Traffic impact analysis Swiss-Belinn Hotel in Gorontalo City

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Abstract. The Swiss-Belinn hotel development plan which will be built in the central area of Gorontalo City will influence on the change in traffic volume. This change will bring an imbalance between the amount of traffic generated and the capacity of the road around the Swiss-Belinn Hotel Development Plan. Data analysis included analysis of road section performance analysis, intersection analysis and, traffic impact analysis. Analysis of the calculation of the performance of roads and intersections using the 1997 MKJI Method. The studied roads are the M.T Haryono, Nani Wartabone Roads, 23 January and, Taki Niode. The results of the study obtained the level of service of roads and intersections after operating the value of C After some kind of handling, the level of service becomes good according to each treatment.

1. Introduction
Gorontalo City which is the capital of Gorontalo province with a total area of 79.03 Km2 with a population inhabitants at 2019 [1]. The city develops as the center of government, services, and trade that has the role and attractiveness of both local and regional levels. To support the development of Gorontalo city should be needed supporting facilities such as a shopping center, office, and hotel. The hotel in Gorontalo is still lacking compared to other areas, for it needs additions to be able to accommodate migrants from outside the area who want to stay and carry out activities at the hotel. To overcome the negative impacts that occur due to the development of the hotel, it is necessary to analyze the impact of traffic impacts around the development area of the Swiss Hotel. Traffic Impact Analysis Swiss Belinn Gorontalo hotel is intended to analyze the impact of traffic arising from development and can be used as a guideline in construction / development activities and post-construction / when operating. With the analysis of this development activities can run following the principles of sustainable development set in the prevailing laws and regulations, so that the smooth traffic can be managed and the impact that is inflicted on the surrounding road networks can be anticipated. Based on this description it is necessary to think about the construction after it is held so that a solution is obtained to minimize the traffic problems that will occur.

2. Method

2.1. Traffic impact analysis
The traffic impact analysis is essentially an analysis of the influence of land-use development on the surrounding traffic flow system, caused by the new traffic generation, traffic switching, and by vehicle out of/into the land [2]. according to The Institute of Transportation Engineers [3] 3 impacts will be
incurred by a center of activities against traffic, namely The smooth flow of traffic, the comfort of pedestrians and traffic safety. In general, the Traffic Impact Analysis method refers to the Analysis of Environmental Impacts The developed area is areas that provide new generation and attraction of traffic that will burden traffic existing cross [4].

2.2. Analysis of trip generation
Traffic generation is an estimating stage of modeling the amount of movement originating from a zone or land use and the amount movements that are interested in land use zones or zones [5]. While any change in land use will certainly require an increase provided by the transportation system of the area concerned [6]. Trip generation for the whole region study estimated using a regression equation which is a combination of free variables and the dependent variable. Variables - variables are the number of trips as the dependent variable, income, number of people working and the number of vehicle ownership as independent variables [7].

2.3. Method of analysis
The analytical method used in this study is as follows [8]:

2.3.1. Analysis of road performance before construction. The analysis carried out is calculating traffic volume, degree of saturation and speed with using the MKJI method [9] Performance measures for roads and intersections are calculated based on the level of service available in the RI transportation minister regulation No. 14 of 2006 [10].

2.3.2. Analysis of road performance during construction. The analysis is done the same as the road performance analysis before construction but the volume data the traffic used is the data from the survey results of traffic volume during construction (vehicles in and out of the project).

2.3.3. Analysis of estimated pull and generation of traffic movements.
- Determine the number of traction and trip generation in hotels
- Calculate the volume of attraction and trip generation from/to Swiss Belin Hotels
- Identify the circulation movement of traffic based on the location of the hotel entrance and exit
- Calculate traffic loading.

2.3.4. Post-construction road performance analysis. Calculation analysis is the same as the analysis of road performance during construction. But the volume of traffic.

2.3.5. Traffic impact analysis.
- Comparing road performance before construction, during construction, and after construction.
- Comparing the speed before construction, during construction, and post-construction.
- Estimating the chances of conflict that will occur when the hotel operates on the established circulation system.

2.3.6. Analysis of handling traffic impact.

3. Results and analysis
The location of the planned Swiss-Belinn Gorontalo hotel is located in Ipilo Sub-district, Kota Timur District. This location is adjacent to several roads and is also adjacent to several intersections that are expected to directly influence the planned construction of the Swiss Belinn hotel. Swiss Belinn Hotels have activities or intended for lodging services. The Swiss-Belinn hotel development plan stands on a former residential building with a land area of 7,233 m², while the area of land for a building of ± 5,810 m² and a building area of 12,333.1 m² consisting of 9 floors.
3.1. Geometric conditions of the road
The planned construction of the Swiss Beliin hotel is located on the National road section and the City road section and in the center of the government center. This very strategic location can cause new traffic generation. Geometric conditions of roads and construction sites can be shown in Table 1.

| Roads                      | Road Type | The width of the road | Median width | Sidewalk width | roadside |
|----------------------------|-----------|-----------------------|--------------|----------------|----------|
| Nani Wartabone Street      | 4/2 D     | 14 m                  | 0,6 m        | 1,5 m          | -        |
| 23 Januari Street          | 2/2 UD    | 7,5 m                 | -            | -              | 1,5 m    |
| Taki Niode Street          | 2/2 UD    | 6 m                   | -            | -              | 0,75 m   |
| M.T Haryono Street         | 2/2 UD    | 10 m                  | -            | -              | 1 m      |

3.2. Road section performance
Based on the results of data collection at peak hours at 09 AM to 10 AM, it was found that the performance of the roads around the construction of the Swiss Beliin Hotel is still good. Data were analyzed into 2 parts namely before construction and after construction (Table 2). The results obtained are projected under conditions during construction (2019-2020), conditions of the operational period (2021), conditions after operations (2026). At the time of construction, the traffic data included heavy vehicles and light vehicles entering and leaving the project. The results obtained show the impact caused by the surrounding roads is not too significant. If based on the value of the degree of saturation, in general, the level of service of all these roads is included in level A, but if based on the existing travel speed, the service level is included in levels C and D. The small travel speed is influenced by the length of the road segment that is very short (around 200-260 m). In summary, the comparison of the performance of road sections in conditions without development and with development can be

3.3. Signalized intersection performance
Performance analysis at the signal intersection was carried out at the peak hour morning conditions obtained service level B (Table 3). However, during the operational period the performance of the Gorontalo Post Office intersection (Jalan Nani Wartabone - Jl. 23 January) as a signaled intersection began to decline, marked by the value of the intersection delay> 15 sec / junior high. For this reason, it is necessary to optimize the traffic light settings. In 2021 until 2026, the type of approach that had previously been challenged was changed to the protected type of approach.

| No | Condition               | Without development | With development |
|----|-------------------------|---------------------|------------------|
| A  | Nani Wartabone street  |                      |                  |
| 1  | Existing                | 842                 | 0,16             | 31,25            | C       | -     | -     | -     |
| 2  | construction period (2019) | 899       | 0,18             | 30,75            | C       | 907   | 0,18  | 30,54  | C     |
| 3  | construction period (2020) | 961       | 0,19             | 30,21            | D       | 1033  | 0,20  | 29,83  | D     |
| 4  | operational period (2021) | 1023      | 0,20             | 29,33            | D       | 1140  | 0,22  | 29,12  | D     |
| 5  | post operational (2026)  | 1414     | 0,28             | 29,00            | D       | 1577  | 0,31  | 28,41  | D     |
| B  | 23 Januari street       |                      |                  |
| 1  | Existing                | 625                 | 0,33             | 31,25            | C       | -     | -     | -     |
| 2  | construction period (2019) | 638       | 0,34             | 31,00            | C       | 661   | 0,35  | 30,63  | C     |
Table 2. Cont

| No | Condition                        | Without development | With development |
|----|----------------------------------|---------------------|------------------|
|    |                                  | Volume (smp/jam) V/C| Kecepatan (km/jam) | Level Of service | Volume (smp/jam) V/C | Kecepatan (km/jam) | Level Of service |
| 3  | construction period (2020)       | 652 0,35 30,50 C   | 675 0,36 29,90 D  |
| 4  | operational period (2021)        | 759 0,40 30,00 C   | 836 0,44 29,17 D  |
| 5  | post operational (2026)          | 1050 0,56 26,78 D  | 1156 0,61 26,04 D |

C MT Haryono street

1 Existing 787 0,32 31,87 C - - - -
2 construction period (2019) 839 0,35 30,21 C 860 0,35 30,21 C
3 construction period (2020) 895 0,37 30,11 C 979 0,40 29,69 D
4 operational period (2021) 955 0,39 29,76 D 1017 0,42 29,17 D
5 post operational (2026) 1321 0,55 28,45 D 1407 0,58 27,08 D

D Taki Niode street

1 Existing 394 34,39 34,39 C - - - -
2 construction period (2019) 420 30,33 30,33 C 445 0,27 30,13 C
3 construction period (2020) 449 30,02 30,02 C 473 0,29 29,58 D
4 operational period (2021) 479 29,76 29,76 D 560 0,35 29,08 D
5 post operational (2026) 662 27,85 27,85 D 774 0,48 26,34 D

Table 3. The performance of the signaled intersection Nani Wartabone Street- January 23 street.

| The performance                              | Approach |
|----------------------------------------------|----------|
|                                              | north    | south   | east    | west    |
| Traffic flow (smp/jam)                       | 427      | 480     | 326     | 295     |
| capacity (smp/jam)                           | 885      | 863     | 629     | 623     |
| Degree Of Saturation                         | 0,38     | 0,56    | 0,52    | 0,46    |
| Number of Vehicles Stopped (smp/jam)         | 312      | 360     | 226     | 199     |
| Queue length (m)                             | 21       | 23      | 34      | 32      |
| Average Delay (detik/smp)                    | 12,8     | 12,98   | 11,06   | 11,32   |

3.4 Conflict point analysis

As a result of the operation of the Swiss Belinn Development in Gorontalo City, it will cause a new point of conflict at the entrance and exit of the Swiss Belinn development site both during the construction period and operational period. An overview of the conflict points at these points is discussed in Figure 1.
3.5. Pedestrian analysis

Pavement service level analysis is carried out on Nani Wartabone Street and January 23 street as described in Table 5. The average sidewalk width is 1.5 m.

| Road                      | Average speed (meters/minute) | Pedestrian current volume, person/meter/minute | Level Of service |
|---------------------------|-------------------------------|-----------------------------------------------|------------------|
| Nani Wartabone Street     |                               |                                               |                  |
| North direction           | 80                            | 1.11                                          | A                |
| South direction           | 81                            | 0.89                                          | A                |
| 23 Januari Street        |                               |                                               |                  |
| West direction            | 79.2                          | 1.33                                          | A                |
| East direction            | 79                            | 1.56                                          | A                |

4. Conclusions

Based on the results of the analysis it can be concluded as follows:

- The performance of the roads around the construction of the Swiss Beliin Hotel is still good. If based on the value of the degree of saturation, in general, the level of service of all these roads is included in level A, but if based on the existing travel speed, the service level is included in levels C and D. The small travel speed is influenced by the length of the road segment that is very short (around 200-260 m).
- However, during the operational period the performance of the Gorontalo Post Office intersection (Nani Wartabone street - 23 January street) as a signaled intersection began to decline, marked by the value of the intersection delay > 15 sec / junior high. For this reason, it is necessary to optimize the traffic light settings. In 2021 until 2026, the type of approach that had previously been challenged was changed to the protected type of approach.

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