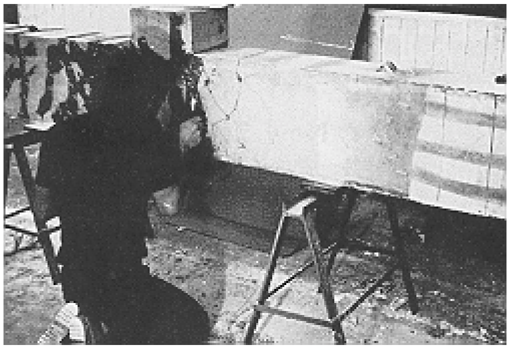

Fig. 1

Fig. 2

Research on Epoxy Repaired Reinforced Concrete Beams

By Dr. **Mehmet Ce1ebi***

In the Earthquake Engineering Research Center (EERC) of the University of California, Berkeley, a series of four tests have been completed on epoxy repaired reinforced concrete beams which were previously tested under combined moment and shear reversals according to a preplanned scheme (1,2).

In this series, it was intended to investigate both the effectiveness of the epoxy injection process in restoring strength and the influence of the process on the energy absorption capacity and the stiffness of the test specimens.

The epoxy repairing process was applied professionally on the test specimens by a specially trained and licensed crack injection contractor. The sealing process (Fig. 1) consists of first cleaning the surface of the specimens to be repaired. All loose concrete particles are removed and dust is blown off.

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Masking tapes and nails for injection holes are placed at prescribed locations. A fast setting epoxy adhesive is applied to seal off the cracks; when it hardens, the tapes are lifted off. These locations are later used as checking (bleeding) points.

The very fast setting "slump-pumping" liquid epoxy adhesive is injected into the specimens by an automatic mixing pump at pressures up to 250-300 psi. The epoxy penetrates the cracks and outflows (bleeds) from the predetermined bleeding points. The process is continued until all cracks are penetrated fully. About 24 hours later, the sealing surface epoxy is ground off to restore the smooth surface.

To test the specimens, the EERC testing facility was used with the test frame in Fig. 3. One of the specimens repaired and tested is Beam 10, shown before repair (Fig. 4). This beam was tested according to a preplanned. triangularly shaped (constant velocity-0.1 in/see) displacement scheme. The load deflection hysteresis loops of the original beam are seen in Fig. 5. (Note: Figs. 5 and 7 are on the next page.)

Fig. 6 shows the state of the repaired Beam 10 after repairing and testing with the same displacement scheme and velocity as the original beam. The hysteresis loops of the repaired beam are seen in Fig. 7.

The following results and conclusions are drawn from the testing of epoxy repaired beams:

1. It was observed in Figs. 5 and 7 that the yielding of the longitudinal reinforcing bars spread continuously along the spans of the beams. An important result of this is the dissimilarity of the shape of the hysteresis loops of the original and repaired beams.

2. The epoxy repaired beams developed strengths which were considerably in excess of their original values. This was due to increased strength of the repaired regions. The increased strength in turn increased the overall stiffness of the specimens.

3. The energy absorption capacities as measured from the area of the hysteresis loops of the repaired beams were very similar to those of the original beams. Normally, decrease in hysteresis loops would be expected. However, it seems that the increase in strength and development of new yielding regions in the spans compensates the expected decrease.

4. Finally, the aesthetics is effectively restored in the epoxy repaired beams.

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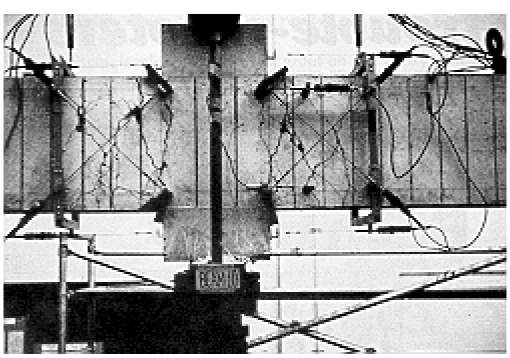

Fig. 4

Fig. 6