Integral Bridges

Fully integral bridges where bearings and expansion are either eliminated or provided only at long distances present a great opportunity for introducing robustness in bridge structures. Bearings and expansion joints are fragile elements and represent the weakest links in bridge structures from the point of view of the following:

a) Increased incidence of inspection and maintenance required. Bridge durability and riding characteristics are often impaired.
b) Necessity of replacement during service life since their design life is much less than that of the rest of the bridge elements.
c) Decrease in redundancy and difficulties in providing adequate ductility for resisting earthquake effects. Mobilising all the piers to resist seismic forces is also not possible.
d) Presenting 'soft targets' for terrorists and vandals for making the bridge unserviceable with little difficulty (i.e sabotage)
e) Sharply skewed superstructures have the possibility of uplift at the acute angle corner, which can be obviated by eliminating bearings.

Bridges will tall flexible piers generally present no serious technical problems when a monolithic connection is adopted between the deck and the substructure. Other situations where monolithic connections pose lesser difficulties include conception with 'twin leaf' piers. However, for small height piers encountered in flyovers and viaducts in cities the designs require special considerations. To ensure that temperature, shrinkage and creep strains can be accommodated safely, the sub-structure and foundations have to be designed along with soil-structure interaction. The piers should be made more flexible as you move away from the neutral point.

Some of the recent flyovers where the fully integral bridge concept has been successfully used are those designed for the PWD of Delhi.

A 150m integral flyover has been provided at the vital T-junction on Ring Road near Kalkaji Temple, Fig --. The satisfactory results of this flyover has been followed up with three similar flyovers at other important junctions on Ring Road and Outer Ring Road at Khelgaon Marg, Motinagar and Panjabi Bagh of similar design.

The typical five span continuous deck (25m + 30m + 40m + 30m + 25m), Fig 6, has a voided slab reinforced concrete deck with a depth of 1.70m, which was haunched and increased to 2.20m at the piers supporting the 40.0m obligatory main span.

The oval shaped piers are oriented such that the minor axis is parallel to the bridge alignment so as to provide less stiffness. The longitudinal seismic forces are distributed to all piers and abutments apart from the other benefits which have been mentioned earlier in the paper.

Each support location has been provided with twin piers to increase redundancy thereby enhancing earthquake resistance in the transverse direction also.

Kalkaji Flyover: Integral Construction High Durability, Low Maintenance, Increased Safety