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THE INFLUENCE OF LEVEL CROSSINGS ON ECONOMIC GROWTH AND SOCIAL DYNAMICS IN CIREBON CITY

Shinta Novriani[1], Mira Lestira Hariani[1*], Fathur Rohman[1]

[1]) Civil Engineering Department, Swadaya Gunung Jati University, Cirebon.
[*]Corresponding Author's Email: mira.hariani0103@gmail.com
Phone number of Corresponding Author: 087718070807

ABSTRACT

Cirebon City is one of the metropolitan areas stipulated in PP No. 26 of 2008 namely RTRWN as a National Activity Center (PKN) in developing metropolitan areas, especially in Ciayumajakuning area. The Cirebon City has become the center of economic growth, resulting in an increase in the flow of urbanization and in line with social dynamics that must be considered due to urban city activities. One of the impacts of urban cities is the increase in traffic density, causing a decrease in traffic performance. The purpose of this study is to determine the existing conditions of railroad level crossings in Cirebon City and see their impact on traffic performance, social dynamics and economic growth in Cirebon City. The research method used is a survey method, including traffic volume surveys, train frequency surveys, and calculating queue lengths and calculating delays. Based on the result of a survey on 8 roads in the Cirebon City with an average capacity of 3191 smp/hour, the degree of saturation is 0.5, the Level of Service value is C, which means the flow is stable, the speed can be controlled by traffic. However, if it is review based on an economic analysis related to the loss of community income due to level crossings if it is assumed that the average income of the people of Cirebon City is IDR 2.304.943.51 each individual experiences losses ranging from IDR 0 – IDR 768.314 for one month depending on the how long the individual experiences waiting time at a level crossing. If analyzed based on fuel consumption, each individual experiences a loss of IDR 0 – IDR 30.294 per month depending on the waiting time and the type of fuel used and if it is associated with the economic growth of Cirebon City, it is expected to increase the contribution of GRDP for each sector and respondents feel that level crossing are very important affect their travel interest.

Keyword: *economic growth, level crossings, social dynamics, traffic performance*

1. INTRODUCTION

The Cirebon City is a city that has been designated as one of the metropolitan areas specified in [1] as the National Activity Center (PKN) in the development of the metropolitan area, especially in the mainstay area, namely Ciayumajakuning (Cirebon City, Regency of Cirebon, Indramayu, Majalengka and Kuningan). The Cirebon City is the center of rapid economic growth in the Ciayumajakuning region, increasing the flow of urbanization and in line with social dynamics that must be considered. This is due to urban activities such as business and trade centers, industry, culinary, tourism, services and government. Therefore, there is an effect of increasing the number of residents, both permanent and part-time residents.

One of the impacts of urban cities is the increase in traffic density, which leads to a decrease in traffic performance. The affected traffic performance includes: traffic flow speed, road capacity, degree of saturation and queue length. The traffic performance assessment is based on [2] issued by the Directorate General of Highways, Directorate of City Road Development (Binkot). Road infrastructure is in need of adjustment along with the Cirebon City which has been designated as PKN, it is necessary to develop

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a precise strategy related to the increasing need for road infrastructure, especially at level crossings that prioritize the concept of Green Grade Separated Crossing. In [3] explains that the task of the city government related to management or one of the authorities in the administration of roads is the regulation of guidance, development and supervision.

In [4] it is stated that the intersection between the railroad and the road is not level. The purpose of a level crossing is to provide a high level of safety and reduce delays for road users. Exceptions to the provisions of level crossings can only be made while ensuring the safety and smoothness of railroad travel and road traffic. At [4] The master plan of the city/district railways is prepared with due regard to the district spatial plan and the city spatial plan. The regulation of city roads carried out by the city government in accordance with the mandate of the Law above includes the formulation of city road implementation policies based on national policies in the field of roads with due regard to inter-regional harmony, preparation of operational guidelines for administration of city roads, determining the status of city roads.

Cirebon City has 11 crossing points between roads and railways where the existence of these crossings affects traffic performance, social aspects and economic growth. The high frequency of railroad crossings and the volume of traffic on the road section results in a decrease in performance on the road section, causing congestion and will ultimately affect social aspects and economic growth. This study aims to determine the existing conditions related to level crossings on roads in Cirebon City and see its effect on traffic performance, social dynamics and economic growth in Cirebon City.

2. LITERATURE REVIEW

The existence of level crossings in a city is one of the causes of decreased traffic performance on roads. This is due to the fact that there are railroad crossings with a fairly high frequency of trains that are on the same level as the road will cause delays and queues on the road, especially during peak hours. Research related to level crossings has been done before. For example, [5] conducted a study related to the effect of railroad level crossings on the Malang - Surabaya KM 10 road section on delays, queues and vehicle operating costs. The results showed that the existence of the level crossing had a negative impact on traffic performance because it affected vehicle speed and caused queues. Reference [6] conducted research on level crossings which aims to determine the performance of the road around the railway level crossing on H.O.S. Cokroaminoto Rd., Yogyakarta under the existing conditions, crossing closures, and crossing closures with flyovers as well as conducting traffic modeling as a result of closing the railroad crossings. The results showed that in the conditions of crossing closure and crossing closure with flyovers, the degree of saturation value on all road sections decreased. Reference [7] evaluated level crossings in Semarang City with reference to the Directorate General of Transportation Regulation SK 770 of 2005. The results showed that the level crossings studied did not meet the technical standards for level crossings, so they should be upgraded to non-level crossings. Reference [8], [9], [10] analyzed the effect of closing railway crossings on traffic performance and proved that the presence of level crossings affects the level of traffic service, queues and delays. Reference [11] analyzes the effect of railway crossings on the performance of Citayam Rd. by looking at the existing road Level of Service conditions and analyzing the queues that occur at the crossing gates. The results showed that there is a need for thought for non-level crossings followed by changes in road geometrics on the road section. Based on previous research, most of them analyzed the effect of level crossings on traffic performance and vehicle operating costs or fuel consumption, while in this study in addition to seeing the effect of level crossings on traffic performance also saw its effect on social dynamics and economic growth in Cirebon City.

P-ISSN : 2598-1277
E-ISSN : 2621-3966

3. METHODOLOGY

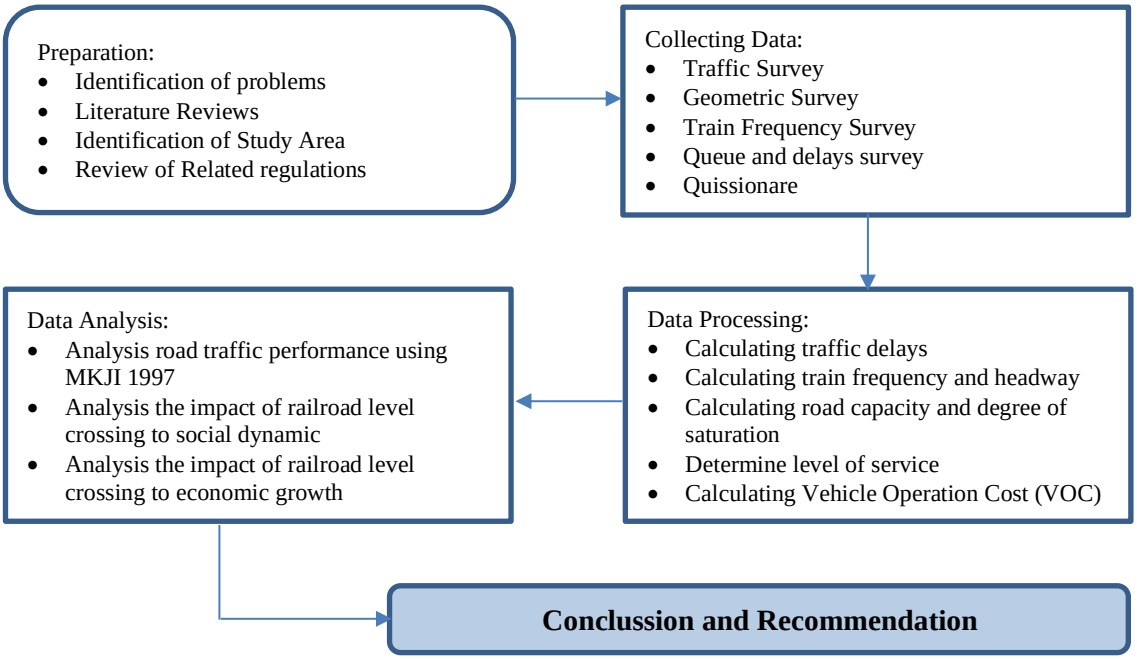

Figure 1. Research Methodology

Figure 1 shows the overall research method. In general, there are several main works to be carried out in this research, which are as follows:

1. Primary survey consisting of:
   a. Geometric survey on road sections
   b. Traffic flow survey at level crossing road in Cirebon City
   c. Survey of queue lengths, delays and waiting times when trains pass
   d. Frequency and headway survey of railroad crossings
   e. Questionnaire survey of road users
2. Secondary survey which includes collecting secondary data from relevant agencies which include:
   a. RTRW or RUTR of Cirebon City
   b. Road Class and Status Data
   c. Demographic Data of Cirebon City
3. Data analysis which includes:
   a. Road Section Capacity Analysis referring to MKJI 1997
   b. Analysis of the effect of level crossings on economic growth based on traffic performance
   c. Analysis of the effect of level crossings on social dynamics

3.1. Survey Location

Even though there are 11 railroad crossing points in Cirebon City which are spread over 9 roads, this research only examines 9 crossing points on 8 roads because the other 2 points are non-level crossings (there are flyovers). Pictures of research locations can be seen in Figure 2.

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E-ISSN : 2621-3966

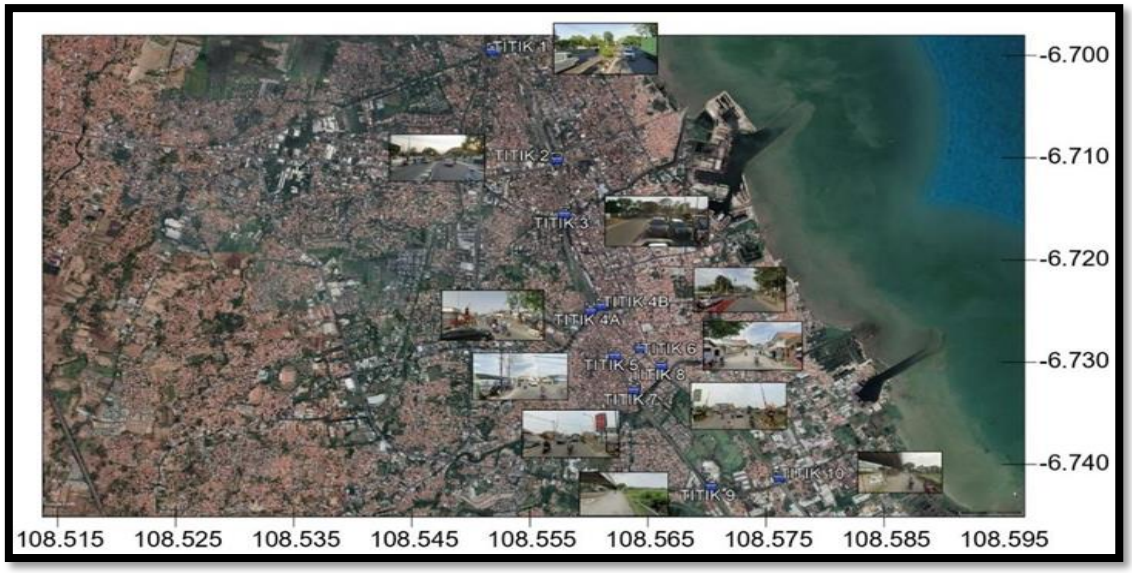

Figure 2. Research Location

4. RESULT AND DISCUSSION

4.1. Road Section Traffic Analysis

Table 1 shows the results of the traffic performance analysis on 8 road sections:

Table 1. Capacity, Degree of Saturation and *Level of Service* values

NO	Road Section	Directtions	Capacity (pcu/hour)	Degree of Saturation (DS)	Level of Service (LOS)
1	Slamet Riyadi Rd.	West - East	3151	0,40	B
		East - West	2903	0,36	B
2	Kartini Rd.	-	4771	0,53	C
3	Tentara Pelajar Rd.	-	5330	0,56	C
4	Kesambi Rd.	-	5022	0,46	C
5	Kesambi Dalam 1 Rd.	-	1374	0,65	C
6	Kesambi Dalam 2 Rd.	-	1345	0,47	C
7	Pangeran Drajat Rd.	-	2089	0,59	C
8	Kutagara Drajat Rd.	-	2737	0,48	C

Source: Result Analysis, 2022.

Based on the results of the study, the highest capacity value is obtained on the Tentara Pelajar road section, where currently the condition of the road section is experiencing rapid improvement in trade and services which makes this road section more congested with various objectives of road users in traffic and various distribution patterns of the number of vehicles from the studied section to the surrounding roads. The capacity value of the Tentara Pelajar road is 5330 pcu / hour and the degree of saturation is 0.56, so the level of service on the Tentara Pelajar road section is included in category C, although there are quite a lot of side friction along the road section such as the number of vehicles stopping and parking due to transactions between sellers and buyers but the flow of traffic are still stable so that the speed can be controlled by traffic.

If viewed from the results of the study, the DS value is used as the main indicator in determining the level of road performance and determining whether the road has a problem with the capacity value or not, the degree of saturation value cannot be more than 1 because if the degree of saturation value is

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more than 1 then the road section has a low level of road performance and indicates that the road section has a problem with capacity that can cause congestion and vice versa if the degree of saturation value is less than 0.75 then the performance of the road section is still in good condition.
Based on the results of the study for the eight roads that have the worst performance occurs on the Tentara Pelajar road even though the level of service is still in the C category. While the best performance occurs on the Slamet Riyadi road section in the East-West direction with the level of service in the B category. If viewed from the traffic performance of the eight roads studied, it can still be said to be in good condition so it can be concluded that congestion or queues that sometimes occur are only caused by trains passing with a fairly high frequency.

Table 2 shows the recapitulation of train frequency and total waiting time for 9 crossing points in Cirebon City.

Tabel 2. Data on Total Train Frequency, Average Queue Length and Total Waiting Time

No.	Crossing Point(Road Section)	Survey Time		Total Train Frequency	Average Queue Length	Total Waiting TIme
		Duration (Time)	Date	(Times/day)	(meters)	(minutes)
1	Kesambi Dalem (Crossing Point 1)	06.00 - 18.00	24 March 2022	28	18,29	51
2	Kesambi Dalem (Crossing Point 2)	06.30 - 18.00	26 March 2022	25	11,32	41
3	Pangeran Drajat – Kutagara	06.30 - 18.00	26 March 2022	25	41,48	41
4	Kesambi – Lawanggada	06.30 - 18.00	28 March 2022	20	154,25	49
5	Lawanggada - Kesambi	06.30 - 18.00	28 March 2022	22	138,95	68
6	Pangeran Drajat	06.30 - 18.00	30 March 2022	22	43,41	42
7	Slamet Riyadi	06.30 - 18.00	30 March 2022	41	134,04	128
8	Tentara Pelajar	06.30 - 18.00	31 March 2022	51	95,47	148
9	Kartini	06.30 - 18.00	31 March 2022	51	119,25	150

Source: Result Analysis, 2022.

Based on the table above, there are 9 level crossing points in Cirebon City, where the survey was conducted from March 24, 2022 - March 31, 2022 with a duration of 06.00 - 18.00 WIB. Of the 9 crossing points, the crossings that have the highest train frequency are on Tentara Pelajar Rd. and Kartini Rd. Then the second highest frequency is found at the level crossing of Slamet Riyadi Rd., while the lowest number of frequencies is at the Kesambi-Lawanggada Rd.

The difference in frequency between the 9 crossing points is due to:
1. The schedules of passenger trains, freight trains, logistic trains, locomotives (puller of a series of railroad cars) etc. are different per day.
2. Between Slamet Riyadi and Kartini level crossings, there is Cirebon Kajaksan Station which is one of the largest stations that has the highest frequency of travel so that trains entering and leaving Cirebon Kejaksan Station pass at low speeds which causes long queues of vehicles and a lot of waiting time.
3. Between Tentara Pelajar and Kesambi-Lawanggada level crossings there is Cirebon Prujakan Station where there are two level crossings, each of which is heading towards Purwokerto and Tegal. Therefore, there is a significant difference in frequency between the crossings before Cirebon Prujakan Station and after Cirebon Prujakan Station.
4. The decrease in train frequency between Kesambi- Lawanggada and Lawanggada-Kesambi crossings is due to the separation of the North and South lines after Cirebon Prujakan Station.

Figure 3 shows the total frequency of trains at 9 crossing points in Cirebon City:

P-ISSN : 2598-1277
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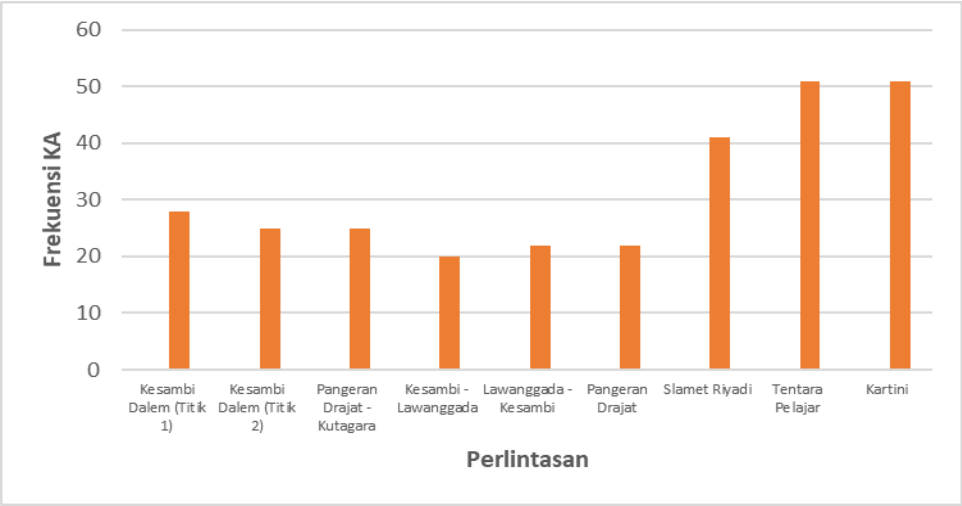

Figure 3. Total Frequency of Trains at 9 Level Crossing in Cirebon City

Figure 4 shows the Total Train Queue Length at 9 Points of Level Crossing in Cirebon City. Based on Figure 4, the highest average queue length is found at Kesambi-Lawanggada and Lawanggada-Kesambi level crossings. This is because the distance between the crossing lines is quite close to one another, triggering the length of the queue of vehicles passing on the road. In addition, the average queue length that is quite high is on the Slamet Riyadi road section. This is caused by:

1. The short distance between the level crossing and the signalized intersection.
2. There are many types of heavy vehicles (HV) that pass through Slamet Riyadi road, triggering a slowdown in vehicle speed and when there are trains passing by, it causes a long queue of vehicles.
3. Slamet Riyadi Road is also one of the access roads from the Bandung-Cirebon route to Indramayu.

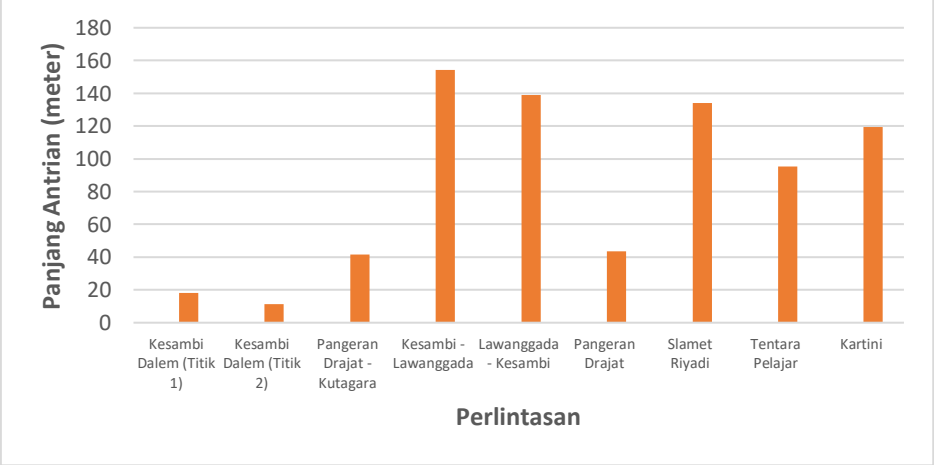

Figure 4. Total Length of Traffic Queues at 9 Level Crossing in Cirebon City

From the results of the total frequency of trains passing and the average length of vehicle queues, the longest total waiting time was obtained at the Kartini level crossing. The reason is that the Kartini level crossing is the entrance and exit of the train to Cirebon Kejaksan Station so that it slows down the speed of the passing train. The same thing also happened at the Tentara Pelajar level crossing, the waiting time for trains was also quite long at 148 minutes because this crossing was an entry and exit access for trains to Cirebon Prujakan Station where the train speed tended to be slow.

The following is a graphical image of the total waiting time at 9 level crossings in Cirebon City:

P-ISSN : 2598-1277
E-ISSN : 2621-3966

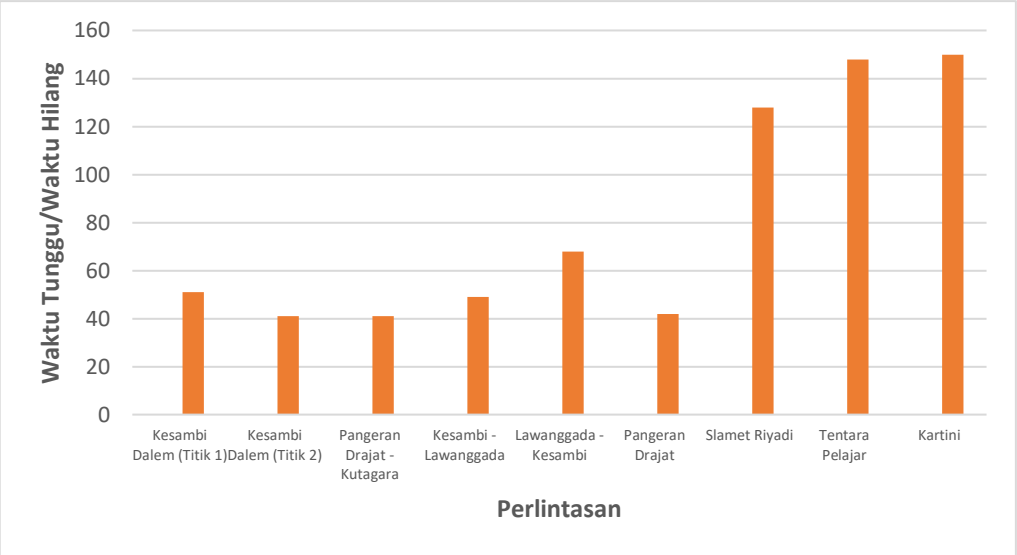

Figure 5. Waiting Times for Trains at 9 Level Crossing Points in Cirebon City

Based on the overall analysis of traffic and train frequency, it can be concluded that:

1. The higher the value of the frequency of passing trains, the greater the waiting time of vehicles caused by closed railroad crossing. On the contrary, the faster the waiting time, the less the frequency of trains passing.
2. The average value of vehicle queue length is influenced by the location where the crossing is located.
3. The type of vehicle passing through the level crossing also affects the total waiting time.
4. The close distance between signalized intersections and level crossings also affects the length of vehicle queues.
5. The crossing waiting time only represents the total waiting time for each crossing in Cirebon City.
6. The existence of level crossings on traffic flow only affects the queue length and waiting time when the train passes.
7. If the level crossing is removed, it will only affect the loss of waiting time and queue length at the crossing.
8. The existence of level crossings has no effect on Level of Service (LOS) because the flow is still stable and the road capacity can still accommodate vehicles.
9. Congestion sometimes occurs only when there is a passing train.

4.2. Analysis of The Effect of Level Crossing on Economic Growth

4.2.1 The effect of Level Crossing on The Income of Cirebon People

Table 3 shows the amount of income lost due to level crossings in Cirebon City which is the result of processing questionnaire survey data on road users and calculating vehicle operating costs.

Table 3. Total Revenue Loss from Railroad Crossings in Cirebon City

Waiting Time /Time lost (minutes/day)	Waiting Time /Time lost (Hour/month)	Income/Month	Lost Income/Month	Lost Income/Month (%)
0 - 5	0 - 2,083	Rp - - Rp 2.000.000,00	Rp - - Rp 20.833,33	0,0% - 1,0%
0 - 5	0 - 2,083	Rp 2.000.000,00 - Rp 5.000.000,00	Rp - - Rp 52.083,33	0,0% - 1,0%
0 - 5	0 - 2,083	Rp 5.000.000,00 - Rp 7.000.000,00	Rp - - Rp 72.916,67	0,0% - 1,0%
0 - 5	0 - 2,083	Rp 7.000.000,00 - Rp 10.000.000,00	Rp - - Rp 104.166,67	0,0% - 1,0%
0 - 5	0 - 2,083	Rp 10.000.000,00 - Rp 15.000.000,00	Rp - - Rp 156.250,00	0,0% - 1,0%
5 - 10	2,083 - 4,167	Rp - - Rp 2.000.000,00	Rp - - Rp 333.333,33	0,0% - 16,7%
5 - 10	2,083 - 4,167	Rp 2.000.000,00 - Rp 5.000.000,00	Rp 166.666,67 - Rp 833.333,33	8,3% - 16,7%
5 - 10	2,083 - 4,167	Rp 5.000.000,00 - Rp 7.000.000,00	Rp 416.666,67 - Rp 1.166.666,67	8,3% - 16,7%
5 - 10	2,083 - 4,167	Rp 7.000.000,00 - Rp 10.000.000,00	Rp 583.333,33 - Rp 1.666.666,67	8,3% - 16,7%
5 - 10	2,083 - 4,167	Rp 10.000.000,00 - Rp 15.000.000,00	Rp 833.333,33 - Rp 2.500.000,00	8,3% - 16,7%
10 - 15	4,167 - 6,25	Rp - - Rp 2.000.000,00	Rp - - Rp 500.000,00	0,0% - 25,0%
10 - 15	4,167 - 6,25	Rp 2.000.000,00 - Rp 5.000.000,00	Rp 333.333,33 - Rp 1.250.000,00	16,7% - 25,0%
10 - 15	4,167 - 6,25	Rp 5.000.000,00 - Rp 7.000.000,00	Rp 833.333,33 - Rp 1.750.000,00	16,7% - 25,0%
10 - 15	4,167 - 6,25	Rp 7.000.000,00 - Rp 10.000.000,00	Rp 1.166.666,67 - Rp 2.500.000,00	16,7% - 25,0%
10 - 15	4,167 - 6,25	Rp 10.000.000,00 - Rp 15.000.000,00	Rp 1.666.666,67 - Rp 3.750.000,00	16,7% - 25,0%

P-ISSN : 2598-1277
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Waiting Time /Time lost (minutes/day)			Waiting Time /Time lost (Hour/month)			Income/Month				Lost Income/Month				Lost Income/Month (%)		
15	-	20	6,25	-	8,333	Rp	-	-	Rp 2.000.000,00	Rp	-	-	Rp 666.666,67	0,0%	-	33,3%
15	-	20	6,25	-	8,333	Rp	2.000.000,00	-	Rp 5.000.000,00	Rp	500.000,00	-	Rp 1.666.666,67	25,0%	-	33,3%
15	-	20	6,25	-	8,333	Rp	5.000.000,00	-	Rp 7.000.000,00	Rp	1.250.000,00	-	Rp 2.333.333,33	25,0%	-	33,3%
15	-	20	6,25	-	8,333	Rp	7.000.000,00	-	Rp 10.000.000,00	Rp	1.750.000,00	-	Rp 3.333.333,33	25,0%	-	33,3%
15	-	20	6,25	-	8,333	Rp	10.000.000,00	-	Rp 15.000.000,00	Rp	2.500.000,00	-	Rp 5.000.000,00	25,0%	-	33,3%
						Rata - Rata Kerugian Per apatan per Bulan d								**10,0%**	-	**19,0%**

Source: Result Analysis, 2022.

Based on table 3 above, the amount of waiting time / time lost is divided according to how many times the respondent passes through the level crossing in 1 day, if 1x passing through the level crossing, which means that the waiting time / time lost is between 0 - 5 minutes / day. If 2x pass through a level crossing, the waiting time / time lost is between 5 - 10 minutes / day, if 3x pass through a level crossing, the waiting time / time lost is between 10 - 15 minutes / day and if the respondent passes through 4x a level crossings, the waiting time / time lost is between 15 - 20 minutes / day. Based on the questionnaires that have been distributed, each income per month is divided into first IDR 0 - IDR 2,000,000, second IDR 2,000,000 - IDR 5,000,000, third IDR 5,000,000 - IDR 7,000,000, fourth IDR 7,000,000 - IDR 10,000,000 and fifth IDR 10,000,000 - IDR 15,000,000. Thus, the value of lost income per month is obtained from the waiting time/lost time in hours per month multiplied by the income per month divided by the number of effective working days so as to obtain the value of lost income per month (waiting time 0 - 5 minutes and 1x crossing a level crossing) for an income of Rp 0 - Rp 2,000,000 amounting to Rp 0 - Rp 20,833.33 or around 0% - 1%, if the income is Rp 2,000,000 - Rp 5,000,000 lost income per month of Rp 0 - Rp 52,083.33 or around 0% - 1%. If the income is Rp 5,000,000 - Rp 7,000,000 then the lost income per month is Rp 0 - Rp 72,916.67, then if the income is Rp 7,000,000 - Rp 10,000,000 then the lost income per month is Rp 0 - Rp 104,166.67 and if the income is Rp 10,000,000 - Rp 15,000,000 then the income lost per month is Rp 0 - Rp 156,250.00 or around 0% - 1%. The same calculation also applies to finding lost income per month for waiting time / lost time between 5 - 10 minutes (2x crossing a level crossings in 1 day), 10 - 15 minutes (3x crossing a level crossings in 1 day) and 15 - 20 minutes (4x crossing a level crossings in 1 day).

Thus it can be concluded that:

1. The respondents' waiting time/lost time in hours/month is obtained from the amount of waiting time/lost time divided by the number of minutes per hour multiplied by the number of effective working days in one day.
2. Meanwhile, the amount of respondents' lost income per month is obtained from the waiting time/lost time in hours per month multiplied by the income per month divided by the number of effective working days divided by the number of effective working hours in 1 day.
3. The greater the respondent's income per month, the greater the value of the respondent's lost income per month.
4. The greater the waiting time/lost time in hours per month or the more crossings a level crossing in 1 day accumulated, the greater the percentage value of lost income per month.
5. The percentage of lost income/month due to level crossings in Cirebon City is influenced by the times of crossing a level crossings and income per month.
6. The average percentage of income lost due to railroad crossings if respondents 4x pass through level crossings in Cirebon City, the percentage is 33.3% of lost income per month.

4.2.2 The Effect of Level Crossing on Vehicle Fuel Consumption

This fuel consumption analysis is based on the length of time the vehicle experiences a stopped delay. Later the data is calculated using the constant fuel consumption of vehicles sourced from AUTO 2000 in Mohamad Nur Socheh (2002) so that the amount of wasted fuel consumption will be obtained while the vehicle is experiencing delays due to the closing of the railroad crossings.

P-ISSN : 2598-1277
E-ISSN : 2621-3966

Table 4. Total Fuel Consumption Due to Railroad Crossings in Cirebon City

Waiting Time/Time Lost (minutes/day)			Vehicle Type	Type of Fuel Used	Fuel Price/Liter	Fuel Consumption			Fuel Consumption During Waiting Time/Day		Fuel Consumption During Waiting Time/Month		Fuel Consumption During Waiting Time/Month Against UMR(%)	
						Liter/Hour	Rupiah/Hour	Rupiah/Second						
0	-	5	Sepeda Motor	Pertalite	Rp 7.650,00	Rp 0,144	Rp 1.101,60	Rp 0,306	Rp -	- Rp 91,800	Rp -	- Rp 2.754,000	0,00%	- 0,12%
0	-	5	Kendaraan Ringan	Pertalite	Rp 7.650,00	Rp 0,396	Rp 3.029,40	Rp 0,842	Rp -	- Rp 252,450	Rp -	- Rp 7.573,500	0,00%	- 0,33%
0	-	5	Angkutan Umum	Solar	Rp 5.150,00	Rp 0,396	Rp 2.039,40	Rp 0,567	Rp -	- Rp 169,950	Rp -	- Rp 5.098,500	0,00%	- 0,22%
5	-	10	Sepeda Motor	Pertalite	Rp 7.650,00	Rp 0,144	Rp 1.101,60	Rp 0,306	Rp 91,800	- Rp 183,600	Rp 2.754,000	- Rp 5.508,000	0,12%	- 0,24%
5	-	10	Kendaraan Ringan	Pertalite	Rp 7.650,00	Rp 0,396	Rp 3.029,40	Rp 0,842	Rp 252,450	- Rp 504,900	Rp 7.573,500	- Rp 15.147,000	0,33%	- 0,66%
5	-	10	Angkutan Umum	Solar	Rp 5.150,00	Rp 0,396	Rp 2.039,40	Rp 0,567	Rp 169,950	- Rp 339,900	Rp 5.098,500	- Rp 10.197,000	0,22%	- 0,44%
10	-	15	Sepeda Motor	Pertalite	Rp 7.650,00	Rp 0,144	Rp 1.101,60	Rp 0,306	Rp 183,600	- Rp 275,400	Rp 5.508,000	- Rp 8.262,000	0,24%	- 0,36%
10	-	15	Kendaraan Ringan	Pertalite	Rp 7.650,00	Rp 0,396	Rp 3.029,40	Rp 0,842	Rp 504,900	- Rp 757,350	Rp 15.147,000	- Rp 22.720,500	0,66%	- 0,99%
10	-	15	Angkutan Umum	Solar	Rp 5.150,00	Rp 0,396	Rp 2.039,40	Rp 0,567	Rp 339,900	- Rp 509,850	Rp 10.197,000	- Rp 15.295,500	0,44%	- 0,66%
15	-	20	Sepeda Motor	Pertalite	Rp 7.650,00	Rp 0,144	Rp 1.101,60	Rp 0,306	Rp 275,400	- Rp 367,200	Rp 8.262,000	- Rp 11.016,000	0,36%	- 0,48%
15	-	20	Kendaraan Ringan	Pertalite	Rp 7.650,00	Rp 0,396	Rp 3.029,40	Rp 0,842	Rp 757,350	- Rp 1.009,800	Rp 22.720,500	- Rp 30.294,000	0,99%	- 1,31%
15	-	20	Angkutan Umum	Solar	Rp 5.150,00	Rp 0,396	Rp 2.039,40	Rp 0,567	Rp 509,850	- 679,800	Rp 15.295,500	- Rp 20.394,000	0,66%	- 0,88%
Average Percentage of Fuel Consumption during waiting time due to railway crossing													0,33%	0,56%

Source: Result Analysis, 2022

Based on the results of questionnaires that have been filled out by 182 respondents, the waiting time / lost time when respondents pass through 1x crossing is 0-5 minutes / day or 0-300 seconds / day, each of which is divided into 3 types of vehicles, namely motorbikes, light vehicles and public transportation. Especially for motorcycles and light vehicles, the fuel used is pertalite at Rp 7,650 /liter while for public transportation using diesel fuel at Rp 5.150 /liter and the multiplier factor to get the value of fuel consumption rupiah per second is to use a constant sourced from AUTO 2000 in Mohamad Nur Socheh (2002) so that the amount of fuel oil consumption wasted during the vehicle is experiencing delays due to the closure of the railway crossing is Rp 0.306 rupiah per second (motorcycles), Rp 0.842 per second (light vehicles) and Rp 0.567 per second (public transport). If converted into rupiah per month, the amount of fuel consumption during the waiting time/month for motorcycles is between Rp 0 - Rp 2,754,000, light vehicles between Rp 0 - Rp 7,573,500 and public transportation between Rp 0 - Rp 5,098,500 or if the percentage of highest fuel consumption during the waiting time per month that passes 1x crossing with a waiting time of 0-5 minutes is a type of light vehicle of 0-0.33%.

Based on the analysis, overall it can be concluded that:

1. The more the number of level crossings traveled by road users, the more waiting time / time lost experienced by road users.
2. The longer the vehicle experiences delays (waiting time/loss time), the more fuel that not optimally consumed or wasted.
3. Fuel consumption during the waiting time per day and per month is the maximum value if the respondent or the road user passes the number of each level crossing according to the waiting time / time lost based on how many times the road user passes the level crossing in Cirebon City.
4. The type of light vehicle is a vehicle that has the highest value of fuel consumption during waiting time per month compared to motorcycle and public transportation vehicle types. This is because light vehicles have the same constant value as public transportation but the difference is the type of fuel used, namely Pertalite.
5. From the results of the calculation of the analysis as in table 5.4 for motorcycle vehicle types, simplification needs to be done due to several factors, one of which is the development of a vehicle technology system that is efficient in fuel consumption. The calculation also needs to consider the development of current motorized vehicle technology such as injection-based motorized vehicles and *iding stop system* (ISS) technology

4.2. The Effect of Level Crossing on Economic Growth in Cirebon City

Based on the explanation in the previous sub-chapter, it can be seen that the existence of level crossings in Cirebon City is indirectly detrimental to the community when viewed from the economic side. The figure below shows the survey results to 184 respondents related to the estimated waiting time at the

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crossing on average when going to and from work/school/other routine activities which are then used as the basis for the city's economic analysis.

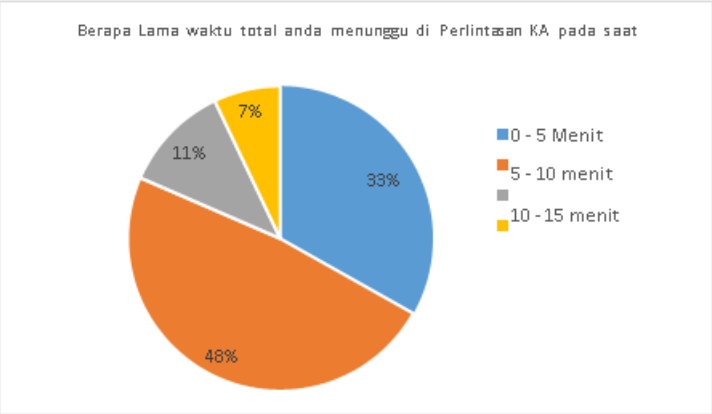

Figure 6. Survey Results Related to Waiting Time at Level Crossings

Based on economic analysis related to fuel consumption, it can be concluded that each individual can experience a minimum loss in fuel consumption of 0% (if on the way to work/school/other routine activities have a waiting time of 0 minutes or do not experience stops at the crossing) and a maximum loss of 1.31% (if on the way to work/school/other routine activities have a waiting time of 20 minutes or experience stops at the crossing 3 - 4 times in 1 day). If it is associated with the minimum wage (UMK) of Cirebon City, it can be concluded that each individual citizen of Cirebon City who has an income of UMK per month will experience a loss of Rp. 0 to Rp. 30,294 per month depending on how long the waiting time at the crossing and the type of vehicle and fuel used. Seeing the number of losses, especially losses in fuel consumption, which are relatively very small, causes people not to realize the losses experienced due to the existence of level crossings. However, if the losses experienced continue for a long period of time, the losses incurred will have a considerable amount.

4.3. Analysis of the Effect of Level Crossings on Social Dynamics

Respondents felt that the presence of level crossings greatly affected their travel interests, is considered time consuming due to the congestion caused and disturbed by vehicle fumes while waiting for trains to pass at the crossings. While some parameters that are less realized by respondents are related to reduced income and fuel use when waiting at the crossing. In fact, based on the economic analysis that has been conducted, it is evident that there are losses in income and fuel consumption due to level crossings in Cirebon City.

Table 5. Public Perception of the Existence of Level Crossings in Cirebon City

No	Parameter	Yes	No
1	Influencing Travel Interest	59,80%	40,20%
2	Considered "Time Wasting"	67,40%	32,60%
3	Considered "Reducing Work/Study hours"	49,50%	50,50%
4	Considered "Reducing Income"	13,60%	86,40%
5	Considered "Emotionally distressing"	44,00%	56,00%
6	Considered "Increasing Fuel Consumption"	42,90%	57,10%
7	Disturbed by vehicle fumes	81,50%	18,50%
8	Disturbed by the Sound of Train Crossing	47,30%	52,70%

Source: Result Analysis, 2022

Every infrastructure development will have an impact on social society, both negative and positive impacts. The existence of level crossings in an area raises several social issues, one of which is the emergence of social fragmentation in communities around level crossings. By definition, fragmentation

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is a division of habitat that results in organisms in it having difficulty making movements from one fragment to another. Social fragmentation means that there is a division in the social life of the community so that people in a fragment or area find it difficult to make movements to other areas due to a barrier that separates them. In the case of a level crossing, the community in the western area with the eastern area is separated by the railroad area so that the community group separated by the level crossing indirectly has low accessibility to go to a location separated by a level crossing. In conclusion, the existence of a level crossing causes social fragmentation and reduces the level of accessibility of the community around the crossing. Based on this, changing the level crossing into a non-level crossing is expected to reduce social fragmentation and increase the accessibility of the community around the crossing.

5. CONCLUSION

Based on the results of the analysis that has been carried out, the following conclusions can be drawn:

1. Based on the survey results on 8 road sections in Cirebon City, each section performance on:
   a. Slamet Riyadi Rd. obtained its Level of Service value is B
   b. Kartini Rd. obtained a Level of Service value of C
   c. Tentara Pelajar Rd. obtained a Level of Service value of C
   d. Kesambi Rd. obtained a Level of Service value of B
   e. Kesambi Dalam 1 Rd. obtained a Level of Service value of C
   f. Kesambi Dalam 2 Rd. obtained a Level of Service value of C
   g. Pangeran Drajat Rd. obtained a Level of Service value of C
   h. Kutagara Drajat Rd. obtained a Level of Service value of C

2. The overview of level crossings on road sections in Cirebon City in relation to economic growth is as follows:
   a. Based on the results of economic analysis related to the loss of community income due to the crossing obtained a minimum loss value of 0% (if on the way to work / school / other routine activities have a waiting time of 0 minutes or do not experience a stop at the crossing) and a maximum loss of 33.3% (if on the way to work / school / other routine activities have a waiting time of 20 minutes or experience a stop at the crossing as much as 3 - 4 times in 1 day). If it is assumed that the average income of the people of Cirebon City is equal to the UMK,which is equal to Rp. 2,304,943.51, it can be concluded that each individual citizen of Cirebon City who has an income of UMK will experience losses ranging from Rp. 0 to Rp. 768,314.5 for one month depending on how long the individual experiences waiting time at a level crossing.
   b. Based on economic analysis related to fuel consumption, it can be concluded that each individual can experience a minimum loss in fuel consumption of 0% (if on the way to work/school/other routine activities have a waiting time of 0 minutes or do not experience stops at the crossing) and a maximum loss of 1.31% (if on the way to work/school/other routine activities have a waiting time of 20 minutes or experience stops at the crossing 3 - 4 times in 1 day). If it is associated with the UMK of Cirebon City, it can be concluded that each individual citizen of Cirebon City who has an income of MSE per month will experience a loss of Rp. 0 to Rp. 30,294 per month depending on how long the waiting time at the crossing and the type of vehicle and fuel used. If the losses experienced continue for a long period of time, the losses incurred will have a large enough amount so that if the level crossing in Cirebon City is made into a non-level crossing, the community losses can be diverted to improve their standard of living.
   c. If it is related to PDRB data and PDRB growth rate in the last 5 years, it can be concluded that if the current condition of the traffic system in the Cirebon City the amount of PDRB and PDRB growth rate in the last 5 years is quite stable both then if the level crossing in the Cirebon City is made into a level crossing, it is expected that it will be able to increase the contribution to GRDP for each sector and indirectly improve the economic conditions of the Cirebon City.
   d. The existence of level crossings in Cirebon City has resulted in several social problems, including social fragmentation and reduced community accessibility. Based on the survey results to 184 respondents, respondents felt that the existence of level crossings greatly affected

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their travel interests, is considered time-consuming due to the congestion caused and disturbed by vehicle fumes while waiting for the train to pass at the crossing.

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