

SUGGESTED MEASURES TO MITIGATE  
ASIAN ELEPHANT - TRAIN COLLISIONS  
ON VULNERABLE RAILWAY STRETCHES

IN THE STATE OF

# ODISHA

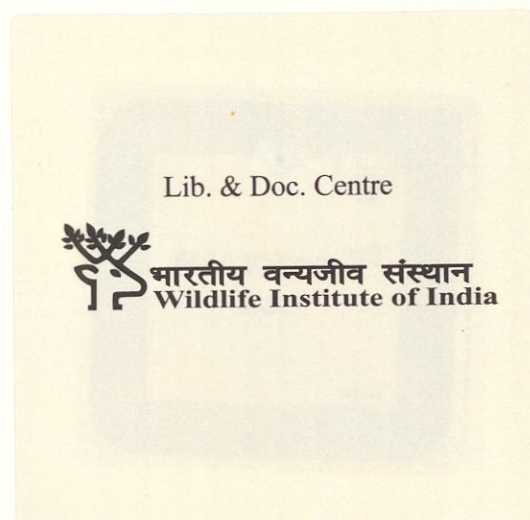


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Wildlife Institute of India

**AUGUST 2024**

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ASIAN ELEPHANT - TRAIN COLLISIONS  
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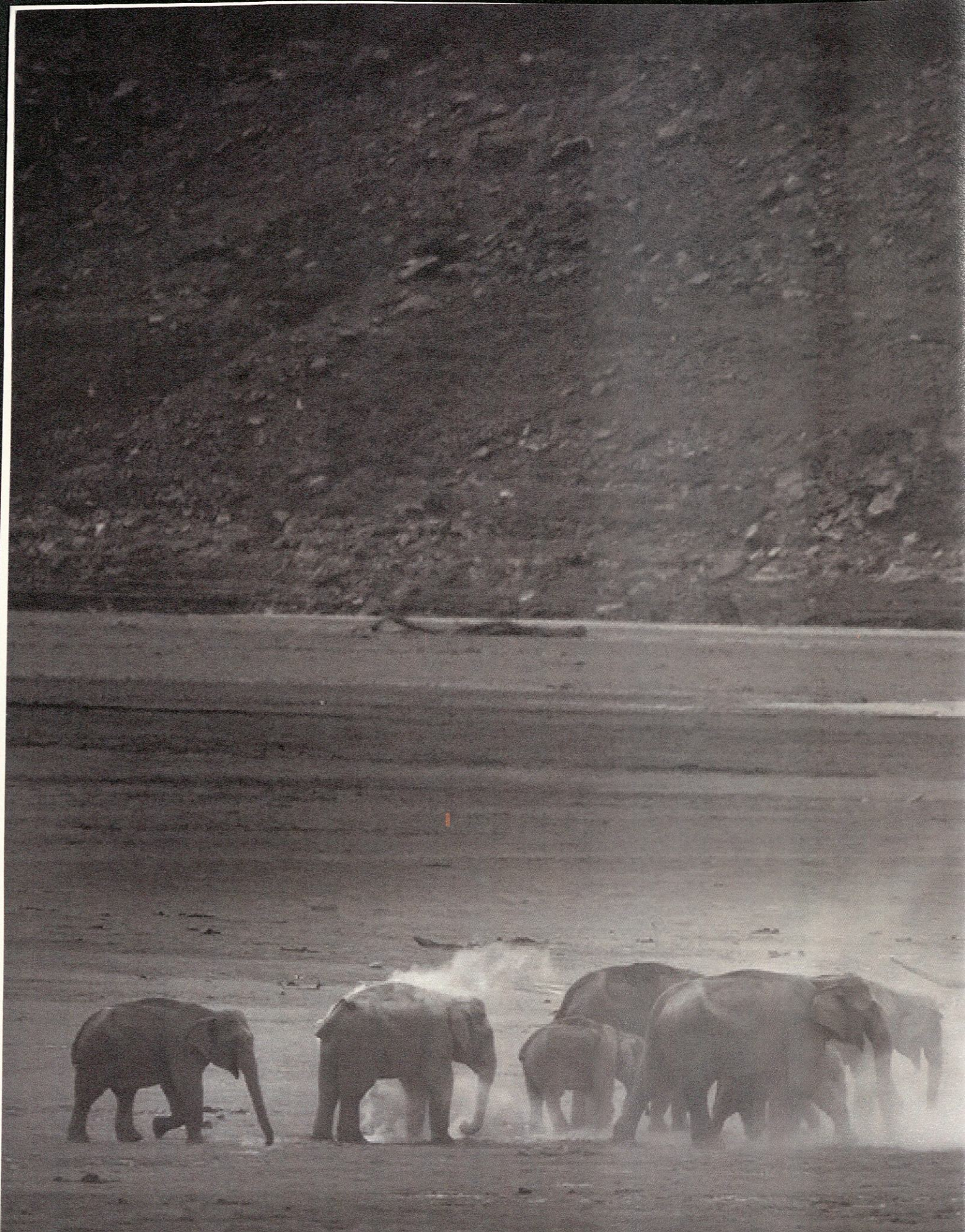
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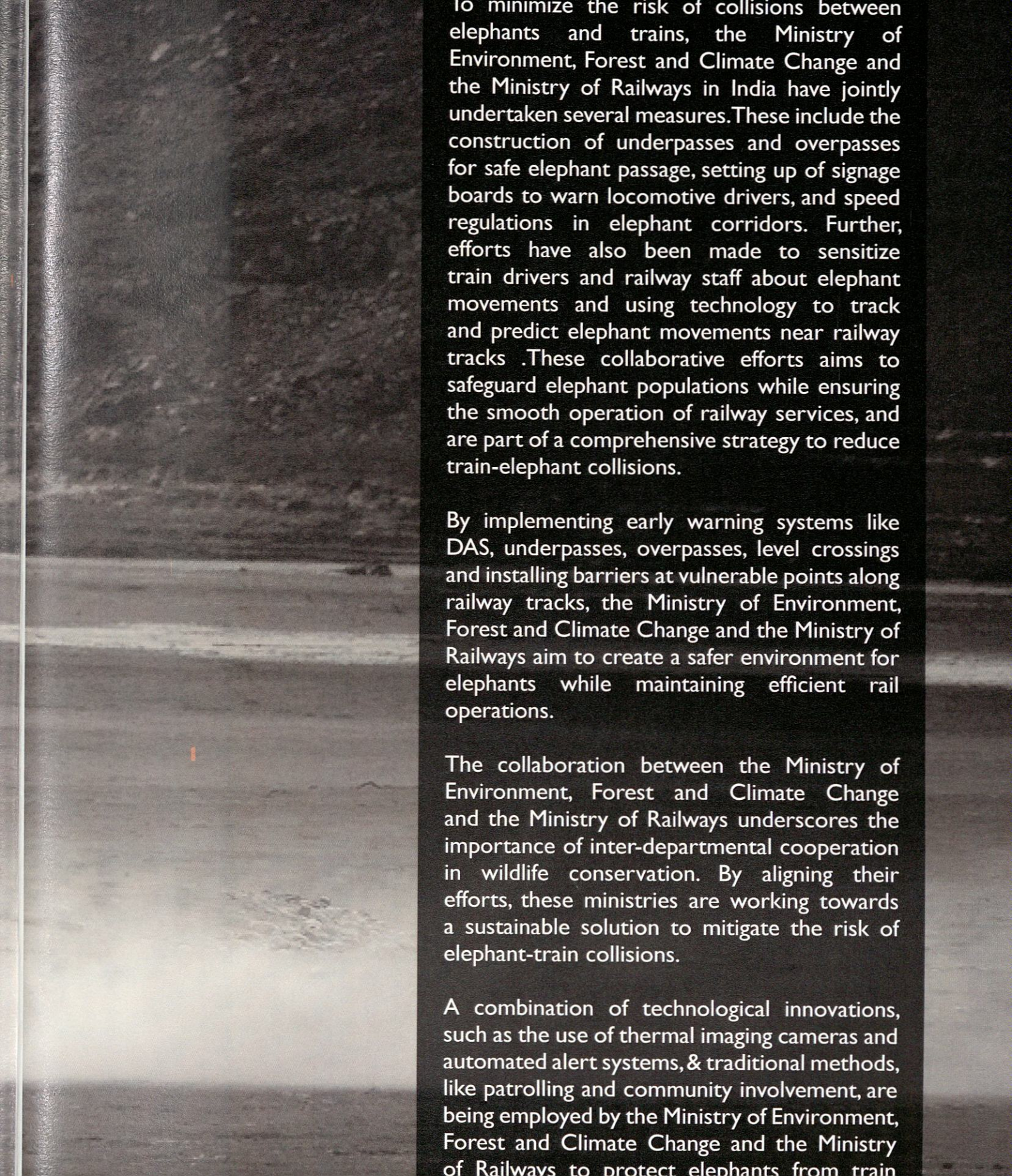
# ODISHA



भारतीय वन्यजीव संस्थान  
Wildlife Institute of India

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To minimize the risk of collisions between elephants and trains, the Ministry of Environment, Forest and Climate Change and the Ministry of Railways in India have jointly undertaken several measures. These include the construction of underpasses and overpasses for safe elephant passage, setting up of signage boards to warn locomotive drivers, and speed regulations in elephant corridors. Further, efforts have also been made to sensitize train drivers and railway staff about elephant movements and using technology to track and predict elephant movements near railway tracks. These collaborative efforts aim to safeguard elephant populations while ensuring the smooth operation of railway services, and are part of a comprehensive strategy to reduce train-elephant collisions.

By implementing early warning systems like DAS, underpasses, overpasses, level crossings and installing barriers at vulnerable points along railway tracks, the Ministry of Environment, Forest and Climate Change and the Ministry of Railways aim to create a safer environment for elephants while maintaining efficient rail operations.

The collaboration between the Ministry of Environment, Forest and Climate Change and the Ministry of Railways underscores the importance of inter-departmental cooperation in wildlife conservation. By aligning their efforts, these ministries are working towards a sustainable solution to mitigate the risk of elephant-train collisions.

A combination of technological innovations, such as the use of thermal imaging cameras and automated alert systems, & traditional methods, like patrolling and community involvement, are being employed by the Ministry of Environment, Forest and Climate Change and the Ministry of Railways to protect elephants from train

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**Shri Bhupender Yadav**  
Hon'ble Minister, Environment, Forest and  
Climate Change, Govt. of India

**Shri Kirtivardhan Singh**  
Hon'ble Minister of State, Environment,  
Forest and Climate Change, Govt. of India

**Shri Ashwini Vaishnav**  
Hon'ble Minister, Ministry of Railways, Govt. of India

**Shri V. Somana**  
Hon'ble Minister of State, Ministry of Railways, Govt. of India

**Shri Ranveet Singh**  
Hon'ble Minister of State, Ministry of Railways, Govt. of India

**Ministry of Environment, Forest and Climate Change, Govt. of India**

**Ms. Leena Nandan**  
Secretary, MoEF&CC

**Shri Jitendra Kumar**  
Director General of Forest & Special Secretary, MoEF&CC

**Sh. C. P. Goyal**  
Former Director General of Forest &  
Special Secretary, MoEF&CC

**Dr. S. P. Yadav**  
Former ADG. (PT & E), MoEF&CC

**Dr. G. S. Bharadwaj**  
ADG. (PT & E), MoEF&CC

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**Principal Chief Conservators of Forests (Wildlife) of Elephant Range States**

**Ministry of Railways, Govt. of India**

**Ms. Jaya Varma Sinha**  
Chairman & Chief Executive Officer, Railway Board

**Shri. Anil Kumar Lahoti**  
Former, Chairman & Chief Executive Officer,  
Railway Board

**Shri. Vinay Kumar Tripathi**  
Former, Chairman & Chief Executive Officer,  
Railway Board

**Shri Anil Kumar Khandelwal**  
Member Infrastructure

**Shri N. C. Karmali**  
ED (Coord.)/Gati Shakti

**Shri. Kamlesh Gosai**  
ED/Gati Shakti (Traffic)

**Shri Dhananjaya Singh**  
ED/GS(Civil)-II

**General Managers and Divisional Railway Managers of Various Railway Zones**

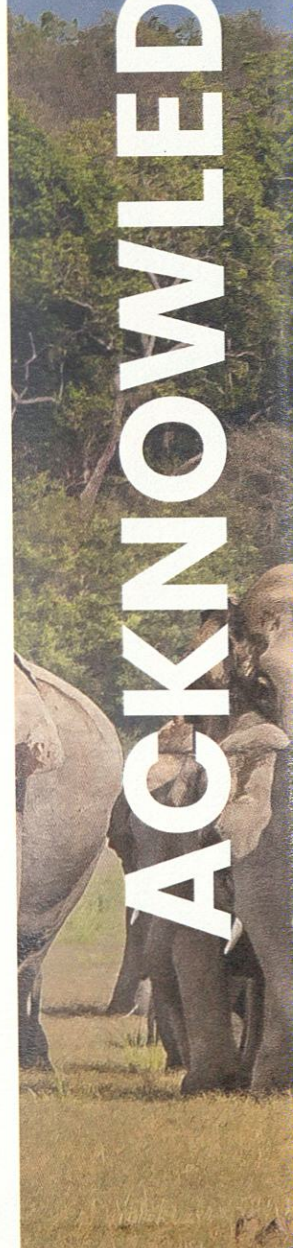
**Wildlife Institute of India**

**Dr. Ruchi Badola**  
Dean, FWS, WII

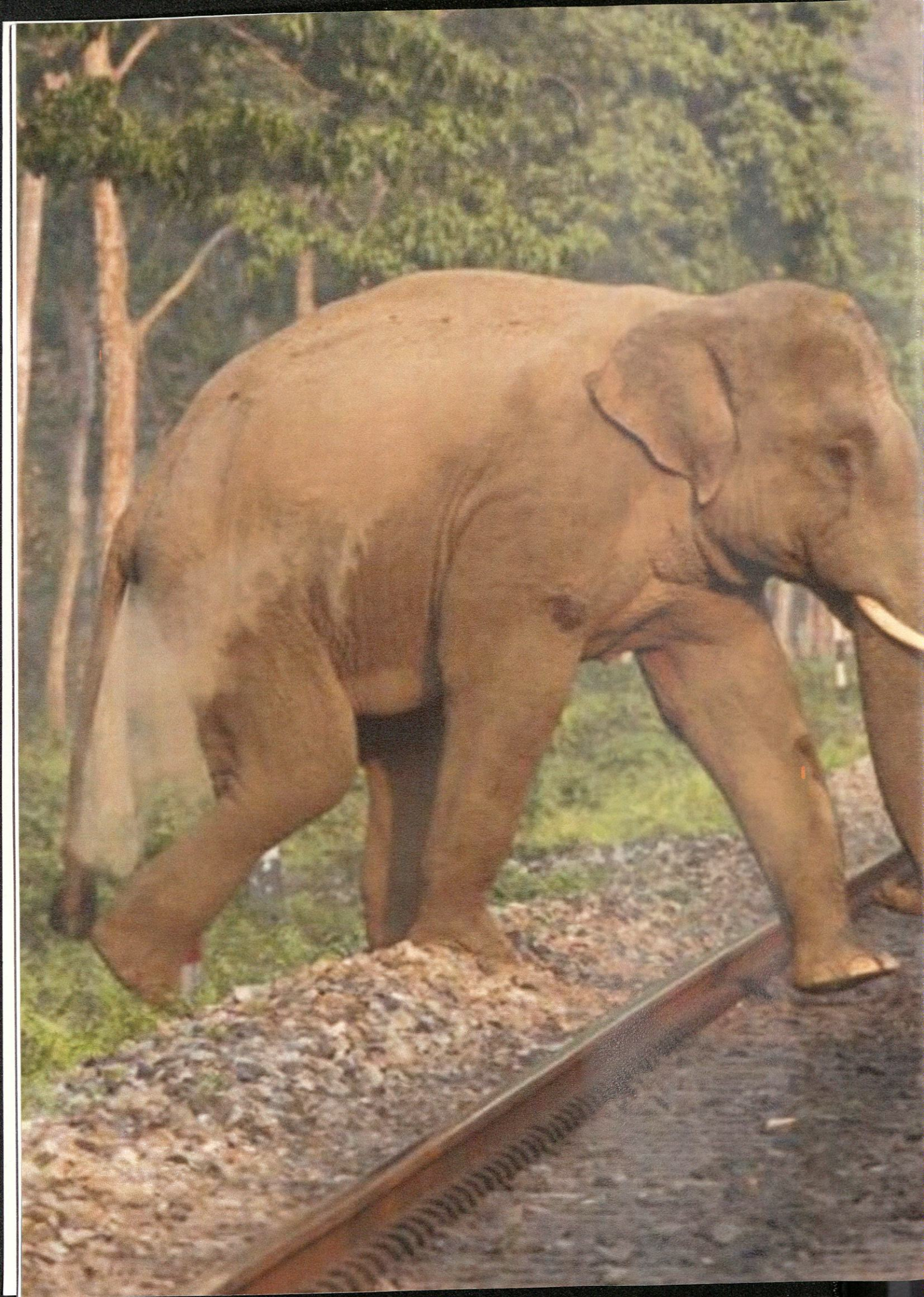
**Dr. S. Sathyakumar**  
Scientist G/Registrar, WII

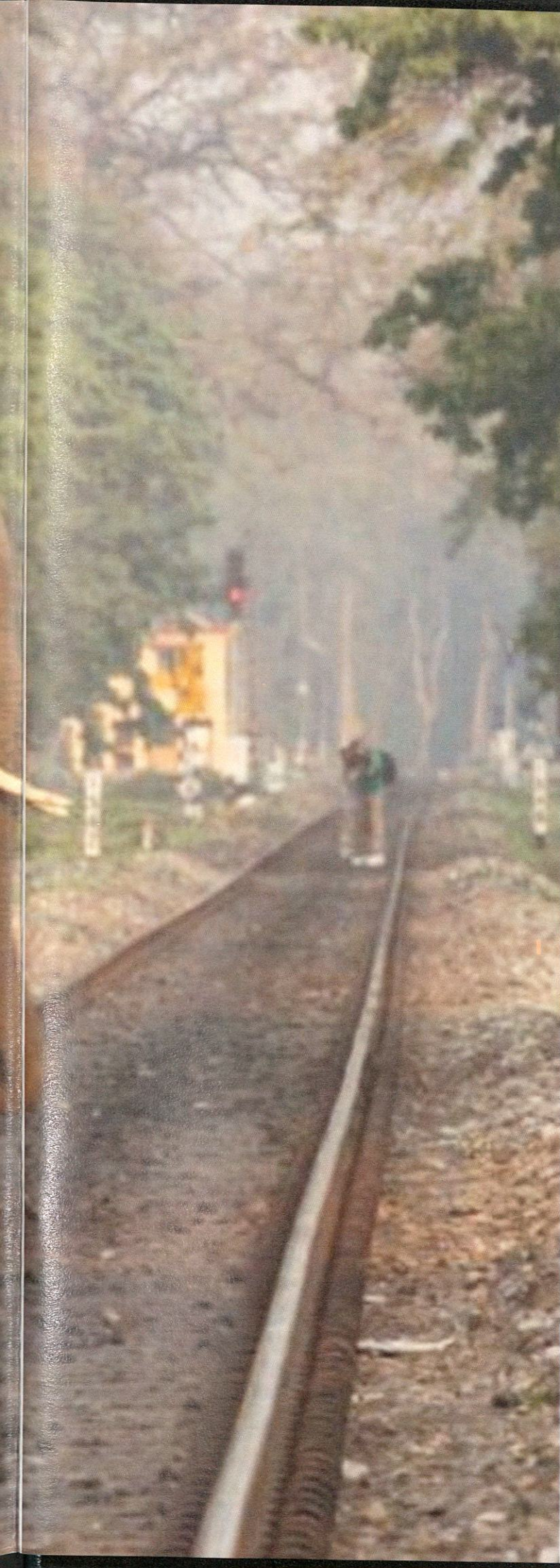
**Dr. Bivash Pandav**  
Scientist G/Research Coordinator

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**Ministry of Environment, Forest and  
Climate Change, Govt. of India**

**Shri Ramesh K. Pandey**  
*IG, (PT & E), MoEFCC*

**Dr. Dheeraj Mittal**  
*AIGF, (PT & E), MoEF&CC*

**Dr. Dharmendra Gupta**  
*Director (S), (PT & E), MoEF&CC*

**Dr. K. Muthamizh Selvan**  
*Addl. Director (S), (PT & E), MoEF&CC*

**Dr. Rajendra Kumar**  
*Scientist D, (PT & E), MoEF&CC*

**Ministry of Railways, Govt. of India**

**Shri Anil Kumar Khandelwal**  
*Member Infrastructure*

**Shri. Kamlesh Gosai**  
*ED/Gati Shakti (Traffic)*

**Shri Dhananjaya Singh**  
*ED/GS(Civil)-II*

**Wildlife Institute of India**

**Sh. Virendra R. Tiwari**  
*Director*

**Dr. Parag Nigam**  
*Scientist G & NO Elephant Cell*

**Dr. Bilal Habib**  
*Scientist F & ANO Elephant Cell*

**Dr. Lakshminarayanan**  
*Project Scientist*

**Sh. Udhayaraj A. D.**  
*GIS Expert*

**Core Coordination Team**

**Dr. Bilal Habib**  
*Scientist F & ANO Elephant Cell, WII*

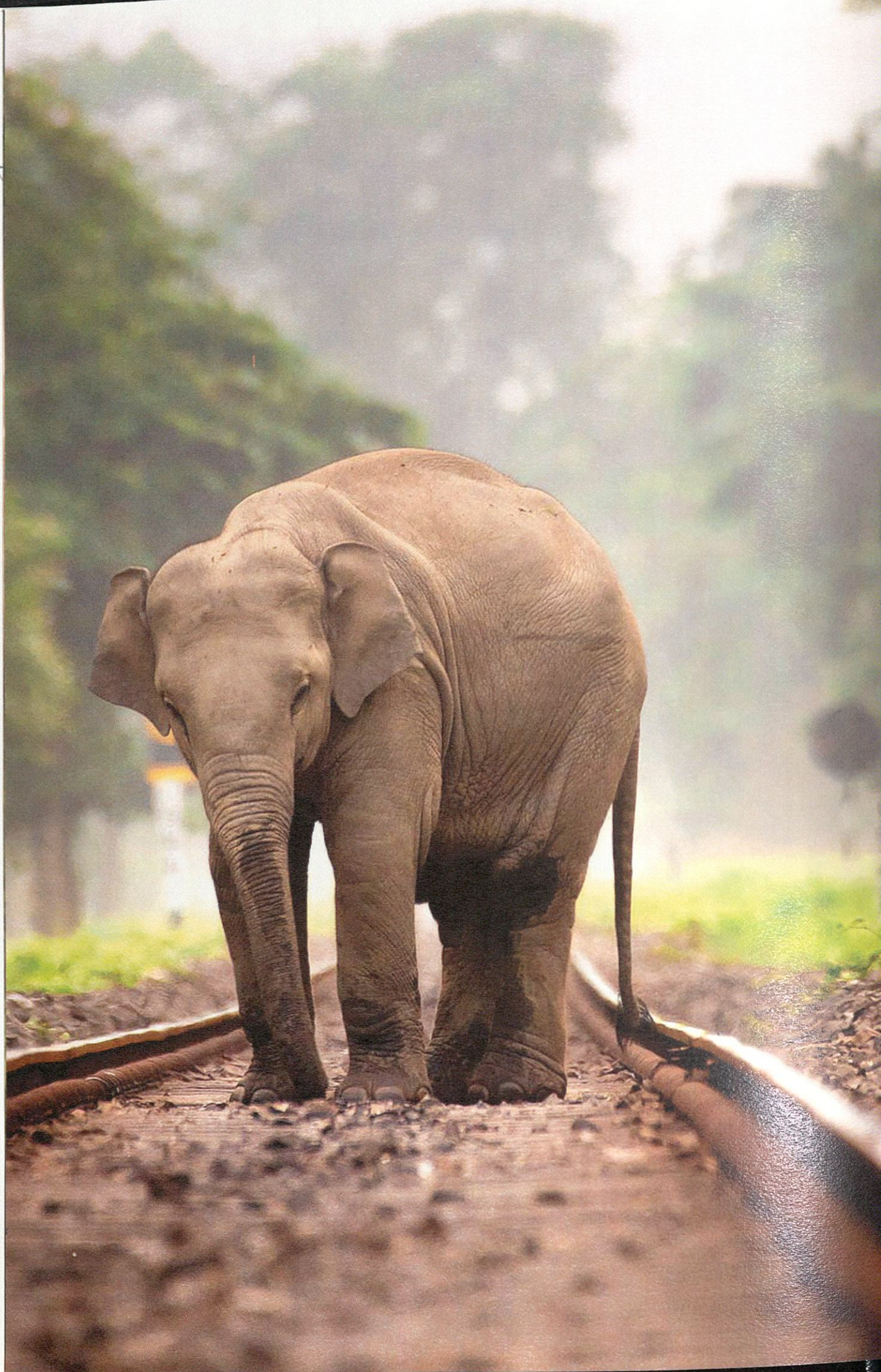
**Dr. Akanksha Saxena**  
*Project Scientist, WII*

**Shri Aditya Bisht**  
*Project Consultant- B*

**SURVEY TEAM: WII & PE, MoEFCC**

**Dr. Dharmendra Kumar Gupta**  
*Director (S)/Scientist F*

**Shri Aditya Bisht**  
*Project Consultant-B*



# CONTENTS

<b>01. INTRODUCTION</b>	<b>01</b>
<b>02. FIELD SURVEY</b>	<b>01</b>
<b>03. SITE SPECIFIC FINDINGS &amp; MITIGATION MEASURES</b>	<b>02</b>
3.1 Dhehenkanal	
3.2 Angul and Athamalik	
3.3 Raidakhol	
3.4 Sambalpur	
3.5 Bonai	
3.6 Keonjhar (Territorial Division)	
3.7 Keonjhar (Wildlife Division)	
3.8 Rairangpur	
3.9 Baripada	
<b>04. GENERAL RECOMMENDATIONS FOR ALL SITES</b>	<b>20</b>
<b>05. DASHBOARD FOR MONITORING IMPLEMENTATION OF MITIGATION MEASURES</b>	<b>21</b>
<b>06. LIST OF STATE FOREST DEPARTMENT &amp; INDIAN RAILWAYS OFFICIALS CONSULTED DURING THE SURVEY</b>	<b>23</b>
<b>07. REFERENCES</b>	<b>23</b>
<b>08. APPENDIX 1</b>	<b>24</b>



# 01. Introduction

Odisha is one of the top five priority landscapes for wild elephant conservation in India with vast tracts of contiguous forests. Despite threats to elephant conservation such as habitat loss, conflict with humans, electrocution and linear infrastructure, the substantial forest cover of the state and relatively well-connected corridors offer protection and hope for conservation. Despite severe pressures on habitat from mining, roads, anthropogenic pressures, etc Orissa is fortunate to still have relatively good connectivity of tiger and elephant habitats in a north-southerly direction throughout the length of the state. The two single largest intact elephant populations, numbering between 400-500 elephants each in the Mahanadi Elephant Reserve in central Orissa (based around Satkosia Tiger Reserve) and Mayurbhanj Elephant Reserve in north Orissa (based around Similipal Tiger Reserve) have been isolated from each other only very recently in history. However, these rich forests and corridors are being intersected by linear infrastructure, including railway lines, leading to incidences of train-elephant collisions. Based on a meeting on 17th August 2022, the Hon'ble Minister of Railways, Government of India, instructed the Ministry of Environment, Forest and Climate Change (MoEF&CC) to provide at least 100 locations of existing railway segments across sensitive elephant and tiger landscapes in the country for construction of permanent mitigation measures in view of wildlife-train collisions (Proceedings under Ministry of Railways letter No. 2022/CE-IV/Elephant Pass dated 30th September 2022). Consequently, details of sensitive stretches for constructing permanent and temporary mitigation measures were provided by the MoEF&CC (vide OM F.No. 12-1/2019-PE (Part-I), dated 30<sup>th</sup> August 2022).

## 02. Field Survey

Joint surveys of the critical stretches of the railway lines passing through the elephant habitats in Odisha for suggesting mitigation measures were conducted during 13-17<sup>th</sup> February, 2024 jointly by the officers/officials of Project Elephant, MoEF&CC, Ministry of Railways and Odisha Forest Department.

The surveys were conducted in the critical stretches of Angul, Athamalik, Baripada, Bonai, Dhenkanal, Rairakhol, Rairangpur, Sambalpur, Keonjhar (Territorial and Wildlife Divisions), with an objective to identify specific elephant crossing zones to suggest site-specific mitigation measures based on the location and the extent of these crossing zones to mitigate train-elephant collisions.

As part of the joint surveys, meetings were held between the officers/officials of the MoEF&CC, Odisha Forest Department and South Eastern Railways and East Coast Railways to deliberate on different structural mitigation measures in the identified critical elephant zones intersected by railway tracks such as level crossings, creation of ramps, wildlife underpasses, wildlife overpasses, efficacy of Intrusion Detection System (IDS) using Distributed Acoustic Sensing (DAS) System.

The joint survey team visited the critical stretches of railway tracks which were identified by the Forest Department for implementing the mitigation measures.

\*The objective of the field survey was to minimise elephant-train collisions either by constructing underpasses and overpasses wherever possible, by reducing the time taken by elephants to cross the railway tracks by easing movement across the track through construction of ramps and level crossings, and by implementation of technology for early detection and warning systems.

## 03. Site-Specific Findings & Mitigation Measures

### 3.1 Dhenkanal

*Date of survey: 13<sup>th</sup> February, 2024*

#### **Locations Surveyed:**

- OHE Mast No. 471/8-471/10
- OHE Mast No. 472/24-472/26
- OHE Mast No. 474/7-474/11

#### **Observations:**

- The critical elephant crossings fall under the Budhapaka Salegaon Railway Project.
- The elephants frequently cross the railway tracks to move between the different habitats in Dhenkanal.
- As per the discussion held with the local Forest Department staffs, it was informed that the elephant movement is being affected (reduced) due to coarse ballast used on the railway tracks.
- On request of Forest Department, the Indian Railways issues caution order to restrict the speed of the trains.
- Drains have been constructed by along the railway tracks which act as barriers for the easy movement of the elephants, especially young ones/calves.
- The railway lines are being doubled *i.e.* from two lines to four lines. This will impact the movement of elephants in future.
- Due to the flat terrain, there was no provision for construction of underpass or overpass for elephants.

#### **Recommendations:**

- Since, the railway tracks are on the ground level, construction of ramps at these stretches would help the elephants in crossing the railway tracks more quickly and smoothly. It is recommended for construction of level crossings and ramps as per Wildlife Institute of India's guidelines by using suitable material (soil/cement/rubberised pads etc.) that flattens towards the top of the track, and allow for smooth and quick movement for the elephants in OHE Mast Nos. 471/8-471/10, 472/24-472/26 and 474/7-474/11.

- Considering the future scenario of doubling the existing railway tracks, the possibility of construction of permanent mitigation measures such as elevated railway tracks, overpasses and underpasses for elephants and other wildlife must be explored.
- The existing ramps around the railway tracks should be levelled with the surrounding terrain by smoothening out the slope.
- Installation of signages and boards about elephant crossings throughout the elephant passing stretches.
- Regular pruning of bushes (upto 30 meters) on both sides of the track for clear visibility to the drivers and the elephants.
- Frequent honking by the train engine when passing through critical stretches especially when elephant or wildlife movement near the railway tracks has been reported or observed.
- The open drains along the railway tracks must be covered with suitable material.



**Figure 1:** Field survey conducted by Project Elephant (MoEF&CC) representatives in collaboration with Indian Railways and State Forest Department officials in sensitive railway line stretches in Dhenkanal, Odisha.

### 3.2 Angul & Athamalilik

Date of survey: 13<sup>th</sup> February, 2024

#### Locations Surveyed:

- OHE Mast No. 131/119- 131/131
- OHE Mast No. 128/26-128/25
- OHE Mast No. 121/3-122/4
- OHE Mast No. 120/6-120/5
- OHE Mast No. 106/3-106/4

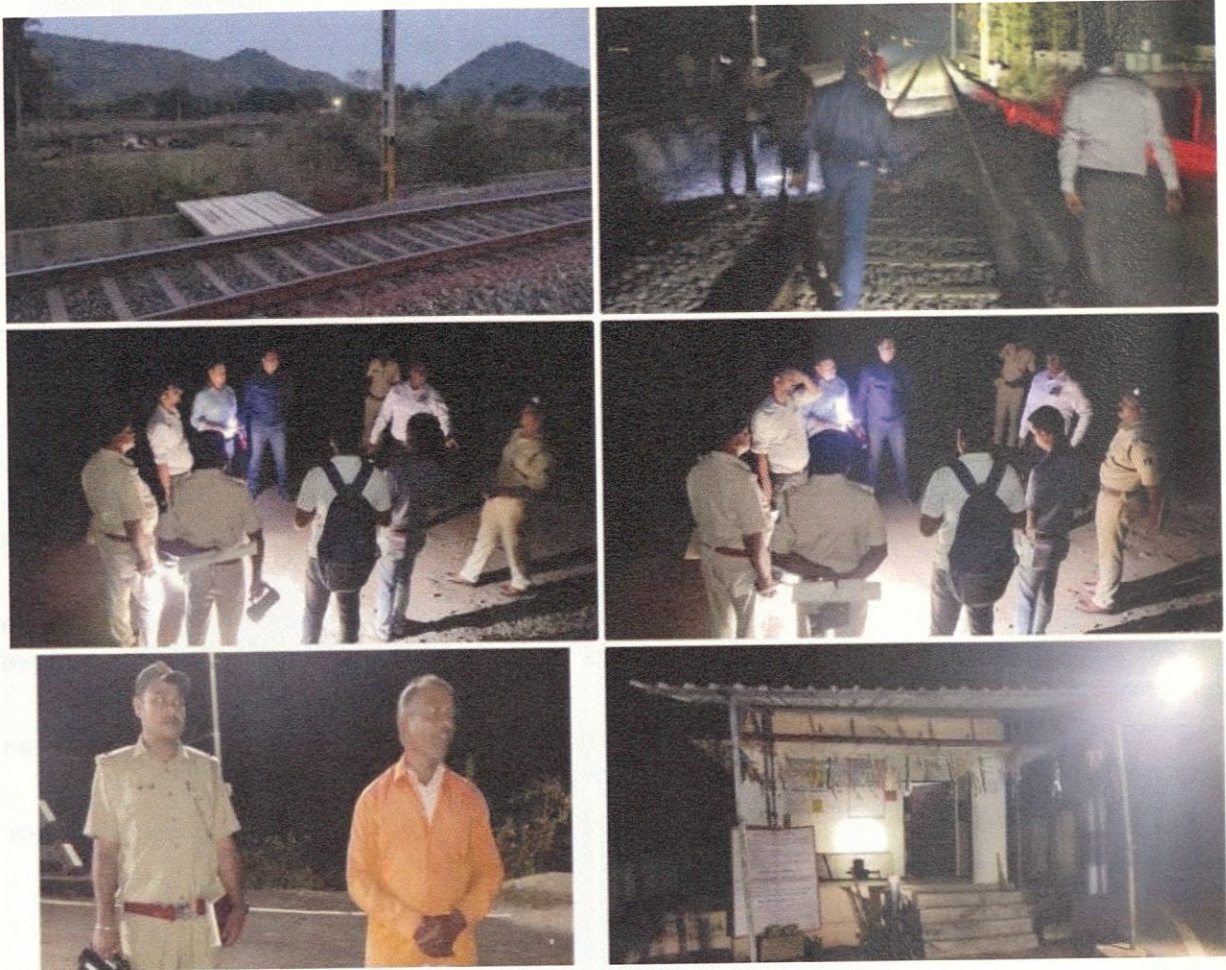
#### Observations:

- The elephants cross the railway track to move between the two habitats in Angul and Athamallik. In Angul, tusker movement is very frequent between the forest blocks of Katada RF, Para RF, and Anshulia RF which are separated by the National Highway and Railway line.
- The death of a Tusker elephant due to a train hit was reported in April 2023 near OHE Mast No. 131/119- 131/131.
- As per the discussion held with the local Forest Department staff, it was informed that the elephant movement is being affected (reduced) due to coarse ballast used on the railway tracks. Edge features along the railway lines have made the movement of the elephants across the track slow and forced the elephants to move along the track. Box-shaped drains on the side of the track prevent their exit.
- At many locations, the railway tracks are in parallel with National Highway 55. The elephants have to cross the railway tracks and then the National Highway to move between the two habitats.
- The National Highway Authority of India (NHAI) has proposed for construction of an overpass for elephants near the OHE Mast No. 121/3-122/4.
- Due to the flat terrain in Angul Division, there has been no construction of underpasses or overpasses for elephants.

#### Recommendations:

- Construction of level crossings and ramps as per Wildlife Institute of India's (WII) guidelines by using suitable material (soil/cement/rubberized pads etc.) that flattens towards the top of the track, and allows for smooth and quick movement for the elephants in OHE Mast Nos. 131/119- 131/131, 128/26-128/25, 121/3-122/4, 120/6-120/5 and 106/3-106/4.
- Such ramps should be leveled with the surrounding terrain by smoothing out the slope.
- The Indian Railway could fence the Gumti near the railway crossing and OHE Mast No. 106/3-106/4 to avoid any conflict with the elephants.
- Installation of signages and boards about elephant crossings throughout the elephant passing stretches.
- Regular pruning of bushes (up to 30 meters) on both sides of the track for clear visibility to the drivers and the elephants.
- At night hours, joint patrolling by at least one team for each division should be done with the forest department. The railway needs to provide sufficient staff for better coordination and communication in these stretches of Angul and Athmallyik Forest Division.

- Frequent honking by the train engine when passing through critical stretches especially when elephant or wildlife movement near the railway tracks has been reported or observed.
- No barriers should be erected along the crossing points by Railways without the completion of the overpass/underpass at above mentioned critical locations/ elephant passing zones.
- The open drains along the railway tracks must be completely covered with suitable material.



**Figure 2:**Field survey conducted by Project Elephant (MoEF&CC) representatives in collaboration with Indian Railways and State Forest Department officials in sensitive railway line stretches in Angul and Athamalik, Odisha.

### 3.3 Raidakhol

Date of survey: 14<sup>th</sup> February, 2024

#### Locations Surveyed:

- OHE Mast No. 81/12-81/16 at Patakhaman in Rairakhhol range.
- OHE Mast No. 81/3-81/4 at Patakhaman in Rairakhhol range.
- OHE Mast No. 80/16-80/20 at Patakhaman in Rairakhhol range.
- OHE Mast No. 73/30-73/26 at Angarpada in Rairakhhol range.
- OHE Mast No. 68/17-68/14 at Kuhi in Badbahal range.
- OHE Mast No. 52/8-52/11 near Landakhot-mochibahal reserve forest in Badmal.
- OHE Mast No. 49/7-49/3 at Lamketa in Badmal range.

#### Observations:

- Regular elephant movement is reported in the above mentioned locations.
- The railway tracks is frequently used by all categories of trains including goods and express trains as it is the main line which connects Sambalpur district with Angul district.
- Death of a Tusker elephant due to train hit was reported in April, 2023 near OHE Mast No. 73/30-73/26 at Angarpada in Rairakhhol range.
- At present there are two railway tracks (up & down line). It was informed by the Railway officers that there is a planning of laying two more railway lines.
- Suitable height on both sides of the railway line near OHE Mast Nos. 81/12-81/16 is available which could be utilized for construction of overpass for elephants.
- Drains have been constructed along the railway tracks which act as barriers for the easy movement of the elephants, especially young ones/calves.

#### Recommendations:

- Since suitable height is available on both sides of the railway tracks near OHE Mast No. 81, it is proposed for construction of an elephant overpass as per Wildlife Institute of India's guidelines near OHE Mast No. 81/12-81/16.
- A ramp to be constructed near OHE Mast No. 80/16-80/20 and 73/30-73/26 as per WII's guidelines by using suitable material (soil/cement/river stones) that flattens towards the top of the track, and allow for smooth and quick movement of the elephants. The ramp should be levelled with the surrounding terrain by smoothening out the slope.
- Soft rubber pads as per WII guidelines should be laid down over the stones lying on railway track to make the crossing of railway track easier for elephants.
- Due to suitable height below the railway tracks at OHE Mast Nos. 68/17-68/14, 52/8-52/11 and 49/7-49/3, under-passes could be constructed as per the WII's guidelines for easy passage of the elephants.
- Installation of signages and boards about elephant crossings throughout the elephant passing stretches.
- Regular pruning of bushes (upto 30 meters) on both sides of the track for clear visibility to the drivers and the elephants.

- Frequent honking by the train engine when passing through critical stretches especially when elephant or wildlife movement near the railway tracks has been reported or observed.
- No barriers should be erected along the crossing points by Indian Railways without the completion of elephant overpass/underpass at above mentioned critical locations/elephant passing zones.
- The open drains along the railway tracks must be covered with suitable material.



**Figure 3:** Field survey conducted by Project Elephant (MoEF&CC) representatives in collaboration with Indian Railways and State Forest Department officials in sensitive railway line stretches in Raidakhol, Odisha.

### 3.4 Sambalpur

Date of survey: 14-15<sup>th</sup> February, 2024

#### Locations Surveyed:

- OHE Mast No. 17/27-17/29
- OHE Mast No. 24/30-24/34
- OHE Mast No. 24/37-24/41
- OHE Mast No. 29/33-29/32
- OHE Mast No. 40/9-40/11
- OHE Mast No. 31/44-31/49
- OHE Mast No. 30/27-30/29

#### Observations:

- Regular elephant movement is reported in the above mentioned locations.
- Death of two elephants due to train hit was reported about 2.5 years ago near OHE Mast No. 17/27-17/29.
- The railway tracks is frequently used by all categories of trains including goods and express trains as it is the main line which connects Sambalpur district with Angul district.
- At present there are two railway tracks (up & down line). It was informed by the Railway officers that there is a planning of laying two more railway lines.
- Thick vegetation was found near OHE Mast No. 24/30-24/41 which needs to be cleared.

#### Recommendations:

- A ramp to be constructed near OHE Mast No. 17/27-17/29, 24/30-24/34 and 24/37-24/41 as per WII's guidelines by using suitable material (soil/cement/river stones) that flattens towards the top of the track, and allow for smooth and quick movement of the elephants.
- The ramp should be levelled with the surrounding terrain by smoothing out the slope.
- Rubber pads as per WII guidelines should be laid down over the stone blast lying on railway track to make the crossing of railway track easier for elephants.
- Due to suitable height below the railway tracks at OHE Mast Nos. 31/44-31/49 and 30/20- 30/24, under-passes could be constructed as per the WII's guidelines for easy passage of the elephants.
- Intrusion Detection System (IDS) using Distributed Acoustic Sensing (DAS) System could be installed near OHE Mast No. 29/33-29/32.
- Installation of signages and boards about elephant crossings throughout the elephant passing stretches.
- Regular pruning of bushes (upto 30 meters) on both sides of the track for clear visibility to the drivers and the elephants.
- Frequent honking by the train engine when passing through critical stretches especially when elephant or wildlife movement near the railway tracks has been reported or observed.
- No barriers should be erected along the crossing points by Railways without the completion of overpass/underpass at above mentioned critical locations/elephant passing zones.
- The open drains along the railway tracks must be covered with suitable material.



**Figure 4:** Field survey conducted by Project Elephant (MoEF&CC) representatives in collaboration with Indian Railways and State Forest Department officials in sensitive railway line stretches in Sambalpur, Odisha.

### 3.5 Bonai

*Date of survey: 15<sup>th</sup> February, 2024*

#### **Locations Surveyed:**

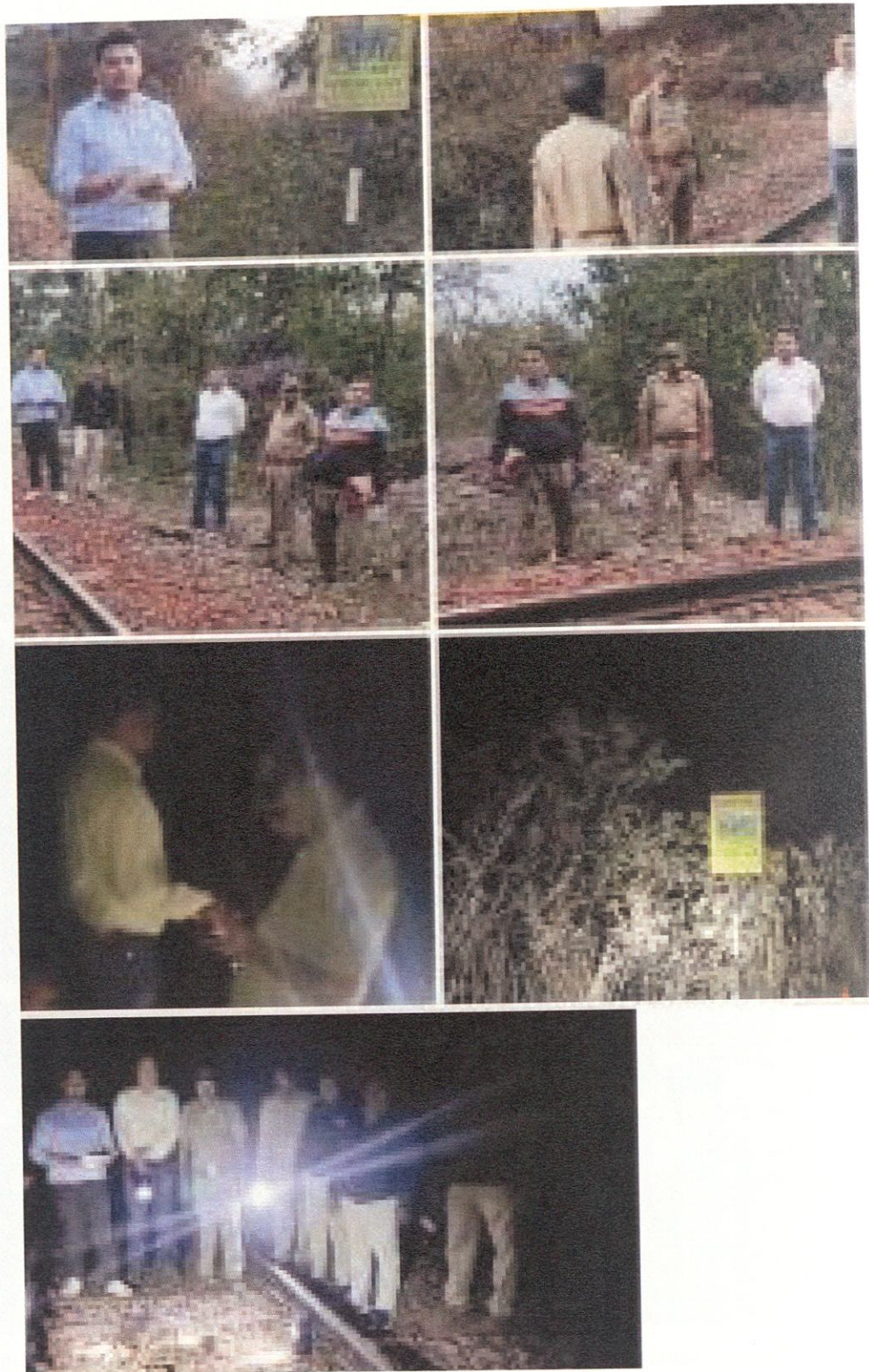
- OHE Mast No. 462/7-462/9
- OHE Mast No. 461/6-461/7

#### **Observations:**

- The critical elephant crossings fall under the Barswen forest range.
- The elephants frequently cross the railway tracks to move between the different habitats in Bonai.
- On request of Forest Department, Indian Railway issues caution order to restrict the speed of the trains.
- Due to the flat terrain, there was no provision for construction of underpass or overpass for elephants.

#### **Recommendations:**

- Construction of level crossings and ramps as per Wildlife Institute of India's guidelines by using suitable material (soil/ cement/rubberised pads etc.) that flattens towards the top of the track, and allow for smooth and quick movement for the elephants in OHE Mast Nos. 462/7-462/9 and 461/6-461/7.
- The existing ramps around the railway tracks should be levelled with the surrounding terrain by smoothing out the slope.
- Installation of signages and boards about elephant crossings throughout the elephant passing stretches.
- Regular pruning of bushes (upto 30 meters) on both sides of the track for clear visibility to the drivers and the elephants.
- Frequent honking by the train engine when passing through critical stretches especially when elephant or wildlife movement near the railway tracks has been reported or observed.
- The open drains along the railway tracks must be covered with suitable material



**Figure 5:** Field survey conducted by Project Elephant (MoEF&CC) representatives in collaboration with Indian Railways and State Forest Department officials in sensitive railway line stretches in Bonai, Odisha.

### 3.6 Keonjhar (Territorial Division)

Date of survey: 16<sup>th</sup> February, 2024

#### Locations Surveyed:

- OHE Mast No. 405/7-405/2 in South East Railways
- OHE Mast No. 414/3-414/2 in South East Railways
- OHE Mast No. 16/15-16/18 in East Coast Railways
- OHE Mast No. 33/31-33/37 in East Coast Railways
- OHE Mast No. 33/37-33/41 in East Coast Railways
- OHE Mast No. 33/41-33/45 in East Coast Railways
- OHE Mast No. 36/21-36/25 in East Coast Railways
- OHE Mast No. 67/3-67/7 in East Coast Railways
- OHE Mast No. 67/7-67/9 in East Coast Railways
- OHE Mast No. 67/9-67/11 in East Coast Railways

#### Observations:

- Elephant movement is reported in the above mentioned locations.
- The railway tracks are frequently used by all categories of trains including goods and express trains. It lies in between two divisions of the Railways i.e. South Eastern Railways and East Coast Railways.
- The Forest department has installed solar fences on both sides of the railway tracks near OHE Mast No. 405/51 to prevent the elephants entering the track.
- Death of three elephants due to train hit was reported in year 2022.
- Suitable height on both sides of the railway line near OHE Mast Nos. 405/7-405/2 is available which could be utilized for construction of overpass for elephants. NHAI has also proposed an over pass for elephants near OHE Mast Nos. 405 in South East Railways.
- Drains have been constructed along the railway tracks which act as barriers for the easy movement of the elephants near OHE Mast No. 415/6 to 16/9, 16/14 to 16/18 and 79/18 to 79/20 especially young ones/calves.

#### Recommendations:

- Since suitable height is available on both sides of the railway tracks near OHE Mast No. 405, it is recommended for construction of an elephant overpass as per Wildlife Institute of India's guidelines near OHE Mast No. 405/7-405/2 which falls under the jurisdiction of South East Railways.
- A ramp to be constructed near OHE Mast No. 16/15- 16/18, OHE Mast No. 36/21-36/25 and 33/37-33/41 along with fencing at 33/31-33/37 and 33/41-33/45 (under east Coast Railways) to guide/route the elephants towards OHE Mast No. 33/37-33/41 as per WII's guidelines by using suitable material (soil/cement/river stones) that flattens towards the top of the track, and allow for smooth and quick movement of the elephants. The ramp should be levelled with the surrounding terrain by smoothening out the slope.
- The feasibility of construction of elevated railway tracks, elephant overpasses and underpasses in future while doubling the railway tracks in future must be carried out by the Ministry of Railways with the support of State Forest Department.

- Soft rubber pads as per WII guidelines should be laid down over the blast stones lying on railway track in the above mentioned critical stretches to make the crossing of railway track easier for elephants.
- A ramp to be constructed on OHE Mast No. 67/7-67/9 along with fencing at 67/3-67/7 and 67/9-67/11 to guide/route the elephants towards OHE Mast No. 67/7-67/9 as per WII's guidelines by using suitable material (soil/cement/river stones) that flattens towards the top of the track, and allow for smooth and quick movement of the elephants. The ramp should be levelled with the surrounding terrain by smoothing out the slope.
- Installation and regular maintenance of signages and boards about elephant crossings throughout the elephant passing stretches.
- Regular pruning of bushes (upto 30 meters) on both sides of the track for clear visibility to the drivers and the elephants.
- Frequent honking/ blowing long horn as well as sharp look out by the loco pilots when passing through critical stretches especially when elephant or wildlife movement near the railway tracks has been reported or observed.
- The open drains along the railway tracks must be covered with suitable material at OHE Mast No. 415/6 to 16/9, 16/14 to 16/18 and 79/18 to 79/20.



**Figure 6:** Field survey conducted by Project Elephant (MoEF&CC) representatives in collaboration with Indian Railways and State Forest Department officials in sensitive railway line stretches in Keonjhar, Odisha.

### 3.7 Keonjhar (Wildlife Division)

Date of survey: 16<sup>th</sup> February, 2024

#### Locations Surveyed:

- OHE Mast No. 126/2-126/4
- OHE Mast No. 126/7-126/9
- OHE Mast No. 126/27-126/29
- OHE Mast No. 132/46-132/48
- OHE Mast No. 135/39-135/41
- OHE Mast No. 136/16-136/18
- OHE Mast No. 138/19-138/21
- OHE Mast No. 139/2-139/6
- OHE Mast No. 140/44-140/48
- OHE Mast No. 141/13 – 141/17

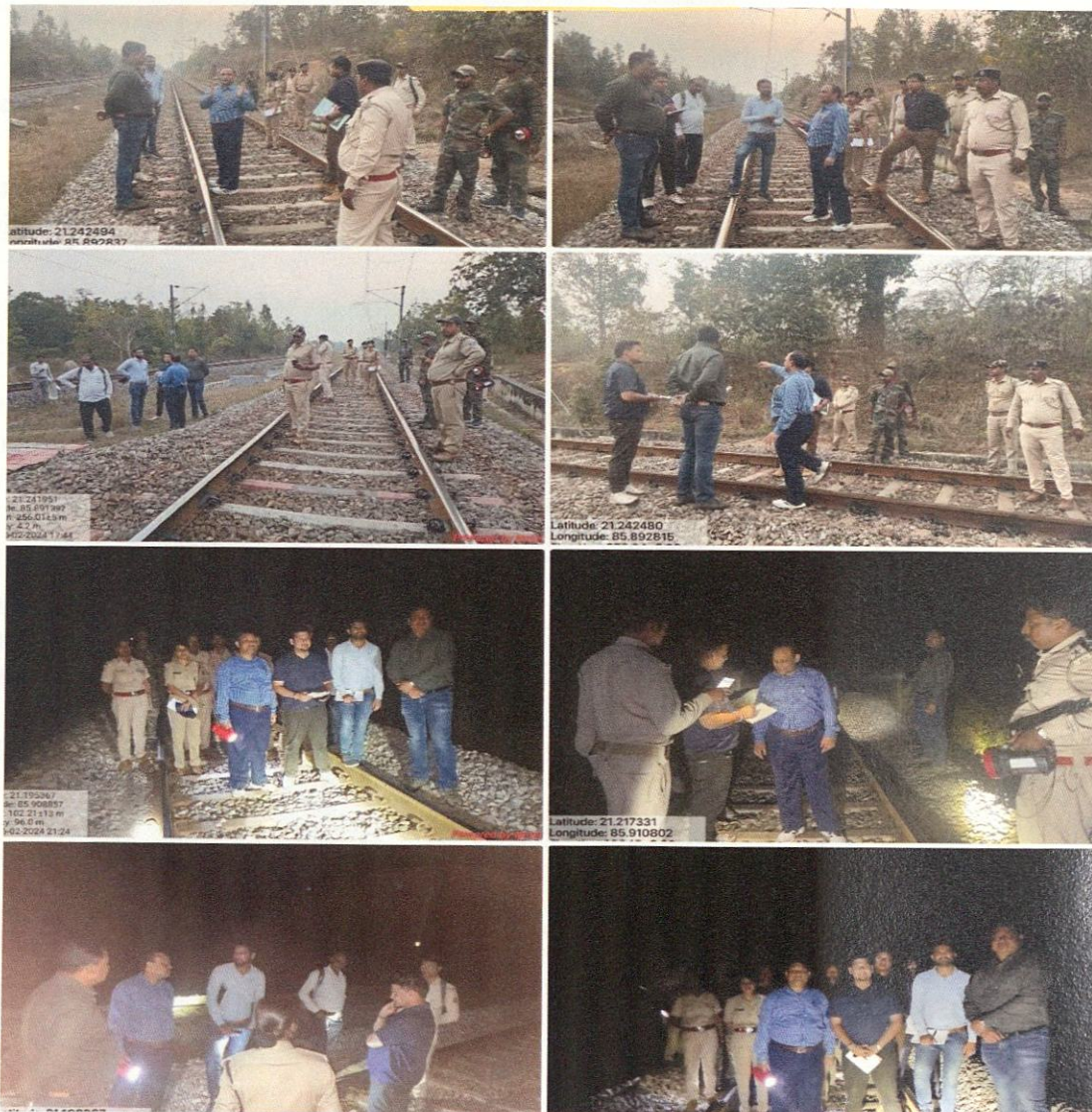
#### Observations:

- Elephant movement is reported in the above mentioned locations.
- The railway tracks are frequently used by all categories of trains including goods and express trains.
- Death of one tusker due to train hit was reported in year 2022 near OHE Mast No. 135/41- 135/39 and three numbers of female elephants had been succumbed to death due to train hit during the year 2023 near OHE Mast No. 141/13 to 141/17.
- Drains have been constructed along the railway tracks which act as barriers for the easy movement of the elephants, especially young ones/calves.
- At most of the identified critical stretches, the railway tracks are on the ground level.
- There are some blind curves on the railway tracks which are prone to elephant-train hits.

#### Recommendations:

- Since, most of the identified critical stretches of the railway tracks are on the ground level, suitable height below the railway tracks/ above the railway tracks is not available for construction of under pass/ overpasses for elephants. Hence, as a short term measure, construction of ramps at these stretches would help the elephants in crossing the railway tracks more quickly and smoothly. It is recommended to develop the ramps near OHE Mast No. 126/2 - 126/4, 126/7 - 126/9, 126/27 - 126/29, 132/46 - 132/48, 135/41 - 135/39, 136/16 - 136/18, 138/21 - 138/19, 139/4 - 139/2, 140/44 - 140/48 and 141/13 – 141/17 along with fencing on both sides of OHE Mast No. 140/44 - 140/48 and from 141/13 – 141/17 to guide/route the elephants as per WII's guidelines by using suitable material (soil/cement/ river stones) that flattens towards the top of the track, and allow for smooth and quick movement of the elephants. The ramp should be levelled with the surrounding terrain by smoothening out the slope.

- The feasibility of construction of elevated railway tracks, overpasses and underpasses in future while doubling the railway tracks in future must be carried out by the Ministry of Railways with the support of State Forest Department.
- Installation of Intrusion Detection System (IDS) near OHE Mast No. 132/46-132/48.
- Soft rubber pads as per WII guidelines should be laid down over the blast stones lying on railway track in the above mentioned critical stretches to make the crossing of railway track easier for elephants.
- Installation and regular maintenance of signages and boards about elephant crossings throughout the elephant passing stretches.
- Regular pruning of bushes (upto 30 meters) on both sides of the track for clear visibility to the drivers and the elephants.
- Frequent honking/ blowing long horn as well as sharp look out by the Loco Pilots by the train engine when passing through critical stretches especially when elephant or wildlife movement near the railway tracks has been reported or observed.
- The open drains along the railway tracks must be covered with suitable material.



**Figure 7:** Field survey conducted by Project Elephant (MoEF&CC) representatives in collaboration with Indian Railways and State Forest Department officials in sensitive railway line stretches in Keonjhar (wildlife division), Odisha.

### 3.8 Rairangpur

Date of survey: 18<sup>th</sup> February, 2024

#### Locations Surveyed:

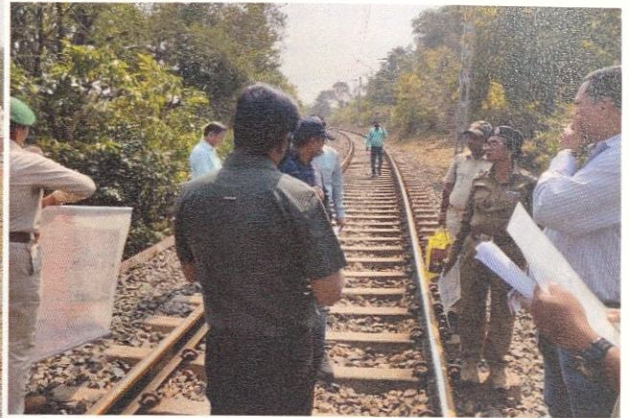
- OHE Mast No. RB 15/7-10

#### Observations:

- The railway tracks are frequently used by Express trains and Goods trains.
- Caution order for speed restriction is issued by Railways on request of Forest Department.
- Permanent speed restriction of 40 Km/h is implemented for trains near OHE Mast No. 336/01- 337/01.
- It was informed by the railway officers that there is a planning of doubling the railway line in future.
- Coordination between Railways and Forest Department personnel is playing a significant role in safe crossing of elephants across the railway track.

#### Recommendations:

- Since, all the identified critical stretches of the railway tracks are on the ground level, construction of ramps at these stretches would help the elephants in crossing the railway tracks more quickly and smoothly. It is recommended to develop the ramps near OHE Mast No.336/27-336/28,327/11-327/13 and 287/09-287/06 as per WII's guidelines by using suitable material (soil/cement/river stones) that flattens towards the top of the track, and allow for smooth and quick movement of the elephants. The ramp should be levelled with the surrounding terrain by smoothening out the slope.
- The feasibility of construction of elevated railway tracks, overpasses and underpasses in future while doubling the railway tracks in future must be carried out by the Ministry of Railways with the support of State Forest Department.
- The ramps must be constructed at critical stretches as per WII's guidelines by using suitable material (soil/cement/river stones etc.) that flattens towards the top of the track, and allow for smooth and quick movement for the elephants.
- Regular pruning of bushes (30 Meter) on both sides of the track for clear visibility of the drivers and the elephants.
- Installation of more signages and boards about animal crossings throughout the elephant passing stretches.



**Figure 8:** Field survey conducted by Project Elephant (MoEF&CC) representatives in collaboration with Indian Railways and State Forest Department officials in sensitive railway line stretches in Rairangpur, Odisha.

### 3.9 Baripada

*Date of survey: 17<sup>th</sup> February, 2024*

#### **Locations Surveyed:**

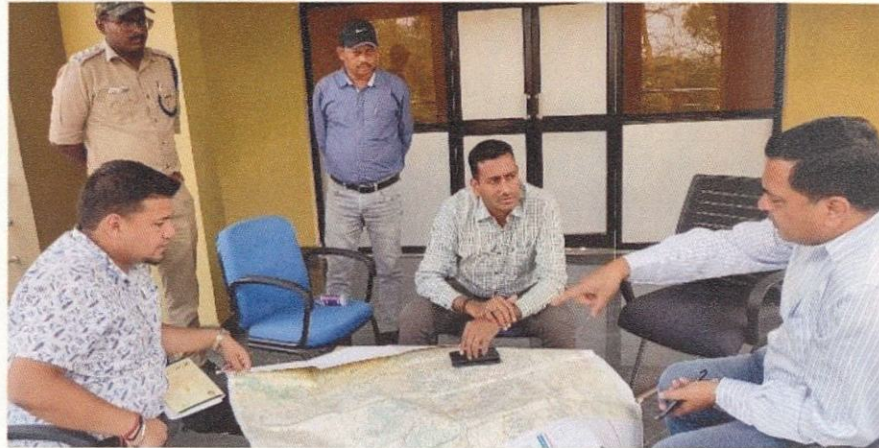
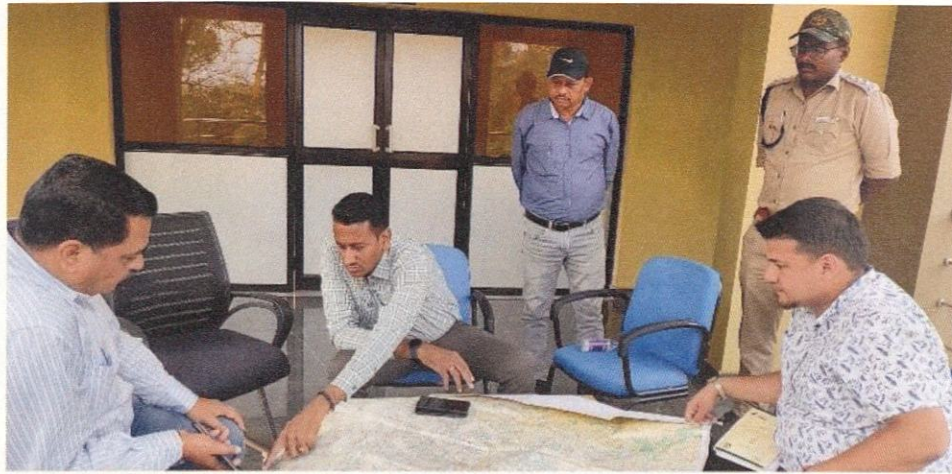
- OHE Mast No. RB 15/7-10

#### **Observations:**

- The railway line is connecting Rupsa-Bangriposi and used by two daily express trains and one weekly superfast train. The railway tracks are surrounded by paddy fields on both sides.
- Elephant herds frequently crosses the railway lines, especially during the paddy season.
- Due to clear visibility, no incident of elephant train hit has been reported in the area.
- Coordination between Railways and Forest Department personnel is playing a significant role in safe crossing of elephants across the railway track.

#### **Recommendations:**

- Since, the railway track is on the ground level, construction of ramp at this stretch would help the elephants in crossing the railway tracks more quickly and smoothly. It is recommended to develop the ramp near OHE Mast No. RB 15/7-10 as per WII's guidelines by using suitable material (soil/cement/river stones) that flattens towards the top of the track, and allow for smooth and quick movement of the elephants. The ramp should be levelled with the surrounding terrain by smoothening out the slope.
- Installation of signages and boards about animal crossings throughout the elephant passing stretches.



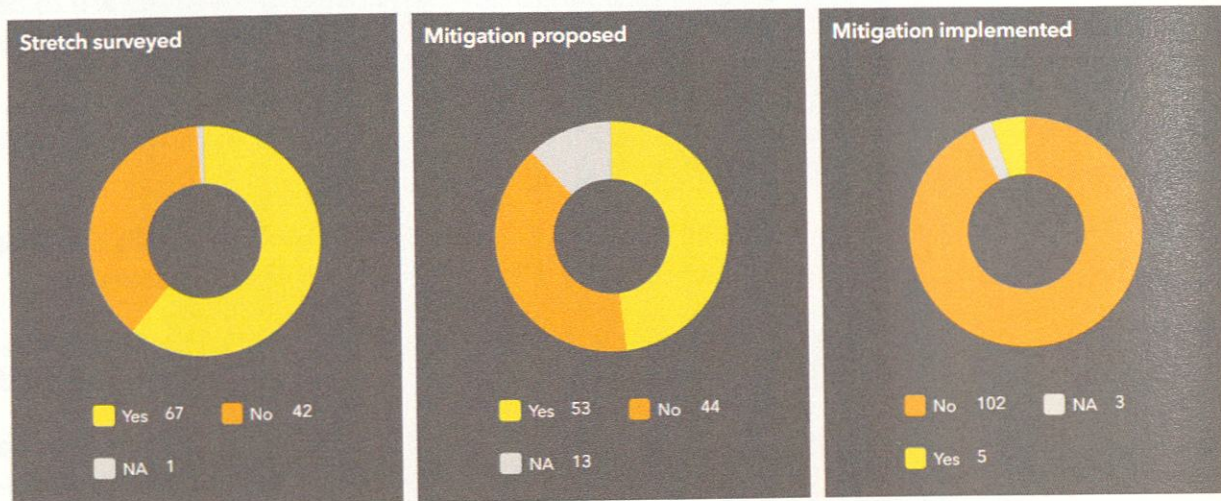
**Figure 9:** Field survey conducted by Project Elephant (MoEF&CC) representatives in collaboration with Indian Railways and State Forest Department officials in sensitive railway line stretches in Baripada, Odisha.

# 04. General recommendations for all sites

The following blanket recommendations are to be implemented across all sites:

1. Distributed Acoustic Sensing (DAS) – based Intrusion Detection Systems (IDS) are to be implemented on all sensitive stretches on priority. Further all level crossings and ramps should incorporate the DAS IDS system as well.
2. Sign boards on the sensitive stretches should be erected to alert loco pilots, along with indications of specific wildlife-crossing zones.
3. Goods trains should be scheduled for the daytime as much as possible or during the time period when the activity of the wildlife species especially elephants is at its minimum.
4. For construction of structural mitigation measures (underpasses, overpasses, level crossings and ramps), the WII report on specifications of mitigation measures should be referred.
5. Regular clearing of vegetation till at least 30 m on either side of the railway tracks is to be done to increase visibility for both loco pilots and elephants. The frequency and responsibility of carrying out pruning may be decided mutually by both parties.
6. Strict restriction and fines on disposal of garbage, especially food items, from operating trains on railway tracks in sensitive stretches and railway stations near them should be imposed.
7. Joint teams of railways and forest department personnel should be formed for all critical stretches. The team would be responsible for joint patrolling on the track of elephant presence, coordination and information sharing, and regular cleaning of railway tracks. This can be achieved by creating WhatsApp groups for each region comprising of senior officials and frontline staff of the railways and forest department.
8. There should be regular cooperation and exchange of information between forest department and railways staff. Regular sensitization workshops for railway staff, especially loco pilots and ground staff should be conducted.
9. Most railway tracks in the surveyed areas are in the process of getting electrified. Adequate measures (insulation and proofing of all electric infrastructure) should be taken to avoid incidents of electrocution of wildlife because of the railway electric infrastructure.
10. To discourage use of wildlife-friendly ramps and level crossings by people and vehicles, concrete barrier poles and/or other barriers should be built that are high enough to block passage of 2 and 4-wheelers, but low enough to allow elephants to pass.
11. Incidences of elephant and wildlife injury and mortality should be documented by both parties, with complete details on GPS location, chainage, date and time of day.
12. In the future, all metre-gauge to broad-gauge conversion projects in elephant landscapes should include comprehensive elephant mitigation plans.
13. In the future, railway stretches posing collision and barrier risks to wildlife should be identified that exist beyond elephant reserves and protected areas, such as corridors.

# 05. Dashboard for monitoring implementation of mitigation measures



Creating zone details								Remarks	ReportLink
Serial No	Name of area	State	Creating zone width (km)	Stretch surveyed	Mitigation proposed	Mitigation implemented			
1	Elephant reserve	Uttarakhand	8.60	Yes	Yes	No		<a href="https://drive.google.com/file/d/1P2ZTc1K1Qw1d5m7y0QgD1700yepw1ew/view?usp=sharing">https://drive.google.com/file/d/1P2ZTc1K1Qw1d5m7y0QgD1700yepw1ew/view?usp=sharing</a>	
2	Elephant reserve	Uttarakhand	14.30	Yes	Yes	No			
3	Elephant reserve	Uttarakhand	28.50	Yes	Yes	Yes	This stretch has been surveyed under Harawa's Project & separately discussed with Mool		
4	Elephant reserve	Uttarakhand	4.50	Yes	Yes	Yes	This stretch has been surveyed under Harawa's Project & separately discussed with Mool		
5	Elephant reserve	Uttarakhand	21.30	Yes	Yes	Yes	This stretch has been surveyed under Harawa's Project & separately discussed with Mool		
6	Elephant distribution	Uttarakhand	5.90	Yes	No	No	Stretch falls within Raigarh city limits		
7	Elephant distribution	Uttarakhand	4.40	Yes	Yes	No	Surveyed by Forest Department	<a href="https://drive.google.com/file/d/1YF1d4d5YAKChR0a2Dng8MqPTW5/view?usp=sharing">https://drive.google.com/file/d/1YF1d4d5YAKChR0a2Dng8MqPTW5/view?usp=sharing</a>	
8	Elephant distribution	Uttarakhand	39.80	Yes	Yes	Yes	This stretch has been surveyed under Harawa's Project & separately discussed with Mool		
9	Elephant distribution	Uttarakhand	30.70	Yes	Yes	Yes	This stretch has been surveyed under Harawa's Project & separately discussed with Mool		
10	Elephant reserve	Uttar Pradesh	7.60	No	No	No			
11	Elephant distribution	Uttar Pradesh	7.60	No	No	No			
12	Elephant distribution	Uttar Pradesh	3.30	No	No	No			
13	Elephant distribution	Uttar Pradesh	10.30	No	No	No			
14	Elephant distribution	Uttar Pradesh	49.80	No	No	No			
15	Elephant distribution	Uttar Pradesh	19.00	No	No	No			

India is a megadiverse country, with only 2.4% of the world's land area, but accounts for 7-8% of all recorded species of the world, including about 91,000 species of animals and 45,500 species of plants. India is also the second-most populous country in the world with a population of over 1.3 billion people! To transport and cater to the needs of such a large population, the Indian Railway is the main artery of inland transportation in India. In 2020, it carried a total of 808.6 crore passengers! Indian Railways is also the single largest employer in India and the eighth largest in the world, employing approximately 13 Lakh people. It is the country's lifeline for large-scale traffic movement – freight and passengers. Railways are at the core of India's economic development and make it possible to conduct many activities like business, sightseeing, and pilgrimage along with the transportation of goods over longer distances. In fact, the Indian Railways is among the world's largest rail networks and runs thousands of trains daily. To cater to India's fast-growing economy, the railway sector has envisaged Vision 2024 to achieve targets of 2024 MT freight loading by 2024. The railway also aims to electrify the entire network.

Recognized as economic, energy-efficient, and environment-friendly relative to other means of transport such as roads and air, the expansion and upgrading of railways is seen as an important measure in supporting development through large-scale movement of people and goods. However, railway construction and operation has its ecological effects, and a range of impacts on wildlife and habitats have also been documented. Several of India's passenger



and freight trains crisscross through some of the country's most sensitive wildlife habitats, particularly protected areas and corridors that are home to critically endangered tigers and elephants, amongst other animals. The extensive network of our Railways cuts through several of these forested landscapes, compromising the connectivity of the landscape and resulting in a barrier effect.

To reduce the impact of railways on our wildlife, it is important to come together and develop measures that can protect India's rich biodiversity and also help to develop a system that is more sustainable and effective in minimizing mortalities and reducing barrier effects across the railways tracks passing through sensitive habitats in India

Project Elephant Division of MoEF&CC in coordination with Ministry of Railways and Wildlife Institute of India has identified sensitive stretches which need prioritization for mitigation planning. The portal is developed to monitor the progress of implementation of mitigation measures from the beginning. The process involves joint surveys of the identified stretches by officials of the Forest Department, Railways and Wildlife Institute of India, recommendation of mitigation measures and implementation of the mitigation measures. The mitigation proposed on the stretches surveyed by various team has been upload on the dashboard. The dashboard can be accessed at Railway Crossing Zones Dashboard ([arcgis.com](http://arcgis.com))

The purpose of the dashboard is to monitor the implementation of the mitigation measures on the surveyed stretches. The officers are requested to update the information on the dashboard developed for the purpose. In case of any issues please reach us at [projectelephant.moef@gmail.com](mailto:projectelephant.moef@gmail.com) or [elephantcell@wii.gov.in](mailto:elephantcell@wii.gov.in)

## 06. List of State Forest Department and Indian Railways officials consulted during the survey

### **Odisha State Forest Department:**

1. Shri Vikas Tyagi, *Divisional Forest Officer (DFO) Angul, DFO Dhenkanal (additional charge)*
2. Ms. Shyama Bharti, *Assistant conservator of Forests, Dhenkanal Forest Division*
3. Shri Vivek Kumar, *IFS, Divisional Forest Officer, Angul (Territorial) Forest Division*
4. Shri Madhab Chandra Nayak, *Range officer, Jarapada Forest Range, Angul (T) Forest Division*
5. Shri Arabinda Mohanty, *DFO, Raidakhol*
6. Shri Harishankar Nayak, *Assistant Conservator of Forest (ACF), Sambalpur*
7. Shri Manoj, *Assistant Conservator of Forest (ACF), Sambalpur*
8. Shri Sushant Kumar Jena, *Assistant Conservator of Forest, Bonai*
9. Shri Nabin Chandra Pradhan, *Range Officer, Bonai*
10. Shri Dhanraj Hanumant Dhamdhare, *DFO, Keonjhar*
11. Shri Ashok Das, *Assistant Conservator of Forest, Keonjhar*
12. Sri Abhay Kumar Dalai, *DFO, Keonjhar Wildlife Division, Anandapur*
13. Sri Umakanta Dash, *Asst. Conservator of Forests, IIC of Deogaon Wildlife Range*
14. Miss Priyadarshini Sahoo, *Range Officer, Brahmanipal Wildlife Range, Daitari*
15. DFO, Baripada
16. Shri Arun Kumar Biswal, *Assistant Conservator of Forest, Baripada*

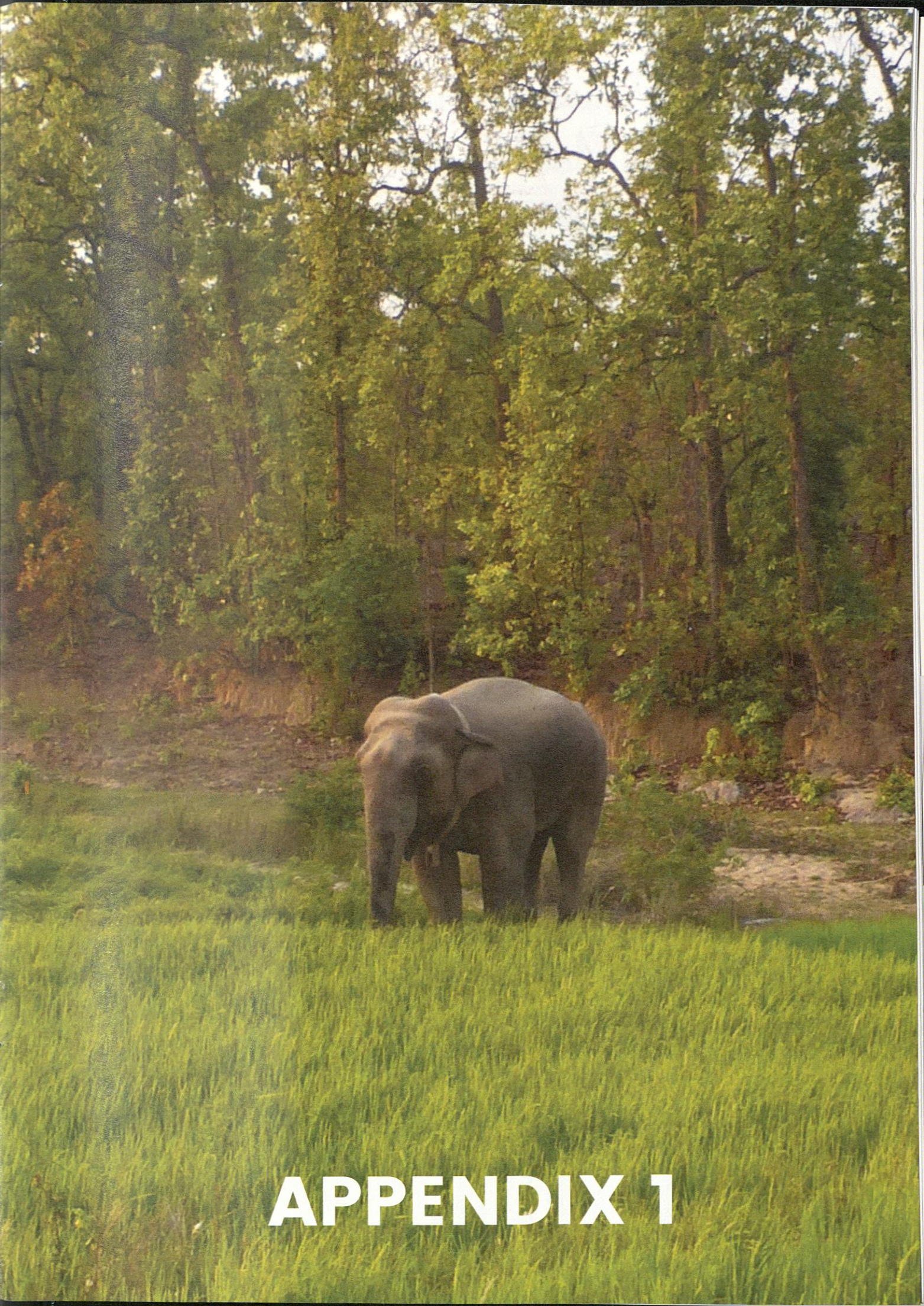
### **Indian Railways :**

17. Shri Prasann Kumar Behera, *Section Officer, East Coast Railways.*
18. Shri Pupun Sahu, *Junior Engineer, East Coast Railways*
19. Shri Vasudev Behera, *Senior Section Engineer (Works), East Coast Railways*
20. Shri Deepak, *Senior Section Engineer*
21. Shri Devender Nayak, *Assistant Divisional Engineer (ADEN), Sambalpur*
22. Mr. D. S. Rout, *SSE, South Eastern Railways*
23. Mr. B. S. Jamuda, *SSE, South Eastern Railways*
24. Bijay Kuma Bana, *ADEN, East Coast Railways*
25. Bijay Pal Bana, *ADEN, Kendujhargarh, East Coast Railways*

## 07. References

Project Elephant, MoEF&CC, Government of India (2023), Elephant Corridors of India 2023 (Edition – 1/2023).

WII, (2024). General Guidelines for Suggesting Mitigation Measures on Existing Railway Tracks Through Elephant Habitats in India.



# APPENDIX 1



भारतीय वन्यजीव संस्थान  
Wildlife Institute of India

# GENERAL GUIDELINES FOR SUGGESTING MITIGATION MEASURES ON EXISTING RAILWAY TRACKS THROUGH ELEPHANT HABITATS IN INDIA



MAY 2023

## **General Guidelines for Suggesting Mitigation Measures on Railway Tracks through Elephant Habitats in India**

Railway lines passing through elephant habitats can alter movement patterns and cause collisions of elephants with trains. Considering the threats to both elephant and human life, WII in consultation with Project Elephant Division of MoEFCC and State Forest Departments has identified 105 stretches of railway lines cutting through elephant reserves and elephant distribution beyond elephant reserves. Subsequently, the Ministry of Environment, Forests and Climate Change (MoEF&CC) and the Ministry of Railways (MoR) in a joint meeting directed that surveys by the railway officials, respective state forest department officers, and WII should be conducted within these stretches. The objectives of the joint field surveys would be to identify specific elephant crossing zones on these stretches and to suggest site-specific mitigation measures based on the location and the extent of these crossing zones.

In the case of existing railway lines, designing and locating structural mitigation measures for wildlife are confounded by several factors. Most critical among these is the limitation of the track height i.e., the height of the railway track with respect to surrounding terrain, making it difficult to allocate the minimum underpass height of 6 m required for animal underpasses in elephant landscapes. Additionally, excavating the ground under the track to achieve the prescribed height makes structures vulnerable to damage by rainwater, and also renders the structures unusable by wildlife. Thus, the choice of mitigation measures on existing railway lines has to be based on multiple factors that include wildlife, landscape as well as railway track design considerations. However, in the case of new railway lines, allocating adequate height to the railway tracks to incorporate wildlife mitigation measures along the line should be ensured.

In light of these factors, the following general pointers are prescribed to guide the Railway and Forest Officials in designing and choosing between different structural mitigation measures in the identified critical elephant zones intersected by railway lines. The choice of mitigation measures can be based on landscape, topography, railway track height, and other logistics.

### **1. Level crossings**

The coarse ballast used on railway tracks is unsuitable for movement by wildlife, particularly elephants. For this reason, level crossings for elephants built using suitable material (soil, cement) and with smooth gradient can help ease movement across the railway track at grade. Level crossings are ideally located where the surrounding land is at level (flat) with the railway track and coincides with a known/identified elephant crossing area. Rubberized level crossings<sup>1</sup> (Fig. 1) may also be used in place of cement and soil.

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<sup>1</sup> Functional Specification for Rubberised Surface at Level Crossings. 2019. Ministry of Railways, Govt of India. <https://rdso.indianrailways.gov.in/>

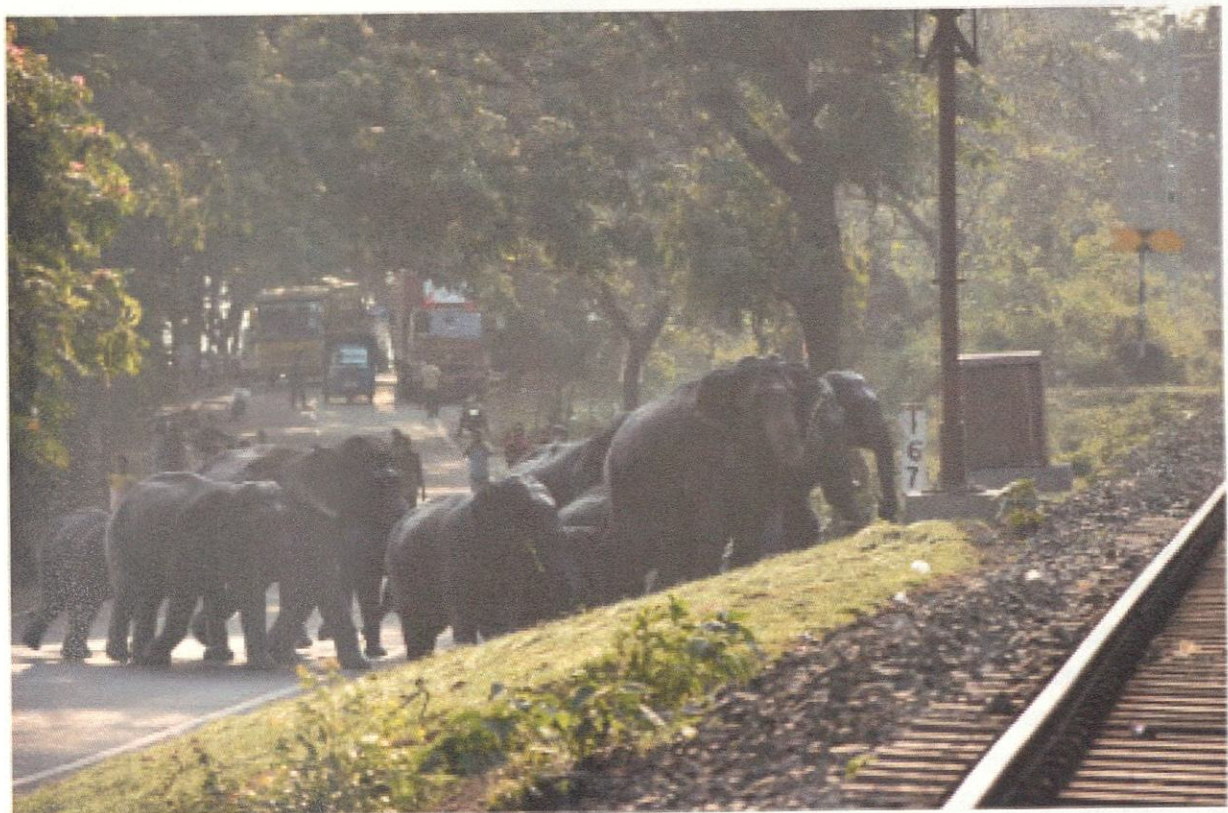
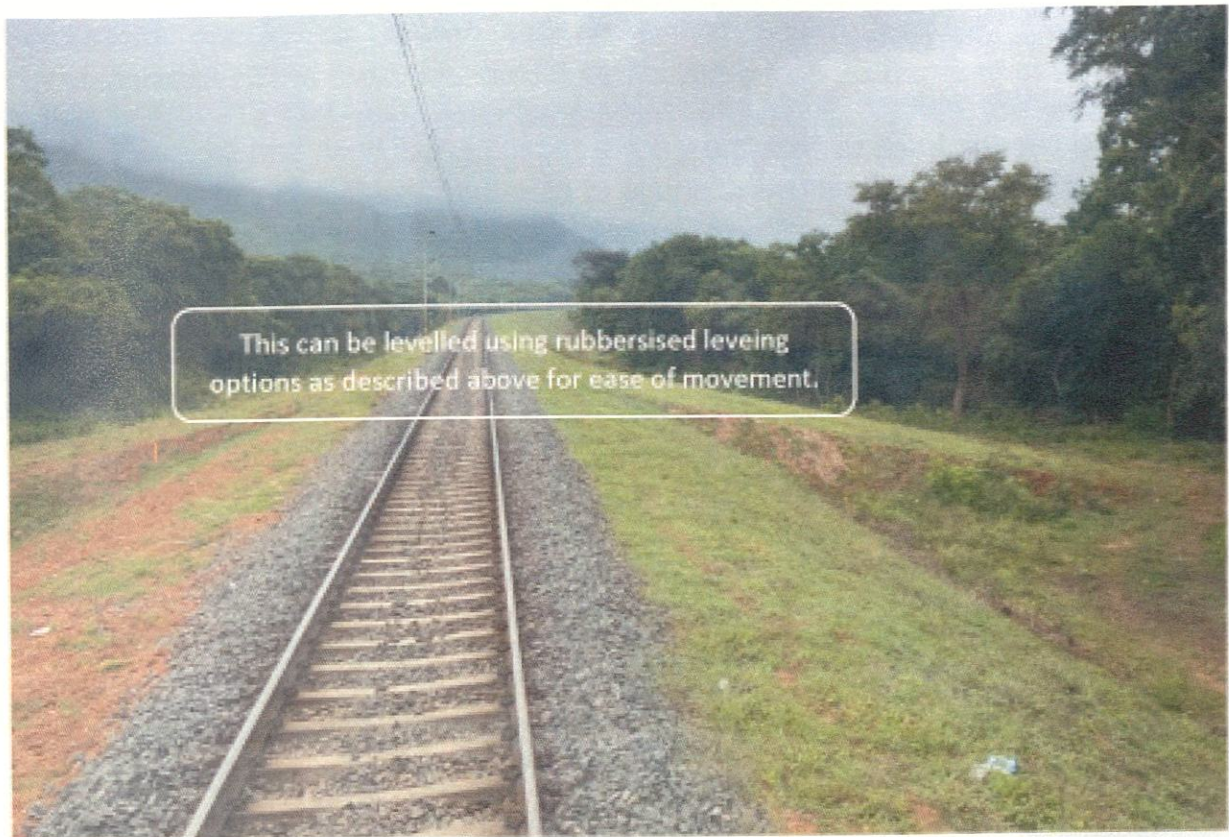


**Figure 1.** A level crossing with a rubberised surface that can be replicated on level crossings for wildlife.

## **2. Ramps**

At most elephant crossing locations intersected by railway lines, the elevation in track height and the additional layer of ballast makes it difficult for a large-bodied hooved animal like an elephant to make quick decisions and move away from a railway track in the event of an approaching train, leading to elephant-train collisions. At such locations, ramps using suitable material (soil, cement) may be constructed that flattens towards the top of the track, and allow for smooth and quick movement by elephants. It is important to include a level crossing instead of ballast at the top of the ramp (near the railway track) to ensure smooth movement by elephants. The sites for construction should be based on identified animal crossing zones and suitable terrain. Ramps should be levelled with the surrounding terrain by smoothening out the slope (Fig. 2). Additionally, in areas with human presence, the ramps may be fenced to funnel elephant movement across the railway track.

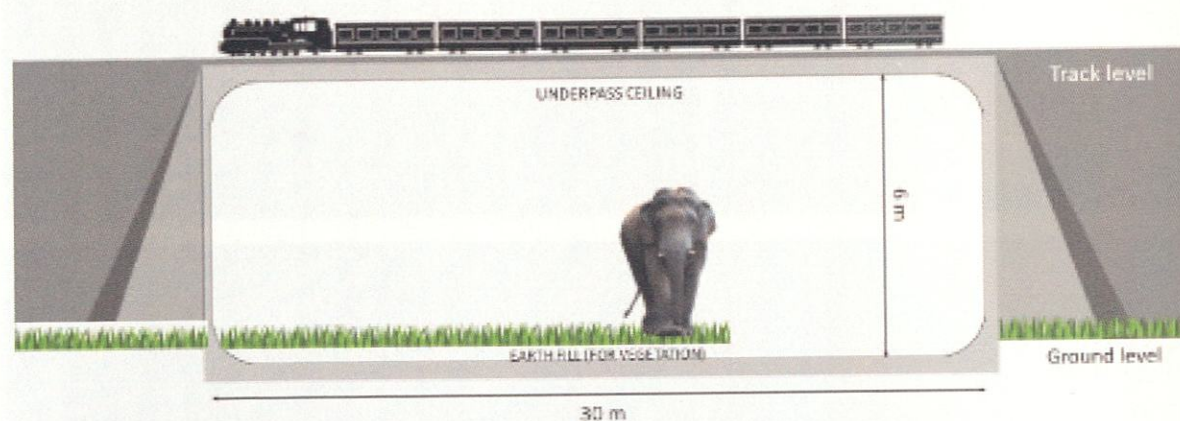
The orientation of the ramps with respect to the railway track may be oblique or perpendicular, depending on the land available for flattening the ramp to a navigable slope. The width of ramps and level crossings for elephants should be at least 50 m wide. Early warning systems or wildlife sensors may be provided at these places as additional measures to detect elephant movement and to avoid collision with trains.



**Figure 2.** An example of a ramp built for aiding elephant movement across a railway line near Coimbatore, Tamil Nadu, India (Top) and an elephant group using a ramp constructed for ease of movement in Deepor Bheel Assam, India (Bottom).

### 3. Wildlife underpasses

The term wildlife underpass can be used to describe different types of structures built below the railway track to facilitate wildlife movement. These can be box culverts, viaducts, or bridges with natural drainage of different heights and widths, depending on the target wild species or community. In elephant landscapes, the minimum height of an underpass should be 6 m, with adequate width (minimum 30 m) to allow for the movement of large elephant herds (Fig. 3). However, the actual size would depend on the width of the crossing zone and feasibility of construction of underpass considering track height and curvature. Nonetheless, all efforts should be made to maintain a minimum width of 30 m. At locations where the track height is suitable, the topography of the adjacent land should be such to avoid flooding of the underpass by rainwater. Additionally, light and sound barriers should be installed above the railway track to reduce the disturbance due to train traffic on animals using underpasses.



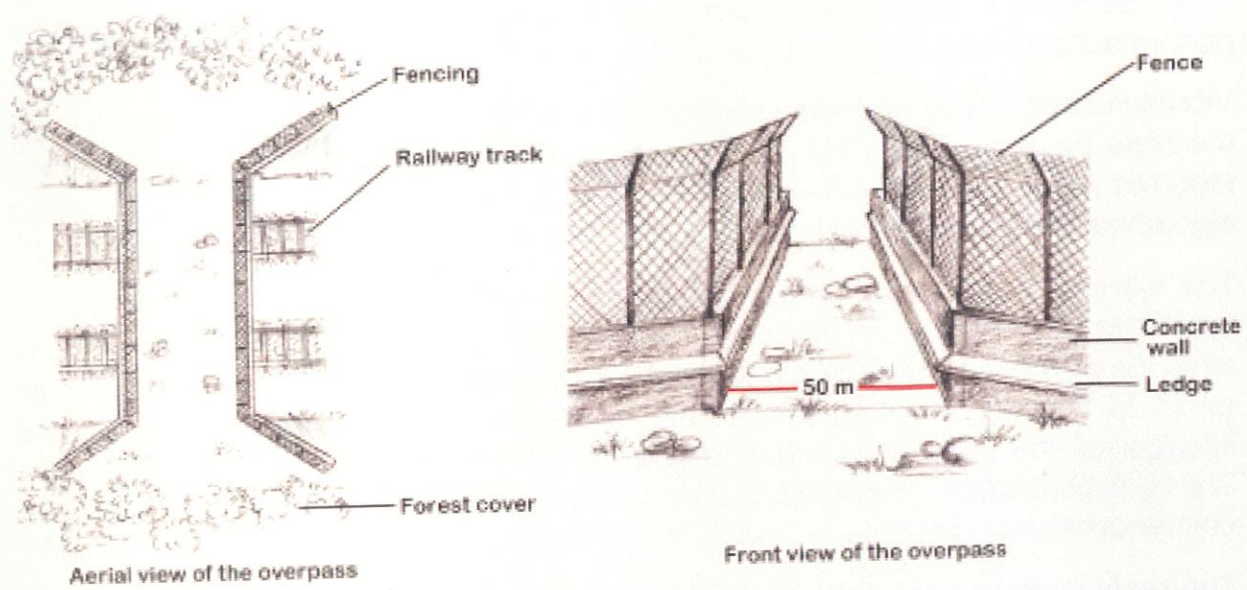
**Figure 3. Graphic representation of an underpass for elephants below a railway track.**

### 4. Wildlife overpasses

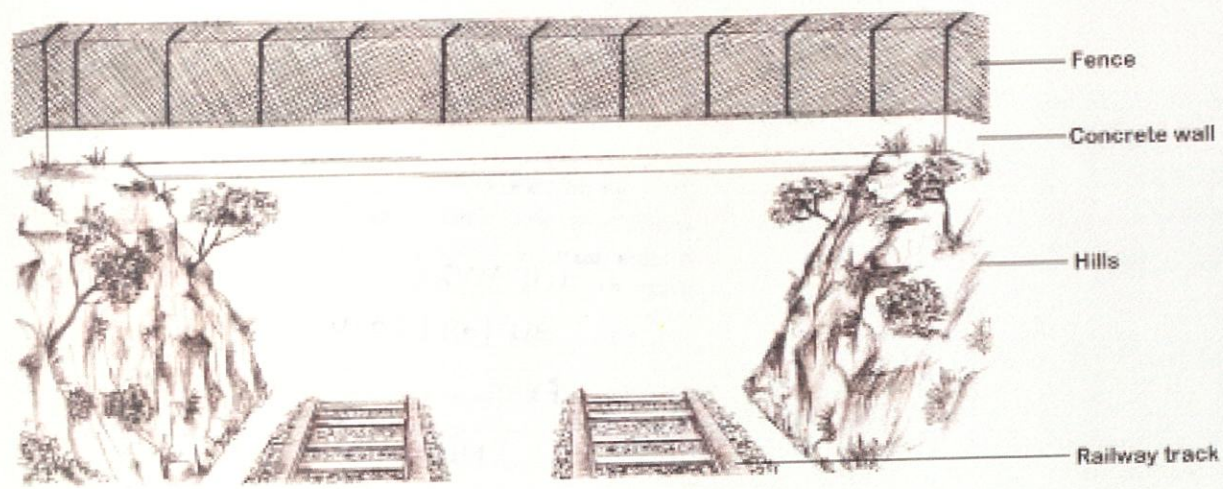
Wildlife overpasses are bridge-like structures built at a height across linear infrastructure (roads and railway lines) to allow wildlife to move across the gap in the habitat. Such structures are usually enhanced with natural habitat features such as native vegetation, rocks and logs. Wildlife overpasses are less confining, quieter and have ambient natural conditions of light and weather as compared to wildlife underpasses. Since wildlife overpasses are built at a height, construction of overpasses requires adequate height on either side of the road/railway line. Thus, overpasses should be built at locations with suitable height ( $> 7\text{m}$ ) and topography on either side. A wildlife overpass should not be less than 30 m wide, and may be wider in case of double or triple parallel railway lines.

Overpasses should ideally be built using pre-fabricated material and installed on-site. The overburden from the construction site or excavated from other sites may be used for filling. Further a suitably thick layer of soil should be laid on top of the pre-fabricated material. Revegetation should then be carried out using native grasses and shrubs on the substrate to provide a natural movement path. Either side of the top of the

overpasses should be fenced with light and sound barriers (Fig. 4). The slope/approach of the overpass should be not more than 30 degrees at any point. If the overpass is to be constructed across two or more railway tracks, a supporting pillar/post may be provided for structural support (Fig. 5).



**Figure 4. Aerial and front view of overpasses on railway tracks, with fencing/noise and sound barrier details.**



**Figure 5. Lateral view of a wildlife overpass on a double-track railway line.**

**5. Installation of Distributed Acoustic Sensing (DAS) System**

Irrespective of the type of mitigation measures to be employed across the sensitive railway stretches, all the sensitive stretches have to be installed with DAS. The system developed by railways to detect the presence and movement of the elephants along the railway tracks is basically an intrusion-based detection system based on Distributed Acoustic Sensing (DAS). A DAS monitoring interrogator converts a standard communications single-mode fiber into thousands of extremely sensitive

acoustic and vibration sensors. The Distributed Acoustic Sensor connected to one end of the fiber uses a laser to send thousands of short pulses of light along the fiber every second. A small portion of the light traveling in fiber is reflected by the process known as Rayleigh Backscatter. The concept of securing a network from malicious entities by capturing and monitoring data packets was first employed by James Anderson in 1980. Since then, researchers have developed various approaches to enhance the performance and accuracy of intrusion detection.

Vibrations from the surrounding environment will disturb the light in the fiber and will therefore be observed by the DAS interrogator. The events that are of concern are reported to the alarm server. As the data is processed in real-time, advanced algorithms can recognize the unique signatures of each type of event.

The system can show the precise location of the event, and information about what event has taken place, which means the laser pulse frequency, pulse width, and many other parameters. These parameters can be controlled, enabling the system to be tuned to the desired requirement. Integrated with machine learning and artificial intelligence, the system can differentiate even between minor variations in the scatter. The optic fiber cable running along infrastructure and other important assets can give uninterrupted and real-time feedback on activities occurring along and around them.

The recommendations of the MoEFCC committee constituted vide office order No. WL-8/28/2022-WL on 3<sup>rd</sup> January 2023 needs to be considered for the implementation of the DAS.

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