BUILDING A FOUNDATION FOR LINEAR INFRASTRUCTURE SAFEGUARDS IN ASIA

MODULE 4.

BEST PRACTICES FOR DATA COLLECTION AND MITIGATION
PART 1

1. IMPACTS OF LI
2. MITIGATION HIERARCHY
   - Case study – Nepal
3. DATA NEEDS:
   - Pre & Post Construction?
   - Methods
   - Case studies

PART 2

1. CASE FOR WILDLIFE CROSSINGS
   - Effective measures
   - Considerations for design
2. ENGAGING BIOLOGISTS
   - Case study – China
3. 5 MOST IMPORTANT POINTS
4. LOOKING FORWARD

*Invited presenter
BIODIVERSITY IS DECLINING ACROSS THE GLOBE AT AN UNPRECEDENTED RATE.

Approximately 50 to 70% of the Earth’s land surface currently modified for human activities* 

HABITAT LOSS AND FRAGMENTATION - CAUSED BY NATURE

Hurricanes – Fires – Drought – Insect outbreaks ....

Credit: Ian Turnell from Pexels
HABITAT LOSS AND FRAGMENTATION – CAUSED BY HUMANS
A PAVED PLANET:
- 25 million km of new road lanes
- 300,000 km new railway tracks

Asia is Global Biodiversity Hotspot

Among 25 of the world’s biodiversity hot spots, 7 are in Asia*

Without proper safeguards, ongoing and anticipated expansion of LI will further fragment habitat, increase wildlife mortality, and threaten biodiversity.

LISA PROJECT TASKS

**Conduct**
- Conduct spatial analyses of LI projects most likely to impact biodiversity and critical habitats

**Synthesize**
- Synthesize research to understand the impacts of LI on wildlife and critical habitats

**Compile**
- Compile case studies of exemplary wildlife-friendly LI projects and provide cautionary examples

**Examine**
- Examine capacities regarding policies, regulations and resources for adopting LI safeguards

**Identify**
- Identify opportunities and barriers for implementing biodiversity safeguards in key countries

**Develop**
- Develop training materials for a capacity building program
LINEAR INFRASTRUCTURE (LI) – ROADS, RAILS, AND TRANSMISSION LINES

Impacts of LI

Direct effects

Indirect effects

LI Effect Zone

D. Mortality
E. Pollution
F. Human settlement

Credit: Asian Elephant Transport Working Group / Center for Large Landscape Conservation
MODULE 4
Conservation of Biodiversity and Wildlife Populations
HABITAT

...is a place where an organism makes its home.

...meets all the environmental conditions an organism needs to survive.

.....everything it needs to find and gather food, select a mate, and successfully reproduce

Credit: Ian Clevenger
HABITAT LOSS AND FRAGMENTATION Vs. ROADS
HABITAT CORRIDORS

Components of the landscape that facilitate the movement of organisms and processes between areas of intact habitat.

Credit: Center for Large Landscape Conservation
LANDSCAPE PERMEABILITY

Keeping Connections Intact

✔ OVERPASSES
  ✔ Tunnels
✔ UNDERPASSES
  ✔ Flyovers
✔ FENCING
  ✔ No fence
MITIGATION HIERARCHY

1. AVOID
2. MINIMIZE / MITIGATE
3. COMPENSATE
4. RED FLAG PROJECTS
MITIGATION HIERARCHY

AVOIDANCE

PROPOSED

PROTECTED AREA

AVOIDANCE ALIGNMENT
CASE STUDY – NEPAL RAILWAY
—Case Study Presenter:

Pramod Neupane,
Sustainable Infrastructure Programs Manager,
WWF Nepal
The case of shifting of Railway Alignment to avoid Chitwan National Park in Nepal

Pramod Neupane
Manager
Sustainable Infrastructure Programs
WWF-Nepal

AVOIDANCE
MITIGATION HIERARCHY

COMPENSATE
(OFFSETS)
RED FLAG PROJECTS

“If you can’t build well, then build nothing at all”

W. Laurance

ENVIRONMENTAL IMPACT ASSESSMENTS

GENERAL IN DESCRIPTION OF IMPACTS
Physical, Ecological, Social, Cultural

“CATEGORY A” – Need greater scrutiny and detail
Baseline Biodiversity Assessment (BBA)

Who does this? – Subject matter experts
PRE-CONSTRUCTION DATA COLLECTION

BIODIVERSITY BASELINE ASSESSMENTS (BBA)

Category A projects
WILDLIFE DATA NEEDS FOR PLANNING

What data do we need to collect?

What are the impacts?

“The objectives”

1. Mortality hotspots
   - Existing LI
   - New alignment?

2. Species occurrence

Credit: Wenjing Xu
DATA OUTPUTS
Results of field data collection

Road-kill hot spots/clusters (transects, surveys)
  - Species occurrence
  - Location
  - Severity of impact

Species Occurrence (detection methods, modelling)
  - Distribution
  - Corridors
  - Modelling Connectivity

Credit: Rob Ament
METHODS

SYSTEMATIC SEASONAL DATA

SURVEY APP USED
- DEAD WILDLIFE
- LIVE OBSERVATIONS
- ROAD CROSSINGS

Credit T Clevenger:
CASE STUDY - NH-37
Kaziranga National Park
Assam, India

ROaDS
METHODS

Camera Trap Surveys
METHODS

Canopy Camera Trap

Arboreal Canopy-dwellers

CAMERA TRAPS

Photo-classification of “Raw Data”

Credit: T Clevenger
Sign Surveys

Wildlife species: Small to large

Credit: T Clevenger
METHODS
UNDERPASS MONITORING (EXISTING)

Camera traps
Tracking mediums:
  Sand
  Sooted track plates

Credit: T Clevenger
ASIAN DEVELOPMENT BANK
Biodiversity Baseline Assessment (BBA)
Pre Construction data collection
Phipsoo case study

Credit: Karma Chogyel
CASE STUDY: BHUTAN

- Mountainous country with high biodiversity
- 52% of country in Protected Areas
- Road Network Project II (East-West Highway)

Southern Bhutan road projects:
- NH2 and NH 5
- NH2 within Phipsoo Wildlife Sanctuary
CASE STUDY: BHUTAN

• EIA conducted: NH 2 & NH5 road projects:
  *Wildlife Crossings recommended*

• BBA for Phipsoo Wildlife Sanctuary (2014-15)
  *1st BBA in Bhutan*

• Surveys in 4 zones
  *Border lowlands to upper foothills*
  Terrain, elevation, vegetation differences
CASE STUDY: BHUTAN

BBA Design
- Desktop screening of IUCN listed species
- Camera trapping
- Forest vegetation inventory
- Avian surveys

SURVEY: 38 Cameras/33 sites (6 months)
- 4300 mammal images
- 27 species, 15 species IUCN-listed (2 Critically End.)
CASE STUDY: BHUTAN

BBA – LESSONS LEARNED

1. Pre-construction data critically important for informed decisions

2. Biodiversity values:
   Highest in Core; Lowest on Border
   Re-alignment recommended (Avoidance, no net loss)

3. Project resulted in 1st wildlife crossing in Bhutan

   Road construction cancelled . . . .
   Security and safety issues along Indian border
MOBEMENT/CONNECTIVITY

Narayanghat-Hetauda-Pathlaiya Road near Chitwan NP, Nepal

Models Used

**Identify:**
- Critical habitats
- Movement corridors
- LI–Wildlife conflict areas

Credit: T. Clevenger
SPATIAL ANALYSIS

SNOW LEOPARD - MONGOLIA

Species occurrence

Predicting LI impacts
SPATIAL ANALYSIS

KAZAKHSTAN  - - Center-West Road Planning
SAIGA ANTELOPE (Betpak-Dala population)

Home range use LI/Surface layers

Impacts on crossings:
  2% paved roads
  16% dirt road
  81% no road
POST-CONSTRUCTION DATA COLLECTION

MITIGATION EVALUATIONS & ASSESSMENTS
MITIGATION OBJECTIVES

REDUCE MORTALITY

CONNECT POPULATIONS
Monitoring Helps Inform Design

USE OF PASSAGE TYPE/DESIGN

Grizzly bears – Trans-Canada Highway
Banff National Park, Canada

Clevenger et al. Unpublished data.
MONITORING OF MEASURES
BEFORE-AFTER CONTROL-IMPACT (BACI)

BEFORE-No fencing

AFTER fencing

No fencing

Credit: T Clevenger

Clevenger, unpublished data
Monitoring of Measures
Before-After Control-Impact (BACI)

Movements and Population Connectivity

Increased movements will result in:
- Demographic connectivity (Breeding females)
- Genetic connectivity (Increased genetic diversity)

Long-term population viability!
True or False:

The mitigation hierarchy is used in the late stage of planning to help locate mitigation measures.
True or False:

Biodiversity Baseline Assessments provide greater detail than Environmental Impact Assessments?
Which of these methods of data collection is not used to detect wildlife species?

a. Camera traps
b. Observations
c. Satellite imagery
d. Surveys searching for sign (e.g. faeces, tracks)
THE CASE FOR WILDLIFE CROSSINGS
PROVEN MITIGATION MEASURES

• Warning signs
• Vegetation removal
• Fencing
• Relocation
• Animal Detection System (ADS)
• Crossing structures
• Speed reduction
WILDLIFE CROSSING DESIGN TYPES

**Overpass Design:**
1. Landscape bridge
2. Wildlife overpass
3. Multi-use overpass
4. Canopy crossing

**Underpass Design:**
5. Viaduct/flyover
6. Large mammal underpass
7. Multi-use underpass
8. Underpass with water flow
9. Small/medium-sized mammal underpass
10. Modified culvert design
11. Herpetile tunnel

Credit: T Clevenger
FENCING IS BY FAR MOST EFFECTIVE

VARIED DESIGNS
Species needs

MATERIALS
Page/woven wire
Barrier walls
Synthetic fabric
EFFECTIVE MEASURES

50 - Research papers reviewed*

“the combination of fencing and crossing structures led to an 83% reduction in road-kill of large mammals, compared to a 57% reduction for animal detection systems, and only a 1% for wildlife reflectors”.

THE CASE FOR WILDLIFE CROSSINGS
PROVEN MITIGATION MEASURES

Bhutan

Credit: Karma Chogyel

Credit: N Dodd
THE CASE FOR WILDLIFE CROSSINGS
PROVEN MITIGATION MEASURES

4.8 x 30m wildlife underpass

Bangladesh
THE CASE FOR WILDLIFE CROSSINGS
PROVEN MITIGATION MEASURES

Credit: Department of Railway, Nepal
THE CASE FOR WILDLIFE CROSSINGS
PROVEN MITIGATION MEASURES

3 Segments – Viaducts Planned
THE CASE FOR WILDLIFE CROSSINGS

METHODS

MONITORING MITIGATION MEASURES

Credit: T Clevenger
THE CASE FOR WILDLIFE CROSSINGS

PLANNING CONSIDERATIONS
SPACING INTERVAL & HOW MANY ??

THE CASE FOR WILDLIFE CROSSINGS

PLANNING CONSIDERATIONS

DESIGN TYPE ?

FOCAL SPECIES ?

MULTI-SPECIES ??
THE CASE FOR WILDLIFE CROSSINGS

PLANNING CONSIDERATIONS
Over or Under?? What Passage Type is Best??

Credit T Clevenger:
THE CASE FOR WILDLIFE CROSSINGS

PLANNING CONSIDERATIONS

Fencing / Barrier Wall

Credit: Rob Ament
THE CASE FOR WILDLIFE CROSSINGS

PLANNING CONSIDERATIONS
Human Use and Disturbance

Credit: T Clevenger
THE CASE FOR WILDLIFE CROSSINGS
RESOURCES AVAILABLE TODAY

GREEN INFRASTRUCTURE DESIGN FOR TRANSPORT PROJECTS
A ROAD MAP TO PROTECTING ASIA'S WILDLIFE BIODIVERSITY

DECEMBER 2019

ASIAN DEVELOPMENT BANK

ADB Handbook

Asian Development Bank

Wildlife Institute of India
WILDLIFE CROSSING STRUCTURE HANDBOOK
Design and Evaluation in North America

Publication No. FHWA-CFL/TD-11-003
March 2011

Central Federal Lands Highway Division
1200 West Dakota Avenue
Lakewood, CO 80228

U.S. Department of Transportation
Federal Highway Administration
Lesson Learned from USAID LISA Case Studies

1. **LI projects need to use most current science** in terms of study design and methods used to assess impacts on key biodiversity and wildlife populations.

2. **Subject matter experts with extensive experience in assessment of LI impacts and design of biodiversity safeguards are critical** to ensure projects meet international standards and best practices are employed.

3. **Post-construction monitoring of safeguards with sufficient budgets** are needed to properly evaluate performance and project mitigation objectives are met.

4. Lessons learned from post-construction monitoring of safeguards should be used to inform future plans and design on projects in Asia.
Case Study Presenter:

Wenjing Xu, Fifth year PhD candidate, University of California, Berkeley.
ADAPTATION/LEARNING

How long do we need to monitor use?

Species-specific trends, Banff NP, 1997-2008

Credit: Clevenger et al. 2009
COMMON QUESTION AND MISCONCEPTION

Aren’t Crossings Prey Traps?
It is important to evaluate mitigation measures because:

a. Others can learn from each project results
b. Mitigation measures are costly
c. Results of evaluations can help adjust future designs
d. All of the above
Which of these is a critical part of the success of wildlife crossing structures?

a. Government endorsement
b. Local community support
c. Fencing
d. Hunting near wildlife crossing structures
e. None of the above
THE CASE FOR WILDLIFE CROSSINGS

5 MOST IMPORTANT POINTS TO REMEMBER

1. LOCATION:
2. SCIENCE-BASED DATA:
3. DESIGN FOR MULTI-SPECIES: But focal drives design
4. RETROFITS: Easy and low-cost
5. MONITOR PERFORMANCE: Good investments?

PROVEN EFFECTIVE! – 2 Decades of research
LOOKING FORWARD

AMBITIOUS LI PROGRAM IN ASIA

CAPACITY BUILDING IMPROVING

PROJECT APPROVALS & INCREASING CAPACITY
The need for rapid change in practices

ROLE OF MODEL PROJECTS TO CHANGE PRACTICES
Compelling evidence for implementation
QUESTION AND ANSWER SESSION

CONTACT:
MARY MELNYK: mmelnyk@usaid.gov
ROB AMENT: rament@largelandscapes.org

Milind Parikawam