

READINESS OF HALIM STATION ACCESS ROAD FOR THE JAKARTA-BANDUNG HIGH SPEED RAILWAYS PASSENGER DEMAND

Eky Hezekiel Jeremy¹, Willy Efraim Eirlangga Dumais², Soemino Eko Saputro³, M.Iqbal Firdaus⁴, Reni Dian Octaviani⁵

^{1,2,3,4}Faculty of Management and Business, Institut Transportasi dan Logistik Trisakti, Jakarta, Indonesia

Corresponding author: hezekieljeremy@gmail.com,

Abstract: The demographic characteristics of Indonesia require the government to provide transportation infrastructure to ensure the efficient, fast, safe, and comfortable movement of people and goods. Generally, the public perceives rail-based transportation in Indonesia as less attractive and less competitive compared to road transport. PT KCIC - Indonesia China High-Speed Railways is a consortium established to build a High-Speed Railways (HSR) spanning 142.3 km between Jakarta and Bandung, West Java. Halim Station is located on the Jakarta-Cikampek Toll Road at KM.0+800, Halim Perdana Kusumah, Makasar District, East Jakarta, Special Capital Region of Jakarta. To travel to Halim Station, two access roads are available: the road connecting Halim Station to D.I. Panjaitan Road and the access road to the Jakarta-Cikampek Toll Road. Traffic flow on this access road is not disrupted by vehicles entering or exiting from the intersection, there are no parked or stopped vehicles, no pedestrians crossing, and no non-motorized/slow vehicles impeding the movement of motorized vehicles, indicating the readiness of the access road to Halim Station.

Keyword: Capacity, Road, Demand Forecast, Readiness, Halim Station

1. INTRODUCTION

PT KCIC aims to be a part of the Indonesian community to build more than just transportation and offer more than just business by creating harmonious transportation integration and sustainable regional integration. In addition to developing public transportation infrastructure, PT KCIC also strives to support the productivity improvement of communities along the high-speed railway route through the development of integrated areas or Transit Oriented Development (TOD) at each station area, namely Halim, Karawang, Padalarang, and Tegalluar. The concept of TOD combined with high-speed rail is believed to enhance regional accessibility, thus accelerating the economic growth of the surrounding areas.

The Unitary State of the Republic of Indonesia is an archipelagic country with the fourth-largest population in the world, inhabited by approximately 240 million people, with 50% of the population concentrated on the island of Java. These demographic characteristics necessitate the government to provide transportation infrastructure to ensure the efficient, fast, safe, and comfortable movement of people and goods. The construction of roads and the development of railway networks continue to be carried out by the government to support connectivity between regions and/or islands.

Generally, the public perceives rail-based transportation in Indonesia as less attractive and less competitive compared to road transport. In Jakarta, 76% of the population prefers private vehicles (POLAR UI, 2021). The significant growth in the number of vehicles cannot be linearly matched by the growth in road length, leading to congestion both within and between cities. This situation has prompted policymakers in the transportation sector to formulate programs for the development of railway networks on the island of Java.

PT KCIC - Kereta Cepat Indonesia China is a consortium established to build a High-Speed Rail (HSR) spanning 142.3 km between Jakarta and Bandung, West Java. The company

consists of a consortium of state-owned companies from Indonesia through PT Pilar Sinergi BUMN Indonesia and a consortium of state-owned companies from China through Beijing Yawan HSR Co. Ltd. The High-Speed Railways will have four stations: Halim Station in Jakarta, Karawang Station in Karawang Regency, Padalarang Station in Padalarang Regency, and Tegaluar Station in Bandung Regency.

Halim Station is located on the Jakarta-Cikampek Toll Road at KM.0+800, Halim Perdana Kusumah, Makasar District, East Jakarta, Special Capital Region of Jakarta. According to a survey conducted by POLAR UI, 37% of respondents in the Halim Station area are familiar with the presence of KCIC and have good accessibility using private vehicles as their main mode of transportation to reach the station. To travel to Halim Station, one can use the access road connecting the station to D.I. Panjaitan Road and the Jakarta-Cikampek Toll Road. This access road has a length of 903m with an effective road width of 4m on each lane for access from D.I.Panjaitan. For access from the Jakarta-Cikampek Toll Road, the road width is 3.5m, intended for four-wheeled vehicles. In designing the curves of this road, attention is given to the curvature radius to meet toll road requirements, as sharp turns are not allowed. Sharp turns can reduce driver visibility and lead to significant centrifugal force (Widianty et al., 2019). Understanding that this access road connects to the Jakarta-Cikampek Toll Road, it's essential to include ramps in its construction. Ramps facilitate smooth transitions between different road levels and ensure a seamless connection between the access road and the toll road. This is particularly important for the overall functionality and safety of the transportation infrastructure.

The main purpose of the upcoming study is to provide an analysis of the capacity of the access road in relation to the forecasted demand for passengers of the Jakarta-Bandung High Speed Railways through Halim Station.

2. LITERATURE REVIEW

a. Accessibility

Accessibility is a concept that combines geographical land-use planning systems with transportation network systems that connect them. Accessibility involves public transportation facilities and proximity to potential consumers (near residential areas, offices, and service-oriented commercial areas) (Sefaji et al., 2018).

b. Capacity Determination (C)

The Indonesian Road Capacity Guidelines establish provisions for the calculation of capacity for urban traffic planning and performance evaluation. This includes road capacity (C) and traffic performance measured by the degree of saturation (DS), travel speed (VT), and travel time (TT). This guideline can be applied to common sections in urban environments with road types 2/2TT, 4/2TT, and main roads of types 4/2T and 6/2T.

Capacity is defined as the maximum flow through a road point that can be sustained per hour under specific conditions (Kementerian Pekerjaan Umum dan Perumahan Rakyat, 2014). The basic equation to determine capacity according to the Indonesian Road Capacity Guidelines (2014) is as follows:

$$C = C_0 \times FC_{LJ} \times FC_{PA} \times FC_{HS} \times FC_{UK}$$

Explanation:

C	is the capacity, vehicles per hour
C_0	is the basic capacity, vehicles per hour
FC_{LJ}	is the capacity adjustment factor related to lane or traffic stream width

- FC_{PA} is the capacity adjustment factor related to directional separation, applicable only on undivided roads
- FC_{HS} is the capacity adjustment factor related to heavy vehicles on roads with shoulders or curbs
- FC_{UK} is the capacity adjustment factor related to urban area size

c. Basic Capacity (C_0)

C_0 is empirically determined from the ideal road segment conditions, which include a straight geometric road with a length of 300m, an average lane width of 2.75m, covered curbs or shoulders, an urban area size of 1-3 million people, and moderate side friction.

Table 1 Basic Capacity (C_0)

Road Type	Basic Capacity (vehicle/hour)	Note
4/2T or one-way road	1.65	Per Lane (one way)
2/2 TT	2900	per Road (two way)

Source: PKJI, 2014

d. Adjustment Factor (FC)

Side friction is activities alongside the road that significantly disrupt the smooth flow of traffic (Citra et al., 2020). The value of C_0 is adjusted based on the differences in lane or traffic stream width (FC_{LJ}), directional separation (FC_{PA}), the side friction class on roads with shoulders (FC_{HS}), and urban area size (FC_{UK}).

Table 2 Adjustment Factor due to Differences in Lane Width or Traffic Lane (FC_{LJ})

Road Type	Effective Traffic Lane Width (W_c) (m)	FCLJ
4/2 T or one way road	Per Lane (one way)	
	3,00	0,92
	3,25	0,96
	3,50	1,00
	3,75	1,04
	4,00	1,08
2/2 TT	Per Road (two way)	
	5	0,56
	6	0,87
	7	1
	8	1,14
	9	1,25
	10	1,29
	11	1,34

Source: PKJI, 2014

Table 3 Adjustment Factor due to Directional Separation (FC_{PA})

Directional Separation PA %-%			50 - 50	55 - 45	60 - 40	65 - 35	70 - 30
FCPA	4/2 TT or one way road		1	0,985	0,97	0,955	0,94
	2/2 TT		1	0,97	0,94	0,91	0,88

Source: PKJI, 2014

Table 4 Adjustment Factor due to Side Friction (FC_{HS})

Road type	Side Friction Class	FCHS			
		Distance: Curb to Nearest Barrier Lkp			
		FCHS			
		≤0,5	1	1,5	≥2,0
4/2 T	SR	0,95	0,97	0,99	1,01
	R	0,94	0,96	0,98	1
	S	0,91	0,93	0,95	0,98
	T	0,86	0,89	0,92	0,95
	ST	0,81	0,85	0,88	0,92
2/2 TT atau jalan satu arah	SR	0,93	0,95	0,97	0,99
	R	0,9	0,92	0,95	0,97
	S	0,86	0,88	0,91	0,94
	T	0,78	0,81	0,84	0,88
	ST	0,68	0,72	0,77	0,82

Source: PKJI, 2014

Table 5 Adjustment Factor for Urban Size (FC_{UK})

Urban Area Size (Millions of Population)	Adjustment Factor for Urban Size (FC_{UK})
<0,1	0,86
0,1 - 0,5	0,90
0,5 - 1,0	0,94
1,0 - 3,0	1,00
>3,0	1,04

Source: PKJI, 2014

Table 6 Level of Service and Degree Statification

Level of Service	Degree Statification (DS)	Explanation
A	0,00 - 0,20	Uncongested flow, free speed
B	0,21 - 0,44	Stable flow, speed begins to be restricted
C	0,45 - 0,74	Stable flow, but speed and vehicle movement are controlled
D	0,75 - 0,84	Unstable flow, speed decreases
E	0,85 - 1,00	Stable flow, vehicles are moving slowly
F	≥ 1,00	Traffic congestion, low speed

Source: PKJI, 2014

3. RESEARCH METHODS

The research approach that will be employed in the study on the Readiness of Halim Station Access Road for the Demand Forecast of Jakarta-Bandung High-Speed Railways involves the use of the 2014 Indonesian Road Capacity Guidelines published by the Ministry of Public Works. In this research, a quantitative approach will be the primary foundation. This research method focuses on the collection of numerically measurable data for the analysis and presentation of findings. The study will compare its findings with the demand forecast data researched by POLAR UI in 2021

4. RESULTS AND DISCUSSION

The population according to Regency/City in the Province of DKI Jakarta, sourced from the Central Statistics Agency in 2022, is 10,679,951 people. The details are as follows: 28,921 people in the Thousand Islands, 2,244,623 people in South Jakarta, 1,079,995 people in Central Jakarta, 2,448,975 people in West Jakarta, 1,793,550 people in North Jakarta, and the highest, with 3,083,883 people, in East Jakarta (Badan Pusat Statistik, 2022).

Table 7 Estimation of Passengers for the Next 10 Years based on POLAR UI experts

Years	% Growth	Demand Forecast (Conservative)
2023	2,86	38.718
2024	3,24	39.824
2025	3,24	41.116
2026	3,24	42.449
2027	3,24	43.825
2028	3,24	45.246
2029	3,24	46.713
2030	3,24	48.228
2031	3,24	49.792
2032	3,24	51.402
2033	3,24	53.073

Source: POLAR UI, 2021

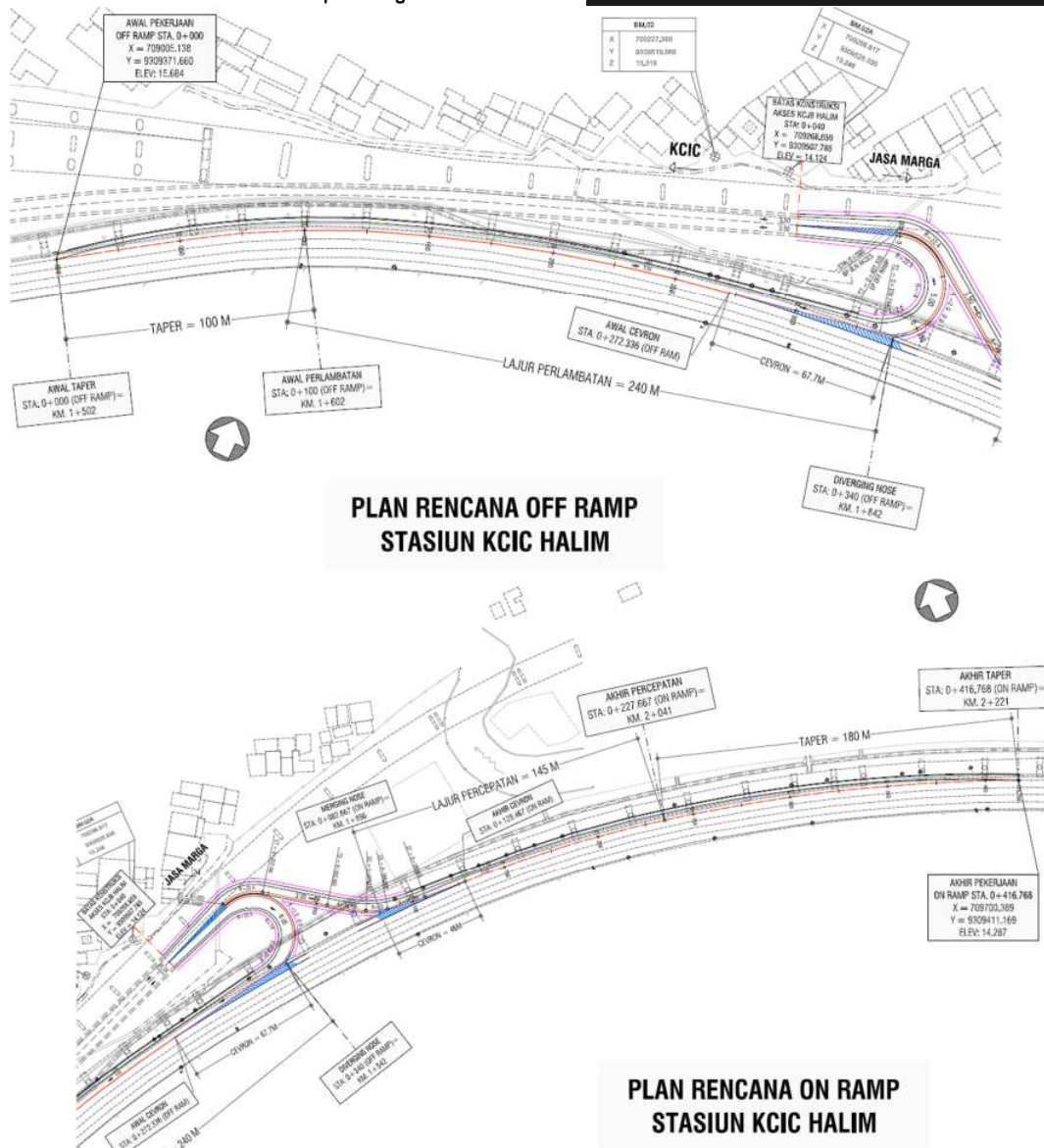
Based on the survey and research conducted by POLAR UI, it is found that the estimated number of high-speed railways passengers in 2023, using a conservative approach, is 38,718 passengers per day (POLAR UI, 2021). To accommodate transportation circulation, especially motorized vehicles, in accessing Halim Station, here is a diagram of the access route to Halim Station:



Picture 1 The access road to Halim Station from Jl. D.I. Panjaitan (Source: WIKA, 2023)

The access road to Halim Station from Jl. D.I. Panjaitan has a length of 903 meters. This access road is a one-way road, a divided road type, with a basic capacity (C_0) of 1,650 vehicles per hour per lane (one way). It has an Effective Traffic Lane Width of 4 meters per lane, resulting in a Width Adjustment Factor (FC_{LJ}) of 1.08. The directional separation of traffic on this road is 50%-50%, leading to a Capacity Adjustment Factor related to Directional Separation (FC_{PA}) of 1.00. The traffic flow on this road segment is not disrupted by vehicles entering or exiting from the parcels, there is no parking/stopping, no pedestrians crossing, and no non-motorized/slow vehicles hindering the movement of motorized vehicles. Therefore, the side friction on this road segment is categorized as Very Low, resulting in a Capacity Adjustment Factor due to Side Friction (FC_{HS}) of 0.95. Since Halim Station is located in the DKI Jakarta Province with a population of 10,679,951, the Adjustment Factor for Urban Size (FC_{UK}) is 1.04.

Also, there is another access road connecting Halim Station to the Jakarta-Cikampek Toll Road



Picture 2 The access road connecting Halim Station from the Jakarta-Cikampek Toll Road
(Source: WIKA, 2023)

This access road has a road width of 3.5 meters designated for four-wheeled vehicles. In this curve, attention is given to the curvature radius in accordance with toll road requirements because sharp turns are not allowed. Sharp turns can reduce the driver's line of sight and create significant centrifugal force (Widianty et al., 2019). Given that this access road connects the Jakarta-Cikampek Toll Road, it is necessary to have a ramp on the Jakarta-Cikampek Toll Road for its construction. This Access Road is a one-way road with a divided type, so it has a basic capacity (C_0) of 1,650 vehicles per hour per lane (one way). It has an Effective Traffic Lane Width of 3.5 meters per lane, so the Effective Traffic Lane Width Adjustment Factor (FC_{LJ}) is 1.00. The separation of traffic direction on this road is 50%-50%, so the Adjustment Factor for Capacity Related to Traffic Direction Separation (FC_{PA}) is 1.00. The traffic on this road section is not affected by vehicles entering or exiting at intersections, there is no parking or stopping of vehicles, no pedestrian crossings, and no slow-moving non-motorized vehicles obstructing the movement of motorized vehicles. Therefore, the side friction on this road section can be

categorized as Very Low, resulting in a Friction Factor Adjustment due to Side Friction (FC_{HS}) of 0.95. Since Halim Station is located in the Jakarta Special Capital Region (DKI Jakarta), which has a population of 10,679,951 people, the Adjustment Factor for City Size (FC_{UK}) is 1.04. After knowing the variables needed to calculate road capacity, the following is the calculation of the road capacity for both access roads connecting Halim Station:

Calculation of the Capacity of the Access Road connecting Jl. D.I. Panjaitan

$$C = C_0 \times FC_{LJ} \times FC_{PA} \times FC_{HS} \times FC_{UK}$$

$$C = 1.650 \times 1,08 \times 1,00 \times 0,95 \times 1,04$$

$$C = 1.761 \text{ skr/jam}$$

$$C = 42.264 \text{ skr/hari}$$

Calculation of the Capacity of the Access Road connecting the Jakarta-Cikampek Toll Road

$$C = C_0 \times FC_{LJ} \times FC_{PA} \times FC_{HS} \times FC_{UK}$$

$$C = 1.650 \times 1,00 \times 1,00 \times 0,95 \times 1,04$$

$$C = 1.596 \text{ skr/jam}$$

$$C = 38.304 \text{ skr/hari}$$

So, the capacity of the access road to Halim Station from Jl. D.I. Panjaitan is 1,761 vehicles per hour or 42,264 vehicles per day. The vehicles that can use this road include two-wheeled vehicles, four-wheeled vehicles, and public transportation.

Meanwhile, the capacity of the access road to Halim Station from the Jakarta-Cikampek Toll Road is 1,596 vehicles per hour or 38,304 vehicles per day. This road can only be used by four-wheeled vehicles and public transportation.

From the calculation results of the capacity of both roads, the Level of Service calculation is obtained as follows:

$$DS = \frac{\text{forecasted demand}}{\text{capacity of the access}}$$

$$DS = \frac{38,718}{42,264 + 38,304}$$

$$DS = 0,48$$

The above results indicate that the Level of Service for both access roads to Halim Station is at level C.

5. CONCLUSION

Based on the calculations presented in the results and discussion, both access roads to Halim Station are ready to be used as access routes for passenger vehicles using the high-speed railways transportation mode from Halim Station. This is because the Access Road to Halim Station has a capacity of 42,264 from the direction of Jl. D.I. Panjaitan and 38,304 from the

direction of the Jakarta-Cikampek Toll Road, specifically for four-wheeled vehicles. In this condition, the capacity is greater than the forecasted demand, which is 38,718. With a Level of Service value of 0.48, the access road to Halim Station is categorized as level C, indicating Stable Flow, but speed and vehicle movement are controlled.

6. IMPLICATION

Implications are direct consequences of scientific research findings. The outcome of this research is to determine the capacity readiness of the two access roads connecting Halim High Speed Railways Station: the access road from D.I. Panjaitan and the access road from the Jakarta-Cikampek Toll Road in relation to the demand forecast for Jakarta-Bandung High Speed Railways customers. Variables used to determine road capacity include the basic road capacity, adjustment factors related to lane width or traffic lane, adjustment factors related to directional separation (only on undivided roads), adjustment factors related to side friction on roads with shoulders or curbs, and adjustment factors related to city size.

The research conducted in the transportation sector, specifically in the field of railway transportation, such as high-speed railways, undoubtedly has implications for the transportation industry itself and for future research. In connection with this, the following implications can be identified:

- a. Based on the research results, it can be concluded that both access roads connected to Halim Station have a capacity greater than the known demand forecast. This indicates the capability to accommodate the traffic flow on those access roads. Knowing this, the efforts that need to be undertaken by PT. Kereta Cepat Indonesia China to maintain and enhance traffic flow in line with increasing customer demand are as follows:
 - i. PT. Kereta Cepat Indonesia China needs to develop a comprehensive vehicle traffic management plan for both access roads and station areas to align with the traffic flow.
 - ii. PT. Kereta Cepat Indonesia China needs to provide clear signage and markings regarding specific locations to facilitate vehicle traffic management effectively.
 - iii. PT. Kereta Cepat Indonesia China needs to assess the development of integrated transportation for public vehicles, especially motorized vehicles entering the station area.
- b. Based on the theories formulated by research experts and related studies, it can be understood that the capacity of both access roads connecting the Halim High-Speed Railways Station to D.I. Panjaitan Road and Jakarta-Cikampek Toll Road can be deemed ready and capable of accommodating the estimated number of motorized vehicles per day from the demand forecast studied by experts from Polar UI.

THANK-YOU NOTE

"All praise and gratitude are offered to the presence of the Almighty God, with all His blessings and grace, the author has been able to complete this research. Not forgetting, the author expresses thanks to those who have provided support in the preparation of this study."

REFERENCES

- Citra, I., Rachman, R., & Palinggi, M. D. M. (2020). Analisis Pengaruh Hambatan Samping Terhadap Kinerja Ruas Jalan Veteran Selatan. *Paulus Civil Engineering Journal*, 2(2). <https://doi.org/10.52722/pcej.v2i2.128>
- Kementerian Pekerjaan Umum dan Perumahan Rakyat. (2014). *Pedoman Kapasitas Jalan Indonesia (Kapasitas Jalan Perkotaan)*.
- POLAR UI. (2021). *Kajian Pembaharuan Permintaan Potensi Penumpang Kereta Cepat Jakarta Bandung*. KCIC.
- Sefaji, G. Y., Soedwiwahjono, S., & Nurhadi, K. (2018). Kesiapan Aksesibilitas Stasiun Solo Balapan dalam Melayani Trayek Kereta Api Penghubung Bandara Adi Soemarmo dan

- Kota Surakarta. *Region: Jurnal Pembangunan Wilayah Dan Perencanaan Partisipatif*, 13(1). <https://doi.org/10.20961/region.v13i1.17250>
- Widianty, D., Rohani, R., & Karyawan, I. A. (2019). Analisis Keselamatan Jalan Pada Tikungan Berdasarkan Jari-jari dan Kemiringan Melintang Tikungan. *Jurnal Rekayasa Sipil (JRS-Unand)*, 15(2). <https://doi.org/10.25077/jrs.15.2.103-114.2019>
- WIKA. (2023a). *Plan & Profile Rencana Jalan Akses Stasiun KCIC Halim dari Jl. D.I. Panjaitan (Detail Engineering Design)*.
- WIKA. (2023b). *Plan & Profile Rencana Jalan Akses Stasiun KCIC Halim dari Tol Jakarta-Cikampek (Detail Engineering Design)*.
- Badan Pusat Statistik. (2022). *Jumlah Penduduk Menurut Kabupaten/Kota di Provinsi DKI Jakarta (Jiwa), 2020-2022*. <https://jakarta.bps.go.id/indicator/12/1270/1/jumlah-penduduk-menurut-kabupaten-kota-di-provinsi-dki-jakarta-.html>