PSCE NEWSLETTER

Breaking News

Figure 1: Pakistan

INSIDE THIS ISSUE

Mahandari Bridge Swept Away by Heavy Flood

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On the unfortunate morning of 30th July, 2024, a bridge was swept away, as a heavy flood overtopped it.

Located at Mahandari, KPK, Pakistan, on Manor stream, which is a tributary of Kunhar River.

Location Plan

The location plan of the site has been produced below:

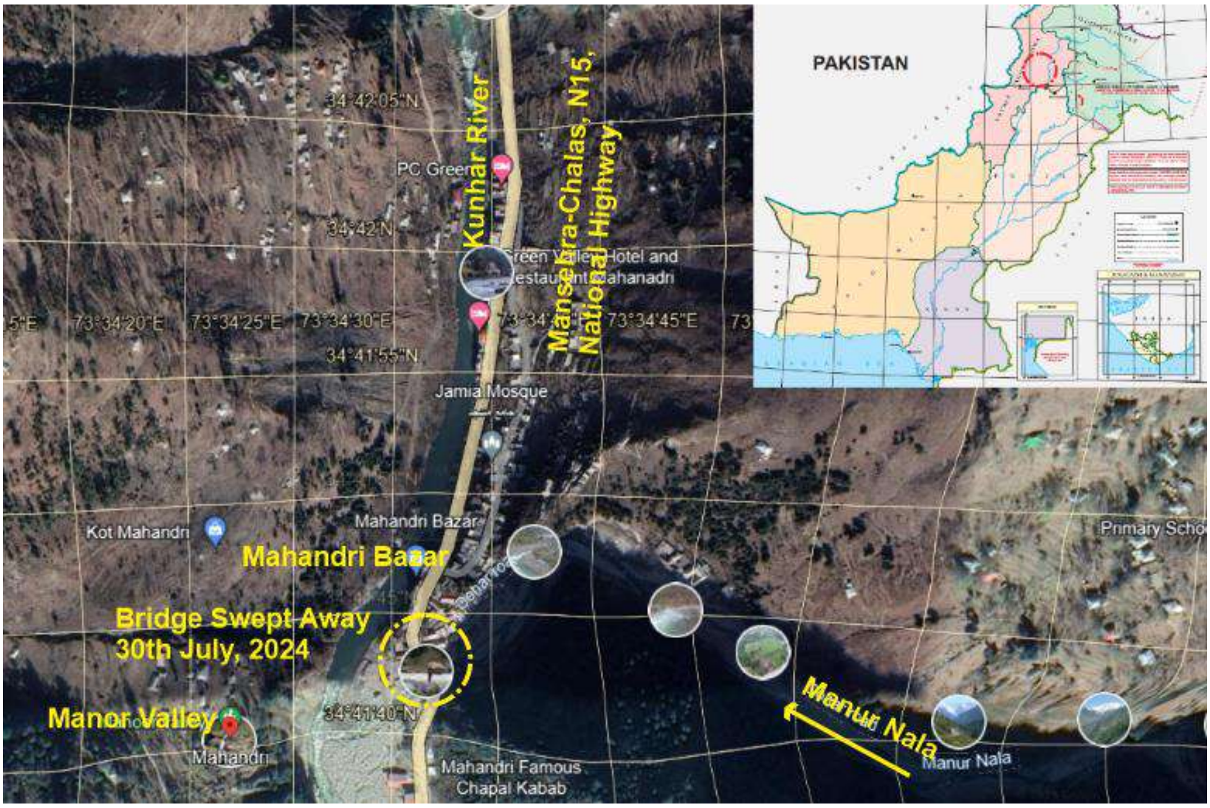

Figure 2: Location Plan

Fallout

A major fallout of the failure is that some 10,000 to 15,00 tourists are now stranded as the shorter Balakot – Naran route has been cut-off.

The second loss is that of the tourism industry of the area which would witness a downward trend.

The third fallout is the economic loss that has taken place.

Pictures

Following are the pictures showing a frame-by-frame analysis of the failure sequence:

Figure 3: File photograph of the bridge

Figure 4: Frame-1, Frame-1, Water flowing across the deck

Figure 5: Frame-2, Bridge dislocated from its abutment

Figure 6: Frame-3, Bridge adrift

Figure 7: Frame-4, Bridge moves farther away from the original position and sitting on debris

Figure 8: frame-5, Bridge moves still farther away from the original position and sitting on debris

Figure 9: Frame-6, Bridge very far away from the original position and about to lose its support from debris

Figure 10: Frame-7, Bridge quite far away from the original position and has almost completely lost its support

Figure 11: Frame-8 Bridge very far away from the original position and about to lose its support on earth

Figure 12: Feame-9, Bridge afloat in water

Figure 13: Frame-10, Bridge afloat in water, with its top partially visible

Figure 14: Frame-11, Sinking bridge, barely visible

Failure Mechanics

The structure was a through bridge, with twin steel trusses at each edge. The truss type is apparently a sort of parallel-chord double-K. There appears to be a triangular framework in the horizontal plane at the top and bottom of each twin truss. There is not lateral load resisting system at the top. The lateral resisting system at the deck is not visible. The flood level had clearly exceeded the assumed safe level of stream water.

The bridge was uprooted from the abutment, as a rigid body as it was battered by the impact caused by violent high-speed flood water laden with charge of boulder, gravel, earth and wood debris. The impact forces were actin transverse to the bridge axis.

It is well-known that the streams in the type of terrain where the bridge is located, may have steep gradients and relatively narrow cross-sections. In fact, the hydraulics of the streams in hilly areas have to have such geometrical features in order to maintain high velocities for providing the required flows. Impact forces, in the event of velocities under consideration, are a real possibility and must be considered in the structural designs.

In addition, buoyancy, once the bridge structure or a part of it, are submerged reduce the fractional forces available at the abutments. This increases the propensity of the bridge structure to dislodge itself from the abutments.

It would be fair to assume that if the weakest link of the chain – the bridge-abutment connection – had not given way first, the next candidate for failure would have been the structural steel members.

With unpredictable hydrological patterns, due to climate changes, it remains unknown if the hydrological design of the bridge had been rationally undertaken.

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