Performance evaluation, violations and driver's perception of the Yellow Box Junction in the city of Surabaya (Case study of the junction of Jl. Ir. Sukarno - Jl. Dharmahusada and the junction of Jl. Kutai - Jl. Adityawarman)

**Abstract;** As part of traffic management, Yellow Box Junction must be optimized because this marking must take precedence over APILL in traffic congestion at the intersection. The crossing performance with YBJ does have a high degree of saturation, especially from the north at Jl. Ir Sukarno - Jl. Dharmawangsa and from the west at the junction of Jl. Adityawarman - Jl. Kutai Violations against YBJ were dominated by motorbikes (90%) in terms of forcing them to enter YBJ when there were still vehicles from other approaches namely 399 vehicles/hour. Most motorists have seen the yellow square markings at the YBJ junction (75% LV, 67% MC), few know that the mark is YBJ (44% LV, 28% MC) and most respondents do not know the meaning and function that YBJ can decipher traffic jam at the intersection. Only a few respondents have ever listened to or seen a socialization about YBJ, so it is necessary to find an appropriate formula for socialization to road users.

**Keywords;** yellow box junction, violation, driver perception, socialization

1. **Introduction**

The city of Surabaya has made a lot of efforts to increase road capacity through the addition of new roads such as West Frontage Road Jl. Ahmad Yani [1], Frontage Road Timur Jl. Ahmad Yani [2], and Jalan MERR (Jl. Ir. Sukarno), to offset the high growth of motorized vehicles. Traffic density often occurs at the intersection, especially during peak hours. One of the efforts to overcome traffic congestion at the signal intersection is by installing Yellow Box Junction (YBJ) which is a sign that prohibits vehicles to stop at the yellow box area under any conditions [3].

Highway Code has also arranged related to YBJ in regulation 174, junction boxes have alternating yellow lines painted on the road. The driver does not have to enter the box until the exit or lane is free of the vehicle, but the driver can enter the box and wait for the right turn, and only stop with approaching traffic, or with other vehicles waiting to turn right [4].
The city of Surabaya has implemented the Yellow Box Markings since 2016 at several crossing points including the Jl. Kertajaya- Jl. Dharmawangsa, intersection Jl. Darmo - Jl. Special Police, intersection Jl. Kutai - Jl. Adityawarman and Jl. Kenjeran - Jl. Ir. Sukarno [5]. Law No. 22/2009 concerning Traffic and Road Transportation states that the function of the yellow square markers must take precedence over APILL in traffic congestion at the intersection [6]. Through this research, we tried to find out how to evaluate the performance of the intersection, how the types and characteristics of violations, and how the driver's perception of YBJ.

The hypothesis to be proven is; signaled intersection performance will improve if YBJ is truly obeyed, drivers lack knowledge of information and functions from YBJ, there are still many drivers who violate YBJ, and driver behavior that violates YBJ will reduce saturation flow and increase traffic conflicts.

2. Methodology
This research was conducted at 2 intersections, namely; junction 4 Jl. Ir. Sukarno - Jl. Dharmahusada, East Surabaya and junction 4 Jl. Kutai - Jl. Adityawarman, South Surabaya. The vehicles surveyed are all types of vehicles passing at an intersection. Drivers investigated regarding violations of YBJ are limited to the type of vehicle; Motorcycle (MC), Non-motorized Vehicle (UM), Passenger Vehicle (LV) and Heavy Vehicle (HV).

The driver under study regarding perceptions of YBJ is limited to the type of vehicle; Motorcycle (MC) and Passenger Vehicle (LV). The collection was done by observation of the location of the study and interview the questionnaire to the respondents, as in 2 previous studies related to YBJ [8] [9]. Number of Samples Respondents interviewed numbered 58 people divided equally on the two intersections, while the proportion of modes; motorcycle (MC), 21 respondents, and passenger vehicles (LV), 8 respondents.

Questionnaire
a. General Questions, including: No wa, name, Age, Gender, Occupation, Last education, Vehicle type, Frequency of driving through the road in a day, Starting trip area, End trip area, Travel purpose (work, school, etc.)
b. Closed Questions
   • Have you ever seen YBJ
   • Do you know that the mark is YBJ
   • The understanding of YBJ
   • Do you know the function of YBJ (if not, it will be briefly explained YBJ function or there is information in the questionnaire)
   • Do you know if YBJ can reduce congestion at an intersection
   • After knowing the function of YBJ, have you ever violated YBJ
   • Do you know that there will be sanctions if you violate YBJ
   • Have you been ticketed after violating YBJ
   • Are you going to violate YBJ again after knowing there is doubt?
   • Have you ever seen/listened to socialization about YBJ Group violations against YBJ;
   • Before the green light comes on, but it has already driven (breaking the red light)
   • Enter YBJ when APILL is green but vehicles from other approaches are still inside YBJ
   • Go against the flow
   • Forcing to stop at YBJ
3. Results and discussion
Traffic flow during the morning peak hours shows that the number of vehicles passing by the intersection of Kutai - Adityawarman is 7,187 vehicles/hour and the intersection of Ir. Sukarno- Dharmahusada 8,237 vehicles/hour. The degree of saturation at the Kutai - Adityawarman junction at the north foot is 0.604, the south foot is 0.557, the east foot is 0.281 and the west foot is 0.774, while the intersection of Ir. Sukarno - Dharmahusada at the northern foot of 0.998, the southern foot of 0.848, the eastern foot of 0.110 and the west foot of 0.182.

Violations by the driver against YBJ that occurred at Kutai - Adityawarman intersection as many as 559 vehicles/hour, violated red lights 6 vehicles/hour, forced to stop at YBJ 128 vehicles/hour, against the current 26 vehicles/hour and entered YBJ but vehicles from other approaches were still in YBJ 399 vehicles/hour. Whereas based on vehicles, most violators are motorbike drivers of 536 vehicles/hour or 90 percent of the number of vehicles that violate YBJ At the intersection of Ir. Sukarno - Dharmahusada at peak hours of 420 vehicles/hour, breaking red lights 71 vehicles/hour, forced to stop at YBJ 316 vehicles/hour, against the current of 3 vehicles/hour and entering YBJ but vehicles from other approaches near YBJ 30 vehicles/hour. Whereas based on vehicles, most violators are motorbike drivers of 416 vehicles/hour or 99 percent of the total number of vehicles that violate YBJ.

Regarding driver perception, most drivers have seen the yellow square markings at the YBJ junction (75% LV, 67% MC), but few know that the mark is YBJ (44% LV, 28% MC) and most respondents do not know the meaning and YBJ functions, most also do not know that YBJ can unravel congestion at the intersection. In the case of violations of YBJ, only a few felt violating YBJ, only a few knew that there were ticketing sanctions for violating YBJ, whereas, in terms of socialization, only a few respondents felt they had ever listened to or seen socialization about YBJ.

| No. | Question                                                      | LV “Yes” | MC “Yes” |
|-----|---------------------------------------------------------------|----------|----------|
| 1   | Have you ever seen YBJ                                       | 75%      | 67%      |
| 2   | Do you know that the mark is YBJ                             | 44%      | 28%      |
| 3   | Do you understand about YBJ                                  | 31%      | 12%      |
| 4   | Do you know the function of YBJ                              | 31%      | 12%      |
| 5   | Do you know if YBJ can reduce congestion at the intersection | 19%      | 17%      |
| 6   | After knowing the function of YBJ, has it ever violated YBJ  | 6%       | 9%       |
| 7   | Do you know that there will be sanctions if you violate YBJ  | 25%      | 9%       |
| 8   | Has it been ticketed after violating YBJ                      | 0%       | 0%       |
| 9   | Will it violate YBJ again after knowing there is a punishment| 0%       | 0%       |
| 10  | Have you ever seen / listened to a socialization about YBJ    | 13%      | 12%      |
4. Conclusion and recommendation
This research produces several conclusions;
• Crossing performance shows that all intersections have a high degree of saturation, so it is still feasible for YBJ to be installed
• The most common violation of YBJ is "forcing into YBJ when the APIILL is green but vehicles from other approaches have not yet finished passing the YBJ".
• Motorcycle drivers are the most dominant YBJ violators
• Most respondents, especially passenger car drivers, have seen YBJ as a Yellow Mark in the middle of an intersection
• However, only a few respondents know that the mark is YBJ and understand the function and understanding of YBJ
• Only a few respondents know that YBJ can break down and reduce congestion at the intersection
• Only a few respondents knew of the socialization of YBJ.

Proven hypothesis: Signal intersection performance will increase if YBJ is truly obeyed, the driver does not know the information and functions of YBJ, there are still many drivers who do not heed YBJ, driver behavior that violates YBJ will reduce saturation flow and increase traffic conflicts

Recommendation :
• YBJ needs to be installed at several other intersections in the city of Surabaya as an effort of traffic management to reduce congestion at the intersection
• Socialization of YBJ is a priority in optimizing the role of YBJ at the intersection, effective and targeted socialization is needed that can explain the understanding and function of YBJ to road users.
• Socialization is mainly directed at motorcycle riders as the most violators of YBJ based on research results

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