

Pembangunan Jalan Tol Yogyakarta–Bawen diharapkan dapat meningkatkan konektivitas antar wilayah. Keberadaan gerbang tol Banyurejo berpotensi mengubah karakteristik lalu lintas pada ruas jalan sekitarnya, khususnya di titik pertemuan antara *exit toll* dan jalan eksisting Klangon–Tempel. Kondisi tersebut menunjukkan perlunya perencanaan sebuah simpang yang mampu melayani arus lalu lintas secara memadai sejak awal operasional jalan tol hingga proyeksi jangka panjang.

Penelitian ini bertujuan untuk menganalisis kinerja simpang *exit toll* Banyurejo pada kondisi operasional dan proyeksi jangka panjang, serta merekomendasikan penanganan lalu lintas. Penelitian ini menggunakan metode studi kasus dengan pengumpulan data primer berupa kecepatan kendaraan, serta volume lalu lintas jalan eksisting melalui survei *traffic counting* dan data sekunder berupa desain rencana simpang, Lalu Lintas Harian Rata-Rata Tahunan (LHRT) jalan tol, serta Produk Domestik Regional Bruto (PDRB). Pedoman Kapasitas Jalan Indonesia (PKJI) 2023 menjadi dasar perancangan waktu siklus dan perhitungan derajat kejenuhan simpang *exit toll*. Selanjutnya dilakukan mikrosimulasi menggunakan PTV Vissim 2026 untuk mengevaluasi tundaan serta panjang antrean pada simpang. Model PTV Vissim dikalibrasi dan divalidasi menggunakan uji *Geoffrey E. Havers* (GEH).

Waktu siklus hasil perancangan untuk simpang rencana *exit toll* Banyurejo berdasarkan PKJI 2023 adalah 50 detik dengan tiga fase. Pada masa operasional 2026, kinerja simpang memenuhi kriteria desain dengan derajat kejenuhan 0,49 dan tundaan tertinggi 19,39 detik/kend. Namun, pertumbuhan volume kendaraan mengakibatkan penurunan kinerja simpang pada masa operasional tahun ke-10 dan tahun ke-20, ditandai dengan peningkatan antrean, tundaan, dan derajat kejenuhan hingga 0,71 pada tahun ke-20. Dari dua skenario alternatif yang diuji, alternatif 2 terbukti lebih efektif karena mampu menurunkan antrean, tundaan, dan derajat kejenuhan. Terlihat dengan penerapan alternatif 2 derajat kejenuhan terbesar ialah 0,42 pada lengan barat untuk masa operasional tahun ke-20.

**Kata kunci:** Simpang *exit toll*, PTV Vissim, Kinerja simpang, Waktu siklus, Derajat kejenuhan

## ABSTRACT

*The construction of the Yogyakarta–Bawen Toll Road is expected to improve interregional connectivity. The presence of the Banyurejo toll gate may alter traffic characteristics on the surrounding road network, particularly at the junction between the toll exit and the existing Klangon–Tempel road. This condition indicates the need for an intersection design capable of adequately accommodating traffic flow from the initial operation of the toll road to long-term projections.*

*This study aims to analyze the performance of the Banyurejo toll exit intersection under operational and long-term projected conditions, as well as to recommend appropriate traffic management measures. This research employed a case study method, using primary data consisting of vehicle speed and existing road traffic volume obtained through traffic counting surveys, and secondary data consisting of the planned intersection design, toll road Annual Average Daily Traffic, and Gross Regional Domestic Product. Indonesian Road Capacity Guidelines (PKJI) 2023 were used as the basis for designing the signal cycle time and calculating the degree of saturation of the toll exit intersection. Furthermore, microscopic simulation was conducted using PTV Vissim 2026 to evaluate delay and queue length at the intersection. The PTV Vissim model was calibrated and validated using the GEH test..*

*Based on PKJI 2023, the designed cycle time for the planned Banyurejo toll exit intersection was 50 seconds with a three-phase signal arrangement. Under 2026 operational conditions, the intersection met the design criteria, with a degree of saturation of 0.49 and the highest delay of 19,39 s/veh. However, traffic volume growth led to a decline in intersection performance in the 10th and 20th years of operation, as indicated by increases in queue length, delay, and degree of saturation, reaching 0.71 in the 20th year. Of the two alternative scenarios tested, Alternative 2 proved more effective in reducing queue length, delay, and degree of saturation. Under Alternative 2, the highest degree of saturation was 0.42 on the west approach in the 20th year of operation.*

**Keywords:** Toll exit intersection, PTV Vissim, Intersection performance, Cycle time, Degree of saturation