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论文

汶川特大地震中山岭隧道变形破坏特征及影响因素分析

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摘要：

汶川大地震造成位于震中附近的都江堰-汶川公路多座隧道严重受损。本文通过现场调研、资料收集与分析，将地震区山岭隧道变形破坏的基本类型概括为洞口边坡崩塌与滑塌、洞门裂损、衬砌及围岩坍塌、衬砌开裂及错位、底板开裂及隆起、初期支护变形及开裂等。分析其影响因素，认为发震断裂的次级断层、基覆界面、洞口不稳定斜坡、高地应力环境下的软弱围岩对隧道强烈震害具有控制作用。以汶川地震给予隧道抗震的启示，建议强震区的山岭隧道应将洞口边坡防护、洞口明洞和洞门结构作为一个系统进行综合设计，在条件允许的情况下尽可能采用削竹式洞门结构；隧道穿越活动断裂带的次级断层时在其两侧一定范围内二次衬砌应采用钢筋混凝土结构；基覆界面、围岩软岩与硬岩之间的过渡地带、围岩质量突变地带等应采用改善围岩力学性质且让其渐变的措施进行处理。

关键词： 汶川地震 山岭隧道 震害 影响因素 抗震启示

FAILURE CHARACTERISTICS AND INFLUENCE FACTOR ANALYSIS OF MOUNTAIN TUNNELS AT EPICENTER ZONES OF GREAT WENCHUAN EARTHQUAKE

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Abstract:

The great Wenchuan Earthquake of Ms 8.0 grade took place in the Longmenshan fault zone of western Sichuan Province on May 12, 2008. Many tunnels on the highway from Dujiangyan to Wenchuan were damaged severely due to the site located near the epicenter. Through the on-site investigation and research, the data collection and analysis, this paper illustrates the failure types and characteristics of the mountain tunnels in the severe earthquake region. It further summarizes the basic types as the avalanche and sliding of tunnel opening, the rhegma of tunnel portal, the collapse of liner and surrounding rock, the crack and dislocation of liner, the uplift and crack of arch invert, the deformation and crack of preliminary bracing. Then, the influencing factors of the tunnel seismic damages are discussed by taking into account especially the controlling functions of the secondary faults of earthquake fractures, the contact zone between cover and bedrock, the unstable slope in the tunnel face, and the weak surrounding rock in high geostress environment on the strong seismic damages. Finally, some revelations of the tunnel earthquake-resistance are summarized based on the natural results of the mountain tunnel damages in Wenchuan Earthquake. It is suggested that in strong earthquake areas, a comprehensive aseismic design be conducted considering the slope of tunnel face, naked tunnel and tunnel portal structure as a system. For tunnel crossing the secondary faults of active fractures, the reinforced concrete structure should be used in the second lining along the faults and their bilateral some distances. For the contact zones between cover and bedrock, the change zones between weak and hard rockmasses, the jump zones of surrounding rock quality and so on, they should be treated by the methods of improving their mechanical property and making it gradual change in preliminary bracing.

Keywords: Wenchuan Earthquake, Mountain tunnel, Seismic damage, Influencing factor, Aseismic revelation

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