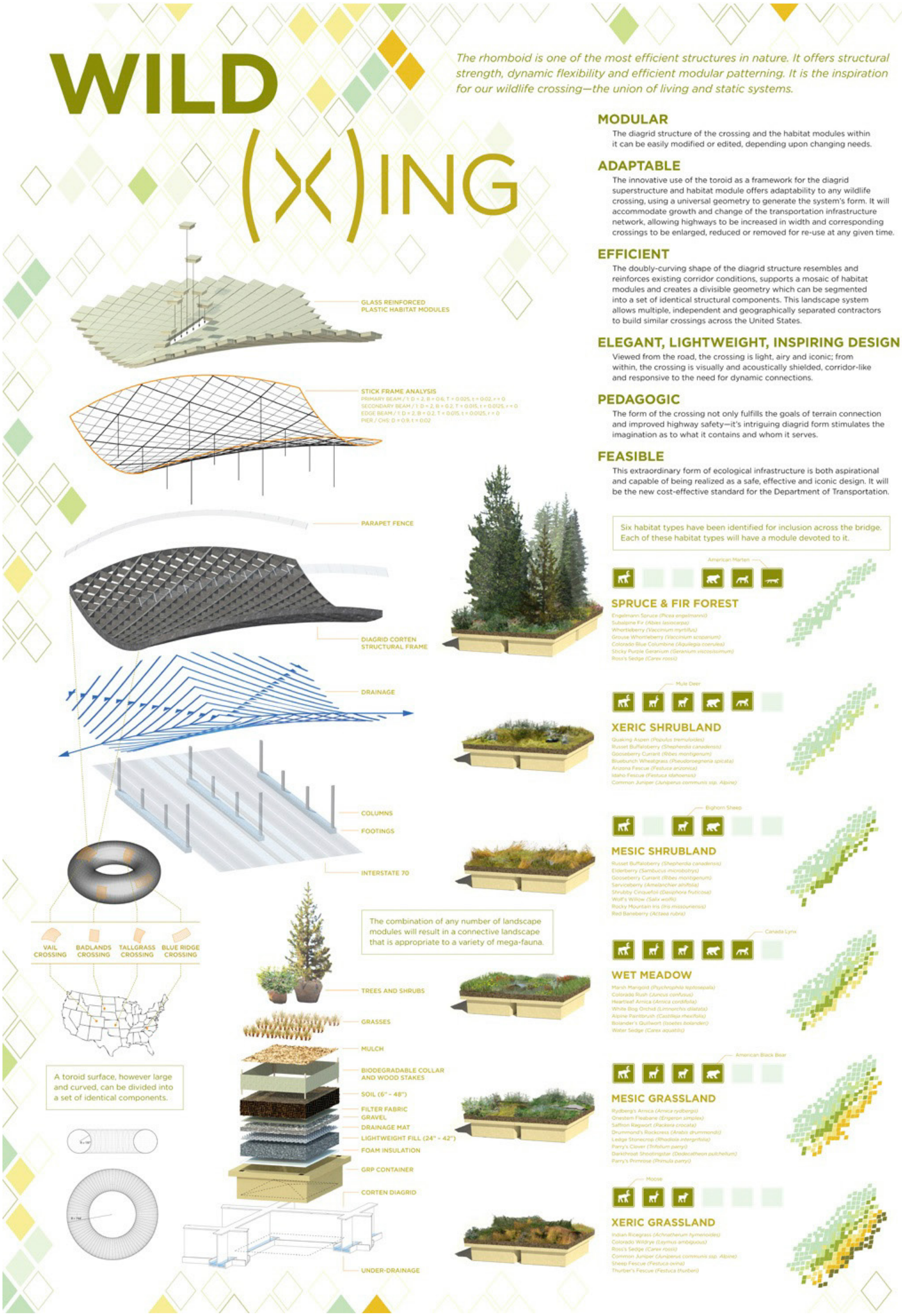
Opportunities

Monitoring - Depending on the target species, commencement in the use of a crossing often lags behind the construction of the structure. Long-term monitoring is critical for tracking the performance of the crossing, both to inform adaptive management of the structure and to serve as a proof-of-concept for future crossing and mitigation projects. The need for monitoring should be included both in the design of the landscape surface and approach and in the allocation of funding plans and responsibilities associated with the maintenance of the structure.

Integrative planning for urban resilience - Municipalities everywhere are working towards long-term resilience and sustainability. Building bridges between disciplines and across departmental boundaries enables the application of specialized knowledge for coordinated action towards sustainable city building. These strategies include biodiversity protection, climate change adaptation, and green infrastructure design approaches to effectively foster resilient landscapes within the urban fabric.

Landscape design - Explore and develop landscape design approaches that facilitate the planning and implementation of ecological connectivity enhancements within the urban matrix. In areas where crossing structures are not feasible or appropriate, alternative approaches such as habitat restoration, green corridors, and strategic land-use planning can be implemented to support wildlife movement and biodiversity.

Increase adoption and prevent duplication - Municipalities are at various stages of addressing issues of sustainability challenges. By deriving lessons from best practices and exchanging insights to identify common emerging approaches and strategies, agencies can advance their transferability to growing municipalities across jurisdictions.


WILD
(X)ING
The rhomboid is one of the most efficient structures in nature. It offers structural strength, dynamic flexibility and efficient modular patterning. It is the inspiration for our wildlife crossing—the union of living and static systems.
MODULAR
The diagrid structure of the crossing and the habitat modules within it can be easily modified or edited, depending upon changing needs.
ADAPTABLE
The innovative use of the toroid as a framework for the diagrid superstructure and habitat module offers adaptability to any wildlife crossing, using a universal geometry to generate the system's form. It will accommodate growth and change of the transportation infrastructure network, allowing highways to be increased in width and corresponding crossings to be enlarged, reduced or removed for re-use at any given time.
EFFICIENT
The doubly-curving shape of the diagrid structure resembles and reinforces existing corridor conditions, supports a mosaic of habitat modules and creates a divisible geometry which can be segmented into a set of identical structural components. This landscape system allows multiple, independent and geographically separated contractors to build similar crossings across the United States.
ELEGANT, LIGHTWEIGHT, INSPIRING DESIGN
Viewed from the road, the crossing is light, airy and iconic; from within, the crossing is visually and acoustically shielded, corridor-like and responsive to the need for dynamic connections.
PEDAGOGIC
The form of the crossing not only fulfills the goals of terrain connection and improved highway safety—it's intriguing diagrid form stimulates the imagination as to what it contains and whom it serves.
FEASIBLE
This extraordinary form of ecological infrastructure is both aspirational and capable of being realized as a safe, effective and iconic design. It will be the new cost-effective standard for the Department of Transportation.
GLASS REINFORCED PLASTIC HABITAT MODULES
STICK FRAME ANALYSIS
PARAPET FENCE
DIAGRID CORTEN STRUCTURAL FRAME
DRAINAGE
COLUMNS
FOOTINGS
INTERSTATE 70
VAIL CROSSING
BADLANDS CROSSING
TALLGRASS CROSSING
BLUE RIDGE CROSSING
A toroid surface, however large and curved, can be divided into a set of identical components.
The combination of any number of landscape modules will result in a connective landscape that is appropriate to a variety of mega-fauna.
TREES AND SHRUBS
GRASSES
MULCH
BIODEGRADABLE COLLAR AND WOOD STAKES
SOIL (6" - 48")
FILTER FABRIC
GRAVEL
DRAINAGE MAT
LIGHTWEIGHT FILL (24" - 42")
FOAM INSULATION
GRP CONTAINER
CORTEN DIAGRID
UNDER-DRAINAGE
Six habitat types have been identified for inclusion across the bridge. Each of these habitat types will have a module devoted to it.
American Marten
SPRUCE & FIR FOREST
Mule Deer
XERIC SHRUBLAND
Bighorn Sheep
MESIC SHRUBLAND
Canada Lynx
WET MEADOW
American Black Bear
MESIC GRASSLAND
Moose
XERIC GRASSLAND

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