

## **Road User Perception about Red Box for Motorcycles at the Signalized Intersection**

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**Abstract:** Red box for motorcycles is one of the solutions to increase intersection performance. Aim of this paper is to analyze the road user perception about the red box. Data collection was done by questionnaire distribution with randomized sampling method to the road user. The data were analyzed with descriptive methods to describe the road user perception. The majority of motorcyclists has agreed and they need the red box implementation (78.93%) because of safety and comfort reasons (83.6%). Road users agreed that the campaign media by using loud speakers at the signalized intersection are very clearly understood what the purpose of the red box (74.46%). The size of the red box is sufficient with good road marking area according to the respondents (78.65%). All in all, the majority of road users has responses positive to the implementation of the red box for motorcycle.

*Keywords:* motorcycle, red box, questionnaire, road user, signalized intersection

### **1. BACKGROUND**

The ownership of motorcycles from year to year has increased and dominated the traffic on the roads with the population of 77.75 million or 82.5% from all composition of vehicles in Indonesia (AISI, 2013). Thus, motorcycles are called as the fastest growing population vehicle. One of the negative effects caused by the growing is irregular queue of motorcycles while waiting during red light at signalized intersection. Motorcyclists often disobey road regulations such as passing over the stop line, or blocking the left lanes. These acts influence the performance and decrease the capacity of signalized intersection.

In order to overcome the decrease of signalized intersection's performance, the engineering approach by making a red box for motorcycles. This is conducted by separating motorcycles with other vehicles to decrease the obstacles caused by motorcycles. The red box is expected that traffic flow can be improved along the green light at the signalized intersections.

Institute of Road Engineering (IRE) has conducted a full scale project of the red box from years 2007 to 2014. Along the seven years the red box has been implemented in six cities; Bandung, Bekasi, Bogor, Denpasar, Badung and Tangerang. The results show that the red box has a significant effect towards the decrease of the traffic conflicts and the increasing volume of vehicles at the signalized intersections (Red Box Manuscript Policy Report, 2014). Besides this implementation, the red box has also been built as the result of Regional Government's initiation (Department of Transportation) which has been built in a few cities such as Depok, Palembang, Medan, Palembang and Jepara.

The data sampling was drawn from the implementation of the red box in Bandung and Denpasar. The data perception is in a form of questionnaire about profile of the motorcyclists and some substantial questions concerning the red box. The data were analyzed to reveal perceptions of the motorcyclist about the red box which has been experimented. The results of the analysis were used to evaluate the red box in terms of its planning and its construction.

## 2. RED MOTORCYCLE BOX

In Indonesia, a Red Motorcycle Box in signalized intersections which was actually developed from the concept of ASLs as an alternative to overcome the issue caused by motorcycles was introduced. In Europe, Advanced Stop Lines (ASLs) refers to UK Department for Transport is a facility for bicycles designed to give the users priority in signalized intersections, because traffic on the European Bike quite dominate especially in the Netherlands. Indonesia's motorcycle became the dominant mode of transportation in traffic. Further research on motorcycles must always be carried out which are adopting the concept of ASLs for motorcycles.

ASLs is a signage prepared as a second stopping sign in signalized intersections in front of stopping line for other vehicles. Between these two stopping lines, there is an area used as a waiting space along the red light. This make it possible for bicycles to wait in front of other vehicles in intersections. As a complement of ASLs, a latching path for bicycles is built to facilitate the bicycles pass the reservoir area while waiting other vehicles at the red light. The previous concept of ASLs for bicycles, then it was tested for motorcycles. In general ASLs can help motorcycles in:

- 1) Placing motorcycles in a front position which can be easily seen by other vehicles in the intersections,
- 2) Enabling the motorcycles to move earlier form other vehicles and prevent the moves to get cut by other vehicles,
- 3) Enabling motorcycles to do a safe maneuver in the intersections.

Red Motorcycles Box is a stopping facility for motorcycles along the red light which is located at the front queue of other four wheeled vehicles. The red box is built by making a space from four wheeled vehicles' stopping line as wide as needed by motorcycles. Thus, the red box is a flat two dimensional line limited by a stopping line for motorcycles and stopping line for four wheeled vehicles. These two stopping signs are located in line which are separated by a red marking area with a certain length and width (Idris, 2007). The red box shown in Figure 1 and Figure 2.



Figure 1. Red Box in Denpasar



Figure 2. Red Box in Bandung

### 3. DATA AND THE ANALYSIS OF QUESTIONNAIRE FOR MOTORCYCLES

The data collection was a collection of primary data using questionnaires. The questionnaires were distributed to motorcyclists around the red box and also places with a high population of motorcycles such as colleges, recreation places, shopping centres and offices building. The technique used is a simple random sampling technique.

Questionnaires were distributed to 225 motorcyclists in Denpasar and 292 motorcyclists in Bandung. Questions asked were about the application of red box for motorcycles in Bandung and Denpasar. Questionnaire data retrieval in Bandung was conducted on 16 and 17 April 2012 for 2 days, then data retrieval questionnaires conducted on the 14th of Denpasar and 15 May 2012 for 2 days. The questionnaires were used to reveal the perceptions of road users about the red box which is expected to build a comprehensive illustration about the red box.

The responds of motorcyclists were needed as an feedback to evaluate the application of the red box in the two locations. The results of the evaluation can be used as a feedback to improve and develop the red box. The analysis is divided into three aspects: social-economy aspect, motorcycles movement aspect, and design aspect. This analysis covers the needs of red box, the knowledge about the red box, the condition of the red box signs, and the possibility of the development of the red box in order to make it more understandable and comprehensive.

#### 3.1. The Needs of the Red Box for Motorcycles

The needs of the red box for motorcycles is influenced by the feelings of safety and comfort felt by the motorcyclists when they are at the roads surrounded by other vehicles along the red light. Those feelings of discomfort and unsafe will push the needs of the motorcyclists to get a specialized facilities for motorcycles. Figure 3 shows the feelings felt by motorcyclists in signalized intersections and Figure 4 shows the need of Red Box for motorcycles.

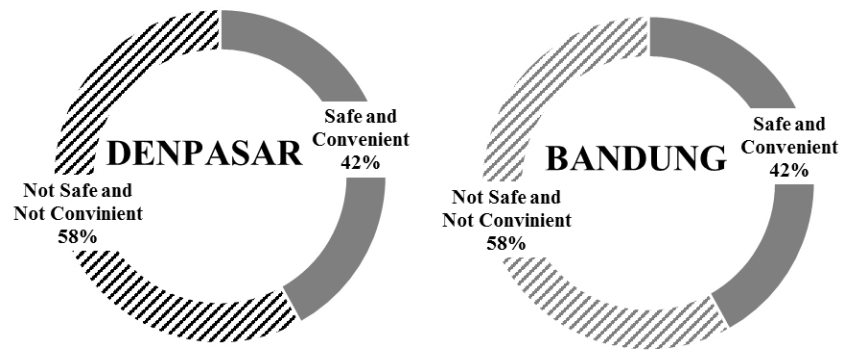


Figure 3. Safety and Comfort in Intersections

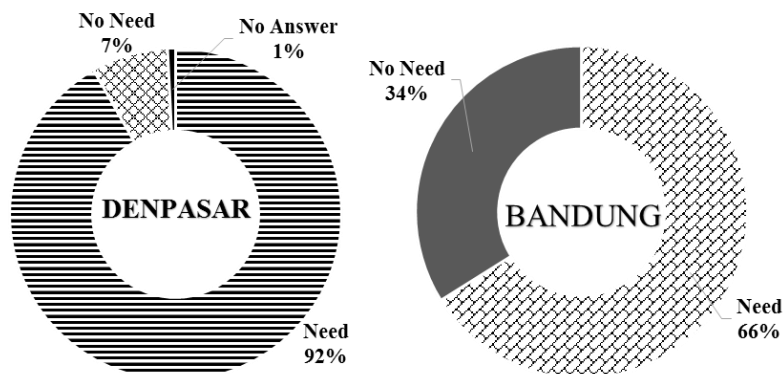


Figure 4. The needs of red box for motorcycles

Motorcyclists in Denpasar who feel insecure when they are surrounded by other vehicles are 58.04% (148 people) and 41.96% (107 people) feel comfortable and safe. In Bandung, 68.84% (201 people) motorcyclists feel insecure and uncomfortable when surrounded by other vehicles and 31.16% (91 people) feel comfortable and safe.

The existence of the red box for motorcycles in Denpasar is very important, this is shown by the total of respondents who chose the red box as many as 91.76% (234 people), meanwhile 7.45% (19 people) respondents feel the red box as unnecessary, and 0.78% (2 people) respondents did not give any answers. In Bandung, around 66.10% respondents (193 people) need the red box and 33.90% respondents (99 people) do not need the red box.

More than half of the respondents feel uncomfortable and insecure when surrounded by other vehicles when stopping at the intersections. Meanwhile there are also many motorcycles stopping which can increase the potency of road accidents. Thus, the red box are really necessary.

### 3.2. Knowledge and Information about Red Box for Motorcycles

This knowledge covers the introduction or the meaning of motorcyclists' knowledge concerning the red box, the information about the red box and the experience when stopping at the red box.

#### 3.2.1 Knowledge about the red box for motorcycles

The knowledge means that the motorcyclists know the location and the regulations applied at the red box area, including the application for motorcyclists and other road users.

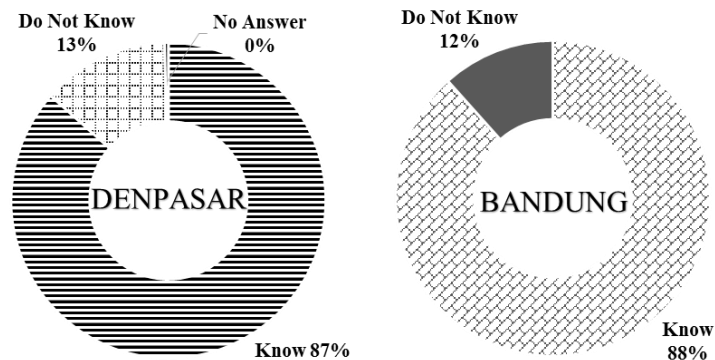


Figure 5. Knowledge about the red box for motorcycles

The results of the data from Denpasar shows that 86.27% respondents (220 people) know about the the red box while 13.33% respondents (34 people) do not know about the red box, and 0.39% respondents (1 people) did not answer. Meanwhile in Bandung, 83.36% respondents (258 people) know about the red box, and 11.64% respondents (34 people) do not know about the red box.

### 3.2.2 Source of information

The Source of information of the red box has shows on Figure 6.

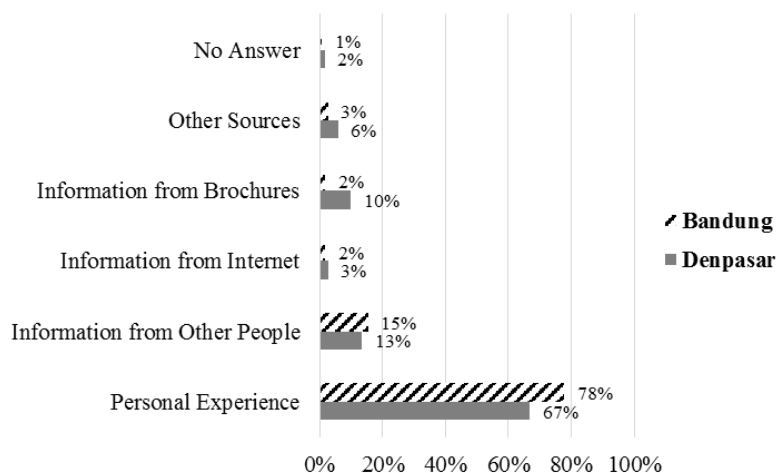


Figure 6. The Source of Information of the red box for motorcycles

Approximately 66.67% motorcyclists (170 people) in Denpasar know about the red box for motorcycles based on their personal experience, 13.33% motorcyclists (34 people) know the information from other people, 9.8% motorcyclists (25 people ) know the information from brochures, 2.75% motorcyclists (7 people) know the information from the Internet and know from other sources are about 5.88% (15 people) and as many as 1.57% motorcyclists (4 people) did not answer. In Bandung 77.74% respondents (227 people) know the information from personal experience, other people's information as many as 15.41% respondents (45 people), 1.71% respondents (5 people) from brochures, 1.71% respondents (5 people) from the Internet, others are as many as 2.74% respondents (8 people) and 0.68% respondents (2 people) did not answer.

The majority of the source of information of the red box for motorcycles comes from self-experience, in which motorcyclists experience and get a direct lesson. It will push other sources (other people's information) as the result of communication between the motorcyclist who has known about the red box for motorcycles and other motorcyclists who has not known about the information.

### 3.3 Safe and Comfortable Feelings when Stopping at the Red box

Figure 7 shows safe and comfortable feelings when stopping at the red box for motorcycles

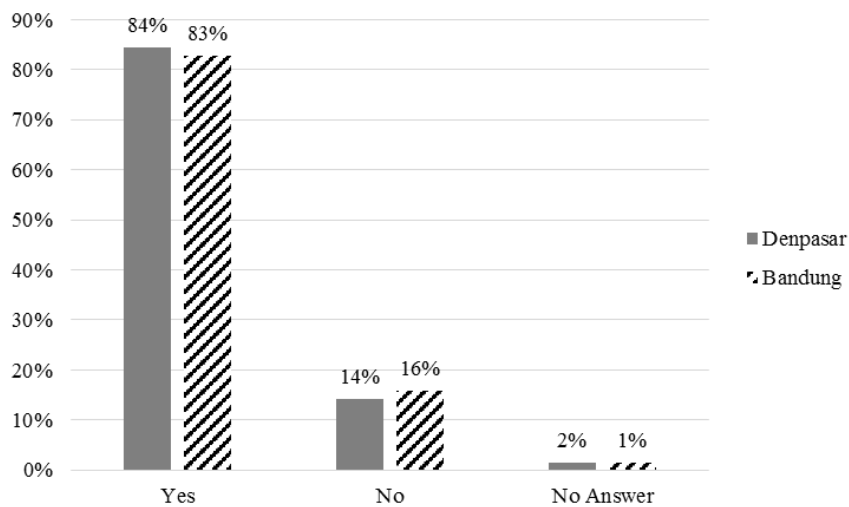


Figure 7. Safe and comfortable feelings

Around 84.31% Motorcyclist (215 people) in Denpasar feel safe and comfortable at the red box for motorcycles, 14.12% motorcyclists (36 people) feel insecure and uncomfortable, and 1.57% motorcyclists (4 people) did not answer. There are 82.88% motorcyclists (242 people) in Bandung feel safe and comfortable, 15.75% motorcyclists (46 people) feel insecure and uncomfortable and 1.37% motorcyclists (4 people) did not answer.

The safe and comfortable feelings are caused by the existence of the red box for motorcycles that is not mixed with other types of vehicles. The area has a firm line and separate between motorcycles and other types of vehicles.

### 3.4 Difficulties to Reach the Red Box Area

Figure 8 shows the difficulties experienced by motorcyclists to reach the red box area in signalized intersections.

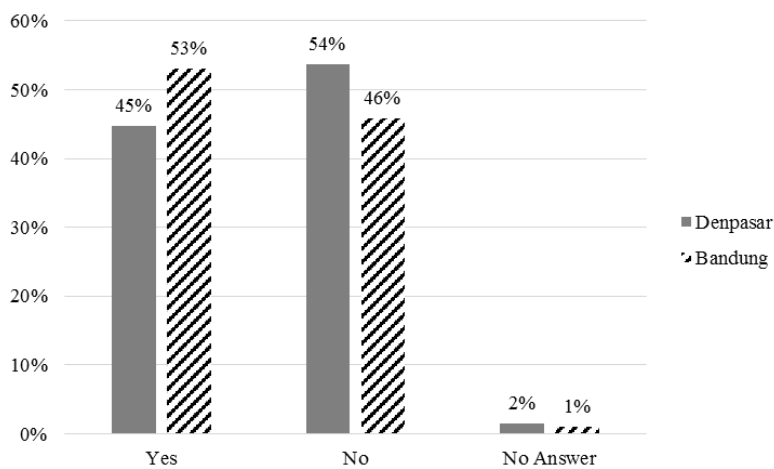


Figure 8. The difficulties to reach the red box area

There were 44.71% motorcyclists in Denpasar (114 people) have difficulties in reaching the red box for motorcycles, 53.73% motorcyclists (137 people) did not feel any difficulties, and 1.57% motorcyclists (4 people) did not answer. Meanwhile 53.08% motorcyclists in Bandung (155 people) feel difficulties in reaching the red box for motorcycles, 45.89% motorcyclists (134 people) do not feel any difficulties, and 1.03% motorcyclists (3 people) did not answer.

The difficulties experienced can be influenced by some factors; the width of the roads, and the condition of the queue of the traffic flow. The narrow widths of the roads make it difficult for motorcycles to reach the red box area.

### 3.5 Sight Distance of the Red Box

Figure 9 shows view distance of motorcyclists in seeing the red box for motorcycles in intersections.

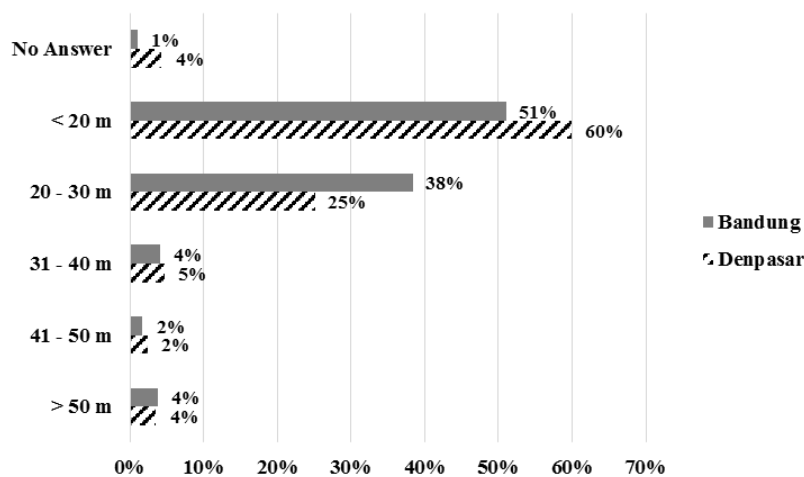


Figure 9. Sight distance of the red box

There were 60% of motorcyclists (153 people) in Denpasar can see the red box for motorcycles within the distance under 20 m, 25.1 % motorcyclists (64 people) within the distance from 20m to 30 m, 4.71% motorcyclists (12 people) within the distance of 31-40 m, 3.53% motorcyclists (9 people) within the distance over 50 m, 2.35% motorcyclists (6 people) within the distance of 41-50 m, and 4.32% motorcyclists (11 people) did not give any answers. Meanwhile 51.03% Motorcyclists (149 people) in Bandung can see the red box for motorcycles within the distance under 20 m, 4.11% motorcyclists (12 people) within the distance of 20-30 m, 4.11% motorcyclists (12 people) within the distance of 31-40 m, 3.77% motorcyclists (11 people) within the distance of >50 m, 1.71% motorcyclists (5 people) within the distance of 41-50 m, and 1.03% motorcyclists (3 people) did not give any answer.

### 3.6 Other Vehicles in the Red Box Area

Figure 10 shows the existence of other types of vehicles that stop in the red box area for motorcycles and types of vehicles that stopping at the red box.

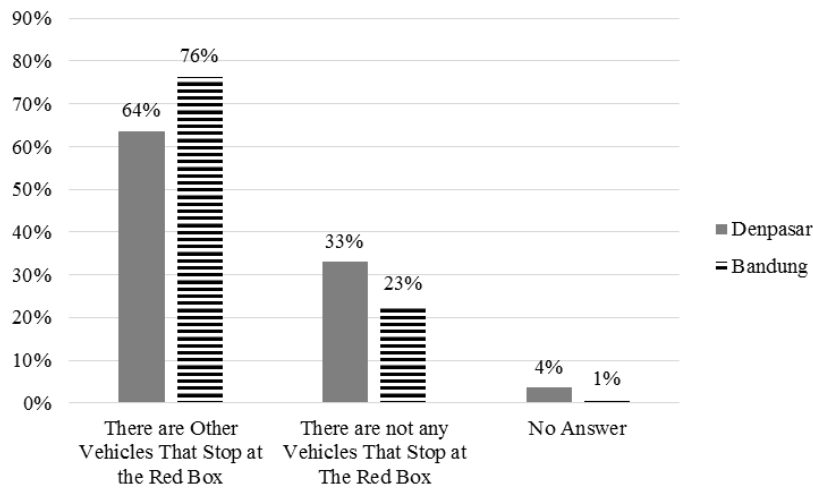


Figure 10. Other types vehicles that stop at the red box for motorcycles

There were 63.53% motorcyclists (162 people) in Denpasar gave the answer that there are other vehicles that stop at the red box for motorcycles, 32.94% motorcyclists (84 people) answered that there are not any vehicles that stop at the red box, and 3.53% motorcyclists (9 people) did not answer. Meanwhile, 76.37% motorcyclists (223 people) in Bandung claim that there are other vehicles that stop at the red box for motorcycles, 22.95% motorcyclists (67 people) claim that there are not any vehicles that stop at the red box, and 0.68% motorcyclists (2 people) did not answer.

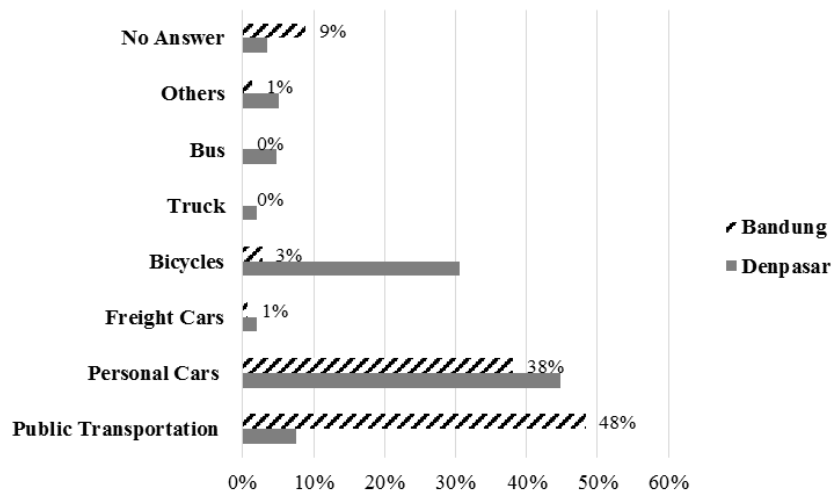


Figure 11. Other types vehicles that often stop at the red box for motorcycles

There were other types of vehicles that often stop at the red box for motorcycles in Denpasar; passenger cars as many as 44.71% (114 people), bicycles as many as 30.59% (78 people), public transportation (mini bus) as many as 7.45% (19 people), bus as many as 4.71% (12 people), freight cars as many as 1.96% (5 people), trucks as many as 1.96% (5 people), others as many as 5.1% (13 people) and as many as 3.53% (9 people) did not answer. Meanwhile, in Bandung, vehicles that often stop at the red box for motorcycles are public transportation as many as 48.29% (141 people), passenger cars as many as 38.01% (111 people), bicycles as many as 2.74% (8 people), freight cars as many as 2.74% (2 people), and others as many as 1.37% (4 people), while as many as 8.9% (26 people) did not answer.



### 3.7 Campaign of the Red Box for Motorcycles

As one of the campaign media of the red box for motorcycles, a loud speaker was installed on traffic lights's pole at signalized intersections. Figure 12 shows the clarity of the sound for the road user.

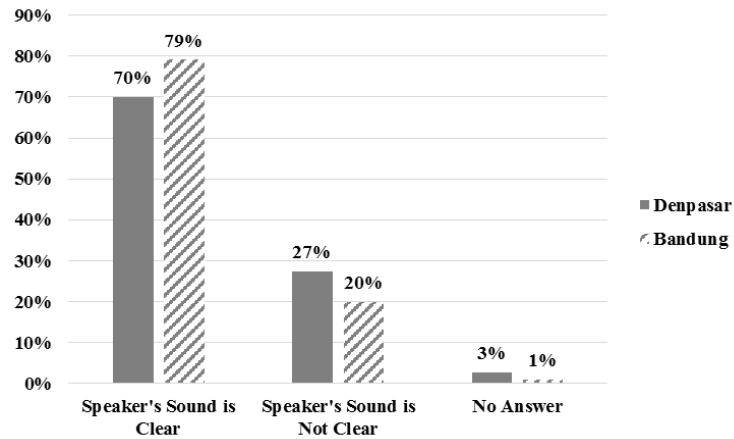


Figure 12. The loud speaker performance at the red box area

There are 69.90% motorcyclists (178 people) in Denpasar that answered the sound of the red box speaker was clear. 27.45% motorcyclist (70 people) claim that the sound is not clear, and 4.71% motorcyclists (7 people) did not answer. Meanwhile, in Bandung, 79.11% motorcyclists (231 people) claim that the sound of the red box speaker was clear, 19.86% motorcyclist (58 people) claim that the sound was not clear, and 1.03% motorcyclists (3 people) did not answer.

### 3.8 Size of the Red Box Area for Motorcycles

Figure 13 shows the size of red box area for motorcycles

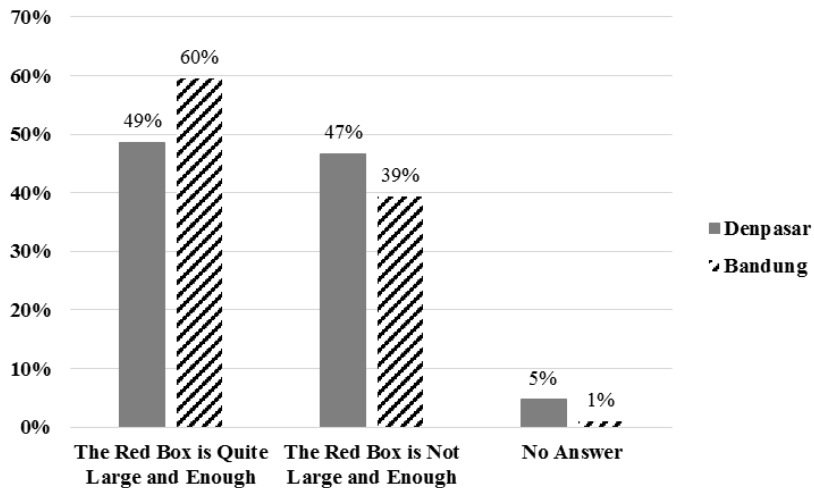


Figure 13. The size of red box area

There were 48.63% motorcyclists (124 people) in Denpasar claim that the red box area is quite large and adequate to accomodate motorcyces, 46.67% motorcyclists (119 people) claim that the red box area is not large enough, and as many as 4.71% motorcyclists (12 people) did not answer. Meanwhile, in Bandung, 59.59% motorcyclists (174 people) claim that the red box area is quite large, 39.38% motorcyclists (115 people) claim that the box area is not large enough, and as many as 1.03% (3 people) did not answer. The area of the red box

for motorcycles was determined by the volume of motorcycles at the signalized intersections.

### 3.9 Condition of Red Marking Area

The condition of road marking covers red marking area, motorcycles logo, and stop line marking.

#### 3.9.1 The Color Clarity of Road Marking Area

Figure 14 shows the color clarity of road marking area

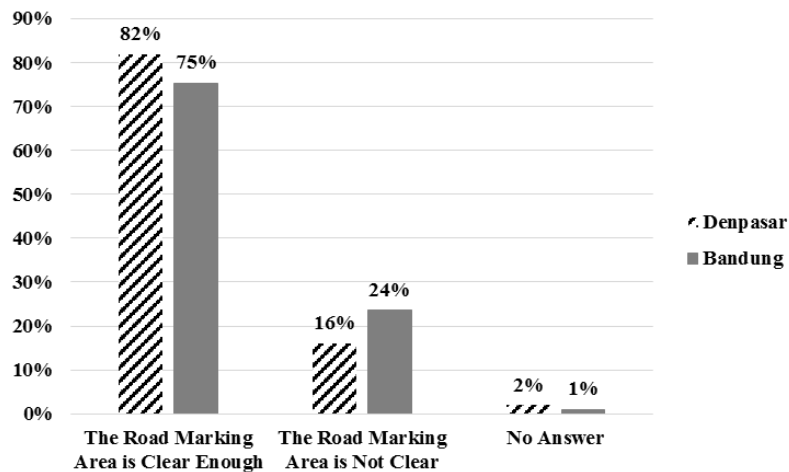


Figure 14. The color clarity of the road marking area

There were 81.96% motorcyclists (209 people) in Denpasar claim that the road marking area is clear enough, 16.09% motorcyclists (41 people) claim the road marking area is not clear, and 1.96% (5 people) did not answer. Meanwhile, in Bandung, 75.34% motorcyclists (220 people) claim that the road marking area is clear enough, 23.63% motorcyclists (69 people) claim the road marking area is not clear, and 1.03% (3 people) did not give any answers.

The clarity of the color is also influenced by the condition and the quality of road marking. Only few of the road area marking are fade and unclear due to poor quality. Most of road marking application are meets the standart.

#### 3.9.2 The color of the box

Figure 15 shows color choice were picked by respondents which was seen to be suitable coloring for box motorcyles area.

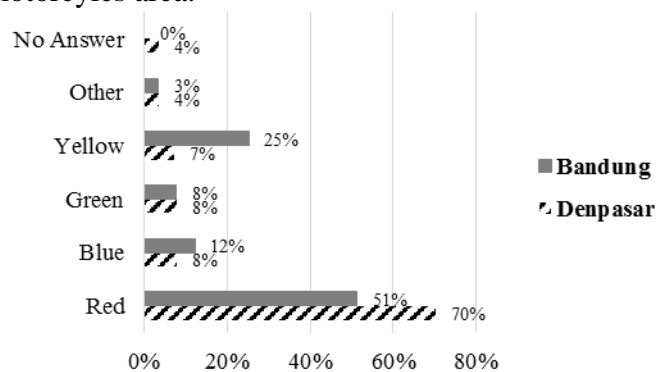


Figure 15. The color for box motorcyles area

The distributions of respondents' color choice in Denpasar, there were 70.20% respondents (179 people) chose red, 7.84% respondents (20 people) chose blue, 7.84% respondents (20 people) chose green, 7.06% respondents (18 people) chose yellow, and other colors are picked by 3.53% respondents (9 people), and 3.53% (9 people) did not answers. Meanwhile, in Bandung, 51.37% respondents (150 people) chose red, 25.34% respondents (74 people) chose yellow, 12.33% respondents (36 people) chose blue, 7.53% respondents (22 people) chose green, and 3.42% respondents (10 people) chose other colors.

Red becomes the most dominant choice of the respondents. Red is a shining color and also related to warning color.

### 3.10 Suitable Names for Red Box Area

Suitable names for red box area are something which can be attached or used to make it easier for motorcyclist to interpret the path in intersections they are using. The use of "specialized stopping space" causes many interpretations because there are no explanations that elaborate types of vehicles that cannot stop in the area. Figure 16 shows most respondents' choice for name of the red box for motorcycles is "Ruang Henti Sepeda Motor".

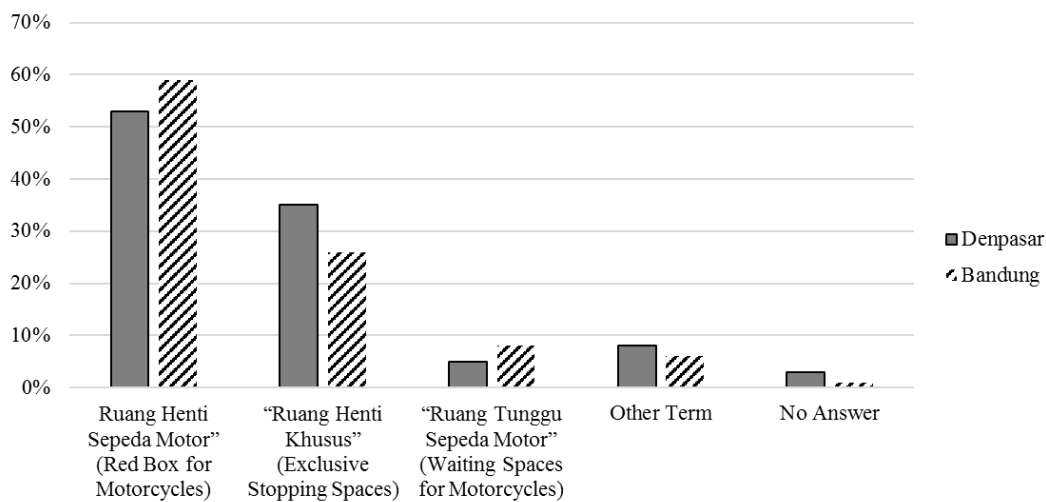


Figure 16. Suitable names for the red box





Followings are the distributions of respondents' choice of red motorcycles box's names in Denpasar: 53.33% respondents (136 people) chose "Ruang Henti Sepeda Motor" (Red Box for Motorcycles), 34.51% respondents (88 people) chose "Ruang Henti Khusus" (Exclusive Stopping Spaces), 4.71% respondents (12 people) chose "Ruang Tunggu Sepeda Motor" (Waiting Spaces for Motorcycles), 4.71% respondents (12 people) chose other names, 2.75% respondents (7 people) did not give any answers. .

In addition, in Bandung 58.90% respondents (172 people) chose "Ruang Henti Sepeda Motor" (Red Box for Motorcycles), 26.03% respondents (76 people) chose "Ruang Henti Khusus" (Exclusive Stopping Spaces), 7.88% respondents (23 people) chose "Ruang Tunggu Sepeda Motor" (Waiting Spaces for Motorcycles), 6.16% respondents (18 people) chose other terms, and 1.03% respondents (3 people) did not give any answers.

### 3.11 Logo for the Red Box

Logo marking is one of campaign media that used to give people information about the red box area for motorcycles. The logo needs to be easily understood in order not to give a wrong interpretation or take too many times to comprehend. Table 1 shows opinions of motorcycles logo at the centre area of the red box..

Table 1. Logo motorcycles at the centre area of the red box.

No	Question	Answer	Denpasar		Bandung	
			%	Total	%	Total
1	Whether a current logo for motorcycles is suitable?	a. Yes	44.71	114	36.64	107
		b. No	53.33	136	61.99	181
		No Answer	1.96	5	1.37	4
2	What's the suitable logo for motorcycles?	a.	32.55	83	34.25	100
						
		b.	18.43	47	14.04	41
						
		c.	4.31	11	10.62	31
						
d.	42.75	109	40.75	119		
						
e. No Answers	1.96	5	0.34	1		

Based on the results of the questionnaires, the logo used by the red box for motorcycles seems not to suit well. It is seen to not be able to show motorcycles' shape as well. It takes time to interpret the logo.

## 4. CONCLUSIONS

Based on the analysis, followings are the conclusions:

- 1) Motorcyclists feel uncomfortable and insecure when they were surrounded with other vehicles in intersections when the traffic light turns red. In Denpasar there were 58.04% respondents who feel uncomfortable and insecure. Meanwhile in Bandung, there were 68.84% respondents who feel the same. This encourages motorcyclists to have the needs of the red box for motorcycles. In Denpasar, there were 91.76% respondents who claim that they need the red box, and there were 66.10% in Bandung who need the red box..
- 2) The existences of the red box in intersections give a comfort feeling and safety for motorcyclists. In Denpasar, 84.31% respondents feel safe and comfortable to stop at the red box and there were 82.88% respondents in Bandung who feel the same.
- 3) There were 81.96% motorcyclists in Denpasar and 75.34% motorcyclists in Bandung who claim that the color of road marking area is clearly seen. Meanwhile there were 16.09% respondents in Denpasar and 23.63% respondents in Bandung does not feel that color of the road marking as clear enough. This is caused by the color of the road marking that starts to fade in several area. There were 70.20% motorcyclist in Denpasar and 51.37% motorcyclists in Bandung who chose red color as the most suitable color for the motorcycle box.
- 4) The most suitable name for the red box for motorcycles is “Ruang Henti Khusus Sepeda Motor”. People who chose that name are 53.33% in Denpasar and 58.90% in Bandung. There were 42.75% motorcyclists in Denpasar and 40.75% motorcyclists in Bandung who chose logo number D as the most suitable logo for the red box because that logo can be easily recognized and comprehended.

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