

9. SLOPE AND EMBANKMENT FAILURES

9.1 Soil Slope Failures

There were some soil slope failures on the banks of roadways and along Ceyhan river (Figures 9.1, 9.2 and 9.3). These are observed Mercimekköy, Yüreğir Pumping Station operated by DSİ and in the vicinity of Abdioğlu, and Mercimekköy at the northeast and southwest parts of the area affected by the earthquake, respectively.

Most of soil slope failures are seemingly circular sliding. The slope failures were mainly observed on the west embankment of Ceyhan river. Their movement was in the direction of north-east, such as N27E (DSİ pump station at Abdioğlu) and N80E (Mercimekköy). The slopes on the eastern embankment of Ceyhan river was very limited in scale. However, a close examination of these soil slope failures implied that they were likely to be a consequence of lateral spreading of ground due to liquefaction. For example, a small pond behind the failed mass was still there even two weeks after the earthquake (see Figure 9.3).

Liquefaction of very shallow subsurface sediments was the cause of such failures at these locations, the liquefied layer decoupled the overlying stiff sediments from the underlying deposits which allowed the upper non-liquefied sediment layers to transiently shift back and forth in the form of ground failure called lateral spreading as illustrated in Figure 9.4. These upper layers broke into large blocks that oscillated independently of surrounding and underlying soils. It is interesting to note that these slope failures were concentrated on western banks of the river.

The other slope failures were observed on a side of lined canal between Misis and Abdioğlu and at southern lined bank of a stream near Sirkeli very close Ceyhan (Figure 9.5). Failure directions at both locations were N20E which are similar to those of the lateral spreads mentioned above.



Figure 9.1: Failure at the southern bank of Ceyhan river near Mercimek village



Figure 9.2: Soil slope failure along Ceyhan River near Abdioglu village



Figure 9.3: Soil slope failure along Ceyhan River near Abdioglu village

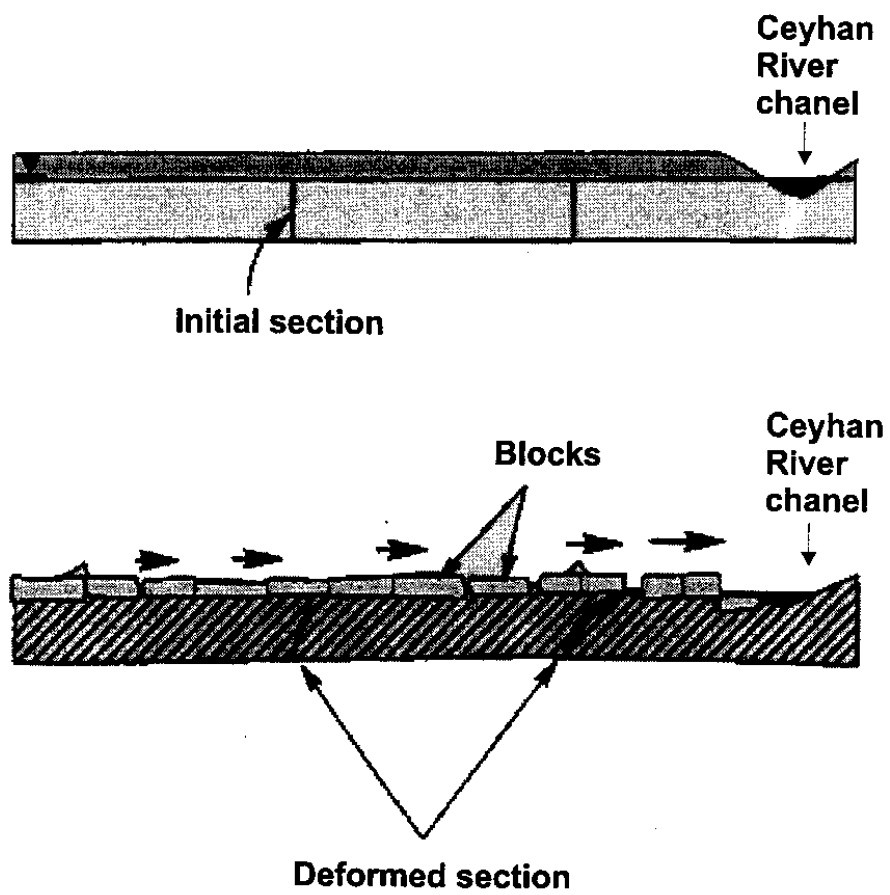


Figure 9.4 lateral spreading adjacent to river channel



Figure 9.5: Failure at the southern bank of a stream near Sirkeli village (SE of Ceyhan town)

9.2 Rock Slope Failures

Rock slopes and rock falls were observed mainly on the eastern side of the basin where mountainous terrain exist. Most of rock slope failures and rock falls were observed at Cebelinur Mountain behind Nacarlı village (Figures 9.6 and 9.7). The rock mass is limestone and the layers are nearly vertical. Most of rock falls were of small scale and associated with existing joints in the rock mass. At one location a limestone block was thrown away by shaking (Figure 9.8).

9.3 Embankment Failures

At several places, embankment failures along roadways and canals were observed. The embankment failures are similar to soil failures having a curved failure surface and scarps of failures were observable (Figure 9.9).



Figure 9.6: Rock slope failure at Cebelinur Mountain near Nacarlı village



Figure 9.7: Rock slope failure at Cebelinur Mountain near Nacarlı village



Figure 9.8: Rock block thrown by the shaking of the earthquake



Figure 9.9: Embankment failure near Abdioglu village