

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

IN THE STATE OF

WEST BENGAL



R/WI/2024
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AUGUST 2024

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Project Elephant, Ministry of Environment,
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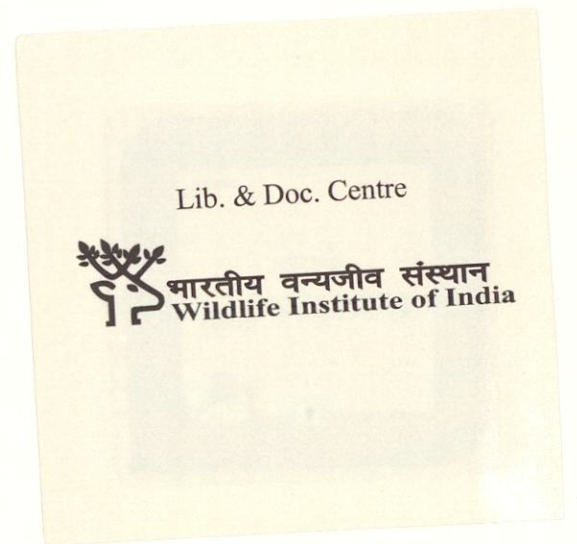


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Graphics, Illustrations & Design

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Citation: PE-MoEFCC-WII (2024). Suggested Measures to Mitigate Asian Elephant - Train Collisions on Vulnerable Railway Stretches in the state of West Bengal. Project Elephant Division, Ministry of Environment, Forest and Climate Change, Government of India and Wildlife Institute of India. Pp. 34

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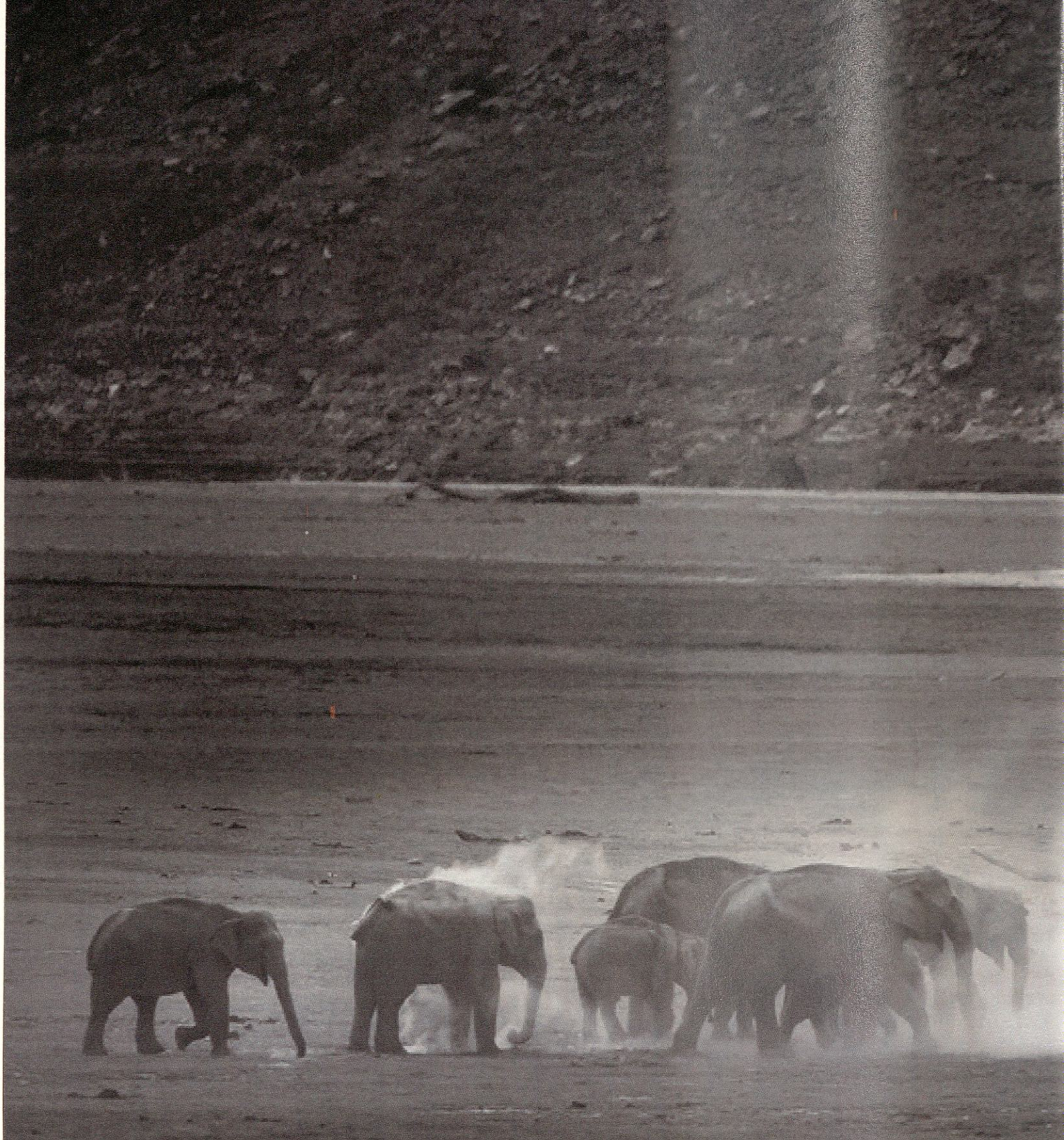
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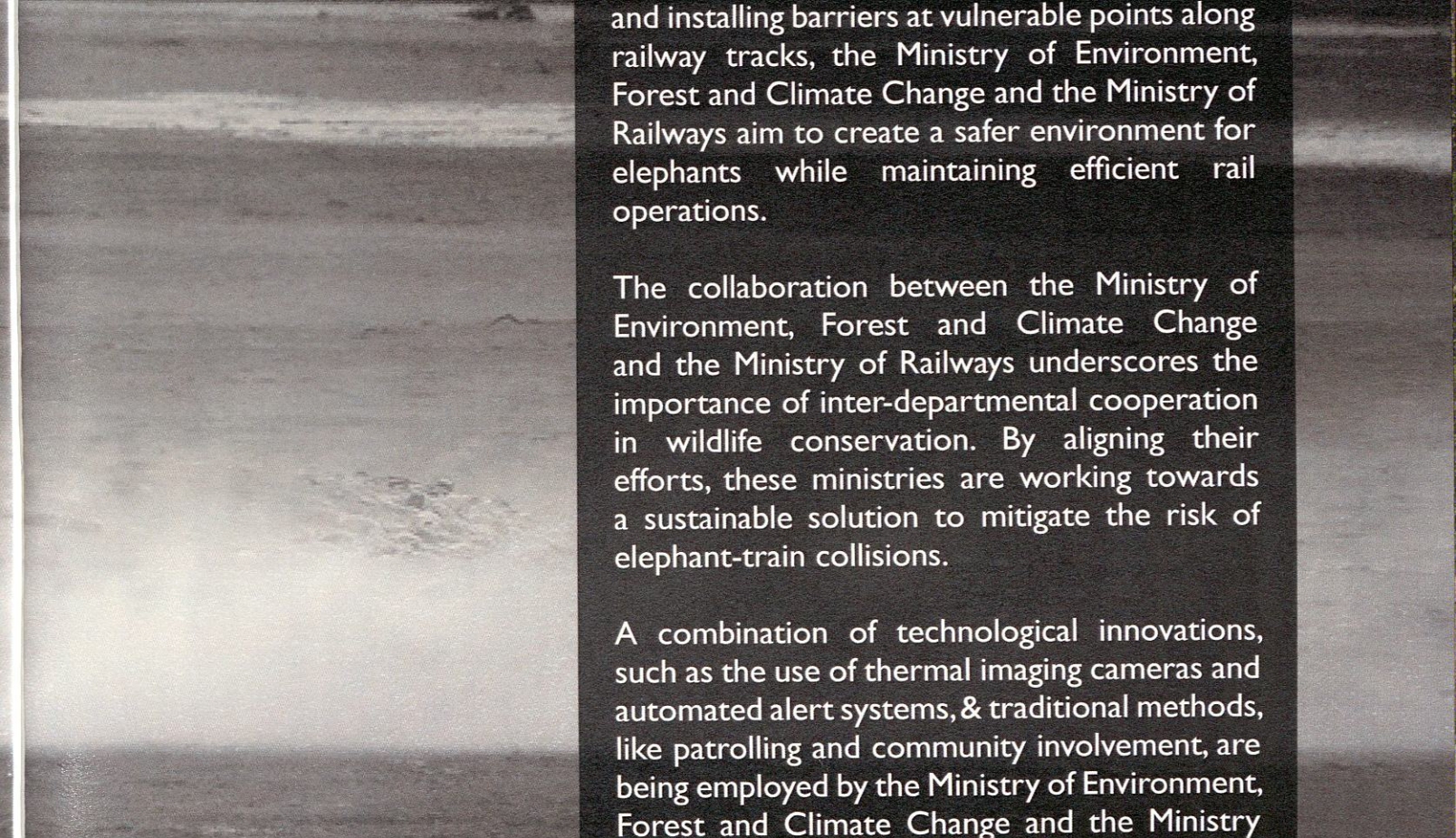
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and installing barriers at vulnerable points along railway tracks, the Ministry of Environment, Forest and Climate Change and the Ministry of Railways aim to create a safer environment for elephants while maintaining efficient rail operations.

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

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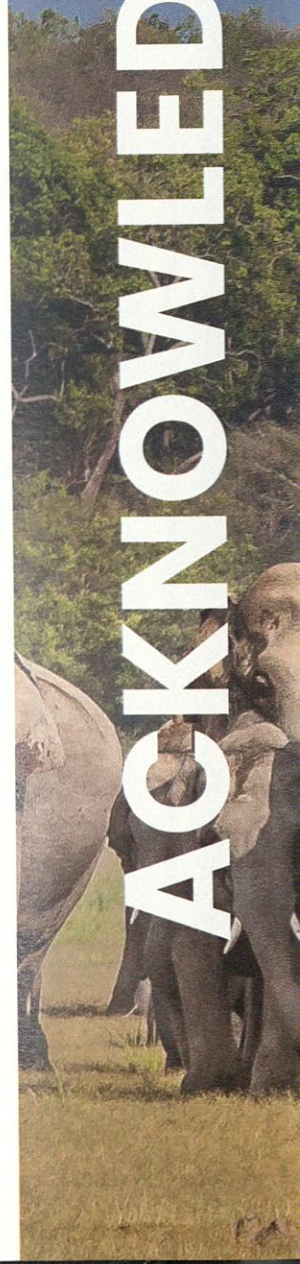
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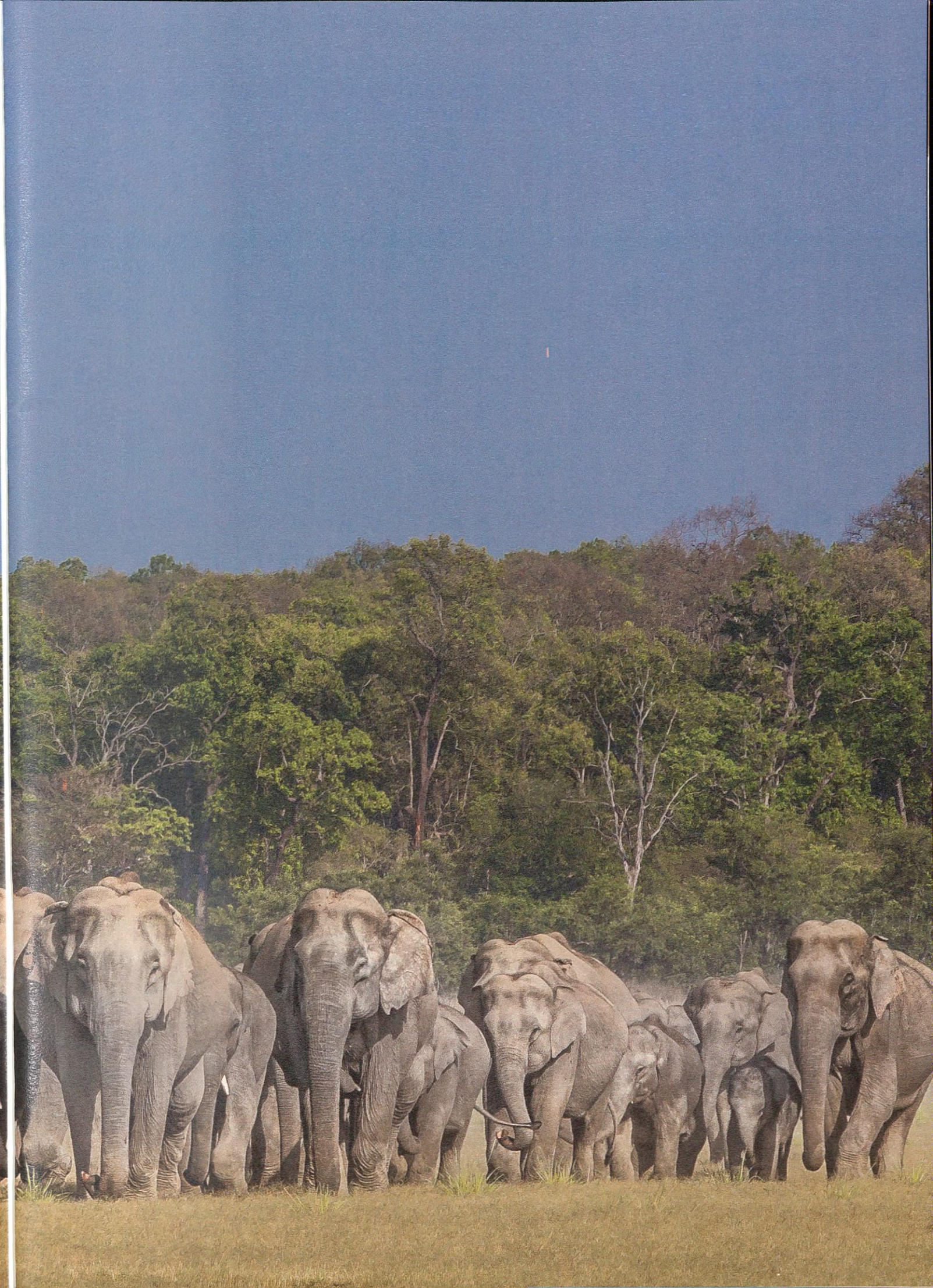
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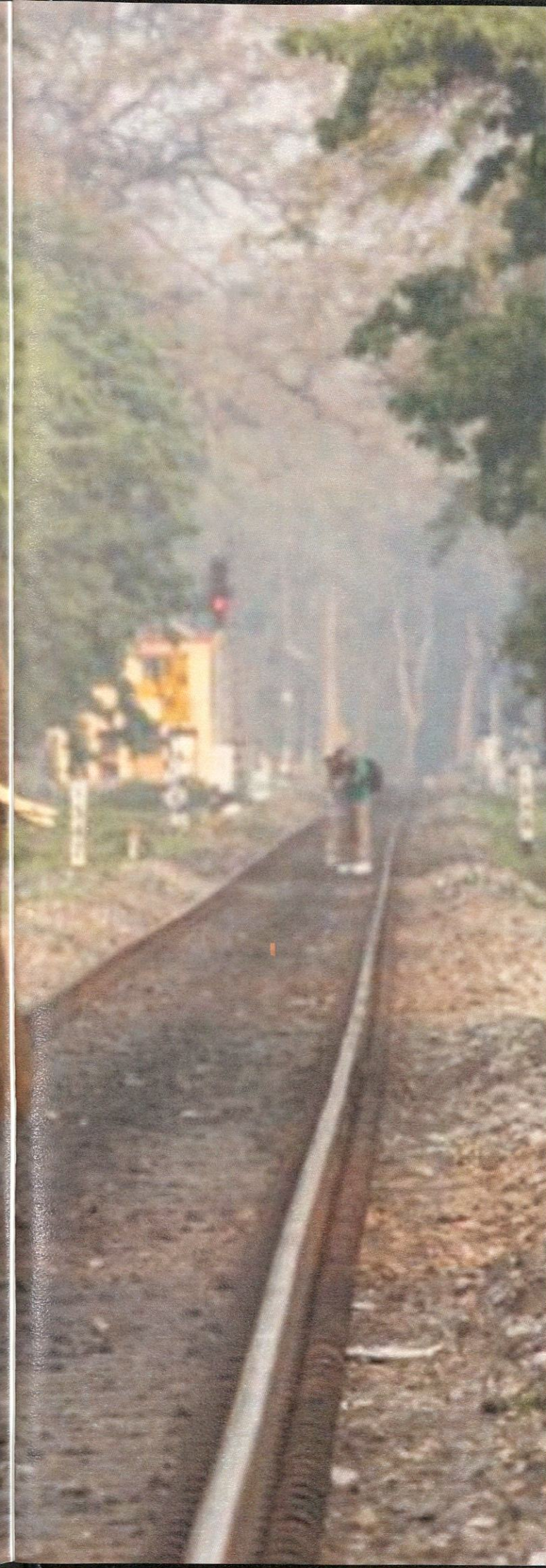
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ACKNOWLEDGEMENT









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01. Introduction

Northern West Bengal is the westernmost extent of the north-eastern population of Asian elephants, with some elephant herds found in southern West Bengal. The state is home to close to 500 elephants in north, and 194 in south Bengal. In north West Bengal, elephants reside in largely fragmented habitats, and move on an east-west axis along the forest areas on northern West Bengal, Nepal, Bhutan and Assam through a series of corridors distributed across the region. There is also some movement on the north-south axis from the hill slopes of southern Bhutan to the Terai region of northern West Bengal. In south West Bengal, the range expansion of elephants has been noticed from the Dalma Wildlife Sanctuary in the adjoining state of Jharkhand. The elephants have now become residents in these regions and their presence in south West Bengal has led to incidences of human-elephant conflict. In a report that recently mapped elephant corridors in the country, West Bengal emerged as the leader with 26 elephant corridors occurring in the state. Of these, 15 corridors are in the north, and the remaining in south Bengal. Of all threats to elephant conservation in the state, railway-related mortality of elephants has emerged as one of the leading.

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 30th August 2022).

02. Field Survey

Based on this information, joint surveys of the critical stretches of the railway lines passing through the elephant habitats in West Bengal for suggesting mitigation measures were conducted during 26-31st December, 2023 jointly by the officers/officials of Project Elephant, MoEF&CC, Ministry of Railways and West Bengal Forest Department.

The survey was conducted in the critical stretches of Alipurduar, Jalpaiguri and Darjeeling Districts of North Bengal region and in Jhargram and Paschim Medinipur Districts of South Bengal region 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 survey, meetings were held between the officers/officials of MoEF&CC and West Bengal Forest Department along with the Sr. Divisional Manager and other senior officials of the North East Frontier Railway (NEFR) 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 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. North Bengal Region: Alipurduar, Jalpaiguri & Darjeeling Districts (I) Date of survey: 27th December, 2023

Locations:

- Damanpur railway crossing near railway Over Head Equipment (OHE) Mast no. 158 to 162/3.
- Near Modhugajtola railway crossing.
- Rajabhatkhawa-Dima Bridge near OHE Mast no. 153/9 to 157/1 (around 5 Km).
- Dabrigate-Madhu Tea Garden, near railway OHE Mast no. 140/2 to 140/8.
- Near Torsa River Bridge near railway OHE Mast no. 128/1 to 130/8.
- Railway crossing near railway OHE Mast no. 122.

Observations:

- The elephants cross the railway tracks to move between the different habitats in Buxa Tiger Reserve and adjoining buffer areas in Alipurduar.
- 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.
- There is dense vegetation on both the sides of the railway tracks at various locations which needs to be cleared at least 30 meters from the railway track.
- The present speed restriction implemented by NEFR during 17:00-05:00 hrs is 30 Km/hr and 50 Km/hr from 05:00 to 17:00 hrs.
- The elevation in track height near Torsa River Bridge near railway OHE Mast no. 128/1 to 130/8 and the additional layer of ballast on the railway tracks makes it difficult for elephants to make quick decisions and move away from a railway track in the event of an approaching train.

Recommendations:

- Construction of level crossings for elephants by using suitable material (soil/ cement/ rubberised pads) and with smooth gradient to help in easy movement across the railway tracks.
- The night speed restriction timings for all the trains may be imposed from 17:00-08:00 hrs.
- Installation of more signage and boards about animal crossings near the railway tracks.
- Regular pruning of vegetation (30 meters) on both sides of the track for clear visibility to the loco pilots and the elephants. Annually 4 pruning are proposed as dense vegetation comes up very fast in the region owing to high rainfall and needs frequent pruning.

The proposed schedule of pruning are as follows:

- a. First pruning- May-June
 - b. Second pruning -August
 - c. Third pruning - October
 - d. Fourth pruning – December-January
- Frequent honking by rail engine when passing through critical stretches, especially when elephant or wildlife movement near the railway tracks has been reported or observed.
 - A new ramp to be constructed near OHE Mast no. 130/8 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.
 - The existing ramps should be levelled with the surrounding terrain by smoothening out the slope.
 - Proposed to construct an underpass between OHE Mast no. 130/1 to 129/9.
 - The existing ramps around the track should be widened to allow easy movement to the herd of elephants.
 - Proposed full time (24 x 7) speed restriction of 30 Km/hr during day and night in the stretch between OHE Mast no. 162/3 to 153/9 in Buxa Tiger Reserve and OHE Mast no. 128/1 to 130/8 in Jaldapara National Park. Since, speed restriction is already imposed in part section in Buxa Tiger Reserve, extending speed restriction to full stretch for distance within Buxa Tiger Reserve and Jaldapara will not significantly delay and hamper the operations as both the stretches are of small distances. This will reduce rail Elephant collision significantly in the stretch.
 - The Divisional Forest Officer of Kalimpong Forest Division suggested some measures which are as follows:
 - a. Breaking of ramp on both sides between Pillars no. 29/2 to 33/0 to ensure movement of elephants smoothly on both sides.
 - b. The ditches on both sides need to be filled up.
 - c. Increase the speed restriction hours from 17.00 hrs to 8.00 hrs between pillars no. 29/2 to 33/0.
 - d. Two watch towers near railway track Pillar no. 32/3 and 31/1 may be constructed and manned by railways to monitor the movement of elephants.
 - Imposition of speed restrictions of 30 Km/hr, through out day and night in all the above mentioned critical stretches for all the unscheduled trains (including the goods trains) passing through these stretches as unscheduled trains have contributed significantly to accidents in this route.
 - Regular cleaning of food waste and other garbage thrown by railway passengers onto forest stretches passing through Wildlife Sanctuaries and National Park by Railway Management.



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 Alipurduar, Jalpaiguri and Darjeeling districts, West Bengal.

3.2. North Bengal Region: Alipurduar, Jalpaiguri and Darjeeling Districts (II)

Date of survey: 28th December, 2023

Locations:

- Binaguri- Near army cantonment and Binaguri railway station- railway Pillar no. 100/3 to 100/9 at Alipurduar.
- OHE Mast nos. 101/8; OHE Mast no. 96 to 97; OHE Mast no. 96/4 to 96/7; OHE Mast no. 89/0 to 89/1; OHE Mast no. 87/7 to 87/8; OHE Mast no. 87/7 to 87/4; OHE Mast no. 86/1 to 86/2; OHE Mast no. 83/7 to 86/2; Near Chapramari railway crossing. OHE Mast no. 72/3; OHE Mast no. 72/4 to 72/5; OHE Mast no. 68/7 to 68/7 at Alipurduar.
- Mahananda Wildlife Sanctuary at railway OHE Mast no. 21/6 to 21/5 at Darjeeling District.

Observations:

- The elephants cross the railway track to move between the two habitats.
- As per the discussions with the local forest department staffs, it was informed that the elephant movement is being effected (reduced) due to uneven ramps and coarse ballast used on the railway tracks.
- Sometimes the elephant enter in the Binaguri cantonment area.
- Presently the speed restrictions are between 18:00 to 05:00 hrs.
- Elephant movements are being detected/recorded through IDS system at OHE Mast no. 83/7 to 86/2 and appropriately communicated to the concern people.

- Elephants cross the railway track to move between the two habitats in Chapramari. The elephant movement is reduced due to no visibility in the curves, coarse ballast used on railway tracks and cliff on the other side.

Proposed Recommendations:

- A ramp to be constructed at railway OHE Mast no. 21/6 to 21/5 and OHE Mast no. 100/3 to 100/9 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 for the elephants. The ramp should be levelled with the surrounding terrain by smoothening out the slope.
- The night speed restriction timings for all the trains may be imposed from 17:00-08:00 hrs.
- Proposed an underpass as per WII's guidelines in between stretch of OHE Mast no. 87/7 to 87/4.
- Installation of more signage and boards about animal crossings near the railway tracks.
- Regular pruning of vegetation (30 meters) on both sides of the track for clear visibility to the loco pilots and the elephants. Annually 4 pruning are proposed as dense vegetation comes up very fast in the region owing to high rainfall and needs frequent pruning.

The proposed schedule of pruning is as follows:

- a. First pruning- May-June
 - b. Second pruning –August
 - c. Third pruning – October
 - d. Fourth pruning - Dec-January
- Frequent honking by train engine when passing through critical stretches especially when elephant or wildlife movement near the railway tracks has been reported or observed.
 - Need efficacy testing of the heavier vehicles such as Tractor trolleys, trucks etc. near the tracks where IDS is being used.
 - Proposed an overpass as per WII guidelines in between OHE Mast no. 72/4 to 72/5.
 - Proposed 24 hours speed restriction of 30 Km/hr in between OHE Mast no. 72/3 to 68/7.
 - Imposition of speed restrictions of 30 Km/hr, throughout day and night in all the above mentioned critical stretches for all the unscheduled trains (including the goods trains) passing through these stretches as unscheduled trains have contributed significantly to accidents in this route.
 - Regular cleaning of food waste and other garbage thrown by railway passengers onto forest stretches passing through Wildlife Sanctuaries and National Parks by Railway Management.



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 Alipurduar, Jalpaiguri and Darjeeling districts, West Bengal.

3.3. North South Bengal Region: Jhargram and Paschim Medinipur Districts (I)

Date of survey: 29th December, 2023

Locations:

- Guptmani- Kumari-Dogeriya near railway Overhead Equipment Number (OHE) Mast no. 132/6. GPS Location: 87° 10'12" E, 22° 20'54" N
- Banstala near railway OHE Mast no. 144/6. GPS Location: 87°04'34" E, 22° 24'52" N

Observations:

- The railway tracks is frequently used by all categories of trains including Goods and Rajdhani trains as it is the main line which connects Kolkata with Mumbai.
- It was informed by the Railway officers that there is a planning of laying a new railway track and proposal of running the high speed trains at around 160 km/hr.
- It was also informed by the railway officers that fencing would be done around the tracks to avoid the cattle movement on tracks.
- Due to straight railway tracks and clear visibility, very few incidents of train-elephant hits have been recorded in the area. However, it is envisaged that since, elephants frequently cross the railway tracks to move between the districts of Pachim Medinipur and Jhargram, the cattle fencing for high speed trains would become a major hurdle in their movement in future.

- A fencing of around 1.2 Km was erected by railways near OHE Mast no. 144 and the same was damaged by the elephants at 3-4 locations to cross the railway tracks. The terrain was also high at one side near OHE Mast no. 144 which is obstructing the smooth movement and crossing of tracks by elephant.
- There is a narrow stretch of approximately 30 to 50 meters which is generally used by Elephant for crossing the railway track. There are total 6 such crossing points under the jurisdiction of Jhargram Forest Division. Point no. 1 and 2 are covered in field inspection conducted on 29.12.2023. Remaining four crossing points are covered in the field inspection conducted on 30.12.2023.

Recommendations:

- Construction of either Overpass or Underpass as per WII guidelines in the mentioned crossing point will allow the safe movement of Elephants across the railway track.
- A ramp to be constructed near OHE Mast no. 144 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.
- 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.
- Installation of more signages and boards about animal 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 such crossing locations.

3.4. South Bengal Region: Jhargram and Paschim Medinipur Districts (II)

Date of survey: 30th December, 2023

Locations:

- Jhargeriya near OHE Mast no. 159/18A/1. GPS Location: 86°56'31" E, 22° 28'27" N.
- Lalbana near OHE Mast no. 146/21. GPS Location: 87°03'21" E, 22° 25'30" N.
- Banstala near OHE Mast no. 145/11. GPS Location: 87°04'01" E, 22° 25'09" N.
- Rasua-Lalgeriya near OHE Mast no. 142/5 to 142/11. GPS Location: 87°05'33" E, 22°24'21" N.
- OHE Mast no. 172/24 to 172/26 (Ledagmara) Amlagora Range in Paschim Medinipur District.
- OHE Mast no. 184/1 to 184/5 (Nachanjam) Garhbeta Range.

Observations:

- The railway tracks is frequently used by all categories of trains including Goods and Rajdhani trains as it is the main line which connects Kolkata with Mumbai.
- It was informed by the railway officers that there is a planning of laying a new railway track and proposal of running the high speed trains at around 160 Km/hr in the railway line passing through Jhargram Forest Division.
- It was also informed by the railway officers that fencing would be done around the tracks to avoid the cattle movement on tracks.
- Due to straight railway tracks and clear visibility, very few incidents of train-elephant hits have been recorded in the area.
- However, it is envisaged that since, elephants frequently cross the railway tracks to move between the districts of Paschim Medinipur and Jhargram, the cattle fencing for high speed trains would become a major hurdle in their movement in future.
- Coordination between Railways and Forest Department personnel is playing a significant role in safe crossing of elephants across the railway track.

Recommendations:

- At most of the identified critical stretches, the railway tracks are on the ground level.
- 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. However, considering the future scenarios, 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 efficacy of electric barrier with energised steel padding and fencing on the railway track must be explored.
- The feasibility of finalizing the mitigation measures such as construction of elevated railway tracks, overpasses and underpasses 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.
- Land leveling is needed about 500 Meters on both sides at OHE Mast no. 172/9 and 172/8.
- Regular pruning of bushes (30 meters) 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.



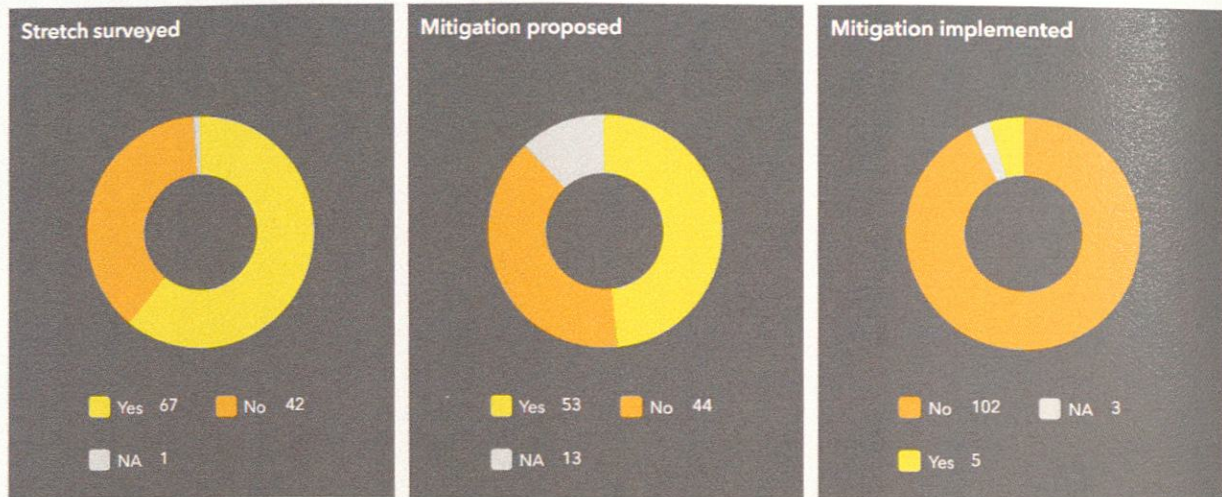
Figure 3: Field survey conducted by Project Elephant (MoEF&CC) representatives in collaboration with Indian Railways and State Forest Department officials in sensitive railway line stretches in Jhargram and Paschim Medinipur districts, West Bengal.

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



Serial No.	Name of area	State	Crossing score width (m)	Stretch surveyed	Mitigation proposed	Mitigation implemented	Remarks	Report Link
1	Elephant reserve	Uttaranchal	8.60	Yes	Yes	No		https://drive.google.com/file/d/1FZ2CtH4G6v0jBw7YnDg2U2C0p2wv7uq/view?usp=sharing
2	Elephant reserve	Uttaranchal	14.30	Yes	Yes	No		
3	Elephant reserve	Uttaranchal	28.92	Yes	Yes	Yes	This stretch has been surveyed under Harrowick Project & separately discussed with MHA	
4	Elephant reserve	Uttaranchal	4.50	Yes	Yes	Yes	This stretch has been surveyed under Harrowick Project & separately discussed with MHA	
5	Elephant reserve	Uttaranchal	21.30	Yes	Yes	Yes	This stretch has been surveyed under Harrowick Project & separately discussed with MHA	
6	Elephant distribution	Uttaranchal	5.90	Yes	No	No	Stretch falls within Kathgodam city limits	
7	Elephant distribution	Uttaranchal	4.40	Yes	Yes	No	Surveyed by Forest Department	https://drive.google.com/file/d/1Fz2CtH4G6v0jBw7YnDg2U2C0p2wv7uq/view?usp=sharing
8	Elephant distribution	Uttaranchal	28.85	Yes	Yes	Yes	This stretch has been surveyed under Harrowick Project & separately discussed with MHA	
9	Elephant distribution	Uttaranchal	32.75	Yes	Yes	Yes	This stretch has been surveyed under Harrowick Project & separately discussed with MHA	
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	5.30	No	No	No		
13	Elephant distribution	Uttar Pradesh	10.20	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)

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 or elephantcell@wii.gov.in

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

West Bengal State Forest department:

1. Shri Ujjal Ghosh, APCCF, North Bengal
2. Shri Apurba Sen, Field Director, Buxa Tiger Reserve
3. Shri Bhaskar J.V., Conservator of Forest, Wildlife North
4. Shri Sandeep Berwal, Divisional Forest Officer, Jaldapara Wildlife Division
5. Shri A.K. Kushwaha, Northeast Frontier Railway
6. Shri Rajesh Kumar, IFS, APCCF (Wildlife) West Bengal.
7. Shri Ashok Pratap Singh, IFS, CCF Western Circle, West Bengal.
8. Shri Pankaj Suryawanshi, IFS, DFO Jhargram Division.
9. Shri Manish Kumar Yadav, WBFS, DFO Kharagpur Division.
10. Shri Balaram Panja, WBFS, ADFO Jhargram Division.
11. Shri Partha Mukherjee, WBFS, ADFO Jhargram Division.

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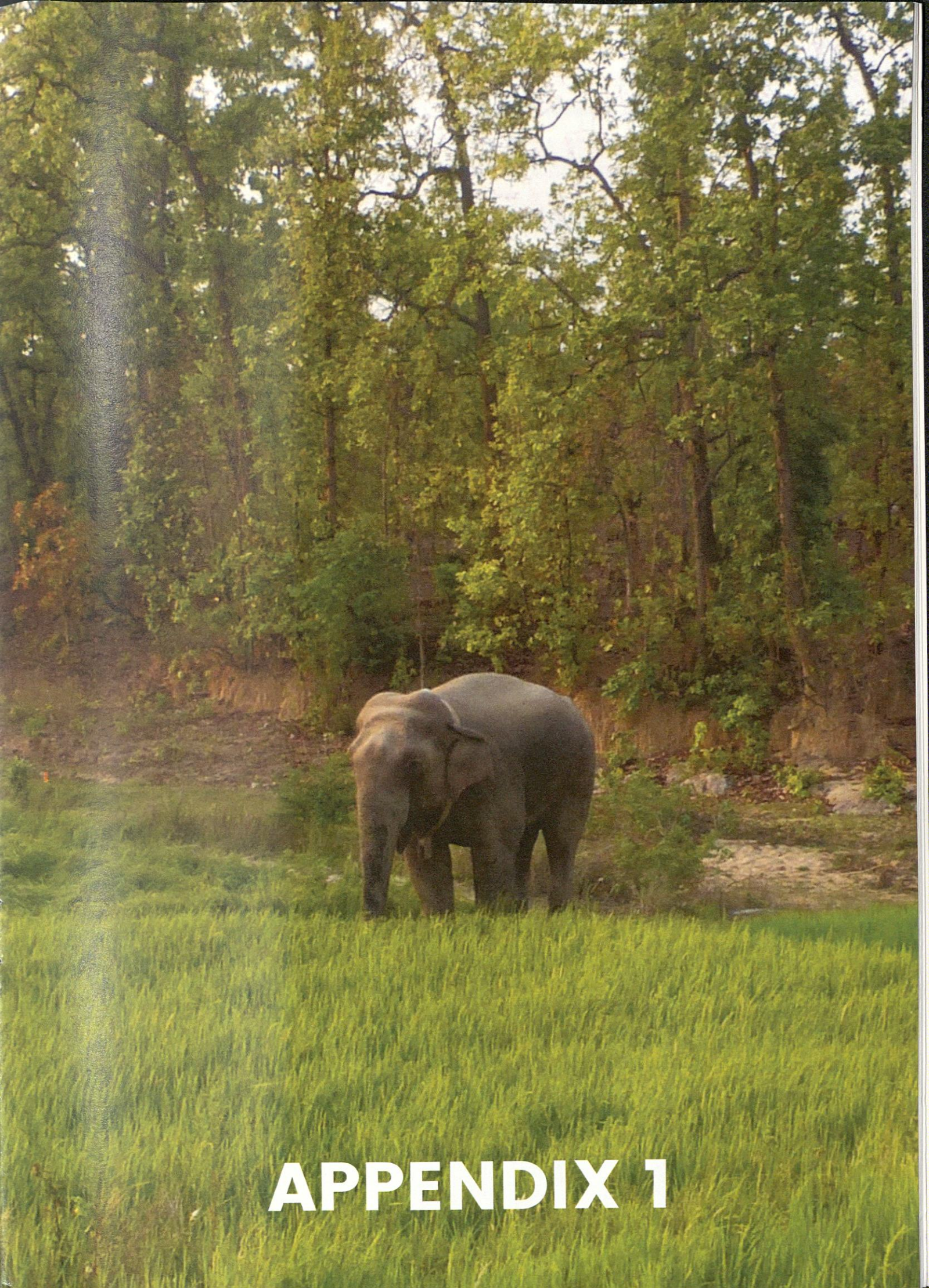
Indian Railways:

12. Shri Narendra Singh, Senior Engineer, Northeast Frontier Railway
13. Shri A.K. Kushwaha, Northeast Frontier Railway
14. Shri Anil Kumar Gupta, DEN West, Kharagpur Railway Division.

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 Railways 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 crossings¹ (Fig. 1) may also be used in place of cement and soil.

¹ Functional Specification for Rubberised Surface at Level Crossings. 2019. Ministry of Railways, Govt of India. <https://rdsso.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 hoofed 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 smoothing 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.

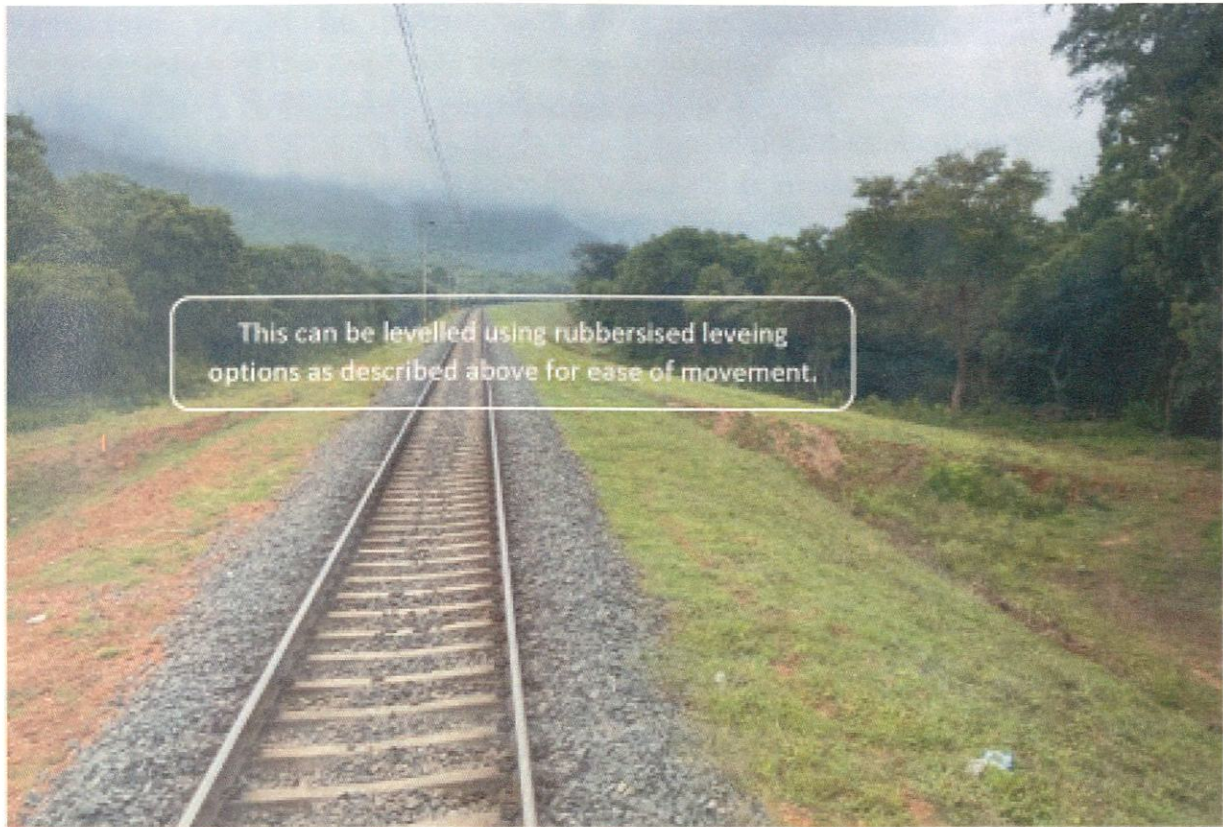


Figure 2. An example of a ramp built for aiding elephant movement across a railway line near Coimbatore, Tamil Nadu, India (Top) and an elephant group using a ramp constructed for ease of movement in Deepor Bheel Assam, India (Bottom).

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.

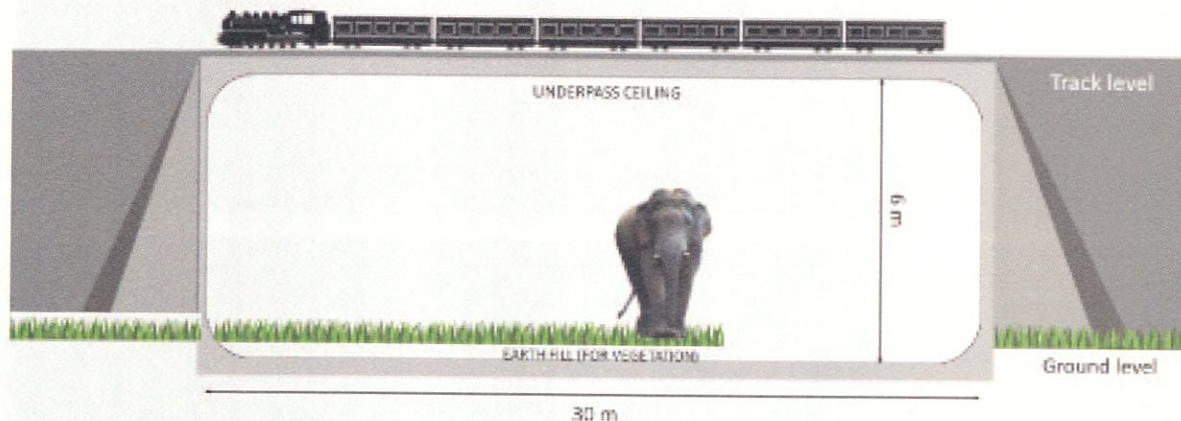


Figure 3. Graphic representation of an underpass for elephants below a railway track.

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 (> 7m) 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).

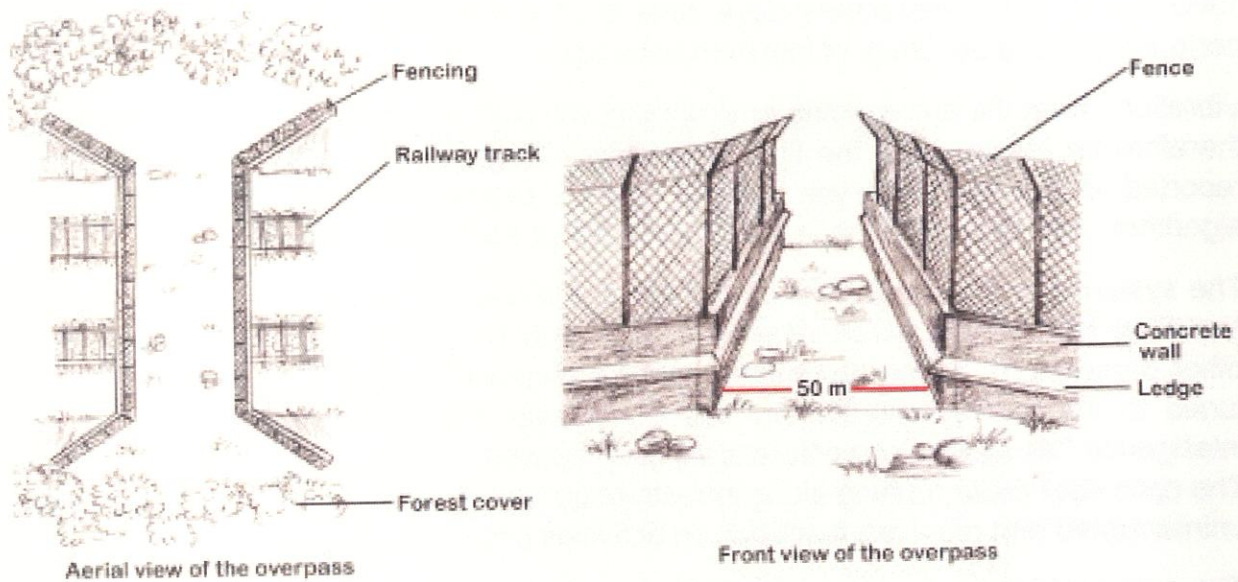


Figure 4. Aerial and front view of overpasses on railway tracks, with fencing/noise and sound barrier details.

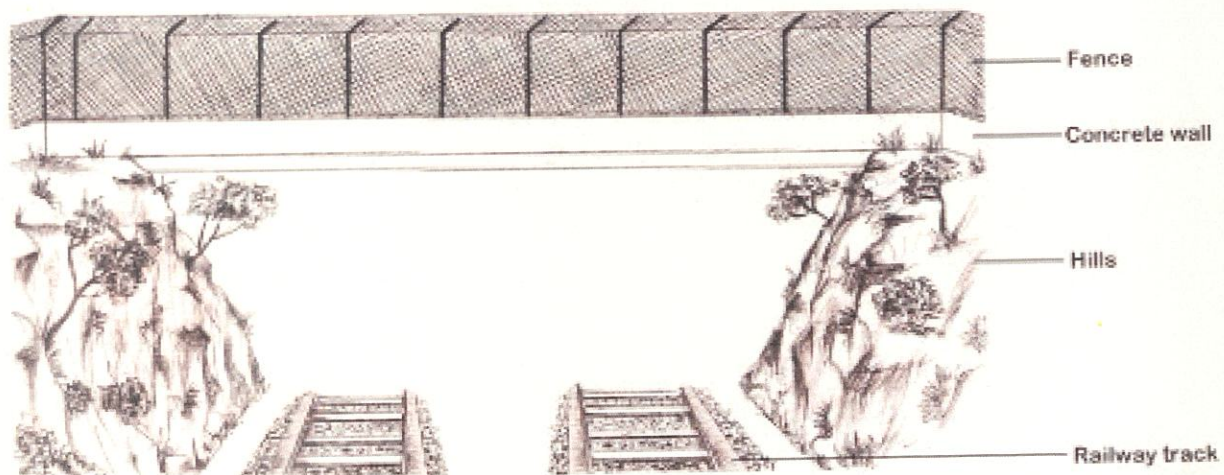


Figure 5. Lateral view of a wildlife overpass on a double-track railway line.

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 3rd January 2023 needs to be considered for the implementation of the DAS.
