Prediction of Air Quality: Carbon monoksida (CO), Nitrogen dioksida (NO2) and Total Suspended Particulate in Mobilization Stage of Railroad Construction Plan Kedundang Station and Yogyakarta New Airpo

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International Journal of Applied Science; Vol. 2, No. 1; 2019
ISSN 2576-7240 E-ISSN 2576-7259
https://doi.org/10.30560/ijas.v2n1p7

The Prediction of Air Quality Status: Carbon Monoksida (CO), Nitrogen Dioxide (NO_2) and Total Suspended Particulate in Mobilization Stage of Railroad Construction Plan Kedundang Station and Yogyakarta New Airport Station

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Received: December 21, 2018; Accepted: January 18, 2019; Published: January 29, 2019

This research was funded by the Class I Railway Engineering Center, Central Java Region.

Abstract

Construction of the National Railway Station Cross Station Kedundang - New Yogyakarta Airport Station is an accelerated development program in supporting the economy of the special region of Yogyakarta. Construction of the railroad as a consequence of infrastructure development that enables potential impacts on the surrounding environment. This study is a predictive study of air quality that might occur after operational construction of a fire pathway with Nitrogen Dioxide (NO2) with the Gas Sampler-Spectrophotometer-Saltzman Method, Carbon Monoxide (CO) with the gas sampler-NDIR analyzer method and dust particles with the dust sample, Hi-Vol gravimetric method. The data obtained is then converted into modeling using Caline 4 software, so that air quality prediction is obtained at the time of operation. Air quality category predictions use the standard air pollution index standard. The results of the analysis of the air quality parameters show a good category, only on the CO2 parameters that address high concentrations. however, based on CO2 conversion using the value of the Air Pollution Standard Index is predicted to remain in the "Good" category at the time of project operation. Therefore an air quality study is needed in the railroad development plan through an analysis study of environmental impacts, so that the management and monitoring of air quality can be carried out properly so as to cause disruption to the environment.

Keywords: Carbon monoxide (CO), Nitrogen dioxide (NO_2), Total suspended particulate (TSP), Environmental impact assessment, Dust pollution, Air Pollution Standard Index

1. Introduction

The city of Yogyakarta is the second largest tourist destination in Indonesia after Bali because it requires good infrastructure to achieve this goal. The Special Region of Yogyakarta is currently building a new Yogyakarta airport in Kulonprogo Regency. This airport will replace Yogyakarta's Adi Sucipto Airport, which is already overcapacity so it cannot be developed due to limited land and various natural obstacles (Syakdiah, 2017). The construction of supporting infrastructure is a considerable obstacle, namely access to the Yogyakarta New Airport to the city center of Yogyakarta which is quite far, namely ± 44 km with a distance of ± 1 hour 30 minutes by car. So we need fast and mass transportation. One of the mass transportation with high capacity and good access speed is the train. Railroad lines to and from Yogyakarta's New Airport in Kulon Progo have not yet been implemented, therefore planning railroad lines to support infrastructure to the new airport in Yogyakarta needs to be implemented immediately (Fauzi and Putriani, 2017)

The Central Java Railway Engineering Office plans to build a railway line from Kedundang Station to Yogyakarta's New Airport Station. The project plan is included in the National Strategic Project listed in Presidential Regulation No. 58 of 2017 and Presidential Regulation No. 3 of 2016 concerning the Acceleration of the Implementation of national strategic projects, and has obtained approval based on Minister of Transportation Decree Number KP.

1502 2017 concerning the Establishment of the National Public Railroad Crossing Kedundang Baru Station - New Airport Station in Kulonprogo Regency. (Directorate General of Railways, Ministry of Transportation, 2017).

Refer to the regulation of the State Minister of Environment Number 05 of 2012 concerning the Study of Environmental Impacts in the Transportation Sector that the construction of railway lines with or without elevated stations with a length of ≥ 5 km must have an impact analysis study on the environment. For scientific reasons specifically for potential activities that have an impact on this in the form of predictions of possible impacts on air quality due to the construction of the General National Railway Development Plan Crossing Kedundang Baru Station - Yogyakarta New Airport Station (Minister of Environment Regulation, 2012 and Department of Land and Spatial Special Region of Yogyakarta. 2017). In the mobilization construction process in this case the transportation of materials and equipment using trucks and dump trucks will have an impact on the form of exhaust gas, namely NO2, SO2 and CO in the study area through mobilization channels are also expected. the higher it is. Therefore a study of the impact of dust on the environment is needed. According to the Environmental Protection Agency (2011) in the National Ambient Air Quality Standard documenting some significant air pollutants, among others, carbon monoxide (CO), lead (Pb), nitrogen oxide (NOx), particulates PM10, particulates PM 2,5, and sulfur dioxide (SO2). (Esworthy, 2013).

The airport element has an important role in the aviation industry with the hope that airports can play a role in terms of economic and social growth, drivers and drivers and even distribution of national development. The airport is the link between regions. Based on the results of flight passenger forecasting in 2016 - 2020, the number of passengers landing at Adi Sucipto Airport reaches 2,733,276 passengers per year. Distribution of passenger origin is 50.7% originating from the city of Yogyakarta, 13.4% originating from Sleman and coming from the area around Yogyakarta. While there were 49.3% towards the city of Yogyakarta, 17.1% went to Sleman and the rest went to around Yogyakarta. With this background, the Central Java Region I Railway Engineering Office plans to build a railway station crossing the Kedundang Station - ± 6 km in length for the Yogyakarta Baru Airport for passenger needs with the existing Yogyakarta crossroad - Kutoarjo. (Purnama and Yuliawati, 2017).

The plan for this railroad has also received a tract determination based on the Decree of the Minister of Transportation Number KP. 1502 2017 concerning Determination of National Public Railroad Trase Crossing Kedundang Baru Station - New Airport Station in Kulonprogo Regency. The plan for this railway has a trajectory of ± 6 km, with ± 500 m of railroad at ground level (at grade) and ± 5.5 km of railroad above ground level (East Java Railway Development Work Unit. 2014). Referring to the regulation of the State Minister of Environment Number 05 of 2012 concerning types of business plans and / or activities that must have an environmental impact analysis in this study mainly regarding air conditioning due to the railway construction project (Director General of Civil Aviation Regulation, 2017)

2. Methods

The research method was adapted in an environmental impact analysis study related to the initial environmental explanation, estimated impact, along with management and monitoring procedures. In general, the location of data collection is determined based on the study area, namely at the project location, mobilization of planned railroad construction work and several locations around the project site which are predicted to be affected by the distribution of impacts. In this way the initial environmental conditions at the potential recipient location can be observed, so that the magnitude of the impact in the study area can be predicted at the stage of job mobilization. In this study the environmental components studied were air quality was Nitrogen dioxida (NO_2), Total Suspended Particulate and Carbon monoxide (CO). Data collected air quality components were then analyzed by comparing environmental quality standards and technical criteria of each environmental component predicted through Prediction Modeling during the project mobilization stage.

1) **Data Collection Method**

The air quality parameters measured are Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), and dust particles that are present in the air. Primary data on ambient air quality was collected by means of air sampling, laboratory measurements and analysis. Air samples are taken with a tool according to the Indonesian National Standard (SNI) that is valid and subsequently analyzed in the laboratory as well as in accordance with the applicable Indonesian National Standard (SNI). Air quality sampling is carried out for 24 hours. The method of collecting samples and analyzing samples for air quality parameters are presented in the following table:

Table 1. Methods of Collecting and Analyzing Air Samples

No	Parameters	Tools used	Analysis Method	Specifications of the test method
1	Total Suspended Particulate	Dust Sample, Hi-Vol	Gravimetri	SNI 19-79119.3:2005
2	CO	Gas Sampler, NDIR Analyzer	NDIR	SNI 19-7119.10-2011
3	NO_2	Gas Sampler, Spektrofotometer	Saltzman	SNI 19-7119.10-2011

Information : Source: Government of the Republic of Indonesia (1999) and Aashto. (1993).

NDIR = Non-Dispersive Infra-Red

SNI = Standar Nasional Indonesia (Indonesian National Standard)

The location for air quality sampling is determined to include areas that represent the designation of settlements, places of worship and educational facilities near the project plan, as shown in the following table below.

Table 2. Location of planned air quality sampling

No.	Allotment	District	Latitude	Longitude
UA01	Traditional market	Kulur village	7°52'45,82" LS	110° 5'44,64" BT
UA02	Worship place	Kaligintung village	7°52'50,35" LS	110° 5'40,54" BT
UA03	Public school	KaliDengen vilage	7°53'40,33" LS	110° 5'20,86" BT
UA04	Community settlement	Glagah village	7°53'58,80" LS	110° 4'02,20" BT
UA05	Community settlement	Glagah village	7°53'53,21" LS	110° 4'30,85" BT

Source: Team of environmental impact analysis consultants, 2018

2) Data Analysis Method

Analysis of air quality parameter data is done by comparing the data from sample analysis with ambient air quality standards according to the Decree of the Governor of Yogyakarta Special Region Number 153 of 2002 as follows:

Table 3. Ambient air quality standards

No.	Parameters	Unit	Quality standards	Time
1	Nitrogen Dioksida (NO_2)	$\mu\gamma/N\mu^3$	150	24 hours
2	Carbon Monoksida (CO)	$\mu\gamma/N\mu^3$	10	8 hours
3	Total Suspended Particulate	$\mu\gamma/N\mu^3$	230	24 hours

Source: Governor of the Special Region of Yogyakarta (2002)

Primary data is the main data which includes taking Air quality sample points in the Project location plan with a sampling point of 5 (five) sample points. The image below shows the location of the sample point:

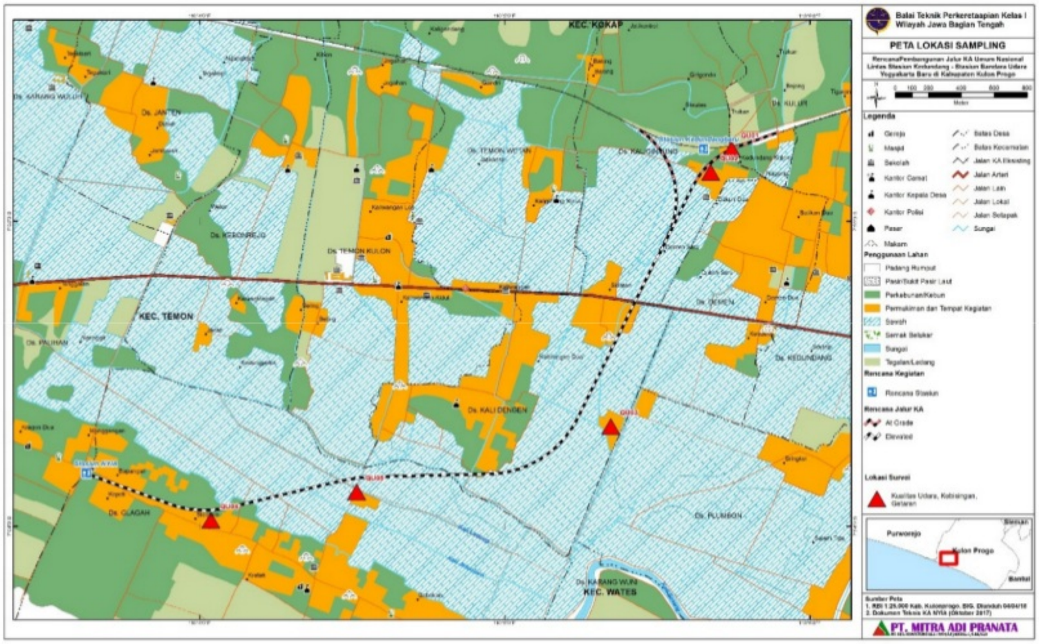

Figure 1. Sampling Location Map

The figure below shows the sampling activity, as follows:

Figure 2. Air quality measurements at the UA-1, UA-2, UA-4 and UA-5 sampling points (left - right)

The air quality data from the measurement results that were converted into the Air Pollution Standard Index refers to the decree of the Head of the Environmental Impact Management Agency Number Kep-107 / Kabapedal / II / 1997. So that the environmental conditions are categorized in the Air Pollution Standard Index as follows (Head of the Environmental Impact Management Agency. 1997).

Table 4. Air Pollution Standard Index category

Indeks	Category	Particulate (PM_{10})
1 – 50	Good condition	There is no effect
51 – 100	Moderate conditions	A decrease in visibility occurs
101 – 199	Unhealthy conditions	Visibility drops and dust contamination occurs everywhere
200 – 299	Very Unhealthy condition	Increased sensitivity in patients with asthma and bronchitis
300 - lebih	Dangerous conditions	A level that is dangerous for all exposed populations

Head of the Environmental Impact Management Agency (1997).

The conversion of air quality parameter values into the ISPU category follows the values in the table as follows:

Table 5. Air Pollution Standard Index Limits in International Units

Standard Air Pollution Index	24 hour PM_{10} μg/m³	8 hour CO μg/m³	1 hour O_3 μg/m³	1 hour NO_2 μg/m³
10	50	5	120	-2
100	150	10	235	-2
200	350	17	400	1130
300	420	34	800	2260
400	500	46	1000	3000
500	600	57.5	1200	3750

While the conversion calculation formula can be done using the following formula:

$$I = \frac{I_a - I_b}{X_a - X_b}(X_x - X_b) + I_b$$

Information :

I : The Air Pollution Standard Index is calculated

Ia : Standard Air Pollution Standard Limit

Ib : Standard Lower Air Pollution Index

Xa : Upper limit Ambient Air Pollution Standard Index

Xb : Lower limit Ambient Air Pollution Standard Index

Xx : Air Pollution Standard Index Ambient level of measurement results

The estimated magnitude of the impact is carried out by analyzing the difference between the conditions of environmental quality predicted by the existence of businesses and / or activities with conditions of environmental quality predicted without the existence of a business and / or activity within a specified time limit. The magnitude of the impact is calculated by the equation as follows

$$\Delta K = KL_{dp} - KL_{tp}$$

Information :

ΔK : Changes in the condition of environmental quality

KLdp : Conditions of environmental quality predicted by the existence of businesses and / or activities

KLtp : The condition of environmental quality predicted without the existence of businesses and /or activities

Air quality prediction: Total Suspended Particulate at the stage of land maturation and mobilization of the construction of the operational railroad project using the modeling formula as follows:

a) Total Suspended Particulate Parameters

To calculate the addition of Total Suspended Particulate parameters then use the formula :

$$C = 20{,}77 \cdot \left(\frac{S}{12}\right) \cdot \left(\frac{V}{48}\right) \cdot \left(\frac{M}{3}\right)^{0{,}7} \cdot \left(\frac{N}{4}\right)^{0{,}5} \cdot \left(\frac{D \cdot T \cdot 10^6}{365 \cdot L \cdot H \cdot 2d}\right)$$

With the count variable as follows:

a) Level of silt = 10%
b) Vehicle speed = max 30 km / hour
c) Vehicle mass = max 20 tons
d) Number of vehicle wheels = 6 wheels
e) Number of days does not rain = an average of 250 days
f) Segment length = 5.5 km
g) Amount of recitation = 12 trips / day
h) Air column height = 5 m

b) SO_2, Carbon Monoxida, (CO) and Nitrogen dioxide(NO_2) Parameters

The prediction of increasing the concentration of each parameter is calculated using the following equation

$$C(x,z) = \frac{2Q_L}{(2\pi)^{0{,}5}\sigma zu} \exp\left[0{,}5\left(\frac{H}{\sigma z}\right)^2\right]$$

Information:

C (x, z) = pollution concentration in ambient air

X = distance between the location of land maturation and the recipient

H = recipient height above ground level

Ql = emission rate

U = average wind speed

σz = Gaussian vertical dispersion coefficient

With the value of the variables entered are as follows

Table 6. The type and value of the variable on which the calculation is based

Variable	Jumlah	Satuan
Number of vehicles	100	Truck
Length of work	8	Hours/day
Track Distance	5.5	km
Height of receiver	1.5	m
Average wind speed	1.38	m/dt
Class atmosphere stability	A	

3. Results

Based on the results of measurements of air quality at the initial environmental baseline before the construction of the railway line at the specified location points, are as follows (table 6) :

Primary Data Air Quality Measurement Results

Table 6. Results of ambient air quality laboratories

Parameter	Sat	UA-1	UA-2	UA-3	UA-4	UA-5	BMUA I	BMUA II	LD
Carbon Monoksida (CO)	μg/m³	< 1.145	< 1.145	< 1.145	1.266	1.205	-	-	1.145
Nitrogen Dioksida (NO_2)	μg/m³	64	65	63	67	66	150		5
Total Suspended Particles	μg/m³	32	37	22	43	52	230	230	0,06

Information

BML: Air quality quality standard DIY Kepgub 153/2002I:

I BMUA Primer that is intended to protect humans,

II: BMUA Secondary intended to protect animals, plants, visibility and comfort as well as cultural heritage objects

BMUA = Ambien Air Quality Standard

BML = Environmental Quality standards

From the results of the laboratory shows that all parameters of ambient air quality sampling location are still below the ambient air quality quality standards. 153/2002 in the category of good air quality. All ambient air quality parameters, namely (SO_2, CO, NO_2 and Total Suspended Particles) do not exceed the specified ambient air quality standard limits.

Secondary Data

This study also compares with secondary data from the results of air quality analysis from PT. Angkasa Pura. Ambient air quality conditions around the study area are based on secondary data as shown in the following table:

Table 7. Ambient air quality in Kulon Progo Regency in 2017

Parameters	Unit	Quality standards*	Analysis results					
			A	B	C	D	E	F
Total Suspended Particles	µg/ml m³	230	70,2	62,88	58,21	57,19	54,11	51,67
Carbon Monoksida (CO)	µg/ml m³	10	< 1.145	< 1.145	< 1.145	< 1.145	< 1.145	226,78
Nitrogen Dioksida (NO_2)	µg/ml m³	150	17,12	14,52	< 10	13,55	23,84	6,16

Information: Source : (PT. Angkasa Pura I (Persero), 2017)

* Governor regulation Special Region of Yogyakarta (2002)

A. Sindutan village (7° 53’ 06,85” LS 110° 02’ 34,37” BT)

B. Kebonrejo village (7° 53’ 10,39” LS 110° 03’ 50,77” BT)

C. Palihan village (7° 53’ 48,56” LS 110° 03’ 35,65” BT)

D. Glagah village (7° 54’ 10,77” LS 110° 04’ 22,24” BT)

E Karangwuni village (7° 54’ 42,27” LS 110° 05’ 26,81” BT)

F. Jangkaran village (7° 53’ 45,80” LS 110° 02’ 07,73” BT)*LS = South Latitude *BT = East longitude

Based on the table above, it shows that all parameters of secondary data tested are still below the ambient air quality quality standards in the Yogyakarta special province referring to the DIY Governor Regulation No. 153 of 2002.

4. Discussion

Air Quality at the stage of project mobilization is influenced by the climate in the area. Climate determines weather conditions in a location / area. The main component of climate that is very important is rainfall and wind. Climate data obtained from secondary data, Meteorology, Climatology and Geophysics Agency (BMKG) Mlati Class IV Station

a) Rainfall

Rainfall will affect the presence and concentration of pollutants in the air. Rainwater will react with pollutants or will dissolve and bring the pollutant to the mainland. Similarly, the direction and speed of the wind will determine the direction of the spread of pollutants in the air. Secondary data on rainfall in 2008 - 2017 are presented in the following table:

Table 8. Monthly Rainfall Data (millimeters)

Years	Jan	Feb	March	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	422	251	340	87	26	-	-	-	-	196	678	339
2009	215	253	187	311	80	112	45	-	17	130	223	61
2010	262	93	226	153	315	90	12	11	282	372	150	414
2011	308	303	267	286	156	-	-	-	-	0	371	436
2012	303	108	285	103	-	0	-	-	-	-	87	314
2013	486	281	154	30	36	135	126	3	-	1	98	X
2014	X	237	195	194	X	82	X	X	-	X	406	544
2015	417	214	457	528	88	0	0	1	-	-	121	550
2016	157	419	190	160	50	345	54	66	416	452	639	583
2017	323	304	276	404	19	36	11	1	89	393	813	441

Description: - = no rain; X = no data

BMKG source

Based on these data it is known that the highest monthly rainfall measured in November 2017 is 813 mm. The climate type of Temon Subdistrict is included in type B climate which is very wet with a comparison value between the average number of dry months with a number of wet months average of 0.3077 (Schmidt & Ferguson, 1951).

b) Rainy Day

The parameters of the rainy day show the number of days in one month where there is rain. The number of rainy days in the study locations in 2008 - 2018 is shown in Table 9

Tabel 9. Number of Rainy Days (days)

Tahun	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Ags	Sep	Okt	Nov	Des
2008	16	10	8	6	3	-	-	-	-	14	25	14
2009	12	14	7	10	6	4	4	-	4	9	11	7
2010	19	8	12	8	13	8	1	1	11	15	12	15
2011	18	19	18	11	6	-	-	-	-	3	14	21
2012	13	13	15	8	-	1	-	-	-	-	15	15
2013	27	10	11	9	5	11	6	3	-	6	18	X
2014	X	17	10	16	X	8	X	X	-	X	15	21
2015	23	15	23	26	7	1	1	1	-	-	6	27
2016	13	16	21	18	8	9	9	10	18	22	19	20
2017	21	18	16	21	4	4	3	1	5	14	23	20

Description: - = no rain; X = no data

c) Speed and Direction Wind

Data on wind direction and speed in the Kulon Progo Regency area are not available, so wind direction and speed data use the closest data, namely at the Stage of Yogyakarta Station. From the data for the past ten years (from 2008 to 2017) obtained from the Class IV Melati Climatology Station, it can be seen that the highest wind speeds occur in September and October 2011 at 14 km / h with the direction to the West. Complete data is presented in the following table

Table 10. Wind Speed in 2008 - 2017 (km / h)

Years	Jan	Feb	March	Apr	Mei	Jun	Jul	Augt	Sept	Oct	Nov	Dec
2008	5	6	6	5	5	5	6	6	7	7	6	6
2009	5	8	6	6	5	5	X	6	7	7	7	7
2010	7	6	6	6	5	5	6	6	6	7	0	0
2011	X	R	R	11	5	11	12	13	14	14	13	13
2012	8	6	7	0	0	3	3	4	5	4	5	4
2013	5	4	5	4	3	4	5	5	5	5	5	4
2014	4	3	4	4	3	X	3	5	5	5	4	4
2015	5	5	4	5	4	4	4	4	4	4	4	4
2016	4	4	4	4	4	3	3	4	4	4	4	4
2017	4	4	4	3	3	3	3	4	4	3	3	3

Description: - = no rain; X = no data

Tabel 11. Wind direction for 2008 - 2017 (°)

Years	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Auc	Sep	Oct	Nov	Dec
2008	S	SW	SW	S	S	SW	SW	SW	S	S	S	SW
2009	SW	SW	S	S	S	SW	X	SW	S	S	S	SW
2010	SW	S	SW	SW	SW	S	SW	SW	S	S	X	X
2011	N	R	SW	W	W	W	W	W	W	W	W	W
2012	W	W	NE	X	X	S	S	S	S	S	S	W
2013	W	W	W	S	C	S	E	S	S	S	S	SW
2014	W	S	S	S	S	X	S	S	S	S	S	SW
2015	S	S	S	S	S	S	S	S	S	S	S	S
2016	S	S	S	S	S	S	S	S	S	S	S	S
2017	S	S	S	S	S	S	S	S	S	S	X	S
Most directions	S	S	S	S	S	S	S	S	S	S	S	SW

Description: S = South; SW = Southwest; W = West; NW = Northwest; N = North; NE = Northeast; E = East; SE = Southeast

From Table 9 and Table 10, Windrose can be made as shown in Figure 3., as follows:

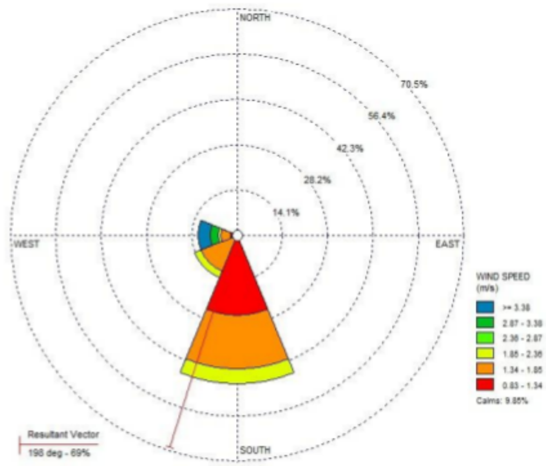

Figure 3. Windrose

From the windrose above, it can be seen that the dominant wind direction is from the south (46.21%), southeast (14.39%) and West (12.35%). The speed in the dominant direction is 1.38 m / s. The average wind speed at the study site ranged from 1.38 m / s. the lowest NO concentration occurs when the wind speed is high, and vice versa. Low wind speeds cause the spread of air to wider space to be slow and accumulate around the study site so that the concentration of NO_2 becomes high. The higher the wind speed, the concentration of NO_2 will be smaller because the pollutants carried by the wind away from the location. Temperature and humidity, the distribution of NO_2 pollution is also influenced by wind speed. Wind speed affects the distribution of pollutant gases. The higher the wind speed, the smaller the concentration of contamination

5. Mobiization Project

Material and equipment mobilization activities at the project site can increase the number of transportation vehicles. Thus, with an estimated increase in traffic volume during construction it is estimated that it will affect the performance of the pavement, so that in the end the traversed road is damaged earlier than the planned age due to excessive load repitations. Calculation of the equivalent value of truck axle load carrying materials and equipment is used to evaluate pavement performance. Calculation of the equivalent value of vehicle truck axle loads carrying materials and equipment is as follows. Material transport vehicles use 6B class trucks with a size of 6 m3 and a capacity of 8 tons, the allowable weight (JBI) = 12 tons (both for class II and class III roads). This transport truck has a 1.2 shaft configuration with axial load distribution between the front wheels - rear wheels = 34% - 66%. In addition, transportation vehicles also use 4 trailer axles which are included in the 7C group which have the amount of permissible weight (JBI) = 34 tons for class II and 28 tons for class III roads. This transport truck has a configuration of 1.2.2 - 2.2 axes with axial load distribution between the front wheels - rear wheels = 18% - 28% - 54%. Heavy equipment transport vehicles use flat bed semi trailers (trailers 5 axles) which are included in the 7C vehicle class which have the amount of weight allowed (JBI) = 56 tons. In accordance with the Guidelines for Planning Flexural Pavement Thickness, Pd T-01-2002-B, with structural numbers (SN) = 5, and the final surface index pt = 2.5, equivalent calculation of numbers is caused by an increase in transport vehicles in the access area of the development project Kedundang Baru cross station train - Yogyakarta Baru Adisucipto Station in Kulonprogo Regency can be seen as follows:

Table 12. Prediction of vehicle traffic mobilization stage

Location	Season	Vehicle Group	Vol Existing (smp/hours)	Vol Prediction (smp/hours)	Equivalent vol	ESA Existing	ESA Contruction
District Office Junction Temon (TRANS 1)	Working days	6B	150	236	1,070	159,91	252,38
		7C	6,5	29,25	5,000	32,50	146,26
	Off days	6B	268	390	1,070	286,45	416,88
		7C	9,1	32,63	5,000	45,50	163,16
Kedundang Intersection (TRANS 2)	Working days	6B	76	140	1,070	81,29	150,18
		7C	4	26	5,000	20,00	130,01
	Off days	6B	143	228	1,070	152,96	243,34
		7C	6,5	29,25	5,000	32,50	146,26
Glagah Beach Intersection (TRANS 3)	Working days	6B	175	269	1,070	187,18	287,84
		7C	2	23,4	5,000	10,00	117,01
	Off days	6B	151	238	1,070	161,30	254,19
		7C	5,2	27,56	5,000	26,00	137,81
Working days Off days	Working days	6B	2,6	45	1,070	2,78	48,11
		7C	0	20,8	5,000	0,00	104,01
	Off days	6B	3	45	1,070	2,78	48,11
		7C	0	20,8	5,000	0,00	104,01
Kaligintung Village Road Section (TRANS 5)	Working days	6B	0	42	1,070	0,00	44,50
		7C	0	20,8	5,000	0,00	104,01
	Off days	6B	0	42	1,070	0,00	44,50
		7C	0	20,8	5,000	0,00	104,01
Glagah Beach Road Section (Front of Temon District) (TRANS 6)	Working days	6B	4	47	1,070	4,17	49,92
		7C	0	20,8	5,000	0,00	104,01
	Off days	6B	7	50	1,070	6,95	53,53
		7C	0	20,8	5,000	0,00	104,01

Information : ESA (Equivalent Standard Axle)

Sumber: Analisa Tim, 2018.

From the description above shows the results of a small comparison on the location of TRANS 1 - TRANS 3 for ESA (Equivalent Standard Axle) on existing conditions and construction with two time differences in the area of crossroad construction project access road Kedundang Baru station - New Yogyakarta International Station The predicted Adisucipto in Kulonprogo Regency will be used as a transportation route. The six observation locations which are estimated to be access roads for transportation routes are flexible pavement (asphalt). However, for locations in TRANS 5, the Jalan Desa Kaligintung section, some roads are still in the form of dirt roads (roads are not in the form of concrete pavement or asphalt). For dirt roads, it must be ensured that it must be hardened to minimize damage to the area if the transport truck will pass through and carry a load that is overloaded. Little additions to the transport vehicle must also be watched out and must ensure that the truck does not overload.

Thus, from a relatively small difference accompanied by the condition of the access road, the impact on the road that is passed by the transport vehicle is not too large. But it needs to be watched out for the Kaligintung Village road section because in addition to the condition of the road section some of it is a dirt road, also the condition of the road that has been severely damaged. While the road conditions on the other roads are still quite good, although relatively there have been damage such as cracks and holes. At the TRANS 4 - TRANS 6 location in the existing condition there were no heavy vehicles in class 6b and 7C that passed through the section, then the difference in the ratio of the predicted construction was more than 10%. For the TRANS 1 - TRANS 3 road segment with an equivalent ratio of existing conditions and when construction is only <10%, the impact that causes damage to the road is considered small. The climate in the project location supports the implementation of activities by reducing air quality parameters. The mobilization activity, possible or predicted can increase the concentration of CO, NO2 and Total Suspended Particulate so that it can affect the quality of air in the area around the project site. Therefore a prediction analysis is needed regarding air quality

Prediction of air quality (CO, NO_2 and Total Suspended Particulate) in the Stage of mobilization of railway construction projects. Air quality prediction modeling is Carbon monoxide, Nitrogen dioxide and Total suspended particulate using CALINE-4 Software. Predictions of pollutant concentrations at the receptor point are located a maximum of 500 meters from the project sampling point. The pollutants predicted are relatively inert pollutants. (Levitin et al, 2005). Figure 3 shows the path or location of the link (access point) which is the source of emissions and the location of the receptor so that ambient parameters are needed, as follows:

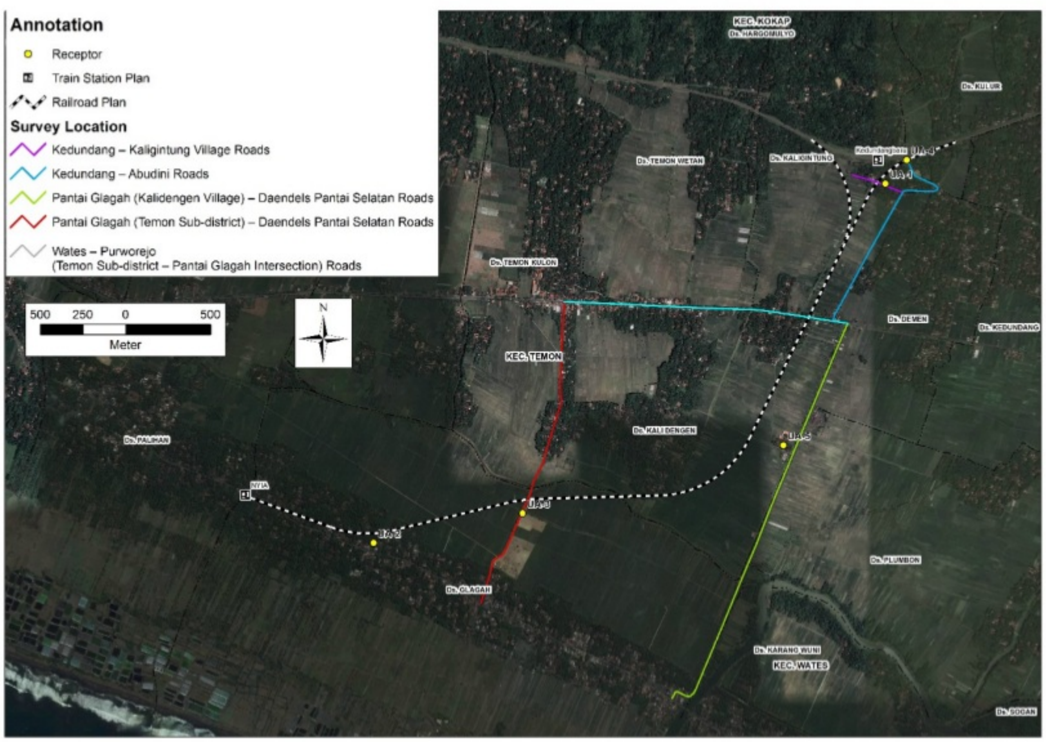

Figure 3. Location of links and receptors on caline 4 modeling

Study of predictions of changes in environmental quality parameters, namely the concentration of Carbon monoxide, Nitrogen dioxide and total suspended particles will occur when the project mobilization process begins. To find out the prediction, an input variable is needed to get the prediction model, as follows:

Table 8. Caline 4 modeling input variables

Variable	Value	Unit	Information
Wind velocity	1,38	m/sc	Average speed in the dominant wind direction
Wind direction	0		The direction of the dominant wind goes north
Class atmosphere stability	1		Atmospheric stability class A = 1
Mixing Height	100	m	*Mixing height* standar
Ambient air temperature	30	°C	Determined based on the weighted average. The latest value gets the highest weight, and gets smaller with the initial data obtained
CO Ambient Concentration	0,61	ppm	
O_3 concentration	0,0068	ppm	
NO_2 Ambient concentration	0,0176	ppm	
TSP Ambient Concentration	73,16	µg/m³	

Source: Primary data analysis, 2018

Air quality modeling predictions using Caline4 software by adding vehicle emission factors used in the project mobilization stage are as follows :

Table 9. Vehicle emission factors used in the stage mobilization and demobilization of railroad construction

Category	CO g/km	HC g/km	Nox g/km	PM_{10} g/km	SO_2 g/km
Motorcycle	14	5,9	0,29	0,24	0,008
Passenger car (gasoline)	40	4	2	0,01	0,026
Passenger car (solar)	2,8	0,2	3,5	0,53	0,44
Passenger car	32,4	3,2	2,3	0,12	0,11
Bus	11	1,3	11,9	1,4	0,93
Truck	8,4	1,8	17,7	1,4	0,82
City transportation	43,1	5,08	2,1	0,006	0,029
Taxi	55,3	5,6	2,8	0,008	0,025
3-wheeled vehicle	70,7	33,8	0,25	1,2	0,013
Pick-up car	31,8	3,5	2	0,026	0,13
Jeep	36,7	3,86	2,36	0,039	0,145
Van/minibus	24	2,9	1,55	0,029	0,14
Car	33,8	3,7	1,9	0,004	0,023

Source: Ministry of Environment. (2013)

The results of the analysis of air quality predictions: Carbon monoxide, Nitrogen dioxide and Total suspended particulate concentrations in the mobilization and demobilization of the project using Caline4 are as follows:

Table 10. Prediction of analysis results: carbon monoxide, nitrogen dioxide and total suspended particulates at the stage of mobilization and demobilization of railroad construction

Parameters	Information	Unit	UA-1	UA-2	UA-3	UA-4	UA-5	Ambien Air Quality Standard
NO_2	Holiday	µg/Nm³	64	65	63	67	66	350
	Workday	µg/Nm³	64	65	63	67	66	350
CO	Holiday	µg/Nm³	27.25	26.75	26.75	47.375	27.25	30.000
	Workday	µg/Nm³	27.125	26.75	26.75	51.875	25.375	30.000
Total Suspended	Holiday	µg/Nm³	74,1	73,7	74	74,7	74,1	230 (24 hours)
Particulate	workday	µg/Nm³	74,1	73,7	74	74,9	74	230 (24 hours)

Source: Primary data analysis, 2018

Based on the table above it can be predicted that there will be an increase in Carbon monoxide, Nitrogen dioxide and Total suspended particulate concentrations due to mobilization and demobilization of equipment and materials. The highest increase occurred in CO parameters, namely an increase to exceed the ambient air quality standard in Yogyakarta at UA-4. Whereas in other locations there was an increase, but it was still below the quality standards of the Yogyakarta ambient air quality. Thus this impact is a negative impact. A very high increase at UA-4 is predicted because the sampling location is included in the project location, so the transport vehicle will cross the location. Estimates of the important nature of the impact of decreasing ambient air quality in the mobilization and demobilization of equipment and materials. Air quality measurement results are then converted by using the Air Pollution Standard Index to determine the impact on the possibility of health disorders around the location of the study area.

Based on the initial environmental setting, based on the Air Pollution Standard Index in the study area were in good condition. The NO_2 index is in the number between 11-12 in the good category. The Total Suspended Particulate index is in lift 4 - 12 in the good category. Cabon dioxide parameters have ISPU 2 values that fall into the good category. The level of public disease is relatively volatile depending on the conditions of the season, wind, air temperature and others. It is assumed that there have been no changes in extreme environmental conditions at the study sites, so the predicted Air Pollution Standard in 2019 has no significant change, which is in good condition

Table 11. Air Pollution Standard Index at the stage of mobilization and demobilization of equipment and materials

Location	Parameters			Air pollution standard index					
	NO_2	TSP	CO_2	NO_2		TSP		CO_2	
UA-1	41	74,1	21,7	7	Good	32	Good	228	Very unhealthy
UA-2	41	73,7	13,2	7	Good	31	Good	146	not healthy
UA-3	41	74	21,4	7	Good	32	Good	226	Very unhealthy
UA-4	41	74,90	41,5	7	Good	32	Good	363	Dangerous
UA-5	41	74	20,3	7	Good	32	Good	219	Very unhealthy
Unit	µg/Nm³	µg/Nm³	ppm						

Information: CO = Carbon monoxide, NO2 = Nitrogen dioxide, TSP = Total Suspended Particulate

From the results of the Air Pollution Standard Index calculation above, it can be seen that there are significant changes especially in the Carbon monoxide parameters. The initial conditions of Carbon monoxide parameters are in the "Good" category. Whereas in the final condition (with the project), the condition of the Carbon monoxide parameter becomes "Unhealthy", "Very Unhealthy" even "Dangerous". Locations with the category "Dangerous" are at the location of UA-4. This location is the location of the project so that it can be understood that at this location there will be a very high increase in Carbon monoxide. The "Very unhealthy" category occurs at the location of UA-6 which is ± 60 m away from the mobilization access road.

6. Conclusion

The stage of mobilization and demobilization of the plans for the construction of the national public railroad that crosses the Kedundang Baru station - New Yogyakarta Airport station - Indonesia has not been an important impact on environmental impact analysis and is still below the standards set by the governor's regulation Yogyakarta special region Number: 153 of 2002.

Further analysis needs to be done, especially on environmental monitoring plans and environmental management plans.

Compliance with ethical standards.

Acknowledgments

The author is very grateful to Mrs. Poerna Sri Oetari as Director of PT. Mtra Adhi Pranata consultant so that this research can run well.

Disclosure of Conflict of Interest.

All authors declare that they have no conflict of interest.

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