

**Summary of the International Technology Scanning Program
For
Wildlife Habitat Connectivity Across European Highways**

BACKGROUND

An understanding of the influences of transportation systems on wildlife ecology and remedial actions to offset negative influences is an emerging science in the United States. However, the International Conference on Wildlife Ecology and Transportation series and the present International Conference on Ecology and Transportation conference, have demonstrated that some European countries are ahead of the United States in this area of science and application of research results. Further, a network of European countries (Infra Eco Network Europe – IENE) has played a leadership role in bringing together a European coordination effort to address wildlife related transportation issues and provide for connectivity of Europe’s remaining green infrastructure. The objectives of the IENE plan are (1) “to promote a safe and sustainable pan-European transport infrastructure through recommending measures and planning procedures to conserve biodiversity and reduce vehicular accidents and fauna casualties; (2) to design methodologies for defining priorities when solving conflicting intersections between nature and transportation infrastructure and implement them in the Environmental Impact Assessment and Strategic Impact Assessment studies; (3) to harmonize mitigation and compensation measures at European level; (4) to stimulate national strategies on environment and transportation; (5) to promote international and multidisciplinary research and monitoring; and (6) to improve public awareness, education and training on habitat fragmentation due to infrastructure”. This coordination effort is being carried out under the European Co-operation in the Field of Scientific and Technical Research (COST) program as COST 341, “Habitat Fragmentation Due to Transportation Infrastructure”. Each individual country has developed individual “State of the Art Reports” and the group of 16 European signatory countries is presently working on a number of initiatives including a European State of the Art Report on Habitat Fragmentation Due to Infrastructure; European Handbook on Fragmentation Due to Linear Transportation Infrastructure (handbook of best practices) and an on-line database (related information database).

A number of state in the U.S. have taken a leadership role in addressing wildlife ecology and transportation through policy, procedure, planning, project development, design, construction and maintenance initiatives related to wildlife. However, the limited application of science in this transportation discipline has often led to subjective decision-making in relation to addressing issues. The states also vary greatly in their treatment of wildlife issues because there is lack of uniform standards for assessment and treatment of wildlife related impacts. Funding of wildlife related activities has only recently received attention in the transportation funding bills. Therefore, the Federal Highway Administration (FHWA) and American Association of State Highway and Transportation Officials (AASHTO) took a leadership role in sponsoring an International Technology

Scan to advance the understanding of this area of science by visiting five European countries that have to varying degrees addressed wildlife in their transportation programs.

OBJECTIVES AND PANEL COMPOSITION

The objective of the International Technology Scan was to identify European activities in the area of (1) national initiatives; (2) technological tools, (3) wildlife assessment methodologies, (4) mitigation measures; and (5) effectiveness of programs, methodologies and mitigation measures. The ultimate objective is to transfer appropriate best practices to the United States transportation community. It is expected that this transfer of information will lead to the reduction of barriers to addressing wildlife related issues. Slovenia, Switzerland, France, Germany and the Netherlands were chosen for the scan because of their wildlife activities. The U.S. delegation met with representatives from the transportation and environmental ministries, research organizations, consultants, and non-governmental organizations.

The delegation was assembled under the Federal Highway Administration's (FHWA) International Technology Scanning Program. A multi-disciplinary team was assembled including the FHWA, U.S. Forest Service, U. S. National Park Service, Florida Department of Transportation, Wisconsin Department of Transportation, Vermont Agency of Transportation, Defenders of Wildlife, Humane Society of the United States and a private consultant. Members were chosen to represent the broad range of interest and expertise involved in the area of wildlife and transportation.

FINDINGS

An overall finding of the delegation was that the five European countries had much to offer as related to the objectives of the visits. While each country had differences in the reasons and approaches to addressing wildlife issues, the IENE effort was obviously leading them to a more comprehensive treatment toward the objectives of the group. The result will be beneficial to each country and Europe as a whole. The following are some of the preliminary findings reported for each individual country.

Slovenia

Slovenia is a young country as the actions being undertaken in this country reflected. They have the necessary environmental documentation process and environmental law to address wildlife issues in their transportation processes. One apparent inconsistency observed in Slovenia was that the Eurasian brown bear was a protected and hunted species. This unique situation led to interesting perspectives when addressing potential impacts to the species from transportation infrastructure. The activities that the delegation observed were the result of the efforts of parties outside the transportation ministry to bring about project designs to accommodate wildlife. The concerns observed were in the framework of increasing wildlife habitat (forests) and the opportunity to significantly accommodate wildlife with international connectivity implications.

Connectivity to the forests of Croatia and Italy exists and there is the potential for improvement. As was the case in several of the European countries, hunting of wildlife is an important factor in management and hunter information is extensively used when looking at connectivity needs.

Specifically, university and forestry personnel studied habitat connectivity needs, wildlife behavior (Eurasian brown bear) and public opinion to influence the transportation ministry to provide connectivity across highways. They also provided the transportation agency with identified connectivity needs and further recommendations for the nations highways. Public opinion resulted in a demonstration to express the need for action for wildlife. The result was a viaduct that was constructed for multiple purposes – wildlife, hydrology and human access. Subsequent studies of the structure indicated that a variety of wildlife cross under the structure. Fencing including electrical fence is used on Slovenian highways to keep wildlife off the highways thereby providing for motorist safety. The scan team felt Slovenia represented a situation similar to the United States where transportation impacts on wildlife is an emerging issue and it often takes diverse interests joining together to influence actions on the part of the state transportation agencies through active public involvement programs.

Switzerland

In contrast to Slovenia, Switzerland has a long history of science and actions related to wildlife in their transportation and environmental programs. It was evident that the Swiss actions were scientifically based. Geographic Information System (GIS) - based identification of wildlife habitat and corridors were completed. Here again, hunter information was used to supplement science. Bottlenecks and voids in connectivity were identified. The remaining corridors were categorized as impacted, impaired or interrupted with only 1/3 categorized as intact. The main corridors are forested as riparian corridors are highly impacted throughout much of Europe. Initial attempts at riparian restoration were observed. Landscape planning plays an important role in Switzerland and habitat restoration and purchase for connectivity was observed.

Expert groups used scientific research to develop standards for assessment, design and mitigation. Scientific information from other European countries was extensively used in this process including investigations of other country's green bridges. Diverse habitats on these green bridges was scientifically identified as important to providing connectivity for the broadest spectrum of species from invertebrates to ungulates. Considerations in vegetation selected even included avian and tree-dwelling species. Research documented the relationship of a highway to badgers and the connectivity absent or present for badgers with the placement of crossing structures.

The Swiss have a wide variety of structural and non-structural measures for wildlife. Overpasses (green bridges or ecoducts) of varying widths were a preferred structure for maintaining connectivity for many species. There is a prevalence of multiple use overpasses with farm roads and vegetation on the structures. These structures were monitored using standard approaches such as tracks and photography as well as evolving

technologies such as infrared video. By use of the video camera, observation of behavior of the animals while using the structures is possible.

Germany

German actions for wildlife were more legally driven than scientifically driven. Germany has strong legal requirements - largely to address motorist safety. Projects are identified at the federal cabinet and parliament levels and then are provided to the transportation ministry for implementation. The Agency of Environment is consulted and enforces environmental actions per the Nature Conservation Act, a Red List (threatened and endangered species) and Endangered Conservation Act. Germany has an early warning system of environmental risk assessment to help avoid environmentally sensitive projects. Landscape planning plays an important role in the identification of protected areas, protection of flora and fauna, and the general protection and mitigation for impacts to the natural environment. Negative changes to land use require compensation measures. Two perspectives - home protection and nature preservation influence the process. Considerable and sustainable (not well defined) impacts have legal consequences. Project managers are obliged to take measures in the case of considerable and sustainable impacts. Three kinds of compensation are possible – in-kind, off-site and compensation fees (in-lieu-fee) in that order of preference.

Germany requires a cost-benefit analysis conducted at the federal level for projects. Job creation and economic stimulation are factors considered in the transportation program. Mathematical decision-making models of questionable value were presented with the conclusion that an argumentative model (verbal description of impairments) usually prevailed. Economic and social need can overpower environmental need in the final analysis. However, the European Commission directives and Nature 2000 program can overrule local decisions. In fact, legal proceedings at the Commission level are possible.

As with some of the other European countries, landscape ecology principles were being applied to highway planning. The team observed areas where adjacent land use and distribution had been changed as a result of highway planning such that the entire area benefited.

The legal requirements in Germany lead to fencing (necessary on all highways as there are many areas having no speed limit), signing, underpasses, overpasses (green bridges) and land conservation as mitigation for transportation facilities. Germany had the largest number of overpasses (32) of the countries visited varying in width from 8.5 to 870 meters. They also have 8 under construction and 20 more planned. Forest and agricultural roads are present on about half of Germany's overpasses. In other cases, rocks were used to keep vehicles out of underpasses and off overpasses. German engineers reported that hourglass overpasses were similar in price to straight shaped overpasses. Extensive projects for amphibians with specific barriers along the fences were observed. They reported that over 100 projects for amphibians have been accomplished nationwide. They also report that 130 bridges over rivers were designed to accommodate wildlife.

Monitoring of effectiveness was limited although some insect research was being conducted. New habitat connections were being built more because they are required by law, rather than from a basis of scientific information. Research presenting some evidence of road density and noise relationships to wildlife species was obtained in Germany.

France

France was the first European country to develop overpasses (green bridges) for wildlife and has an extensive network of such structures. It was also the first country where the team visited highways developed by private companies. In France, the transportation plan is derived from a land use plan that has the goal of having all residents within 5 km or 45 minutes from a limited access highway or high-speed rail. Roads are funded out of general tax funds rather than a gas tax. Using the Law of Protection on Nature as guidance, both the Environmental and the Transportation Ministry must approve highway projects. There are no separate permits for various aspects of a project – one approval does it all. There is an extensive public involvement process to arrive at an alternative suitable to all parties. Legal challenge is prevalent and projects can take as long as 10 years to develop. Environmental factors receive equal consideration with social and economic factors.

The Transportation Ministry objective is to increase motorist safety. Approximately 30 deaths a year result from animal related accidents.

France has taken numerous measures to reduce wildlife collisions with fencing being required on all federal highways. France indicated that reflectors and deer whistles were researched and found to be ineffective. They also reported that permanent signing does little to reduce wildlife mortality. Culverts, underpasses, overpasses and viaducts have been used in France as structural alternatives. France was the first to try hourglass shaped overpasses with the narrowest point from 8 – 15 meters. France also has a large number of overpasses (green bridges) that were built specifically for wildlife with the widest being 800 meters. Structures are generally monitored for a one-year period and then revisited 3-5 years later with the information used in future projects and guidance documents. France has also tried a number of designs for amphibian crossings including a trench and drop inlet application with one way pipes. In another case, a plastic fence attached to the regular fence was used to guide amphibians to culverts.

The Netherlands

The Netherlands is definitely playing a leadership role in the European community as related to wildlife and transportation. However, the Netherlands has limited habitat for wildlife and the measures being taken are for a few remaining species. The most extensive measures for badger and hedgehogs seem to have resulted from non-government organization pressure on the Environmental and Transportation Ministry. An extensive system of culverts (approximately 600) is provided for these species and

retrofits are being done using maintenance funds. They are based on a system wide plan. They have ten pipe-culvert systems designed specifically for amphibians that are strategically located to provide for seasonal movements. They have also modified existing bridges and culverts for waterways by providing dry passage on wood or earthen shelves along the inside of the structures to provide for primarily small mammal movement. Four overpasses have been constructed from 17 to 50 meters wide. They have done both the hourglass shape and straight sides with both fences and earthen berms for noise and light protection. Tree stumps are placed on or under structures to provide cover for small species habitat and passage. They have used sand beds, inkpads and infrared cameras for detecting animal movement over structures.

The Netherlands also has a national connectivity plan that is looked at in relation to the transportation system and projects. A philosophy for providing and improving connectivity across the highway system prevails.

GENERAL CONCLUSIONS

The Wildlife Habitat Connectivity and Highways Scan Team found these general areas of conclusion and application in the United States: Policy, Communication, Guidance Manuals and Research.

Policy

Strong policy and regulatory guidance is leading the efforts in Europe. Several European countries provide funding for retrofit of structures for wildlife. An approach taken in Europe is to include these funds in the maintenance budget to be implemented as maintenance activities.

A stronger policy for “avoidance” of impacts to wildlife and habitats exists in Europe than in the U.S. The Scan Team sees a need for greater attention to avoidance in the United States when demonstrating the current “avoidance and minimization” requirements of the Federal Highway Administration’s NEPA process. This can result from a stronger consideration of avoidance alternatives in transportation planning and implementation.

Because of significant habitat losses in the past, some of the European countries compensate for habitat loss irrespective of habitat type. The Scan Team concludes that at least two principles of European policy could be implemented in the United States: 1) an ecological rather than species-specific perspective for compensation and 2) the principle of compatible land use management in areas of highway structures built for wildlife passage. European countries also make a strong effort to involve private lands in their adjacent land-use plans. The role of private lands adjacent to highways is an area that needs further policy development in the United States.

The Scan Team identified the following specific policy improvements that would be helpful in the United States:

- ✍ Include wildlife/transportation issues in the Federal Highway Administration and American Association of State Highway Transportation Officials strategic plans.
- ✍ Enhance the gains made in TEA-21 through dedicated funds for wildlife issues.
- ✍ Include funding for retrofit of structures for wildlife in TEA-21 reauthorization.
- ✍ Establish a policy for actions based on well-supported research to build a scientific basis for action within TEA-21 reauthorization.
- ✍ Implement a stronger analysis of alternatives in transportation planning and implementation that avoid wildlife and habitat impacts.
- ✍ Implement a habitat mitigation policy for all viable wildlife habitat losses that is similar to that in the “no net loss” policy currently applicable for wetlands.
- ✍ Accomplish compensation for habitat loss at the ecosystem level rather than “postage stamp” mitigation in order to accomplish compatible wildlife habitat adjacent to the highway. An approach would be habitat banking similar to the current wetland banking programs. Such an approach would be currently eligible for Federal-aid funds under TEA-21 and the FHWA regulation, Mitigation of Impacts to Wetlands and Natural Habitat, 23 CFR 777.
- ✍ Establish a stronger policy for consistency of highway alignment and design with public lands and public land management compatible with highway features for wildlife.
- ✍ Develop a manual that further describes land acquisition options for wildlife conservation in the transportation process.
- ✍ Require post-construction monitoring of structures for wildlife in order to build a strong scientific base for future decision-making.

The agencies identified for implementation of policy elements were the Federal Highway Administration, U.S. Forest Service, Fish and Wildlife Service, Environmental Protection Agency and Bureau of Land Management.

Communication Strategy

One of the strong points of the European effort is the communications network that has developed in order to coordinate information, enhance wildlife connectivity and garner support for providing measures for wildlife in their transportation system. The Europeans have used many symposia and journals to spread information related to wildlife and transportation.

The Scan Team identified the following specific communication strategies that would be helpful in the United States:

- ✍ Identify a central point of contact in the United States for coordination and communication of information with the European community.
- ✍ Recruit organizations such as the Society for Conservation Biology, Wildlife Society, Ecological Society of America and use publications, such as the FHWA newsletter “Greener Roadsides,” to spread information related to wildlife and transportation.
- ✍ Include the University community and state wildlife agencies that are conducting a great deal of the research in this communications effort.

- ~~✍~~ Initiate an international and national coordination effort in the United States to involve critical stakeholders in the process, with an interagency workshop on communication strategies.
- ~~✍~~ Develop a central source of information about transportation and wildlife. The further development of the capabilities of the Center for Transportation and the Environment should be used for this strategy.
- ~~✍~~ Coordinate interagency cross-training so that all stakeholders understand the issues and solutions involved in wildlife and highway conflicts.
- ~~✍~~ Utilize programs such as streamlining, environmental stewardship and context-sensitive design to communicate the need and approaches for assuring that wildlife are given adequate consideration in transportation decision-making.

Guidance Manuals

Many of the countries visited have been developing guidance documents that will greatly facilitate additional measures for wildlife on their transportation systems. Strong interagency and other external coordination was evident in several countries that were visited. Similar efforts should be initiated in the United States. The European countries visited seemed to have a common definition for terminology typically used in addressing wildlife issues. This is not the case in this country. Specific guidance on structure types, sizes and designs are developed in several European countries. Several European countries visited had specific requirements for post-construction monitoring and successful methodologies such as infrared camera for monitoring structure use by animals.

The Scan Team recommends that the following guidance packages would be helpful in the United States:

- ~~✍~~ Develop an assessment methodology manual to provide guidance to environmental personnel and engineers in the evaluation of
 - the need and objectives of measures for wildlife,
 - the tools to evaluate micro-habitat to landscape level perspectives,
 - the tools to identify site specific locations,
 - species group specific information on evaluation techniques, and
 - alternative methodologies for conservation and mitigation.
- ~~✍~~ Include guidance on the coordination of highway and habitat issues with resource agencies and non-governmental organizations in this manual.
- ~~✍~~ Undertake an interagency effort to develop definitions for commonly used terms in the transportation/wildlife area of science. Landscape linkages, connectivity, permeability, landscape ecology, ecosystem management are some examples of regularly used terms that have different meanings to different audiences.
- ~~✍~~ Develop manuals for structure selection, sizing and design guidelines for transportation departments in the United States. The inclusion of cost information would add to the value of such manuals.
- ~~✍~~ Develop a guidance document with specific recommendations on the temporal and spatial requirements and techniques for monitoring structures.

- ✍️ Coordinate the development of these guidance documents with the Transportation Research Board and be published as American Association of State Highway Transportation Officers guidance manuals.

The manuals should be developed and coordinated by the Federal Highway Administration, U.S. Forest Service, Fish and Wildlife Service, National Park Service and the Environmental Protection Agency.

Research Strategy

Several of the countries visited had strong research programs to support their decisions on wildlife measures. While this has begun in the United States, several areas for emphasis were identified. One thing that was evident in European measures to provide wildlife connectivity was the consideration of all types of animals in the design of their structures.

The Scan Team recommends that the following research efforts would be helpful in the United States:

- ✍️ Promote interagency coordination of research and the utilization of pooled fund strategies to maximize the effectiveness of research funds. The Transportation Research Board and AASHTO Standing Committee on the Environment need to take a leadership role in the research effort.
- ✍️ Support research on the definitions to support the recommendation for a terminology guide.
- ✍️ Support a national habitat connectivity study to identify the areas where highways traverse important habitats. This will be beneficial for the planning purposes of both the transportation and the land management agencies.
- ✍️ Study connectivity for all types of wildlife in the United States, including arboreal connectivity.