

Workshops to Disseminate the Handbook to Mitigate the Impacts of Roads and Railways on Asian Elephants

Fernanda Z. Teixeira^{1,2*}, Nilanga Jayasinghe^{1,3,4}, Sandeep Kumar Tiwari^{1,4,5}, Rob Ament^{1,2}, Kezang Yangden⁶, Tandin⁶, Sonam Wangdi^{4,7}, Cheryl Cheah^{4,8}, Ee Phin Wong^{1,4,9} and Yun Wang^{1,10}

¹IUCN WCPA-CCSG/SSC-AsESG Asian Elephant Transport Working Group;

²Center for Large Landscape Conservation; ³WWF-US;

⁴IUCN SSC Asian Elephant Specialist Group; ⁵Wildlife Trust of India; ⁶WWF-Bhutan;

⁷Nature Conservation Division of the Department of Forests and Park Services, Bhutan;

⁸WWF-Malaysia; ⁹The University of Nottingham Malaysia;

¹⁰China Academy of Transportation Sciences, MOT, PRC

*Corresponding author's e-mail: fernandateixeira@largelandscapes.org

Introduction

Linear infrastructure has been identified by Asian elephant range countries as a significant threat to elephant conservation. In the 2017 Jakarta Declaration, range states committed to reducing habitat impacts from infrastructure and incorporating elephant movement into development planning. In response, the Asian Elephant Transport Working Group (AsETWG), a joint initiative of the IUCN World Commission on Protected Areas (WCPA) Connectivity Conservation Specialist Group (CCSG) and the IUCN Species Survival Commission (SSC) Asian Elephant Specialist Group (AsESG), was formed in 2018 to support Asia's 13 elephant range countries in integrating wildlife-friendly considerations into linear infrastructure development. A key output of the AsETWG was the Handbook to Mitigate the Impacts of Roads and Railways on Asian Elephants, published in 2024.

This handbook provides the first set of guidelines for designing elephant-specific crossing structures and offers strategies to reduce wildlife-infrastructure conflict. It offers practical, evidence-based recommendations for minimising harm to elephants throughout the lifecycle of infrastructure projects. Key components include avoidance measures (such as alternative siting or rerouting of the transport corridor) and mitigation solutions (including underpasses and overpasses designed for elephants).

Following the handbook's release, the AsETWG has engaged partners and governments across Asia to share knowledge, build capacity, promote research, and support conservation initiatives addressing the impacts of linear transport infrastructure on elephants. The group briefed representatives from 13 range countries on the handbook's recommendations to minimise the negative impacts of linear infrastructure on Asian elephants at the 4th Annual Asian Elephant Range States meeting in Siem Reap, Cambodia in February 2025; to AsESG and range state forest officials in Vietnam in September 2025; and to transport experts and government officials at the 3rd Asia Transportation Ecology Forum in Beijing in October 2025.

Workshops form a central part of this effort, bringing practitioners together to apply the handbook's recommendations in local contexts. As part of this goal to socialise the handbook in Asian elephant range countries, two in-person workshops were held, one in Bhutan and the other in Sabah, Malaysia, in early 2025. The workshops brought together government agencies, infrastructure planners, engineers, researchers, and conservation partners with the aim of advancing wildlife-friendly infrastructure planning and implementation across range countries. The first two workshops were held through a collaboration between the AsETWG, the Center for Large Landscape Conservation, WWF-Bhutan, WWF-Malaysia, and government agencies from the two host countries. The

workshops aimed to apply the handbook's principles and strengthen technical capacity among stakeholders to support infrastructure development that balances conservation and development objectives.

Workshop in Bhutan

From March 25–27, 2025, Bhutan hosted its first Wildlife-Friendly Infrastructure Training Workshop in Thimphu. Around 50 participants from 27 institutions attended (Fig. 1), including highway engineers involved in major national projects such as the Gelephu Mindfulness City, as well as representatives from government departments, NGOs, and funding agencies. The workshop, which focused on wildlife-friendly infrastructure at a national level, included technical sessions led by the AsETWG on the handbook's content, current evidence on the impacts of linear infrastructure on wildlife, and examples of mitigation measures and best practices.

The Bhutan Highways Connectivity Master Plan to 2040 was presented by the Department of Surface Transport, outlining the country's approach to improving transport connectivity while maintaining ecological integrity. Discussions focused on integrating wildlife-friendly infrastructure into policy and planning frameworks, and participants collaboratively identified national capacity needs and outlined priority actions. The workshop concluded with a session in which participants proposed a roadmap for short-, medium-, and long-term actions, in-

cluding capacity building and the development of national guidelines for mitigating the impacts of linear infrastructure on wildlife to support Bhutan's sustainable development objectives.

Workshop in Sabah, Malaysia

From May 6–9, 2025, the Workshop on Constructing Wildlife-Friendly Infrastructure was held in the Maliau Basin Conservation Area in Sabah, Malaysia. The event brought together 45 participants (Fig. 2) representing government agencies, non-governmental organisations, and an environmental consultancy agency. The workshop, which was largely focused on reducing the impacts of the Phase 3 of the Pan Borneo Highway, provided a platform for sharing cross-sectoral experiences related to sustainable road infrastructure, including presentations by the Department of Wildlife and National Parks Peninsular Malaysia (PERHILITAN) and the Public Works Department, drawing on mitigation measures and monitoring data from Peninsular Malaysia.

The workshop included a field visit to existing wildlife crossing structures within the Maliau Basin Conservation Area, as well as to high-biodiversity sites along a single-lane road scheduled for upgrading under Phase 3 of the Pan Borneo Highway Project in Sabah. This project aims to connect the towns of Tawau and Keningau, crossing remote districts of Kalabakan and Pensiangan, which traverse protected areas with primary forest and important elephant movement corridors. As planning and



Figure 1. Workshop participants in Thimphu, Bhutan (Photo: WWF-Bhutan).

budget allocation for Phase 3 had not yet taken place, discussions focused on co-developing preliminary recommendations for wildlife-friendly design options for the project.

The workshop concluded with a synthesis of recommended mitigation measures, including extended elevated highway sections (viaducts or flyovers) at critical locations along Phase 3 of the Pan Borneo Highway Project. Broader recommendations for government action were also identified, including early stakeholder engagement, project feasibility assessments, cost-benefit analyses, improved data sharing between NGOs and government agencies, and adaptation of the AsETWG handbook guidelines to the Sabah context.

Lessons learned and next steps

The workshops focused on disseminating the handbook and facilitating discussion on wildlife-friendly infrastructure with key stakeholders. With core objectives aligned, the workshop agendas were adapted by local counterparts to national contexts, structuring the flow to enable

sharing, feedback, disagreement, and consensus building. In Bhutan, discussions emphasised the integration of wildlife-friendly infrastructure into higher-level policy frameworks and the identification of national capacity needs. In Sabah, discussions focused primarily on Phase 3 of the Pan Borneo Highway Project, reflecting lessons learned from previous infrastructure projects and highlighting the importance of addressing environmental considerations and budgeting for biodiversity safeguards early in the planning process.

Plans are underway to further disseminate the handbook across Asia and to support the implementation of wildlife-friendly infrastructure in elephant range countries. Additional workshops are planned in other range states, and the handbook is being translated into several Asian languages in response to interest from government representatives. Through these efforts, as well as through continued technical advice on infrastructure projects, the AsETWG will continue to support improved planning and design of linear infrastructure to reduce impacts on Asian elephants, other wildlife, and their habitats.



Figure 2. Workshop participants at the Maliau Basin Conservation Area in Sabah, Malaysia (Photo: WWF-Malaysia).