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Spatial Validation Analysis And Prediction Of Service Reach Of Trans Banyumas Purwokerto-Banyumas Corridor 4 Ahead Of Operation In January 2026

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Abstract

The expansion of Trans Banyumas services through Corridor 4 to the Banyumas area has entered the final stage with an operational schedule set for January 1, 2026. This study conducted a pre-operational evaluation to validate route readiness and predict service coverage using Geographic Information Systems (GIS). By modeling the route along the Bulupitu Purwokerto Terminal to Banyumas Terminal which includes 49 Bus Stops (TPB), the analysis used QGIS 3.40.11 with Network Analysis and Service Area Analysis methods. The results show that the route has high efficiency with an estimated travel time of 45-60 minutes. Service Area analysis with a radius of 400 meters confirmed that the TPB is able to cover 6 major hospitals, 8 educational institutions, and all major tourist destinations in the Old Town of Banyumas. Spatial validation concluded that the route is very feasible for operation, with high potential to support the revitalization of heritage areas and the integration of public transportation in the Greater Banyumas area.

Keywords: Trans Banyumas, Corridor 4, Geographic Information System, QGIS, Route Validation, Service Area Analysis.

INTRODUCTION

Road-based public transportation through the Buy The Service (BTS) program, branded as "Teman Bus" by the Indonesian Ministry of Transportation, has become the backbone of mobility in Banyumas Regency. Trans Banyumas, which currently operates three corridors, has demonstrated a positive impact in shifting public preference from private vehicles to public transportation. This success has encouraged the expansion of services to other strategic areas.

Trans Banyumas Corridor 4, which connects Purwokerto and Banyumas, is a response to the connectivity needs of the Banyumas Old Town area, which is being developed as a heritage tourism destination and a center of cultural governance. This route is designed to pass through national and primary arterial roads, including Sultan Agung Street, Suparjo Rustam Street, Jenderal Sudirman Street, and Gatot Subroto Street, with a total of 49 Bus Stop Points (BSP).

Prior to its scheduled operation on January 1, 2026, a technical study based on a pre-operational assessment is crucial to ensure that the route is not only physically feasible in terms of infrastructure, but also effective in serving major activity centers within the community.

Problem Formulation

Although route planning has been conducted by the operator and the Transportation Agency, spatial validation regarding geometric efficiency, travel time estimation, and service coverage (catchment area) needs to be confirmed before the fleet becomes fully operational. The research questions proposed are:

How efficient are the geometric characteristics and travel time estimation of the Terminal Bulupitu Purwokerto – Terminal Banyumas route based on network analysis?

How effective is the service coverage of bus stop points in serving vital facilities (health and education) and tourist destinations in the Banyumas area?

How does the efficiency of Corridor 4 compare with existing modes of transportation?

RESEARCH METHODS

Research Location and Time

This study was conducted along Corridor 4 of Trans Banyumas, which connects Bulupitu Terminal in Purwokerto with Banyumas Terminal, passing through South Purwokerto, Sokaraja, Kalibagor, and Banyumas Districts. Data collection and processing were carried out in December 2025, prior to the operational launch scheduled for January 1, 2026.

Types and Sources of Data

Primary Data

Primary data include the digital road network map of Banyumas Regency obtained from OpenStreetMap (OSM), which was verified using the latest satellite imagery as of December 2025. In addition, coordinate data of 49 official Bus Stop Points (TPB) from the Trans Banyumas operator were used, consisting of 24 TPBs for the outbound route (Purwokerto–Banyumas) and 25 TPBs for the return route (Banyumas–Purwokerto).

Secondary Data

Secondary data consist of Points of Interest (POI), including 6 hospitals, 8 educational institutions, and various tourist destinations in the Old Town area. Official Teman Bus fare operational data were also used as reference material.

Tools and Software

Hardware: Laptop with minimum specifications of Intel Core i5 processor and 8 GB RAM
Software: QGIS version 3.40.11
Plugin: ORS

Analysis Methods

Network Analysis (Route Solver)

This method was applied to model the optimal bus route along Corridor 4. The analysis stages are as follows:

Road Data Preprocessing:

Road network data from OSM were preprocessed, including network topology verification and speed attribution based on road classification (40 km/h for national roads, 30 km/h for collector roads, and 20 km/h for local roads) (Plue et al., 2022).

Routing Analysis:

Routing analysis was performed by inputting the starting point at Bulupitu Terminal and the destination point at Banyumas Terminal, using impedance parameters of road length and travel time.

Route Validation:

The resulting optimal route was validated by overlaying it with the 49 TPB coordinates to verify their proximity to the generated route.

In addition to road length and speed limits, the impedance parameter also considered service time (dwell time) or stopping time at each TPB, with an assumed average of 30 seconds per stop (Hadi, n.d.), which significantly affects the average travel speed.

Service Area Analysis

This method was used to predict the service coverage area of each TPB. The analysis stages include:

Parameter Settings:

- Method: Network Distance (actual road network distance)
- Service Radius: 400 meters (standard walking distance)
- Walking Speed: 5 km/h (normal pedestrian assumption)

Polygon Generation:

- Generating service area polygons for each TPB
- Merging polygons to obtain the total corridor catchment area

Overlay Analysis:

- Spatial join between service area polygons and POIs

- Calculating coverage percentages for each POI category
- Identifying blank spots (unserved areas)

Comparative Analysis

Comparative analysis was conducted to compare the efficiency of Corridor 4 with existing transportation modes in terms of travel time (Trans Bus vs. minibus/angkot vs. motorcycle), cost, and qualitative aspects of service comfort.

Research Flowchart

The research flowchart illustrates the systematic stages of the study, starting from data collection, preprocessing, network analysis, service area analysis, comparative analysis, and finally the formulation of conclusions and recommendations.

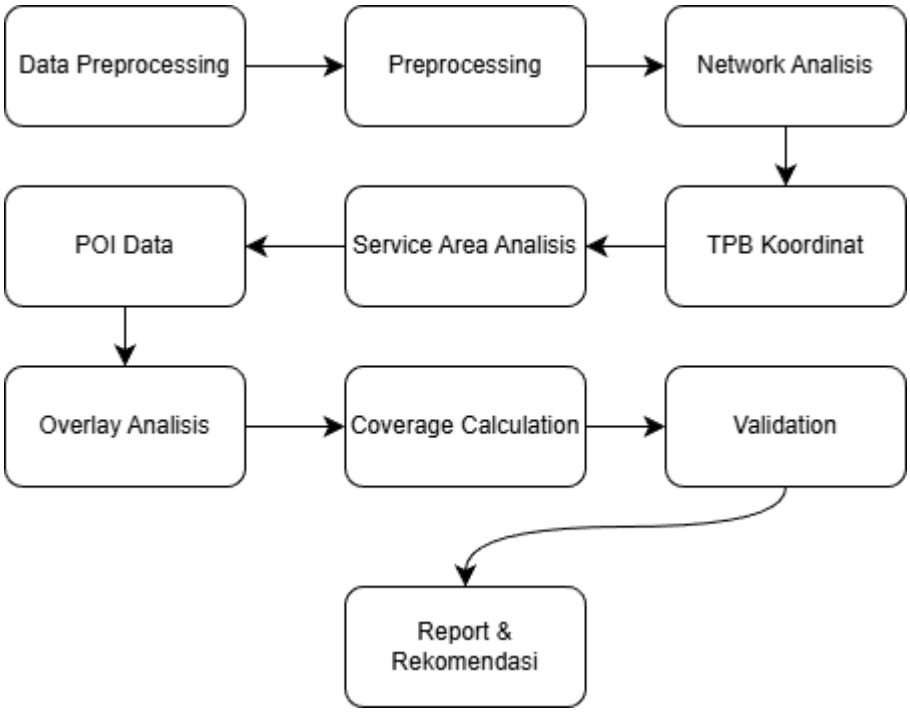

Figure 1. Research Flowchart

RESULTS AND DISCUSSION

Characteristics of Corridor 4 Route

Route Geometric Profile

Based on the results of Network Analysis using QGIS 3.40.11, Trans Banyumas Corridor 4 has the following characteristics:

Total Route Length: ±23 km (round-trip)

One-Way Route Length: ±11.5 km

Road Classification: Dominated by national roads (70%) and primary arterial roads (25%), with local roads (5%)

Number of Major Intersections: 8 intersections with traffic lights

Pavement Condition: 95% good asphalt, 5% fair asphalt

This route is strategically designed to pass through the main Purwokerto-Sokaraja-Banyumas corridor, avoiding congestion-prone areas such as the inner loop of Sokaraja Market. The alternative via PMI Sokaraja and Depo Pelita Sokaraja has proven to be more efficient based on network modeling.

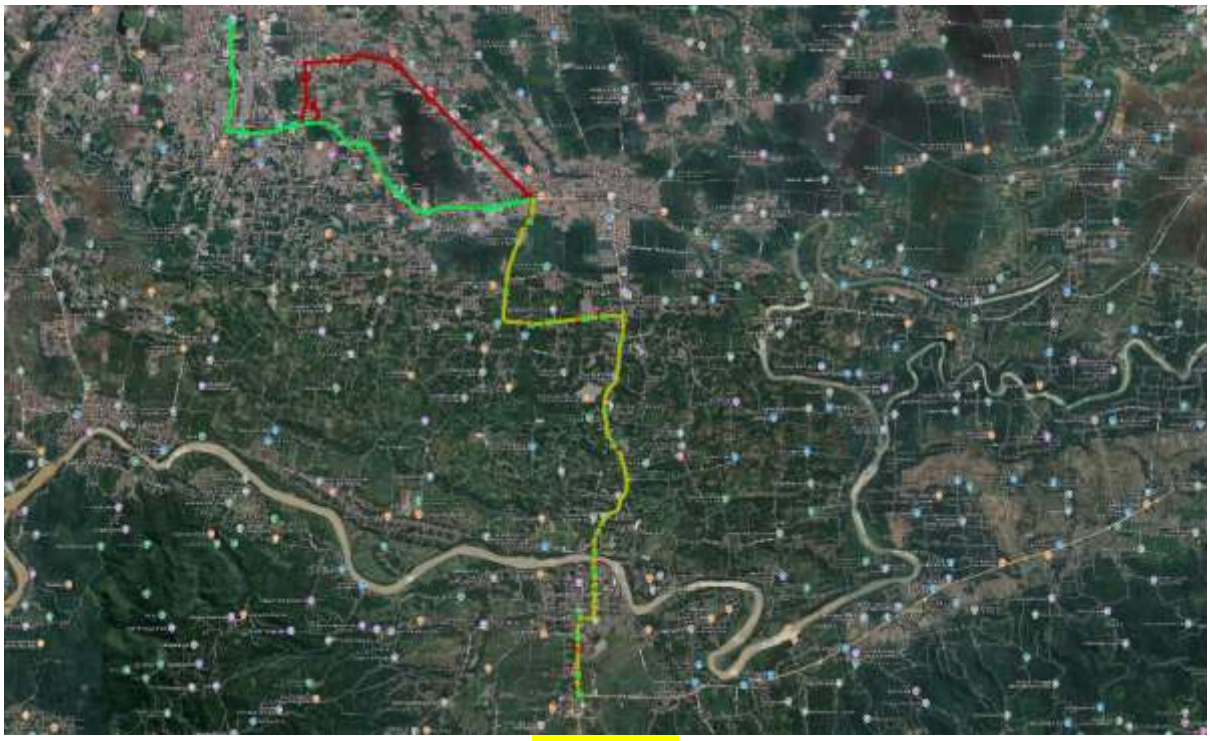

Figure 2. ?

Travel Time Estimation

The Network Analysis simulation results produce the following travel time estimates:

Table 1. ?

Traffic Condition	Travel Time	Average Speed
Free-flow (Off-peak)	45 minutes	15.3 km/h
Normal	50–55 minutes	12.6–13.8 km/h
Congested (Peak hour)	60–65 minutes	10.6–11.5 km/h

The estimated travel time of 45-60 minutes is considered very competitive compared to:

- Conventional public transportation (angkot): 70-90 minutes (due to frequent stops and waiting for passengers)
- Private motorcycles: 30-40 minutes (but with fuel costs of approximately Rp15,000 and a higher risk of accidents)
- Private cars: 35-50 minutes (with parking and fuel costs of approximately Rp25,000)

From a value-for-money perspective, the Teman Bus fare of Rp3,900 (general) with a predictable travel time is an attractive alternative, especially for students with a fare of Rp2,000.

Service Coverage Analysis

Service Area Methodology

Service Area analysis was conducted using the QNEAT3 plugin with the following parameters:

- Radius: 400 meters (5-minute walking distance)
- Method: Network-based distance (following the road/sidewalk network)
- Input: 49 TPB coordinates
- Output: Isochrone polygon of the serviced area

Figure 2. ?

Health Facility Coverage

The overlay analysis results show that 100% of large health facilities (6 hospitals) are within the service area:

Table 2. ?

Hospital Name	Nearest Bus Stop (TPB)	Distance (meters)	Coverage Status
Margono Soekarjo Hospital	TPB Margono Hospital	50	✓ Covered
Orthopaedic Hospital	TPB Orthopaedic Hospital	80	✓ Covered
Wiradadi Husada Hospital	TPB Wiradadi Hospital	120	✓ Covered
Dadi Keluarga Hospital	TPB Dadi Keluarga Hospital	150	✓ Covered
Siaga Medika Hospital	TPB Siaga Medika Hospital A/B	100	✓ Covered
Banyumas Regional Public Hospital (RSUD Banyumas)	TPB Banyumas Terminal	250	✓ Covered

Implications: Accessibility to healthcare facilities is a vital indicator of the success of public transportation. With 100% coverage, Corridor 4 provides a mobility solution for patients, caregivers, and medical personnel in the Sokaraja-Banyumas area without dependence on private vehicles. This aligns with the principle of equitable access to healthcare within the sustainable city concept.

Educational Facility Coverage

Of the nine identified educational institutions, 88.9% (8 institutions) are located within the optimal service area.

Table 3. ?

Institution	Nearest Bus Stop (TPB)	Distance (meters)	Status
UMP Campus II	TPB UMP Campus II	100	✓ Covered
SMKN 1 Kalibagor	SMKN 1 Kalibagor Bus Stop	50	✓ Covered
SMKN 2 Banyumas	SMKN 2 Banyumas Bus Stop	120	✓ Covered
SMKN 1 Banyumas	TPB Banyumas Terminal	30	✓ Covered
SMAN 1 Banyumas	SMAN 1 Banyumas Bus Stop	80	✓ Covered

SMPN 1 Kalibagor	TPB SMPN 1 Kalibagor	200	✓ Covered
SMPN 2 Sokaraja	SMPN 2 Sokaraja Bus Stop	150	✓ Covered
SDN 3 Berkoh	TPB SDN 3 Berkoh	100	✓ Covered

Coverage of Tourist Destinations in the Old Town Area

The analysis shows that 100% of the main tourist destinations in the Old Town Area of Banyumas are covered by the following service areas:

Table 4. ?

Tourist Destination	Nearest Bus Stop (TPB)	Distance (meters)	Category
Banyumas Town Square	TPB Banyumas Town Square A/B	50	Heritage
Karesidenan Building (Old Town)	TPB Banyumas Old Town A/B	100	Heritage
Sendang Mas Puppet Museum	TPB Banyumas Old Town A/B	250	Museum
Taman Sari Park	TPB Banyumas Town Square A/B	300	City Park
Banyumas Market (Culinary Area)	TPB Banyumas Market A/B	80	Culinary

Strategic Implications:

1. Supporting Heritage Tourism Revitalization: With high accessibility, tourists from Purwokerto can visit the Old Town area at a minimal cost (Rp3,900 round-trip and Rp7,800 round-trip), compared to using a motorcycle (fuel costs around Rp10,000) or online motorcycle taxis (around Rp30,000 round-trip).
2. Transportation-Tourism Integration: Corridor 4 can be integrated with the Banyumas Heritage Tour program currently being promoted by the Tourism Office. The potential for collaboration on integrated ticket packages (bus + museum tickets) can increase ridership.
3. Local Economic Stimulus: Improving accessibility to Banyumas Market and culinary areas can increase culinary tourism visits, providing a multiplier effect on local MSMEs.

Identification of Blank Spots and Areas for Improvement

Despite excellent coverage, spatial analysis identified several areas that require attention:

Geographic Blank Spots

Spatial analysis identified several areas that are not yet optimally served. New residential areas on the outskirts of Kalibagor, particularly the northern part of the Grand Kaliori Hills Housing Complex, are outside the 400-meter radius, but future TPB additions are possible as the area grows. Furthermore, the small industrial area south of Jl. Jenderal Sudirman is also not optimally covered, although this area is not the primary target market.

Recommendations for Improvement

To address the gap, it is recommended that an optional TPB be added to Phase 2 of the North Kaliori Housing Complex after a six-month demand evaluation. Improvements to last-mile connectivity are also recommended through collaboration with online motorcycle taxis for integrated fares and the provision of bike-sharing facilities at strategic points such as Banyumas Square.

Comparative and Competitive Analysis

Comparison of Capital Split Efficiency

Table 5. ?

Aspect	Trans Banyumas Corridor 4	Conventional Minibus (Angkot)	Private Motorcycle
Travel Time	45–60 minutes	70–90 minutes	30–40 minutes
Cost per Trip	IDR 3,900 (general), IDR 2,000 (students)	IDR 5,000–7,000	IDR 7,000–10,000 (fuel)

Predictability	High (fixed schedule)	Low (waiting for passengers)	Moderate (traffic-dependent)
Comfort	Air conditioning, WiFi, seat belts	Non-AC, crowded	Flexible, weather exposure risk
Safety	High (insurance, CCTV)	Moderate	Low (accident risk)
Environmental Impact	Low (per capita)	Moderate	High

Analysis: Trans Banyumas Corridor 4 offers the best value proposition in terms of cost, comfort, and predictability. The main drawback is the longer travel time compared to private motorcycles, but this is offset by very low fares and superior comfort (AC, free Wi-Fi, charging ports).

Target Market Segmentation

Based on coverage analysis, the primary target markets for Corridor 4 are students (40%) who need affordable transportation to campus/school, and employees/workers (30%) who commute between Purwokerto and Banyumas. Other segments include domestic tourists (20%) heading to Kota Lama, and hospital patients/patients (10%) who benefit from easy access to the five major hospitals along the corridor.

Demand and Capacity Projections

Initial Demand Estimates

Based on benchmarking the existing Trans Banyumas corridor and catchment area population:

Population in the Service Area: ±180,000 people (estimated from BPS data)

Potential Trip Generation: 1-2% of the population using transit per day = 1,800-3,600 passengers/day (Abu-Eisheh et al., 2024)

Target Demand for Year 1: 1,000-1,500 passengers/day (conservative)

Target Demand for Year 3: 3,000-4,000 passengers/day (after habit formation)

Operational Capacity

Assuming:

Fleet: 6 buses with a capacity of 50 passengers

Headway: 20-30 minutes (peak hours), 40-60 minutes (off-peak hours)

Hours Operational Hours: 5:00 AM - 8:00 PM WIB (15 hours)

Daily Capacity: With an estimated round trip time of 120 minutes plus layover time, one fleet is estimated to be able to serve 7 trips (14 one-way trips) per day.

Calculation: 6 buses × 50 passengers × 14 trips/bus = 4,200 passengers/day. This figure is more realistic for the initial operational phase than the theoretical maximum capacity. Target Load Factor: 30-40% in the first month, 50-60% in the first year, and ideally 70-80% for sustained operation.

Discussion: Challenges and Mitigation

Operational Challenges

The main challenges include peak-hour congestion, which risks reducing reliability, and competition from online motorcycle taxis offering door-to-door services. Furthermore, changing the habits of people accustomed to using private motorcycles is also a challenge. Suggested mitigation measures include traffic management coordination, cost-benefit education campaigns, and promotional programs such as "Free Bus for the First Month."

Long-Term Sustainability

To maintain the sustainability of Corridor 4, the following is required:

Regular Monitoring and Evaluation:

- Quarterly passenger satisfaction surveys
- Monthly ridership data analysis
- Schedule adjustments based on demand patterns

Integration with Other Corridors:

- Transfer point at the Sokaraja Hub for connections to Corridors 1, 2, and 3
- Integrated ticketing system (one card for all corridors)

Phase 2 Development:

- Extension to secondary destinations (Baturaden tourist area via Banyumas)

Addition of feeder services for last-mile connectivity.

CONCLUSIONS

Based on a pre-operational evaluation using a Geographic Information System (GIS) approach with QGIS for Trans Banyumas Corridor 4 (Purwokerto-Banyumas), this study yielded the following conclusions:

Route Readiness:

- Geometrically and in terms of network efficiency, the approximately 11.5 km (one-way) route with 49 bus stops is highly feasible, with an estimated travel time of 45-60 minutes.
- The route via national roads and primary arteries (avoiding Sokaraja Market) was proven optimal based on Network Analysis.

Service Effectiveness:

- Service Area Analysis with a 400-meter radius shows very good coverage:
  - 100% of major healthcare facilities (5 hospitals)
  - 87.5% of educational institutions (7 of 8 schools/campuses)
    % of major tourist destinations in the Old Town area of Banyumas.

REFERENCES

Abu–Eisheh, S., Ghanim, M. S., & Dodeen, A. (2024). Trip generation model for a developing city in an emerging country. *Transportation Research Interdisciplinary Perspectives*, *24*. https://doi.org/10.1016/j.trip.2024.101048

Afandi, F., Khairina, E., Dompak, T., & Negara, A. (2025). STRATEGI OPTIMALISASI PEMERINTAH INDONESIA DALAM MENINGKATKAN KUALITAS PELAYANAN TRANSPORTASI UMUM. *Jurnal Progress Administrasi Publik (JPAP)*, *5*(1), 39–45.

Faiz, A. (2022). Data Openstreetmap Untuk Memetakan Aksesibilitas Spasial dan Jangkauan Pelayanan Dasar Pendidikan dan Kesehatan di Kota Semarang. *Jurnal Litbang Provinsi Jawa Tengah*, *20*(1), 79–96. https://doi.org/10.36762/jurnaljateng.v20i1.933

Fasya Rahmat Sanusi, A., Sugiarto Waloejo, B., & Yudono, A. (n.d.). *PENERAPAN KONSEP TRANSIT ORIENTED DEVELOPMENT (TOD) DI KAWASAN MANGGARAI*.

Floriantina, E. (2021). *PERBANDINGAN ANTARA PRODUCTION SHARING CONTRACT COST RECOVERY DAN GROSS SPLIT DALAM USAHA HULU MINYAK DAN GAS BUMI DI INDONESIA* (Vol. 9). Januari-Juni.

Hadi, W. (n.d.). *STUDI DELAY TIME DAN TIME HEADWAY BUS TRANJAKARTA KORIDOR IV*.

Plue, V. H. A., Da Costa, D. G. N., & Pattiraja, A. H. (2022). ANALISIS BATAS KECEPATAN PADA JALAN LOKAL SEKUNDER. *Jurnal Teknik Sipil*, *2*(1).