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(An Autonomous Institute under Ministry of Environment, Forest & Climate Change, Govt. of India)
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Azadi Ka Amrit Mahotsav

No. WII/AE&CB/BH/Nagpur-Katol/2022-01

Dehradun, the July 12, 2022

To

Chief General Manager (Tech)/R.O.
Regional Office – Nagpur
3rd Floor,
Opp. to Office of Dy. Commissioner of Police Traffic (Nagpur City)
Palm Road, Nagpur – 440 001, Maharashtra
E-mail: ronagpur@nhai.org

Sub.: Review of proposed mitigation plan for upgradation of Nagpur – Katol Road (NH 353J) – reg.

Ref.: Letter NHAI/RO-NAG/Plantation/2021-22/3526 from your office dated 13.01.2022

Letter D-23(2)/Survey/C.N.145/2713/2021-22 from the office of the Principal Chief Conservator of Forests (HoFF), Maharashtra dated 25.01.2022

Sir,

With reference to the aforementioned communication, please find attached a report regarding review of the proposed wildlife mitigation plan for diversion of 14.07 Ha of forest land for upgradation of Nagpur-Katol section of NH 353J from km 13+00 (Outer Ring Road, Nagpur) to 62+900 (End of Katol Bypass).

Thanking you.

Yours faithfully,

(Dr. Y. V. Jhala)
Dean, FWS

Encls: As above.

Copy to

The Principal Chief Conservator of Forests (Wildlife)/Chief Wildlife Warden, Maharashtra State, Nagpur, Van Bhawan, Ramgiri Road, Civil Lines, NAGPUR- 440 001 (Maharashtra), *E-mail: pccfwlngp@mahaforest.gov.in.*

Review of proposed mitigation plan for upgradation of Nagpur - Katol Road (NH 353J)

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Review of the Proposed Wildlife Mitigation Plan for Diversion of 14.07 Ha of Forest land for Upgradation of Nagpur-Katol section of NH 353J from Km 13+00 (Outer Ring Road, Nagpur) to 62+900 (End of Katol Bypass)

The National Highways Authority of India (NHAI) has proposed the up-gradation to 4-lane with paved shoulders of the Nagpur – Katol section of NH-353J from km 13+000 (Outer ring road, Nagpur) to km 62+900 (end of Katol Bypass), spanning 49.9 km. The project road connects Katol and Kalmeshwar Tehsil of Nagpur to Nagpur City and thereafter ensures connectivity of Warud Tehsil of Amravati district to Nagpur City. The traffic for the Nagpur-Katol section is 21,794 as of November 2020, and thereby requires up-gradation to 4-lane configuration.

While the necessary permission for forest land clearance have been approved and the alignment does not pass through any protected area, the alignment passes through the Pench-Bor tiger corridor of the Eastern Vidarbha Landscape (Figure 1). The corridor may consist of forest land as well as forest patches interspersed within the agricultural landscape.

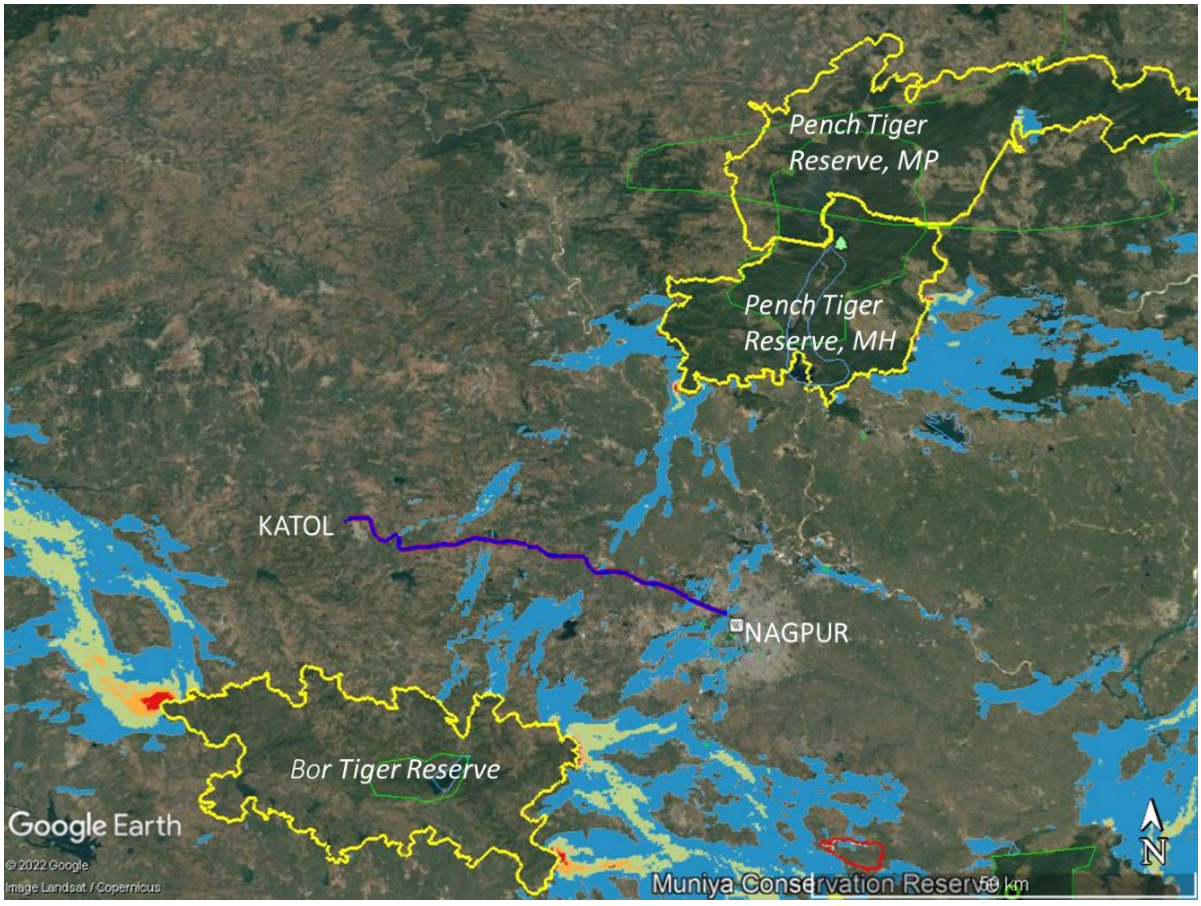


Figure 1. Proposed alignment for four-laning of the National Highway 353J passing through the Pench – Bor tiger corridor in the Vidarbha Landscape, Maharashtra.

Projected impacts of the highway up-gradation

The proposed up-gradation of NH-353J passes through a matrix of forested patches and agricultural areas, both of which make up tiger corridor connecting Pench and Bor

tiger reserves in Maharashtra. The proposed up-gradation is to be carried out for 59.8 km.

While the project site is highly fragmented with small patches of forest in a matrix of human settlements and agriculture, the highway up-gradation could further deteriorate the connectivity of the Pench-Bor tiger corridor. Widening of the roads would amplify the negative impacts on wildlife. High speed traffic on the up-graded highway can cause wildlife mortality (Jackson 2000; Saxena et al. 2020; Dennehy et al. 2021). This could impact not only large mammals like tigers and associated species, but across small mammals, birds, amphibians and reptiles. Traffic-related disturbance is known to adversely affect birds, herpetofauna and small mammals populations (Roedenbeck & Voser 2008; Rao & Koli 2017). Increased traffic intensity, fast-paced traffic along with higher probability of wildlife-vehicle collisions therefore creates a physical barrier for animal movement (Rico et al. 2007; van der Ree et al. 2011; Shilling et al. 2020) as well as poses a threat to human life (Taylor & Goldingay 2010; Diaz-Varela et al. 2011; Kučas & Balčiauskas 2021).

Mitigation Measures proposed by NHAI

NHAI has prepared a wildlife mitigation plan with details of mitigation structures to be built along the highway to be up-graded. Mitigation measures have also been included within forest patches. Subsequently, the PCCF (Wildlife), Maharashtra State vide letter D-23(2)/Survey/C.N.145/2713/2021-22 dated 25th January 2022 requested WII to review the mitigation measures on NH 353J.

Review of proposed mitigation measures

We conducted a review of the aforementioned mitigation measures using information based on radio-telemetry based tiger corridors of Vidarbha Landscape (Habib et al., 2021). Highway segments overlapping the corridor, demarcated forest patches and continuous forest patches adjacent to the highway were identified, and dimensions of the mitigation structures were revised in view of their location vis-à-vis the corridor and adjacent forest patches (Table 1). Details of recommendations and revision in dimensions are provided in the columns highlighted in green.

Details of structure (type, dimensions) for forest patches before chainage km 37.125 has not been provided. For this section, we have used structure details provided in the kml file.

All minor bridges are recommended, with a minimum height of 5 m. Minimum dimensions of all box culverts falling within forest patches should be 5 x 5 m. The dimensions of some box culverts located adjacent to forest patches (not marked in kml) have also been modified accordingly.

Structures with remark “not a mitigation structure” refer to structures that would not function as crossing structures because of their location, and may not be included as part of the mitigation plan.

Table 1. Mitigation measures proposed by NHAI for proposed upgradation of NH 353J, and revised recommended dimensions for maintaining the connectivity of the Pench-Bor tiger corridor in the Vidarbha Landscape, Maharashtra.

S. No.	Location (Km)	Earlier Proposed Structure as per Forest Proposal	Earlier Proposed Span/ Opening (m.)	Modified Structure considering Wildlife crossing	Modified Span/ Opening (m)	Recommended structure dimensions (m)	Remarks
1.	17.100	Box culvert	Span- 2 x 2m Height- 2 m				
2.	37.125	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	No structure found in kml; Not a mitigation structure	
3.	37.262	Culvert	1.2 m	Culvert	1.2 m	Not a mitigation structure	
4.	37.592	Culvert	1.2 m	Culvert	1.2 m	5 x 5	Recommended
5.	37.890	Culvert	-	Culvert	Span: 2 x 1.5 x 1.5	5 x 5	Recommended
6.	38.400	Minor Bridge	**Width-8 m; Height 2 m**	Minor Bridge	**Width- 12m x 3no. = 36m; Height 4.5m**	Width: 36 Height: 5	Recommended
7.		Culvert	-				
8.	39.066	Minor Bridge	Width- 12m; Height 4m	Minor Bridge	Width- 12m; Height 4m	Recommended	
9.	39.150	Culvert	-		1 x 2 x 2	5 x 5	Recommended; Move to ch. 39.065
10.	39.425	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	Not a mitigation structure	
11.	39.750	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	Not a mitigation structure	
12.	40.000	Culvert	-			5 x 5	Dimensions of proposed structure have not been provided
13.	40.320	Culvert	-			5 x 5	Dimensions of proposed structure

S. No.	Location (Km)	Earlier Proposed Structure as per Forest Proposal	Earlier Proposed Span/ Opening (m.)	Modified Structure considering Wildlife crossing	Modified Span/ Opening (m)	Recommended structure dimensions (m)	Remarks
							have not been provided
14.	40.460	Culvert	2 x 1.2m	**Minor Bridge**	**Width- 12m x 2no. = 24m ; Height 4.5m**	Recommended	
15.	40.633	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	5 x 5	Recommended
16.	40.925	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	5 x 5	Recommended
17.	41.200	Minor Bridge	Width 8m; Height 5m	Minor Bridge	Width 8m; Height 5m	Recommended	
18.	41.570	Culvert	1.2 m	Culvert	1.2 m	Not a mitigation structure	
19.	41.910	Culvert	2 x 1.2m	Culvert	2 x 1.2m	5 x 5	Recommended
20.	42.267	Culvert	Width-2 m; Height 2 m	Culvert	Width-2 m; Height 2 m	5 x 5	Recommended
21.	42.560	Culvert	Span: 2x1.5			5 x 5	Recommended
22.	42.700	Minor Bridge	Width 24m; Height 5m	Minor Bridge	Width 24m; Height 5m	Recommended	
23.	43.150	Culvert	-	Culvert	-	5 x 5	Recommended
24.	43.452	Minor Bridge	Width 16 m; Height 5m	Minor Bridge	Width 16 m; Height 5m	Recommended	
25.	43.670	Culvert	1.2 m	Culvert	1.2 m	5 x 5	Recommended
26.	44.000	Box Culvert	Width - 2 m; Height 2 m	Box Culvert	Width - 2 m; Height 2 m	Width: 10 Height: 5	Merge culverts on chainage 43960 and 44000
27.	45.100	Underpass	Width-12m; Height 4.5 m	Underpass	Width-12m; Height 4.5 m	Not a mitigation structure	
28.	45.200	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	Not a mitigation structure	

S. No.	Location (Km)	Earlier Proposed Structure as per Forest Proposal	Earlier Proposed Span/ Opening (m.)	Modified Structure considering Wildlife crossing	Modified Span/ Opening (m)	Recommended structure dimensions (m)	Remarks
29.	45.670	Culvert	1.2 m	Culvert	1.2 m	5 x 5	Recommended
30.	46.000	Minor Bridge	Width – 2 x 12; Height – 4 m	Minor Bridge	Width – 2 x 12; Height – 4 m	Width: 2 x 12 Height: 5	Recommended
31.	46.200	Underpass	Width-12m; Height 4.5 m	Underpass	Width-12m; Height 4.5 m	Not a mitigation structure	
32.	46.300	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	Not a mitigation structure	
33.	46.550	Box culvert	1 x 2 x 2			Not a mitigation structure	
34.	46.840	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	Not on kml; Not a mitigation structure	
35.	47.250	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	Not a mitigation structure	
36.	47.570	Minor Bridge	Width – 2 x 12.5; Height 3.5m	Minor Bridge	Width – 2 x 12.5; Height 3.5m	Recommended with height 5 m	
37.	47.800	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	Not a mitigation structure	
38.	48.185	Culvert	1.2m	Culvert	1.2m	Not a mitigation structure	
39.	48.737	Minor Bridge	Width – 2 x 12.5; Height 3 m	Minor Bridge	Width – 2 x 12.5; Height 3 m	Not a mitigation structure	
40.	48.850	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	Not a mitigation structure	
41.	49.365	Culvert	2 x 1.2m	Culvert	2 x 1.2m	Not a mitigation structure	
42.	49.700	Culvert	1m	Culvert	1m	No structure in kml	
43.	49.785	Culvert	3 x 0.9m	Culvert	3 x 0.9m	5 x 5	No structure in kml
44.	50.400	Culvert	3 x 0.9m	Culvert	3 x 0.9m	Not a mitigation structure	
45.	50.645	Box Culvert	Width-2 m; Height 2 m	Box Culvert	Width-2 m; Height 2 m	Not a mitigation structure	

S. No.	Location (Km)	Earlier Proposed Structure as per Forest Proposal	Earlier Proposed Span/ Opening (m.)	Modified Structure considering Wildlife crossing	Modified Span/ Opening (m)	Recommended structure dimensions (m)	Remarks
46.	51.225	Culvert	-	Culvert		Not a mitigation structure	
47.	51.785	Minor Bridge	Width 30 m; Height 10 m	**Minor Bridge**	**Width 30 m; Height 10 m**	Recommended	
48.	50.900	Flyover	Width-30m; Height 5.5 m	Flyover	Width-30m; Height 5.5 m	Not a mitigation structure	
49.	51.685	Underpasses	Width-12m; Height 4.5 m	Underpasses	Width-12m; Height 4.5 m	Not a mitigation structure	
50.	52.025	Box Culvert	Width-2 m; Height 2 m	52.025	Box Culvert	Not a mitigation structure	
51.	52.475	ROB/ Flyover	Width- 98m; Height 13 m	ROB/ Flyover	Width- 98m; Height 13 m	Not a mitigation structure	
52.	53.150	Culvert	-			5 x 5	Recommended
53.	53.800	Culvert	-			5 x 5	No details provided; Recommended
54.	54.075	Minor Bridge	Width 12m; Height 6m	**Minor Bridge**	**Width- 2 nox 6m + 1no x 12m; (Total 24m) Height 6m**	Recommended	
55.	54.162	Underpasses	Width-12m; Height 4.5 m	Underpasses	Width-12m; Height 4.5 m	Realignment recommended (Figure 2)	
56.	54.370	Culvert	-	Deleted			
57.	54.590	Culvert	-	Deleted			
58.	54.800	**Box Culvert**	Width-2 m; Height 2 m	**Deleted**			
59.	**54+995**			Animal overpass	50 m wide		
60.	**NA**			**Minor Bridge**	**Width- 20m; Height 4.5m**		
61.	55.120	Culvert	-				

S. No.	Location (Km)	Earlier Proposed Structure as per Forest Proposal	Earlier Proposed Span/ Opening (m.)	Modified Structure considering Wildlife crossing	Modified Span/ Opening (m)	Recommended structure dimensions (m)	Remarks
62.	55.400	Underpasses	Width-12m; Height 4.5 m	Underpasses	Width-12m; Height 4.5 m		
63.	56.130	Culvert	1.2			5 x 5	Recommended
64.	56.300			**Underpass**	**Width – 12m x 2no.; Height – 4.5 m**	Recommended with height 5 m	
65.	56.872	Culvert	1.2			5 x 5	Recommended
66.	57.200	Culvert	-	Culvert	-	5 x 5	No details provided
67.	57.408	Minor Bridge	Width 15m; Height 8m	Minor Bridge	Width 15m; Height 8m		Recommended
68.	57.540	Minor Bridge	Width 12m; Height 8m	Minor Bridge	Width 12m; Height 8m		
69.	57.600	Minor Bridge	Width 15m; Height 8m	Minor Bridge	Width 15m; Height 8m		
70.	57.730	Culvert	-			5 x 5	Recommended
71.	58.100	Culvert	-			5 x 5	Recommended
72.	58.230	Underpasses	Width-12m; Height 4.5 m			Not a mitigation structure	
73.	58.907	Minor Bridge	Width 15m; Height 5m			Recommended	
74.	59.620	Flyover	Width-60m; Height 12 m			Not a mitigation structure	

Realignment of NH 353J between ch. 54.075 and 55.800

The proposed alignment between chainages 54.100 and 55.550 bisects an intact patch of scrub forest. Therefore, realignment of this section is recommended such that the highway goes around the patch and not through it (Fig. 2). Two additional box culverts are recommended on the realigned stretch, each measuring 20 x 5 m (Table 2).

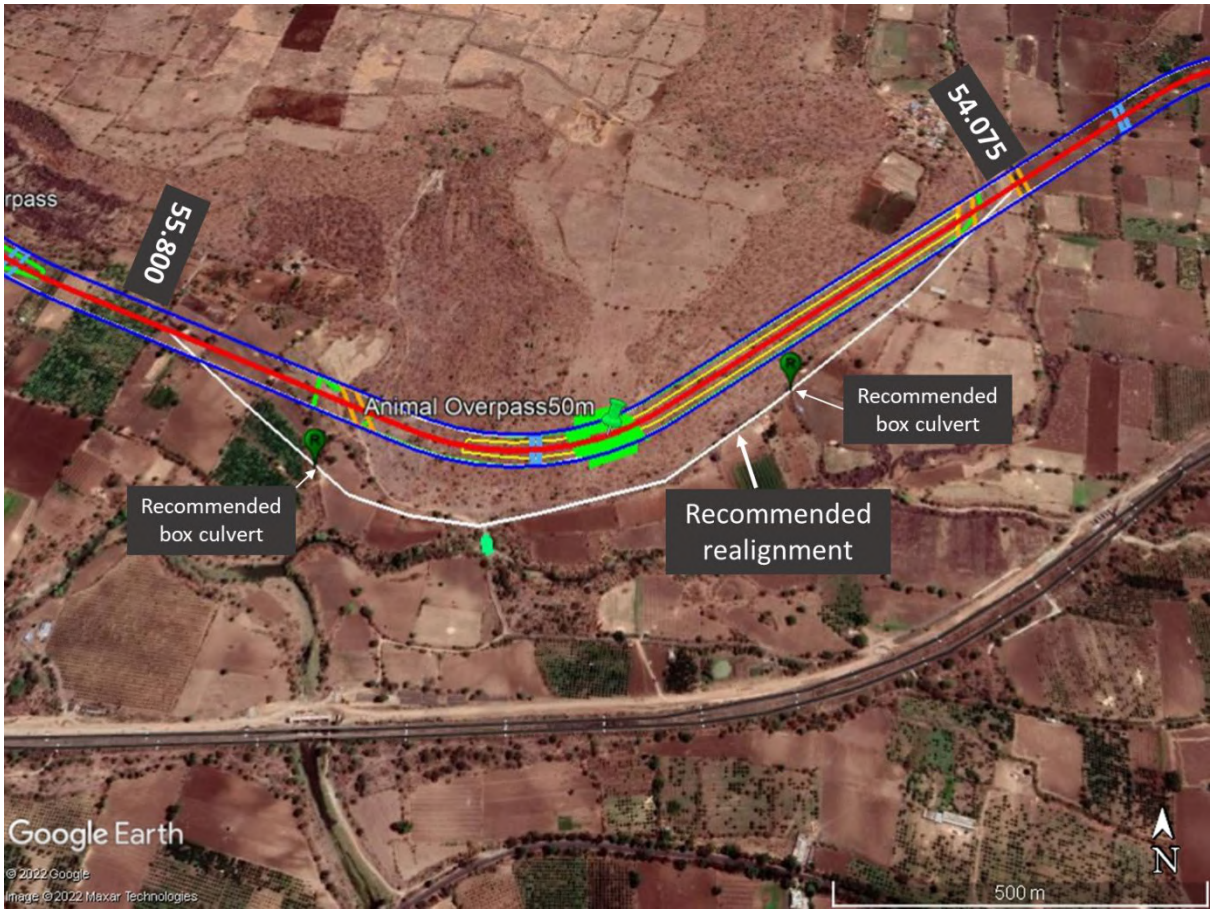


Figure 2. Realignment of NH 353J between chainage km. 54.075 and 55.800 to avoid fragmentation of the forest patch

Table 2. Details of crossing structures to be built on the realigned highway section between ch. 54.075 and 55.800.

S. No.	Location	Dimensions (m)
1.	21°15'47.93"N 78°37'29.44"E	20 x 5
2.	21°15'43.19"N 78°37'2.74"E	20 x 5

General recommendations

1. The height of all bridges, box culverts and other drainage structures (including those in agricultural areas) should not be less than 5 m. The minimum width of all box culverts should not be less than 5 m. The minimum height should not be achieved by ground excavation, but by elevating the road.

2. Divisions between the minor bridges should be of pillar type, instead of wall-type (Fig. 3).

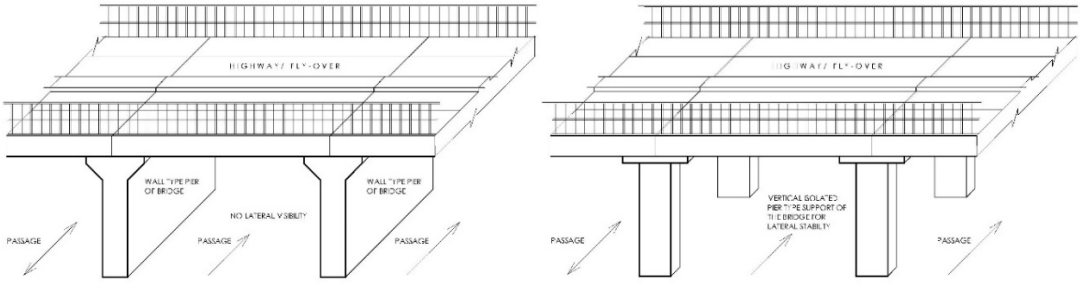


Figure 3. Wall-type division of bridge and **(b)** pillar-type division

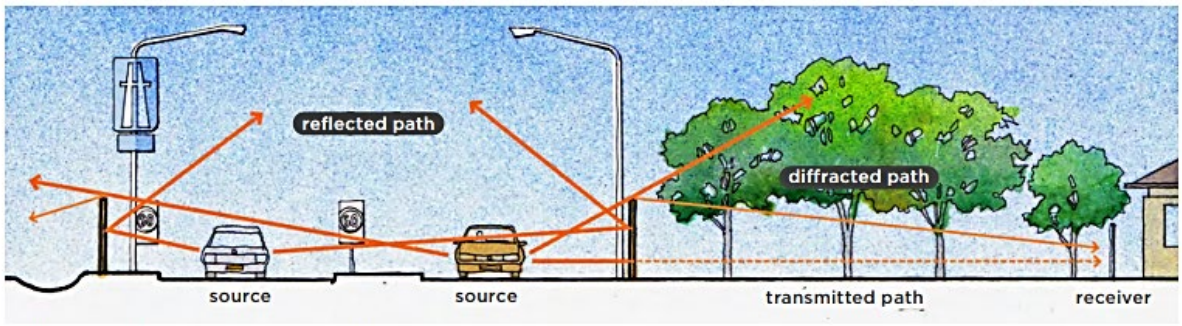
3. Noise and sound barriers 2 m high should be installed along the entire stretch of the highway passing through identified corridor area, which would also act as fencing to prevent animals from entering the road corridor. Additionally cattle guards (2 m wide) are to be installed at both ends of all structures to prevent wild and domestic animals from getting trapped within the fences/barriers (Fig. 4).

Figure 4. Cattle guards/grids to be installed at both ends of the crossing structure on NH 353 at Chainage 60/350 and 61/050. (Source: Clevenger & Huijser 2011)

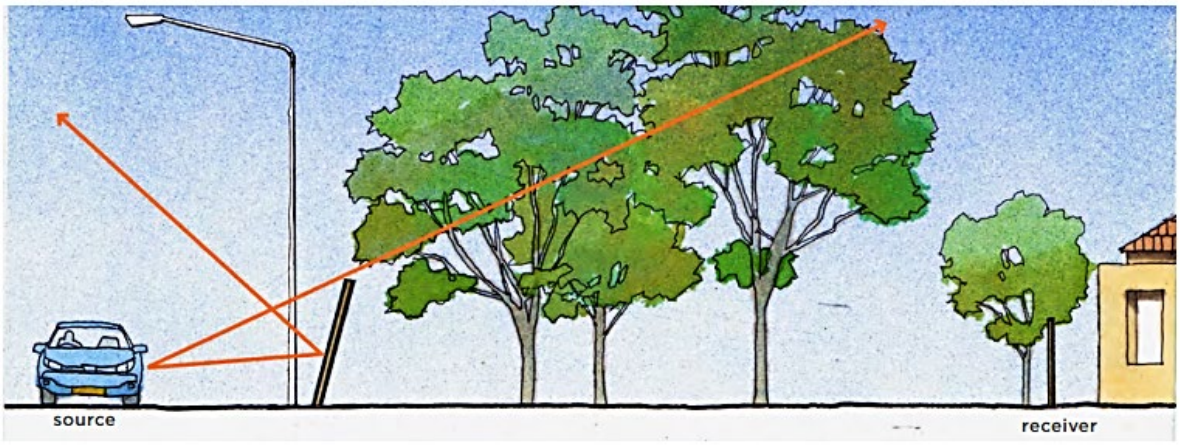
4. The underpasses must be kept free of all human-related activities and disturbances including foot-trails and roads, as these have a negative influence on the use of crossing structures by wildlife.

5. Disturbance during construction in the sensitive areas is to be kept minimum by the following mechanisms:
- Use of pre-fabricated materials for construction
- Use of water from sources other than the river
- Disposal of construction-related debris away from the sensitive sites
- Prohibition on camping of construction personnel near these sites

6. Light and sound barriers are to be installed along crossing structures in corridor area. The top ends of the barrier should be turning outwards or be slightly tilted/angled outwards (Fig. 5), to reduce inward propagation of noise (and subsequently within the crossing structure via the gap in the median). Additionally, a fibre glass covering should be installed on top of the median opening to reduce ingress of noise into the crossing structures.



Reflective paths can add to noise and need to be considered.



Tilted noise barriers can direct noise away from the receiver.

Figure 5. Barriers for attenuating noise along the highway showing reflected noise (top); tilted noise barriers for minimising reflected noise (bottom). (Source: Noise wall design guideline, Centre for Urban Design, NSW Government).

7. Site-specific measures to avoid water pollution and siltation are to be employed including use of oil interceptors.

8. Warning and information boards for awareness should be erected along the highway regarding the ecological importance of the area.

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July 2022