

INTISARI

Gorong-gorong memegang peranan penting dalam memfasilitasi aliran air di bawah jalan raya. Namun, kebocoran pada bagian gorong-gorong dapat merusak kestabilan tanah, yang berpotensi menyebabkan kerusakan permukaan jalan atau terbentuknya *sinkhole*, sehingga menimbulkan risiko serius bagi infrastruktur transportasi dan keselamatan publik. Kebocoran biasanya terjadi akibat pemasangan segmen gorong-gorong yang kurang tepat atau kerusakan struktur pada dinding *outlet*. Kebocoran di lokasi tersebut melemahkan struktur tanah, sehingga semakin rentan terhadap erosi seiring waktu. Dalam penelitian ini, dilakukan pengujian laboratorium untuk menyelidiki mekanisme erosi tanah berpasir yang disebabkan oleh kebocoran pada dua titik kritis, yaitu sambungan dan *outlet*. Fokus utama penelitian mencakup pengaruh waktu pengaliran, lebar kebocoran pada sambungan dan *outlet*, serta efektivitas penutup sambungan dalam mengurangi erosi. Selain itu, karakteristik butiran tanah juga dikaji untuk melihat kaitannya dengan tingkat kemudahan erosi. Hasil uji menunjukkan bahwa erosi berkembang dalam tiga tahap: (1) fase awal, ketika air mulai meresap dan melemahkan tanah; (2) fase stabil sementara, di mana tanah terlihat stabil meskipun partikel tanah mulai terangkut; dan (3) fase akhir, ketika kerusakan struktur semakin parah dan berpotensi terbentuknya *sinkhole*. Waktu pengaliran dan lebar celah kebocoran terbukti sangat mempengaruhi intensitas erosi. Penggunaan penutup sambungan efektif dalam menekan laju erosi, dan tanah dengan gradasi butiran baik (SW) terbukti lebih tahan terhadap erosi dibandingkan tanah dengan gradasi buruk (SP).

KATA KUNCI *sinkhole*, proses erosi tanah, kebocoran sambungan, tanah berpasir, gradasi butiran, fase erosi tanah

ABSTRACT

Culverts play a vital role in facilitating water flow beneath roadways. However, leakage in culvert sections can compromise soil stability, potentially leading to pavement damage or the formation of sinkholes, posing serious risks to transportation infrastructure and public safety. Such leakage typically results from improper installation of culvert segments or structural damage to the outlet wall. Leakage at these locations weakens the surrounding soil structure, making it increasingly susceptible to erosion. This study conducted laboratory experiments to investigate the erosion mechanisms in sandy soils caused by leakage at two critical points: the joint and the outlet. The primary focus of the research includes the influence of flow duration, the width of leakage at both the joint and outlet, and the effectiveness of joint seals in reducing erosion. Additionally, the characteristics of soil grain gradation were examined in terms of erosion susceptibility. Test results revealed that erosion progresses through three stages: (1) the initial phase, marked by water infiltration and soil weakening; (2) the temporary stability phase, where the soil appears stable despite the gradual transport of particles; and (3) the final phase, characterised by severe structural degradation and potential sinkhole formation. Flow duration and the size of the leakage gap were found to influence the extent of erosion significantly. Applying joint seals effectively reduced the erosion rate, and well-graded soils (SW) demonstrated greater erosion resistance than poorly graded soils (SP).

KEYWORDS *sinkhole, erosion process, joint leakage, sandy soils, soils gradation, erosion phases.*