

‘Biodiversity and Infrastructure. A handbook for action’

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 101019890



Agenda

1. Introducing the tool

- Background / 'Making of'
- Main features
- Overview

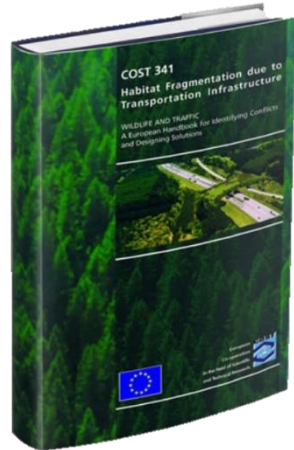
2. Search examples

3. Chapter's contents

4. Future development



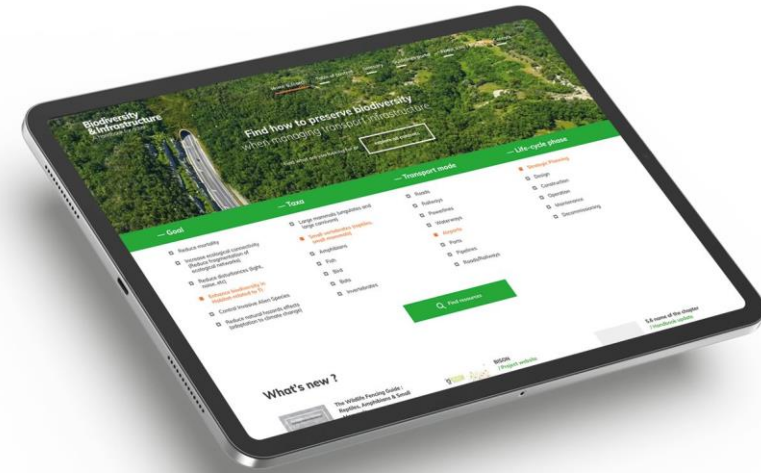
Background



**Based upon
'Wildlife & Traffic' (2003)**
COST Action 341.
European Commission.
Promoted by IENE, Rijkswaterstaat (NL)
and 18 partners.



Update and website development by Infra Eco Network Europe (IENE) Working Group (2020). Swedish Transport Administration, Conference of European Director of Roads (CEDR), French Ministry for Ecological Transition (MTES).



**New online handbook
'Biodiversity and Infrastructure' (2023)**

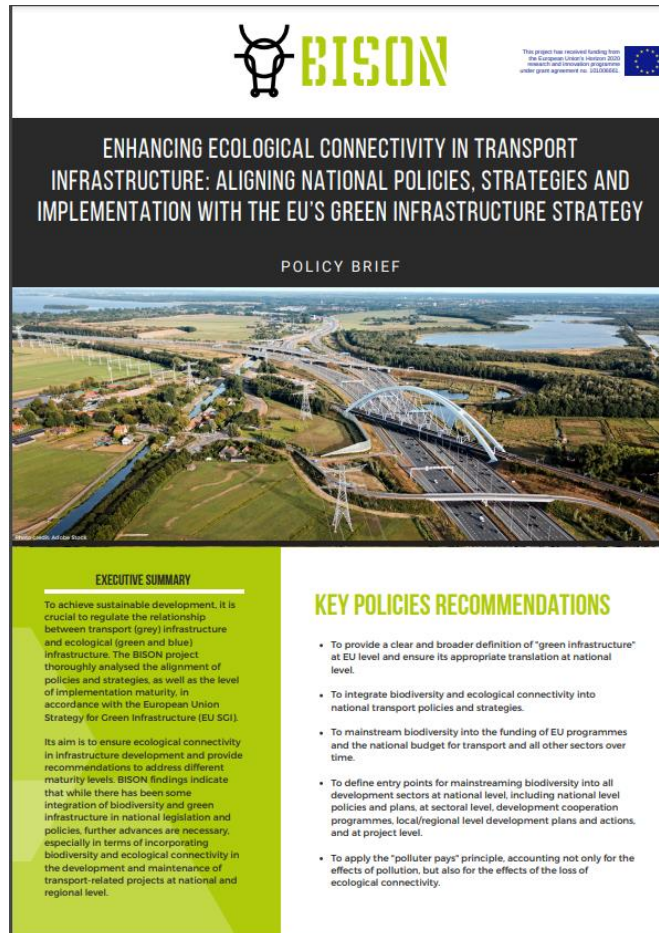
Project Horizon 2020 'BISON'
44 partners 16 countries

IENE undertakes management and
update

Find all the BISON project Outcomes

<https://bison-transport.eu/>

Policy Briefs



BISON

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 101019162

ENHANCING ECOLOGICAL CONNECTIVITY IN TRANSPORT INFRASTRUCTURE: ALIGNING NATIONAL POLICIES, STRATEGIES AND IMPLEMENTATION WITH THE EU'S GREEN INFRASTRUCTURE STRATEGY

POLICY BRIEF

EXECUTIVE SUMMARY

To achieve sustainable development, it is crucial to regulate the relationship between transport (grey) infrastructure and ecological (green and blue) infrastructure. The BISON project thoroughly analysed the alignment of policies and strategies, as well as the level of implementation maturity, in accordance with the European Union Strategy for Green Infrastructure (EU SGI).

Its aim is to ensure ecological connectivity in infrastructure development and provide recommendations to address different maturity levels. BISON findings indicate that while there has been some integration of biodiversity and green infrastructure in national legislation and policies, further advances are necessary, especially in terms of incorporating biodiversity and ecological connectivity in the development and maintenance of transport-related projects at national and regional level.

KEY POLICIES RECOMMENDATIONS

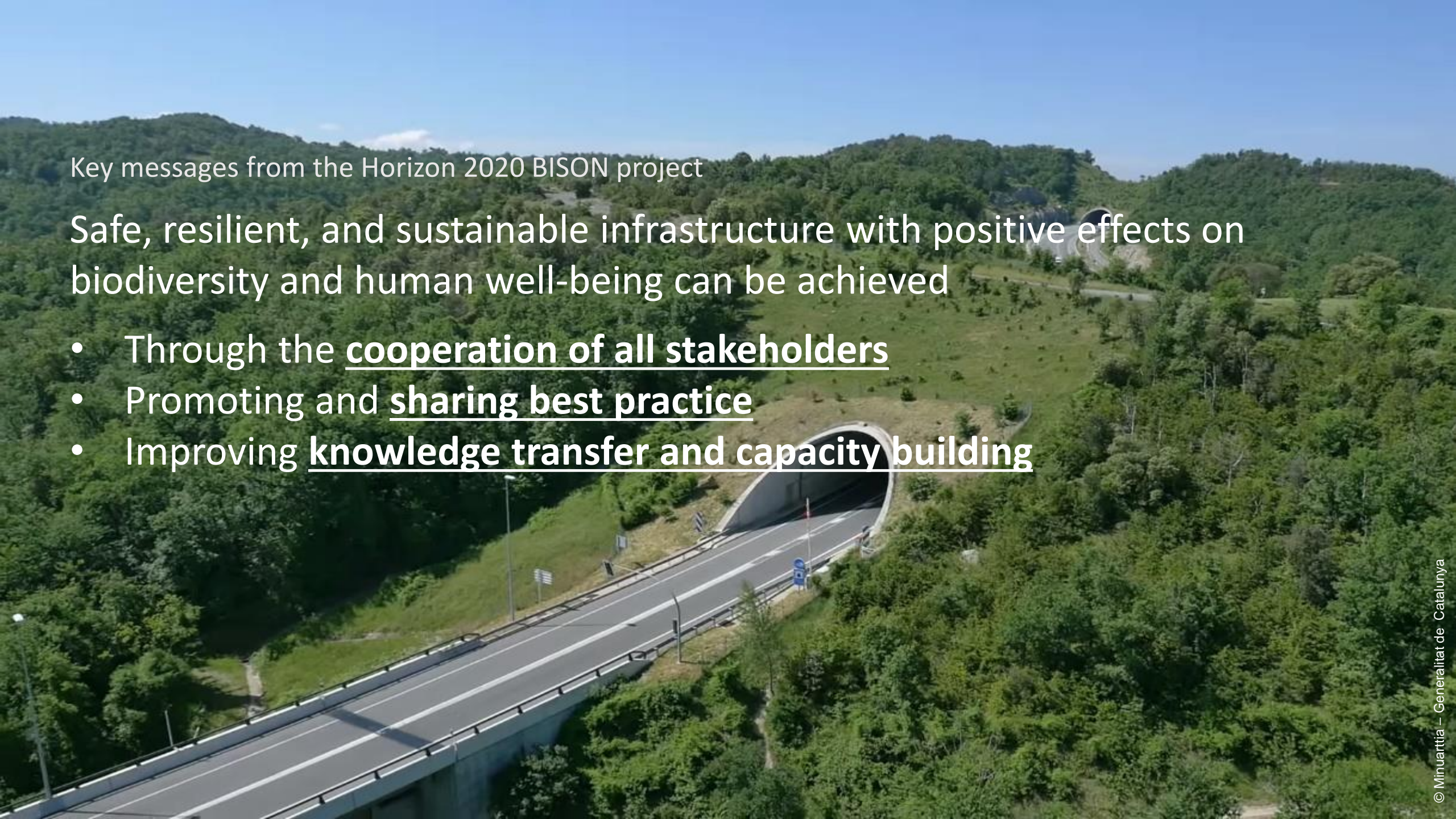
- To provide a clear and broader definition of "green infrastructure" at EU level and ensure its appropriate translation at national level.
- To integrate biodiversity and ecological connectivity into national transport policies and strategies.
- To mainstream biodiversity into the funding of EU programmes and the national budget for transport and all other sectors over time.
- To define entry points for mainstreaming biodiversity into all development sectors at national level, including national level policies and plans, at sectoral level, development cooperation programmes, local/regional level development plans and actions, and at project level.
- To apply the "polluter pays" principle, accounting not only for the effects of pollution, but also for the effects of the loss of ecological connectivity.

Strategic Research Development Agenda



BISON

BIODIVERSITY & INFRASTRUCTURE SYNERGIES AND OPPORTUNITIES FOR EUROPEAN TRANSPORT NETWORKS STRATEGIC RESEARCH AND DEPLOYMENT AGENDA

An aerial photograph showing a multi-lane highway bridge crossing a valley. The bridge leads to a tunnel entrance cut into a hillside. The surrounding landscape is lush with green trees and vegetation under a clear blue sky.

Key messages from the Horizon 2020 BISON project

Safe, resilient, and sustainable infrastructure with positive effects on biodiversity and human well-being can be achieved

- Through the cooperation of all stakeholders
- Promoting and sharing best practice
- Improving knowledge transfer and capacity building

The 'Making of' – Cooperative knowledge

70 people; 15 countries working together (BISON framework)

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Other external organisations



Bridging research and practice

A tool to provide ... and to gather knowledge

www.biodiversityinfrastructure.org



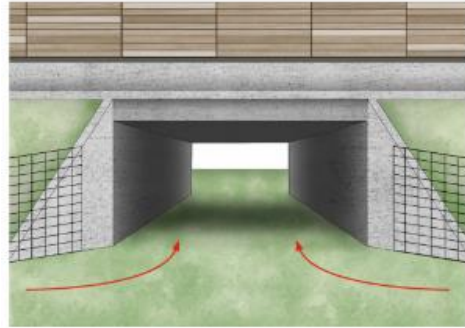
- Knowledge
- Needs for innovation and research ('non-mature' measures and technologies)



- Gather comments from users
- Compile new guidelines
- New knowledge and resources



Biodiversity and Infrastructure. A handbook for action



Source: Rosell et al., 2023

Knowledge

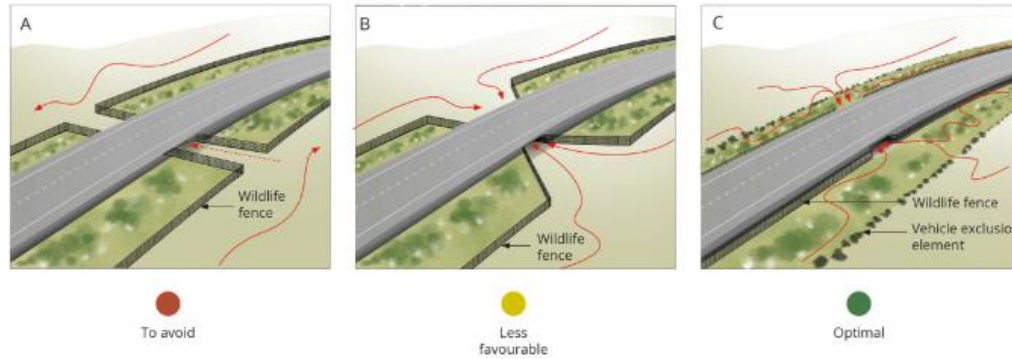
- ✓ Evidence-based
- ✓ Oriented to action
- ✓ Feasible and effective
- ✓ Innovative
- ✓ Useful for training



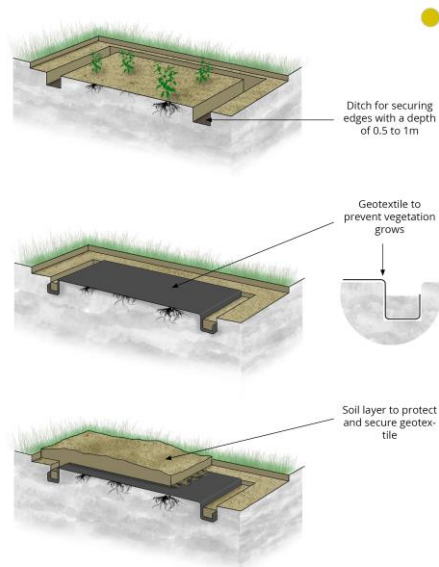
(BAST and Baader Concept)

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Fostering application of best practice



Rosell et al., 2023 (adapted from Cerema, 2021).



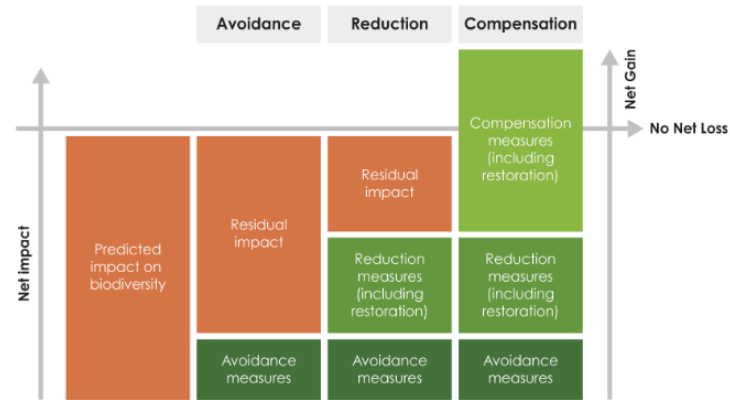
Rosell et al., 2023 (adapted from Bernd Walser, Regierungspräsidium Freiburg).

- To avoid
- Less favourable
- More research required
- Optimal

- ✓ Stop using ineffective measures
- ✓ Promote research to evaluate effectiveness
- ✓ Promote research to complete knowledge gaps

Biodiversity and Infrastructure. A handbook for action

300 pictures and 120 technical drawings and infographics

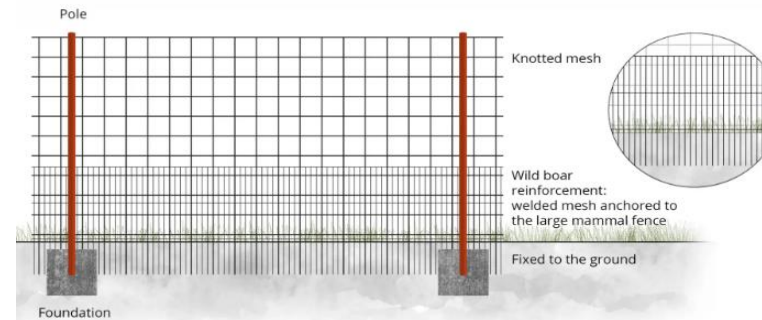


Source: Moulherat et al., 2023; adapted from BBOP, 2012

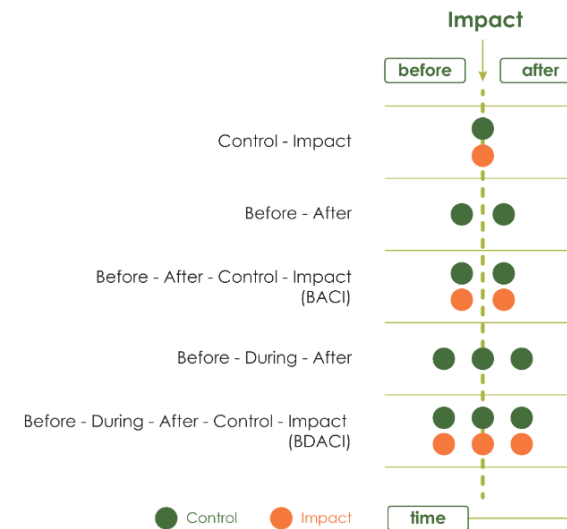
Screens to reduce noise and visual disturbance from traffic



Source: Rosell et al., 2023



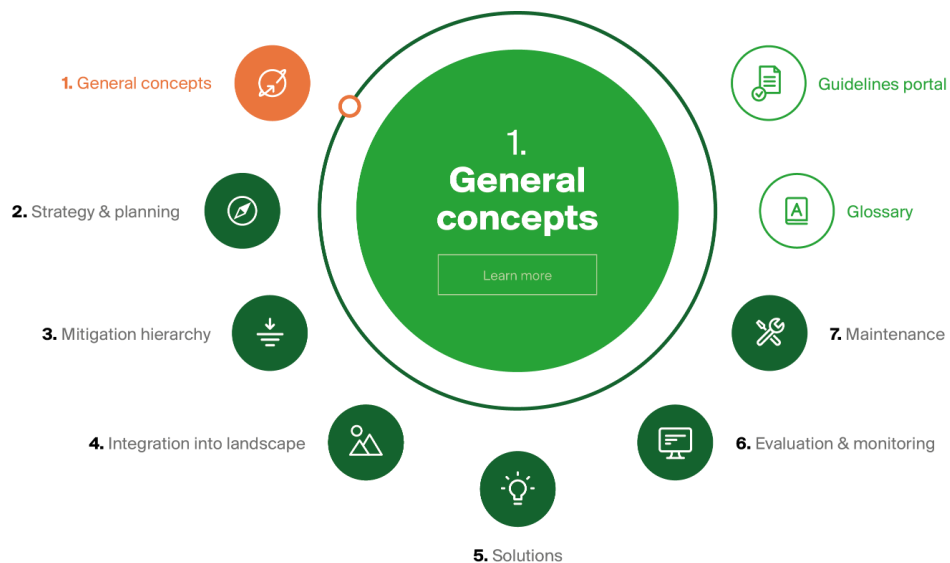
Source: Rosell et al., 2023



Source: Guinard et al., 2023; adapted from Sordello et al., 2019

Online handbook overview: 7 Chapters

www.biodiversityinfrastructure.org



Provides knowledge, solutions, and innovative measures to reduce the ecological impact of infrastructure and traffic.

Promotes the application of Nature-Based Solutions and encourages to reduce habitat fragmentation, enhance Green Infrastructure and restore nature.

Online handbook overview: a Glossary

‘Using a common vocabulary is the basis to undertake interdisciplinary cooperative work’

Cooperation with

- PIARC: Biodiversity Group & Technical Committee 3.4
- ISO TC 331 Working Group on Biodiversity.
- French Ministry for Ecological Transition



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Adapted viaduct

Large structure, usually supported by pillars or arches, which carries transport infrastructure and enables the preservation of valuable ecosystems and ecological corridors below the structure.

Preservation and restoration of continuous terrestrial, riparian and aquatic habitats below viaducts facilitate movement of multiple vertebrate and invertebrate species. Land uses and activities under the structure must be compatible with fauna movements and preservation of ecological connectivity. Viaducts must not be considered as **wildlife passage** when human disturbance or infrastructure with high traffic volume is beneath. Combined with perimeter fencing that funnels the animals to the structure and with light/noise screens to reduce disturbance when required. Synonym: 'Landscape underpass'.

Crossing

Designated or recognised place for people or fauna to cross from one side of a linear infrastructure to the other. The crossing site could be provided by an structure (overpass or underpass) or take place directly over the carriageway or railway. See also '**Wildlife Crossing**' '**Wildlife Passage**'.

Ecological asset

Items of the infrastructure that have an ecological value. It includes **wildlife** mitigation measures preventing impacts on **wildlife** and enhancing traffic safety such as fencing, **wildlife passage**, screens, adapted illumination and **wildlife** traffic signs. Drainage systems, road verges and other green areas associated with the infrastructure, managed in a way that supports **wildlife** conservation are also included.

Fauna passage

See '**Wildlife passage**'.

Wildlife crossing structure

See '**Wildlife passage**'.

Wildlife passage

Structure designed to facilitate the safe movement of **wildlife** across linear transport infrastructure, located over or under the infrastructure. It can be specifically designed for **wildlife** use or modified to combine **wildlife** crossing with other uses such as drainage and other. Synonyms: '**Wildlife** crossing structure', 'Fauna passage'.


Online handbook overview: a Guidelines portal


Access to projects, guidelines and standards on the topic


Biodiversity & Infrastructure
A handbook for action


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Guidelines portal

Transport Ecology

Country: World
Complementary info: TransportEcology.info aims to provide free resources for those involved in any types of linear infrastructure and transport in order to include the world's best ecological-practice in projects.

Global Congress for Linear Infrastructure and Environment (GCLIE)

Country: World
Complementary info: GCLIE will compliment the existing continental conferences on transportation ecology, through providing a platform that allows focus on broader, higher-level, global issues and policies that can influence national and international knowledge sharing and bring about positive change.

Biodiversity and infrastructure synergies and opportunities for European transport networks (BISON)

Country: Europe
Complementary info: EU-funded BISON project that will identify future research and innovation needs for a better integration of biodiversity with infrastructure planning, construction, operation and decommissioning.

Trame verte et bleue – resource centre

Country: france
Complementary info: The 'Trame verte et bleue' is a network made up of terrestrial and aquatic ecological continuities identified by regional schemes as well as by planning documents of the national and local authorities.

Category

- Any
- Publications (95)
- Projects
- Websites (16)

Search term

Enter keywords

Country

- Any
- Europe (4)
- World (3)
- france (2)
- Switzerland (2)
- Australia (1)
- Austria (1)
- Belgium (1)
- Spain (1)
- Sweden (1)


Language


- Any
- English (8)
- French (2)
- Dutch (1)
- France (1)
- Swedish (1)


Biodiversity & Infrastructure
A handbook for action


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Guidelines portal

Leidraad Faunavoorzieningen Bij Infrastructuur 2021

Country: Netherlands
Language: Dutch
Year: 2021

The Wildlife Fencing Guide : Reptiles, Amphibians & Small Mammals

Country: Global
Language: English
Year: 2021

Edge and Verge effects of transport infrastructure. Mitigating their impact on biodiversity

Country: Spain
Language: English
Year: 2021

Les passages à faune. Préserver et restaurer les continuités écologiques avec les infrastructures linéaires de transport

Country: France
Language: French
Year: 2021

Category

- Any
- Publications (95)
- Projects
- Websites (16)

Search term

Enter keywords

Country

- Any
- Ireland (12)
- France (11)
- Austria (9)
- Czech Republic (7)
- Netherlands (7)
- Spain (7)
- Belgium (6)
- Denmark (5)
- Germany (3)
- Italy (3)

Language

- Any
- English (38)
- Dutch (12)
- German (12)
- French (10)
- Spanish (6)

Agenda

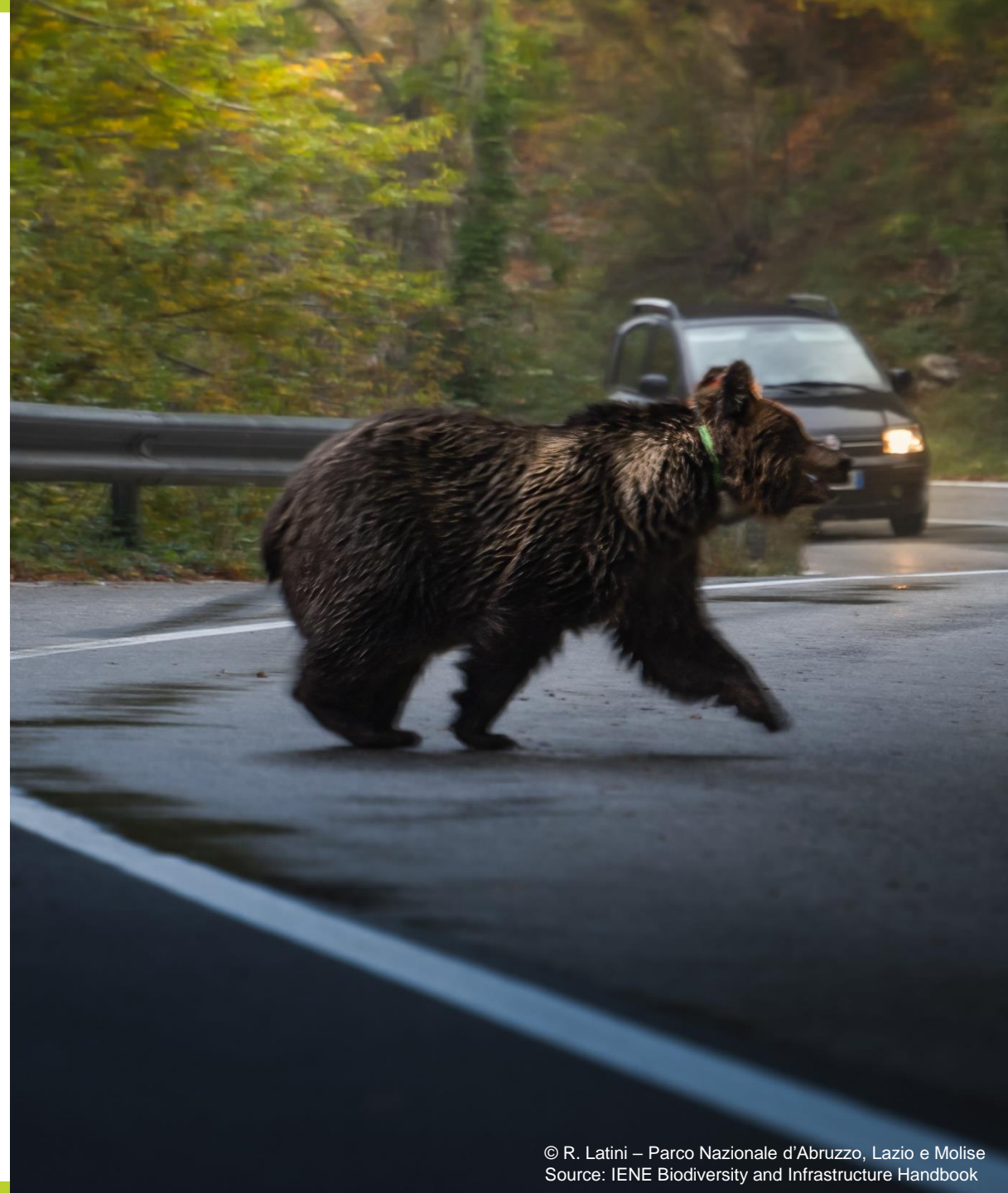
1. Introducing the tool

2. Search examples

- How to reduce amphibian mortality?
- What measures are available to protect bats?
- What should be considered at the 'Design' phase?
- How to provide feedback about a specific measure?
- What term must be used for a specific type of wildlife passage?
- Are there any guidelines in my language?

3. Chapter's contents

4. Future development

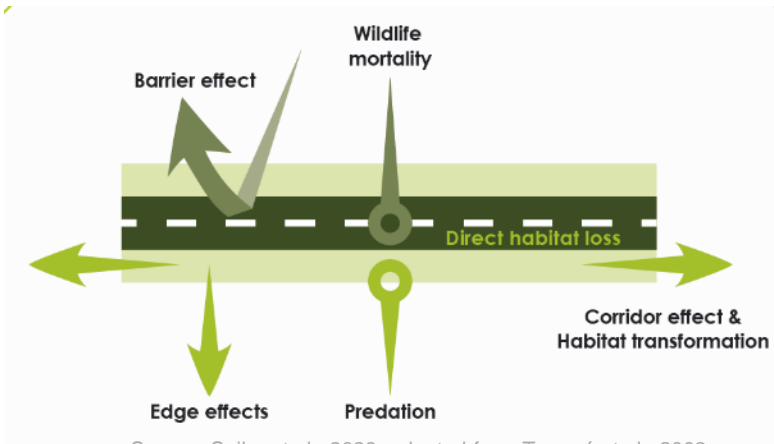


Agenda

1. Introducing the tool
2. Search examples
- 3. Chapter's contents**
4. Future development



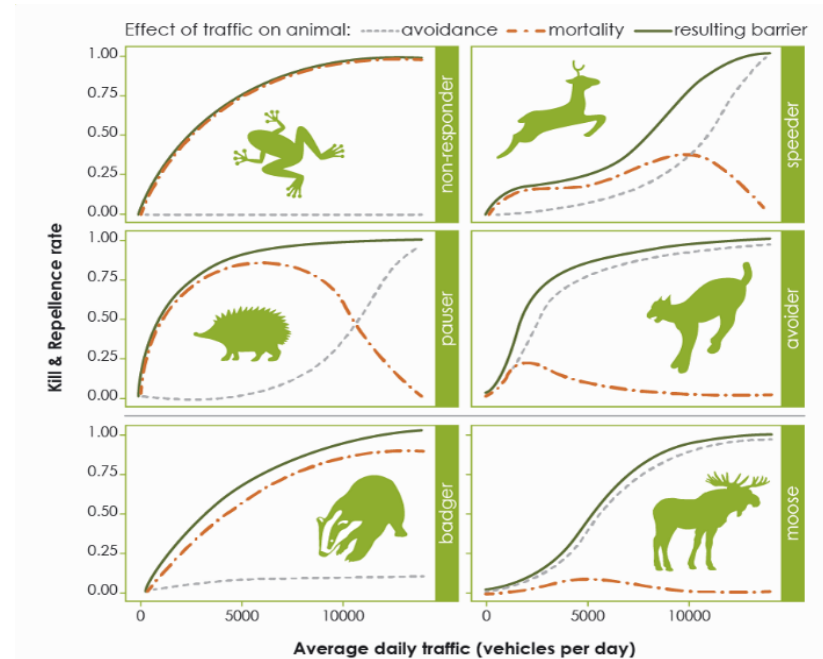
Ch 1. Ecological effects of infrastructure



Source: Seiler et al., 2023; adapted from Trocmé et al., 2003

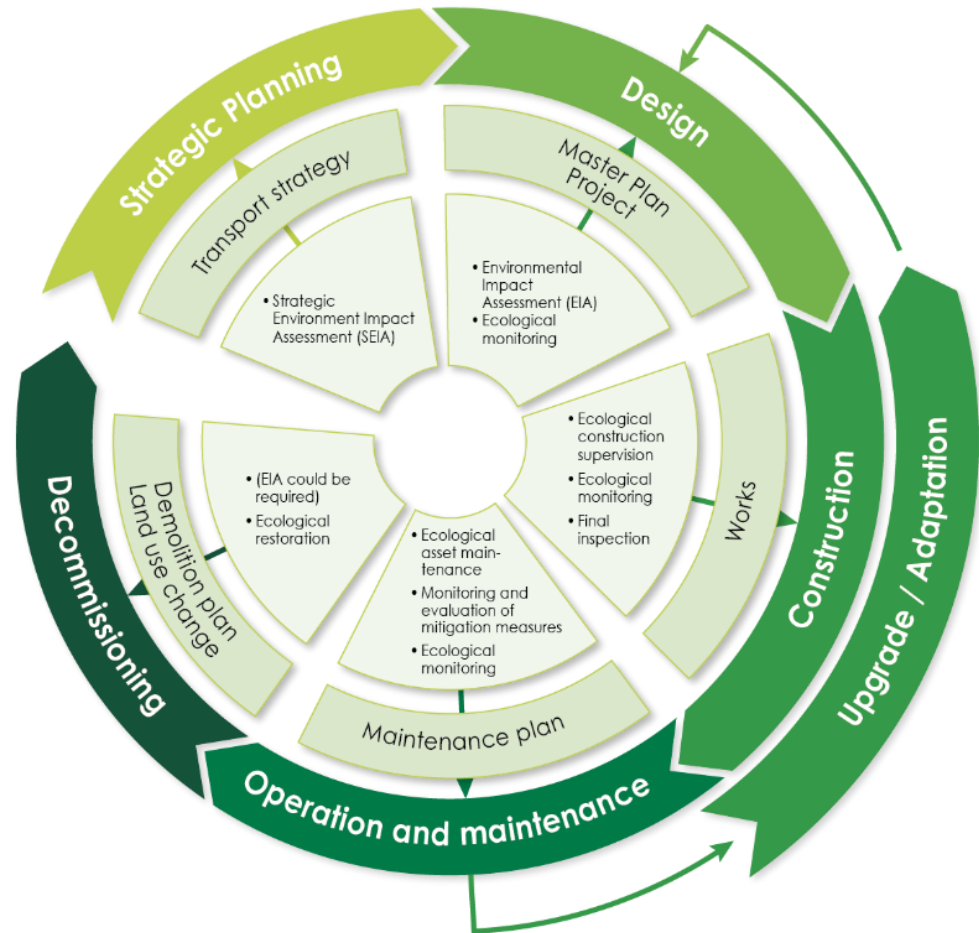


- Basic concepts
- Primary effects (Habitat loss; Wildlife mortality; Barrier effect; Edge effects; Habitat transformation)
- Secondary effects (Landscape fragmentation; Cumulative effects)
- References



Source: Seiler et al., 2023; adapted from Seiler et al 2016

Ch 2. Policy, strategy and planning

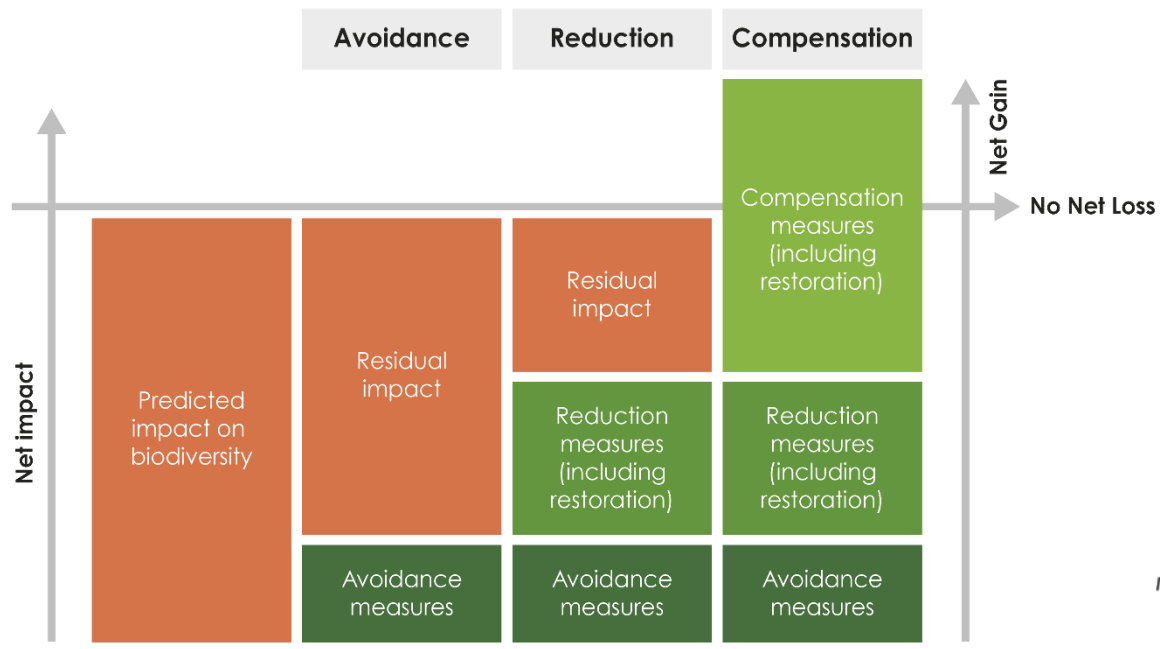


- Biodiversity within infrastructure life cycle
- Strategic planning
- Design
- Construction
- Operation and maintenance
- Decommissioning
- Upgrade/Adaptation

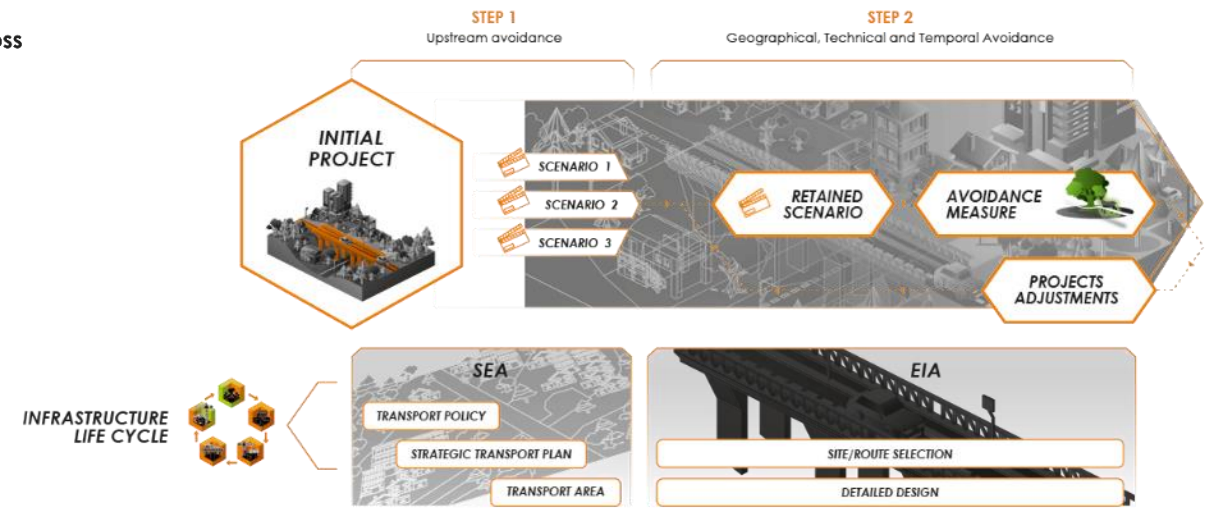
Source: Hlavac et al., 2023

Ch 3. The mitigation hierarchy

- Concept, regulation and practice
- Avoidance
- Reduction
- Compensation
- Cumulative effect management



Source: Moulherat et al., 2023; adapted from BBOP, 2012



Source: Moulherat et al., 2023

Ch 4. Integration of infrastructure into the landscape

Interconnection among main international sustainability goals concerned by transport infrastructure



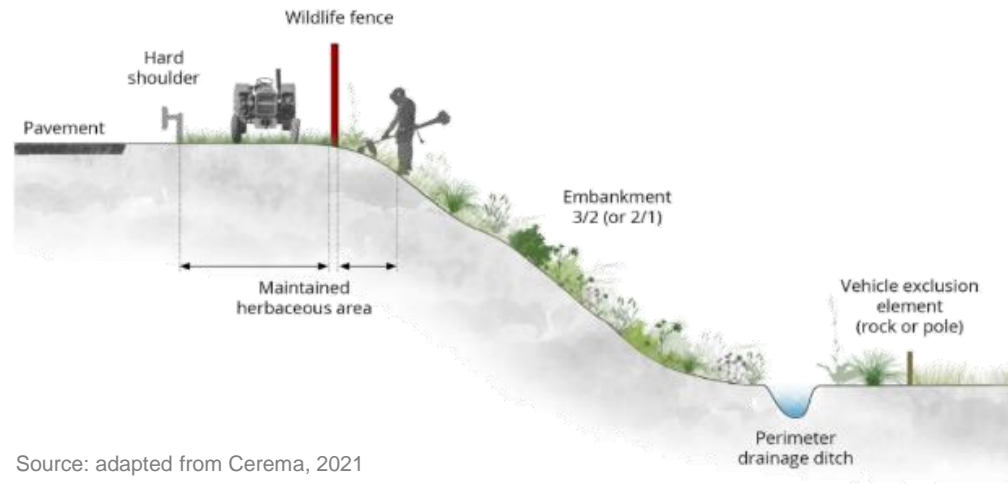
- Integrated landscape management
- Management at landscape scale
- Technical solutions to integrate transport infrastructure into the landscape



© C. Rosell

Source: Moulerat et al., 2023

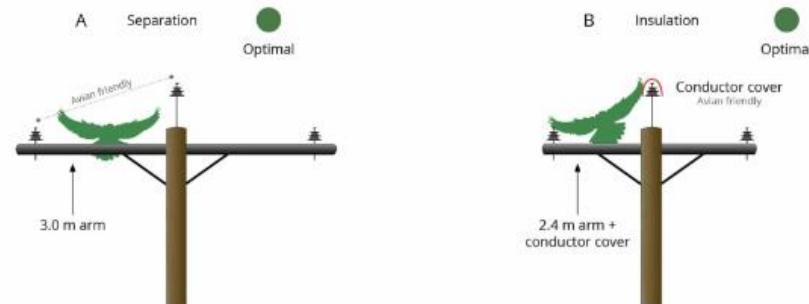
Ch 5. Solutions to mitigate impacts and benefit nature



Source: adapted from Cerema, 2021



Source: Rosell et al., 2023



- Fencing
- Driver warnings
- Wildlife deterrents
- Wildlife passages
- Measures to reduce disturbance
- Habitat related to transport infrastructure
- Invasive Alien Species (IAS)
- Adaptation of infrastructure to climate change: risks and opportunities for biodiversity
- Measures to reduce impacts from other transport modes



Ch 5. Solutions to mitigate impacts and benefit nature

Key measures contributing to preserve and restore ecological connectivity



© Minuartia

Landscape overpass
Ecoduct
Green bridge



© A. Seiler

Adapted viaduct
Landscape underpass



© Cerema

Wildlife overpass
Fauna overpass



© C. Boschi

Wildlife underpass
Fauna underpass



© F. Nowicki

Multiuse overpass

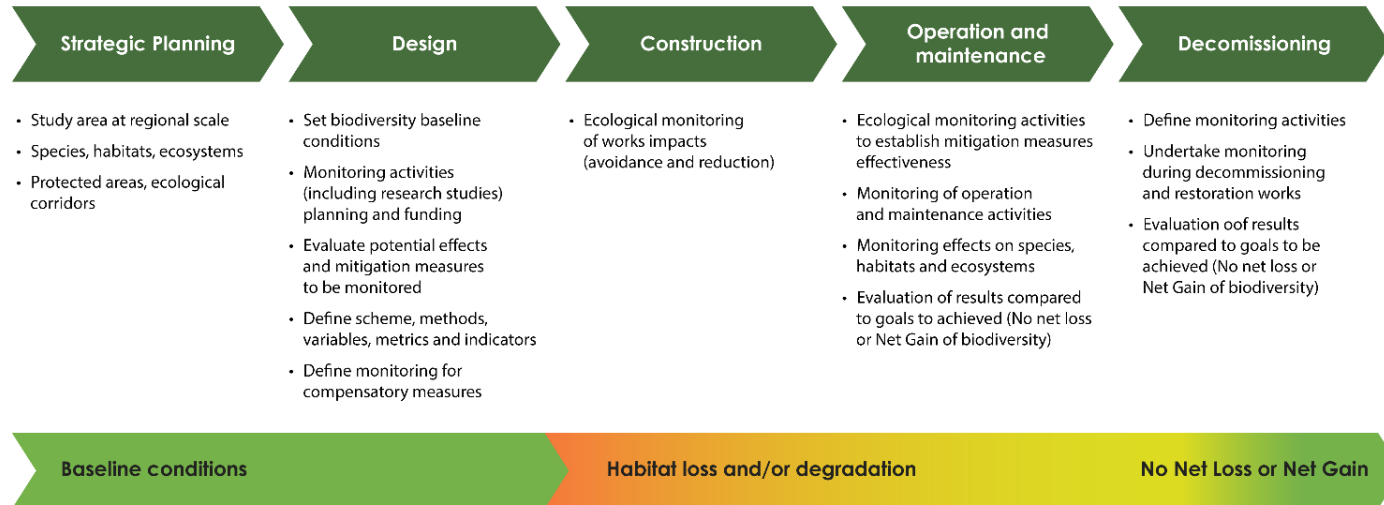


© Minuartia

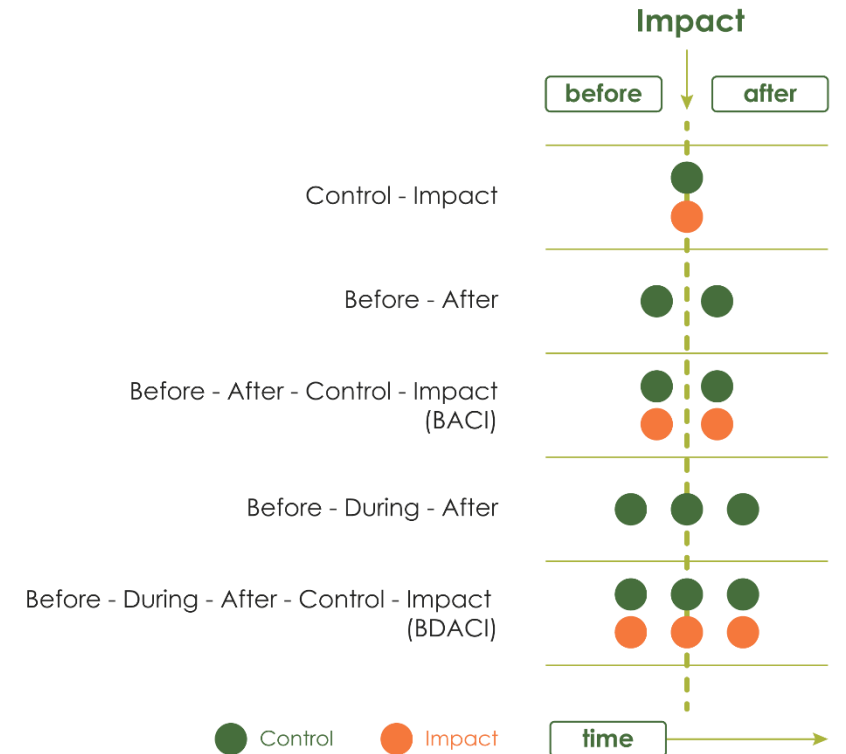
Multiuse underpass

Ch 6. Evaluation and monitoring

- General principles
- Monitoring plan
- Field techniques



Source: Guinard et al 2023, Adapted from CEREMA unpublished



Source: Guinard et al 2023. Adapted from Sordello et al., 2019

Ch 7. Maintenance

From: 'Wildlife and Traffic' Ch 10.
Produced in cooperation with CEDR

- Developing adaptive maintenance of ecological assets
- Maintenance requirements
- Maintenance tasks sheets



INSPECTION TASKS To check

- ☐ Poles are well-fixed to the ground and stable.
- ☐ Mesh is not broken or deformed.
- ☐ Mesh is well-fixed to the ground or to the protection against digging.
- ☐ Mesh is well-fixed to the crossing structure walls or to screens.
- ☐ Reinforcing mesh is well-anchored to the main mesh.
- ☐ Intersections of fences with perimeter drainage ditches are well-protected to stop animals from entering.
- ☐ Branches or other vegetation elements are not damaging the fence.

SPECIFIC MAINTENANCE TASKS To do

- Change any pole that is broken or damaged and fix any unstable posts.
- Repair or replace broken or deformed meshes. Replace any anchorages to fix the mesh to the poles and/or to the ground that are corroded or broken.
- Install reinforcement meshes or protection against digging by wild boar, rabbits or other target species when required. Anchor reinforcing elements to main fence and bury their bottom section into the ground.
- Consider replacing the existing fence when its design or materials are inappropriate, and it requires considerable effort and cost to maintain.
- Restrict access and/or educate and inform local stakeholders in case of repeated damage caused by people.
- Regularly mow and prune bushes or tree branches to avoid fence damage. Maintaining a narrow corridor along the fence free of trees and bushes allows field crews to undertake maintenance tasks.

SCHEDULE

- Minimum: once a year, just before seasonal migrations or periods when target species movements are increased.
- Mowing and pruning vegetation should be scheduled according to local conditions.
- More frequent inspection may be required in sections that are repeatedly damaged.
- Additional inspections should be planned following floods, strong winds, snow or other adverse weather events.



Biodiversity and Infrastructure Handbook. Ch 7 Maintenance of ecological asset on transport infrastructure.



INSPECTION TASKS To check

- ☐ Materials and drainage of the surface are appropriate.
- ☐ No human misuse of the structure is found.
- ☐ In multiuse overpasses, provisions to make human and wildlife uses compatible (guiding fences, informative panels, etc.) are appropriately maintained.
- ☐ Fences are continuous and anchored to wildlife passage entrances or to lateral screens.
- ☐ Any components of the screen remain stable and have not been damaged or stolen, and that there is good continuity with fences.
- ☐ Vegetation height, composition and patch design is consistent with the standards.
- ☐ No Invasive Alien Species are found.
- ☐ No debris or other objects pose obstacles or prevent the appropriate use of the wildlife passage.
- ☐ Any refuges for fauna such as stumps or stone rows are in good condition and in accordance with standards provided.

SPECIFIC MAINTENANCE TASKS To do

- Structural features and uses**
- Maintain or restore entrance areas to ensure these are free of obstacles to fauna movements and appropriately connected with the surrounding habitats.
 - Replace any elements damaged by vandalism.
 - In wildlife overpasses where no human use is planned, maintain appropriate state of the structures located at the entrances to avoid access of people and vehicles (large rocks, tree trunks or any other barrier).
 - Periodically clean, fix, repair or replace any informative panels and no entry signs.

- Fences and screens > see [Sheet 7.4.1](#)
- Replace broken or deformed meshes and repair any damage on screens.
 - Reinforce the anchorage of the mesh to the ground and poles when needed. If a reinforced mesh is already present, ensure it is well attached to the lower part of the fence.



Biodiversity and Infrastructure Handbook. Ch 7 Maintenance of ecological asset on transport infrastructure.

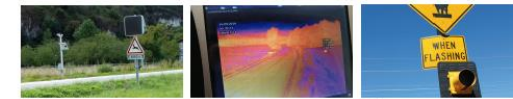


INSPECTION TASKS To check

- ☐ Signs are clean and well fixed.
- ☐ Signs are installed at hazardous road sections according to information provided in the maintenance plan.
- ☐ Signs are working correctly according to the below periodic tests:
 - Sensors to detect movement are in line with the target animal size.
 - Position and orientation of sensors is correct.
 - Sensors are not blocked by obstacles (e.g. rocks, vegetations or other objects) which impede the detection of the approaching animals.
 - Solar panels, batteries and connections function appropriately.
 - LED lights function appropriately when a detection event occurs.
 - The signs remain activated for the correct period depending on the target species' behaviour and crossing time.

SPECIFIC MAINTENANCE TASKS To do

- Clean the signs. Repair or replace when damage is detected.
- Replace batteries, solar panels or any other elements damaged by vandalism or theft.
- Keep the detection area and zones between the sensors and sign receivers free from branches, bushes or tall grass vegetation. Accumulation of snow during winter requires additional maintenance tasks.
- To save time checking the correct system function, consider ADS systems which allow remote control and testing.
- Add panels to inform drivers how the ADS system functions, warning them when sign is active, indicates the immediate danger of collision with an animal close to or on the road.
- After re-evaluation of AVC hazard risk, signs which no longer indicate the correct location of the hazardous stretch should be removed and/or relocated.



Biodiversity and Infrastructure Handbook. Ch 7 Maintenance of ecological asset on transport infrastructure.

Agenda

1. Introducing the tool
2. Search examples
3. Chapter's contents
4. **Future development**



What's next?

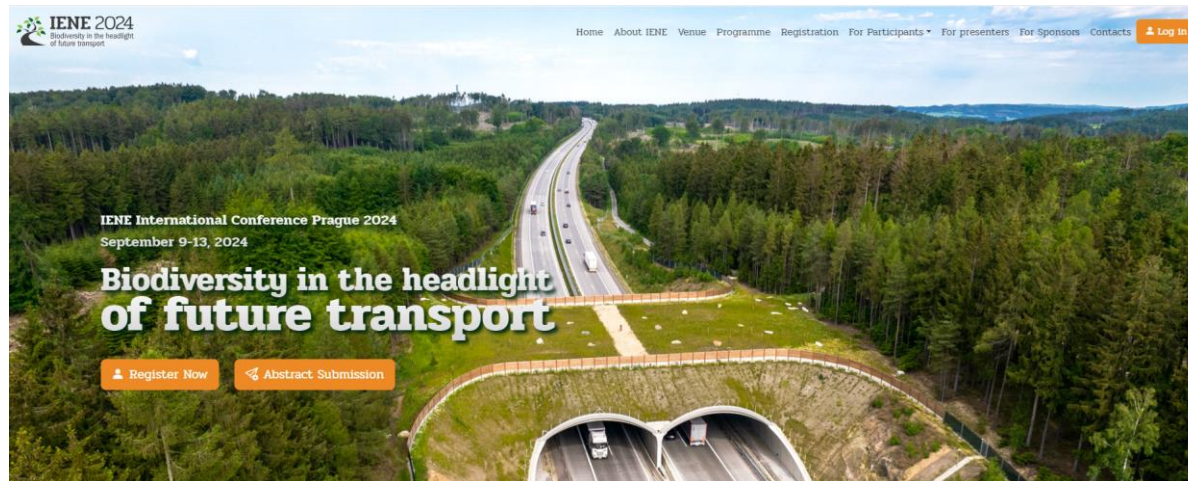
- IENE undertakes maintenance and update
- Handbook Working Group reactivates
IENE members are invited to join / Volunteers
Meetings: online (6 month) – presential at the IENE Conference
- Future works
 - **Continue the contents' update.** New topic: waterways, energy production
 - **Continue developing the Glossary.** Cooperation PIARC, UIC and other
 - **Website maintenance.** Include new guidelines, other resources
 - **Translation.** France already initiated (Glossary)
 - **To develop IENE Training Seminars.** Next one at the IENE Conferences 2024
 - **Search for funding.** Apply to new Calls; sponsorship



Any idea to improve future handbook development and cooperation is welcome. Thank you!

Access the handbook at <https://www.biodiversityinfrastructure.org/>

Join us at the IENE 2024 Conference on Ecology and Transportation (Prague Sep 9-13, 2024)



IENE - BISON project - Minuartia - Cerema - UPGE