

D. Case study 4: A Preopening Stage Audit of a 120-km Section of a National Highway in the Western Province

(i) Title

158. The complete technical title of the audit, including its location and aims.

(ii) Audit team

159. The name and the role of the team leader and each audit team member.

(iii) Project background

160. The national highway links the capital with the nation's second largest city and onward into the border. One section of the highway (120 km in length) was recently rehabilitated as a category III road with two lanes (one in each direction) as a part of a national program of improving national highways. Most of the highway is quite straight and flat, with only a few undulating areas. The highway passes mainly through rural areas, and there are several villages along the route. Near the midpoint of this section of highway is a rocky hill section that has led to lower

design parameters for rehabilitation. The highway passes through this hill section for approximately 8 km. It has several steep grades (some up to 12%) and some sharp horizontal curves (four are 180° curves each with a radius of 50 m or less). Traffic speeds in the hill sections were observed to be around 60 km/h, and in the flat open areas, around 90 km/h–110 km/h during the site inspection.

161. No earlier audits were undertaken for this road project. A preopening stage audit was requested to ensure road safety was adequately considered. Some truck drivers expressed some concerns for safety in the hill section, while the client sought the audit to assist with decision making during the 12-month “maintenance period” when the contractor is required to maintain the highway.

(iv) Audit details




162. This preopening stage road safety audit included a daytime and a nighttime site inspection on Monday, 29 November. The weather during the inspection was windy, but generally fine and cold. The audit team comprised three accredited road safety auditors.

163. The audit findings are provided in table 11.






The highway links two large cities. A length of the highway was rehabilitated as a category III road. The preopening audit has examined the highway from the point of view of safety for all road user groups.

Table 11: Case Study 4–A Preopening Stage Audit of a 120-km Section of a National Highway in the Western Province

Km	Safety Concern	Risk	Photo	Recommendations	Client Response
Safety Concerns along the Newly Completed National Highway in the Western Province					
General	Curves are delineated inconsistently. Several have too many CAMs installed, some have CAMs in one direction only (the other direction is not delineated), and there are several curves (especially in the hill section) that need CAMs but have none. Such inconsistent delineation can cause drivers to be surprised at sharp curves; run-off-road crashes can result.	High		<ul style="list-style-type: none"> • Undertake a review of the delineation (especially the use of CAMs) throughout the length of the highway. • Ensure all curves with a radius less than 150 m have at least three CAMs (with standard spacings) installed on the outside of the curve to face both directions of travel. • Remove redundant CAMs. 	
General	<p>The line marking is clear and correct at the beginning of the newly completed road. However, the edge lines are not continuous in the second half of the highway. Loose gravel and sand from the shoulder are obscuring most of the edge lines installed.</p> <p>This leads to safety issues due to reduced daytime and nighttime delineation.</p>	Medium		<ul style="list-style-type: none"> • Sweep the road pavement and the shoulders to keep the road free of gravel and sand, and to make visible the edge lines installed. • Then, complete the edge lines as shown in the contract drawings. 	
General	W-beam barrier is installed at each of the six bridges along this highway to shield the side slope on each approach. However, none of these sections of barrier were stiffened nor correctly affixed to the bridge parapets. There is a risk of “pocketing” into these bridge parapets.	Medium		<ul style="list-style-type: none"> • Ensure the barrier is securely attached to the bridge parapets as described in the <i>CAREC Roadside Hazard Management Manual</i>. • Reduce the post spacings in the final 10 m before each bridge to half of the original spacing. Use double-nested railing as necessary to prevent “pocketing”. 	

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Table 11: continued

Km	Safety Concern	Risk	Photo	Recommendations	Client Response
Km 10–14	At the large cross-intersection at Km 10.8, many items of agricultural machinery enter and leave the highway. They travel slowly along the highway for about 3 km to either the local petrol station or the next side road junction near Km 13.6. However, the shoulders are unsealed, and the drivers try to stay on the highway to minimize dust. Because they are slow-moving and large machines, they are difficult to overtake. Head-on and rear-end collisions may result.	Low		<ul style="list-style-type: none"> • Pave the shoulders of the highway between Km 10+00 and Km 14+00 to a width at least 2 m to provide an option for drivers of large machinery to use. • Install advance warning signs on the highway to advise drivers of the possibility of machinery using the road. • Install two street lights at the crossroad at Km 11.8 and another two at the side road junction near Km 13+60 to highlight turning vehicles. 	
Km 45	There is a school on the right (north) side of the highway near Km 45. It is approximately 600 m outside the nearby village, and it appears most of the young children attending the school walk along the edge of the highway from the village. With an unpaved shoulder and nearby long grass, children sometimes walk on the road pavement. This exposes them to a risk of a collision with fast-moving traffic.	Medium		<ul style="list-style-type: none"> • Discuss options with the school. • Pave the shoulders between the village and the school (at least 2 m wide). • Construct an all-weather footpath (and possibly cycling path) within the road reservation (right side). This off-road path should be at least 3 m wide and should have a sign indicating it is for pedestrians and cyclists only. 	
Km 60–64	There are steep, undriveable roadsides in the hill section between Km 60 and Km 64 (approximately). Some W-beam barriers are installed, but are too short in four places, leaving unsafe side slopes unshielded. These side slopes are a serious risk to the occupants of errant vehicles. The slopes cannot be “softened” due to the topography. High-quality delineation and more safety barriers are needed.	High		<ul style="list-style-type: none"> • Improve delineation by installing CAMs (minimum of three per curve in both directions) on the four tightest curves. • Seal the shoulders on the outside of these curves; match the shoulder slope to the super elevation of the curve. • Increase the length of W-beam barrier at the four locations. Ensure all side slopes greater than 3 m deep and within the 5 m clear zone are shielded by barriers. 	

CAM = Chevron Alignment Marker, Km = kilometer, m = meter.

Note: The audit team has carried out this preopening stage road safety audit according to the *CAREC Road Safety Audit Manual*.

SIGNED:

{INSERT NAME HERE} Team leader on behalf of the Road Safety Audit team

{DATE}

Source: Asian Development Bank.