

公路隧道V级围岩初支型钢支架受力分布及动态变化研究

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PRESSURE DISTRIBUTION AND ITS VARYING CHARACTERISTICS OF STEEL RIB SUPPORT IN GRADE V SURROUNDING ROCK OF ROAD TUNNEL

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- 摘要
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摘要 随着隧道施工地层条件的复杂化,型钢支架与锚喷网联合支护体系已被广泛应用于围岩较差的隧道初期支护。型钢支架是初支的主要受力结构,其受力分布及其动态变化是支护体系稳定的关键控制因素之一,隧道顶部、拱腰及仰拱连接处型钢支架受力变化能有效反应围岩压力的变化情况。针对V级围岩隧道开挖后复杂的应力状况,采用围岩变形控制理论作为隧道施工的安全控制标准。通过对河北省道京承线滦平过境路棒槌沟隧道初支型钢支架受力的监测与分析,基于大量监测数据对监测断面型钢支架受力分布动态变化状况展开研究。结果表明:(1)隧道偏压现象严重,应根据受力分布规律,及时优化支护参数;(2)隧道掌子面与监测断面距离为0~4m时,型钢支架压力增加显著,是隧道施工中加强支架控制的关键时段;(3)型钢支架连接处及拱脚位置受力较大,设计时应合理调整各段型钢支架的长度及连接位置,确保连接处的刚度。研究结果对指导施工及反馈隧道设计具有重要理论与实际意义,也为类似研究提供参考。

关键词: 公路隧道 V级围岩 型钢支架 受力分布 动态变化

Abstract: More complicated geological conditions can be encountered in tunnel construction. Flexible support system composing of anchors, sprayed concrete and steel ribs is widely employed in road tunnels with poor surrounding rock conditions such as the grade V surrounding rock. The steel rib is the skeleton and the main bearing structure of the flexible support system. Its pressure distribution state is one of the key factors for controlling the stability of temporary support system in advance. The pressure varying characteristics between the joint areas of steel ribs and surrounding rock can greatly reflect the surrounding rock state. These areas are the crown, the jointed points and the feet of steel ribs..According to the varying characteristics of such complicated pressure states in the grade V surrounding rock after excavation of road tunnel, safety control standards of tunnel construction process are adopted as the key factor of surrounding rock deformation. The pressure sensors are used for monitoring its variation on steel ribs in the Bangchuigou road tunnel. With a large number of monitoring data analysis, the following pre-conclusions can be obtained: (1)Pressure on the steel ribs is not symmetric. The parameters of temporary support system should be optimized in time according to the surrounding rock pressure distribution.(2)Within four meters between tunnel face and monitoring section, the pressure on steel rib at arch centering increases significantly. The stiffness of the jointed steel rib as a whole should be properly kept in high state.(3)the pressure on steel rib at the joints and feet of steel ribs also greatly changes, where the weakness parts of steel rib support system are .So the stiffness and stability should be fully considered at design stage for assuring the safety of tunnel construction. These results not only are of theoretical and constructional importance for tunnel projects, but also can help us improve our tunnel design for other similar studies.

Key words: Road tunnel Grade V surrounding rock Steel ribs Pressure distribution Flexible support system

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