



# Reconnaissance Report on Damage of Bridges in 2021 Maduo, China, Earthquake

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## Abstract

A powerful earthquake occurred in Maduo, Qinghai Province, China, on May 22, 2021. Bridges at the earthquake-stricken area were damaged or even collapsed. Post-earthquake field investigations of damaged bridges were conducted by the authors during May 28-30, 2021. This is a reconnaissance report on the damage to two typical girder bridges near the epicenter as well as possible damage mechanisms. It is found that the velocity pulse effect of near-fault ground motions could trigger excessive longitudinal displacements and severe pounding of superstructures of long multi-span girder bridges. Abutments could effectively reduce longitudinal seismic damage of short girder bridges through providing sufficient translational restraints.

**Keywords:** Maduo earthquake; reconnaissance report; damage mechanism; girder bridge; velocity pulse effect; near-fault ground motion; abutment.

## 1 Introduction

An earthquake struck Maduo, Qinghai Province, China, at 2:04 am (local time) on May 22, 2021. According to China Earthquake Administration (CEA), the magnitude of the Maduo earthquake was 7.4. As the most powerful earthquake occurred in China since the 2008 Wenchuan earthquake, the Maduo earthquake caused damage and even collapse of several bridges near the epicenter, resulting in severe traffic disruptions.

Post-event field investigations on damaged bridges are of great significance, through which damage/failure mechanisms of bridges under seismic loads can be obtained and lessons can be

learned for seismic design of bridges in the future. The Maduo earthquake happened at high altitude cold areas. Seasonally frozen soils and liquefiable soils are detected near damaged bridges. It is important to investigate how bridges located in such complex geotechnical conditions behaved during the earthquake.

A reconnaissance team jointly established by Institute of Engineering Mechanics of CEA, Tongji University and Qinghai Earthquake Agency visited the earthquake-stricken area during May 28~30, 2021. In this paper, the damage to two representative girder bridges near the epicenter: Yematan Second Bridge and Heihezhong Bridge, are reported and discussed.