INTISARI

Pembangunan Jalan Tol Yogyakarta-Solo sebagai salah satu Proyek Strategis Nasional (PSN) membawa dampak signifikan terhadap jaringan jalan lokal, khususnya Simpang Monjali di Kabupaten Sleman. Desain jalan tol yang dibangun sebidang (*at-grade*) di lokasi ini yang bertujuan untuk melindungi kelestarian Sumbu Filosofis Yogyakarta yang diakui UNESCO, secara langsung membelah simpang eksisting dan meniadakan pergerakan langsung dari beberapa arah. Penelitian ini bertujuan untuk mengkaji kinerja Simpang Monjali sebelum adanya Jalan Tol Jogja - Solo. Selain itu, dilakukan juga perancangan konfigurasi geometrik dan sistem manajemen lalu lintas Simpang Monjali untuk mengakomodasi perubahan arus akibat operasional jalan tol dengan tetap memperhatikan batasan budaya dan tata ruang yang ada. Selanjutnya, dilakukan kajian mengenai kinerja desain Simpang Monjali yang baru.

Metodologi perancangan ini mencakup tiga tahap utama yaitu analisis kinerja simpang eksisting, perancangan geometrik simpang baru beserta fasilitas pendukungnya, dan analisis kinerja simpang hasil perancangan. Analisis kinerja dilakukan dengan dua pendekatan yaitu menggunakan perhitungan manual Pedoman Kapasitas Jalan Indonesia (PKJI) 2023 dan simulasi lalu lintas mikroskopik menggunakan perangkat lunak PTV Vissim. Perancangan geometrik mengacu pada pedoman teknis dari Bina Marga.

Hasil analisis kondisi eksisting menunjukkan bahwa Simpang Monjali telah beroperasi dalam kondisi sangat jenuh (*oversaturated*), dengan nilai Derajat Kejenuhan (D_J) dari perhitungan manual mencapai 3,2 hingga 4,7 di semua lengan, yang mengindikasikan kegagalan layanan. Desain yang diusulkan mengubah konfigurasi dari satu simpang empat lengan bersinyal menjadi dua simpang tiga lengan (simpang T) terpisah yang tidak bersinyal, dengan pengendalian prioritas rambu STOP. Untuk mengakomodasi pergerakan yang terputus, dirancang fasilitas putar balik (*u-turn*) di lengan timur dan barat simpang. Namun, hasil simulasi terhadap desain baru memprediksi timbulnya titik-titik kemacetan kritis baru, terutama antrean ekstrem pada fasilitas putar balik dan lengan minor (utara dan selatan) akibat sulitnya kendaraan bergabung dengan arus utama yang padat.

Meskipun desain geometrik yang diusulkan telah memenuhi standar teknis, kinerja operasionalnya menghadapi tantangan berat di bawah asumsi volume lalu lintas skenario terburuk. Volume lalu lintas yang dialihkan ke fasilitas putar balik diasumsikan sangat besar dengan tidak mempertimbangkan *diverted traffic*, sehingga diperlukan studi lanjutan mengenai distribusi ulang lalu lintas (*diverted traffic*) untuk memperoleh estimasi volume yang lebih realistis dan mengevaluasi kembali kinerja desain secara akurat.

Kata kunci: Simpang Monjali, Jalan Tol Yogyakarta-Solo, Perancangan Geometrik Simpang, Kinerja Simpang, Simulasi Mikroskopik, PTV Vissim.

ABSTRACT

The construction of the Yogyakarta-Solo Toll Road, one of Indonesia's National Strategic Projects (PSN), significantly impacts the local road network, particularly the Monjali Intersection in Sleman Regency. The at-grade design of the toll road at this location, intended to preserve the philosophical axis of Yogyakarta which is recognized as a UNESCO World Heritage site, directly bisects the existing intersection and eliminates direct movements from several directions.This research aims to evaluate the performance of the Monjali Intersection before the operation of the Yogyakarta-Solo Toll Road. Furthermore, it involves designing a new geometric configuration and traffic management system for the intersection to accommodate the altered traffic flow resulting from the toll road's operation, while adhering to existing cultural and spatial planning constraints. Subsequently, a performance analysis of the newly designed intersection is conducted.

The design methodology comprises three main stages: performance analysis of the existing intersection, geometric design of the new intersection and its supporting facilities, and performance analysis of the proposed design. The performance analysis was carried out using two approaches: manual calculations based on the Indonesian Road Capacity Manual (PKJI) 2023 and microscopic traffic simulation using PTV Vissim software. The geometric design refers to the technical guidelines from Bina Marga (the Directorate General of Highways).

The analysis of the existing conditions reveals that the Monjali Intersection is already operating under oversaturated conditions, with the Degree of Saturation (DS) from manual calculations reaching 3,2 to 4,7 on all approaches, indicating service failure. The proposed design reconfigures the single four-legged signalized intersection into two separate unsignalized three-legged (T-junction) intersections, controlled by STOP signs. To accommodate the discontinued movements, u-turn facilities are designed on the east and west approaches. However, simulation results of the new design predict the emergence of new critical congestion points, particularly extreme queues at the u-turn facilities and on the minor approaches (north and south) due to the difficulty for vehicles to merge into the dense mainline traffic.

Although the proposed geometric design meets technical standards, its operational performance faces significant challenges under the worst-case traffic volume scenario. The traffic volume diverted to the u-turn facilities is assumed to be very large without considering diverted traffic. Therefore, a further study on traffic redistribution (diverted traffic) is necessary to obtain a more realistic volume estimation and to accurately re-evaluate the design's performance.

Keywords: *Monjali Intersection, Yogyakarta-Solo Toll Road, Intersection Geometric Design, Intersection Performance, Microscopic Simulation, PTV Vissim.*