

# NCHRP 25-25, Task 113

## ROAD PASSAGES AND BARRIERS FOR SMALL TERRESTRIAL WILDLIFE SPECIES

### SUMMARY CONSIDERATIONS FOR OVERPASSES

*Prepared for:*

AASHTO Committee on Environment and Sustainability

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## OVERPASSES FOR SMALL ANIMAL SPECIES

This is a summary of considerations for wildlife overpasses designed or modified to increase habitat connectivity for small animal species. This summary is based on the literature review, the survey report, and the knowledge and experience of the authors. The literature review and survey report are available as separate documents produced for this project (NCHRP 25-25, Task 113).

### A. GENERAL CONSIDERATIONS

This section describes general design, operation, and maintenance considerations for designated overpasses that list small animal species as one of the target species or species groups. It also includes existing overpasses originally built for other purposes that were modified for small animal species (i.e., amphibians, reptiles, or mammal species smaller than a coyote [*Canis latrans*]). In contrast to underpasses, overpasses are situated above a road and associated traffic.

#### Characteristics:

**Location:** A designated wildlife overpass is (or should be) located where improved connectivity for the target species is expected to have the greatest benefit for survival of the population (Figure 1) (Clevenger & Huijser, 2011). A designated overpass is fundamentally different from modifying an existing structure that was originally built for other purposes because the location and dimensions of a designated structure are based on the connectivity needs and natural history characteristics of the target species (Figure 2). Modification of existing overpasses to allow connectivity may result in challenges in creating appropriate habitat for small animals on top of the overpass (Clevenger & Huijser, 2011).



**Figure 1:** The top of a designated wildlife overpass for species associated with dry forests, heathlands, and inland sand dunes. Note the wildlife cameras, the sparse vegetation characteristic of this type of habitat, and root wads on top of wildlife overpass Oud Reemst, south of Otterlo, The Netherlands.



**Figure 2:** This overpass was originally a two-lane bridge for pedestrians, cyclists, and cars across a motorway. Much later, about half the width was made into a “nature strip” with some soil, root wads, grasses, herbs and shrubs. This is an example of an overpass, originally built for other purposes than wildlife, that was modified for wildlife later. The Netherlands.

**Continuous Habitat:** Overpasses allow (at least in theory) for uninterrupted habitat between the areas on either side of a road. Some small animal species move very slowly. To move across the landscape, they may need continuous suitable habitat with similar soil, hydrology, light, temperature, cover, food, and vegetation (McGregor et al., 2015). These requirements can be provided on overpasses, preventing disruption in these parameters (e.g., D'Amico et al. 2015). Providing habitat in underpasses is more difficult due to the lack of sunlight for growing vegetation.

**Structure Dimensions:** For large mammals, suitable dimensions of a crossing structure are often based on their behavior. Space, line of sight, minimal disturbance from people, cars, headlights, and traffic noise are examples of parameters that dictate what a suitable structure looks like for large mammals. The same principles apply to small animal species, but on a much smaller scale. Small animal species typically need continuous habitat or steppingstones of suitable habitat, including cover and food, at short intervals. If there are multiple target species that require different habitat, it influences the dimensions of the structure because more habitat types require more space. Most overpasses for which large mammals are among the target species are about 50 to 70 meters (m) wide (164-230 ft). This width also allows for different types of habitat on top of an overpass which can benefit a wide range of small animal species.

**Habitat:** For amphibians, presence or proximity to water or wetlands in addition to cover and vegetation structure is especially important. In many cases where amphibians are among the target species, there are ponds on both sides of a crossing structure, and sometimes also on the overpass itself (Figure 3) (Hamer et al., 2015). Such a pond may have open areas (short grass-herb vegetation with open soil), as well as

other sections of the bank where there is more cover (shrubs, trees, root wads, rocks or dead branches). For reptiles, the habitat requirements vary; turtles may be relatively dependent on water, whereas snakes, tortoises and lizards may benefit from dry, warm areas with a combination of sunny spots (e.g., sandy or open grass-herb vegetation) as well as cover (e.g., root wads, tree branches, rocks, thorny shrubs) (Figures 4 and 5). For small mammal species, cover is especially important. Because small animal species move slowly, food may also have to be available on the overpass. This may include terrestrial and aquatic invertebrates, seeds, fruits, vegetation, etc. This has consequences for the physical environment as well as the (planted) vegetation on top of the overpass. Providing habitat that is a suitable living environment for small animal species is critical; the width of a road or the length of a crossing structure, including the approaches in the right-of-way, may be too great of a distance for small animal species to cross if cover, food, and water cannot be accessed along the way (Figure 3, 4, 5, and 6).



**Figure 3:** Pool (during dry time of the year) on top of wildlife overpass “Groote Heide” across A2 motorway, near Leende, The Netherlands. This pool is a stepping stone for the following target species for this overpass: moor frog (*Rana arvalis*), great crested newt (*Triturus cristatus*).



**Figure 4:** A row of root wads on an approach of a wildlife overpass guides small animal species dependent on cover across the structure, Ecoduct “Waterloo” across A73 motorway near Roermond, The Netherlands.



**Figure 5:** Open habitat (sandy spots, grass herb vegetation) and cover (stacks of root wads) on wildlife overpass “Zanderij (Crailoo)”, near Hilversum, The Netherlands. The structure connects forests and heath lands, is 800 m long, 50 m wide and crosses a 2-lane road, a 2-track railroad, a railroad yard, and a golf course and field hockey complex. Among the target species currently present in the area, are two lizard species, 1 snake species, 2 frog species, 2 toad species, 1 newt species, and a range of small-medium sized mammal species. Note that there is also a trail for non-motorized traffic on this overpass. More information on the effectiveness of this overpass in van der Grift et al. (2009).



**Figure 6:** Cover and food for wildlife (rose hips) on top of multifunctional overpass (wildlife, bicyclists, pedestrians; about 100 m wide), across A4 motorway, Parndorf, Austria. The overpass is designed for farmers, agricultural machinery, hunters and wildlife including roe deer (*Capreolus capreolus*) and European hare (*Lepus europaeus*).

**Fences or Other Barrier Types:** Fences or other barriers are required to keep wildlife off the highway, reduce collisions, and reduce direct road mortality of the animals concerned. Barriers also help guide wildlife to the crossing structures, including overpasses (Hamer et al. 2015). Fences can be designed for multiple species groups, including amphibians, reptiles, small mammals, and large mammals (Figure 7).



**Figure 7:** Wildlife fence for large mammals (e.g., roe deer (*Capreolus capreolus*)) (tall wire mesh), medium mammals (smaller mesh size towards bottom) (e.g., Eurasian badger (*Meles meles*)), and small animal species (smooth black plastic sheets that extend into the soil), including amphibians, reptiles, and small mammal species. This fence keeps wildlife from accessing a railroad (three tracks) and guides them toward the wildlife overpass "Op Hees" across the railroad tracks between Utrecht and Soest/Amersfoort, Soest, The Netherlands.

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