High Density Polyethylene Half-Pipe as a Roadside Mitigation Barrier: Design Success and Material Failures

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Title: *A Unique Barrier Wall and Underpass to Reduce Road Mortality of Three Freshwater Turtle Species (Heaven, Litzgus, and Tinker)*

Finding:

Using the half-pipe design composed of HDPE, the number of turtles accessing the road reduced by 94%, and there was no evidence of turtles circumnavigating the barrier. This trend was present at the impact site, but not the control site, signifying that the reduced road encounters are a result of the half-pipe barrier design.

Neither the culvert nor barrier wall were compromised within the 3-year study. As of 2024, evidence of shifting, cracking, and insufficient rip-rap backfill are present.

Title: *Effects of Exposure Conditions on Antioxidant Depletion, Tensile Strength, and Creep Modulus of Corrugated HDPE Pipes Made With or Without Recycled Resins (Nguyen et al.)*

Both freeze/thaw cycles and saline cause thermo-oxidative degradation, which reduces the tensile strength of the pipes. Saline has a larger effect on antioxidant degradation than freezing temperatures. This has consequences in regions with deicing salts, abrasion, and freeze/thaw cycles.

RESEARCH & MONITORING

Title: *Best Management Practices for Mitigating the Effects of Roads on Amphibian and Reptile Species at Risk in Ontario (Gunson, Seburn, Kintsch, and Crowley)*

Finding:

Best Management Practices for Mitigating the Effects of Roads on Amphibian and Reptile Species at Risk in Ontario (Gunson, Seburn, Kintsch, and Crowley)

Product: *ACO One-Way Fence*

Uses the concave design in combination with backfill to allow for safe exit off the road. It is made of plastic materials (polypropylene, polyvinylchloride, and polyethylene). These materials should be stored away from direct sunlight if exposed for over 6 weeks, and protected from prolonged sub-zero temperatures. Heavy materials cannot be stacked on or against this product (ACO Plastic Products, MSDS).

Article: *'Findings are super exciting': Georgian Bay Biosphere project to reduce reptile mortality on roadways in final stages*

A half-pipe HDPE barrier is being used to mitigate fox snake road mortality. The concave surface of the pipe will prevent reptiles from climbing it. This is a thesis-in-progress by

Sabrina Lounsbury (Litzgus Lab, Laurentian University), and will test if the design keeps snakes off the road, as well as how the material does in freezing temperatures and how it interacts with public works activities.

NOTE: the design led to snakes getting stuck in the holes of the HDPE pipe, so they had to be filled/blocked (Jackie Litzgus, pers. comm, 2024).

Article: *Wild Snake Half Pipe - A Directional Fauna Safety Barrier*

This design consists of a concrete pipe that is cut lengthways. Fauna approaching from the concave side are unable to climb up, and from the convex side they can traverse the backfill and jump to the lower level. This can also be applied in sinuous riparian areas.

Product: *Reptile Mitigation Strategy Appendix A: Example Reptile Fencing Design*

Semi-permanent one-way reptile fence using twin wall plastic drainage pipe. This design is more effective in allowing reptiles to negotiate the fence in one direction, and it is less visually obtrusive.

Title: Measures to Reduce Road Impacts on Reptiles and Amphibians in California (Langton and Clevenger)

Consists of HDPE pipe cut lengthways. Life expectancy is a few years for thinner material, and 10-15 years for thicker material according to site conditions.

Title: Effect of Ultraviolet Radiation on Recycled and Virgin HDPE Corrugated Pipes Used in Road Drainage Systems (Nguyen et al.)

The ends of exposed HDPE pipe are known to degrade under UV, light, temperature, and moisture. UV damages the physicomechanical and chemical properties of HDPE, causing impaired tensile strength and impacts the strength of the material. This is determined under accelerated lab simulations of the North American climate.

RESEARCH & MONITORING

Literature Cited

ACO One-Way Fence and Tunnel Entrance (https://www.aco.co.uk/products/one-way-fence-and-tunnel-entrance)

Best Management Practices for Mitigating the Effects of Roads on Amphibian and Reptile Species at Risk in Ontario (Gunson, Seburn, Kintsch, and Crowley) https://files.ontario.ca/bmp_herp_2016_final_final_resized.pdf#page=13.10

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Reptile Mitigation Strategy Appendix A: Example Reptile Fencing Design (https://www.wyreforestdc.gov.uk/media/lmsjjry5/cd10-7-example-reptile-fencing-design.pdf#page=3.00)

Wild Snake Half Pipe - A Directional Fauna Safety Barrier (https://www.abelecology.com.au/post/wild-snake-half-pipe-a-directional-fauna-safety-barrier)