# *Traffic Impact Analysis Of The Surabaya Waterfront Land Development On Dr. Ir. H. Soekarno Road Intersection*

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**Abstract**. *The Surabaya City Government is currently planning a reclamation project in the coastal area of East Surabaya, specifically through the development of the Surabaya Waterfront Land area. This plan has received considerable public attention due to its potential to cause significant impacts on traffic conditions, particularly on Dr. Ir. H. Soekarno Road. The area serves as an economic growth center with dense tourism, office, and educational activities, thus causing traffic congestion that negatively impacts the economic sector. This research aims to analyze and compare the performance of four main intersections, namely Kertajaya Intersection, Dharmahusada Indah Intersection, Mulyorejo Intersection, and Kenjeran Intersection, under existing conditions and post-traffic generation due to the reclamation project. The analysis is conducted based on PKJI 2023 guidelines, which represents the latest national standard for intersection capacity analysis in Indonesia, providing more accurate and updated methodologies compared to previous standards such as MKJI 1997. The analysis results show that under existing conditions, several intersections have experienced congestion. Under post-traffic generation conditions, all intersections experience significant increases in saturation levels, even exceeding ideal capacity. Based on the traffic flow distribution results due to this generation, the construction of a 6/2 D road type (six lanes, two directions) on the Outer East Ring Road (OERR) is recommended as an alternative to reduce high vehicle volume.*

***Keywords***: Dr. Ir. H. Soekarno Road Intersection, Signalized Intersection, Outer East Ring Road (OERR), Surabaya Waterfront Land, PKJI 2023

## 1. Introduction

The coastal reclamation plan in East Surabaya by the Surabaya City Government has attracted significant public concern due to its potential impact on traffic, particularly on Dr. Ir. H. Soekarno Road. This area serves as an economic growth center with dense tourism, office, and educational activities. The reclamation project involves the construction of four islands covering 1,085 hectares to be implemented in phases over 20 years and is expected to generate significant traffic volume in the surrounding areas. Previous research (Luqman & Wibisono 2024) using MKJI 1997 provisions showed that saturation levels at major intersections are already in critical condition: Kertajaya Indah (1.05-1.54), Dharmahusada Permai (1.25-1.5), and Mulyorejo (1.43-1.69), indicating the occurrence of congestion. Four signalized intersections along Dr. Ir. H. Soekarno Road, Raya Kertajaya Indah, Dharmahusada Indah, Mulyorejo, and Kenjeran frequently experience congestion during peak hours due to high traffic volume. Coastal area development is expected to worsen these conditions and decrease intersection performance. This research analyzes traffic impacts at these four intersections by comparing current performance with post-development scenarios using PKJI 2023 provisions (Direktorat Jenderal Bina Marga 2023). The objective of this research is to provide critical considerations for the large-scale reclamation project in East Surabaya and identify potential benefits and solutions to implementation challenges.

## 2. Method

This research uses a capacity and degree of saturation calculation approach based on PKJI 2023 guidelines, which is the national standard for traffic analysis in Indonesia.

### 2.1 Data Collection

Traffic count surveys were conducted for one week from 06:00 to 19:00 at all four intersections. The survey employed manual counting methods with trained surveyors positioned at each approach. Each surveyor team consisted of three personnel: one for vehicle counting, one for data recording, and one for quality control. Vehicle classifications were recorded according to PKJI 2023 standards, distinguishing between light vehicles (LV), heavy vehicles (HV), and motorcycles (MC). Data validation was performed through cross-checking between surveyors at 30-minute intervals, video recording during peak hours for verification, weather condition monitoring to ensure data validity, and hourly data compilation and consistency checks. Peak hour identification was conducted by analyzing hourly traffic volumes across all survey days, with Tuesday evening (16:30-17:30) identified as the critical peak hour across all intersections based on the highest total vehicle volume.

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### 2.2 Trip Generation Analysis

Traffic generation estimates for the Surabaya Waterfront Land project were derived through comparative analysis with Pantai Indah Kapuk (PIK) Jakarta, which serves as a comparable waterfront development. The PIK data was obtained through field surveys and secondary data from PT Granting Jaya (2025). Trip generation rates were calculated per hectare of developed land and adjusted for the Surabaya context considering local economic conditions and transportation patterns. The proportional method was applied based on the land area ratio between PIK (1,160 Ha) and each development block in Surabaya Waterfront Land.

### 2.3 Future Traffic Prediction

Twenty-year traffic growth projections were calculated using the compound growth rate method based on Surabaya's historical vehicle registration data from the Department of Transportation. The annual growth rate was determined at 3.2% for light vehicles and 2.8% for motorcycles, consistent with regional urbanization trends.

### 2.4 Determination of Saturation Flow

$$S = S_0 \times F_{SF} \times F_{CS} \times F_G \times F_P \times F_{LT} \times F_{RT}$$

Description:
$S_0$ = Base saturation flow (pcu/hour)
$F_{SF}$ = A correction factor for $S_0$ due to side friction around the road
$F_{CS}$ = An adjustment factor for $S_0$ related to city size
$F_G$ = An adjustment factor for $S_0$ due to the longitudinal gradient of the approach
$F_P$ = An adjustment factor for $S_0$ due to parking activities near the intersection arm
$F_{LT}$ = An adjustment factor for $S_0$ due to left-turn movement
$F_{RT}$ = A correction factor for $S_0$ due to right-turn movement

### 2.5 Determination of Cycle Time and Green Time

$$S = \frac{(1{,}5 \times W_{HH} + 5)}{1 - \sum R\frac{q}{j}critical}$$

Description:
S = Cycle time (Seconds)
$W_{HH}$ = Minimum green time in each cycle (Seconds)
$R_{qj}$ = Ratio for saturation flow when divided by $^{q}/_{S}$
$Rq_{/_j}$ critical = Maximum $^{q}/_{S}$ value when equivalent phase begins

$$W_{Hi} = (S - W_{HH}) \times \left(1 - \sum R\frac{R\frac{q}{j}critical}{\sum\left(R\frac{q}{j}critical\right)i}\right)$$

Description:
$W_{Hi}$ = Green time duration (Seconds)
i = Phase i indicator

### 2.6 Determination of Capacity

$$C = S\frac{G}{c}$$

Description:
C = APILL Intersection Capacity (pcu/hour)
S = Saturation flow (pcu/hour)
G = Total green cycle time in one rotation (seconds)
c = Cycle time (seconds)

### 2.7 Degree of Saturation Analysis

$$D_S = \frac{q}{C}$$


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Description:
$D_S$ = Degree of Saturation
q = Traffic flow on that approach (pcu/hour)
C = Capacity (pcu/hour)
Performance criteria based on PKJI 2023: DS ≤ 0.75: Good performance; 0.75 < DS ≤ 0.85: Acceptable performance; DS > 0.85: Poor performance (congested).

### 2.8 Queue Analysis

$$N_q = N_{q^1} + N_{q^2}$$

If $D_S \leq 0{,}5$, then $N_{q^1} = 0$ and if $D_S \geq 0{,}5$, then

$$N_{q^1} = 0{,}25 \times C \times (D_S - 1) + \sqrt{\frac{((D_S - 1) \times 2) + (8 \times (D_S - 0{,}5))}{C}}$$

$$N_{q^2} = S \times \frac{(1 - R_H)^2}{(1 - R_H \times D_S)} + {}^{q}/_{3600}$$

Description:
$N_{q^1}$ = Number of vehicles stopped before green time
Queue length is calculated using the equation:

$$P_A = N_{q_{max}} + \frac{20}{LM}$$

### 2.9 Delay Analysis

Average delay is calculated using the equation:

$$T_i = T_{LLi} + T_{Gi}$$

Description:
$T_i$ = Average stopping delay for approach I (sec/pcu)
$T_{LL}$ = Traffic transition delay (sec/pcu)
$T_G$ = Geometric delay (sec/pcu)
Average traffic delay is calculated using the equation:

$$T_L = s \times \frac{0{,}5 \times (1 - R_H)^2}{(1 - R_H \times D_S)} + \frac{N_{q^1} \times 3600}{c}$$

Description:
s = Cycle time (seconds)
$R_H$ = Green time ratio
C = Vehicle volume (pcu/hour)

Average geometric delay is calculated using the equation:

$$T_G = (1 - R_{KH}) \times P_B \times 6 + (R_{KH} \times 4)$$

$$R_{KH} = 0{,}9 \times \left(\frac{N_q}{q \times s}\right) \times 3600$$

Description:
$P_B$ = Vehicle value at an approach
$R_{KH}$ = Proportion of vehicles that must stop at the intersection before the green light turns on

## 3. Results and Analysis

### 3.1 Intersection Capacity Under Existing Conditions

Peak hour traffic surveys conducted during Tuesday evening (16:30-17:30) revealed critical traffic conditions across all studied intersections. The following sections present detailed analysis for each intersection.


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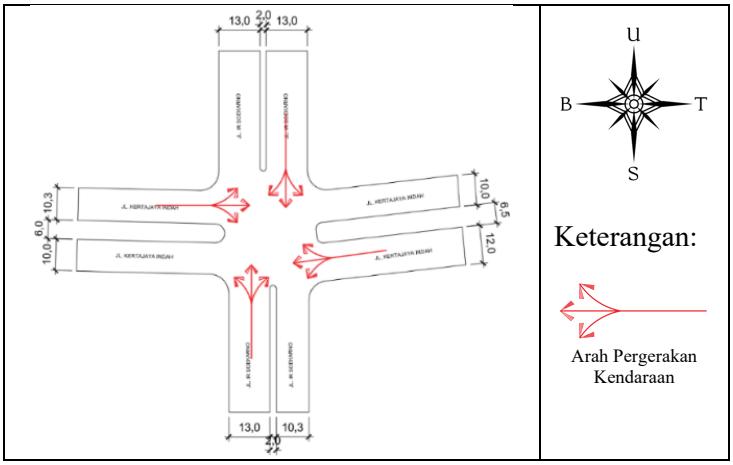
### 3.1.1 Kertajaya Indah Intersection Performance Analysis Under Existing Conditions

The analysis results show whether the degree of saturation has exceeded the established limit of 0.85.

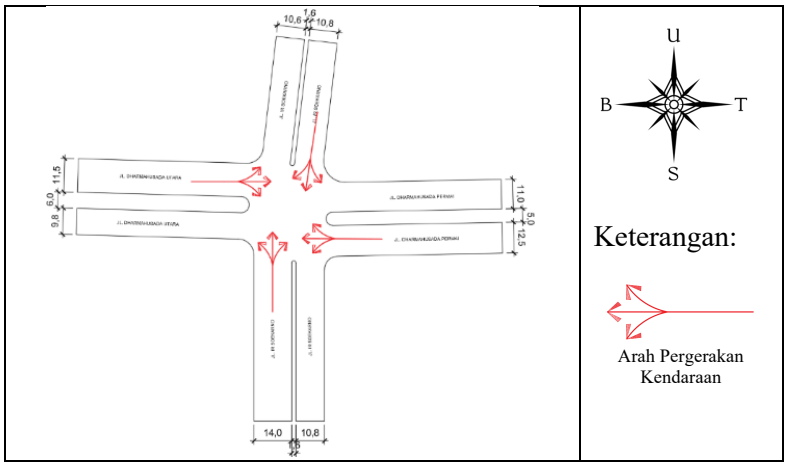



*Source: Personal Documentation, 2025*

**Table 1**. Total Motor Vehicle Volume Kertajaya Indah Intersection

| Approach Code | Direction | Ver/hour | Protected (pcu/hour) | Opposing (pcu/hour) | Capacity (C) | Degree of Saturation ($D_S$) |
|---|---|---|---|---|---|---|
| N | Straight | 1859 | 895,9 | 798,94 | 1304,26 | 1,48 |
| | Turn Right | 821 | 451,85 | 413,48 | | |
| | Turn Left | 1078 | 580,6 | 530,8 | | |
| | **Total** | **3758** | **1928** | **1743** | | |
| E | Straight | 1715 | 756,5 | 655,37 | 1139,00 | 1,14 |
| | Turn Right | 700 | 330,05 | 292,67 | | |
| | Turn Left | 435 | 210,55 | 191,8 | | |
| | **Total** | **2850** | **1297** | **1140** | | |
| S | Straight | 3539 | 1178,45 | 938,54 | 1574,08 | 1,42 |
| | Turn Right | 776 | 375 | 336,84 | | |
| | Turn Left | 1828 | 680,05 | 567,1 | | |
| | **Total** | **6143** | **2234** | **1842** | | |
| W | Straight | 2187 | 1023,3 | 905,10 | 1334,42 | 1,79 |
| | Turn Right | 1410 | 774,6 | 709,83 | | |
| | Turn Left | 1105 | 595,15 | 544,39 | | |
| | **Total** | **4702** | **2393** | **2159** | | |

### 3.1.2 Dharmahusada Indah Intersection Performance Analysis Under Existing Conditions




*Source: Personal Documentation, 2025*


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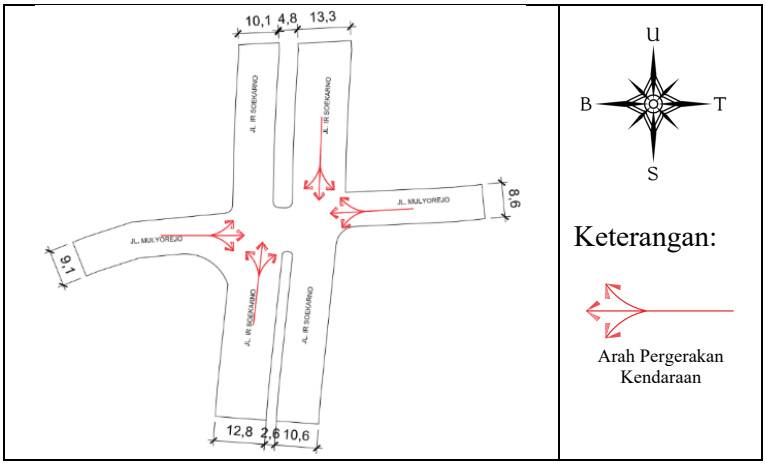
**Table 2**. Total Motor Vehicle Volume Dharmahusada Indah Intersection

| Approach Code | Direction | Ver/hour | Protected (pcu/hour) | Opposing (pcu/hour) | Capacity (C) | Degree of Saturation ($D_S$) |
|---|---|---|---|---|---|---|
| N | Straight | 3413 | 1134,25 | 901,21 | 1536,92 | 2,03 |
| | Turn Right | 2409 | 1198,6 | 1070,44 | | |
| | Turn Left | 1647 | 790,05 | 702,18 | | |
| | **Total** | **7469** | **3123** | **2674** | | |
| E | Straight | 493 | 213,7 | 185,56 | 891,28 | 0,82 |
| | Turn Right | 449 | 143,6 | 111,98 | | |
| | Turn Left | 784 | 371,75 | 328,1 | | |
| | **Total** | **1726** | **729** | **626** | | |
| S | Straight | 4885 | 1297,6 | 933,52 | 2087,53 | 0,75 |
| | Turn Right | 473 | 170,4 | 138,36 | | |
| | Turn Left | 290 | 104,7 | 85,08 | | |
| | **Total** | **5648** | **1573** | **1157** | | |
| W | Straight | 221 | 152,2 | 145,99 | 1047,55 | 0,48 |
| | Turn Right | 326 | 229,1 | 218,84 | | |
| | Turn Left | 201 | 120,55 | 112,39 | | |
| | **Total** | **748** | **502** | **477** | | |

### 3.1.3 Mulyorejo Intersection Performance Analysis Under Existing Conditions




*Source: Personal Documentation, 2025*

**Table 3**. Total Motor Vehicle Volume Mulyorejo Intersection

| Approach Code | Direction | Ver/hour | Protected (pcu/hour) | Opposing (pcu/hour) | Capacity (C) | Degree of Saturation ($D_S$) |
|---|---|---|---|---|---|---|
| N | Straight | 2166 | 1018,3 | 935,11 | 1892,01 | 0,18 |
| | Turn Right | 653 | 367,85 | 353,42 | | |
| | Turn Left | 384 | 143,8 | 138,07 | | |
| | **Total** | **3203** | **1530** | **1427** | | |
| E | Straight | 375 | 200,25 | 183,18 | 628,73 | 0,98 |
| | Turn Right | 366 | 197,45 | 180,32 | | |
| | Turn Left | 408 | 216,3 | 198,51 | | |
| | **Total** | **1149** | **614** | **562** | | |
| S | Straight | 1539 | 719,4 | 640,5 | 1792,83 | 0,68 |
| | Turn Right | 847 | 301,9 | 244,9 | | |
| | Turn Left | 681 | 191,15 | 140 | | |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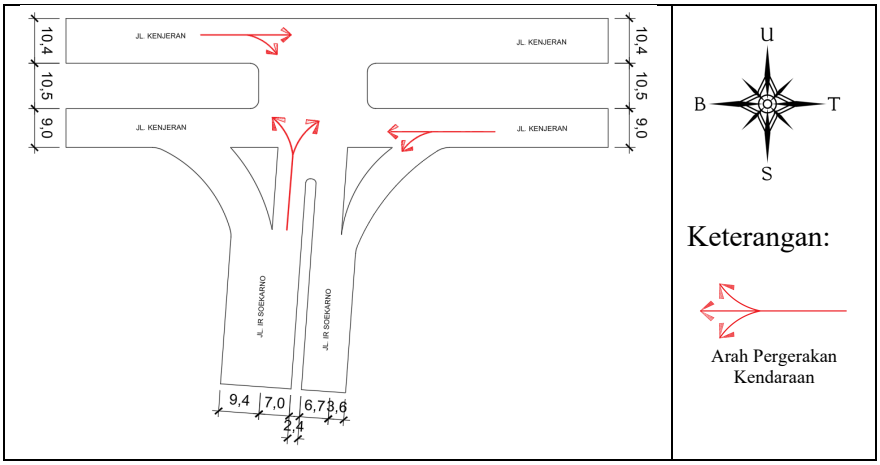
| Approach Code | Direction | Ver/hour | Protected (pcu/hour) | Opposing (pcu/hour) | Capacity (C) | Degree of Saturation ($D_S$) |
|---|---|---|---|---|---|---|
| | **Total** | **3067** | **1212** | **1025** | | |
| W | Straight | 498 | 109,6 | 69,55 | 348,86 | 0,96 |
| | Turn Right | 577 | 111,2 | 61,88 | | |
| | Turn Left | 512 | 113,7 | 72,96 | | |
| | **Total** | **1587** | **335** | **204** | | |

### 3.1.4 Kenjeran Intersection Performance Analysis Under Existing Conditions




*Source: Personal Documentation, 2025*

**Table 4**. Total Motor Vehicle Volume

| Approach Code | Direction | Ver/hour | Protected (pcu/hour) | Opposing (pcu/hour) | Capacity (C) | Degree of Saturation ($D_S$) |
|---|---|---|---|---|---|---|
| E | Straight | 1890 | 988,9 | 897,43 | 1838,35 | 0,89 |
| | Turn Right | 0 | 0 | 0 | | |
| | Turn Left | 1405 | 653,35 | 580,57 | | |
| | **Total** | **3295** | **1642** | **1478** | | |
| S | Straight | 0 | 0 | 0 | 983,39 | 1,22 |
| | Turn Right | 1118 | 571,05 | 516,72 | | |
| | Turn Left | 1696 | 631,75 | 524,08 | | |
| | **Total** | **2814** | **1203** | **1041** | | |
| W | Straight | 3250 | 976,2 | 740,46 | 1930,47 | 0,94 |
| | Turn Right | 3048 | 846,35 | 622,19 | | |
| | Turn Left | 0 | 0 | 0 | | |
| | **Total** | **6298** | **1823** | **1363** | | |

Under existing conditions, the average of the four intersections shows a high degree of saturation, indicating that road capacity has approached or even exceeded optimal limits. This condition can cause increased traffic delays, vehicle queue lengths, and decreased movement efficiency at each intersection.

## 3.2 Intersection Capacity in 20-Year Future Prediction and Vehicle Generation Impact Due to Surabaya Water Front Land Project

Based on vehicle growth data in Surabaya City which increases significantly every year, and considering the impact of the Surabaya Waterfront Land project, it is estimated that the number of vehicles will experience a greater surge in the next 20 years. This estimation is also based on vehicle generation data at Pantai Indah Kapuk (PIK) Jakarta which is compared to the planned land area.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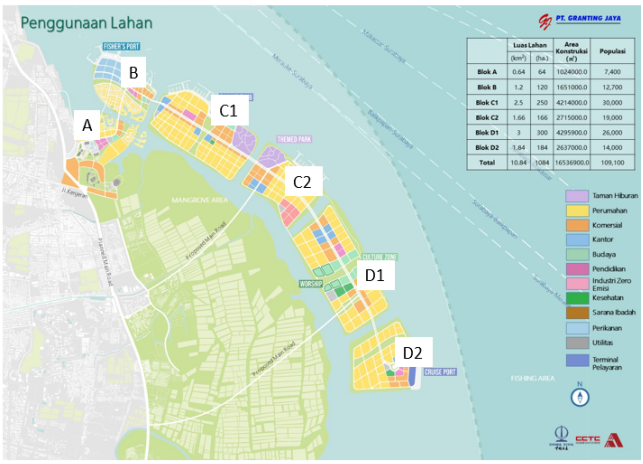


*Source: PT Granting Jaya, 2025*

**Table 6**. Percentage of Vehicle Count Against Land Area

| Region | Area | Unit | Total Vehicles | Protected | Opposing | Percentage of PIK Land Area |
|---|---|---|---|---|---|---|
| PIK Land Area | 1160 | Ha | 10925,0 | 8743,5 | 8631,8 | |
| Block D1 D2 (Kertajaya) | 484 | Ha | 4558,4 | 3648,2 | 3601,5 | 41,7% |
| Block C2 (Dharma Husada Indah) | 166 | Ha | 1563,4 | 1251,2 | 1235,2 | 14,3% |
| Block C1 (Mulyorejo) | 250 | Ha | 2354,5 | 1884,4 | 1860,3 | 21,6% |
| Block A & B (Mulyorejo) | 184 | Ha | 1732,9 | 1386,9 | 1369,2 | 15,9% |

Intersection capacity and traffic flow distribution generated by the Surabaya Water Front Land development are analyzed based on existing conditions for each approach. This evaluation is intended to assess the impact of traffic volume increases on intersection performance and to identify traffic engineering measures needed to optimize mobility within the area.

### 3.2.1 Performance Evaluation of Kertajaya Intersection Under Generated Traffic Conditions

20-Year Vehicle Volume Forecast + Trip Generation Volume

**Table 7**. Total Motor Vehicle Volume and Degree of Saturation

| Approach Code | Direction | Ver/hour | Protected (pcu/hour) | Opposing (pcu/hour) | Degree of Saturation ($D_S$) |
|---|---|---|---|---|---|
| N | Straight | 3446 | 1843 | 1692 | 3,05 |
| | Turn Right | 1750 | 936 | 859 | |
| | Turn Left | 2248 | 1202 | 1104 | |
| | **Total** | **7444** | **3980** | **3655** | **3,05** |
| E | Straight | 3319 | 1568 | 1394 | 2,37 |
| | Turn Right | 1457 | 688 | 612 | |
| | Turn Left | 935 | 442 | 393 | |
| | **Total** | **5711** | **2698** | **2398** | **2,27** |
| S | Straight | 6556 | 2471 | 2045 | 3,00 |
| | Turn Right | 2149 | 810 | 670 | |
| | Turn Left | 3825 | 1442 | 1193 | |
| | **Total** | **12531** | **4723** | **3908** | **3,00** |
| W | Straight | 3966 | 2102 | 1926 | 3,70 |
| | Turn Right | 3030 | 1606 | 1472 | |
| | Turn Left | 2327 | 1233 | 1130 | |
| | **Total** | **9322** | **4942** | **4528** | **3,70** |
| **Existing + Generated** | | **35008** | **16343,61** | **14488,74** | |

### 3.2.2 Performance Evaluation of Dharmahusada Intersection Under Generated Traffic Conditions

20-Year Vehicle Volume Forecast + Trip Generation Volume


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**Table 8**. Total Motor Vehicle Volume and Degree of Saturation

| Approach Code | Direction | Ver/hour | Protected (pcu/hour) | Opposing (pcu/hour) | Degree of Saturation ($D_S$) |
|---|---|---|---|---|---|
| N | Straight | 4941 | 2045 | 1751,4 | 3,73 |
| | Turn Right | 5377 | 2224,95 | 1905,9 | |
| | Turn Left | 3539 | 1464,46 | 1254,5 | |
| | **Total** | **13856** | **5734** | **4912** | **3,73** |
| E | Straight | 940 | 393 | 338 | 1,50 |
| | Turn Right | 616 | 257,41 | 221,11 | |
| | Turn Left | 1643 | 687,12 | 590,21 | |
| | **Total** | **3199** | **1338** | **1149** | **1,50** |
| S | Straight | 8705 | 2380 | 1716 | 1,43 |
| | Turn Right | 1176 | 321,59 | 231,86 | |
| | Turn Left | 723 | 197,63 | 142,49 | |
| | **Total** | **10764** | **2993** | **2171** | **1,43** |
| W | Straight | 401 | 272 | 263 | 0,85 |
| | Turn Right | 603 | 409,28 | 395,13 | |
| | Turn Left | 315 | 213,92 | 206,52 | |
| | **Total** | **1319** | **895** | **864** | **0,85** |
| **Existing + Generated** | | **29138** | **10960,16** | **9096,64** | |

### 3.2.3 Performance Evaluation of Mulyorejo Intersection Under Generated Traffic Conditions

20-Year Vehicle Volume Forecast + Trip Generation Volume

**Table 9**. Total Motor Vehicle Volume and Degree of Saturation

| Approach Code | Direction | Ver/hour | Protected (pcu/hour) | Opposing (pcu/hour) | Degree of Saturation ($D_S$) |
|---|---|---|---|---|---|
| N | Straight | 3284 | 2122,3 | 2003,4 | 1,69 |
| | Turn Right | 1546 | 775,9 | 732,4 | |
| | Turn Left | 1546 | 301,8 | 284,9 | |
| | **Total** | **6376** | **3200** | **3021** | **1,69** |
| E | Straight | 808 | 419,5 | 392,2 | 2,05 |
| | Turn Right | 727 | 413,5 | 386,6 | |
| | Turn Left | 727 | 453,4 | 423,9 | |
| | **Total** | **2262** | **1286** | **1203** | **2,05** |
| S | Straight | 3146 | 1559,0 | 1333,4 | 1,45 |
| | Turn Right | 1530 | 639,5 | 546,9 | |
| | Turn Left | 1530 | 395,4 | 338,2 | |
| | **Total** | **6205** | **2594** | **2219** | **1,45** |
| W | Straight | 1244 | 250,6 | 156,1 | 2,26 |
| | Turn Right | 1052 | 248,2 | 154,6 | |
| | Turn Left | 1052 | 291,2 | 181,3 | |
| | **Total** | **3347** | **790** | **492** | **2,26** |
| **Existing + Generated** | | **18190** | **7870,08** | **6933,88** | |

### 3.2.4 Performance Evaluation of Kenjeran Intersection Under Generated Traffic Conditions

20-Year Vehicle Volume Forecast + Trip Generation Volume

**Table 10**. Total Motor Vehicle Volume and Degree of Saturation

| Approach Code | Direction | Ver/hour | Protected (pcu/hour) | Opposing (pcu/hour) | Degree of Saturation ($D_S$) |
|---|---|---|---|---|---|
| E | Straight | 3708 | 1880 | 1717 | 1,69 |
| | Turn Right | 0 | 0 | 0 | |
| | Turn Left | 2435 | 1235 | 1128 | |


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| Approach Code | Direction | Ver/hour | Protected (pcu/hour) | Opposing (pcu/hour) | Degree of Saturation ($D_S$) |
|---|---|---|---|---|---|
| | **Total** | **6143** | **3115** | **2844** | **1,69** |
| S | Straight | 0 | 0 | 0 | 2,34 |
| | Turn Right | 2555 | 1107 | 967 | |
| | Turn Left | 2765 | 1198 | 1047 | |
| | **Total** | **5320** | **2305** | **2014** | **2,34** |
| W | Straight | 6573 | 1944 | 1448 | 1,87 |
| | Turn Right | 5656 | 1673 | 1246 | |
| | Turn Left | 0 | 0 | 0 | |
| | **Total** | **12229** | **3616** | **2694** | **1,87** |
| **Existing + Generated** | | **23692** | **9036,82** | **7552,21** | |

### 3.3 Summary of Degree of Saturation for Existing Conditions and Due to Trip Generation

The following table shows the degree of saturation at several intersections in Surabaya based on current conditions and predictions due to traffic generation.

**Table 11**. Table of Degree of Saturation (Existing & Prediction)

| Intersection | Approach | Existing Traffic Conditions | Predicted Impact from Trip Generation |
|---|---|---|---|
| **Kertajaya** | North | 1,48 | 3,05 |
| | East | 1,14 | 2,73 |
| | South | 1,42 | 3,00 |
| | West | 1,79 | 3,70 |
| **Dharmahusada Indah** | North | 2,03 | 3,73 |
| | East | 0,82 | 1,50 |
| | South | 0,75 | 1,43 |
| | West | 0,48 | 0,85 |
| **Mulyorejo** | North | 0,81 | 1,96 |
| | East | 0,98 | 1,91 |
| | South | 0,68 | 1,45 |
| | West | 0,96 | 2,26 |
| **Kenjeran** | North | 0,89 | 1,69 |
| | East | 1,22 | 2,34 |
| | South | 0,94 | 1,87 |

The above data indicates that at several intersections, the degree of saturation has exceeded the threshold limits. Road segments are beginning to experience saturated conditions and even congestion, particularly with future traffic generation.

### 3.4 Traffic Congestion Mitigation Alternatives

An alternative for alleviating traffic congestion is to distribute a portion of the traffic flow to the planned OERR Road that will be constructed. This measure aims to reduce the burden on existing approaches, thereby optimizing intersection performance and minimizing potential congestion. The largest traffic distribution is planned through Kertajaya Intersection.

**Table 12**. Traffic Flow Distribution Alternatives

| Traffic Flow | | Degree of Saturation After Adjustment | Distributed Flow |
|---|---|---|---|
| 29% | 1098 | 0,8500 | 2882 |
| 29% | 744 | 0,8500 | 1954 |
| 29% | 1303 | 0,8500 | 3420 |
| 29% | 1363 | 0,8500 | 3579 |

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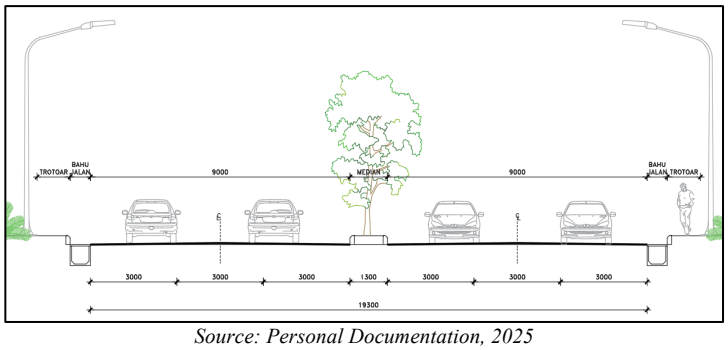
### 3.5 OERR Road Capacity

To address the projected traffic surge, a comprehensive traffic redistribution strategy through the construction of the Outer East Ring Road (OERR) is proposed.

**Table 13**. OERR Road Capacity

| Direction | Basic Capacity C0 (pcu/hour) | Adjustment Factor | | | | Capacity C | Traffic Flow q (pcu/hour) | Degree of Saturation DS |
|---|---|---|---|---|---|---|---|---|
| | | Lane Width FC LW | Direction Separation FC DS | Side Frictio FC SF | City Size FC CS | | | |
| North | 5100 | 0,92 | 1 | 1 | 1,04 | 4880 | 2,882 | 0,59 |
| South | 5100 | 0,92 | 1 | 1 | 1,04 | 4880 | 3,579 | 0,73 |

The recommended 6/2-D (six lanes, two directions with median divider) configuration provides adequate capacity with DS values well within acceptable limits (DS < 0.75). This configuration is considered capable of optimally accommodating traffic flow, reducing the burden on existing road networks, and supporting smooth vehicle movement in the Surabaya Waterfront Land development area.




*Source: Personal Documentation, 2025*

## 4. Conclusion

This comprehensive analysis of the traffic impacts from the Surabaya Waterfront Land development reveals that all four studied intersections currently operate under stressed conditions with degree of saturation values ranging from 0.48 to 2.03, and the proposed development will exacerbate these conditions with projected DS values reaching 3.73, representing traffic demand that exceeds design capacity by nearly four times. The study demonstrates that without immediate intervention through the construction of a 6/2-D type Outer East Ring Road (OERR) with a design capacity of 4,880 pcu/hour per direction, the development will create gridlock conditions that could paralyze traffic movement in East Surabaya. The analysis using PKJI 2023 guidelines indicates that the OERR can effectively redistribute 29% of critical traffic flows, reducing intersection DS values to acceptable levels below 0.85, making it an essential prerequisite rather than an optional enhancement for the waterfront development. The magnitude of predicted traffic impacts suggests that while the Surabaya Waterfront Land project offers potential economic benefits, it poses significant risks to urban mobility that require mandatory infrastructure investments, synchronized phased development approaches, and comprehensive traffic management strategies including signal optimization, public transportation enhancement, and travel demand management to prevent systematic traffic failure and ensure sustainable regional mobility.

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