ROAD SAFETY AUDIT REPORT

PAKSEY BRIDGE CONSTRUCTION PROJECT

Background
The need to do an audit was discussed when the EE Road Safety Division met the Project Director, Mr Shahidul Alam on 29 November 1999.

Drawings (Paksey Bridge Construction Project, Tender Documents, November / December 1998) were provided by the supervision consultants.

The persons undertaking the audit were:
Mr Habibur Rahman, EE, Road Safety Division, RHD
Mr Allan Jones, Road Safety Engineering Advisor, RHD
Mr Arif Ahmed, Road Safety Engineering Consultant, RHD

It was not possible for the audit team to inspect the site.

A meeting took place on 20 December with the Messrs Round and Aves of the supervision consultants to seek clarification of some points, and have a preliminary discussion about the main safety concerns.

Presentation of audit findings

A. CROSS-SECTION

A1. Problem
Lack of provision for NMVs on the bridge means that they will be at risk of being hit by MVs.

Recommendation
If NMVs are permitted on the bridge they should be given a lane of minimum 1.5m width. Ideally this should be segregated from the MV lanes by a safety barrier. If physical segregation is not possible a rickshaw lane marking (sign F19) should be laid, preferably in thermoplastic screed.

A2. Problem
On the connecting and approach roads NMVs and pedestrians may prefer to use the carriageway unless the DBST on the shoulder provides a smooth, comfortable surface. Demarcation of the carriageway / shoulder may be unclear if road paint is used.

Recommendation
Ensure that DBST on shoulder produces a smooth surface. Consider using thermoplastic screed to mark the edge of the carriageway (sign F9).

B. ALIGNMENT

B1. Problem
There are a number of moderately hazardous sections (bends, sections on high embankments, etc.) on the connecting roads and drivers will need clear guidance through them. Road markings may be insufficient.

Recommendation
Provide delineator posts with reflectors (sign B56) on hazardous sections, such as:
West Connecting Road (WCR): curve at ch. 2080 (posts could be used to block view of “old” road for northbound traffic); high embanked section at ch. 5275
East Connecting Road (ECR): high embanked section between ch. 2975 and ch. 3425 (Shahapur Roundabout); high embanked section at ch. 9650 (Dasuria culvert)

C. JUNCTIONS

C1. Problem
In general the roundabout designs fail to restrict entry and circulating speeds to the low levels necessary for safe mixing of MVs, NMVs, and pedestrians. Roundabouts of particular concern are:
(a) Shahapur Roundabout on ECR – insufficient deflection is provided to slow down traffic entering the roundabout from the west and going north to Dasuria – this is dangerous
(b) Dasuria Roundabout on ECR – insufficient deflection on the entry from the east

Recommendation
Modify roundabout designs to control entry speeds to 20 km/h or below. This involves consideration of entry widths, entry radii, and size and position of centre island. For safety all roundabouts must be fully signed in
accordance with the provisions of the BRTA Traffic Signs Manual. See also problem D3 regarding pedestrian safety at the roundabouts.

C2. Problem
The T-junction at ch. 2930 on ECR just west of Shahapur Market gives rise to a number of safety concerns, as follows. Ghost-island layouts of this kind are thought to be inappropriate for Bangladesh, as drivers will probably ignore the ghost-island marking and will regard the extra carriageway width as an invitation to overtake. The ghost island arrangement does not assist traffic turning right out of the minor road, and this is likely to be the dominant traffic movement. Moreover the alignment of the minor road approach is particularly awkward. Drivers approaching the junction along the minor road from Iswardi may fail to appreciate that the road bends very sharply to the left – especially as the straight ahead movement is still permitted. The channelising island in the minor road is too short to be effective and easily seen and could be a hazard, especially at night.

Recommendation
The design of this junction needs to be completely re-thought. A forecast of DY junction turning movements would be useful. A roundabout may be the most safe and effective way of handling the traffic movements. A single lane dualling layout could also be considered but would not be as a safe as a well-designed roundabout.

C3. Problem
In general the T-junction designs do not take sufficient account of the need to: keep speeds of turning vehicles to a safe, low level; make priorities clear, guide the path of turning vehicles. Short channelising islands in the minor road approach can help pedestrians, but from experience of these in Bangladesh drivers will often go the wrong side of them, especially where large corner radii facilitate this. Junctions of particular concern are:

ECR ch. 4225 – stagger between the minor roads is insufficient to prevent drivers on minor road treating it as crossroads
  ch. 7100 – priorities at the secondary junction are not clear
  ch. 8400 – the skewed alignment of the minor road increases the risk of accidents
  ch. 9450 – stagger between the minor roads is insufficient

WC R ch. 2350 – priorities at the secondary junction are unclear

Recommendation
Review the design of the T-junctions, especially corner radii, channelising islands, stagger distances, and guidance on priorities.

D. PEDESTRIANS

D1. Problem
The bridge may be used by considerable numbers of pedestrians, but the facilities provided for them are inadequate. Specific concerns are:
(a) The footway is too narrow to enable pedestrians to overtake or cross each other without one of them having to step into the carriageway. Where two pedestrians are walking together across the bridge they will probably walk in the carriageway.
(b) The location of the pedestrian stairways appears not to be related to likely pedestrian movement desire lines.
(c) The footway appears to end at the abutments, and pedestrians walking between there and the top of the stairways or the terminal roundabouts will be unprotected, and over part of this length will be walking in front of safety barrier.
(d) No provision has been made for pedestrians who want to walk parallel to the river to cross the approach roads. If they use the stairways as currently located they will be faced with crossing a dual carriageway road with a safety barrier in the centre.

Recommendation
Review the likely usage of the bridge by pedestrians, estimate the likely movement desire line, and incorporate appropriate facilities. Particular attention should be paid to getting the pedestrians to and from the bridge footway in a convenient and safe manner.

D2. Problem
There are many places where the connecting roads pass through established communities and inevitably there will be a lot of pedestrian crossing movements. There appears to be no provision for safe crossings other than at the subways. Pedestrians may come up the embankment and suddenly appear on the carriageway giving drivers little time to avoid them.

Recommendation
Examine pedestrian movements in the area; try to determine likely crossing points; and consider providing appropriate facilities (e.g., steps up the embankment, paved shoulder area, pedestrian guardrail, and delineator posts / warning signs) at these crossing points. Crossing flows are probably insufficient to warrant formal pedestrian crossings.
D3. Problem
There is no provision for pedestrians at the roundabouts, and this means that they will walk in the carriageways and cross everywhere. This will put them at risk of being hit by motor vehicles.

Recommendation
Examine the pedestrian movements in the area, try to determine movement desire lines through the roundabouts; and consider providing appropriate facilities, such as footways, crossing points on the channelising islands, etc.

E. BUSES AND BUS USERS

E1. Problem
Buses stopping on the carriageway are a hazard to other traffic. Passengers waiting on the carriageway for buses are at risk of being hit by vehicles. There appears to be no provision for bus facilities in the scheme other than an “Area for Future Bus Facility” near the Shahapur Roundabout. In the absence of details of how and when this will be made to work it can be assumed that buses will stop on the carriageway.

Recommendation
Forecast bus movements in the area after the bridge is open; try to determine likely stopping points, and consider providing bus lay-bys at these points.

F. SAFETY BARRIER / GUARDRAIL

F1. Problem
Out-of-control vehicles should be protected from falling off the high embanked approach roads by the provision of safety barrier or guardrail. The steel safety barrier on the bridge approaches appears to extend 150m from the bridge abutments, but this is not far enough to give a reasonable degree of protection (at this point on the west approach the embankment is 7m high). Nor does it extend over the hazardous transition from the wide road formation with low median to narrow formation with concrete median barrier. Moreover there are insufficient details given of the connection between the steel barrier and the bridge parapet (this connection is critical for the effectiveness of the barrier installation) and the end treatment.

Recommendation
Review the need for safety barrier on the bridge approaches as well as the installation details.

F2. Problem
The ends of the concrete New Jersey Barrier on the bridge approaches (dwg. BA/404) are potentially hazardous and need to be well marked.

Recommendation
Mark the ends of the barrier with reflective Dangerous Obstruction marker plates (sign B49).

F3. Problem
The drawings of the end treatment of the safety barrier installations (connecting roads) fail to provide for a concrete end block. This is necessary to protect any pedestrians, cyclists, or other vulnerable road users who may get thrown against the end of the barrier. Alternatively the end of the beam can be buried into the ground.

Recommendation
Review the end treatment of the safety barrier.

F4. Problem
All the roundabouts except Dasuria are on embankments of about 3m height. If the side slopes of the embankments are steeper than 1:4 they will be sufficiently hazardous in this location to warrant safety barrier around the outer perimeter. At Shahapur Roundabout (see C1 for concerns about its design) the southern arm is on an embanked sharp bend and this also needs safety barrier.

Recommendation
Consider making the side slopes of the embankments at roundabouts 1:4 or less. If this is not possible consider installing safety barrier around the perimeter.

G. BRIDGE PARAPETS

G1. Problem
The RCC post and rail parapet proposed for the subways and culverts is not a modern safety-conscious design. It is believed to have limited capability to contain out-of-control vehicles.

Recommendation
Review the parapet design.
G2.  Problem
On the canal bridge (ECR) the parapet on the south-west side and its extension wall may restrict visibility of the rail crossing, particularly for north-bound car drivers. Although crossing gates are to be provided it cannot be assumed that these will always be in place.

Recommendation
Consider replacing the solid parapet and extension wall with a more open design which will give car drivers some view of the rail approaches to the crossing.

H. SIGNS AND MARKINGS

H1. Problem
The proposed signs and markings (designs, colours, sizes, positioning, etc.) do not follow the new BRTA standards.

Recommendation
Provide full signing and marking in accordance with the provisions of the BRTA Traffic Signs Manual. Critical signs should be reflective. Consider the use of thermoplastic road markings in view of their superior performance and durability. Particular care is needed with the signing of the rail crossing on the West Connecting Road, and advice and approval should be sought from the railway authorities. A detailed signing and marking plan should be prepared for the whole scheme and this should be made available for safety audit. Workzone signing should be in accordance with the Code of Practice given in the Traffic Signs Manual.

I. LIGHTING

I1. Problem
It appears that the lighting scheme extends only to the bridge abutments, so the stairways, the transition from narrow formation to wide formation, and the remainder of the approach roads will be unlit at night. These sections will seem very dark when compared to the bridge itself, and this adds to the accident risk, especially if pedestrians use the bridge at night.

Recommendation
Consider extending the lighting scheme to and including the terminal roundabouts. If this is not possible then the lighting should at least cover the stairways and the transition section.

J. OTHER CONCERNS

J1. Problem
Detailed plans are not available for significant elements of the scheme, including:

a) the toll plaza
b) the upgraded section between the east terminal roundabout and the East Connecting Road
c) the side road (dual carriageway) leading south from the Shahapur Roundabout
d) the bus facility at Shahapur.

All of these elements could have safety problems and could have significant safety implications for the rest of the scheme.

Recommendation
These above elements need to be designed at an early stage and the plans should be made available for safety audit.

J2. Problem
Experience suggests that local communities affected by new roads and bridges often have difficulty in coping with the new traffic situation, and as result there are many pedestrian accidents in the first few months after opening. Local children and others often steal or damage signs and road furniture.

Recommendation
It is strongly recommended that Community Road Safety Officers be employed to inform local communities of what is being built, how to use it safely, and why they should respect what is being provided. It will be essential to work with local Police, teachers, and community leaders.