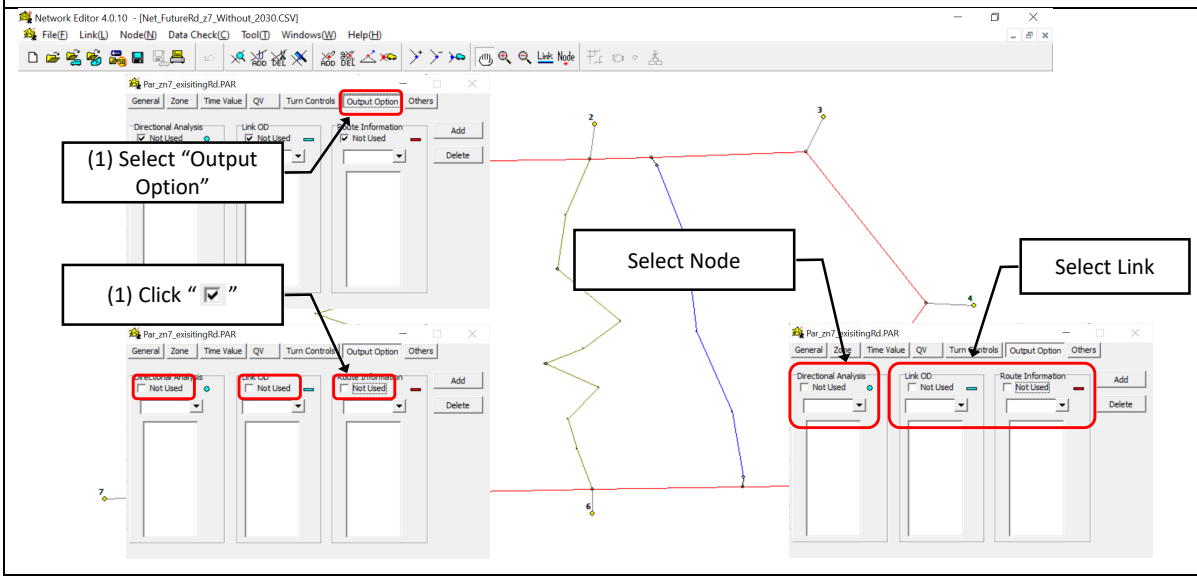
Step-1 (2) : Set the Output Options

Set the Output Option. There are three output options that can be set here.

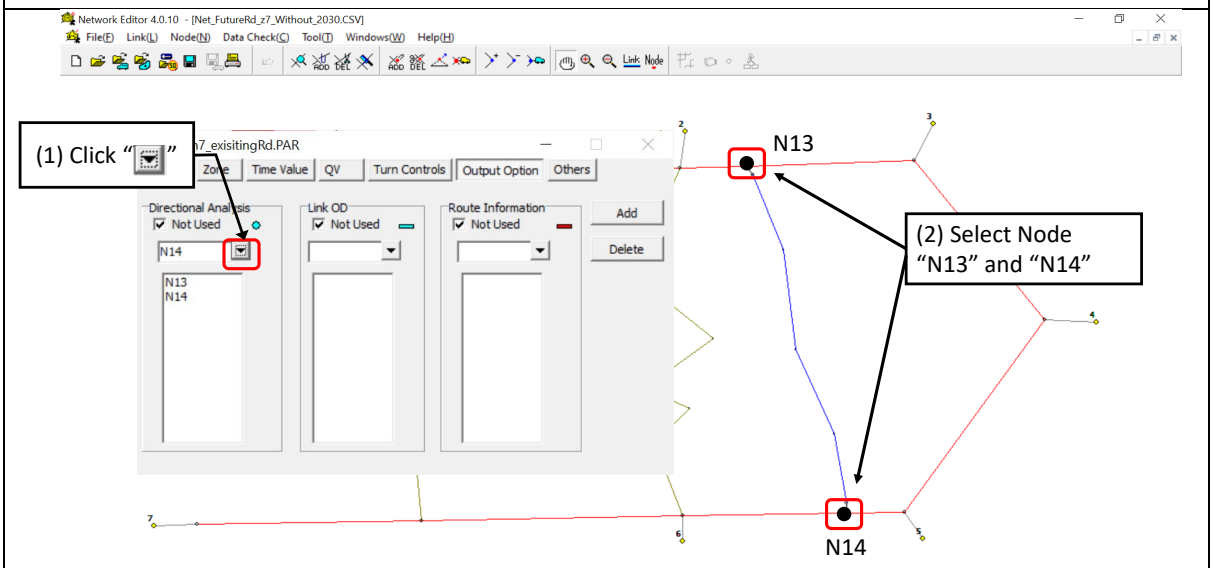
1) Directional Analysis, 2) Link OD and 3) Route information can be set to check the information of the selected Node or Link.




Step-1 (3) : Set the Output Options (Directional Analysis)

This section explains the methods for setting Directional Analysis. This Directional Analysis can be used to understand inflow and outflow traffic volume at a traffic intersection. The results are explained in Section 4.1.4.

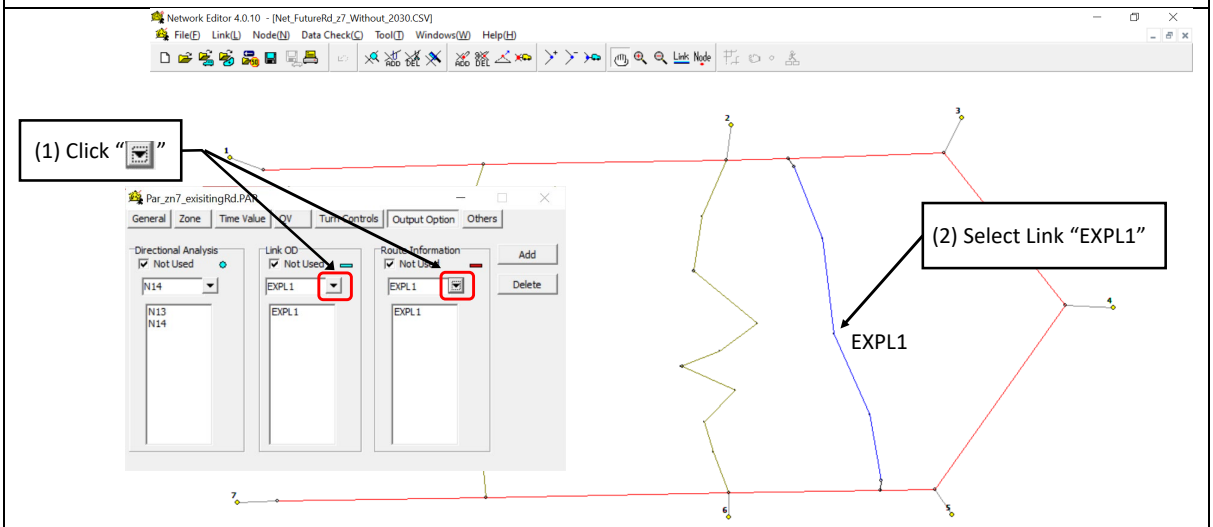
In this section, two nodes N13 and N14 are setting.



Step-1 (3) : Set the Output Options (Link OD and Link Information)

This section explains the methods for setting Link OD and Link Information. The Link OD and Route Information will be able to understand the OD breakdown and routes of vehicles passing through the link. The results are described in Section 4.1.4.

In this section, we will set up a link for EXPL1.



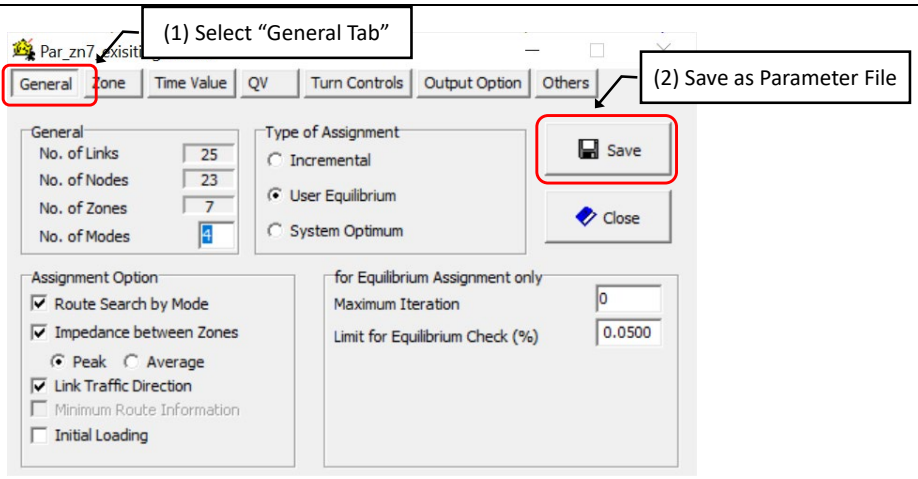

Step-1 (4) : Save as Parameter File

When all the settings are completed, return to the General Tab and save the Parameter File. The save name should be "Par_zn7_futureRd.PAR".

Point:

1) Save the Parameter file in the desktop first. Saving in extended sub-folder is often not saved.

2) Saved parameter data will be moved to your designated folder.



### 4.1.3 Traffic Assignment Undertaken

The traffic assignment is undertaken using the network data and parameter files prepared in sections 4.1.1 and 4.1.2 and the future OD table has already been prepared. The traffic volume assignment method is "User Equilibrium Assignment". In this section, the methodology of the traffic assignment is explained.

Step-1 (1) : Select Input Data

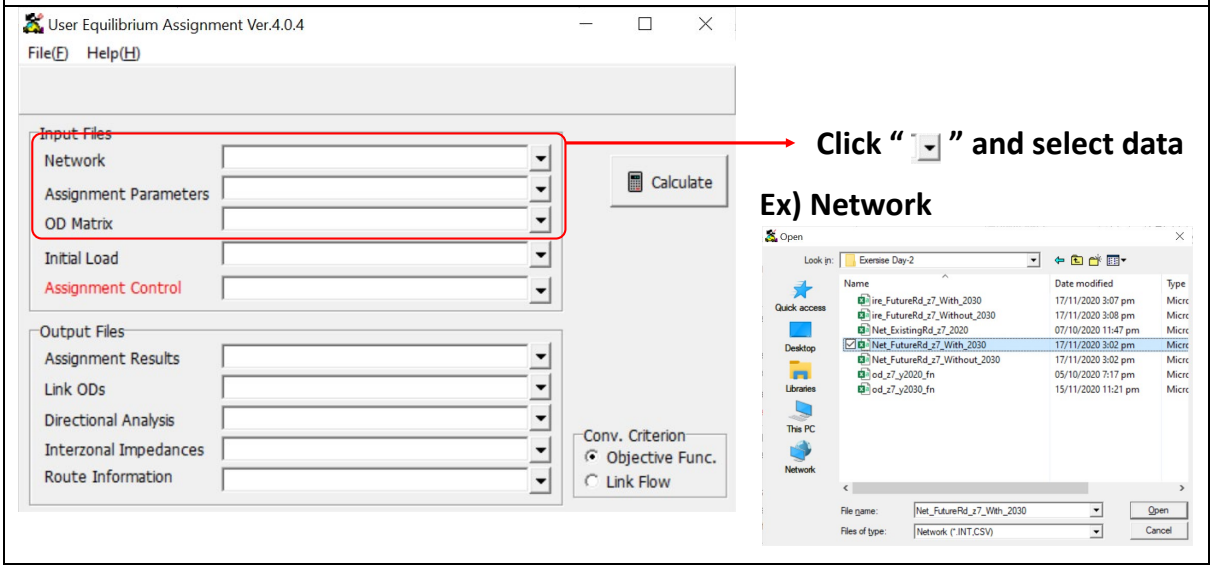
Open "User Equilibrium Assignment" (Window => JICA STRADA 4 => User Equilibrium Assignment). Then, click on " ".

Then, select Network, Assignment Paremeters and OD Matrix in the interface shown below. The files to be selected are as follows.

Network File : Net_FutureRd_z7_With_2030

Parameter File : Par_zn7_futureRd.PAR

OD File : od_z7_y2030_fn.csv



Step-1 (2) : Select Output Data

In this section, set the data for the assignment result. As shown in the figure below, Assignment Result, Link ODs, Directional Analysis and Route Information are set. Note that Interzonal Impedance is not set here.

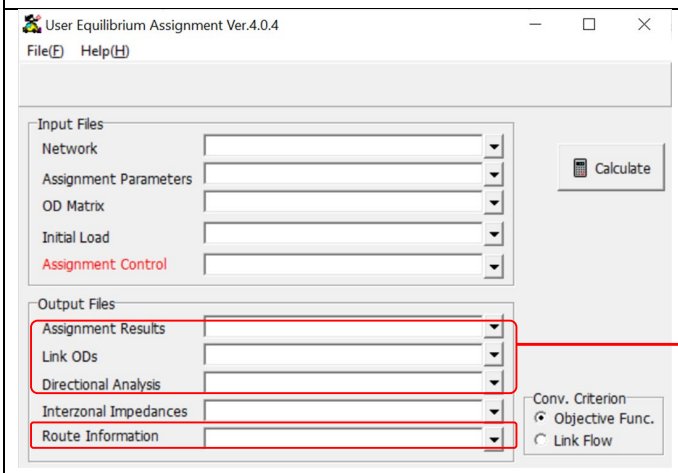
The file name to be saved is as shown below.

Assignment Result : ire_FutureRd_z7_With_2030.CSV

Link Ods : dod_FutureRd_z7_With_2030.DOD

Directional Analysis : dre_FutureRd_z7_With_2030.DRE

Route Information : rre_ FutureRd_z7_With_2030.RRE



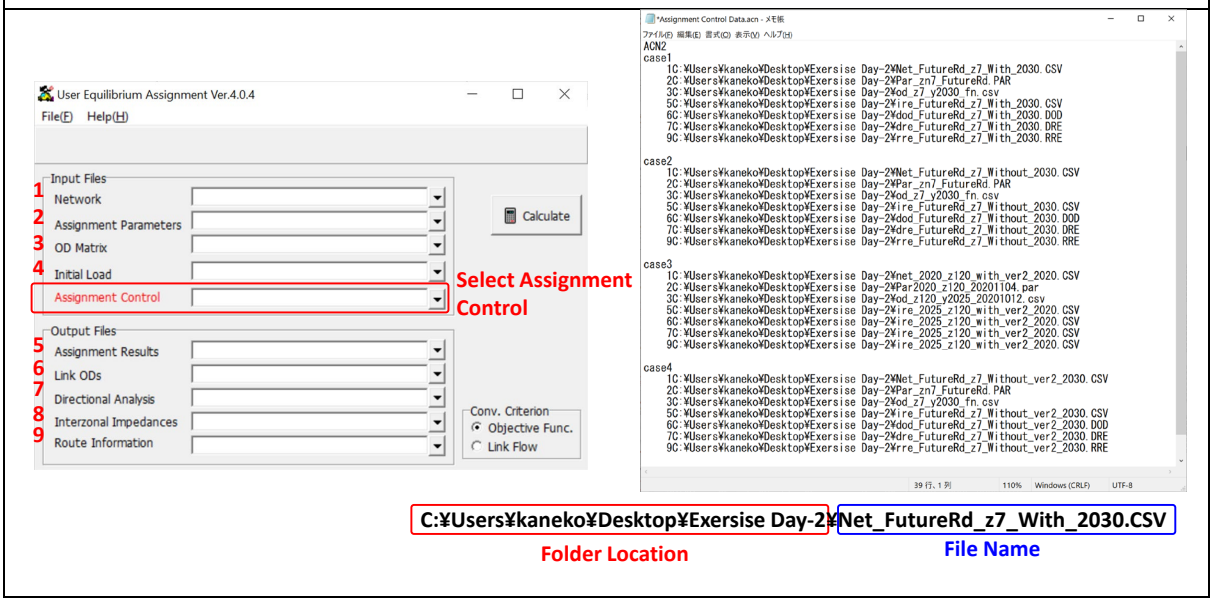

**Name**

I. Assignment Result: ire_FutureRd_z7_With_2030.CSV
II. Link OD: dod_FutureRd_z7_With_2030.DOD
III. Directional Analysis: dre_FutureRd_z7_With_2030.DRE
IV. Route Information: rre_ FutureRd_z7_With_2030.RRE

**Click " ▾ " and select Folder And to be named**

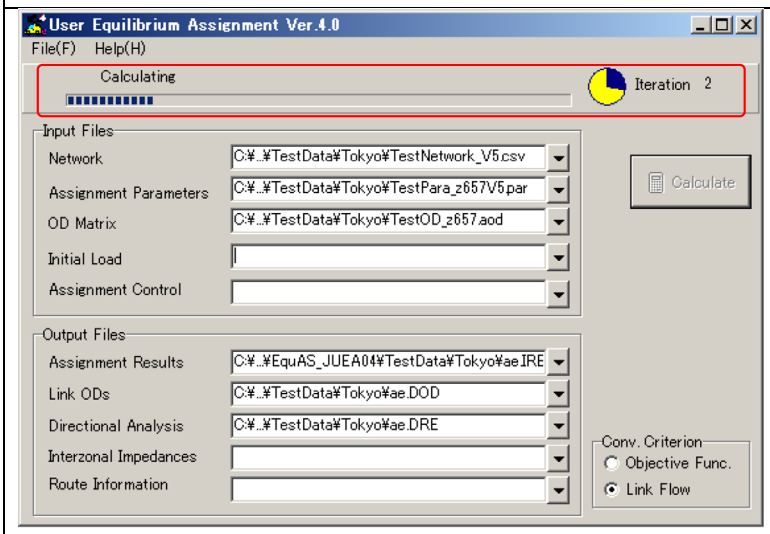
Step-1 (3) : Multiple Assignment (Some Case)

If there are many traffic distribution cases, it is possible to calculate multiple files for "Assignment Control" as shown in the figure below. Therefore, it is necessary to prepare the " Assignment Control Data. acn" file as shown in the figure below. The number on the left side of the Interface matches the number of the ACN file and set the file name and save folder.



Step-1 (4) : Calculation of Traffic Volume

After all Input and Output files have been set, “Calculate” is run. If the file is insufficient or the number of links and nodes in the Network Data and Parameter File do not match, error will occur and calculation will not be done. If the error occurs, check the settings of the file and the number of links and nodes of the Network Data and Parameter File.




### 4.1.4 Analysis for Result of Traffic Assignment

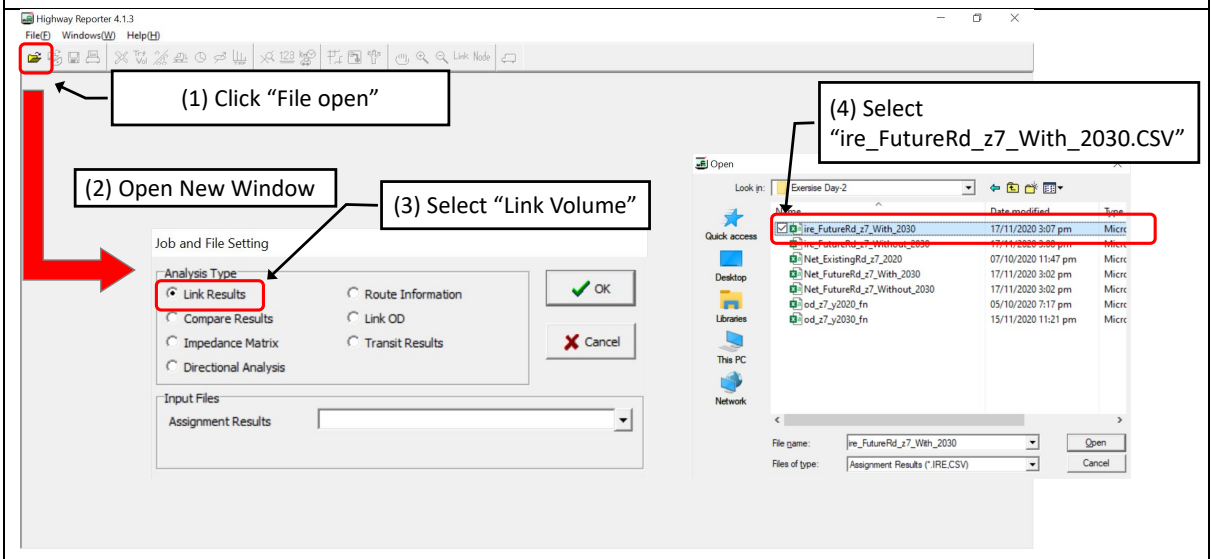
#### (1) Display for Traffic Assignment Result (User Equilibrium Assignment)

This section shows the methodology for presenting the traffic assignment results and other output file results calculated in Section 4.1.3.

Step-2 (1) : Traffic volume and Traffic Flow-1

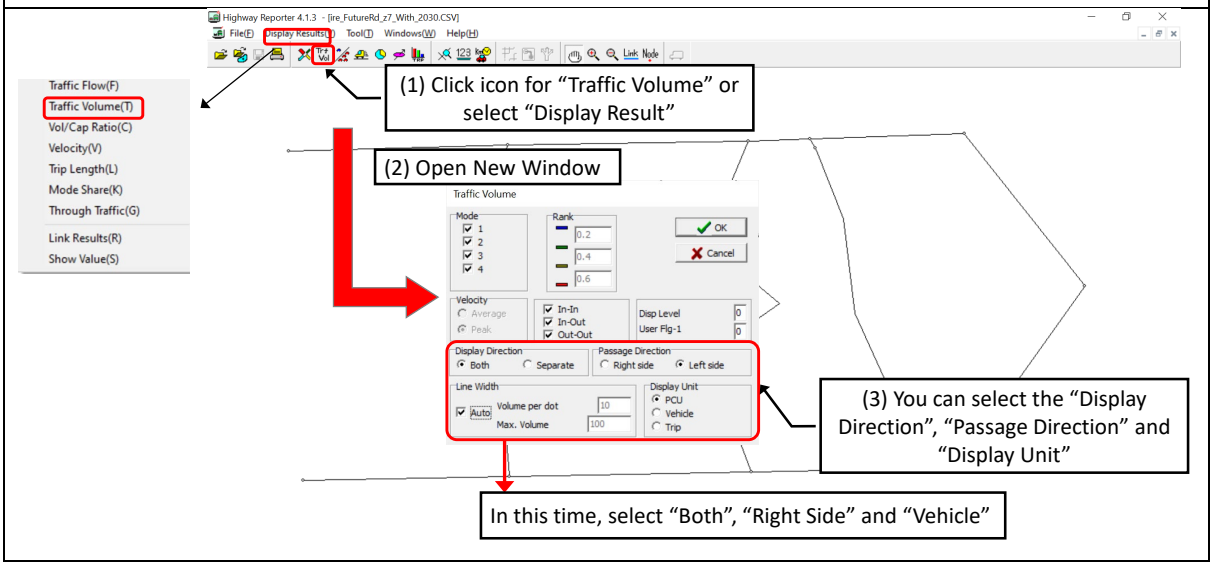
First, the results of traffic volume and traffic flow are shown.

Open the "Highway Reporter" and follow the steps shown in the below figure to show the results of traffic volume and traffic flow.



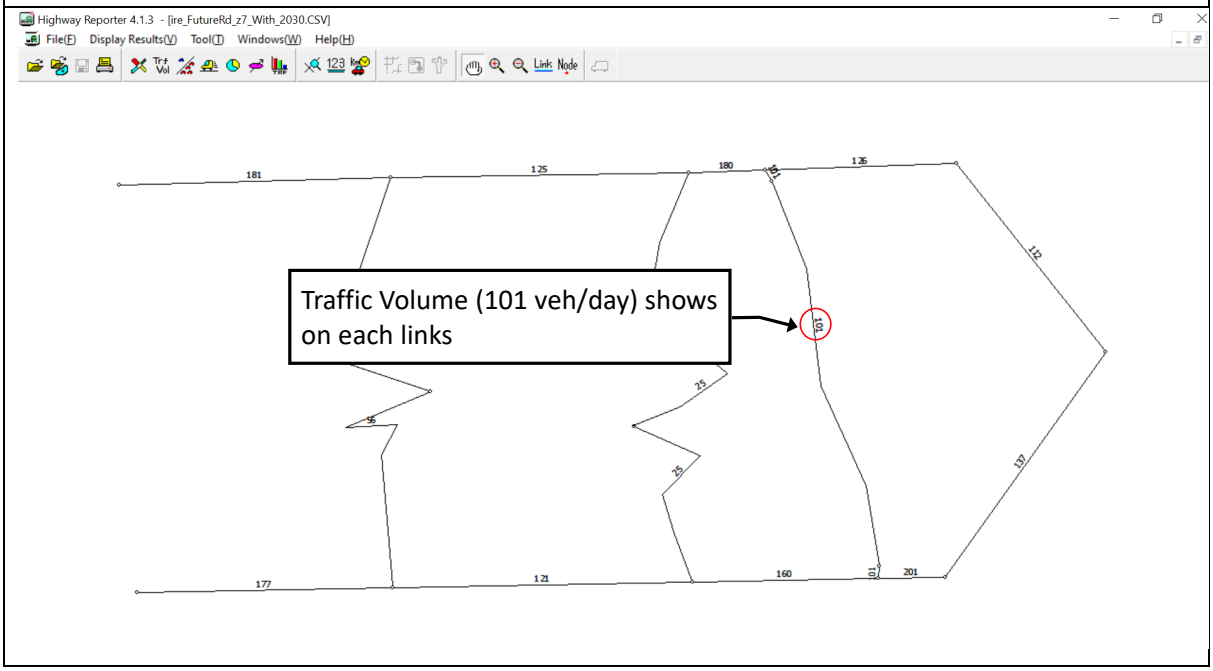
Step-2 (1) : Traffic volume and Traffic Flow-2

Traffic volume results are shown according to the procedure's below.



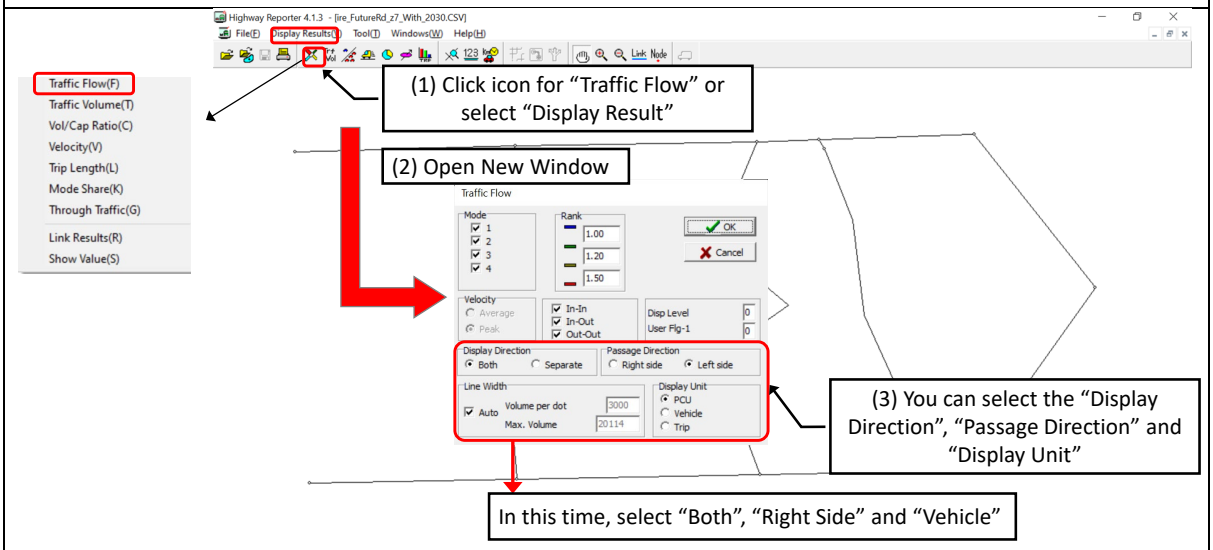

Step-2 (1) : Traffic volume and Traffic Flow-3

Traffic volume results are shown in the figure below. The unit can be shown as veh/day or PCU/day: 100 vehicles/day or 100 PCU/day.



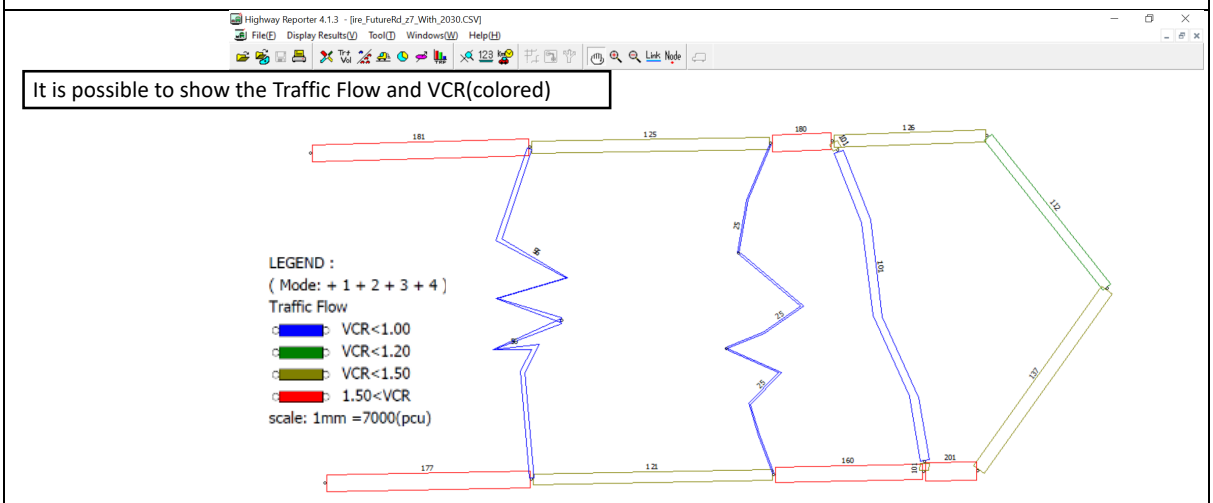
Step-2 (1) : Traffic volume and Traffic Flow-4

In order to show the traffic flow results, follow the following steps below.



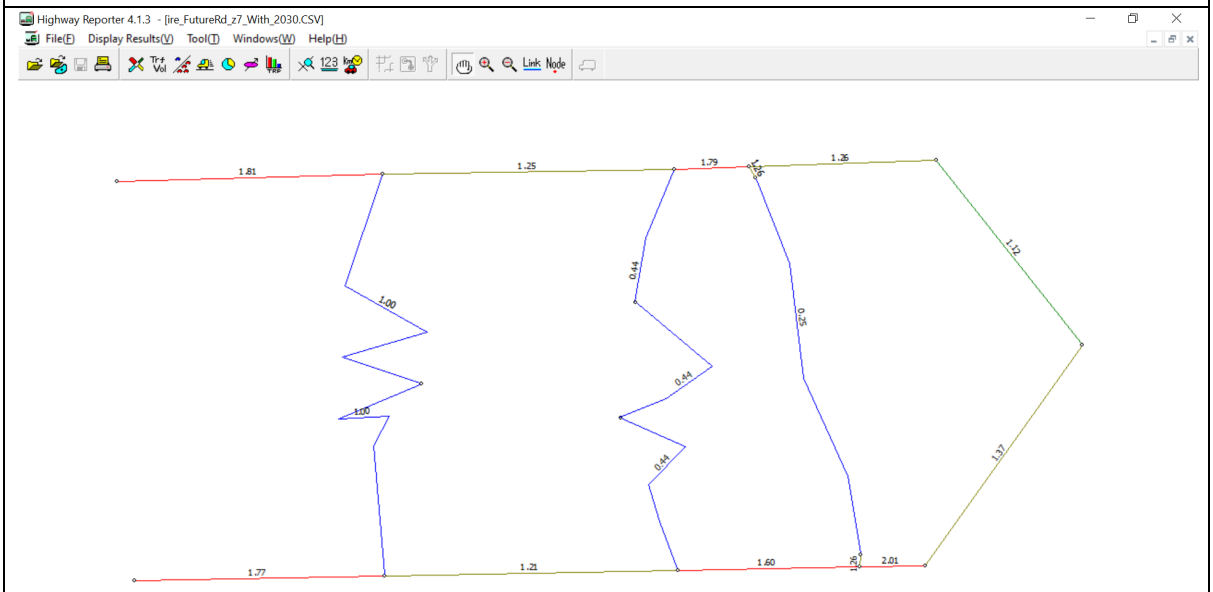

Step-2 (1) : Traffic volume and Traffic Flow-5

The results of the traffic flow are shown in the figure below. As with the traffic volume, the units can be shown in two ways: 100 vehicles/day or 100 PCU/day. It is also possible to show the congestion level by color which is used to show the results in reports.



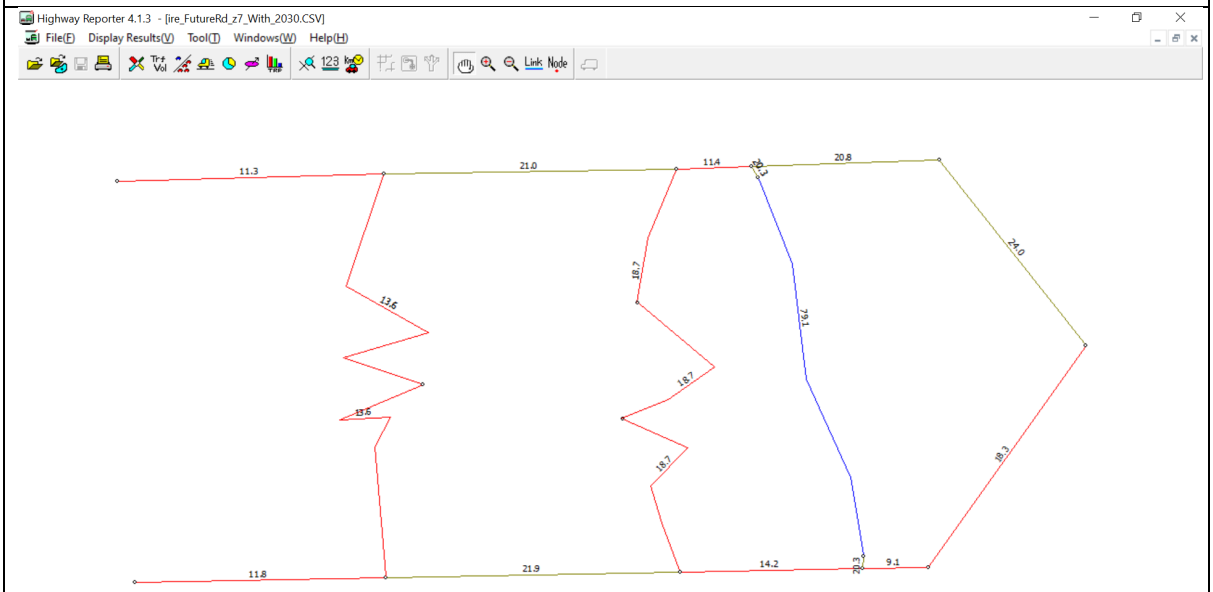
Step-2 (2) : Other Display_Vehicle Capacity Ratio (VCR)

The result of the congestion level is displayed as shown in the figure below. The color legend is the same as the one shown in "Step-2 (1) : Traffic volume and Traffic Flow-5" and the values can also be displayed.



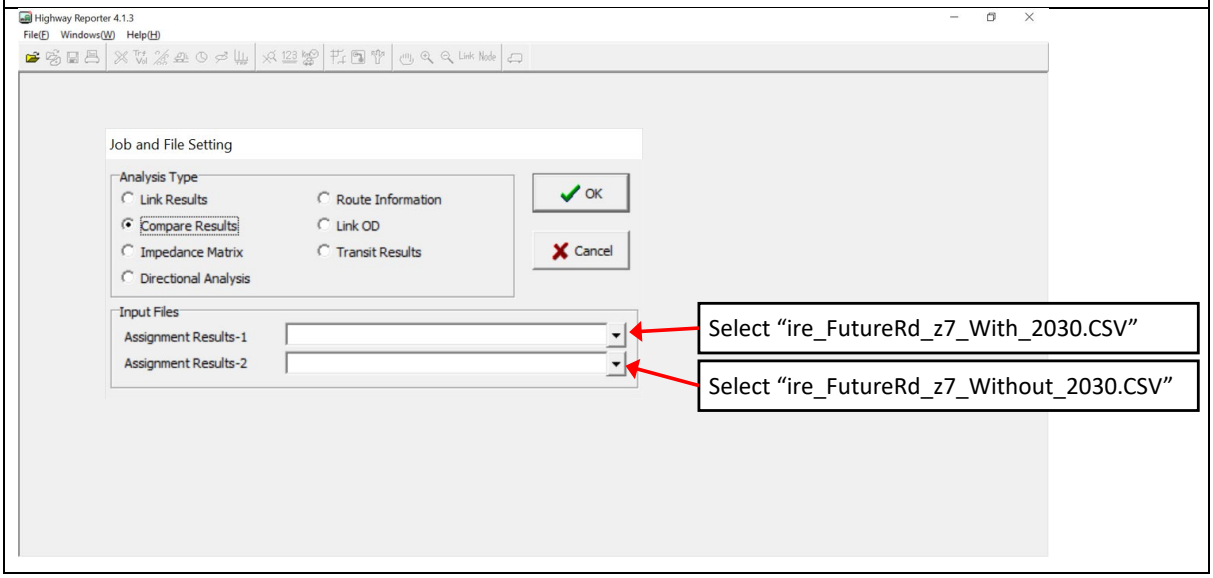

Step-2 (2) : Other Display_Velocity

The result of the velocity is shown in the figure below. It is possible to show two results: the average speed and the final speed.



Step-2 (3) : Comparing Two Assignments-1

In this section, it is possible to compare the results of the two assignment results of the estimated With Expressway and Without Expressway in Section 4.1.3. Following the figure below, select "Compare Results" and click on "ire_FutureRd_z7_With_2030.CSV" and "ire_ FutureRd_z7_With_2030.CSV". FutureRd_z7_Without_2030.CSV" as input files.

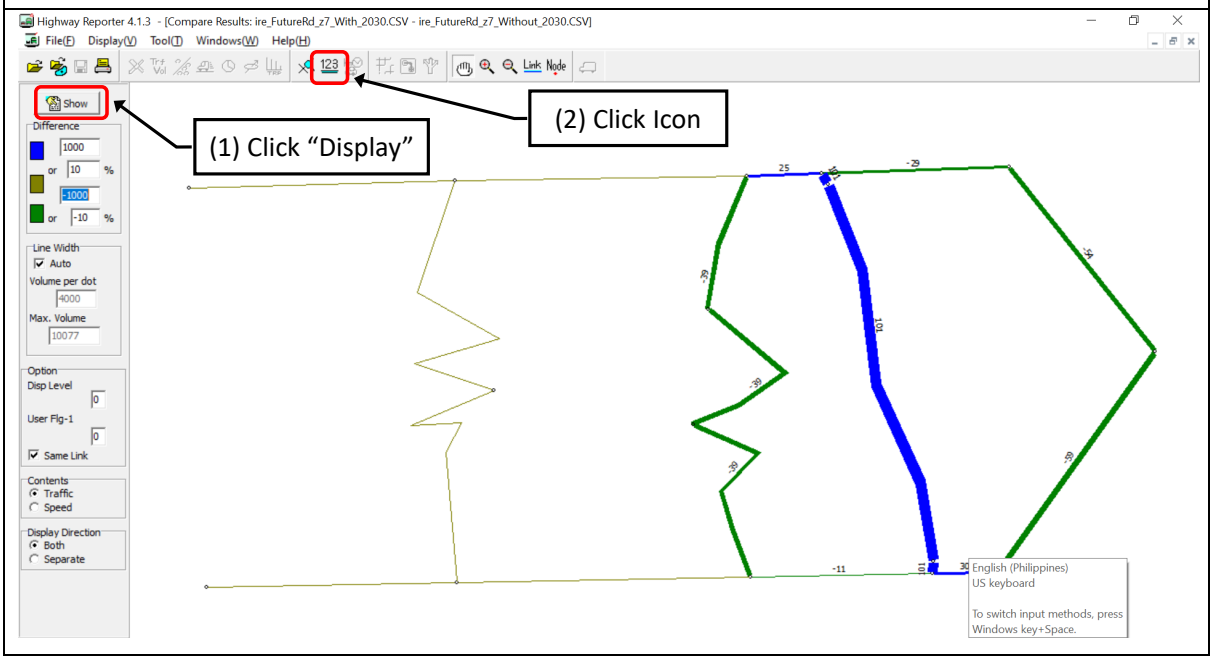



Step-2 (3) : Comparing Two Assignments-2

The two comparison results are shown according to the figure below. As a result, the traffic volume on each link is compared. It is possible to compare the with and without traffic volume and understand the shifting traffic volume.

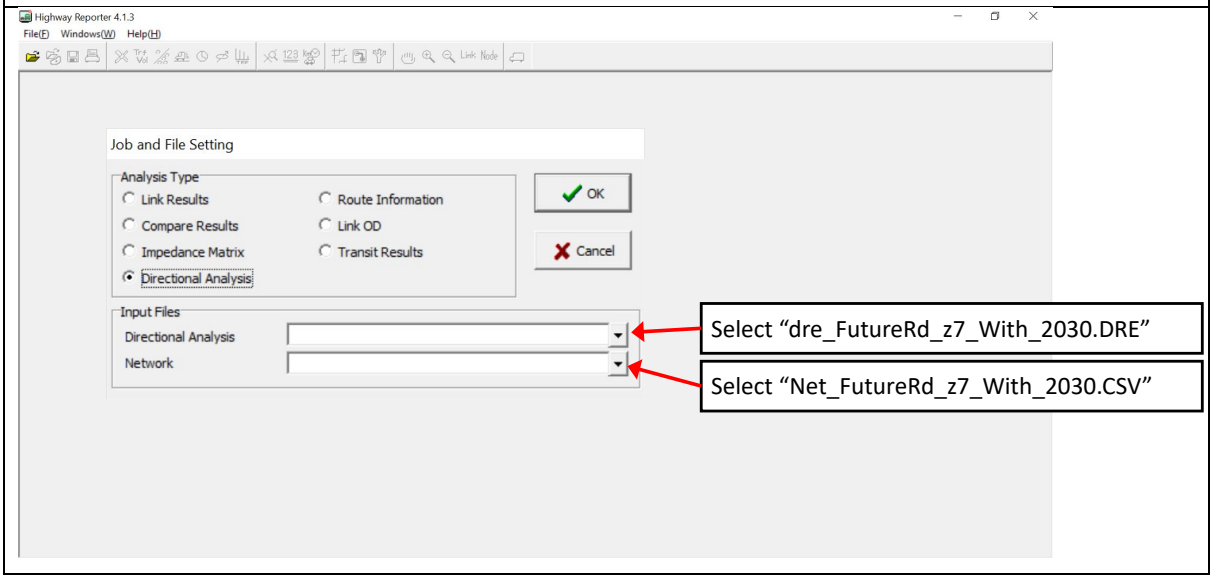
Point:

If the file of Assignment Result-1 is selected as "Without Expressway", the comparison result of EXPL1 will be minus.



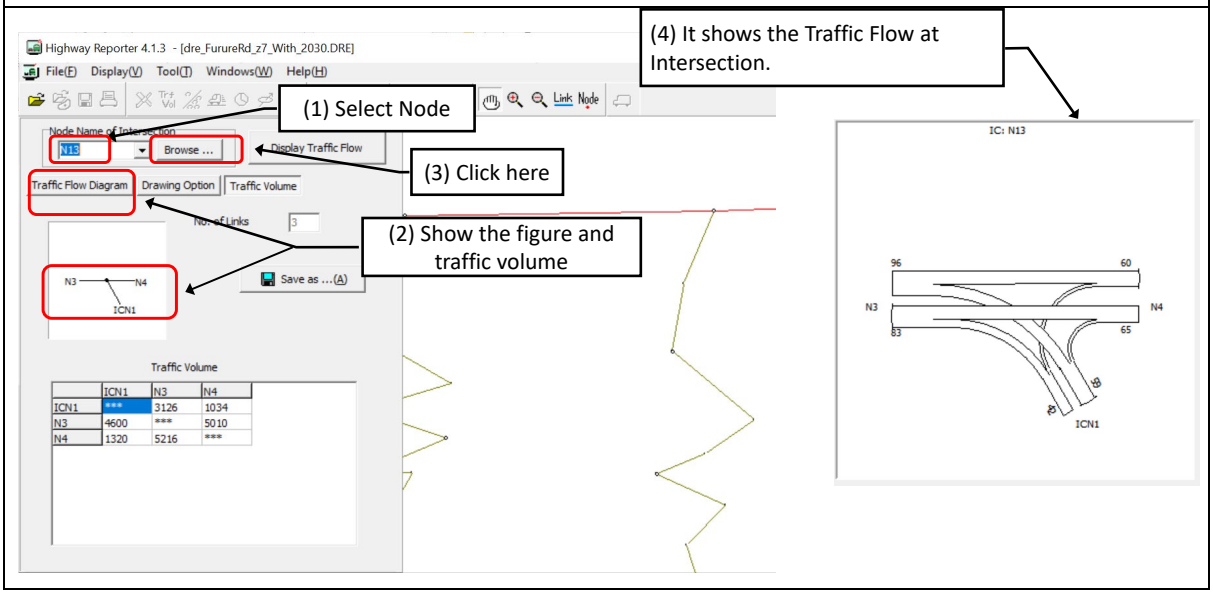
Step-2 (4) : Directional Flows at Intersection-1

In this section, it is possible to show the inflow and outflow traffic volumes at the intersection. Using the estimated Directional Analysis in section 4.1.3, select "dre_FutureRd_z7_With_2030.DRE " and " Net_FutureRd_z7_With_2030.CSV " as input files according to the figure below.



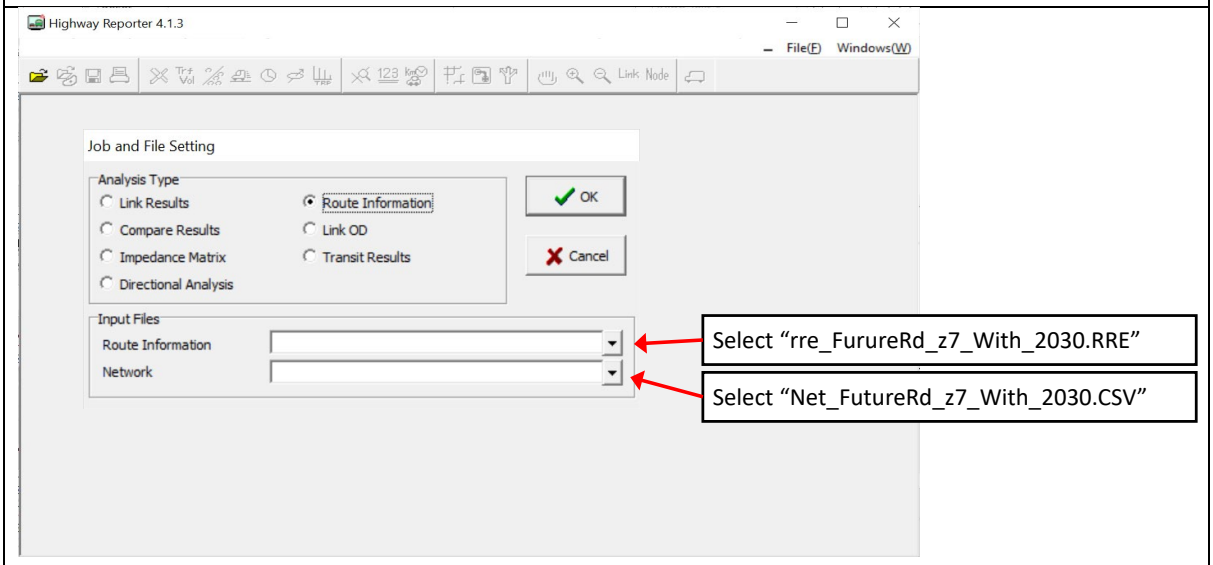

Step-2 (4) : Directional Flows at Intersection-2

The inflow and outflow traffic flow results for the intersection are shown in the figure below. It is possible to show the traffic volume and traffic flow by inflow and outflow. This can be applied to the intersection planning.



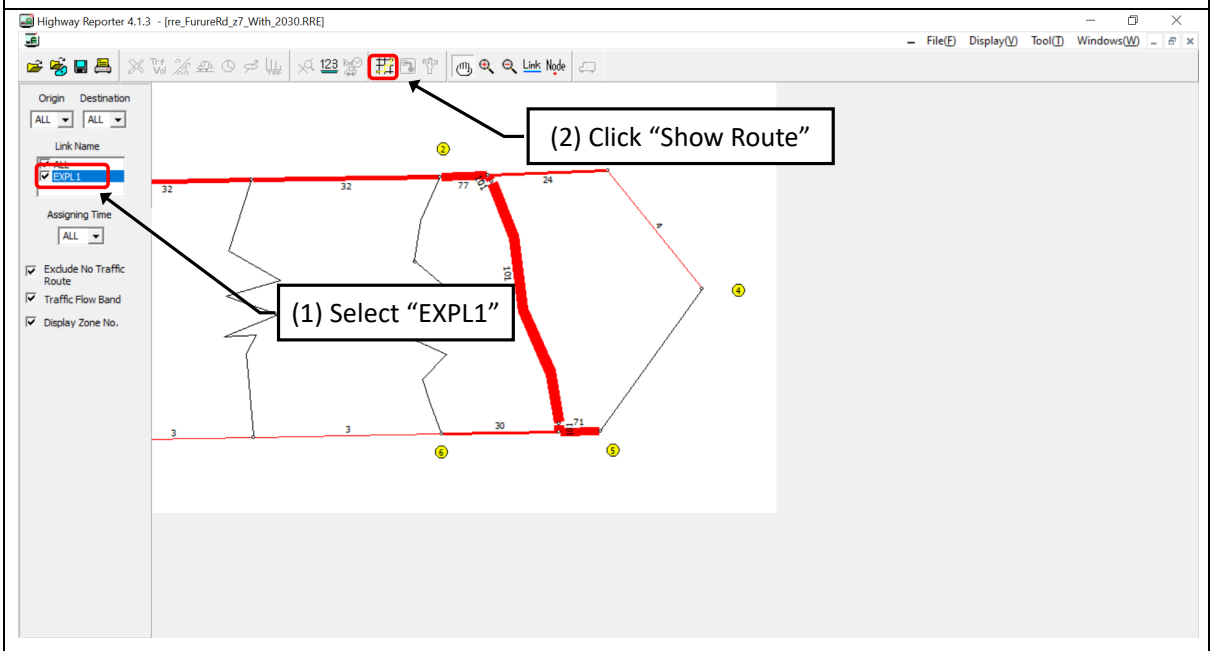
Step-2 (5) : Route Information-1

In this section, it is possible to show the results of Route Information for the selected link. As shown below, by using the results of estimated Route Information in section 4.1.3 and select "rre_FutureRd_z7_With_2030.RRE " and "Net_FutureRd_z7_With_2030.CSV" as input files.



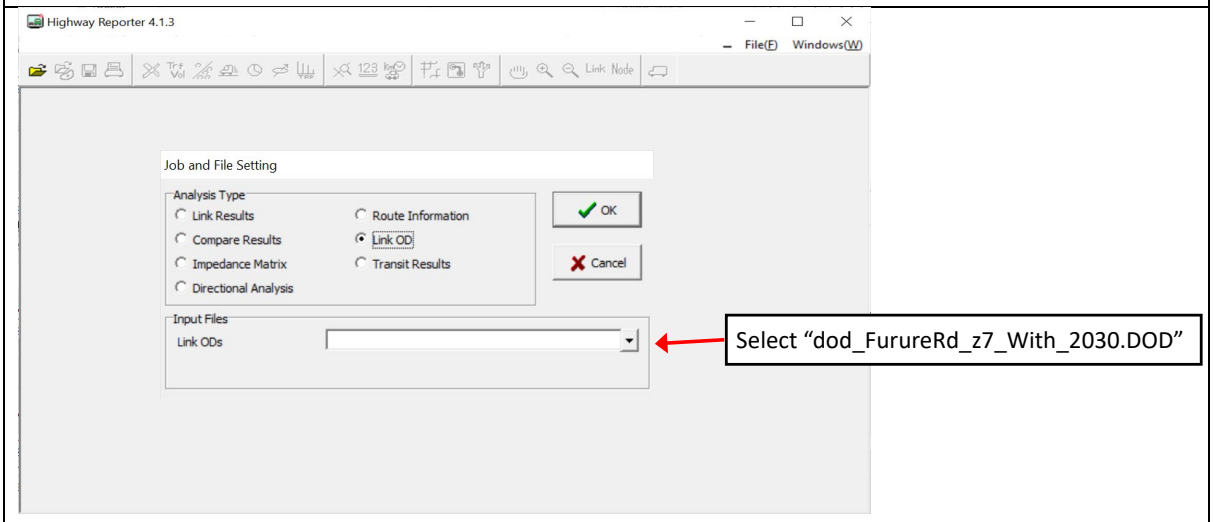

Step-2 (5) : Route Information-2

The following figure shows the results of the EXPL1 link information. It is possible to understand the traffic from where to where on the EXPL1 link.



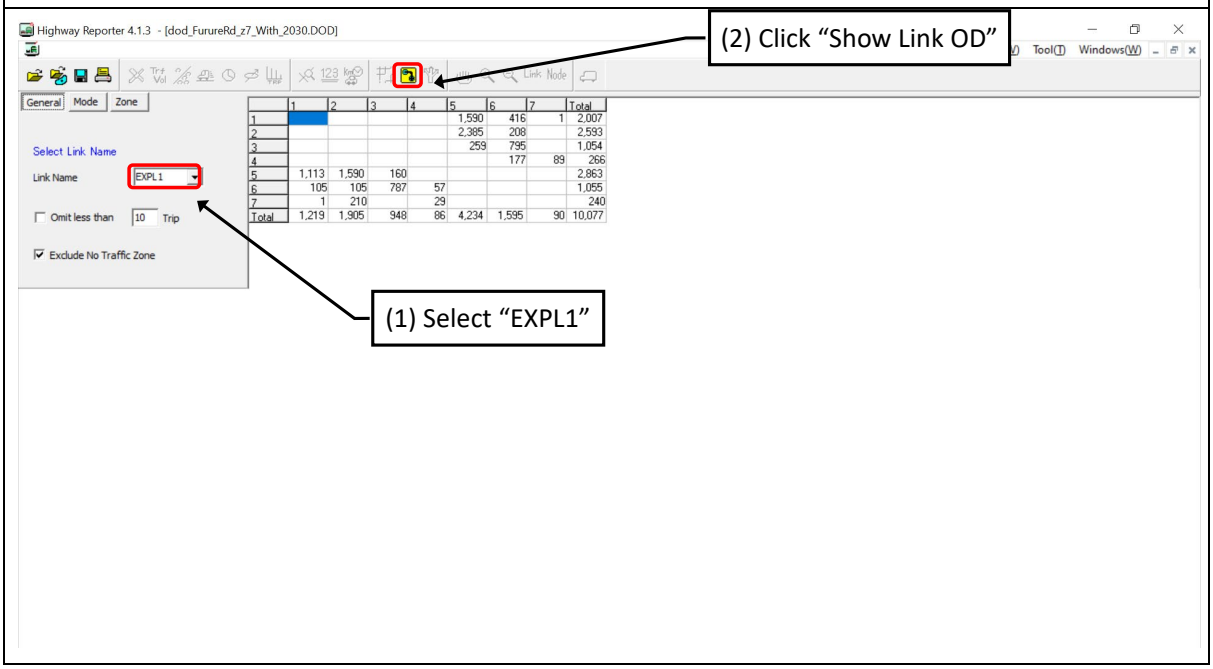
Step-2 (6) : Link OD Detail-1

In this section, it is possible to show the results of Link OD for the selected link. Using the results of the estimated Link OD in section 4.1.3, select "dod_FururеRd_z7_With_2030.DOD" as the input file according to the figure below.




Step-2 (6) : Link OD Detail-2

According to the figure below, the results of Link OD for EXPL1 are shown. This result is related with “Route Information”. It is possible to understand the volume from where to where on Subject Road.



## 4.2 Economic Analysis Undertaken

In this section, the economic analysis will be undertaken using the With and Without results of the expressway network prepared by JICA Strada. The EIRR calculation sheet that was presented in Section 3.4.2 will be explained in more detail in this section.

### (1) Benefit Calculation

Set the basic unit for TTC and VOC in the Evaluator and calculate the benefits by inputting the results of With and Without created in Section 2.3. The benefits are calculated according to the following procedure.

Step-1: Revision of Unit Cost

Unit cost was revised to Unit Cost of Time and Operation in 2020 as shown in below. “Peso/min” Unit cost of time is applied in this Evaluator.

<Time Cost>

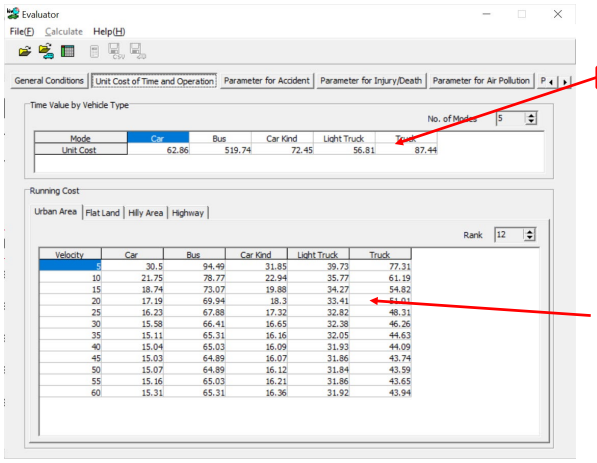
Vehicle Type: 4 Types (Car, Jeepney, Bus, Truck), No. of Modes should be changed “4”.

<Running Cost>

Vehicle Type: Ditto (Automatically changed 4 types)

Speed: 10 Rank (Rank should be changed “10”)

Area: Urban, Flat, Hilly and Highway Area should be revised same running cost.




Travel Time Cost in 2020

| | Passenger Car | Jeepney | Bus | Truck |
|---|---|---|---|---|
| Peso/Hour | 455.6 | 502.7 | 1,878.8 | 172.2 |
| Peso/Min | 7.6 | 8.4 | 31.3 | 2.9 |

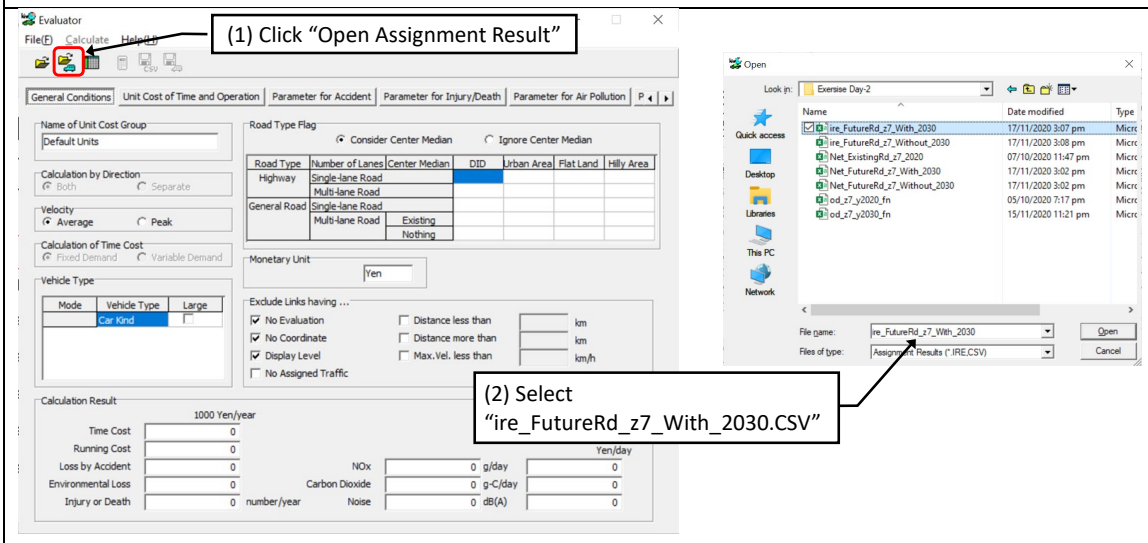
Vehicle Operation Cost in 2020

Unit: Peso/km/Veh

| km/h | Passenger Car | Jeepney | Bus | Truck |
|---|---|---|---|---|
| 10 | 12.2 | 13.2 | 42.8 | 71.1 |
| 20 | 11.7 | 12.3 | 39.7 | 66.6 |
| 30 | 10.3 | 10.3 | 32.8 | 56.4 |
| 40 | 9.4 | 8.9 | 27.7 | 49.0 |
| 50 | 8.9 | 8.2 | 25.0 | 45.4 |
| 60 | 8.7 | 7.9 | 23.5 | 43.8 |
| 70 | 8.7 | 7.8 | 22.9 | 43.2 |
| 80 | 8.8 | 7.9 | 22.8 | 43.3 |
| 90 | 9.0 | 8.1 | 22.8 | 43.6 |
| 100 | 9.2 | 8.4 | 22.8 | 43.8 |

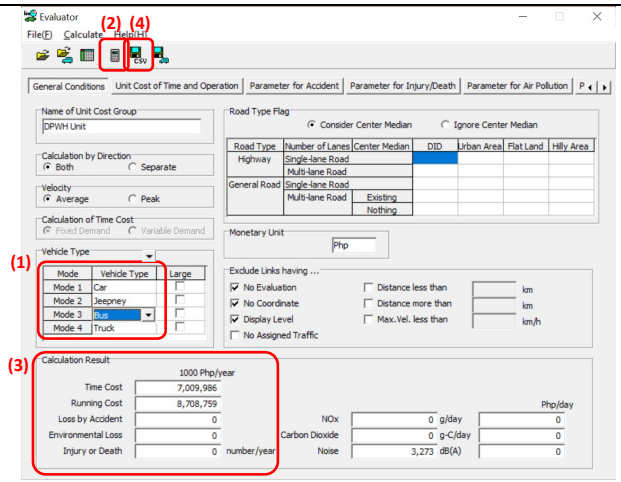
Step-2: Open Result of Traffic Assignment

Open the “ire_FutureRd_z7_With_2030.CSV” file.




Step-3: Calculation of Benefit

Select "Car, Jeepney, Bus and Truck" as the Vehicle Type. The result will be shown in the Calculation Result Window to lick " ". It is possible to save this result to CSV file which can be used as back data. "ire_FutureRd_z7_Without_2030.CSV" calculates the benefits in the same way.




1. Select “Car, Jeepney, Bus Truck” from “ ”.
2. Click “Calculation”
3. Calculation result show the Time cost and Running Cost in 1,000 PhP/year.
4. Save as CSV file for calculation result.

Continue to calculation for without Case

### (2) Estimation of Economic Cost

The project cost and calculation form as shown below will be used to calculate the economic cost. The procedure is as follows.

Step-1: Civil Work Cost

a) Apply SER to the Foreign Cost in "1-1. Direct Cost" times 1.2.

b) For Local Cost, apply SWR and 0.6 times Unskilled Labor Cost.

c) Tax is excluded.

Step-2: Consultancy Service Cost

a) Apply SER to Foreign Cost for "2-1. Detailed Design" and "2-2. Construction Supervision" times 1.2.

b) Tax is excluded.

Step-3: Administration Cost

a) Tax is excluded.

Step-4: Environmental Cost

a) Apply SER to Foreign Cost in "Environmental Monitor" times 1.2.

b) Tax is excluded.

**Financial Cost to Economic Cost** Unit: Mil. Peso

| Item | Financial Cost | Economic Cost | Remarks |
|---|---|---|---|
| 1. Civil Work | **4,802.0** | **4,767.4** | |
| 1-1. Direct Cost | 2,135.8 | 2,276.9 | |
| Foreign | 793.8 | 952.5 | SER:20% |
| Local | 1,342.0 | 1,324.4 | SWR |
| 1-2. Physical Contingency | 213.6 | 213.6 | |
| 1-3. Tax | 316.9 | 0.0 | |
| 2. Consultancy Service Cost | **279.6** | **183.6** | |
| 2-1. Detail Design | **106.8** | **68.8** | |
| Foreign | 23.8 | 28.6 | SER:20% |
| Local | 40.3 | 40.3 | |
| 2-2. Construction Supervision | **149.5** | **114.7** | |
| Foreign | 39.7 | 47.6 | SER:20% |
| Local | 67.1 | 67.1 | |
| 2-3. VAT | 23.3 | 0.0 | |
| 3. Administration Cost | **91.7** | **80.7** | |
| Admin Cost | 80.7 | 80.7 | |
| VAT | 11.0 | 0.0 | |
| 4. Environmental Cost | **88.4** | **78.6** | |
| 1) Land Acquisition | 67.1 | 67.1 | |
| Foreign | 0.0 | 0.0 | SER:20% |
| Local | 67.1 | 67.1 | |
| 2) Environmental Monitor | 10.7 | 11.5 | |
| Foreign | 4.0 | 4.8 | SER:20% |
| Local | 6.7 | 6.7 | |
| VAT | 10.6 | 0.0 | |
| Grand Total (M Php) | 5,261.7 | 5,110.3 | Ratio of Economic and Financial |
| | | | **0.971** |

### (3) Establishment of Cost Sharing by Implementation Schedule

Based on the established project implementation schedule, the annual share of civil work cost, consulting service cost, O&M and ROW cost shall be set. The procedure is shown below.

Step-1: Comfirmation of Implementation Schedule

From the Implementation Schedule, set the annual sharing ratio for each Item. (ex. For November-December 2020, 0.2MM is inserted as 2 months/12 months)

2. Implementation Schedule

| No. | Items | Period |
|---|---|---|
| 1 | Detailed Engineering Design | 2020/11 - 2021/10 |
| 2 | Tender Assistance | 2021/10 - 2022/4 |
| 3 | Construction | 2022/5 - 2024/4 |

| | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.ROW Acquisition Cost | 0.2 | 1.0 | 0.3 | | | | | | | | | 1.5 |
| 2.Detailed Engineering Design | 0.2 | 1.0 | 0.3 | | | | | | | | | 1.5 |
| 3. Construction Cost | | | 0.7 | 1.0 | 0.3 | | | | | | | 2.0 |
| 4. Construction Supervision Cost | | | 0.7 | 1.0 | 0.3 | | | | | | | 2.0 |
| 5. Environmental Monitor | | | 0.7 | 1.0 | 0.3 | | | | | | | 2.0 |
| 6. Administration Cost | 0.2 | 1.0 | 1.0 | 1.0 | 0.3 | | | | | | | 3.5 |
| Total | | | | | | | | | | | | 0.0 |

Step-2: Cost Sharing

Divide the Economic Cost amount by the cost sharing ratio set in Step-1 and calculate the total amount for each year.

Confirm that the total cost is consistent each other.

**Costs by Implementation** Unit :Mil. Peso

| | Economic Cost | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.ROW Acquisition Cost | 67.1 | 7.5 | 44.7 | 14.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.Detailed Engineering Design | 68.8 | 7.6 | 45.9 | 15.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3. Construction Cost | 4,767.4 | 0.0 | 0.0 | 1,589.1 | 2,383.7 | 794.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4. Construction Supervision Cost | 114.7 | 0.0 | 0.0 | 38.2 | 57.4 | 19.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5. Environmental Monitor | 11.5 | 0.0 | 0.0 | 3.8 | 5.7 | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6. Administration Cost | 80.7 | 3.8 | 23.1 | 23.1 | 23.1 | 7.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 5,110.3 | 18.9 | 113.7 | 1,684.5 | 2,469.9 | 823.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Unit :Mil. Peso

| | Economic Cost |
|---|---|
| **2020** | 18.9 |
| **2021** | 113.7 |
| **2022** | 1,684.5 |
| **2023** | 2,469.9 |
| **2024** | 823.3 |
| **2025** | 0.0 |
| **2026** | 0.0 |
| **2027** | 0.0 |
| **2028** | 0.0 |
| **2029** | 0.0 |
| **2030** | 0.0 |

Total
5,110.3 OK

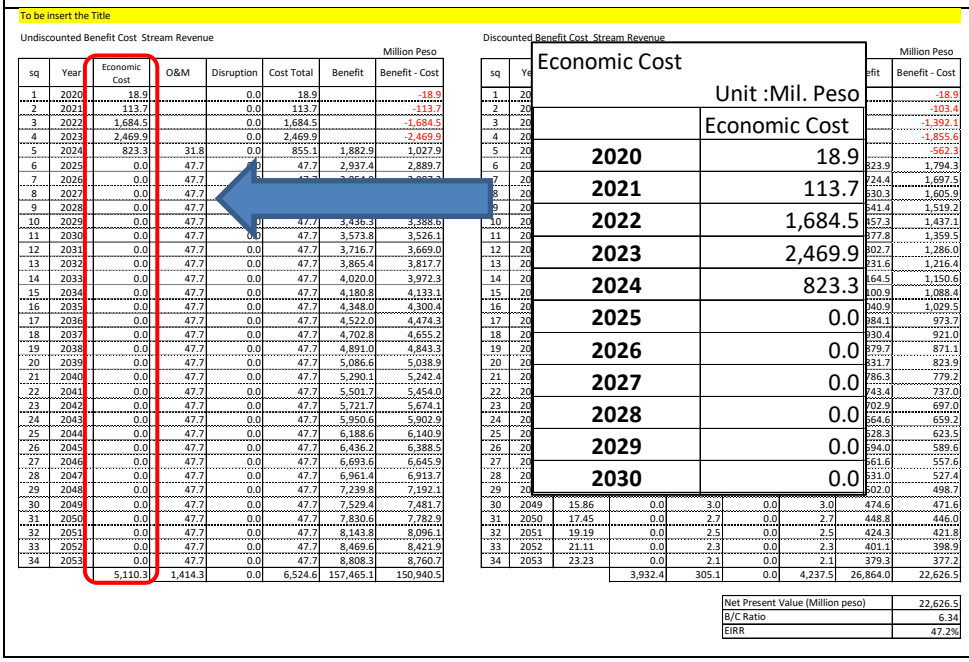
| | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.ROW Acquisition Cost | 0.2 | 1.0 | 0.3 | | | | | | | | | 1.5 |
| 2.Detailed Engineering Design | 0.2 | 1.0 | 0.3 | | | | | | | | | 1.5 |
| 3. Construction Cost | | | 0.7 | 1.0 | 0.3 | | | | | | | 2.0 |
| 4. Construction Supervision Cost | | | 0.7 | 1.0 | 0.3 | | | | | | | 2.0 |
| 5. Environmental Monitor | | | 0.7 | 1.0 | 0.3 | | | | | | | 2.0 |
| 6. Administration Cost | 0.2 | 1.0 | 1.0 | 1.0 | 0.3 | | | | | | | 3.5 |
| Total | | | | | | | | | | | | 0.0 |

## (4) Preparation of Cost Benefit Stream, Analysis for Economic Indicators and Sensitivity Analysis

As explained in section 3.4.2, prepare Cost Benefit Stream for calculating the EIRR and link the costs set in each sheet to calculate the EIRR. At the same time, a sensitivity analysis will be undertaken.

Step-1: Linked with Economic Cost

Link between "Cost Beneft Stream Sheet" and "Financial to Economic Cost Sheet".



To be insert the Title

Undiscounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|
| 1 | 2020 | 18.9 | | 0.0 | 18.9 | | -18.9 |
| 2 | 2021 | 113.7 | | 0.0 | 113.7 | | -113.7 |
| 3 | 2022 | 1,684.5 | | 0.0 | 1,684.5 | | -1,684.5 |
| 4 | 2023 | 2,469.9 | | 0.0 | 2,469.9 | | -2,469.9 |
| 5 | 2024 | 823.3 | 31.8 | 0.0 | 855.1 | 1,882.9 | 1,027.9 |
| 6 | 2025 | 0.0 | 47.7 | 0.0 | 47.7 | 2,937.4 | 2,889.7 |
| 7 | 2026 | 0.0 | 47.7 | | | | |
| 8 | 2027 | 0.0 | 47.7 | | | | |
| 9 | 2028 | 0.0 | 47.7 | | | | |
| 10 | 2029 | 0.0 | 47.7 | | 47.7 | 3,436.3 | 3,388.6 |
| 11 | 2030 | 0.0 | 47.7 | 0.0 | 47.7 | 3,573.8 | 3,526.1 |
| 12 | 2031 | 0.0 | 47.7 | 0.0 | 47.7 | 3,716.7 | 3,669.0 |
| 13 | 2032 | 0.0 | 47.7 | 0.0 | 47.7 | 3,865.4 | 3,817.7 |
| 14 | 2033 | 0.0 | 47.7 | 0.0 | 47.7 | 4,020.0 | 3,972.3 |
| 15 | 2034 | 0.0 | 47.7 | 0.0 | 47.7 | 4,180.8 | 4,133.1 |
| 16 | 2035 | 0.0 | 47.7 | 0.0 | 47.7 | 4,348.0 | 4,300.4 |
| 17 | 2036 | 0.0 | 47.7 | 0.0 | 47.7 | 4,522.0 | 4,474.3 |
| 18 | 2037 | 0.0 | 47.7 | 0.0 | 47.7 | 4,702.8 | 4,655.2 |
| 19 | 2038 | 0.0 | 47.7 | 0.0 | 47.7 | 4,891.0 | 4,843.3 |
| 20 | 2039 | 0.0 | 47.7 | 0.0 | 47.7 | 5,086.6 | 5,038.9 |
| 21 | 2040 | 0.0 | 47.7 | 0.0 | 47.7 | 5,290.1 | 5,242.4 |
| 22 | 2041 | 0.0 | 47.7 | 0.0 | 47.7 | 5,501.7 | 5,454.0 |
| 23 | 2042 | 0.0 | 47.7 | 0.0 | 47.7 | 5,721.7 | 5,674.1 |
| 24 | 2043 | 0.0 | 47.7 | 0.0 | 47.7 | 5,950.6 | 5,902.9 |
| 25 | 2044 | 0.0 | 47.7 | 0.0 | 47.7 | 6,188.6 | 6,140.9 |
| 26 | 2045 | 0.0 | 47.7 | 0.0 | 47.7 | 6,436.2 | 6,388.5 |
| 27 | 2046 | 0.0 | 47.7 | 0.0 | 47.7 | 6,693.6 | 6,645.9 |
| 28 | 2047 | 0.0 | 47.7 | 0.0 | 47.7 | 6,961.4 | 6,913.7 |
| 29 | 2048 | 0.0 | 47.7 | 0.0 | 47.7 | 7,239.8 | 7,192.1 |
| 30 | 2049 | 0.0 | 47.7 | 0.0 | 47.7 | 7,529.4 | 7,481.7 |
| 31 | 2050 | 0.0 | 47.7 | 0.0 | 47.7 | 7,830.6 | 7,782.9 |
| 32 | 2051 | 0.0 | 47.7 | 0.0 | 47.7 | 8,143.8 | 8,096.1 |
| 33 | 2052 | 0.0 | 47.7 | 0.0 | 47.7 | 8,469.6 | 8,421.9 |
| 34 | 2053 | 0.0 | 47.7 | 0.0 | 47.7 | 8,808.3 | 8,760.7 |
| | | 5,110.3 | 1,414.3 | 0.0 | 6,524.6 | 157,465.1 | 150,940.5 |

Discounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Benefit | Benefit - Cost |
|---|---|---|---|
| 1 | 20 | | -18.9 |
| 2 | 20 | | -103.4 |
| 3 | 20 | | -1,392.1 |
| 4 | 20 | | -1,855.6 |
| 5 | 20 | | -562.3 |
| 6 | 20 | 1,823.9 | 1,794.3 |
| 7 | 20 | 1,724.4 | 1,697.5 |
| 8 | 20 | 1,630.3 | 1,605.9 |
| 9 | 20 | 1,541.4 | 1,519.2 |
| 10 | 20 | 1,457.3 | 1,437.1 |
| 11 | 20 | 1,377.8 | 1,359.5 |
| 12 | 20 | 1,302.7 | 1,286.0 |
| 13 | 20 | 1,231.6 | 1,216.4 |
| 14 | 20 | 1,164.5 | 1,150.6 |
| 15 | 20 | 1,100.9 | 1,088.4 |
| 16 | 20 | 1,040.9 | 1,029.5 |
| 17 | 20 | 984.1 | 973.7 |
| 18 | 20 | 930.4 | 921.0 |
| 19 | 20 | 879.7 | 871.1 |
| 20 | 20 | 831.7 | 823.9 |
| 21 | 20 | 786.3 | 779.2 |
| 22 | 20 | 743.4 | 737.0 |
| 23 | 20 | 702.9 | 697.0 |
| 24 | 20 | 664.6 | 659.2 |
| 25 | 20 | 628.3 | 623.5 |
| 26 | 20 | 594.0 | 589.6 |
| 27 | 20 | 561.6 | 557.6 |
| 28 | 20 | 531.0 | 527.4 |
| 29 | 20 | 502.0 | 498.7 |
| 30 | 2049 | 474.6 | 471.6 |
| 31 | 2050 | 448.8 | 446.0 |
| 32 | 2051 | 424.3 | 421.8 |
| 33 | 2052 | 401.1 | 398.9 |
| 34 | 2053 | 379.3 | 377.2 |
| | | 26,864.0 | 22,626.5 |

Economic Cost

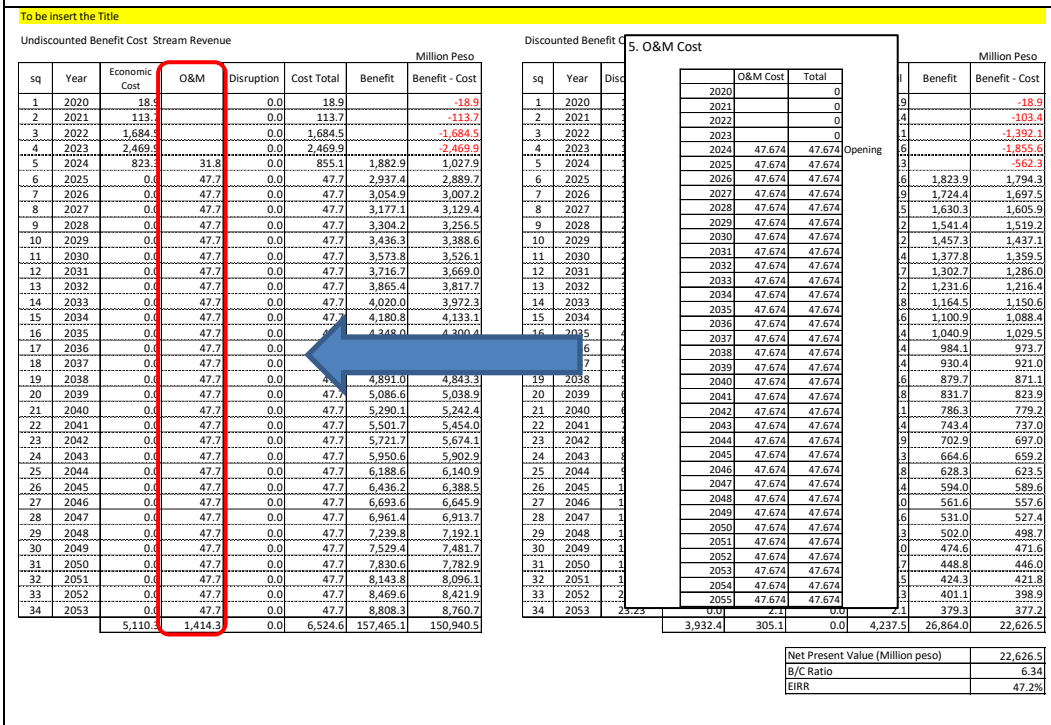
Unit :Mil. Peso

| | Economic Cost |
|---|---|
| 2020 | 18.9 |
| 2021 | 113.7 |
| 2022 | 1,684.5 |
| 2023 | 2,469.9 |
| 2024 | 823.3 |
| 2025 | 0.0 |
| 2026 | 0.0 |
| 2027 | 0.0 |
| 2028 | 0.0 |
| 2029 | 0.0 |
| 2030 | 0.0 |

| | |
|---|---|
| Net Present Value (Million peso) | 22,626.5 |
| B/C Ratio | 6.34 |
| EIRR | 47.2% |

Step-2: Linked with O&M Cost

Since the opening of the road is scheduled to begin in May 2024, 8 months/12 months (0.67) was applied to the first year in 2024.



To be insert the Title

Undiscounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|
| 1 | 2020 | 18.9 | | 0.0 | 18.9 | | -18.9 |
| 2 | 2021 | 113.7 | | 0.0 | 113.7 | | -113.7 |
| 3 | 2022 | 1,684.5 | | 0.0 | 1,684.5 | | -1,684.5 |
| 4 | 2023 | 2,469.9 | | 0.0 | 2,469.9 | | -2,469.9 |
| 5 | 2024 | 823.3 | 31.8 | 0.0 | 855.1 | 1,882.9 | 1,027.9 |
| 6 | 2025 | 0.0 | 47.7 | 0.0 | 47.7 | 2,937.4 | 2,889.7 |
| 7 | 2026 | 0.0 | 47.7 | 0.0 | 47.7 | 3,054.9 | 3,007.2 |
| 8 | 2027 | 0.0 | 47.7 | 0.0 | 47.7 | 3,177.1 | 3,129.4 |
| 9 | 2028 | 0.0 | 47.7 | 0.0 | 47.7 | 3,304.2 | 3,256.5 |
| 10 | 2029 | 0.0 | 47.7 | 0.0 | 47.7 | 3,436.3 | 3,388.6 |
| 11 | 2030 | 0.0 | 47.7 | 0.0 | 47.7 | 3,573.8 | 3,526.1 |
| 12 | 2031 | 0.0 | 47.7 | 0.0 | 47.7 | 3,716.7 | 3,669.0 |
| 13 | 2032 | 0.0 | 47.7 | 0.0 | 47.7 | 3,865.4 | 3,817.7 |
| 14 | 2033 | 0.0 | 47.7 | 0.0 | 47.7 | 4,020.0 | 3,972.3 |
| 15 | 2034 | 0.0 | 47.7 | 0.0 | 47.7 | 4,180.8 | 4,133.1 |
| 16 | 2035 | 0.0 | 47.7 | 0.0 | | | |
| 17 | 2036 | 0.0 | 47.7 | 0.0 | | | |
| 18 | 2037 | 0.0 | 47.7 | 0.0 | | | |
| 19 | 2038 | 0.0 | 47.7 | 0.0 | 47.7 | 4,891.0 | 4,843.3 |
| 20 | 2039 | 0.0 | 47.7 | 0.0 | 47.7 | 5,086.6 | 5,038.9 |
| 21 | 2040 | 0.0 | 47.7 | 0.0 | 47.7 | 5,290.1 | 5,242.4 |
| 22 | 2041 | 0.0 | 47.7 | 0.0 | 47.7 | 5,501.7 | 5,454.0 |
| 23 | 2042 | 0.0 | 47.7 | 0.0 | 47.7 | 5,721.7 | 5,674.1 |
| 24 | 2043 | 0.0 | 47.7 | 0.0 | 47.7 | 5,950.6 | 5,902.9 |
| 25 | 2044 | 0.0 | 47.7 | 0.0 | 47.7 | 6,188.6 | 6,140.9 |
| 26 | 2045 | 0.0 | 47.7 | 0.0 | 47.7 | 6,436.2 | 6,388.5 |
| 27 | 2046 | 0.0 | 47.7 | 0.0 | 47.7 | 6,693.6 | 6,645.9 |
| 28 | 2047 | 0.0 | 47.7 | 0.0 | 47.7 | 6,961.4 | 6,913.7 |
| 29 | 2048 | 0.0 | 47.7 | 0.0 | 47.7 | 7,239.8 | 7,192.1 |
| 30 | 2049 | 0.0 | 47.7 | 0.0 | 47.7 | 7,529.4 | 7,481.7 |
| 31 | 2050 | 0.0 | 47.7 | 0.0 | 47.7 | 7,830.6 | 7,782.9 |
| 32 | 2051 | 0.0 | 47.7 | 0.0 | 47.7 | 8,143.8 | 8,096.1 |
| 33 | 2052 | 0.0 | 47.7 | 0.0 | 47.7 | 8,469.6 | 8,421.9 |
| 34 | 2053 | 0.0 | 47.7 | 0.0 | 47.7 | 8,808.3 | 8,760.7 |
| | | 5,110.3 | 1,414.3 | 0.0 | 6,524.6 | 157,465.1 | 150,940.5 |

Discounted Benefit C

Million Peso

| sq | Year | Disc | Benefit | Benefit - Cost |
|---|---|---|---|---|
| 1 | 2020 | | | -18.9 |
| 2 | 2021 | | | -103.4 |
| 3 | 2022 | | | -1,392.1 |
| 4 | 2023 | | | -1,855.6 |
| 5 | 2024 | | | -562.3 |
| 6 | 2025 | | 1,823.9 | 1,794.3 |
| 7 | 2026 | | 1,724.4 | 1,697.5 |
| 8 | 2027 | | 1,630.3 | 1,605.9 |
| 9 | 2028 | | 1,541.4 | 1,519.2 |
| 10 | 2029 | | 1,457.3 | 1,437.1 |
| 11 | 2030 | | 1,377.8 | 1,359.5 |
| 12 | 2031 | | 1,302.7 | 1,286.0 |
| 13 | 2032 | | 1,231.6 | 1,216.4 |
| 14 | 2033 | | 1,164.5 | 1,150.6 |
| 15 | 2034 | | 1,100.9 | 1,088.4 |
| 16 | 2035 | | 1,040.9 | 1,029.5 |
| 17 | 2036 | | 984.1 | 973.7 |
| 18 | 2037 | | 930.4 | 921.0 |
| 19 | 2038 | | 879.7 | 871.1 |
| 20 | 2039 | | 831.7 | 823.9 |
| 21 | 2040 | | 786.3 | 779.2 |
| 22 | 2041 | | 743.4 | 737.0 |
| 23 | 2042 | | 702.9 | 697.0 |
| 24 | 2043 | | 664.6 | 659.2 |
| 25 | 2044 | | 628.3 | 623.5 |
| 26 | 2045 | | 594.0 | 589.6 |
| 27 | 2046 | | 561.6 | 557.6 |
| 28 | 2047 | | 531.0 | 527.4 |
| 29 | 2048 | | 502.0 | 498.7 |
| 30 | 2049 | | 474.6 | 471.6 |
| 31 | 2050 | | 448.8 | 446.0 |
| 32 | 2051 | | 424.3 | 421.8 |
| 33 | 2052 | | 401.1 | 398.9 |
| 34 | 2053 | 25.23 | 379.3 | 377.2 |
| | | 3,932.4 | 26,864.0 | 22,626.5 |

5. O&M Cost

| | O&M Cost | Total | |
|---|---|---|---|
| 2020 | | 0 | |
| 2021 | | 0 | |
| 2022 | | 0 | |
| 2023 | | 0 | |
| 2024 | 47.674 | 47.674 | Opening |
| 2025 | 47.674 | 47.674 | |
| 2026 | 47.674 | 47.674 | |
| 2027 | 47.674 | 47.674 | |
| 2028 | 47.674 | 47.674 | |
| 2029 | 47.674 | 47.674 | |
| 2030 | 47.674 | 47.674 | |
| 2031 | 47.674 | 47.674 | |
| 2032 | 47.674 | 47.674 | |
| 2033 | 47.674 | 47.674 | |
| 2034 | 47.674 | 47.674 | |
| 2035 | 47.674 | 47.674 | |
| 2036 | 47.674 | 47.674 | |
| 2037 | 47.674 | 47.674 | |
| 2038 | 47.674 | 47.674 | |
| 2039 | 47.674 | 47.674 | |
| 2040 | 47.674 | 47.674 | |
| 2041 | 47.674 | 47.674 | |
| 2042 | 47.674 | 47.674 | |
| 2043 | 47.674 | 47.674 | |
| 2044 | 47.674 | 47.674 | |
| 2045 | 47.674 | 47.674 | |
| 2046 | 47.674 | 47.674 | |
| 2047 | 47.674 | 47.674 | |
| 2048 | 47.674 | 47.674 | |
| 2049 | 47.674 | 47.674 | |
| 2050 | 47.674 | 47.674 | |
| 2051 | 47.674 | 47.674 | |
| 2052 | 47.674 | 47.674 | |
| 2053 | 47.674 | 47.674 | |
| 2054 | 47.674 | 47.674 | |
| 2055 | 47.674 | 47.674 | |

| | |
|---|---|
| Net Present Value (Million peso) | 22,626.5 |
| B/C Ratio | 6.34 |
| EIRR | 47.2% |

## Step-3: Linked with Benefit

Since the opening of the road is scheduled to begin in May 2024, 8 months/12 months (0.67) was applied to the first year in 2024. The benefits in 2030 are calculated and multiplied by a growth rate of 4% before and after 2030.

To be insert the Title

Undiscounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|
| 1 | 2020 | 18.9 | | 0.0 | 18.9 | | -18.9 |
| 2 | 2021 | 113.7 | | 0.0 | 113.7 | | -113.7 |
| 3 | 2022 | 1,684.5 | | 0.0 | 1,684.5 | | -1,684.5 |
| 4 | 2023 | 2,469.9 | | 0.0 | 2,469.9 | | -2,469.9 |
| 5 | 2024 | 823.3 | 31.8 | 0.0 | 855.1 | 1,882.9 | 1,027.9 |
| 6 | 2025 | 0.0 | 47.7 | 0.0 | 47.7 | 2,937.4 | 2,889.7 |
| 7 | 2026 | 0.0 | 47.7 | 0.0 | 47.7 | 3,054.9 | 3,007.2 |
| 8 | 2027 | 0.0 | 47.7 | 0.0 | 47.7 | 3,177.1 | 3,129.4 |
| 9 | 2028 | 0.0 | 47.7 | 0.0 | 47.7 | 3,304.2 | 3,256.5 |
| 10 | 2029 | 0.0 | 47.7 | 0.0 | 47.7 | 3,436.3 | 3,388.6 |
| 11 | 2030 | 0.0 | 47.7 | 0.0 | 47.7 | 3,573.8 | 3,526.1 |
| 12 | 2031 | 0.0 | 47.7 | 0.0 | 47.7 | 3,716.7 | 3,669.0 |
| 13 | 2032 | 0.0 | 47.7 | 0.0 | 47.7 | 3,865.4 | 3,817.7 |
| 14 | 2033 | 0.0 | 47.7 | 0.0 | 47.7 | 4,020.0 | 3,972.3 |
| 15 | 2034 | 0.0 | 47.7 | 0.0 | 47.7 | 4,180.8 | 4,133.1 |
| 16 | 2035 | 0.0 | 47.7 | 0.0 | 47.7 | 4,348.0 | 4,300.4 |
| 17 | 2036 | 0.0 | 47.7 | 0.0 | 47.7 | 4,522.0 | 4,474.3 |
| 18 | 2037 | 0.0 | 47.7 | 0.0 | 47.7 | 4,702.8 | 4,655.2 |
| 19 | 2038 | 0.0 | 47.7 | 0.0 | 47.7 | 4,891.0 | 4,843.3 |
| 20 | 2039 | 0.0 | 47.7 | 0.0 | 47.7 | 5,086.6 | 5,038.9 |
| 21 | 2040 | 0.0 | 47.7 | 0.0 | 47.7 | 5,290.1 | 5,242.4 |
| 22 | 2041 | 0.0 | 47.7 | 0.0 | 47.7 | 5,501.7 | 5,454.0 |
| 23 | 2042 | 0.0 | 47.7 | 0.0 | 47.7 | 5,721.7 | 5,674.1 |
| 24 | 2043 | 0.0 | 47.7 | 0.0 | 47.7 | 5,950.6 | 5,902.9 |
| 25 | 2044 | 0.0 | 47.7 | 0.0 | 47.7 | 6,188.6 | 6,140.9 |
| 26 | 2045 | 0.0 | 47.7 | 0.0 | 47.7 | 6,436.2 | 6,388.5 |
| 27 | 2046 | 0.0 | 47.7 | 0.0 | 47.7 | 6,693.6 | 6,645.9 |
| 28 | 2047 | 0.0 | 47.7 | 0.0 | 47.7 | 6,961.4 | 6,913.7 |
| 29 | 2048 | 0.0 | 47.7 | 0.0 | 47.7 | 7,239.8 | 7,192.1 |
| 30 | 2049 | 0.0 | 47.7 | 0.0 | 47.7 | 7,529.4 | 7,481.7 |
| 31 | 2050 | 0.0 | 47.7 | 0.0 | 47.7 | 7,830.6 | 7,782.9 |
| 32 | 2051 | 0.0 | 47.7 | 0.0 | 47.7 | 8,143.8 | 8,096.1 |
| 33 | 2052 | 0.0 | 47.7 | 0.0 | 47.7 | 8,469.6 | 8,421.9 |
| 34 | 2053 | 0.0 | 47.7 | 0.0 | 47.7 | 8,808.3 | 8,760.7 |
| | | 5,110.3 | 1,414.3 | 0.0 | 6,524.6 | 157,465.1 | 150,940.5 |

Discounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Disco |
|---|---|---|
| 1 | 2020 | 1 |
| 2 | 2021 | 1 |
| 3 | 2022 | 1 |
| 4 | 2023 | 1 |
| 5 | 2024 | 1 |
| 6 | 2025 | 1 |
| 7 | 2026 | 1 |
| 8 | 2027 | 1 |
| 9 | 2028 | 2 |
| 10 | 2029 | 2 |
| 11 | 2030 | 2 |
| 12 | 2031 | 2 |
| 13 | 2032 | 3 |
| 14 | 2033 | 3 |
| 15 | 2034 | 3 |
| 16 | 2035 | 4 |
| 17 | | 4 |
| 18 | | 5 |
| 19 | | 5 |
| 20 | 2039 | 6 |
| 21 | 2040 | 6 |
| 22 | 2041 | 7 |
| 23 | 2042 | 8 |
| 24 | 2043 | 8 |
| 25 | 2044 | 9 |
| 26 | 2045 | 10 |
| 27 | 2046 | 11 |
| 28 | 2047 | 11 |
| 29 | 2048 | 14 |
| 30 | 2049 | 15 |
| 31 | 2050 | 17 |
| 32 | 2051 | 19 |
| 33 | 2052 | 21 |
| 34 | 2053 | 23 |

7. Benefit

Unit: Mill Pesos/year

| | VOC | TTC | Total |
|---|---|---|---|
| 2020 | | | 0 |
| 2021 | | | 0 |
| 2022 | | | 0 |
| 2023 | | | 0 |
| 2024 | 1,323.6 | 1,500.8 | 2,824.4 |
| 2025 | 1,376.5 | 1,560.8 | 2,937.4 |
| 2026 | 1,431.6 | 1,623.3 | 3,054.9 |
| 2027 | 1,488.9 | 1,688.2 | 3,177.1 |
| 2028 | 1,548.4 | 1,755.7 | 3,304.2 |
| 2029 | 1,610.4 | 1,826.0 | 3,436.3 |
| 2030 | 1,674.8 | 1,899.0 | 3,573.8 |
| 2031 | 1,741.8 | 1,975.0 | 3,716.7 |
| 2032 | 1,811.4 | 2,054.0 | 3,865.4 |
| 2033 | 1,883.9 | 2,136.1 | 4,020.0 |
| 2034 | 1,959.3 | 2,221.6 | 4,180.8 |
| 2035 | 2,037.6 | 2,310.4 | 4,348.0 |
| 2036 | 2,119.1 | 2,402.8 | 4,522.0 |
| 2037 | 2,203.9 | 2,498.9 | 4,702.8 |
| 2038 | 2,292.0 | 2,598.9 | 4,891.0 |
| 2039 | 2,383.7 | 2,702.9 | 5,086.6 |
| 2040 | 2,479.1 | 2,811.0 | 5,290.1 |
| 2041 | 2,578.2 | 2,923.4 | 5,501.7 |
| 2042 | 2,681.4 | 3,040.4 | 5,721.7 |
| 2043 | 2,788.6 | 3,162.0 | 5,950.6 |
| 2044 | 2,900.2 | 3,288.4 | 6,188.6 |
| 2045 | 3,016.2 | 3,420.0 | 6,436.2 |
| 2046 | 3,136.8 | 3,556.8 | 6,693.6 |
| 2047 | 3,262.3 | 3,699.1 | 6,961.4 |
| 2048 | 3,392.8 | 3,847.0 | 7,239.8 |
| 2049 | 3,528.5 | 4,000.9 | 7,529.4 |
| 2050 | 3,669.6 | 4,160.9 | 7,830.6 |
| 2051 | 3,816.4 | 4,327.4 | 8,143.8 |
| 2052 | 3,969.1 | 4,500.5 | 8,469.6 |
| 2053 | 4,127.9 | 4,680.5 | 8,808.3 |
| 2054 | 4,293.0 | 4,867.7 | 9,160.7 |
| 2055 | 4,464.7 | 5,062.4 | 9,527.1 |
| | 3,932.4 | 305.1 | 0.0 | 4,237.5 | 26,864.0 | 22,626.5 |

Growth Rate

| VOC | TTC |
|---|---|
| 1.04 | 1.04 |

Opening Year

| | |
|---|---|
| Net Present Value (Million peso) | 22,626.5 |
| B/C Ratio | 6.34 |
| EIRR | 47.2% |

## Step-4: Discount Rate

As indicated in the General Sheet, a Discount Rate of 10% is applied. Each cost (Economic Cost, O&M Cost, Disruption Cost and Benefit) is multiplied by this Discount Rate.

To be insert the Title

Undiscounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|
| 1 | 2020 | 18.9 | | 0.0 | 18.9 | | -18.9 |
| 2 | 2021 | 113.7 | | 0.0 | 113.7 | | -113.7 |
| 3 | 2022 | 1,684.5 | | 0.0 | 1,684.5 | | -1,684.5 |
| 4 | 2023 | 2,469.9 | | 0.0 | 2,469.9 | | -2,469.9 |
| 5 | 2024 | 823.3 | 31.8 | 0.0 | 855.1 | 1,882.9 | 1,027.9 |
| 6 | 2025 | 0.0 | 47.7 | 0.0 | 47.7 | 2,937.4 | 2,889.7 |
| 7 | 2026 | 0.0 | 47.7 | 0.0 | 47.7 | 3,054.9 | 3,007.2 |
| 8 | 2027 | 0.0 | 47.7 | 0.0 | 47.7 | 3,177.1 | 3,129.4 |
| 9 | 2028 | 0.0 | 47.7 | 0.0 | 47.7 | 3,304.2 | 3,256.5 |
| 10 | 2029 | 0.0 | 47.7 | 0.0 | 47.7 | 3,436.3 | 3,388.6 |
| 11 | 2030 | 0.0 | 47.7 | 0.0 | 47.7 | 3,573.8 | 3,526.1 |
| 12 | 2031 | 0.0 | 47.7 | 0.0 | 47.7 | 3,716.7 | 3,669.0 |
| 13 | 2032 | 0.0 | 47.7 | 0.0 | 47.7 | 3,865.4 | 3,817.7 |
| 14 | 2033 | 0.0 | 47.7 | 0.0 | 47.7 | 4,020.0 | 3,972.3 |
| 15 | 2034 | 0.0 | 47.7 | 0.0 | 47.7 | 4,180.8 | 4,133.1 |
| 16 | 2035 | 0.0 | 47.7 | 0.0 | 47.7 | 4,348.0 | 4,300.4 |
| 17 | 2036 | 0.0 | 47.7 | 0.0 | 47.7 | 4,522.0 | 4,474.3 |
| 18 | 2037 | 0.0 | 47.7 | 0.0 | 47.7 | 4,702.8 | 4,655.2 |
| 19 | 2038 | 0.0 | 47.7 | 0.0 | 47.7 | 4,891.0 | 4,843.3 |
| 20 | 2039 | 0.0 | 47.7 | 0.0 | 47.7 | 5,086.6 | 5,038.9 |
| 21 | 2040 | 0.0 | 47.7 | 0.0 | 47.7 | 5,290.1 | 5,242.4 |
| 22 | 2041 | 0.0 | 47.7 | 0.0 | 47.7 | 5,501.7 | 5,454.0 |
| 23 | 2042 | 0.0 | 47.7 | 0.0 | 47.7 | 5,721.7 | 5,674.1 |
| 24 | 2043 | 0.0 | 47.7 | 0.0 | 47.7 | 5,950.6 | 5,902.9 |
| 25 | 2044 | 0.0 | 47.7 | 0.0 | 47.7 | 6,188.6 | 6,140.9 |
| 26 | 2045 | 0.0 | 47.7 | 0.0 | 47.7 | 6,436.2 | 6,388.5 |
| 27 | 2046 | 0.0 | 47.7 | 0.0 | 47.7 | 6,693.6 | 6,645.9 |
| 28 | 2047 | 0.0 | 47.7 | 0.0 | 47.7 | 6,961.4 | 6,913.7 |
| 29 | 2048 | 0.0 | 47.7 | 0.0 | 47.7 | 7,239.8 | 7,192.1 |
| 30 | 2049 | 0.0 | 47.7 | 0.0 | 47.7 | 7,529.4 | 7,481.7 |
| 31 | 2050 | 0.0 | 47.7 | 0.0 | 47.7 | 7,830.6 | 7,782.9 |
| 32 | 2051 | 0.0 | 47.7 | 0.0 | 47.7 | 8,143.8 | 8,096.1 |
| 33 | 2052 | 0.0 | 47.7 | 0.0 | 47.7 | 8,469.6 | 8,421.9 |
| 34 | 2053 | 0.0 | 47.7 | 0.0 | 47.7 | 8,808.3 | 8,760.7 |
| | | 5,110.3 | 1,414.3 | 0.0 | 6,524.6 | 157,465.1 | 150,940.5 |

Discounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Discounte | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|---|
| 1 | 2020 | 1.00 | 18.9 | | 0.0 | 18.9 | | -18.9 |
| 2 | 2021 | 1.10 | 103.4 | | 0.0 | 103.4 | | -103.4 |
| 3 | 2022 | 1.21 | 1,392.1 | | 0.0 | 1,392.1 | | -1,392.1 |
| 4 | 2023 | 1.33 | 1,855.6 | | 0.0 | 1,855.6 | | -1,855.6 |
| 5 | 2024 | 1.46 | 562.3 | | 0.0 | 562.3 | | -562.3 |
| 6 | 2025 | 1.61 | 0.0 | 29.6 | 0.0 | 29.6 | 1,823.9 | 1,794.3 |
| 7 | 2026 | 1.77 | 0.0 | 26.9 | 0.0 | 26.9 | 1,724.4 | 1,697.5 |
| 8 | 2027 | 1.95 | 0.0 | 24.5 | 0.0 | 24.5 | 1,630.3 | 1,605.9 |
| 9 | 2028 | 2.14 | 0.0 | 22.2 | 0.0 | 22.2 | 1,541.4 | 1,519.2 |
| 10 | 2029 | 2.36 | 0.0 | 20.2 | 0.0 | 20.2 | 1,457.3 | 1,437.1 |
| 11 | 2030 | 2.59 | 0.0 | 18.4 | 0.0 | 18.4 | 1,377.8 | 1,359.5 |
| 12 | 2031 | 2.85 | 0.0 | 16.7 | 0.0 | 16.7 | 1,302.7 | 1,286.0 |
| 13 | 2032 | 3.14 | 0.0 | 15.2 | 0.0 | 15.2 | 1,231.6 | 1,216.4 |
| 14 | 2033 | 3.45 | 0.0 | 13.8 | 0.0 | 13.8 | 1,164.5 | 1,150.6 |
| 15 | 2034 | 3.80 | 0.0 | 12.6 | 0.0 | 12.6 | 1,100.9 | 1,088.4 |
| 16 | 2035 | 4.18 | 0.0 | 11.4 | 0.0 | 11.4 | 1,040.9 | 1,029.5 |
| 17 | 2036 | 4.59 | 0.0 | 10.4 | 0.0 | 10.4 | 984.1 | 973.7 |
| 18 | 2037 | 5.05 | 0.0 | 9.4 | 0.0 | 9.4 | 930.4 | 921.0 |
| 19 | 2038 | 5.56 | 0.0 | 8.6 | 0.0 | 8.6 | 879.7 | 871.1 |
| 20 | 2039 | 6.12 | 0.0 | 7.8 | 0.0 | 7.8 | 831.7 | 823.9 |
| 21 | 2040 | 6.73 | 0.0 | 7.1 | 0.0 | 7.1 | 786.3 | 779.2 |
| 22 | 2041 | 7.40 | 0.0 | 6.4 | 0.0 | 6.4 | 743.4 | 737.0 |
| 23 | 2042 | 8.14 | 0.0 | 5.9 | 0.0 | 5.9 | 702.9 | 697.0 |
| 24 | 2043 | 8.95 | 0.0 | 5.3 | 0.0 | 5.3 | 664.6 | 659.2 |
| 25 | 2044 | 9.85 | 0.0 | 4.8 | 0.0 | 4.8 | 628.3 | 623.5 |
| 26 | 2045 | 10.83 | 0.0 | 4.4 | 0.0 | 4.4 | 594.0 | 589.6 |
| 27 | 2046 | 11.92 | 0.0 | 4.0 | 0.0 | 4.0 | 561.6 | 557.6 |
| 28 | 2047 | 13.11 | 0.0 | 3.6 | 0.0 | 3.6 | 531.0 | 527.4 |
| 29 | 2048 | 14.42 | 0.0 | 3.3 | 0.0 | 3.3 | 502.0 | 498.7 |
| 30 | 2049 | 15.86 | 0.0 | 3.0 | 0.0 | 3.0 | 474.6 | 471.6 |
| 31 | 2050 | 17.45 | 0.0 | 2.7 | 0.0 | 2.7 | 448.8 | 446.0 |
| 32 | 2051 | 19.19 | 0.0 | 2.5 | 0.0 | 2.5 | 424.3 | 421.8 |
| 33 | 2052 | 21.11 | 0.0 | 2.3 | 0.0 | 2.3 | 401.1 | 398.9 |
| 34 | 2053 | 23.23 | 0.0 | 2.1 | 0.0 | 2.1 | 379.3 | 377.2 |
| | | | 3,932.4 | 305.1 | 0.0 | 4,237.5 | 26,864.0 | 22,626.5 |

| | |
|---|---|
| Net Present Value (Million peso) | 22,626.5 |
| B/C Ratio | 6.34 |
| EIRR | 47.2% |

## Step-5: Calculation of EIRR

EIRR is calculated by the formula based on Benefit-Cost in undiscounted benefit cost stream.

Formula: EIRR = IRR(Red Area,0.2)

To be insert the Title

Undiscounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|
| 1 | 2020 | 18.9 | | 0.0 | 18.9 | | -18.9 |
| 2 | 2021 | 113.7 | | 0.0 | 113.7 | | -113.7 |
| 3 | 2022 | 1,684.5 | | 0.0 | 1,684.5 | | -1,684.5 |
| 4 | 2023 | 2,469.9 | | 0.0 | 2,469.9 | | -2,469.9 |
| 5 | 2024 | 823.3 | 31.8 | 0.0 | 855.1 | 1,882.5 | 1,027.9 |
| 6 | 2025 | 0.0 | 47.7 | 0.0 | 47.7 | 2,937.4 | 2,889.7 |
| 7 | 2026 | 0.0 | 47.7 | 0.0 | 47.7 | 3,054.9 | 3,007.2 |
| 8 | 2027 | 0.0 | 47.7 | 0.0 | 47.7 | 3,177.1 | 3,129.4 |
| 9 | 2028 | 0.0 | 47.7 | 0.0 | 47.7 | 3,304.2 | 3,256.5 |
| 10 | 2029 | 0.0 | 47.7 | 0.0 | 47.7 | 3,436.3 | 3,388.6 |
| 11 | 2030 | 0.0 | 47.7 | 0.0 | 47.7 | 3,573.8 | 3,526.1 |
| 12 | 2031 | 0.0 | 47.7 | 0.0 | 47.7 | 3,716.7 | 3,669.0 |
| 13 | 2032 | 0.0 | 47.7 | 0.0 | 47.7 | 3,865.4 | 3,817.7 |
| 14 | 2033 | 0.0 | 47.7 | 0.0 | 47.7 | 4,020.0 | 3,972.3 |
| 15 | 2034 | 0.0 | 47.7 | 0.0 | 47.7 | 4,180.8 | 4,133.1 |
| 16 | 2035 | 0.0 | 47.7 | 0.0 | 47.7 | 4,348.0 | 4,300.4 |
| 17 | 2036 | 0.0 | 47.7 | 0.0 | 47.7 | 4,522.0 | 4,474.3 |
| 18 | 2037 | 0.0 | 47.7 | 0.0 | 47.7 | 4,702.9 | 4,655.2 |
| 19 | 2038 | 0.0 | 47.7 | 0.0 | 47.7 | 4,891.0 | 4,843.3 |
| 20 | 2039 | 0.0 | 47.7 | 0.0 | 47.7 | 5,086.6 | 5,038.9 |
| 21 | 2040 | 0.0 | 47.7 | 0.0 | 47.7 | 5,290.1 | 5,242.4 |
| 22 | 2041 | 0.0 | 47.7 | 0.0 | 47.7 | 5,501.7 | 5,454.0 |
| 23 | 2042 | 0.0 | 47.7 | 0.0 | 47.7 | 5,721.7 | 5,674.1 |
| 24 | 2043 | 0.0 | 47.7 | 0.0 | 47.7 | 5,950.6 | 5,902.9 |
| 25 | 2044 | 0.0 | 47.7 | 0.0 | 47.7 | 6,188.6 | 6,140.9 |
| 26 | 2045 | 0.0 | 47.7 | 0.0 | 47.7 | 6,436.2 | 6,388.5 |
| 27 | 2046 | 0.0 | 47.7 | 0.0 | 47.7 | 6,693.6 | 6,645.9 |
| 28 | 2047 | 0.0 | 47.7 | 0.0 | 47.7 | 6,961.4 | 6,913.7 |
| 29 | 2048 | 0.0 | 47.7 | 0.0 | 47.7 | 7,239.8 | 7,192.1 |
| 30 | 2049 | 0.0 | 47.7 | 0.0 | 47.7 | 7,529.4 | 7,481.7 |
| 31 | 2050 | 0.0 | 47.7 | 0.0 | 47.7 | 7,830.6 | 7,782.9 |
| 32 | 2051 | 0.0 | 47.7 | 0.0 | 47.7 | 8,143.8 | 8,096.1 |
| 33 | 2052 | 0.0 | 47.7 | 0.0 | 47.7 | 8,469.6 | 8,421.9 |
| 34 | 2053 | 0.0 | 47.7 | 0.0 | 47.7 | 8,808.3 | 8,760.7 |
| | | 5,110.3 | 1,414.3 | 0.0 | 6,524.6 | 157,465.1 | 150,940.5 |

Discounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Discounted | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|---|
| 1 | 2020 | 1.00 | 18.9 | | 0.0 | 18.9 | | -18.9 |
| 2 | 2021 | 1.10 | 103.4 | | 0.0 | 103.4 | | -103.4 |
| 3 | 2022 | 1.21 | 1,392.1 | | 0.0 | 1,392.1 | | -1,392.1 |
| 4 | 2023 | 1.33 | 1,855.6 | | 0.0 | 1,855.6 | | -1,855.6 |
| 5 | 2024 | 1.46 | 562.3 | | 0.0 | 562.3 | | -562.3 |
| 6 | 2025 | 1.61 | 0.0 | 29.6 | 0.0 | 29.6 | 1,823.9 | 1,794.3 |
| 7 | 2026 | 1.77 | 0.0 | 26.9 | 0.0 | 26.9 | 1,724.4 | 1,697.5 |
| 8 | 2027 | 1.95 | 0.0 | 24.5 | 0.0 | 24.5 | 1,630.3 | 1,605.9 |
| 9 | 2028 | 2.14 | 0.0 | 22.2 | 0.0 | 22.2 | 1,541.4 | 1,519.2 |
| 10 | 2029 | 2.36 | 0.0 | 20.2 | 0.0 | 20.2 | 1,457.3 | 1,437.1 |
| 11 | 2030 | 2.59 | 0.0 | 18.4 | 0.0 | 18.4 | 1,377.8 | 1,359.5 |
| 12 | 2031 | 2.85 | 0.0 | 16.7 | 0.0 | 16.7 | 1,302.7 | 1,286.0 |
| 13 | 2032 | 3.14 | 0.0 | 15.2 | 0.0 | 15.2 | 1,231.6 | 1,216.4 |
| 14 | 2033 | 3.45 | 0.0 | 13.8 | 0.0 | 13.8 | 1,164.5 | 1,150.6 |
| 15 | 2034 | 3.80 | 0.0 | 12.6 | 0.0 | 12.6 | 1,100.9 | 1,088.4 |
| 16 | 2035 | 4.18 | 0.0 | 11.4 | 0.0 | 11.4 | 1,040.9 | 1,029.5 |
| 17 | 2036 | 4.59 | 0.0 | 10.4 | 0.0 | 10.4 | 984.1 | 973.7 |
| 18 | 2037 | 5.05 | 0.0 | 9.4 | 0.0 | 9.4 | 930.4 | 921.0 |
| 19 | 2038 | 5.56 | 0.0 | 8.6 | 0.0 | 8.6 | 879.7 | 871.1 |
| 20 | 2039 | 6.12 | 0.0 | 7.8 | 0.0 | 7.8 | 831.7 | 823.9 |
| 21 | 2040 | 6.73 | 0.0 | 7.1 | 0.0 | 7.1 | 786.3 | 779.2 |
| 22 | 2041 | 7.40 | 0.0 | 6.4 | 0.0 | 6.4 | 743.4 | 737.0 |
| 23 | 2042 | 8.14 | 0.0 | 5.9 | 0.0 | 5.9 | 702.9 | 697.0 |
| 24 | 2043 | 8.95 | 0.0 | 5.3 | 0.0 | 5.3 | 664.6 | 659.2 |
| 25 | 2044 | 9.85 | 0.0 | 4.8 | 0.0 | 4.8 | 628.3 | 623.5 |
| 26 | 2045 | 10.83 | 0.0 | 4.4 | 0.0 | 4.4 | 594.0 | 589.6 |
| 27 | 2046 | 11.92 | 0.0 | 4.0 | 0.0 | 4.0 | 561.6 | 557.6 |
| 28 | 2047 | 13.11 | 0.0 | 3.6 | 0.0 | 3.6 | 531.0 | 527.4 |
| 29 | 2048 | 14.42 | 0.0 | 3.3 | 0.0 | 3.3 | 502.0 | 498.7 |
| 30 | 2049 | 15.86 | 0.0 | 3.0 | 0.0 | 3.0 | 474.6 | 471.6 |
| 31 | 2050 | 17.45 | 0.0 | 2.7 | 0.0 | 2.7 | 448.8 | 446.0 |
| 32 | 2051 | 19.19 | 0.0 | 2.5 | 0.0 | 2.5 | 424.3 | 421.8 |
| 33 | 2052 | 21.11 | 0.0 | 2.3 | 0.0 | 2.3 | 401.1 | 398.9 |
| 34 | 2053 | 23.23 | 0.0 | 2.1 | 0.0 | 2.1 | 379.3 | 377.2 |
| | | | 3,932.4 | 305.1 | 0.0 | 4,237.5 | 26,864.0 | 22,626.5 |

| | |
|---|---|
| Net Present Value (Million peso) | 22,626.5 |
| B/C Ratio | 6.34 |
| EIRR | 47.2% |

## Step-6: Calculation of B/C

B/C is calculated by formula based on Benefit-Cost in discounted benefit cost stream.

Formula: B/C= Benefit / Cost Total

To be insert the Title

Undiscounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|
| 1 | 2020 | 18.9 | | 0.0 | 18.9 | | -18.9 |
| 2 | 2021 | 113.7 | | 0.0 | 113.7 | | -113.7 |
| 3 | 2022 | 1,684.5 | | 0.0 | 1,684.5 | | -1,684.5 |
| 4 | 2023 | 2,469.9 | | 0.0 | 2,469.9 | | -2,469.9 |
| 5 | 2024 | 823.3 | 31.8 | 0.0 | 855.1 | 1,882.9 | 1,027.9 |
| 6 | 2025 | 0.0 | 47.7 | 0.0 | 47.7 | 2,937.4 | 2,889.7 |
| 7 | 2026 | 0.0 | 47.7 | 0.0 | 47.7 | 3,054.9 | 3,007.2 |
| 8 | 2027 | 0.0 | 47.7 | 0.0 | 47.7 | 3,177.1 | 3,129.4 |
| 9 | 2028 | 0.0 | 47.7 | 0.0 | 47.7 | 3,304.2 | 3,256.5 |
| 10 | 2029 | 0.0 | 47.7 | 0.0 | 47.7 | 3,436.3 | 3,388.6 |
| 11 | 2030 | 0.0 | 47.7 | 0.0 | 47.7 | 3,573.8 | 3,526.1 |
| 12 | 2031 | 0.0 | 47.7 | 0.0 | 47.7 | 3,716.7 | 3,669.0 |
| 13 | 2032 | 0.0 | 47.7 | 0.0 | 47.7 | 3,865.4 | 3,817.7 |
| 14 | 2033 | 0.0 | 47.7 | 0.0 | 47.7 | 4,020.0 | 3,972.3 |
| 15 | 2034 | 0.0 | 47.7 | 0.0 | 47.7 | 4,180.8 | 4,133.1 |
| 16 | 2035 | 0.0 | 47.7 | 0.0 | 47.7 | 4,348.0 | 4,300.4 |
| 17 | 2036 | 0.0 | 47.7 | 0.0 | 47.7 | 4,522.0 | 4,474.3 |
| 18 | 2037 | 0.0 | 47.7 | 0.0 | 47.7 | 4,702.8 | 4,655.2 |
| 19 | 2038 | 0.0 | 47.7 | 0.0 | 47.7 | 4,891.0 | 4,843.3 |
| 20 | 2039 | 0.0 | 47.7 | 0.0 | 47.7 | 5,086.6 | 5,038.9 |
| 21 | 2040 | 0.0 | 47.7 | 0.0 | 47.7 | 5,290.1 | 5,242.4 |
| 22 | 2041 | 0.0 | 47.7 | 0.0 | 47.7 | 5,501.7 | 5,454.0 |
| 23 | 2042 | 0.0 | 47.7 | 0.0 | 47.7 | 5,721.7 | 5,674.1 |
| 24 | 2043 | 0.0 | 47.7 | 0.0 | 47.7 | 5,950.6 | 5,902.9 |
| 25 | 2044 | 0.0 | 47.7 | 0.0 | 47.7 | 6,188.6 | 6,140.9 |
| 26 | 2045 | 0.0 | 47.7 | 0.0 | 47.7 | 6,436.2 | 6,388.5 |
| 27 | 2046 | 0.0 | 47.7 | 0.0 | 47.7 | 6,693.6 | 6,645.9 |
| 28 | 2047 | 0.0 | 47.7 | 0.0 | 47.7 | 6,961.4 | 6,913.7 |
| 29 | 2048 | 0.0 | 47.7 | 0.0 | 47.7 | 7,239.8 | 7,192.1 |
| 30 | 2049 | 0.0 | 47.7 | 0.0 | 47.7 | 7,529.4 | 7,481.7 |
| 31 | 2050 | 0.0 | 47.7 | 0.0 | 47.7 | 7,830.6 | 7,782.9 |
| 32 | 2051 | 0.0 | 47.7 | 0.0 | 47.7 | 8,143.8 | 8,096.1 |
| 33 | 2052 | 0.0 | 47.7 | 0.0 | 47.7 | 8,469.6 | 8,421.9 |
| 34 | 2053 | 0.0 | 47.7 | 0.0 | 47.7 | 8,808.3 | 8,760.7 |
| | | 5,110.3 | 1,414.3 | 0.0 | 6,524.6 | 157,465.1 | 150,940.5 |

Discounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Discounted | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|---|
| 1 | 2020 | 1.00 | 18.9 | | 0.0 | 18.9 | | -18.9 |
| 2 | 2021 | 1.10 | 103.4 | | 0.0 | 103.4 | | -103.4 |
| 3 | 2022 | 1.21 | 1,392.1 | | 0.0 | 1,392.1 | | -1,392.1 |
| 4 | 2023 | 1.33 | 1,855.6 | | 0.0 | 1,855.6 | | -1,855.6 |
| 5 | 2024 | 1.46 | 562.3 | | 0.0 | 562.3 | | -562.3 |
| 6 | 2025 | 1.61 | 0.0 | 29.6 | 0.0 | 29.6 | 1,823.9 | 1,794.3 |
| 7 | 2026 | 1.77 | 0.0 | 26.9 | 0.0 | 26.9 | 1,724.4 | 1,697.5 |
| 8 | 2027 | 1.95 | 0.0 | 24.5 | 0.0 | 24.5 | 1,630.3 | 1,605.9 |
| 9 | 2028 | 2.14 | 0.0 | 22.2 | 0.0 | 22.2 | 1,541.4 | 1,519.2 |
| 10 | 2029 | 2.36 | 0.0 | 20.2 | 0.0 | 20.2 | 1,457.3 | 1,437.1 |
| 11 | 2030 | 2.59 | 0.0 | 18.4 | 0.0 | 18.4 | 1,377.8 | 1,359.5 |
| 12 | 2031 | 2.85 | 0.0 | 16.7 | 0.0 | 16.7 | 1,302.7 | 1,286.0 |
| 13 | 2032 | 3.14 | 0.0 | 15.2 | 0.0 | 15.2 | 1,231.6 | 1,216.4 |
| 14 | 2033 | 3.45 | 0.0 | 13.8 | 0.0 | 13.8 | 1,164.5 | 1,150.6 |
| 15 | 2034 | 3.80 | 0.0 | 12.6 | 0.0 | 12.6 | 1,100.9 | 1,088.4 |
| 16 | 2035 | 4.18 | 0.0 | 11.4 | 0.0 | 11.4 | 1,040.9 | 1,029.5 |
| 17 | 2036 | 4.59 | 0.0 | 10.4 | 0.0 | 10.4 | 984.1 | 973.7 |
| 18 | 2037 | 5.05 | 0.0 | 9.4 | 0.0 | 9.4 | 930.4 | 921.0 |
| 19 | 2038 | 5.56 | 0.0 | 8.6 | 0.0 | 8.6 | 879.7 | 871.1 |
| 20 | 2039 | 6.12 | 0.0 | 7.8 | 0.0 | 7.8 | 831.7 | 823.9 |
| 21 | 2040 | 6.73 | 0.0 | 7.1 | 0.0 | 7.1 | 786.3 | 779.2 |
| 22 | 2041 | 7.40 | 0.0 | 6.4 | 0.0 | 6.4 | 743.4 | 737.0 |
| 23 | 2042 | 8.14 | 0.0 | 5.9 | 0.0 | 5.9 | 702.9 | 697.0 |
| 24 | 2043 | 8.95 | 0.0 | 5.3 | 0.0 | 5.3 | 664.6 | 659.2 |
| 25 | 2044 | 9.85 | 0.0 | 4.8 | 0.0 | 4.8 | 628.3 | 623.5 |
| 26 | 2045 | 10.83 | 0.0 | 4.4 | 0.0 | 4.4 | 594.0 | 589.6 |
| 27 | 2046 | 11.92 | 0.0 | 4.0 | 0.0 | 4.0 | 561.6 | 557.6 |
| 28 | 2047 | 13.11 | 0.0 | 3.6 | 0.0 | 3.6 | 531.0 | 527.4 |
| 29 | 2048 | 14.42 | 0.0 | 3.3 | 0.0 | 3.3 | 502.0 | 498.7 |
| 30 | 2049 | 15.86 | 0.0 | 3.0 | 0.0 | 3.0 | 474.6 | 471.6 |
| 31 | 2050 | 17.45 | 0.0 | 2.7 | 0.0 | 2.7 | 448.8 | 446.0 |
| 32 | 2051 | 19.19 | 0.0 | 2.5 | 0.0 | 2.5 | 424.3 | 421.8 |
| 33 | 2052 | 21.11 | 0.0 | 2.3 | 0.0 | 2.3 | 401.1 | 398.9 |
| 34 | 2053 | 23.23 | 0.0 | 2.1 | 0.0 | 2.1 | 379.3 | 377.2 |
| | | | 3,932.4 | 305.1 | 0.0 | 4,237.5 | 26,864.0 | 22,626.5 |

| | |
|---|---|
| Net Present Value (Million peso) | 22,626.5 |
| B/C Ratio | 6.34 |
| EIRR | 47.2% |

## Step-7: Calculation of NPV

NPV is calculated by total Benefit – Cost in discounted benefit cost stream.

To be insert the Title

Undiscounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|
| 1 | 2020 | 18.9 | | 0.0 | 18.9 | | -18.9 |
| 2 | 2021 | 113.7 | | 0.0 | 113.7 | | -113.7 |
| 3 | 2022 | 1,684.5 | | 0.0 | 1,684.5 | | -1,684.5 |
| 4 | 2023 | 2,469.9 | | 0.0 | 2,469.9 | | -2,469.9 |
| 5 | 2024 | 823.3 | 31.8 | 0.0 | 855.1 | 1,882.9 | 1,027.9 |
| 6 | 2025 | 0.0 | 47.7 | 0.0 | 47.7 | 2,937.4 | 2,889.7 |
| 7 | 2026 | 0.0 | 47.7 | 0.0 | 47.7 | 3,054.9 | 3,007.2 |
| 8 | 2027 | 0.0 | 47.7 | 0.0 | 47.7 | 3,177.1 | 3,129.4 |
| 9 | 2028 | 0.0 | 47.7 | 0.0 | 47.7 | 3,304.2 | 3,256.5 |
| 10 | 2029 | 0.0 | 47.7 | 0.0 | 47.7 | 3,436.3 | 3,388.6 |
| 11 | 2030 | 0.0 | 47.7 | 0.0 | 47.7 | 3,573.8 | 3,526.1 |
| 12 | 2031 | 0.0 | 47.7 | 0.0 | 47.7 | 3,716.7 | 3,669.0 |
| 13 | 2032 | 0.0 | 47.7 | 0.0 | 47.7 | 3,865.4 | 3,817.7 |
| 14 | 2033 | 0.0 | 47.7 | 0.0 | 47.7 | 4,020.0 | 3,972.3 |
| 15 | 2034 | 0.0 | 47.7 | 0.0 | 47.7 | 4,180.8 | 4,133.1 |
| 16 | 2035 | 0.0 | 47.7 | 0.0 | 47.7 | 4,348.0 | 4,300.4 |
| 17 | 2036 | 0.0 | 47.7 | 0.0 | 47.7 | 4,522.0 | 4,474.3 |
| 18 | 2037 | 0.0 | 47.7 | 0.0 | 47.7 | 4,702.8 | 4,655.2 |
| 19 | 2038 | 0.0 | 47.7 | 0.0 | 47.7 | 4,891.0 | 4,843.3 |
| 20 | 2039 | 0.0 | 47.7 | 0.0 | 47.7 | 5,086.6 | 5,038.9 |
| 21 | 2040 | 0.0 | 47.7 | 0.0 | 47.7 | 5,290.1 | 5,242.4 |
| 22 | 2041 | 0.0 | 47.7 | 0.0 | 47.7 | 5,501.7 | 5,454.0 |
| 23 | 2042 | 0.0 | 47.7 | 0.0 | 47.7 | 5,721.7 | 5,674.1 |
| 24 | 2043 | 0.0 | 47.7 | 0.0 | 47.7 | 5,950.6 | 5,902.9 |
| 25 | 2044 | 0.0 | 47.7 | 0.0 | 47.7 | 6,188.6 | 6,140.9 |
| 26 | 2045 | 0.0 | 47.7 | 0.0 | 47.7 | 6,436.2 | 6,388.5 |
| 27 | 2046 | 0.0 | 47.7 | 0.0 | 47.7 | 6,693.6 | 6,645.9 |
| 28 | 2047 | 0.0 | 47.7 | 0.0 | 47.7 | 6,961.4 | 6,913.7 |
| 29 | 2048 | 0.0 | 47.7 | 0.0 | 47.7 | 7,239.8 | 7,192.1 |
| 30 | 2049 | 0.0 | 47.7 | 0.0 | 47.7 | 7,529.4 | 7,481.7 |
| 31 | 2050 | 0.0 | 47.7 | 0.0 | 47.7 | 7,830.6 | 7,782.9 |
| 32 | 2051 | 0.0 | 47.7 | 0.0 | 47.7 | 8,143.8 | 8,096.1 |
| 33 | 2052 | 0.0 | 47.7 | 0.0 | 47.7 | 8,469.6 | 8,421.9 |
| 34 | 2053 | 0.0 | 47.7 | 0.0 | 47.7 | 8,808.3 | 8,760.7 |
| | | 5,110.3 | 1,414.3 | 0.0 | 6,524.6 | 157,465.1 | 150,940.5 |

Discounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Discounted | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|---|
| 1 | 2020 | 1.00 | 18.9 | | 0.0 | 18.9 | | -18.9 |
| 2 | 2021 | 1.10 | 103.4 | | 0.0 | 103.4 | | -103.4 |
| 3 | 2022 | 1.21 | 1,392.1 | | 0.0 | 1,392.1 | | -1,392.1 |
| 4 | 2023 | 1.33 | 1,855.6 | | 0.0 | 1,855.6 | | -1,855.6 |
| 5 | 2024 | 1.46 | 562.3 | | 0.0 | 562.3 | | -562.3 |
| 6 | 2025 | 1.61 | 0.0 | 29.6 | 0.0 | 29.6 | 1,823.9 | 1,794.3 |
| 7 | 2026 | 1.77 | 0.0 | 26.9 | 0.0 | 26.9 | 1,724.4 | 1,697.5 |
| 8 | 2027 | 1.95 | 0.0 | 24.5 | 0.0 | 24.5 | 1,630.3 | 1,605.9 |
| 9 | 2028 | 2.14 | 0.0 | 22.2 | 0.0 | 22.2 | 1,541.4 | 1,519.2 |
| 10 | 2029 | 2.36 | 0.0 | 20.2 | 0.0 | 20.2 | 1,457.3 | 1,437.1 |
| 11 | 2030 | 2.59 | 0.0 | 18.4 | 0.0 | 18.4 | 1,377.8 | 1,359.5 |
| 12 | 2031 | 2.85 | 0.0 | 16.7 | 0.0 | 16.7 | 1,302.7 | 1,286.0 |
| 13 | 2032 | 3.14 | 0.0 | 15.2 | 0.0 | 15.2 | 1,231.6 | 1,216.4 |
| 14 | 2033 | 3.45 | 0.0 | 13.8 | 0.0 | 13.8 | 1,164.5 | 1,150.6 |
| 15 | 2034 | 3.80 | 0.0 | 12.6 | 0.0 | 12.6 | 1,100.9 | 1,088.4 |
| 16 | 2035 | 4.18 | 0.0 | 11.4 | 0.0 | 11.4 | 1,040.9 | 1,029.5 |
| 17 | 2036 | 4.59 | 0.0 | 10.4 | 0.0 | 10.4 | 984.1 | 973.7 |
| 18 | 2037 | 5.05 | 0.0 | 9.4 | 0.0 | 9.4 | 930.4 | 921.0 |
| 19 | 2038 | 5.56 | 0.0 | 8.6 | 0.0 | 8.6 | 879.7 | 871.1 |
| 20 | 2039 | 6.12 | 0.0 | 7.8 | 0.0 | 7.8 | 831.7 | 823.9 |
| 21 | 2040 | 6.73 | 0.0 | 7.1 | 0.0 | 7.1 | 786.3 | 779.2 |
| 22 | 2041 | 7.40 | 0.0 | 6.4 | 0.0 | 6.4 | 743.4 | 737.0 |
| 23 | 2042 | 8.14 | 0.0 | 5.9 | 0.0 | 5.9 | 702.9 | 697.0 |
| 24 | 2043 | 8.95 | 0.0 | 5.3 | 0.0 | 5.3 | 664.6 | 659.2 |
| 25 | 2044 | 9.85 | 0.0 | 4.8 | 0.0 | 4.8 | 628.3 | 623.5 |
| 26 | 2045 | 10.83 | 0.0 | 4.4 | 0.0 | 4.4 | 594.0 | 589.6 |
| 27 | 2046 | 11.92 | 0.0 | 4.0 | 0.0 | 4.0 | 561.6 | 557.6 |
| 28 | 2047 | 13.11 | 0.0 | 3.6 | 0.0 | 3.6 | 531.0 | 527.4 |
| 29 | 2048 | 14.42 | 0.0 | 3.3 | 0.0 | 3.3 | 502.0 | 498.7 |
| 30 | 2049 | 15.86 | 0.0 | 3.0 | 0.0 | 3.0 | 474.6 | 471.6 |
| 31 | 2050 | 17.45 | 0.0 | 2.7 | 0.0 | 2.7 | 448.8 | 446.0 |
| 32 | 2051 | 19.19 | 0.0 | 2.5 | 0.0 | 2.5 | 424.3 | 421.8 |
| 33 | 2052 | 21.11 | 0.0 | 2.3 | 0.0 | 2.3 | 401.1 | 398.9 |
| 34 | 2053 | 23.23 | 0.0 | 2.1 | 0.0 | 2.1 | 379.3 | 377.2 |
| | | | 3,932.4 | 305.1 | 0.0 | 4,237.5 | 26,864.0 | 22,626.5 |

| | |
|---|---|
| Net Present Value (Million peso) | 22,626.5 |
| B/C Ratio | 6.34 |
| EIRR | 47.2% |

# 5. Case Study
# - Technical Part -

## Data Explanation for HSH Phase2
## Traffic Assginment and Economic Analysis in Urban Area Undertaken

# 5. CASE STUDY -TECHNICAL PART -

This chapter will be able to undertake traffic demand forecasting and economic analysis for urban and regional cities by using JICA Strada data prepared by MP up to the approval process for individual projects.

## 5.1 Data Explanation for HSH Phase2

### 5.1.1 Network Data

#### (1) General Information Setting

The network data (INT file) in HSH Phase 2 was prepared for the nationwide road network in the Philippines. This network data includes the existing roads and the high standard roads planned for HSH Phase 2. The general conditions are set as follows.

**1) General Information**

In HSH Phase 2, the network consists of national and municipal roads in Luzon, Visayas and Mindanao with more than 10,000 links and nodes. Four types of vehicles (Car, Jeepney, Bus and Truck) are applied.

- Total Number of Links: 16,141 Links
- Total Number of Nodes: 13,827 Nodes
- Number of Modes: 4 modes (Car, Jeepney, Bus and Truck)

**2) Traffic Assignment Method**

The traffic assignment method for HSH Phase 2 applied the "User Equilibrium Assignment" and link cost function of BPR formula.

**3) Velocity and Capacity**

The link specification consists of velocity at zero flow and road capacity is shown in **Table 5-1**.

**Table 5-1 Link Specification: Free Flow Speed (Velocity) and Road Capacity**

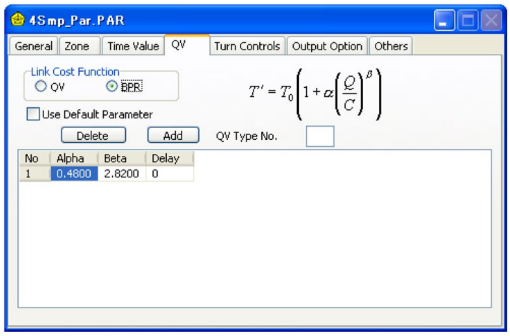
| Type | Road Class | Topography | Lane | Free flow velocity (km/h) | Road Capacity (PCU/day) |
|---|---|---|---|---|---|
| 1 | HSH Class1 (Expressway) | Plain | 10 | 100 | 200,000 |
| 2 | | | 8 | 100 | 160,000 |
| 3 | | | 6 | 100 | 120,000 |
| 4 | | | 4 | 100 | 80,000 |
| 5 | HSH Class1 (Urban Area) | Plain | 6 | 80 | 120,000 |
| 6 | | | 4 | 80 | 80,000 |
| 7 | HSH Class 2 (Access Controlled National Road) | Plain | 6 | 60 | 72,000 |
| 8 | | | 4 | 60 | 48,000 |
| 9 | | | 2 | 60 | 24,000 |
| 10 | National Road (Primary) | Plain | 8 | 50 | 96,000 |
| 11 | | | 6 | 50 | 72,000 |
| 12 | | | 5 | 50 | 60,000 |
| 13 | | | 4 | 50 | 48,000 |
| 14 | | | 2 | 40 | 10,000 |
| 15 | National Road (Secondary) | Plain | 6 | 40 | 60,000 |
| 16 | | | 4 | 40 | 40,000 |
| 17 | | | 2 | 30 | 8,000 |
| 18 | National Road (Tertiary) | Plain | 6 | 40 | 48,000 |
| 19 | | | 4 | 40 | 32,000 |
| 20 | | | 2 | 30 | 6,000 |
| 21 | HSH Class1 | Mountainous | 6 | 80 | 84,000 |

| | | | | | |
|---|---|---|---|---|---|
| 22 | | | 4 | 80 | 56,000 |
| 23 | HSH Class 2 | Mountainous | 4 | 60 | 48,000 |
| 24 | | | 2 | 50 | 24,000 |
| 25 | National Road (Primary) | Mountainous | 8 | 40 | 67,200 |
| 26 | | | 6 | 40 | 50,400 |
| 27 | | | 4 | 40 | 33,600 |
| 28 | | | 2 | 30 | 7,000 |
| 29 | National Road (Secondary) | Mountainous | 6 | 30 | 42,000 |
| 30 | | | 4 | 30 | 28,000 |
| 31 | | | 2 | 20 | 5,600 |
| 32 | National Road (Tertiary) | Mountainous | 4 | 30 | 22,400 |
| 33 | | | 2 | 20 | 4,200 |
| 34 | Ferry | - | - | 5 | 1,000 |

*Source: JICA Study Team*

#### 4) QV code

In applying the equilibrium assignment method in this manual, a type of BPR function for daily traffic assignment is utilized as link performance function as shown in Formula (3). For this function, the standard parameter α=0.48, β=2.82, which was developed by the Japan Society of Civil Engineers is applied.




### (2) Fare Setting

The toll system is shown in Table 5-2. For existing expressways, the toll system set by TRB is applied.

**Table 5-2 Fare Setting for Existing Expressway**

*Unit: Peso/km (Closed System), Pesos (Open System)*

| No. | Expressway | | System | Class1 | Class2 | Class3 |
|---|---|---|---|---|---|---|
| 1 | Tarlac–Pangasinan–La Union Expressway | TPLEx | Closed | 3.5 | 8.7 | 10.5 |
| 2 | North Luzon Expressway (Outside Metro Manila) | NLEX | Closed | 3.2 | 8.0 | 9.6 |
| | North Luzon Expressway (Inside Metro Manila) | | Open | 55 | 137 | 165 |
| | Segment 8.1, 9 | | | | | |
| 3 | Subic–Clark–Tarlac Expressway | SCTEX | Closed | 3.7 | 7.6 | 11.2 |
| 4 | Muntinlupa–Cavite Expressway | MCX | Open | 17 | 34 | 51 |
| 5 | Metro Manila Skyway | SKYWAY | Closed | 9.9 | 19.9 | 29.9 |
| 6 | South Luzon Expressway | SLEX | Closed | 3.5 | 7.0 | 10.6 |
| 7 | Southern Tagalog Arterial Road (Calabarzon Expressway) | STAR | Closed | 2.3 | 4.5 | 6.8 |
| 8 | Manila-Cavite Expressway | CAVITEX | Open | 24 | 48 | 72 |
| | Manila-Cavite Expressway (Extension) | | | 64 | 129 | 194 |
| 9 | NAIA Expressway (Full) | NAIAX | Open | 45 | 90 | 134 |
| | NAIA Expressway (Short Segment) | | | 35 | 69 | 104 |
| 10 | Proposed Expressway in HSH Phase2 | - | Closed | 3.5 | 8.7 | 10.5 |

*Source: TRB and JICA Study Team*

### (3) Directional control Setting

The direction in road network data is set based on the directional situation (one-way traffic, traffic control) of existing roads. Since there are restrictions on Jeepney traffic, it has been set as impassable on the expressway. For the EDSA in Metro Manila, one-way restrictions have been set because the road network is divided into upper and lower sections.

### (4) Flags Setting

It is possible to set various flags in JICA Strada's road network. In the network data used in this manual, various flags are also set as shown below.

**Table 5-3 Structure of Network Data**

| | Items | Contents |
|---|---|---|
| (1) | Road Type | 0: General Road, 1: Expressway, 2: Railway |
| (2) | Evaluation | 0: Evaluation, 1: No-evaluation |
| (3) | Display | 1: Display, 9: Un-display |
| (4) | User Flag-1 (Area Code) | 1: Luzon, 2: Visayas, 3: Mindanao |
| (5) | User Flag-2 (Road Type) | 1: Primary NR<br>2: Secondary NR<br>3: Tertiary NR<br>4: Other Road<br>5: Expressway<br>6: Ferry<br>7: IC and JCT<br>8: Centroid<br>9: Train<br>10: Intercity Road<br>11: IC not used |
| (6) | User Flag-3 (Highway) | Existing and Proposed Highway (Total 53) |
| (7) | User Flag-4 – 10 | - |
| (8) | Color | Blue: Expressway, Red: Primary NR, Green: Secondary NR, Yellow: Tertiary NR, Purple: Centroid, Black: Others |

*Source: JICA Strada Manual, Network Editor (EM40-06.pdf)*

## 5.1.2 Parameter Data

### (1) General Information

The general conditions for the parameters set in HSH Phase 2 are the same as the conditions in the basic part.

### (2) Zone Condition

The number of zones is described in Section 2.2.3 and 920 zones is set in the parameter file.

### (3) Time Equivalence

Value of time was established based on “Procedure Manual for Updating Vehicle Costs and User Cost, Work Unit Cost, Asset Values, Traffic Growth Rates in 2014.”

Current and future value of time were calculated using an AGR of 2.60%, which was estimated using Inflation Rate from 2012 to 2018.

**Table 5-4 Value of Time**

*Unit: Peso/min*

| Vehicle Type | Y2015 | Y2019 |
|---|---|---|
| Passenger Car | 6.68 | 7.40 |
| Jeepney | 7.37 | 8.17 |
| Bus | 27.54 | 30.52 |
| Truck | 7.75 | 8.59 |

### 5.1.3 OD Data

#### (1) Zoning System

The creation of traffic zones is necessary to study the HSH network that handles regional traffic. The size of the zone varies depending on the socio-economic data attributed.

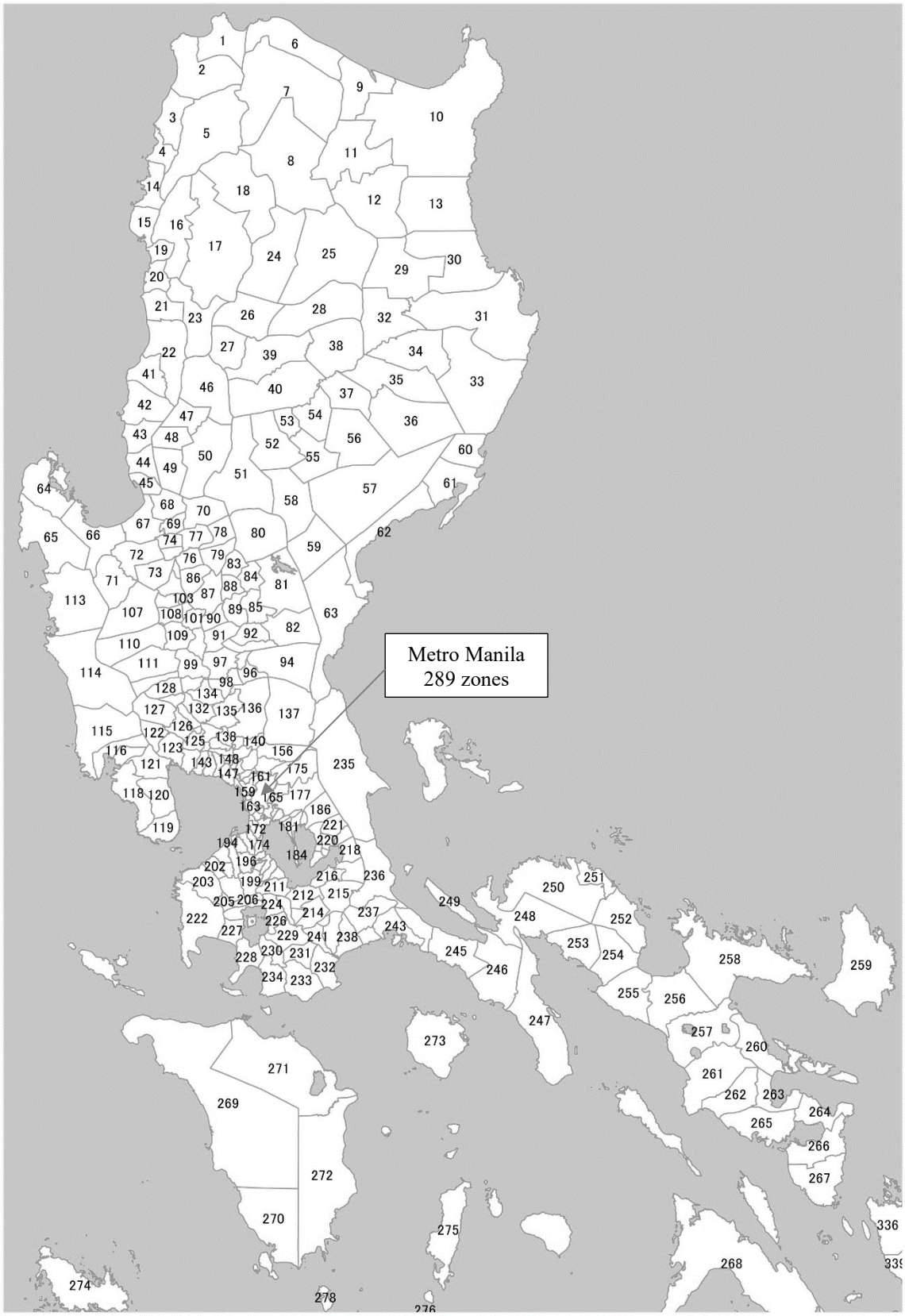
In the present condition, cities and municipalities where road network is dense and generates significant traffic were assigned as the smallest unit of traffic zone

However, for the three major metropolitan areas (Metro Manila, Metro Cebu and Metro Davao), cities and municipalities were further subdivided into different zones, depending on the traffic projects implemented in the existing urban areas.

**Table 5-5 Zoning System for Traffic Demand Forecast**

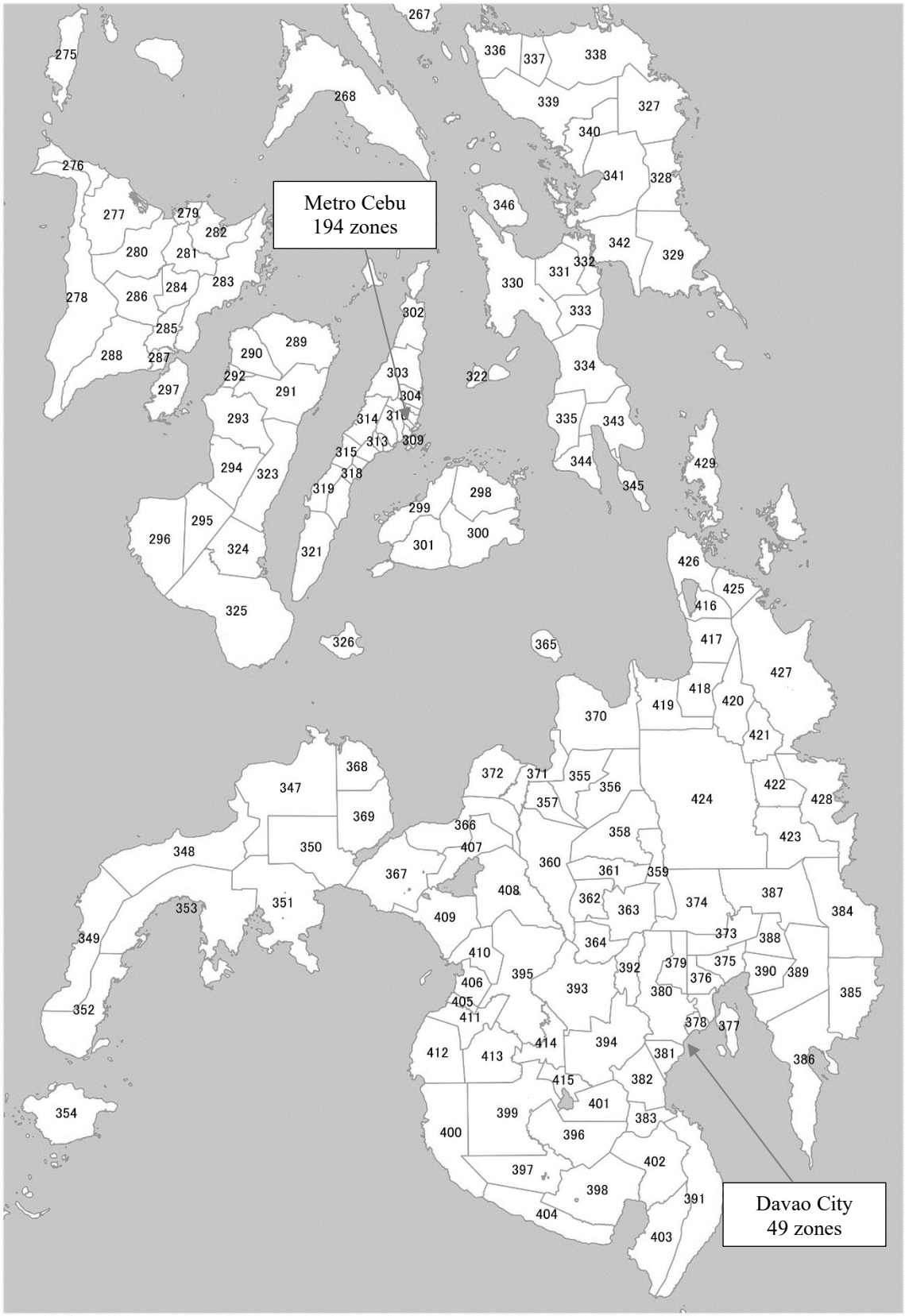
| Region | Number of Zones | Number of Municipalities/Cities |
|---|---|---|
| Region I | 33 | 125 |
| Region II | 24 | 93 |
| Region III | 82 | 130 |
| NCR | 289 | 17 |
| Region IV-A | 75 | 142 |
| Region IV-B | 7 | 73 |
| Region V | 19 | 114 |
| Region VI | 22 | 133 |
| Region VII | 210 | 132 |
| (Metro Cebu) | (194) | (13) |
| Region VIII | 20 | 143 |
| Region IX | 7 | 72 |
| Region X | 18 | 93 |
| Region XI | 57 | 49 |
| (Davao City) | (49) | (11) |
| Region XII | 14 | 50 |
| Region XIII | 14 | 73 |
| ARMM | 11 | 118 |
| CAR | 18 | 77 |
| Total | 920 | 1,634 |

*Source: JICA Study Team*




*Source: JICA Study Team*

**Figure 5-1 Zoning System in Luzon**




*Source: JICA Study Team*

**Figure 5-2 Zoning System in Visayas and Mindanao**

### (2) Preparation of Present OD Table

In the first step, a present OD matrix was created as basic data for traffic demand forecasting. The base year for the present OD matrix is 2019. The type of OD matrix is an automobile OD matrix (unit is vehicle / day). Aggregate analysis of OD survey data and application of reverse OD traffic volume estimation method were applied for the reason given below.

The OD creation conducted in Japan is based on the results of large-scale surveys such as nationwide car owner interview surveys, roadside OD surveys, urban area traffic surveys (PT surveys), and mainstream flow surveys. However, it will require a large budget and time, and applying the Japanese method to this project is problematic in terms of efficiency and immediacy.

On the other hand, in the Philippines, DPWH conducts traffic surveys at some locations throughout the country, and there is a stock of valid cross-sectional traffic data. In metropolitan areas, traffic data for urban traffic studies exist. In this project, the OD reverse estimation method was applied to estimate the current OD matrix while using the stock data and the roadside OD survey results at 65 locations nationwide. The current OD matrix was created according to the following procedures:

- Tentative OD matrix creation based on roadside OD survey results of 65 stations,
- Complementary OD creation above OD matrix based on the distribution OD model,
- Creation of OD matrix for the three major metropolitan areas and surrounding areas based on existing OD data (MUCEP project, Cebu Urban Transport M/P, Davao Bypass Project),
- Preparation of provisional OD matrix integrating above OD matrix,
- Provisional OD matrix adjustment by applying OD reverse estimation method (see Figure ***) and balance check with zone indicators,

**Reference**

Preparation of Present OD Matrix in the HSH Phase2, JST applied to use “OD reverse estimation method”.

<Methodology of OD reverse estimation method>

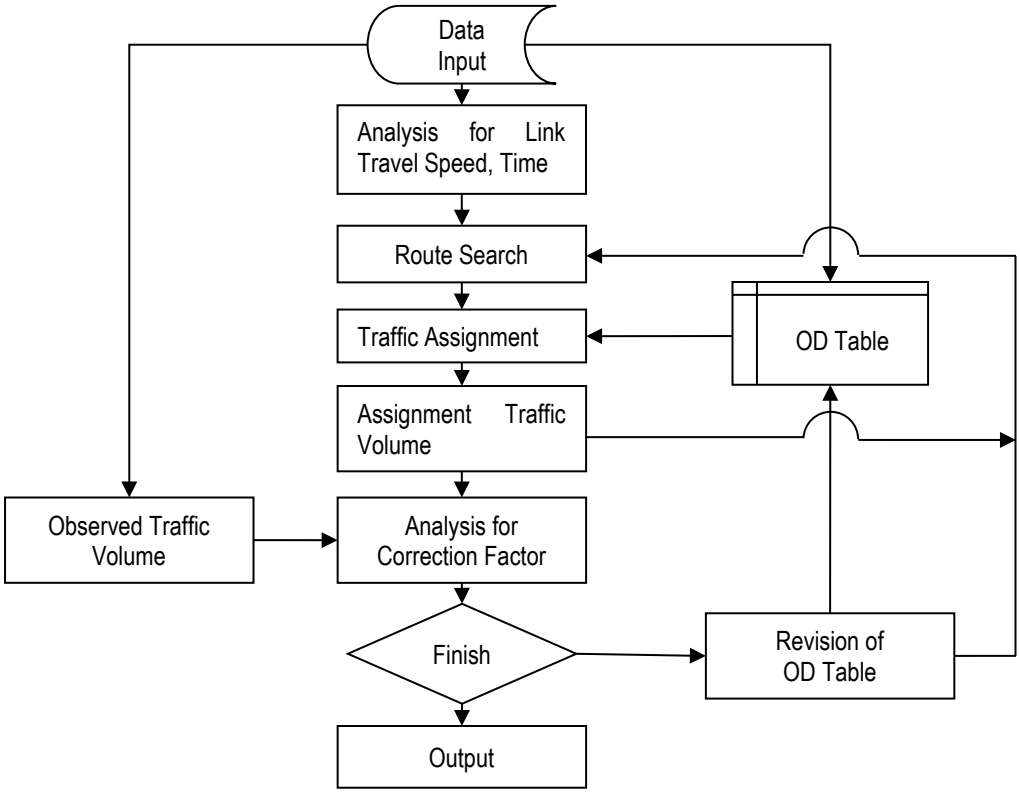
i. First, the traffic volume for each link is calculated by assignment of existing OD table to the network.

ii. The difference is recorded by comparing the observed traffic volume and the results of assignment for the corresponding link.

iii. Calculate the correction factors for each OD pair, modify the OD table, and return to the assignment calculation step to estimate the traffic volume again.

iv. These steps are iteratively carried out to modify the OD table so that the traffic volumes are distributed close to the observed traffic volumes.

v. Finally, the calculation is completed after confirming that the average error and maximum error have been reduced.




*Source: JICA Study Team*

**Figure 5-3 Flow of OD Reverse Estimation Method**

## 5.2 Traffic Assignment and Economic Analysis in Urban Area Undertaken

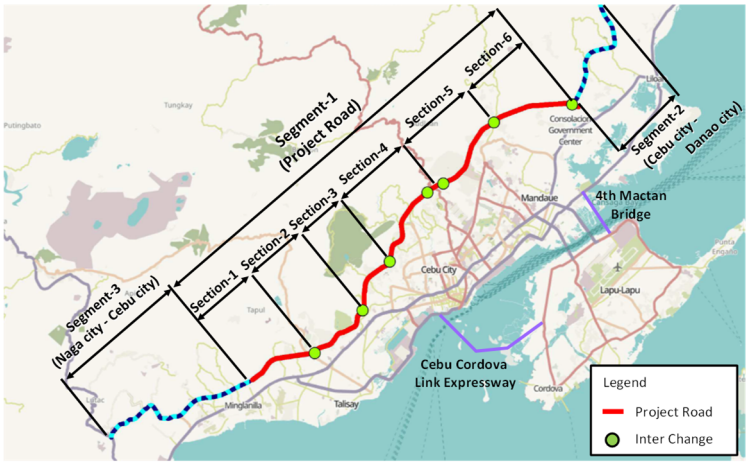
### 5.2.1 Road Network Preparation

The road network in 2040 to be prepared in the technical part will be the Cebu Circumferential Road as shown in the figure below.

The following figure shows the road plan drawing, IC locations, distance between ICs, access roads, and other conditions.

Road Alignment

Segment-3 is implemented under DPWH, Segment-1 is planned by JST.

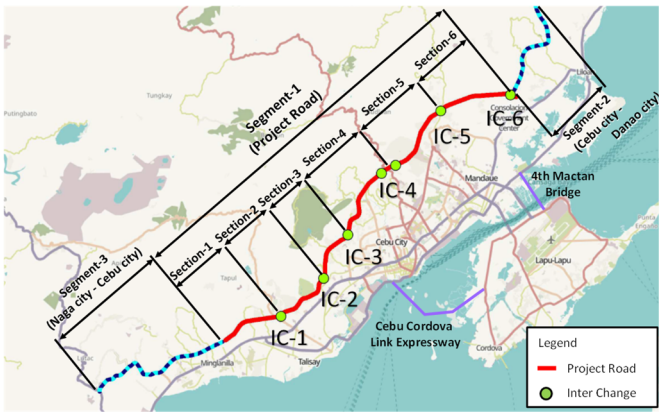



No. of Section : 5 Sections
No. of IC : 5 ICs
Future Road Network:
Cebu Cordova Link Expressway
4th Mactan Bridge
(not considered the **Segment-2 (Cebu City – Danao City)**)

Road Length

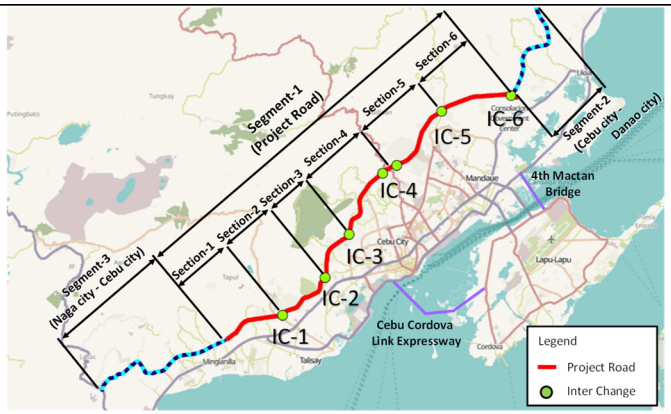
| Section | Length (km) |
|---|---|
| Section-1 | 3.0 |
| Section-2 | 3.8 |
| Section-3 | 3.2 |
| Section-4 | 5.0 |
| Section-5 | 4.8 |
| Section-6 | 4.2 |

| Inter change | Length (km) |
|---|---|
| IC-1 | 0.10 |
| IC-2 | 0.10 |
| IC-3 | 0.95 |
| IC-4 | 0.10 |
| IC-5 | 0.10 |
| IC-6 | 0.10 |



## Link Information

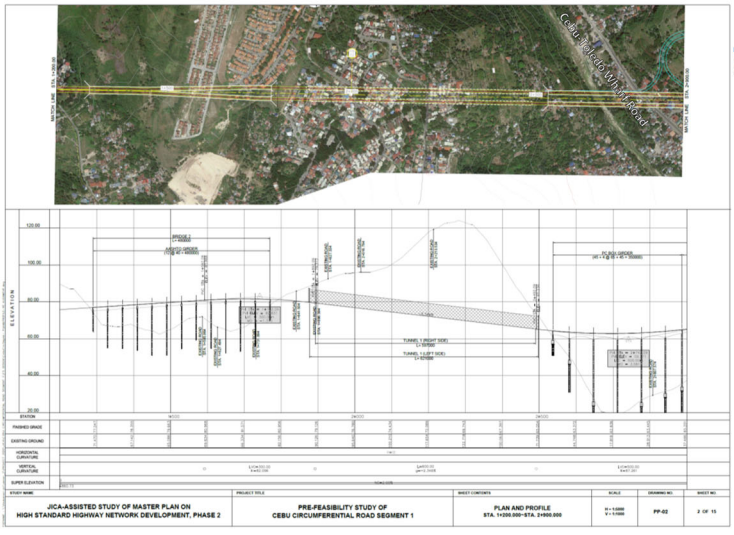
| | CCR | Interchange |
|---|---|---|
| Line Color | ——— | ——— |
| Vmax (km/h) | 80.0 | 80.0 |
| Qmax (PCU) | 56,000 | 48,000 |
| QV Type | 6 | 4 |
| Evaluation | No Check | No Check |
| Figure | 0 | 0 |
| Fare (closed) | Car: 3.5<br>Bus: 8.7<br>Truck: 10.5 | None |
| Direction | ⇔ | ⇔ |

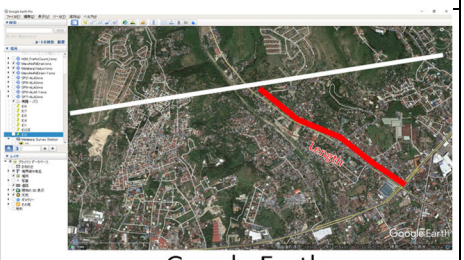



**IC Vmax and Qmax**

1) Many traffic volume will be diverted to CCR, traffic will pass through interchanges.
2) Vmax and Qmax for interchange is set as left table.

## Technic for Specified the IC Locations





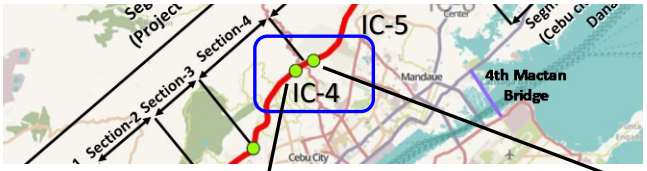
Google Earth

**IC locations**

1) It is difficult to fix the IC connection to existing road, length from interchange to existing intersection by Drawing Data.
2) It is useful to utilize the Google Earth to fix the length and connection point.

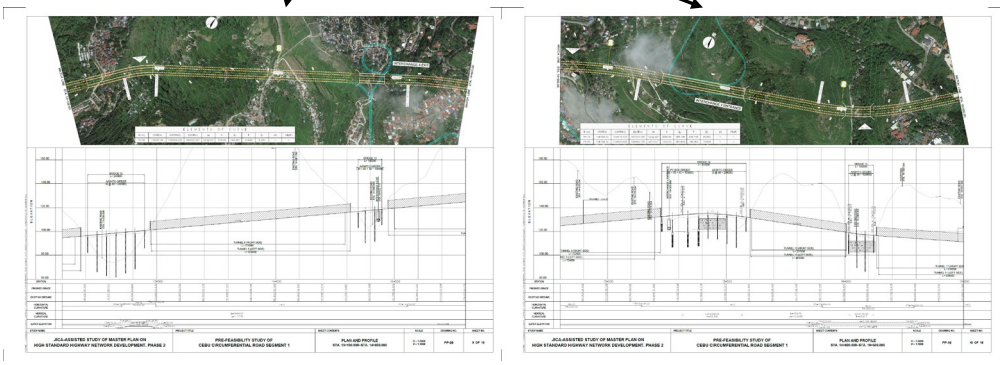
*Note: Design Drawings are shown in Appendix.*

Technic for IC Setting




**Half Ramp**

1) Consideration of toll gate setting (no.of lane), it is better to prepare the 2 ICs connection.
2) In this training, it is assumed to be full ramp, connection is to be 1 IC.



### 5.2.2 Update the Parameter File

Since the road conditions have been changed, the parameter file will be updated. The methodology for updating is as explained in Section 4.1.2. As mentioned in Section 4.1.2, it is important to set up 1) Directional Analysis, 2) Link OD and 3) Route information.

### 5.2.3 Future Traffic Assignment

Traffic demand forecasting (With Segment-1 Project and Without Segment-1 project) using 2040 road network and OD tables.

The validity of the assignment results will be confirmed based on the balance of traffic volume between links, IC traffic volume and traffic converted from national roads.

An example of the analysis is shown below.

<Traffic Volume>

It is possible to calculate the section traffic volume for the year 2040 as follows. Confirm the balance of traffic volume between sections. If the traffic volume of a section is too high or too low, the link conditions may have been filled out incorrectly.

**Table 5-6 Future Traffic Volume**

*Unit: Vehicle/day*

| Year | Section-1 | Section-2 | Section-3 | Section-4 | Section-5 | Section-6 |
|---|---|---|---|---|---|---|
| 2030 | 30,700 | 27,300 | 27,100 | 17,800 | 17,800 | 9,800 |
| 2035 | 33,900 | 30,200 | 29,900 | 19,700 | 19,700 | 10,800 |
| 2040 | 37,400 | 33,300 | 33,100 | 21,700 | 21,700 | 11,900 |

*Note: Traffic volume in year 2030 and 2035 were estimated by approx. 2.0 % per year based on the socio-economic indicators such as population growth.*

<IC Traffic Volume>

As shown in the figure below, Directional Analysis can be used to show the In and Out of IC traffic volumes. And, it is also possible to calculate the IC traffic volume from the CSV file of the assignment results. If the characteristics of the files in the software manual format (ANNEX A Standard Record Formats) are understood, it is possible to calculate the IC traffic volume.

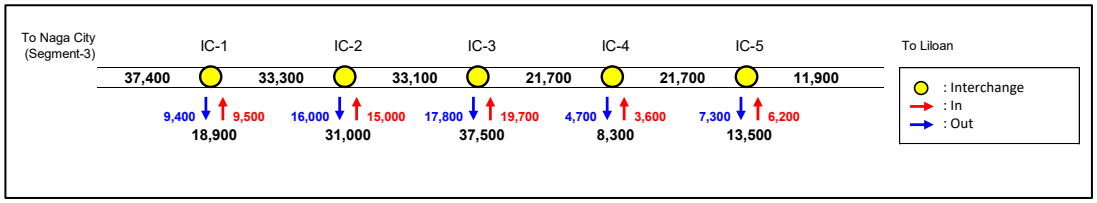



**Figure 5-4 Interchange Traffic Volume**

< Comparison of Traffic Volume and V/C >

Table and figure below show traffic diversion, V/C and travel speed savings in 2040 is compared at typical screen. It is possible to understand the traffic volume converted from national road and another road to expressway. These values are collected from the result of the traffic assignment via Highway Reporter and CSV file.

**Table 5-7 Comparison of Traffic Volume, V/C and Travel Speed at Typical Screen**

| Road Name | Traffic Volume (veh/day) in Year 2040 | | | V/C | | | Travel Speed (km/h) | | |
|---|---|---|---|---|---|---|---|---|---|
| | W Project | WO Project | W-WO | W | WO | W-WO | W | WO | W-WO |
| Central Nautical Highway East | 63,300 (100%) | 70,900 (112%) | -7,600 (-12%) | 1.32 | 1.48 | -0.16 | 34.8 | 30.9 | 3.9 |
| Cebu South Coastal Road East | 20,900 (100%) | 20,300 (97%) | 600 (3%) | 0.52 | 0.51 | 0.01 | 38.5 | 38.5 | -0.1 |
| Talamban Road (Mountainous Area) | 27,800 (100%) | 37,500 (135%) | -9,700 (-35%) | 1.96 | 2.64 | -0.68 | 12.9 | 6.6 | 6.3 |
| Mardonio Ceniza Road (Mountainous Area) | 7,900 (100%) | 11,300 (143%) | -3,400 (-43%) | 1.32 | 1.89 | -0.57 | 20.7 | 14.9 | 5.7 |
| CCR (Section-4) | 21,700 (100%) | - | 21,700 (100%) | 0.39 | - | - | 76.7 | 0.0 | - |
| Total | 141,600 | 140,000 | 1,600 | - | - | - | - | - | - |

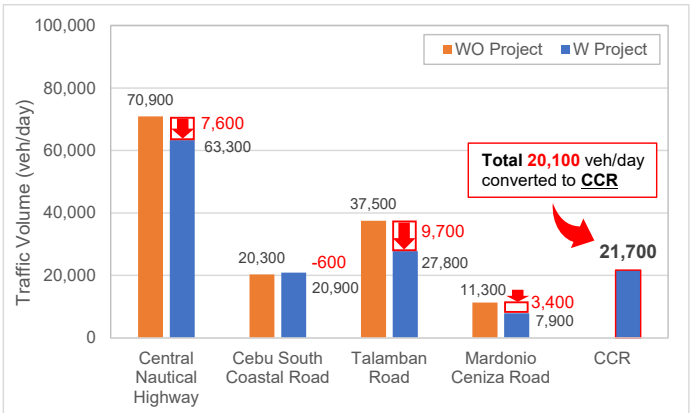



**Figure 5-5 Comparison of Traffic Volume at Typical Screen**

< Total Vehicle Kilometer and Total Travel Time >

Reduction of Total vehicle kilometer and travel time and improvement of travel speed for CCR is shown in the table below. As shown in Section 2.2.4 (3), it is possible to calculate the vehicle kilometer and vehicle hour within a certain range (in this case, the Cebu urban area). These values are collected from the result of traffic assignment via Highway Reporter and CSV file.

**Table 5-8 Reduction of Total Vehicle Kilometer and Total Travel Time, Improvement of Travel Speed in Year 2040**

| Items | WO Project | W Project | WO - W |
|---|---|---|---|
| Veh-km (veh*km/day) | 11,700,000 | 11,627,000 | 73,000 |
| Veh-Hour (veh*hour/day) | 689,000 | 635,000 | 54,000 |
| Speed (km/h) | 17.2 | 18.6 | -1.4 |

*Note: Evaluation area is set as Cebu Urban Area*

< Reduction of Travel Time >

Reduction of travel time from Naga City to East Side of Cebu Urban Area is shown in figure below. It is possible to calculate the travel time from the length and speed of the relevant links.

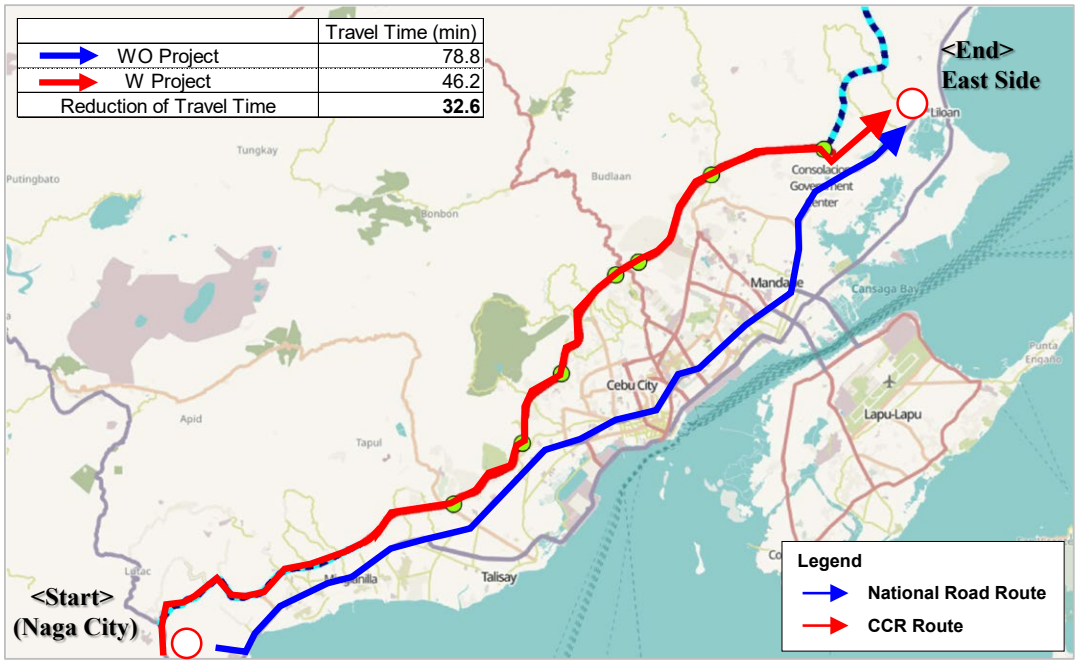



**Figure 5-6 Comparison of Traffic Volume at Typical Screen**

In this way, the assignment results can be used to conduct various types of analysis. Hopefully you will understand the characteristics of the assignment results and study the various analyses and use them in the project.

### 5.2.4 Economic Analysis

In this section, the economic analysis of CCR is undertaken to evaluate the expressway. The methodology for undertaking the economic analysis is explained in Chapters 3 and 4. For the calculation of benefits, the results of traffic assignment results in Section 5.2.3 are used.

#### (1) Condition of Economic Evaluation for CCR

##### 1) General Information

The General Condition is shown table below. This condition is applied in calculating economic analysis.

| Items | Description | |
|---|---|---|
| Base year | 2020 | year |
| Discount Rate | 10 | % |
| Evaluation Period | 30 | years |
| Opening Year | 2025 | year |
| VAT | 12 | % |
| Physical Contingency | 10 | % |
| O&M Cost (1% of Civil Work Cost) | 1 | % |
| Growth Rate for Traffic Volume | 2 | % |

##### 2) Project Cost

The project cost is assumed to be Civil Cost, Consultancy Service Cost, Administration Cost and Environment Cost as shown in the table below.

**Table 5-9 Project Cost estimated in 2020**

*Unit: Million PhP*

| No. | Items | | Local Cost | Foreign Cost | Total Cost |
|---|---|---|---|---|---|
| 1 | Civil Work Cost | | **27,000.0** | **18,000.0** | **45,000.0** |
| | 1.1 | Equipment | 14,256.0 | 6,336.0 | 20,592.0 |
| | 1.2 | Material | 7,128.0 | 8,712.0 | 15,840.0 |
| | 1.3 | Skilled Labor | 1,900.8 | 792.0 | 2,692.8 |
| | 1.4 | Unskilled Labor | 475.2 | 0 | 475.2 |
| | 1.5 | VAT | 3,240.0 | 2,160.0 | 5,400.0 |
| 2 | Consultancy Cost | | **2,160.0** | **1,440.0** | **3,600.0** |
| | 2.1 | Detailed Engineering Design | 712.8 | 475.2 | 1,188.0 |
| | 2.2 | Construction Supervision | 1,188.0 | 792.0 | 1,980.0 |
| | 2.3 | VAT | 259.2 | 172.8 | 432.0 |
| 3 | Administration Cost | | **945.0** | **630.0** | **1,575.0** |
| | 3.1 | Admin Cost | 831.6 | 554.4 | 1,386.0 |
| | 3.2 | VAT | 113.4 | 75.6 | 189.0 |
| 4 | Environment | | **5,027.0** | **18.0** | **5,045.0** |
| | 4.1 | Land Acquisition | 4,400.0 | 0.0 | 4,400.0 |
| | 4.2 | Environmental Monitoring Cost | 23.8 | 15.8 | 39.6 |
| | 4.3 | VAT | 603.2 | 2.2 | 605.4 |
| Ground Total | | | **35,132.0** | **20,088.0** | **55,220.0** |

## (2) Economic Analysis

Following the methodology for economic analysis in Section 4.2, economic analysis will be undertaken using the EIRR calculation sheet.

It is necessary to confirm whether the percentage exceeds 10%, which is the standard requirement for project approval in NEDA. And if not, it is necessary to review the road plan and traffic demand forecast again, including consideration of additional IC and widening of access roads.

The result of EIRR is shown in table below.

**Table 5-10 Result of EIRR based on Cost Benefit Stream**

Cebu Circumferential Road Segment-1 with Segment-3

Undiscounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|
| 1 | 2020 | 524.9 | | 0.0 | 524.9 | | -524.9 |
| 2 | 2021 | 3,149.5 | | 0.0 | 3,149.5 | | -3,149.5 |
| 3 | 2022 | 8,762.4 | | 0.0 | 8,762.4 | | -8,762.4 |
| 4 | 2023 | 36,826.8 | | 0.0 | 36,826.8 | | -36,826.8 |
| 5 | 2024 | 36,826.8 | | 0.0 | 36,826.8 | | -36,826.8 |
| 6 | 2025 | 12,275.6 | 450.0 | 0.0 | 12,725.6 | 12,624.7 | -100.9 |
| 7 | 2026 | 0.0 | 450.0 | 0.0 | 450.0 | 12,877.2 | 12,427.2 |
| 8 | 2027 | 0.0 | 450.0 | 0.0 | 450.0 | 13,134.7 | 12,684.7 |
| 9 | 2028 | 0.0 | 450.0 | 0.0 | 450.0 | 13,397.4 | 12,947.4 |
| 10 | 2029 | 0.0 | 450.0 | 0.0 | 450.0 | 13,665.4 | 13,215.4 |
| 11 | 2030 | 0.0 | 450.0 | 0.0 | 450.0 | 13,938.7 | 13,488.7 |
| 12 | 2031 | 0.0 | 450.0 | 0.0 | 450.0 | 14,217.4 | 13,767.4 |
| 13 | 2032 | 0.0 | 450.0 | 0.0 | 450.0 | 14,501.8 | 14,051.8 |
| 14 | 2033 | 0.0 | 450.0 | 0.0 | 450.0 | 14,791.8 | 14,341.8 |
| 15 | 2034 | 0.0 | 450.0 | 0.0 | 450.0 | 15,087.7 | 14,637.7 |
| 16 | 2035 | 0.0 | 450.0 | 0.0 | 450.0 | 15,389.4 | 14,939.4 |
| 17 | 2036 | 0.0 | 450.0 | 0.0 | 450.0 | 15,697.2 | 15,247.2 |
| 18 | 2037 | 0.0 | 450.0 | 0.0 | 450.0 | 16,011.1 | 15,561.1 |
| 19 | 2038 | 0.0 | 450.0 | 0.0 | 450.0 | 16,331.4 | 15,881.4 |
| 20 | 2039 | 0.0 | 450.0 | 0.0 | 450.0 | 16,658.0 | 16,208.0 |
| 21 | 2040 | 0.0 | 450.0 | 0.0 | 450.0 | 16,991.2 | 16,541.2 |
| 22 | 2041 | 0.0 | 450.0 | 0.0 | 450.0 | 17,331.0 | 16,881.0 |
| 23 | 2042 | 0.0 | 450.0 | 0.0 | 450.0 | 17,677.6 | 17,227.6 |
| 24 | 2043 | 0.0 | 450.0 | 0.0 | 450.0 | 18,031.1 | 17,581.1 |
| 25 | 2044 | 0.0 | 450.0 | 0.0 | 450.0 | 18,391.8 | 17,941.8 |
| 26 | 2045 | 0.0 | 450.0 | 0.0 | 450.0 | 18,759.6 | 18,309.6 |
| 27 | 2046 | 0.0 | 450.0 | 0.0 | 450.0 | 19,134.8 | 18,684.8 |
| 28 | 2047 | 0.0 | 450.0 | 0.0 | 450.0 | 19,517.5 | 19,067.5 |
| 29 | 2048 | 0.0 | 450.0 | 0.0 | 450.0 | 19,907.8 | 19,457.8 |
| 30 | 2049 | 0.0 | 450.0 | 0.0 | 450.0 | 20,306.0 | 19,856.0 |
| 31 | 2050 | 0.0 | 450.0 | 0.0 | 450.0 | 20,712.1 | 20,262.1 |
| 32 | 2051 | 0.0 | 450.0 | 0.0 | 450.0 | 21,126.4 | 20,676.4 |
| 33 | 2052 | 0.0 | 450.0 | 0.0 | 450.0 | 21,548.9 | 21,098.9 |
| 34 | 2053 | 0.0 | 450.0 | 0.0 | 450.0 | 21,979.9 | 21,529.9 |
| 35 | 2054 | 0.0 | 450.0 | 0.0 | 450.0 | 22,419.5 | 21,969.5 |
| | | 98,366.0 | 13,500.0 | 0.0 | 111,866.0 | 512,158.8 | 400,292.8 |

Discounted Benefit Cost Stream Revenue

Million Peso

| sq | Year | Discounted | Economic Cost | O&M | Disruption | Cost Total | Benefit | Benefit - Cost |
|---|---|---|---|---|---|---|---|---|
| 1 | 2020 | 1.00 | 524.9 | | 0.0 | 524.9 | | -524.9 |
| 2 | 2021 | 1.10 | 2,863.2 | | 0.0 | 2,863.2 | | -2,863.2 |
| 3 | 2022 | 1.21 | 7,241.7 | | 0.0 | 7,241.7 | | -7,241.7 |
| 4 | 2023 | 1.33 | 27,668.5 | | 0.0 | 27,668.5 | | -27,668.5 |
| 5 | 2024 | 1.46 | 25,153.2 | 0.0 | 0.0 | 25,153.2 | | -25,153.2 |
| 6 | 2025 | 1.61 | 7,622.2 | 279.4 | 0.0 | 7,901.6 | 7,838.9 | -62.7 |
| 7 | 2026 | 1.77 | 0.0 | 254.0 | 0.0 | 254.0 | 7,268.8 | 7,014.8 |
| 8 | 2027 | 1.95 | 0.0 | 230.9 | 0.0 | 230.9 | 6,740.2 | 6,509.3 |
| 9 | 2028 | 2.14 | 0.0 | 209.9 | 0.0 | 209.9 | 6,250.0 | 6,040.1 |
| 10 | 2029 | 2.36 | 0.0 | 190.8 | 0.0 | 190.8 | 5,795.4 | 5,604.6 |
| 11 | 2030 | 2.59 | 0.0 | 173.5 | 0.0 | 173.5 | 5,374.0 | 5,200.5 |
| 12 | 2031 | 2.85 | 0.0 | 157.7 | 0.0 | 157.7 | 4,983.1 | 4,825.4 |
| 13 | 2032 | 3.14 | 0.0 | 143.4 | 0.0 | 143.4 | 4,620.7 | 4,477.3 |
| 14 | 2033 | 3.45 | 0.0 | 130.3 | 0.0 | 130.3 | 4,284.7 | 4,154.3 |
| 15 | 2034 | 3.80 | 0.0 | 118.5 | 0.0 | 118.5 | 3,973.1 | 3,854.6 |
| 16 | 2035 | 4.18 | 0.0 | 107.7 | 0.0 | 107.7 | 3,684.1 | 3,576.4 |
| 17 | 2036 | 4.59 | 0.0 | 97.9 | 0.0 | 97.9 | 3,416.2 | 3,318.2 |
| 18 | 2037 | 5.05 | 0.0 | 89.0 | 0.0 | 89.0 | 3,167.7 | 3,078.7 |
| 19 | 2038 | 5.56 | 0.0 | 80.9 | 0.0 | 80.9 | 2,937.3 | 2,856.4 |
| 20 | 2039 | 6.12 | 0.0 | 73.6 | 0.0 | 73.6 | 2,723.7 | 2,650.1 |
| 21 | 2040 | 6.73 | 0.0 | 66.9 | 0.0 | 66.9 | 2,525.6 | 2,458.7 |
| 22 | 2041 | 7.40 | 0.0 | 60.8 | 0.0 | 60.8 | 2,341.9 | 2,281.1 |
| 23 | 2042 | 8.14 | 0.0 | 55.3 | 0.0 | 55.3 | 2,171.6 | 2,116.3 |
| 24 | 2043 | 8.95 | 0.0 | 50.3 | 0.0 | 50.3 | 2,013.7 | 1,963.4 |
| 25 | 2044 | 9.85 | 0.0 | 45.7 | 0.0 | 45.7 | 1,867.2 | 1,821.5 |
| 26 | 2045 | 10.83 | 0.0 | 41.5 | 0.0 | 41.5 | 1,731.4 | 1,689.9 |
| 27 | 2046 | 11.92 | 0.0 | 37.8 | 0.0 | 37.8 | 1,605.5 | 1,567.8 |
| 28 | 2047 | 13.11 | 0.0 | 34.3 | 0.0 | 34.3 | 1,488.7 | 1,454.4 |
| 29 | 2048 | 14.42 | 0.0 | 31.2 | 0.0 | 31.2 | 1,380.5 | 1,349.3 |
| 30 | 2049 | 15.86 | 0.0 | 28.4 | 0.0 | 28.4 | 1,280.1 | 1,251.7 |
| 31 | 2050 | 17.45 | 0.0 | 25.8 | 0.0 | 25.8 | 1,187.0 | 1,161.2 |
| 32 | 2051 | 19.19 | 0.0 | 23.4 | 0.0 | 23.4 | 1,100.7 | 1,077.2 |
| 33 | 2052 | 21.11 | 0.0 | 21.3 | 0.0 | 21.3 | 1,020.6 | 999.3 |
| 34 | 2053 | 23.23 | 0.0 | 19.4 | 0.0 | 19.4 | 946.4 | 927.0 |
| 35 | 2054 | 25.55 | 0.0 | 17.6 | 0.0 | 17.6 | 877.6 | 859.9 |
| | | | 71,073.7 | 2,897.4 | 0.0 | 73,971.1 | 96,596.5 | 22,625.4 |

| | |
|---|---|
| Net Present Value (Million peso) | 22,625.4 |
| B/C Ratio | 1.31 |
| EIRR | 13.0% |

# *APPENDIX 12*

# *BASE UNIT COST ESTIMATION FOR EACH CATEGORY OF HIGH STANDARD HIGHWAY*

## 12.1 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH 1 ( R ) 6 LANES INTER-REGIONAL EXPRESSWAY

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Embankment Section (6 Lanes, W=36.4m, H=7m) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 6.6 | 291,964.48 | 1,938,644.00 |
| 1.2 | Embankment from Roadway Excavation | m3 | 319,640.0 | 242.33 | 77,459,320.00 |
| 1.3 | Subgrade Preparation | m2 | 36,400.0 | 30.06 | 1,094,249.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 6,080.0 | 1,530.27 | 9,304,063.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 16,920.0 | 1,765.50 | 29,872,260.00 |
| 1.6 | Cement Treated Base Course (t=20cm) | m3 | 6,080.0 | 2,800.44 | 17,026,675.00 |
| 1.7 | Bituminous Tack Coat | m2 | 30,400.0 | 36.38 | 1,105,935.00 |
| 1.8 | Bituminous Prime Coat | m2 | 30,400.0 | 33.07 | 1,005,396.00 |
| 1.9 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 30,400.0 | 1,010.31 | 30,713,441.00 |
| 1.10 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 30,400.0 | 1,087.45 | 33,058,466.00 |
| 1.11 | Median Strip | m2 | 6,000.0 | 1,011.11 | 6,066,634.00 |
| 1.12 | Slope Net with Seeding for Common Soil on Fill | m2 | 31,284.0 | 310.00 | 9,698,040.00 |
| 1.13 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.14 | RCPC, 1220 mm dia | l.m. | 603.0 | 8,406.67 | 5,069,223.00 |
| 1.15 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.16 | Lighting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 1.17 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.18 | General Requirement (2.5% of Civil Work) | LS | 1 | | 6,312,100.13 |
| | **Total** | | | | **258,796,105.13** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **258.80** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **8,513.03** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **2** | **Cut Section (6 Lanes, W=36.4m, H=15m) Section (L=1.0 km)** | | | | |
| 2.1 | Clearing and Grubbing | ha | 10.0 | 291,964.48 | 2,919,645.00 |
| 2.2 | Roadway Excavation (Common Soil) | m3 | 133,840.0 | 642.11 | 85,939,869.00 |
| 2.3 | Roadway Excavation (Soft Rock) | m3 | 57,360.0 | 963.16 | 55,247,058.00 |
| 2.4 | Subgrade Preparation | m2 | 40,400.0 | 30.06 | 1,214,497.00 |
| 2.5 | Aggregate Base Course (t=20cm) | m3 | 6,080.0 | 1,530.27 | 9,304,063.00 |
| 2.6 | Aggregate Sub Base Course (t=30cm) | m3 | 16,920.0 | 1,765.50 | 29,872,260.00 |
| 2.7 | Cement Treated Base Course (t=20cm) | m3 | 6,080.0 | 2,800.44 | 17,026,675.00 |
| 2.8 | Bituminous Tack Coat | m2 | 30,400.0 | 36.38 | 1,105,935.00 |
| 2.9 | Bituminous Prime Coat | m2 | 30,400.0 | 33.07 | 1,005,396.00 |
| 2.10 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 30,400.0 | 1,010.31 | 30,713,441.00 |
| 2.11 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 30,400.0 | 1,087.45 | 33,058,466.00 |
| 2.12 | Median Strip | m2 | 6,000.0 | 1,011.11 | 6,066,634.00 |
| 2.13 | Slope Net with Seeding for Common Soil on Cut | m2 | 29,694.0 | 510.00 | 15,143,940.00 |
| 2.14 | Slope Net with Seeding for Soft Rock | l.m. | 12,726.0 | 630.00 | 8,017,380.00 |
| 2.15 | Drainage (Grouted Riprap Class A Slide Ditch,) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 2.16 | RCPC, 1220 mm dia | l.m. | 185.0 | 8,406.67 | 1,555,234.00 |
| 2.17 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 2.18 | Lighting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 2.19 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 2.20 | General Requirement (2.5% of Civil Work) | LS | 1 | | 8,181,553.80 |
| | **Total** | | | | **335,443,705.80** |
| | **Unit Cost (Item 2 -Million Peso / km)** | | | | **335.44** |
| | **Unit Cost (Item 2 -Peso /sq.m)** | | | | **11,034.33** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **3** | **Cost of Steel Viaduct L=1km (Steel Box Girder, Span=50m Concrete Pier Single-Column 6 Lanes, W=33.5m, H=15m)** | | | | |
| 3.1 | Structure Excavation | m3 | 8,400.0 | 753.97 | 6,333,337.00 |
| 3.2 | Foundation Backfill | m3 | 3,360.0 | 1,328.46 | 4,463,614.00 |
| 3.3 | Bituminous Tack Coat | m2 | 31,900.0 | 33.07 | 1,055,004.00 |
| 3.4 | Bituminous Concrete Surface Course (t=5cm) | m2 | 31,900.0 | 1,087.45 | 34,689,641.00 |
| 3.5 | Concrete Piles Cast in Drilled Holes, 2.0m | m | 4,000.0 | 50,301.23 | 201,204,912.00 |
| 3.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608.00 |
| 3.7 | Reinforcing Steel | kg | 6,488,850.0 | 76.68 | 497,565,018.00 |
| 3.8 | Prestressing Steel | kg | 3,111.5 | 183.48 | 570,894.00 |
| 3.9 | Lean Concrete 17Mpa | m3 | 168.0 | 4,888.50 | 821,268.00 |
| 3.10 | Structural Concrete, Class A Pile Cap | m3 | 5,040.0 | 6,747.60 | 34,007,904.00 |
| 3.11 | Structural Concrete, Class AA Columun | m3 | 8,960.0 | 13,995.89 | 125,403,156.00 |
| 3.12 | Structural Concrete, Class P Coping | m3 | 12,060.0 | 20,024.50 | 241,495,422.00 |
| 3.13 | Structural Concrete, Class AA Deck Slab | m3 | 7,705.0 | 9,171.97 | 70,670,044.00 |
| 3.14 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056.00 |
| 3.15 | Non Shrink Grout | m3 | 4.0 | 96,554.59 | 386,218.00 |
| 3.16 | Structural Steel(Super Structure) | kg | 10,050,000.0 | 218.23 | 2,193,231,600.00 |
| 3.17 | Structural Steel(Sub Structure) | kg | 0.0 | 207.32 | 0- |
| 3.18 | Metal Decking (8 mm thk) | sq.m | 33,500.0 | 2,913.90 | 97,615,650.00 |
| 3.19 | Elastomeric Bearing Pad (800 x 800 x 60mm) | each | 320.0 | 19,507.65 | 6,242,449.00 |
| 3.20 | Ruber Filler (400 x 150 x 50mm) | each | 320.0 | 1,039.00 | 332,479.00 |
| 3.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 320.0 | 1,888.57 | 604,343.00 |
| 3.22 | Expansion Joint (For Steel Girder) | m | 642.0 | 35,302.36 | 22,664,113.00 |
| 3.23 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 5,592.66 | 5,592,660.00 |
| 3.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548.00 |
| 3.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036.00 |
| 3.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296.00 |
| 3.27 | Toll Road Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 3.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 3.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 89,738,170.83 |
| | **Total** | | | | **3,679,265,003.83** |
| | **Unit Cost (Item 3 -Million Peso / km)** | | | | **3,679.27** |
| | **Unit Cost (Item 3 -Peso /sq.m)** | | | | **115,337.46** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **4** | **Cost of Concrete Viaduct L=1km (P/S Concrete Girder, Span=35m, Single-Column 6 Lanes, W=33.5m, H=15m)** | | | | |
| 4.1 | Structure Excavation | m3 | 10,000.0 | 753.97 | 7,539,686.00 |
| 4.2 | Foundation Backfill | m3 | 4,000.0 | 1,328.46 | 5,313,826.00 |
| 4.3 | Bituminous Tack Coat | ton | 31,900.0 | 33.07 | 1,055,004.00 |
| 4.4 | Bituminous Concrete Surface Course | ton | 31,900.0 | 1,087.45 | 34,689,641.00 |
| 4.5 | Concrete Piles Cast in Drilled Holes, 1.8m | m | 5,714.3 | 41,675.04 | 238,143,086.00 |
| 4.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608.00 |
| 4.7 | Reinforcing Steel | kg | 6,637,221.4 | 76.68 | 508,942,139.00 |
| 4.8 | Prestressing Steel | kg | 4,445.0 | 183.48 | 815,563.00 |
| 4.9 | Lean Concrete 17Mpa | m3 | 200.0 | 4,888.50 | 977,700.00 |
| 4.10 | Structural Concrete, Class A Pile Cap | m3 | 6,000.0 | 6,747.60 | 40,485,600.00 |
| 4.11 | Structural Concrete, Class AA Columun | m3 | 9,600.0 | 13,995.89 | 134,360,525.00 |
| 4.12 | Structural Concrete, Class P Coping | m3 | 10,050.0 | 20,024.50 | 201,246,185.00 |
| 4.13 | Structural Concrete, Class AA Deck Slab | m3 | 7,705.0 | 9,171.97 | 70,670,044.00 |
| 4.14 | Structural Concrete, Class AA Diaphram | m3 | 1,234.3 | 22,025.16 | 27,185,340.00 |
| 4.15 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056.00 |
| 4.16 | Non Shrink Grout | m3 | 5.7 | 96,554.59 | 551,741.00 |
| 4.17 | AASHTO PC Girder Type V, L=35.0m | each | 348.0 | 1,395,023.20 | 485,468,072.00 |
| 4.18 | Metal Decking (8 mm thk) | sq.m | 32,100.0 | 2,913.90 | 93,536,190.00 |
| 4.19 | Elastomeric Bearing Pad (606 x 306 x 60mm) | each | 457.1 | 5,596.26 | 2,558,289.00 |
| 4.20 | Ruber Filler (400 x 150 x 50mm) | each | 457.1 | 1,039.00 | 474,970.00 |
| 4.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 457.1 | 1,888.57 | 863,347.00 |
| 4.22 | Expansion Joint | m | 957.1 | 35,302.36 | 33,789,398.00 |
| 4.23 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 5,592.66 | 5,592,660.00 |
| 4.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548.00 |
| 4.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036.00 |
| 4.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296.00 |
| 4.27 | Toll Road Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 4.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 4.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 48,470,902.83 |
| | **Total** | | | | **1,987,307,015.83** |
| | **Unit Cost (Item 4 -Million Peso / km)** | | | | **1,987.31** |
| | **Unit Cost (Item4 -Peso /sq.m)** | | | | **62,298.03** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **5** | **Tunnel (One Cell 2 Lanes-2 Cell) include Tunnel Facilities** | | | | |
| 5.1 | Main Tunnel Construction for One Cell (2 Lanes) | l.m | 200.00 | 1,045,000.00 | 209,000,000.00 |
| 5.2 | Evacuation Tunnel Construction | l.m | 100.00 | 187,000.00 | 18,700,000.00 |
| 5.3 | Tunnel Facilities for One Cell | l.m | 200.00 | 172,000.00 | 34,400,000.00 |
| | General Requirement (2.5% of Civil Work) | L.S | 1.00 | | 6,552,500.00 |
| | **Total (Pesp/100m)** | | | | **268,652,500.00** |
| | **Unit Cost (Item 5 - Million Peso / km)** | | | | **2,686.53** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **6** | **Traffic Control System & Toll Correction System (6 Lanes, W=33.5m)** | | | | |
| 6.1 | Portable Weigning Station | set | 6.00 | 4,277,373.88 | 25,664,243.00 |
| 6.2 | Toll Island | each | 48.00 | 165,870.88 | 7,961,802.00 |
| 6.3 | Crash Attenuators | set | 48.00 | 54,935.15 | 2,636,887.00 |
| 6.4 | Toll Booth (Type 1) | each | 42.00 | 464,645.32 | 19,515,103.00 |
| 6.5 | Toll Booth (Maxi Type 2) | each | 6.00 | 1,010,267.24 | 6,061,603.00 |
| 6.6 | Toll Plaza | sq.m. | 4,000.00 | 26,106.00 | 104,424,000.00 |
| 6.7 | Toll Collection System | l.s. | 1.00 | 48,000,000.00 | 48,000,000.00 |
| 6.8 | Traffic Control System | l.s. | 1.00 | 300,000,000.00 | 300,000,000.00 |
| 6.9 | Toll Plaza Lighting System | each | 48.00 | 369,430.48 | 17,732,663.00 |
| 6.10 | Toll Operation Building | l.s. | 1.00 | 120,000,000.00 | 120,000,000.00 |
| 6.11 | Toll House | Unit | 6.00 | 5,400,000.00 | 32,400,000.00 |
| 6.12 | General Requirement (2.5% of Civil Work) | LS | 1.00 | | 17,109,907.53 |
| | **Total** | | | | **701,506,208.53** |
| | **Unit Cost (Item 6 - Million Peso / set)** | | | | **701.51** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **7** | **Long Span for over sea or water (more than 200m) Bridge (6 Lanes, W=33.5m) Per 200m** | | | | |
| 7.1 | SBHS Steel (include Election) | ton | 3,953.00 | 500,000.00 | 1,976,500,000.00 |
| 7.2 | Special Paint | sq.m. | 20,456.08 | 15,000.00 | 306,841,259.00 |
| 7.3 | Bituminous Concrete Surface Course (t=5cm) | sq.m. | 6,380.0 | 1,087.45 | 6,937,928.00 |
| 7.4 | Polymer Asphalt Concrete III-WF Type (t=4 cm) | sq.m. | 6,380.0 | 11,718.11 | 74,761,556.00 |
| 7.5 | Sub Structure | each | 2.00 | 250,000,000.00 | 500,000,000.00 |
| 7.6 | General Requirement (2.5% of Civil Work) | LS | 1.00 | | 71,626,018.58 |
| | **Total** | | | | **2,936,666,761.58** |
| | **Unit Cost (Item 6 - Million Peso / 100m)** | | | | **1,468.33** |
| | **Unit Cost (Item 6 - Peso / Sq.m)** | | | | **460,292.60** |

## 12.2 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH 1 ( R ) 4 LANES INTER-REGIONAL EXPRESSWAY

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Embankment Section (4 Lanes, W=29.1m, H=7m) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 5.9 | 291,964.48 | 1,725,510.00 |
| 1.2 | Embankment from Roadway Excavation | m3 | 297,375.0 | 242.33 | 72,063,776.00 |
| 1.3 | Subgrade Preparation | m2 | 29,100.0 | 30.06 | 874,798.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 4,620.0 | 1,530.27 | 7,069,864.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 6,930.0 | 1,765.50 | 12,234,915.00 |
| 1.6 | Cement Treated Base Course (t=20cm) | m3 | 4,620.0 | 2,800.44 | 12,938,033.00 |
| 1.7 | Bituminous Tack Coat | m2 | 23,100.0 | 36.38 | 840,365.00 |
| 1.8 | Bituminous Prime Coat | m2 | 23,100.0 | 33.07 | 763,968.00 |
| 1.9 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 23,100.0 | 1,010.31 | 23,338,174.00 |
| 1.10 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 23,100.0 | 1,087.45 | 25,120,085.00 |
| 1.11 | Median Strip | m2 | 6,000.0 | 1,011.11 | 6,066,634.00 |
| 1.12 | Slope Net with Seeding for Common Soil on Fill | m2 | 31,284.0 | 310.00 | 9,698,040.00 |
| 1.13 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.14 | RCPC, 1220 mm dia | l.m. | 540.0 | 8,406.67 | 4,539,603.00 |
| 1.15 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.16 | Lighting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 1.17 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.18 | General Requirement (2.5% of Civil Work) | LS | 1 | | 5,158,635.60 |
| | **Total** | | | | **211,504,059.60** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **211.50** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **9,156.02** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **2** | **Cut Section (4 Lanes, W=29.1m, H=15m) Section (L=1.0 km)** | | | | |
| 2.1 | Clearing and Grubbing | ha | 9.4 | 291,964.48 | 2,744,466.00 |
| 2.2 | Roadway Excavation (Common Soil) | m3 | 118,510.0 | 642.11 | 76,096,338.00 |
| 2.3 | Roadway Excavation (Soft Rock) | m3 | 50,790.0 | 963.16 | 48,919,074.00 |
| 2.4 | Subgrade Preparation | m2 | 33,100.0 | 30.06 | 995,045.00 |
| 2.5 | Aggregate Base Course (t=20cm) | m3 | 4,620.0 | 1,530.27 | 7,069,864.00 |
| 2.6 | Aggregate Sub Base Course (t=30cm) | m3 | 14,730.0 | 1,765.50 | 26,005,815.00 |
| 2.7 | Cement Treated Base Course (t=20cm) | m3 | 4,620.0 | 2,800.44 | 12,938,033.00 |
| 2.8 | Bituminous Tack Coat | m2 | 23,100.0 | 36.38 | 840,365.00 |
| 2.9 | Bituminous Prime Coat | m2 | 23,100.0 | 33.07 | 763,968.00 |
| 2.10 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 20,600.0 | 1,010.31 | 20,812,398.00 |
| 2.11 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 20,600.0 | 1,087.45 | 22,401,461.00 |
| 2.12 | Median Strip | m2 | 6,000.0 | 1,011.11 | 6,066,634.00 |
| 2.13 | Slope Net with Seeding for Common Soil on Cut | m2 | 29,694.0 | 510.00 | 15,143,940.00 |
| 2.14 | Slope Net with Seeding for Soft Rock | l.m. | 12,726.0 | 630.00 | 8,017,380.00 |
| 2.15 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 2.16 | RCPC, 1220 mm dia | l.m. | 150.0 | 8,406.67 | 1,261,001.00 |
| 2.17 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 2.18 | Lighting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 2.19 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 2.20 | General Requirement (2.5% of Civil Work) | LS | 1 | | |
| **Total** | | | | | **279,147,441.00** |
| **Unit Cost (Item 2 -Million Peso / km)** | | | | | **279.15** |
| **Unit Cost (Item 2 -Peso /sq.m)** | | | | | **12,084.30** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **3** | **Cost of Steel Viaduct (Steel Box Girder, 4 Lanes, W=26.2m, Span=50m Concrete Pier Single-Column H=15m)** | | | | |
| 3.1 | Structure Excavation | m3 | 7,000.0 | 753.97 | 5,277,780.00 |
| 3.2 | Foundation Backfill | m3 | 2,800.0 | 1,328.46 | 3,719,679.00 |
| 3.3 | Bituminous Tack Coat | m2 | 24,600.0 | 33.07 | 813,577.00 |
| 3.4 | Bituminous Concrete Surface Course (t=5cm) | m2 | 24,600.0 | 1,087.45 | 26,751,259.00 |
| 3.5 | Concrete Piles Cast in Drilled Holes, 1.8m | m | 4,000.0 | 41,675.04 | 166,700,160.00 |
| 3.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608.00 |
| 3.7 | Reinforcing Steel | kg | 4,748,580.0 | 76.68 | 364,121,114.00 |
| 3.8 | Prestressing Steel | kg | 2,433.5 | 183.48 | 446,491.00 |
| 3.9 | Lean Concrete 17Mpa | m3 | 140.0 | 4,888.50 | 684,390.00 |
| 3.10 | Structural Concrete, Class A Pile Cap | m3 | 4,200.0 | 6,747.60 | 28,339,920.00 |
| 3.11 | Structural Concrete, Class AA Columun | m3 | 6,720.0 | 13,995.89 | 94,052,367.00 |
| 3.12 | Structural Concrete, Class P Coping | m3 | 7,860.0 | 20,024.50 | 157,392,539.00 |
| 3.13 | Structural Concrete, Class AA Deck Slab | m3 | 5,658.0 | 9,171.97 | 51,895,018.00 |
| 3.14 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056.00 |
| 3.15 | Non Shrink Grout | m3 | 3.0 | 96,554.59 | 289,664.00 |
| 3.16 | Structural Steel(Super Structure) | kg | 7,860,000.0 | 218.23 | 1,715,303,520.00 |
| 3.17 | Structural Steel(Sub Structure) | kg | 0.0 | 207.32 | - |
| 3.18 | Metal Decking (8 mm thk) | sq.m | 26,200.0 | 2,913.90 | 76,344,180.00 |
| 3.19 | Elastomeric Bearing Pad (800 x 800 x 60mm) | each | 240.0 | 19,507.65 | 4,681,837.00 |
| 3.20 | Ruber Filler (400 x 150 x 50mm) | each | 240.0 | 1,039.00 | 249,359.00 |
| 3.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 240.0 | 1,888.57 | 453,257.00 |
| 3.22 | Expansion Joint (For Steel Girder) | m | 524.0 | 35,302.36 | 18,498,435.00 |
| 3.23 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 5,592.66 | 5,592,660.00 |
| 3.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548.00 |
| 3.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036.00 |
| 3.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296.00 |
| 3.27 | Toll Road Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 3.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 3.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 69,154,607.83 |
| **Total** | | | | | **2,835,338,920.83** |
| **Unit Cost (Item 3 -Million Peso / km)** | | | | | **2,835.34** |
| **Unit Cost (Item 3 -Peso /sq.m)** | | | | | **115,257.68** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **4** | **Cost of Concrete Viaduct (P/S Concrete Girder, 4 Lanes, W=26.2m, Span=35m, Single-Column H=15m)** | | | | |
| 4.1 | Structure Excavation | m3 | 6,857.1 | 753.97 | 5,170,071 |
| 4.2 | Foundation Backfill | m3 | 2,742.9 | 1,328.46 | 3,643,767 |
| 4.3 | Bituminous Tack Coat | ton | 24,600.0 | 33.07 | 813,577 |
| 4.4 | Bituminous Concrete Surface Course | ton | 24,600.0 | 1,087.45 | 26,751,259 |
| 4.5 | Concrete Piles Cast in Drilled Holes, 1.2m | m | 5,714.3 | 23,976.19 | 137,006,811 |
| 4.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608 |
| 4.7 | Reinforcing Steel | kg | 5,487,231.4 | 76.68 | 420,760,906 |
| 4.8 | Prestressing Steel | kg | 2,317.6 | 183.48 | 425,229 |
| 4.9 | Lean Concrete 17Mpa | m3 | 137.1 | 4,888.50 | 670,423 |
| 4.10 | Structural Concrete, Class A Pile Cap | m3 | 4,114.3 | 6,747.60 | 27,761,554 |
| 4.11 | Structural Concrete, Class AA Columun | m3 | 8,000.0 | 13,995.89 | 111,967,104 |
| 4.12 | Structural Concrete, Class P Coping | m3 | 10,105.7 | 20,024.50 | 202,361,835 |
| 4.13 | Structural Concrete, Class AA Deck Slab | m3 | 6,026.0 | 9,171.97 | 55,270,303 |
| 4.14 | Structural Concrete, Class AA Diaphram | m3 | 1,234.3 | 22,025.16 | 27,185,340 |
| 4.15 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056 |
| 4.16 | Non Shrink Grout | m3 | 4.3 | 96,554.59 | 413,805 |
| 4.17 | AASHTO PC Girder Type V, L=35.0m | each | 232.0 | 1,395,023.20 | 323,645,381 |
| 4.18 | Steel Decking | sq.m | 26,200.0 | 2,913.90 | 76,344,180 |
| 4.19 | Elastomeric Bearing Pad (606 x 306 x 60mm) | each | 342.9 | 5,596.26 | 1,918,717 |
| 4.20 | Ruber Filler (400 x 150 x 50mm) | each | 342.9 | 1,039.00 | 356,227 |
| 4.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 342.9 | 1,888.57 | 647,510 |
| 4.22 | Expansion Joint | m | 748.6 | 35,302.36 | 26,426,335 |
| 4.23 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 5,592.66 | 5,592,660 |
| 4.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548 |
| 4.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036 |
| 4.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296 |
| 4.27 | Toll Road Linghting | each | 34.0 | 190,406.32 | 6,473,815 |
| 4.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748 |
| 4.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 37,492,753 |
| | **Total** | | | | **1,537,202,853.53** |
| | **Unit Cost (Item 4 -Million Peso / km)** | | | | **1,537.20** |
| | **Unit Cost (Item 4 -Peso /sq.m)** | | | | **62,487.92** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **5** | **Tunnel (One Cell 2 Lanes-2 Cell) include Tunnel Facilities** | | | | |
| 5.1 | Main Tunnel Construction for One Cell (2 Lanes) | l.m | 200.00 | 1,045,000.00 | 209,000,000.00 |
| 5.2 | Evacuation Tunnel Construction | l.m | 100.00 | 187,000.00 | 18,700,000.00 |
| 5.3 | Tunnel Facilities for One Cell | l.m | 200.00 | 172,000.00 | 34,400,000.00 |
| | General Requirement (2.5% of Civil Work) | L.S | 1.00 | | 6,552,500.00 |
| | **Total (Pesp/100m)** | | | | **268,652,500.00** |
| | **Unit Cost (Item 5 - Million Peso / km)** | | | | **2,686.53** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **6** | **Traffic Control System & Toll Correction System (4 Lanes, W=29.1m)** | | | | |
| 6.1 | Portable Weigning Station | set | 6.00 | 4,277,373.88 | 25,664,243.00 |
| 6.2 | Toll Island | each | 36.00 | 165,870.88 | 5,971,352.00 |
| 6.3 | Crash Attenuators | set | 36.00 | 54,935.15 | 1,977,665.00 |
| 6.4 | Toll Booth (Type 1) | each | 30.00 | 464,645.32 | 13,939,359.00 |
| 6.5 | Toll Booth (Maxi Type 2) | each | 6.00 | 1,010,267.24 | 6,061,603.00 |
| 6.6 | Toll Plaza | sq.m. | 4,000.00 | 26,106.00 | 104,424,000.00 |
| 6.7 | Toll Collection System | l.s. | 1.00 | 48,000,000.00 | 48,000,000.00 |
| 6.8 | Traffic Control System | l.s. | 1.00 | 300,000,000.00 | 300,000,000.00 |
| 6.9 | Toll Plaza Lighting System | each | 36.00 | 369,430.48 | 13,299,497.00 |
| 6.10 | Toll Operation Building | l.s. | 1.00 | 120,000,000.00 | 120,000,000.00 |
| 6.11 | Toll House | Unit | 6.00 | 5,400,000.00 | 32,400,000.00 |
| 6.12 | General Requirement (2.5% of Civil Work) | LS | 1.00 | | 16,793,442.98 |
| | **Total** | | | | **688,531,161.98** |
| | **Unit Cost (Item 6 - Million Peso / set)** | | | | **688.53** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **7** | **Long Span (more than 200m) Bridge (4 Lanes, W=26.2m)** | | | | |
| 7.1 | SBHS Steel (include Election) | ton | 3,091.60 | 500,000.00 | 1,545,800,000.00 |
| 7.2 | Special Paint | sq.m. | 15,998.49 | 15,000.00 | 239,977,343.00 |
| 7.3 | Bituminous Concrete Surface Course (t=5cm) | sq.m. | 4,920.0 | 1,087.45 | 5,350,252.00 |
| 7.4 | Polymer Asphalt Concrete III-WF Type (t=4 cm) | sq.m. | 4,920.0 | 11,718.11 | 57,653,112.00 |
| 7.5 | Sub Structure | each | 2.00 | 180,000,000.00 | 360,000,000.00 |
| 7.6 | General Requirement (2.5% of Civil Work) | LS | 1.00 | | 55,219,517.68 |
| | **Total** | | | | **2,264,000,224.68** |
| | **Unit Cost (Item 6 - Million Peso / 100m)** | | | | **1,132.00** |
| | **Unit Cost (Item 6 - Peso / Sq.m)** | | | | **460,162.65** |

## 12.3 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH 1 ( U ) 6 LANES URBAN EXPRESSWAY

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Embankment Section (6 Lanes, W=29.9m, H=2m) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 4.0 | 291,964.48 | 1,164,938.00 |
| 1.2 | Embankment from Roadway Excavation | m3 | 43,080.0 | 242.33 | 10,439,706.00 |
| 1.3 | Subgrade Preparation | m2 | 29,900.0 | 30.06 | 898,848.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 5,980.0 | 1,530.27 | 9,151,036.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 11,470.0 | 1,765.50 | 20,250,285.00 |
| 1.6 | Cement Treated Base Course (t=20cm) | m3 | 5,980.0 | 2,800.44 | 16,746,631.00 |
| 1.7 | Bituminous Tack Coat | m2 | 29,900.0 | 36.38 | 1,087,745.00 |
| 1.8 | Bituminous Prime Coat | m2 | 29,900.0 | 33.07 | 988,860.00 |
| 1.9 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 29,900.0 | 1,010.31 | 30,208,286.00 |
| 1.10 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 29,900.0 | 1,087.45 | 32,514,742.00 |
| 1.11 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 5,592.66 | 5,592,660.00 |
| 1.12 | Slope Net with Seeding for Common Soil on Fill | m2 | 31,284.0 | 310.00 | 9,698,040.00 |
| 1.13 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.14 | RCPC, 1220 mm dia | l.m. | 360.0 | 8,406.67 | 3,026,402.00 |
| 1.15 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.16 | Lighting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 1.17 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.18 | General Requirement (2.5% of Civil Work) | LS | 1 | | 4,270,995.95 |
| | **Total** | | | | **175,110,833.95** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **175.11** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **5,856.55** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **2** | **Cut Section (6 Lanes, W=29.9m, H=3m) Section (L=1.0 km)** | | | | |
| 2.1 | Clearing and Grubbing | ha | 4.0 | 291,964.48 | 1,164,938.00 |
| 2.2 | Roadway Excavation (Common Soil) | m3 | 25,830.0 | 642.11 | 16,585,675.00 |
| 2.3 | Roadway Excavation (Soft Rock) | m3 | 11,070.0 | 963.16 | 10,662,220.00 |
| 2.4 | Subgrade Preparation | m2 | 29,900.0 | 30.06 | 898,848.00 |
| 2.5 | Aggregate Base Course (t=20cm) | m3 | 5,980.0 | 1,530.27 | 9,151,036.00 |
| 2.6 | Aggregate Sub Base Course (t=30cm) | m3 | 11,470.0 | 1,765.50 | 20,250,285.00 |
| 2.7 | Cement Treated Base Course (t=20cm) | m3 | 5,980.0 | 2,800.44 | 16,746,631.00 |
| 2.8 | Bituminous Tack Coat | m2 | 29,900.0 | 36.38 | 1,087,745.00 |
| 2.9 | Bituminous Prime Coat | m2 | 29,900.0 | 33.07 | 988,860.00 |
| 2.10 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 29,900.0 | 1,010.31 | 30,208,286.00 |
| 2.11 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 29,900.0 | 1,087.45 | 32,514,742.00 |
| 2.12 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 1,011.11 | 1,011,106.00 |
| 2.13 | Slope Net with Seeding for Common Soil on Cut | m2 | 5,936.0 | 510.00 | 3,027,360.00 |
| 2.14 | Slope Net with Seeding for Soft Rock | m2 | 2,544.0 | 630.00 | 1,602,720.00 |
| 2.15 | Drainage (Grouted Riprap Class A Slide Ditch,) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 2.16 | RCPC, 1220 mm dia | l.m. | 150.0 | 8,406.67 | 1,261,001.00 |
| 2.17 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 2.18 | Road Lighting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 2.19 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 2.20 | General Requirement (2.5% of Civil Work) | LS | 1 | | 4,405,827.80 |
| | **Total** | | | | **180,638,939.80** |
| | **Unit Cost (Item 2 -Million Peso / km)** | | | | **180.64** |
| | **Unit Cost (Item 2 -Peso /sq.m)** | | | | **6,041.44** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **3** | **Cost of Steel Viaduct L=1km (Steel Box Girder, Span=50m Concrete Pier Single-Column 6 Lanes, W=30.5m, H=15m)** | | | | |
| 3.1 | Structure Excavation | m3 | 8,400.0 | 753.97 | 6,333,337.00 |
| 3.2 | Foundation Backfill | m3 | 3,360.0 | 1,328.46 | 4,463,614.00 |
| 3.3 | Bituminous Tack Coat | m2 | 28,400.0 | 33.07 | 939,251.00 |
| 3.4 | Bituminous Concrete Surface Course (t=5cm) | m2 | 28,400.0 | 1,087.45 | 30,883,567.00 |
| 3.5 | Concrete Piles Cast in Drilled Holes, 2.0m | m | 4,000.0 | 50,301.23 | 201,204,912.00 |
| 3.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608.00 |
| 3.7 | Reinforcing Steel | kg | 6,149,550.0 | 76.68 | 471,547,494.00 |
| 3.8 | Prestressing Steel | kg | 2,832.8 | 183.48 | 519,769.00 |
| 3.9 | Lean Concrete 17Mpa | m3 | 168.0 | 4,888.50 | 821,268.00 |
| 3.10 | Structural Concrete, Class A Pile Cap | m3 | 5,040.0 | 6,747.60 | 34,007,904.00 |
| 3.11 | Structural Concrete, Class AA Columun | m3 | 8,960.0 | 13,995.89 | 125,403,156.00 |
| 3.12 | Structural Concrete, Class P Coping | m3 | 10,980.0 | 20,024.50 | 219,868,966.00 |
| 3.13 | Structural Concrete, Class AA Deck Slab | m3 | 7,015.0 | 9,171.97 | 64,341,384.00 |
| 3.14 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056.00 |
| 3.15 | Non Shrink Grout | m3 | 4.0 | 96,554.59 | 386,218.00 |
| 3.16 | Structural Steel(Super Structure) | kg | 9,150,000.0 | 218.23 | 1,996,822,800.00 |
| 3.17 | Structural Steel(Sub Structure) | kg | 0.0 | 207.32 | - |
| 3.18 | Metal Decking (8 mm thk) | sq.m | 30,500.0 | 2,913.90 | 88,873,950.00 |
| 3.19 | Elastomeric Bearing Pad (800 x 800 x 60mm) | each | 320.0 | 19,507.65 | 6,242,449.00 |
| 3.20 | Ruber Filler (400 x 150 x 50mm) | each | 320.0 | 1,039.00 | 332,479.00 |
| 3.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 320.0 | 1,888.57 | 604,343.00 |
| 3.22 | Expansion Joint (For Steel Girder) | m | 610.0 | 35,302.36 | 21,534,437.00 |
| 3.23 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 5,592.66 | 5,592,660.00 |
| 3.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548.00 |
| 3.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036.00 |
| 3.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296.00 |
| 3.27 | Road Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 3.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 3.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 83,132,526.63 |
| | **Total** | | | | **3,408,433,591.63** |
| | **Unit Cost (Item 3 -Million Peso / km)** | | | | **3,408.43** |
| | **Unit Cost (Item 3 -Peso /sq.m)** | | | | **117,938.88** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **4** | **Cost of Concrete Viaduct L=1km (P/S Concrete Girder, Span=35m, Single-Column 6 Lanes, W=30.5m, H=15m)** | | | | |
| 4.1 | Structure Excavation | m3 | 10,000.0 | 753.97 | 7,539,686.00 |
| 4.2 | Foundation Backfill | m3 | 4,000.0 | 1,328.46 | 5,313,826.00 |
| 4.3 | Bituminous Tack Coat | m2 | 28,400.0 | 33.07 | 939,251.00 |
| 4.4 | Bituminous Concrete Surface Course | m2 | 28,400.0 | 1,087.45 | 30,883,567.00 |
| 4.5 | Concrete Piles Cast in Drilled Holes, 1.8m | m | 5,714.3 | 41,675.04 | 238,143,086.00 |
| 4.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608.00 |
| 4.7 | Reinforcing Steel | kg | 6,330,321.4 | 76.68 | 485,409,047.00 |
| 4.8 | Prestressing Steel | kg | 4,046.9 | 183.48 | 742,528.00 |
| 4.9 | Lean Concrete 17Mpa | m3 | 200.0 | 4,888.50 | 977,700.00 |
| 4.10 | Structural Concrete, Class A Pile Cap | m3 | 6,000.0 | 6,747.60 | 40,485,600.00 |
| 4.11 | Structural Concrete, Class AA Columun | m3 | 9,600.0 | 13,995.89 | 134,360,525.00 |
| 4.12 | Structural Concrete, Class P Coping | m3 | 9,150.0 | 20,024.50 | 183,224,138.00 |
| 4.13 | Structural Concrete, Class AA Deck Slab | m3 | 7,015.0 | 9,171.97 | 64,341,384.00 |
| 4.14 | Structural Concrete, Class AA Diaphram | m3 | 1,234.3 | 22,025.16 | 27,185,340.00 |
| 4.15 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056.00 |
| 4.16 | Non Shrink Grout | m3 | 5.7 | 96,554.59 | 551,741.00 |
| 4.17 | AASHTO PC Girder Type V, L=35.0m | each | 290.0 | 1,395,023.20 | 404,556,727.00 |
| 4.18 | Metal Decking (8 mm thk) | sq.m | 30,500.0 | 2,913.90 | 88,873,950.00 |
| 4.19 | Elastomeric Bearing Pad (606 x 306 x 60mm) | each | 457.1 | 5,596.26 | 2,558,289.00 |
| 4.20 | Ruber Filler (400 x 150 x 50mm) | each | 457.1 | 1,039.00 | 474,970.00 |
| 4.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 457.1 | 1,888.57 | 863,347.00 |
| 4.22 | Expansion Joint | m | 871.4 | 35,302.36 | 30,763,482.00 |
| 4.23 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 5,592.66 | 5,592,660.00 |
| 4.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548.00 |
| 4.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036.00 |
| 4.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296.00 |
| 4.27 | Road Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 4.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 4.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 44,958,948.78 |
| | **Total** | | | | **1,843,316,899.78** |
| | **Unit Cost (Item 4 -Million Peso / km)** | | | | **1,843.32** |
| | **Unit Cost (Item 4 -Peso /sq.m)** | | | | **63,782.59** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **5** | **Tunnel (One Cell 2 Lanes-2 Cell) include Tunnel Facilities** | | | | |
| 5.1 | Main Tunnel Construction for One Cell (2 Lanes) | l.m | 200.00 | 1,045,000.00 | 209,000,000.00 |
| 5.2 | Evacuation Tunnel Construction | l.m | 100.00 | 187,000.00 | 18,700,000.00 |
| 5.3 | Tunnel Facilities for One Cell | l.m | 200.00 | 172,000.00 | 34,400,000.00 |
| | General Requirement (2.5% of Civil Work) | L.S | 1.00 | | 6,552,500.00 |
| | **Total (Pesp/100m)** | | | | **268,652,500.00** |
| | **Unit Cost (Item 5 - Million Peso / km)** | | | | **2,686.53** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **6** | **Traffic Control System & Toll Correction System (6 Lanes, W=30.5m)** | | | | |
| 6.1 | Portable Weigning Station | set | 6.00 | 4,277,373.88 | 25,664,243.00 |
| 6.2 | Toll Island | each | 48.00 | 165,870.88 | 7,961,802.00 |
| 6.3 | Crash Attenuators | set | 48.00 | 54,935.15 | 2,636,887.00 |
| 6.4 | Toll Booth (Type 1) | each | 42.00 | 464,645.32 | 19,515,103.00 |
| 6.5 | Toll Booth (Maxi Type 2) | each | 6.00 | 1,010,267.24 | 6,061,603.00 |
| 6.6 | Toll Plaza | sq.m. | 4,000.00 | 26,106.00 | 104,424,000.00 |
| 6.7 | Toll Collection System | l.s. | 1.00 | 48,000,000.00 | 48,000,000.00 |
| 6.8 | Traffic Control System | l.s. | 1.00 | 300,000,000.00 | 300,000,000.00 |
| 6.9 | Toll Plaza Lighting System | each | 48.00 | 369,430.48 | 17,732,663.00 |
| 6.10 | Toll Operation Building | l.s. | 1.00 | 120,000,000.00 | 120,000,000.00 |
| 6.11 | Toll House | Unit | 6.00 | 5,400,000.00 | 32,400,000.00 |
| 6.12 | General Requirement (2.5% of Civil Work) | LS | 1.00 | | 17,109,907.53 |
| | **Total** | | | | **701,506,208.53** |
| | **Unit Cost (Item 6 - Million Peso / Set)** | | | | **701.51** |

## 12.4 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH 1 ( U ) 4 LANES URBAN EXPRESSWAY

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Embankment Section (4 Lanes, W=22.6m, H=2m) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 3.3 | 291,964.48 | 951,804.00 |
| 1.2 | Embankment from Roadway Excavation | m3 | 34,320.0 | 242.33 | 8,316,869.00 |
| 1.3 | Subgrade Preparation | m2 | 22,600.0 | 30.06 | 679,397.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 4,520.0 | 1,530.27 | 6,916,836.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 9,280.0 | 1,765.50 | 16,383,840.00 |
| 1.6 | Cement Treated Base Course (t=20cm) | m3 | 4,520.0 | 2,800.44 | 12,657,989.00 |
| 1.7 | Bituminous Tack Coat | m2 | 22,600.0 | 36.38 | 822,176.00 |
| 1.8 | Bituminous Prime Coat | m2 | 22,600.0 | 33.07 | 747,432.00 |
| 1.9 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 22,600.0 | 1,010.31 | 22,833,019.00 |
| 1.10 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 22,600.0 | 1,087.45 | 24,576,360.00 |
| 1.11 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 1,011.11 | 1,011,106.00 |
| 1.12 | Slope Net with Seeding for Common Soil on Fill | m2 | 8,940.0 | 310.00 | 2,771,400.00 |
| 1.13 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.14 | RCPC, 1220 mm dia | l.m. | 369.0 | 8,406.67 | 3,102,062.00 |
| 1.15 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.16 | Lighting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 1.17 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.18 | General Requirement (2.5% of Civil Work) | LS | 1 | | 3,271,048.73 |
| | **Total** | | | | **134,112,997.73** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **134.11** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **5,934.20** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **2** | **Cut Section (4 Lanes, W=22.6m, H=3m) Section (L=1.0 km)** | | | | |
| 2.1 | Clearing and Grubbing | ha | 3.3 | 291,964.48 | 951,804.00 |
| 2.2 | Roadway Excavation (Common Soil) | m3 | 20,720.0 | 642.11 | 13,304,498.00 |
| 2.3 | Roadway Excavation (Soft Rock) | m3 | 8,880.0 | 963.16 | 8,552,892.00 |
| 2.4 | Subgrade Preparation | m2 | 22,600.0 | 30.06 | 679,397.00 |
| 2.5 | Aggregate Base Course (t=20cm) | m3 | 4,520.0 | 1,530.27 | 6,916,836.00 |
| 2.6 | Aggregate Sub Base Course (t=30cm) | m3 | 9,280.0 | 1,765.50 | 16,383,840.00 |
| 2.7 | Cement Treated Base Course (t=20cm) | m3 | 4,520.0 | 2,800.44 | 12,657,989.00 |
| 2.8 | Bituminous Tack Coat | m2 | 22,600.0 | 36.38 | 822,176.00 |
| 2.9 | Bituminous Prime Coat | m2 | 22,600.0 | 33.07 | 747,432.00 |
| 2.10 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 22,600.0 | 1,010.31 | 22,833,019.00 |
| 2.11 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 22,600.0 | 1,087.45 | 24,576,360.00 |
| 2.12 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 1,011.11 | 1,011,106.00 |
| 2.13 | Slope Net with Seeding for Common Soil on Cut | m2 | 5,936.0 | 510.00 | 3,027,360.00 |
| 2.14 | Slope Net with Seeding for Soft Rock | m2 | 2,544.0 | 630.00 | 1,602,720.00 |
| 2.15 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 2.16 | RCPC, 1220 mm dia | l.m. | 125.0 | 8,406.67 | 1,050,834.00 |
| 2.17 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 2.18 | Road Lighting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 2.19 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 2.20 | General Requirement (2.5% of Civil Work) | LS | 1 | | 3,604,748.05 |
| **Total** | | | | | **147,794,670.05** |
| **Unit Cost (Item 2 -Million Peso / km)** | | | | | **147.79** |
| **Unit Cost (Item 2 -Peso /sq.m))** | | | | | **6,539.59** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **3** | **Cost of Steel Viaduct (Steel Box Girder, 4 Lanes, W=23.2m, Span=50m Concrete Pier Single-Column H=15m)** | | | | |
| 3.1 | Structure Excavation | m3 | 7,000.0 | 753.97 | 5,277,780.00 |
| 3.2 | Foundation Backfill | m3 | 2,800.0 | 1,328.46 | 3,719,679.00 |
| 3.3 | Bituminous Tack Coat | m2 | 21,100.0 | 33.07 | 697,824.00 |
| 3.4 | Bituminous Concrete Surface Course (t=5cm) | m2 | 21,100.0 | 1,087.45 | 22,945,186.00 |
| 3.5 | Concrete Piles Cast in Drilled Holes, 1.5m | m | 4,000.0 | 32,825.62 | 131,302,460.00 |
| 3.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608.00 |
| 3.7 | Reinforcing Steel | kg | 4,518,960.0 | 76.68 | 346,513,853.00 |
| 3.8 | Prestressing Steel | kg | 2,154.8 | 183.48 | 395,366.00 |
| 3.9 | Lean Concrete 17Mpa | m3 | 140.0 | 4,888.50 | 684,390.00 |
| 3.10 | Structural Concrete, Class A Pile Cap | m3 | 4,200.0 | 6,747.60 | 28,339,920.00 |
| 3.11 | Structural Concrete, Class AA Columun | m3 | 6,720.0 | 13,995.89 | 94,052,367.00 |
| 3.12 | Structural Concrete, Class P Coping | m3 | 6,960.0 | 20,024.50 | 139,370,492.00 |
| 3.13 | Structural Concrete, Class AA Deck Slab | m3 | 5,336.0 | 9,171.97 | 48,941,643.00 |
| 3.14 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056.00 |
| 3.15 | Non Shrink Grout | m3 | 3.0 | 96,554.59 | 289,664.00 |
| 3.16 | Structural Steel(Super Structure) | kg | 6,960,000.0 | 218.23 | 1,518,894,720.00 |
| 3.17 | Structural Steel(Sub Structure) | kg | 0.0 | 207.32 | - |
| 3.18 | Metal Decking (8 mm thk) | sq.m | 23,200.0 | 2,913.90 | 67,602,480.00 |
| 3.19 | Elastomeric Bearing Pad (800 x 800 x 60mm) | each | 240.0 | 19,507.65 | 4,681,837.00 |
| 3.20 | Ruber Filler (400 x 150 x 50mm) | each | 240.0 | 1,039.00 | 249,359.00 |
| 3.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 240.0 | 1,888.57 | 453,257.00 |
| 3.22 | Expansion Joint (For Steel Girder) | m | 464.0 | 35,302.36 | 16,380,293.00 |
| 3.23 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 5,592.66 | 5,592,660.00 |
| 3.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548.00 |
| 3.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036.00 |
| 3.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296.00 |
| 3.27 | Road Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 3.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 3.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 62,024,058.43 |
| | **Total** | | | | **2,542,986,395.43** |
| | **Unit Cost (Item 3 -Million Peso / km)** | | | | **2,542.99** |
| | **Unit Cost (Item 3 -Peso /sq.m)** | | | | **117,730.85** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **4** | **Cost of Concrete Viaduct (P/S Concrete Girder, 4 Lanes, W=23.2m, Span=35m, Single-Column H=15m)** | | | | |
| 4.1 | Structure Excavation | m3 | 5,000.0 | 753.97 | 3,769,843 |
| 4.2 | Foundation Backfill | m3 | 2,000.0 | 1,328.46 | 2,656,913 |
| 4.3 | Bituminous Tack Coat | m2 | 21,100.0 | 33.07 | 697,824 |
| 4.4 | Bituminous Concrete Surface Course | m2 | 21,100.0 | 1,087.45 | 22,945,186 |
| 4.5 | Concrete Piles Cast in Drilled Holes, 1.0m | m | 5,714.3 | 19,980.16 | 114,172,343 |
| 4.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608 |
| 4.7 | Reinforcing Steel | kg | 4,752,034.3 | 76.68 | 364,385,989 |
| 4.8 | Prestressing Steel | kg | 2,052.2 | 183.48 | 376,539 |
| 4.9 | Lean Concrete 17Mpa | m3 | 100.0 | 4,888.50 | 488,850 |
| 4.10 | Structural Concrete, Class A Pile Cap | m3 | 3,000.0 | 6,747.60 | 20,242,800 |
| 4.11 | Structural Concrete, Class AA Columun | m3 | 8,000.0 | 13,995.89 | 111,967,104 |
| 4.12 | Structural Concrete, Class P Coping | m3 | 8,352.0 | 20,024.50 | 167,244,591 |
| 4.13 | Structural Concrete, Class AA Deck Slab | m3 | 5,336.0 | 9,171.97 | 48,941,643 |
| 4.14 | Structural Concrete, Class AA Diaphram | m3 | 822.9 | 22,025.16 | 18,123,560 |
| 4.15 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056 |
| 4.16 | Non Shrink Grout | m3 | 4.3 | 96,554.59 | 413,805 |
| 4.17 | AASHTO PC Girder Type V, L=35.0m | each | 232.0 | 1,395,023.20 | 323,645,381 |
| 4.18 | Steel Decking | sq.m | 23,200.0 | 2,913.90 | 67,602,480 |
| 4.19 | Elastomeric Bearing Pad (606 x 306 x 60mm) | each | 342.9 | 5,596.26 | 1,918,717 |
| 4.20 | Ruber Filler (400 x 150 x 50mm) | each | 342.9 | 1,039.00 | 356,227 |
| 4.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 342.9 | 1,888.57 | 647,510 |
| 4.22 | Expansion Joint | m | 662.9 | 35,302.36 | 23,400,419 |
| 4.23 | Concrete Barrier (New Jersey Type ) | l.m. | 1,000.0 | 5,592.66 | 5,592,660 |
| 4.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548 |
| 4.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036 |
| 4.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296 |
| 4.27 | Road Linghting | each | 34.0 | 190,406.32 | 6,473,815 |
| 4.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748 |
| 4.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 33,604,187 |
| | **Total** | | | | **1,377,771,678.28** |
| | **Unit Cost (Item 4 -Million Peso / km)** | | | | **1,377.77** |
| | **Unit Cost (Item 4 -Peso /sq.m)** | | | | **63,785.73** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **5** | **Tunnel (One Cell 2 Lanes-2 Cell) include Tunnel Facilities** | | | | |
| 5.1 | Main Tunnel Construction for One Cell (2 Lanes) | l.m | 200.00 | 1,045,000.00 | 209,000,000.00 |
| 5.2 | Evacuation Tunnel Construction | l.m | 100.00 | 187,000.00 | 18,700,000.00 |
| 5.3 | Tunnel Facilities for One Cell | l.m | 200.00 | 172,000.00 | 34,400,000.00 |
| | General Requirement (2.5% of Civil Work) | L.S | 1.00 | | 6,552,500.00 |
| | **Total (Pesp/100m)** | | | | **268,652,500.00** |
| | **Unit Cost (Item 5 - Million Peso / km)** | | | | **2,686.53** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **6** | **Traffic Control System & Toll Correction System (4 Lanes, W=29.1m)** | | | | |
| 6.1 | Portable Weigning Station | set | 6.00 | 4,277,373.88 | 25,664,243.00 |
| 6.2 | Toll Island | each | 36.00 | 165,870.88 | 5,971,352.00 |
| 6.3 | Crash Attenuators | set | 36.00 | 54,935.15 | 1,977,665.00 |
| 6.4 | Toll Booth (Type 1) | each | 30.00 | 464,645.32 | 13,939,359.00 |
| 6.5 | Toll Booth (Maxi Type 2) | each | 6.00 | 1,010,267.24 | 6,061,603.00 |
| 6.6 | Toll Plaza | sq.m. | 4,000.00 | 26,106.00 | 104,424,000.00 |
| 6.7 | Toll Collection System | l.s. | 1.00 | 48,000,000.00 | 48,000,000.00 |
| 6.8 | Traffic Control System | l.s. | 1.00 | 300,000,000.00 | 300,000,000.00 |
| 6.9 | Toll Plaza Lighting System | each | 36.00 | 369,430.48 | 13,299,497.00 |
| 6.10 | Toll Operation Building | l.s. | 1.00 | 120,000,000.00 | 120,000,000.00 |
| 6.11 | Toll House | Unit | 6.00 | 5,400,000.00 | 32,400,000.00 |
| 6.12 | General Requirement (2.5% of Civil Work) | LS | 1.00 | | 16,793,442.98 |
| | **Total** | | | | **688,531,161.98** |
| | **Unit Cost (Item 6 - Million Peso / Set)** | | | | **688.53** |

## 12.5 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH-2 4 LANES INTER-URBAN SECTION

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Embankment Section (4 Lanes, W=21.5m, H=7m Asphalt Pavement) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 5.2 | 291,964.48 | 1,503,617.00 |
| 1.2 | Embankment from Roadway Excavation | m3 | 228,750.0 | 242.33 | 55,433,674.00 |
| 1.3 | Subgrade Preparation | m2 | 21,500.0 | 30.06 | 646,329.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 3,900.0 | 1,530.27 | 5,968,067.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 6,850.0 | 1,765.50 | 12,093,675.00 |
| 1.6 | Cement Treated Base Course (t=20cm) | m3 | 3,900.0 | 2,800.44 | 10,921,716.00 |
| 1.7 | Bituminous Tack Coat | m2 | 19,500.0 | 36.38 | 709,399.00 |
| 1.8 | Bituminous Prime Coat | m2 | 19,500.0 | 33.07 | 644,908.00 |
| 1.9 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 19,500.0 | 1,010.31 | 19,701,056.00 |
| 1.10 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 19,500.0 | 1,087.45 | 21,205,266.00 |
| 1.11 | Median Strip | m2 | 2,000.0 | 1,011.11 | 2,022,211.00 |
| 1.12 | Slope Net with Seeding for Common Soil on Fill | m2 | 31,284.0 | 310.00 | 9,698,040.00 |
| 1.13 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.14 | RCPC, 1220 mm dia | l.m. | 468.0 | 8,406.67 | 3,934,322.00 |
| 1.15 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.16 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 1.17 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.18 | General Requirement (2.5% of Civil Work) | LS | 1 | | 4,338,848.48 |
| | | | | | |
| | **Total** | | | | **177,892,787.48** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **177.89** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **8,274.08** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **2** | **Cut Section (4 Lanes, W=21.5m, H=15m Asphalt Pavement) Section (L=1.0 km)** | | | | |
| 2.1 | Clearing and Grubbing | ha | 6.6 | 291,964.48 | 1,926,966.00 |
| 2.2 | Roadway Excavation (Common Soil) | m3 | 94,150.0 | 642.11 | 60,454,562.00 |
| 2.3 | Roadway Excavation (Soft Rock) | m3 | 40,350.0 | 963.16 | 38,863,647.00 |
| 2.4 | Subgrade Preparation | m2 | 21,500.0 | 30.06 | 646,329.00 |
| 2.5 | Aggregate Base Course (t=20cm) | m3 | 3,900.0 | 1,530.27 | 5,968,067.00 |
| 2.6 | Aggregate Sub Base Course (t=30cm) | m3 | 6,850.0 | 1,765.50 | 12,093,675.00 |
| 2.7 | Cement Treated Base Course (t=20cm) | m3 | 3,900.0 | 2,800.44 | 10,921,716.00 |
| 2.8 | Bituminous Tack Coat | m2 | 19,500.0 | 36.38 | 709,399.00 |
| 2.9 | Bituminous Prime Coat | m2 | 19,500.0 | 33.07 | 644,908.00 |
| 2.10 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 19,500.0 | 1,010.31 | 19,701,056.00 |
| 2.11 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 19,500.0 | 1,087.45 | 21,205,266.00 |
| 2.12 | Median Strip | m2 | 2,000.0 | 1,011.11 | 2,022,211.00 |
| 2.13 | Slope Net with Seeding for Common Soil on Cut | m2 | 29,694.0 | 510.00 | 15,143,940.00 |
| 2.14 | Slope Net with Seeding for Soft Rock | m2 | 12,726.0 | 630.00 | 8,017,380.00 |
| 2.15 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 2.16 | RCPC, 1220 mm dia | l.m. | 130.0 | 8,406.67 | 1,092,867.00 |
| 2.17 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 2.18 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 2.19 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 2.20 | General Requirement (2.5% of Civil Work) | LS | 1 | | |
| | **Total** | | | | **228,483,648.00** |
| | **Unit Cost (Item 2 -Million Peso / km)** | | | | **228.48** |
| | **Unit Cost (Item 2 -Peso /sq.m)** | | | | **10,627.15** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **3** | **Cost of Steel Viaduct (Steel Box Girder, 4 Lanes, W=21.5m, Span=50m Concrete Pier Single-Column H=15m)** | | | | |
| 3.1 | Structure Excavation | m3 | 7,000.0 | 753.97 | 5,277,780.00 |
| 3.2 | Foundation Backfill | m3 | 2,800.0 | 1,328.46 | 3,719,679.00 |
| 3.3 | Bituminous Tack Coat | m2 | 19,500.0 | 33.07 | 644,908.00 |
| 3.4 | Bituminous Concrete Surface Course (t=5cm) | m2 | 19,500.0 | 1,087.45 | 21,205,266.00 |
| 3.5 | Concrete Piles Cast in Drilled Holes, 1.5m | m | 4,000.0 | 32,825.62 | 131,302,460.00 |
| 3.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608.00 |
| 3.7 | Reinforcing Steel | kg | 4,508,730.0 | 76.68 | 345,729,416.00 |
| 3.8 | Prestressing Steel | kg | 2,433.5 | 183.48 | 446,491.00 |
| 3.9 | Lean Concrete 17Mpa | m3 | 140.0 | 4,888.50 | 684,390.00 |
| 3.10 | Structural Concrete, Class A Pile Cap | m3 | 4,200.0 | 6,747.60 | 28,339,920.00 |
| 3.11 | Structural Concrete, Class AA Columun | m3 | 6,720.0 | 13,995.89 | 94,052,367.00 |
| 3.12 | Structural Concrete, Class P Coping | m3 | 6,930.0 | 20,024.50 | 138,769,757.00 |
| 3.13 | Structural Concrete, Class AA Deck Slab | m3 | 5,313.0 | 9,171.97 | 48,730,687.00 |
| 3.14 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056.00 |
| 3.15 | Non Shrink Grout | m3 | 3.0 | 96,554.59 | 289,664.00 |
| 3.16 | Structural Steel(Super Structure) | kg | 6,930,000.0 | 218.23 | 1,512,347,760.00 |
| 3.17 | Structural Steel(Sub Structure) | kg | 0.0 | 207.32 | 0.00 |
| 3.18 | Metal Decking (8 mm thk) | sq.m | 23,100.0 | 2,913.90 | 67,311,090.00 |
| 3.19 | Elastomeric Bearing Pad (800 x 800 x 60mm) | each | 240.0 | 19,507.65 | 4,681,837.00 |
| 3.20 | Ruber Filler (400 x 150 x 50mm) | each | 240.0 | 1,039.00 | 249,359.00 |
| 3.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 240.0 | 1,888.57 | 453,257.00 |
| 3.22 | Expansion Joint (For Steel Girder) | m | 462.0 | 35,302.36 | 16,309,688.00 |
| 3.23 | Median Strip | m2 | 2,000.0 | 1,011.11 | 2,022,211.00 |
| 3.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548.00 |
| 3.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036.00 |
| 3.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296.00 |
| 3.27 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 3.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 3.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 61,678,627.35 |
| **Total** | | | | | **2,528,823,721.35** |
| **Unit Cost (Item 3 -Million Peso / km)** | | | | | **2,528.82** |
| **Unit Cost (Item 3 -Peso /sq.m)** | | | | | **117,619.71** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **4** | **Cost of Concrete Viaduct (P/S Concrete Girder, 4 Lanes, W=21.5m, Span=35m, Single-Column H=15m)** | | | | |
| 4.1 | Structure Excavation | m3 | 5,000.0 | 753.97 | 3,769,843 |
| 4.2 | Foundation Backfill | m3 | 2,000.0 | 1,328.46 | 2,656,913 |
| 4.3 | Bituminous Tack Coat | m2 | 19,500.0 | 33.07 | 644,908 |
| 4.4 | Bituminous Concrete Surface Course | m2 | 19,500.0 | 1,087.45 | 21,205,266 |
| 4.5 | Concrete Piles Cast in Drilled Holes, 1.0m | m | 5,714.3 | 19,980.16 | 114,172,343 |
| 4.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608 |
| 4.7 | Reinforcing Steel | kg | 4,847,644.3 | 76.68 | 371,717,364 |
| 4.8 | Prestressing Steel | kg | 2,043.4 | 183.48 | 374,916 |
| 4.9 | Lean Concrete 17Mpa | m3 | 100.0 | 4,888.50 | 488,850 |
| 4.10 | Structural Concrete, Class A Pile Cap | m3 | 3,000.0 | 6,747.60 | 20,242,800 |
| 4.11 | Structural Concrete, Class AA Columun | m3 | 8,000.0 | 13,995.89 | 111,967,104 |
| 4.12 | Structural Concrete, Class P Coping | m3 | 8,910.0 | 20,024.50 | 178,418,259 |
| 4.13 | Structural Concrete, Class AA Deck Slab | m3 | 5,313.0 | 9,171.97 | 48,730,687 |
| 4.14 | Structural Concrete, Class AA Diaphram | m3 | 822.9 | 22,025.16 | 18,123,560 |
| 4.15 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056 |
| 4.16 | Non Shrink Grout | m3 | 4.3 | 96,554.59 | 413,805 |
| 4.17 | AASHTO PC Girder Type V, L=35.0m | each | 232.0 | 1,395,023.20 | 323,645,381 |
| 4.18 | Steel Decking | sq.m | 23,100.0 | 2,913.90 | 67,311,090 |
| 4.19 | Elastomeric Bearing Pad (606 x 306 x 60mm) | each | 342.9 | 5,596.26 | 1,918,717 |
| 4.20 | Ruber Filler (400 x 150 x 50mm) | each | 342.9 | 1,039.00 | 356,227 |
| 4.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 342.9 | 1,888.57 | 647,510 |
| 4.22 | Expansion Joint | m | 660.0 | 35,302.36 | 23,299,555 |
| 4.23 | Median Strip | m2 | 2,000.0 | 1,011.11 | 2,022,211 |
| 4.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548 |
| 4.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036 |
| 4.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296 |
| 4.27 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815 |
| 4.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748 |
| 4.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 33,917,610 |
| | **Total** | | | | **1,390,622,026.40** |
| | **Unit Cost (Item 4 -Million Peso / km)** | | | | **1,390.62** |
| | **Unit Cost (Item 4 -Peso /sq.m)** | | | | **56,529.35** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **5** | **Tunnel (One Cell 2 Lanes-2 Cell) include Tunnel Facilities** | | | | |
| 5.1 | Main Tunnel Construction for One Cell (2 Lanes) | l.m | 200.00 | 1,045,000.00 | 209,000,000.00 |
| 5.2 | Evacuation Tunnel Construction | l.m | 100.00 | 187,000.00 | 18,700,000.00 |
| 5.3 | Tunnel Facilities for One Cell | l.m | 200.00 | 172,000.00 | 34,400,000.00 |
| | General Requirement (2.5% of Civil Work) | L.S | 1.00 | | 6,552,500.00 |
| | **Total (Peso/100m)** | | | | **268,652,500.00** |
| | **Unit Cost (Item 5 - Million Peso / km)** | | | | **2,686.53** |

## 12.6 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH 2 4 LANES URBAN SECTION

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Embankment Section (4 Lanes, W=31.5m, H=2m Asphalt Pavement) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 3.2 | 291,964.48 | 919,688.00 |
| 1.2 | Embankment from Roadway Excavation | m3 | 37,800.0 | 242.33 | 9,160,187.00 |
| 1.3 | Subgrade Preparation | m2 | 21,500.0 | 30.06 | 646,329.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 3,900.0 | 1,530.27 | 5,968,067.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 6,850.0 | 1,765.50 | 12,093,675.00 |
| 1.6 | Cement Treated Base Course (t=20cm) | m3 | 3,900.0 | 2,800.44 | 10,921,716.00 |
| 1.7 | Bituminous Tack Coat | m2 | 19,500.0 | 36.38 | 709,399.00 |
| 1.8 | Bituminous Prime Coat | m2 | 19,500.0 | 33.07 | 644,908.00 |
| 1.9 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 19,500.0 | 1,010.31 | 19,701,056.00 |
| 1.10 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 19,500.0 | 1,087.45 | 21,205,266.00 |
| 1.11 | Median Strip | m2 | 2,000.0 | 1,011.11 | 2,022,211.00 |
| 1.12 | Side Walk | m2 | 10,000.0 | 720.00 | 7,200,000.00 |
| 1.13 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.14 | RCPC, 1220 mm dia | l.m. | 283.5 | 8,406.67 | 2,383,292.00 |
| 1.15 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.16 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 1.17 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.18 | General Requirement (2.5% of Civil Work) | LS | 1 | | 3,066,186.33 |
| | **Total** | | | | **125,713,639.33** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **125.71** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **5,847.15** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **3** | **Cost of Steel Viaduct (Steel Box Girder, 4 Lanes, W=27.5m, Span=50m Concrete Pier Single-Column H=15m)** | | | | |
| 3.1 | Structure Excavation | m3 | 8,000.0 | 753.97 | 6,031,749.00 |
| 3.2 | Foundation Backfill | m3 | 3,200.0 | 1,328.46 | 4,251,061.00 |
| 3.3 | Bituminous Tack Coat | m2 | 19,500.0 | 33.07 | 644,908.00 |
| 3.4 | Bituminous Concrete Surface Course (t=5cm) | m2 | 19,500.0 | 1,087.45 | 21,205,266.00 |
| 3.5 | Concrete Piles Cast in Drilled Holes, 1.8m | m | 4,000.0 | 41,675.04 | 166,700,160.00 |
| 3.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608.00 |
| 3.7 | Reinforcing Steel | kg | 5,362,050.0 | 76.68 | 411,161,994.00 |
| 3.8 | Prestressing Steel | kg | 2,554.2 | 183.48 | 468,645.00 |
| 3.9 | Lean Concrete 17Mpa | m3 | 160.0 | 4,888.50 | 782,160.00 |
| 3.10 | Structural Concrete, Class A Pile Cap | m3 | 4,200.0 | 6,747.60 | 28,339,920.00 |
| 3.11 | Structural Concrete, Class AA Columun | m3 | 8,960.0 | 13,995.89 | 125,403,156.00 |
| 3.12 | Structural Concrete, Class P Coping | m3 | 8,250.0 | 20,024.50 | 165,202,092.00 |
| 3.13 | Structural Concrete, Class AA Deck Slab | m3 | 6,325.0 | 9,171.97 | 58,012,723.00 |
| 3.14 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056.00 |
| 3.15 | Non Shrink Grout | m3 | 3.0 | 96,554.59 | 289,664.00 |
| 3.16 | Structural Steel(Super Structure) | kg | 8,250,000.0 | 218.23 | 1,800,414,000.00 |
| 3.17 | Structural Steel(Sub Structure) | kg | 0.0 | 207.32 | - |
| 3.18 | Metal Decking (8 mm thk) | sq.m | 27,500.0 | 2,913.90 | 80,132,250.00 |
| 3.19 | Elastomeric Bearing Pad (800 x 800 x 60mm) | each | 240.0 | 19,507.65 | 4,681,837.00 |
| 3.20 | Ruber Filler (400 x 150 x 50mm) | each | 240.0 | 1,039.00 | 249,359.00 |
| 3.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 240.0 | 1,888.57 | 453,257.00 |
| 3.22 | Expansion Joint (For Steel Girder) | m | 464.0 | 35,302.36 | 16,380,293.00 |
| 3.23 | Median Strip | m2 | 2,000.0 | 1,011.11 | 2,022,211.00 |
| 3.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548.00 |
| 3.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036.00 |
| 3.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296.00 |
| 3.27 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 3.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 3.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 73,435,095.30 |
| | **Total** | | | | **3,010,838,907.30** |
| | **Unit Cost (Item 3 -Million Peso / km)** | | | | **3,010.84** |
| | **Unit Cost (Item 3 -Peso /sq.m)** | | | | **109,485.05** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **4** | **Cost of Concrete Viaduct (P/S Concrete Girder, 4 Lanes, W=27.5m, Span=35m, Single-Column H=15m)** | | | | |
| 4.1 | Structure Excavation | m3 | 7,142.9 | 753.97 | 5,385,490 |
| 4.2 | Foundation Backfill | m3 | 2,857.1 | 1,328.46 | 3,795,590 |
| 4.3 | Bituminous Tack Coat | m2 | 19,500.0 | 33.07 | 644,908 |
| 4.4 | Bituminous Concrete Surface Course | m2 | 19,500.0 | 1,087.45 | 21,205,266 |
| 4.5 | Concrete Piles Cast in Drilled Holes, 1.5m | m | 4,000.0 | 32,825.62 | 131,302,460 |
| 4.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608 |
| 4.7 | Reinforcing Steel | kg | 5,553,210.0 | 76.68 | 425,820,143 |
| 4.8 | Prestressing Steel | kg | 2,432.6 | 183.48 | 446,328 |
| 4.9 | Lean Concrete 17Mpa | m3 | 142.9 | 4,888.50 | 698,357 |
| 4.10 | Structural Concrete, Class A Pile Cap | m3 | 4,285.7 | 6,747.60 | 28,918,286 |
| 4.11 | Structural Concrete, Class AA Columun | m3 | 9,600.0 | 13,995.89 | 134,360,525 |
| 4.12 | Structural Concrete, Class P Coping | m3 | 8,352.0 | 20,024.50 | 167,244,591 |
| 4.13 | Structural Concrete, Class AA Deck Slab | m3 | 6,325.0 | 9,171.97 | 58,012,723 |
| 4.14 | Structural Concrete, Class AA Diaphram | m3 | 1,234.3 | 22,025.16 | 27,185,340 |
| 4.15 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056 |
| 4.16 | Non Shrink Grout | m3 | 4.3 | 96,554.59 | 413,805 |
| 4.17 | AASHTO PC Girder Type V, L=35.0m | each | 290.0 | 1,395,023.20 | 404,556,727 |
| 4.18 | Steel Decking | sq.m | 27,500.0 | 2,913.90 | 80,132,250 |
| 4.19 | Elastomeric Bearing Pad (606 x 306 x 60mm) | each | 342.9 | 5,596.26 | 1,918,717 |
| 4.20 | Ruber Filler (400 x 150 x 50mm) | each | 342.9 | 1,039.00 | 356,227 |
| 4.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 342.9 | 1,888.57 | 647,510 |
| 4.22 | Expansion Joint | m | 785.7 | 35,302.36 | 27,737,565 |
| 4.23 | Median Strip | m2 | 2,000.0 | 1,011.11 | 2,022,211 |
| 4.24 | Cast Iron Deck Drain | each | 200.0 | 23,615.48 | 4,723,097 |
| 4.25 | Rainwater Downspout (PVC 150) | l.m. | 1,800.0 | 950.04 | 1,710,072 |
| 4.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296 |
| 4.27 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815 |
| 4.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748 |
| 4.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 39,264,968 |
| | **Total** | | | | **1,609,863,678.78** |
| | **Unit Cost (Item 4 -Million Peso / km)** | | | | **1,609.86** |
| | **Unit Cost (Item 4 -Peso /sq.m)** | | | | **58,540.50** |

## 12.7 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH-2 WIDENING INTER URBAN SECTION

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Widening Section (additional 3.5m+2m Both side Concrete Pavement ) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 1.3 | 291,964.48 | 379,554.00 |
| 1.2 | Roadway Excavation | m3 | 7,800.0 | 642.11 | 5,008,450.00 |
| 1.3 | Subgrade Preparation | m2 | 11,000.0 | 30.06 | 330,680.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 2,200.0 | 1,530.27 | 3,366,602.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 3,300.0 | 1,765.50 | 5,826,150.00 |
| 1.6 | Portland Cement Concrete Reinforced with Wire Mesh Pavement, 320mm thk | m2 | 7,000.0 | 2,505.52 | 17,538,669.00 |
| 1.7 | Shoulder for Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 4,000.0 | 1,087.45 | 4,349,798.00 |
| 1.8 | Bituminous Prime Coat | m2 | 4,000.0 | 33.07 | 132,289.00 |
| 1.9 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.10 | RCPC, 1220 mm dia | l.m. | 130.0 | 8,406.67 | 1,092,867.00 |
| 1.11 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.12 | Highway Linghting | each | 0.0 | 190,406.32 | - |
| 1.13 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.14 | General Requirement (2.5% of Civil Work) | LS | 1 | | 1,515,572.58 |
| | **Total** | | | | **62,138,475.58** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **62.14** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **4,971.08** |

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Detour Road New Construction Section (4 Lanes, W=21.5m, H=2m Concrete Pavement) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 3.2 | 291,964.48 | 919,688.00 |
| 1.2 | Embankment From Borrow Excavation | m3 | 33,000.0 | 1,208.34 | 39,875,262.00 |
| 1.3 | Subgrade Preparation | m2 | 19,500.0 | 30.06 | 586,205.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 3,900.0 | 1,530.27 | 5,968,067.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 6,850.0 | 1,765.50 | 12,093,675.00 |
| 1.6 | Portland Cement Concrete Reinforced with Wire Mesh Pavement, 320mm thk | m2 | 15,500.0 | 2,505.52 | 38,835,623.00 |
| 1.7 | Shoulder for Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 4,000.0 | 1,087.45 | 4,349,798.00 |
| 1.8 | Bituminous Prime Coat | m2 | 4,000.0 | 33.07 | 132,289.00 |
| 1.9 | Median Strip | m2 | 2,000.0 | 1,011.11 | 2,022,211.00 |
| 1.10 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.11 | RCPC, 1220 mm dia | l.m. | 295.0 | 8,406.67 | 2,479,968.00 |
| 1.12 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.13 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 1.14 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.15 | General Requirement (2.5% of Civil Work) | LS | 1 | | 3,408,361.13 |
| | **Total** | | | | **136,334,445.00** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **136.33** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **6,991.51** |

## 12.8 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH-2 2 LANES NEW CONSTRUCTION INTER URBAN SECTION

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Detour Road New Construction Section (2 Lanes, W=14.5m, H=2m Concrete Pavement) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 2.5 | 291,964.48 | 715,313.00 |
| 1.2 | Embankment From Borrow Excavation | m3 | 24,600.0 | 1,208.34 | 29,725,195.00 |
| 1.3 | Subgrade Preparation | m2 | 12,500.0 | 30.06 | 375,772.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 2,500.0 | 1,530.27 | 3,825,684.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 4,750.0 | 1,765.50 | 8,386,125.00 |
| 1.6 | Portland Cement Concrete Reinforced with Wire Mesh Pavement, 320mm thk | m2 | 8,500.0 | 2,505.52 | 21,296,955.00 |
| 1.7 | Shoulder for Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 4,000.0 | 1,087.45 | 4,349,798.00 |
| 1.8 | Bituminous Prime Coat | m2 | 4,000.0 | 33.07 | 132,289.00 |
| 1.9 | Median Strip | m2 | 2,000.0 | 1,011.11 | 2,022,211.00 |
| 1.10 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.11 | RCPC, 1220 mm dia | l.m. | 225.0 | 8,406.67 | 1,891,501.00 |
| 1.12 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.13 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 1.14 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.15 | General Requirement (2.5% of Civil Work) | LS | 1 | | 2,544,812.55 |
| | **Total** | | | | **101,792,502.00** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **101.79** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **8,143.40** |

## 12.9 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH-2 BRIDGE WIDENING INTER URBAN SECTION

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **4** | **Cost of P/S Concrete Bridge (Add 2 Lane, W=11m , Span=35m, Single-Column P/S Concrete Girder,)** | | | | |
| 4.1 | Structure Excavation | m3 | 2,857.1 | 753.97 | 2,154,196 |
| 4.2 | Foundation Backfill | m3 | 1,142.9 | 1,328.46 | 1,518,236 |
| 4.3 | Bituminous Tack Coat | m2 | 11,000.0 | 33.07 | 363,794 |
| 4.4 | Bituminous Concrete Surface Course | m2 | 11,000.0 | 1,087.45 | 11,961,945 |
| 4.5 | Concrete Piles Cast in Drilled Holes, 1.0m | m | 4,285.7 | 19,980.16 | 85,629,257 |
| 4.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608 |
| 4.7 | Reinforcing Steel | kg | 1,819,465.7 | 76.68 | 139,516,631 |
| 4.8 | Prestressing Steel | kg | 729.8 | 183.48 | 133,898 |
| 4.9 | Lean Concrete 17Mpa | m3 | 57.1 | 4,888.50 | 279,343 |
| 4.10 | Structural Concrete, Class A Pile Cap | m3 | 1,714.3 | 6,747.60 | 11,567,314 |
| 4.11 | Structural Concrete, Class AA Columun | m3 | 2,057.1 | 13,995.89 | 28,791,541 |
| 4.12 | Structural Concrete, Class P Coping | m3 | 2,750.0 | 20,024.50 | 55,067,364 |
| 4.13 | Structural Concrete, Class AA Deck Slab | m3 | 2,898.0 | 9,171.97 | 26,580,375 |
| 4.14 | Structural Concrete, Class AA Diaphram | m3 | 205.7 | 22,025.16 | 4,530,890 |
| 4.15 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056 |
| 4.16 | Non Shrink Grout | m3 | 2.9 | 96,554.59 | 275,870 |
| 4.17 | AASHTO PC Girder Type V, L=35.0m | each | 116.0 | 1,395,023.20 | 161,822,691 |
| 4.18 | Steel Decking | sq.m | 12,600.0 | 2,913.90 | 36,715,140 |
| 4.19 | Elastomeric Bearing Pad (606 x 306 x 60mm) | each | 228.6 | 5,596.26 | 1,279,145 |
| 4.20 | Ruber Filler (400 x 150 x 50mm) | each | 228.6 | 1,039.00 | 237,485 |
| 4.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 228.6 | 1,888.57 | 431,674 |
| 4.22 | Expansion Joint | m | 360.0 | 35,302.36 | 12,708,848 |
| 4.23 | Median Strip | m2 | 0.0 | 1,011.11 | - |
| 4.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548 |
| 4.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036 |
| 4.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296 |
| 4.27 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815 |
| 4.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748 |
| 4.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 15,653,569 |
| | **Total** | | | | **641,796,312.60** |
| | **Unit Cost (Item 4 -Million Peso / km)** | | | | **641.80** |
| | **Unit Cost (Item 4 -Peso /sq.m)** | | | | **58,345.12** |

## 12.10 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH-2 WIDENING URBAN SECTION

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Widening Section (additional 3.5m+2m+5m, Both side Concrete Pavement ) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 2.1 | 291,964.48 | 613,125.00 |
| 1.2 | Roadway Excavation | m3 | 12,600.0 | 642.11 | 8,090,573.00 |
| 1.3 | Subgrade Preparation | m2 | 21,000.0 | 30.06 | 631,298.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 2,200.0 | 1,530.27 | 3,366,602.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 6,850.0 | 1,765.50 | 12,093,675.00 |
| 1.6 | Portland Cement Concrete Reinforced with Wire Mesh Pavement, 320mm thk | m2 | 11,000.0 | 2,505.52 | 27,560,765.00 |
| 1.7 | Side Walk | m2 | 10,000.0 | 720.00 | 7,200,000.00 |
| 1.8 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.9 | RCPC, 1220 mm dia | l.m. | 210.0 | 8,406.67 | 1,765,401.00 |
| 1.10 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.11 | Highway Linghting | each | 0.0 | 190,406.32 | - |
| 1.12 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.13 | General Requirement (2.5% of Civil Work) | LS | 1 | | 2,097,982.08 |
| | **Total** | | | | **86,017,265.08** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **86.02** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **6,881.38** |

## 12.11 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH-2 4 LANES NEW CONSTRUCTION URBAN SECTION

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Detour Road New Construction Section (4 Lanes, W=31.5m, H=2m Concrete Pavement) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 3.2 | 291,964.48 | 919,688.00 |
| 1.2 | Embankment From Borrow Excavation | m3 | 37,800.0 | 1,208.34 | 45,675,300.00 |
| 1.3 | Subgrade Preparation | m2 | 19,500.0 | 30.06 | 586,205.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 3,900.0 | 1,530.27 | 5,968,067.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 11,850.0 | 1,765.50 | 20,921,175.00 |
| 1.6 | Portland Cement Concrete Reinforced with Wire Mesh Pavement, 320mm thk | m2 | 19,500.0 | 2,505.52 | 48,857,719.00 |
| 1.7 | Median Strip | m2 | 2,000.0 | 1,011.11 | 2,022,211.00 |
| 1.8 | Side Walk | m2 | 10,000.0 | 720.00 | 7,200,000.00 |
| 1.9 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.10 | RCPC, 1220 mm dia | l.m. | 295.0 | 8,406.67 | 2,479,968.00 |
| 1.11 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.12 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 1.13 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.14 | General Requirement (2.5% of Civil Work) | LS | 1 | | 4,092,549.80 |
| | **Total** | | | | **167,794,541.80** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **167.79** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **8,604.85** |

## 12.12 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH-2 2 LANES NEW CONSTRUCTION URBAN SECTION

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Detour Road New Construction Section (2 Lanes, W=20.5m, H=2m Concrete Pavement) Section (L=1.0 km)** | | | | |
| 1.1 | Clearing and Grubbing | ha | 3.1 | 291,964.48 | 890,492.00 |
| 1.2 | Embankment From Borrow Excavation | m3 | 24,600.0 | 1,208.34 | 29,725,195.00 |
| 1.3 | Subgrade Preparation | m2 | 12,500.0 | 30.06 | 375,772.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 2,500.0 | 1,530.27 | 3,825,684.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 9,750.0 | 1,765.50 | 17,213,625.00 |
| 1.6 | Portland Cement Concrete Reinforced with Wire Mesh Pavement, 320mm thk | m2 | 12,500.0 | 2,505.52 | 31,319,051.00 |
| 1.7 | Median Strip | m2 | 2,000.0 | 1,011.11 | 2,022,211.00 |
| 1.8 | Side Walk | m2 | 10,000.0 | 720.00 | 7,200,000.00 |
| 1.9 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 2,000.0 | 4,553.05 | 9,106,104.00 |
| 1.10 | RCPC, 1220 mm dia | l.m. | 285.0 | 8,406.67 | 2,395,902.00 |
| 1.11 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748.00 |
| 1.12 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815.00 |
| 1.13 | ROW Fence | l.m. | 2,000.0 | 1,681.00 | 3,361,992.00 |
| 1.14 | General Requirement (2.5% of Civil Work) | LS | 1 | | 3,100,989.78 |
| | **Total** | | | | **127,140,580.78** |
| | **Unit Cost (Item 1 - Million Peso / km)** | | | | **127.14** |
| | **Unit Cost (Item 1 - Peso /sq.m)** | | | | **10,171.25** |

## 12.13 UNIT COST OF MAJOR CONSTRUCTION ITEMS HSH-2 BRIDGE WIDENING URBAN SECTION

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **4** | **Cost of P/S Concrete Bridge (Add 2 Lane, W=17m , Span=35m, Single-Column P/S Concrete Girder,)** | | | | |
| 4.1 | Structure Excavation | m3 | 3,571.4 | 753.97 | 2,692,745 |
| 4.2 | Foundation Backfill | m3 | 1,428.6 | 1,328.46 | 1,897,795 |
| 4.3 | Bituminous Tack Coat | ton | 11,000.0 | 33.07 | 363,794 |
| 4.4 | Bituminous Concrete Surface Course | ton | 11,000.0 | 1,087.45 | 11,961,945 |
| 4.5 | Concrete Piles Cast in Drilled Holes, 1.5m | m | 4,285.7 | 32,825.62 | 140,681,207 |
| 4.6 | Railing | l.m. | 2,000.0 | 6,008.30 | 12,016,608 |
| 4.7 | Reinforcing Steel | kg | 2,897,665.7 | 76.68 | 222,193,007 |
| 4.8 | Prestressing Steel | kg | 1,503.8 | 183.48 | 275,912 |
| 4.9 | Lean Concrete 17Mpa | m3 | 71.4 | 4,888.50 | 349,179 |
| 4.10 | Structural Concrete, Class A Pile Cap | m3 | 2,142.9 | 6,747.60 | 14,459,143 |
| 4.11 | Structural Concrete, Class AA Columun | m3 | 3,657.1 | 13,995.89 | 51,184,962 |
| 4.12 | Structural Concrete, Class P Coping | m3 | 3,300.0 | 20,024.50 | 66,080,837 |
| 4.13 | Structural Concrete, Class AA Deck Slab | m3 | 5,778.0 | 9,171.97 | 52,995,654 |
| 4.14 | Structural Concrete, Class AA Diaphram | m3 | 257.1 | 22,025.16 | 5,663,613 |
| 4.15 | Structural Concrete, Class A Parapet | m3 | 1,000.0 | 10,111.06 | 10,111,056 |
| 4.16 | Non Shrink Grout | m3 | 3.4 | 96,554.59 | 331,044 |
| 4.17 | AASHTO PC Girder Type V, L=35.0m | each | 174.0 | 1,395,023.20 | 242,734,036 |
| 4.18 | Steel Decking | sq.m | 12,600.0 | 2,913.90 | 36,715,140 |
| 4.19 | Elastomeric Bearing Pad (606 x 306 x 60mm) | each | 342.9 | 5,596.26 | 1,918,717 |
| 4.20 | Ruber Filler (400 x 150 x 50mm) | each | 342.9 | 1,039.00 | 356,227 |
| 4.21 | Hard Rubber Filer & Restrainer Bolt dia 30mm | set | 342.9 | 1,888.57 | 647,510 |
| 4.22 | Expansion Joint | m | 531.4 | 35,302.36 | 18,760,681 |
| 4.23 | Median Strip | m2 | 0.0 | 1,011.11 | - |
| 4.24 | Cast Iron Deck Drain | each | 100.0 | 23,615.48 | 2,361,548 |
| 4.25 | Rainwater Downspout (PVC 150) | l.m. | 900.0 | 950.04 | 855,036 |
| 4.26 | Rainwater Downspout (PVC 200) | l.m. | 1,900.0 | 1,383.84 | 2,629,296 |
| 4.27 | Highway Linghting | each | 34.0 | 190,406.32 | 6,473,815 |
| 4.28 | Traffic Sign and Safety Facilities | l.m. | 1,000.0 | 10,129.75 | 10,129,748 |
| 4.29 | General Requirement (2.5% of Civil Work) | L.S | 1.0 | | 22,921,006 |
| | **Total** | | | | **939,761,261.38** |
| | **Unit Cost (Item 4 -Million Peso / km)** | | | | **939.76** |
| | **Unit Cost (Item 4 -Peso /sq.m)** | | | | **55,280.07** |

## 12.14 UNIT COST OF TRUMPET TYPE INTERCHANGE

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Trumpet Type Interchange (1.0m+3.5m+2m) Ramp** | | | | |
| 1.1 | Clearing and Grubbing | ha | 2.9 | 291,964.48 | 832,099.00 |
| 1.2 | Embankment from Roadway Excavation | m3 | 197,220.0 | 242.33 | 47,792,914.00 |
| 1.3 | Subgrade Preparation | m2 | 28,185.0 | 30.06 | 847,292.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 4,491.0 | 1,530.27 | 6,872,458.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 6,736.5 | 1,765.50 | 11,893,291.00 |
| 1.6 | Cement Treated Base Course (t=20cm) | m3 | 4,011.0 | 2,800.44 | 11,232,565.00 |
| 1.7 | Bituminous Tack Coat | m2 | 20,300.0 | 36.38 | 738,503.00 |
| 1.8 | Bituminous Prime Coat | m2 | 20,055.0 | 33.07 | 663,263.00 |
| 1.9 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 20,300.0 | 1,010.31 | 20,509,304.00 |
| 1.10 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 20,055.0 | 1,087.45 | 21,808,801.00 |
| 1.11 | Portland Cement Concrete Reinforced with Wire Mesh Pavement, 320mm thk | m2 | 2,400.0 | 2,505.52 | 6,013,258.00 |
| 1.12 | Concrete Barrier (New Jersey Type ) | l.m. | 760.0 | 5,592.66 | 4,250,422.00 |
| 1.13 | Slope Net with Seeding for Common Soil on Fill | m2 | 37,654.2 | 310.00 | 11,672,814.00 |
| 1.14 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 4,210.0 | 4,553.05 | 19,168,349.00 |
| 1.15 | RCPC, 1220 mm dia | l.m. | 272.0 | 8,406.67 | 2,286,615.00 |
| 1.16 | Traffic Sign and Safety Facilities | l.m. | 2,900.0 | 10,129.75 | 29,376,270.00 |
| 1.17 | Tool Road Lighting | each | 26.0 | 190,406.32 | 4,950,564.00 |
| 1.18 | ROW Fence | l.m. | 4,300.0 | 1,681.00 | 7,228,283.00 |
| 1.19 | Bridge 35m PC-I Girder | m2 | 490.0 | 63,782.59 | 31,253,470.00 |
| 1.20 | Portable Weigning Station | set | 1.00 | 4,277,373.88 | 4,277,374.00 |
| 1.21 | Toll Island | each | 6.00 | 165,870.88 | 995,225.00 |
| 1.22 | Crash Attenuators | set | 6.00 | 54,935.15 | 329,611.00 |
| 1.23 | Toll Booth (Type 1) | each | 4.00 | 464,645.32 | 1,858,581.00 |
| 1.24 | Toll Booth (Maxi Type 2) | each | 2.00 | 1,010,267.24 | 2,020,534.00 |
| 1.25 | Toll Plaza | sq.. | 300.00 | 26,106.00 | 7,831,800.00 |
| 1.26 | Toll House | Unit | 1.00 | 5,400,000.00 | 5,400,000.00 |
| 1.27 | Toll Plaza Lighting System | each | 6.00 | 369,430.48 | 2,216,583.00 |
| 1.28 | General Requirement (2.5% of Civil Work) | LS | | | 6,608,006.08 |
| | **Total** | | | | **270,928,249.08** |
| | **Unit Cost (Item 1 - Million Peso / Interchange)** | | | | **270.93** |

## 12.15 UNIT COST OF CLOVER TYPE JUNCTION

| No. | Description | Unit | Quantities | Unit Price (Pesos) | Cost (Pesos) |
|---|---|---|---|---|---|
| **1** | **Clover Type Interchange (1.0m+3.5m+2m) Ramp** | | | | |
| 1.1 | Clearing and Grubbing | ha | 5.3 | 291,964.48 | 1,546,653.00 |
| 1.2 | Embankment from Roadway Excavation | m3 | 153,036.0 | 242.33 | 37,085,673.00 |
| 1.3 | Subgrade Preparation | m2 | 52,974.0 | 30.06 | 1,592,494.00 |
| 1.4 | Aggregate Base Course (t=20cm) | m3 | 8,240.4 | 1,530.27 | 12,610,066.00 |
| 1.5 | Aggregate Sub Base Course (t=30cm) | m3 | 12,360.6 | 1,765.50 | 21,822,639.00 |
| 1.6 | Cement Treated Base Course (t=20cm) | m3 | 8,240.4 | 2,800.44 | 23,076,746.00 |
| 1.7 | Bituminous Tack Coat | m2 | 41,202.0 | 36.38 | 1,498,906.00 |
| 1.8 | Bituminous Prime Coat | m2 | 41,202.0 | 33.07 | 1,362,642.00 |
| 1.9 | Anti Rutting Bituminous Concrete Binder Course, Hot Laid (t=5 cm) | m2 | 41,202.0 | 1,010.31 | 41,626,816.00 |
| 1.10 | Anti Rutting Bituminous Wearing Concrete Course, Hot Laid (t=5 cm) | m2 | 41,202.0 | 1,087.45 | 44,805,096.00 |
| 1.11 | Concrete Barrier (New Jersey Type ) | l.m. | 0.0 | 5,592.66 | - |
| 1.12 | Slope Net with Seeding for Common Soil on Fill | m2 | 52,620.8 | 310.00 | 16,312,460.00 |
| 1.13 | Drainage (Grouted Riprap Class A Slide Ditch) | l.m. | 11,772.0 | 4,553.05 | 53,598,528.00 |
| 1.14 | RCPC, 1220 mm dia | l.m. | 416.0 | 8,406.67 | 3,497,176.00 |
| 1.15 | Traffic Sign and Safety Facilities | l.m. | 5,886.0 | 10,129.75 | 59,623,699.00 |
| 1.16 | Lighting | each | 145.0 | 190,406.32 | 27,608,916.00 |
| 1.17 | ROW Fence | l.m. | 8,652.0 | 1,681.00 | 14,543,977.00 |
| 1.18 | General Requirement (2.5% of Civil Work) | LS | 1 | | 9,055,312.18 |
| | **Total** | | | | **371,267,799.18** |
| | **Unit Cost (Item 1 - Million Peso / Junction)** | | | | **371.27** |

# *APPENDIX 13*

# *STRATEGIC ENVIRONMENTAL ASSESSMENT*

# 13.1 1ST STAKEHOLODER MEETING REPORT

# 1st Stakeholders Meeting Report

Venue: DPWH Multi-Purpose Hall, DPWH
Date and Time: July 31, 2019, 9:00-16:00
Target Region: I, II, III and CAR

## 1.0. Background and Purpose of the Meeting

The Department of Public Works and Highways (DPWH) with technical assistance from Japan International Cooperation Agency (JICA) is undertaking a study on Masterplan for High Standard Highway Network Development in the Philippines, Phase 2 (HSH Phase 2).

The study is aimed at providing higher quality of HSH network for faster, safer, more comfortable, more reliable, and environmentally friendly means of road transport, which would support national goals of rapid, inclusive, and sustained economic growth of the country.

The objectives of the 1st stakeholder meeting is 1) to be able to present to the stakeholders the project outline, what Strategic Environmental Assessment is, Pre-Scoping of the HSH Masterplan Phase 2, and the present road and traffic problems, 2) gather regional information and be able to identify the present problems and issues concerning environmental and social in the respective areas, and 3) to be able to come up with policies, guidelines, recommendations, and measures to address the identified problem and issues.

## 2.0. Program

Below is the detailed program for the 1st Stakeholders Meeting conducted in Regions I, II, III and CAR.

| TIME | ACTIVITY | |
|---|---|---|
| 08:00 – 09:00 | Registration | |
| 09:30 – 09:35 | Invocation and Singing of the National Anthem | |
| 09:35 – 09:40 | Introduction of Stakeholder Members | |
| 09:40 – 09:55 | Welcome Remarks | Dir. Constante A. LLANES, JR.<br>PS, DPWH Central |
| 09:55 – 10:00 | Group Picture | |
| 10:00 – 10:30 | Message and Project Outline | Dir. Constante A. LLANES, JR.<br>PS, DPWH Central |
| 10:30 – 10:35 | Image of HSH Output | Mr. Ryuichi UENO<br>Team Leader, JICA Study Team |
| 10:35 – 10:55 | What is SEA?<br>Pre-Scoping of HSH Master Plan | Mr. Tomoaki TANABE<br>Social and Environmental Specialist, JICA Study Team |
| 10:55 – 11:15 | Present Road/Traffic Problems<br>-Traffic Congestion, Road Closure, Protected Area, etc. | Mr. Ryuichi OIKAWA<br>Deputy Team Leader, JICA Study Team |
| 11:15 – 11:25 | Open Forum | |
| 11:25 - 11:35 | Explanation of next group discussion | |
| 11:35 – 12:15 | Group Discussion by Region | |
| 12:15 – 13:15 | Lunch | |
| 13:15 – 14:15 | Continuation of Group Discussion | |
| 14:15 – 15:15 | Presentation by Group | Leader of each Group |

| TIME | ACTIVITY | |
|---|---|---|
| 15:15 – 15:25 | Forward to next SHM | Mr. Ryuichi UENO<br>Team Leader, JICA Study Team |
| 15:25 – 15:45 | Wrap up | Dr. Rosemarie DEL ROSARIO<br>ESSD-PS, DPWH Central |
| 15:45 – 15:55 | Closing Remarks | Dr. Rosemarie DEL ROSARIO<br>ESSD-PS, DPWH Central |
| 15:55 – 16:00 | Distribution of Certificates | |

### 3.0. Attendees

The target participants are key stakeholders for road development and environment from Luzon Region (Region I, II, III and CAR) held at DPWH Multi-Purpose Hall, Manila City on July 31, 2019. It was attended by different government agencies (DENR, NEDA, & DPWH), local government units and private sectors (See attached attendance sheet). Total attendees are 61, 17 female and 44 male with the following distribution:

| Sector/Unit | Region/Office | No. of Participants |
|---|---|---|
| Government Agencies | DPWH Region I | 2 |
| | DPWH Region III | 4 |
| | DPWH Region CAR | 2 |
| | DPWH Central Office | 13 |
| | NEDA Region I | 2 |
| | NEDA Region II | 1 |
| | NEDA Region III | 2 |
| | NEDA Region CAR | 2 |
| | PEZA | 1 |
| | PPP Center | 2 |
| | DENR Region I | 2 |
| | DENR Region II | 1 |
| | DENR Region III | 1 |
| | DENR Region CAR | 1 |
| Local Government Units | Quirino | 2 |
| | Nueva Vizcaya | 2 |
| | Benguet | 2 |
| | Isabela | 2 |
| | Pangasinan | 1 |
| | Ilocos Norte | 2 |
| | Aurora | 3 |
| | Kalinga | 3 |
| | Bataan | 1 |
| | La Union | 1 |
| | Tarlac | 2 |
| Private Sectors and NGOs | TPLEX | 2 |
| | NLEX | 1 |
| | PCCI | 1 |
| **Total Attendance** | | 61 |

## 4.0. Highlights of the Meeting

The meetings were started with a word of prayer and singing of the National Anthem lead by Mr. Randy Hugo of KRC Environmental Services. Ms. Carmela Capule, Moderator and Master of Ceremony, provided overview of the whole-day-program and introduced the different stakeholders present in the meeting. This was followed by welcome address, message and presentations from JICA Study Team, key stakeholders and representative from workshop groups.

***Welcome Remarks by Dir. Constante A. Llanes Jr., Director IV, Planning Service, DPWH Central Office***

**Dir. Constante A. Llanes Jr., DPWH-Central**

Dir. Llanes welcomed the guest from different regions, the JICA Study Team, and stakeholders from different private sectors and thanked them for coming to the meeting. Dir. Constante shared that there was already stakeholder meeting conducted in Cebu City and Davao City last July 23 and July 25, 2019, respectively. He requested to the participants to actively participate and cooperate in every activity. He mentioned the objectives of the activity is to be able to present to the stakeholder the HSH phase 2, pre-scoping, road traffic problem and identify the presents problems in every region and to come up policy recommendations and guidelines. He said that high standard highway is essential to improve the transportation system in the Philippines for the benefits of the people and for the economic development that they are hoping. He said that this assistance from Japan is a testament of unrelenting support for the Philippine infrastructure development and economic growth, as expanding the expressway network will hasten the development of the country's regional cities, which will eventually help minimize over-concentration of socio-economic activities in Metro Manila and diminish economic disparities across the country.

He mentioned that the High Standard Highway Master Plan Network Development in the Philippines is an answer to the long-awaited realization of the Filipino people to have a quality, faster, safer, more comfortable, and more reliable and environment friendly means transport system which support national goals of inclusive and sustainable economic growth of the country. Also, he emphasizes that if we have a HSH roads it will make a crucial contribution to economic development and growth and bring important social benefits. They are of vital importance in order to make a nation grow and develop. In addition, providing access to employment, social, health and education services makes a road network crucial in fighting against poverty.

He thanked to the Japan government through JICA for the support and he wished for the success of the study and the support of the formulation of masterplan.

***Project Outline by Dir. Constante A. Llanes, Jr., DPWH Central Office***

Dir. Llanes explained that his presentation will cover the background of what DPWH is doing and relate this high standard highway strategic plans and programs of the department. He mentioned that DPWH and JICA formulated the first phase of the HSH network development master plan, which intends to draw up various measures such as develop expressways networks, construct bypasses and ring roads in regional cities, and widen existing roads to address traffic congestion particularly in highly urbanized areas.


**Dir. Constante A. Llanes Jr.**

Dir. Lllanes provided the project outline of the High Standing Highway Development Master Plan Study Phase II. He stated that this is part of the DPWH performance governance system strategy road map of the department from 2017 to 2022. Their vision is to be an efficient an effective government agency improving the light of every Filipino through quality restructure by

2030. He highlighted the DPWH three (3) major outcomes (Konkreto 2022, The DPWH Strategy Map) which includes: 1) Reduce Travel Time, 2) Improve Road Quality and Safety, and 3) Lives and Properties Protected from Natural Disasters. According to him, in order to reduce travel time and to increase low network capacity and construction road and bridges and transport seamless transport system. To improve road quality and safety, he stated the need to meet international standard for road quality and safety and provide engineering solutions and road safety concerns. For outcome 3, lives and properties protected from natural disasters are more on land control project.

He mentioned that part of strategic plan of DPWH is to have a sustainable and resilient communities. This includes the implementation of integrated water resource management program, disaster risk reduction and climate change adaptation program, infrastructure support for marginalized sectors and create environment-friendly communities. Second strategic plan indicated by Dir. Llanes is convergence and rural road development program. This is actually the convergence of DPWH with the Department of Tourism, Department of Trade and Industry and Department of Transportation that will construct/upgrade access roads to designated tourism destination, industrial trade corridors, RORO ports/seaports and airports. Another strategic plan is the integrated and seamless transportation system. He said that DPWH has the integrated and seamless transport system and they have the Mindanao infrastructure network that focuses on the central road network of the program the leading of the western Mindanao. The inter-island linkage and mega bridge program, connect gaps along national roads and construct new bridges. He explained that DPWH included in their plan that a series of short and long-span bridges linking island provinces will eventually connect Mindanao to Visayas and to Luzon via land travel. It will be composed of 17 short and long span bridges or 175,650 meters.

He discussed that the strategy of DPWH in this program is strategic plan where they will be building high standard highways. This also includes building expressways, by passes, under passes and diversion roads. He also added that there were widening in the national roads especially those that are in congested areas. He discussed the chronic traffic congestion is experienced in urban roads of mega cities and urban road sections of inter-city roads. This will results to an increase in travel time, failure of timely delivery of goods and people, and loss of valuable time of people. He provided example the experiences in Metro Manila were heavy traffic is the main problem of the people. It affects socio economic development because of the lost in the finance of every business. Through HSH, the Philippines will become internationally competitive in terms of industry as well as foreign and domestic investment.

He presented the result of the Phase 1 study that identified priority projects in Metro Manila, Metro Cebu and Metro Davao. He exampled the North Luzon Expressway and fringe of business center in Metro Manila. He said that the achievement right now in the high standard highway is updating the 2010 high standard highway master plan and identified projects under short term, region term, short term could be implemented immediately within 6yrs and the long term a program is serve as the basis on developing an integrated nationwide high standard highways not only by the DPWH but also for the agencies. The objectives of the high standard highway network development phase 2 is to review and update the high master plan in 2010 which is expanded from previous 200 km to 300 km. He mentioned that the HSH phase 1 network development was focused mainly in Metro Manila and its suburbs, and the Government of the Philippines has no nationwide HSH network development plan yet. The government of the Philippines requested the Government of Japan to implement “The study of Mater Plan on High Standard Highway Network Development in the Republic of the Philippines as a follow through study of phase 1.

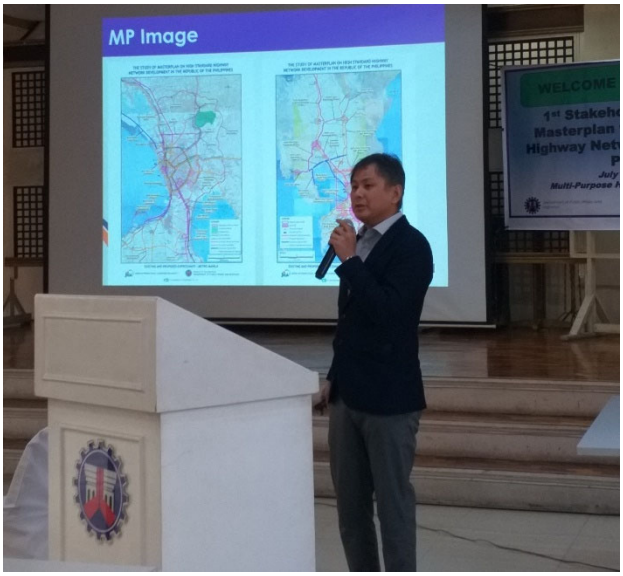
He presented the road investment project of the Department of Public Works and Highways in the past from 2011 to 2017 and their target for this master plan as the road map of the DPWH from investment budget plan. He also showed the logistics cost, logistics are the factor, and the country complete globally just the matter of interest. So the 2018 logistics performance where being required on how efficiently we move goods and good across the quarters. This will allow them to compare the healthy life across 160 countries for logistic performance indicators determined by the performance on the following in customs, infrastructure, international shipments delivery, logistics competence, drinking and timeliness of delivery of goods. He stressed out the importance of improving the transport system infrastructure of the country and connect with the production areas, consumption areas, seaports and airports. He also presented the total length of the expressways in the Philippines compared to other countries and how HSH will increase expressways in the country.

Lastly, he presented the organization to carry out study and the members of Joint Coordination Committee (JCC) which functions is to: 1) Evaluate and approve the annual work plan of the Project to be formulated under the framework of Record of Discussion (R/D) , 2) Evaluate the achievement of the annual work plan and overall progress of the project , 3) Provide guidance and resolve issues/constraints that may arise during the course of the study and implementation of the project, 4) Evaluate the results and recommendations of the study, and 5) Ensure to attain the desired outcome of the study. He also showed the members of Technical Working Group (TWG) which functions is to oversee/monitor the progress of the study being conducted by the Study Team including coordination of the pilot projects and

assist the JCC in the performance of its overall functions to ensure the optimum output needed in the study and will review materials prepared by the Counterpart Working Group (CWG).

***Image of HSH Output by Mr. Ryuichi Ueno, JICA Study Team***

Mr. Ryuichi Ueno briefly discussed the Image of High Standards Highway Master Plan. He presented the road network maps (existing and proposed expressway) in Metro Manila and within 200Km sphere of Metro Manila. The presentation reflects the location of Regional Urban Center, eco-zone, international airport and port, existing and on-gong expressway, proposed expressway, expressway beyond 2030 and Regional Standard Highway.




**Mr. Ryuichi Ueno, JICA Study Team**

On his presentation, he also discussed the 1st and 2nd priority of HSH Projects with a total length of 576.3 kilometers with a total cost of 470.27 billion pesos. He also showed the implementation schedule and the effects of HSH MP to travel time and average time speed with and without Master Plan scenario. He very thankful for the government of the Philippines for the strong partnership.

***Presentation on What is SEA and Pre-Scoping by Mr. Tomoaki Tanabe, JICA Study Team***

Mr. Tanabe presented the Strategic Environmental Assessment (SEA) and the Environmental and Social Issues on Highway Network Development. He defines SEA based on definition of international agencies (OECD/DAC 2006 and World Bank 2002) and explained the different approach between the SEA and EIA. According to him, the SEA is applied at the very earliest stages/higher levels of decision-making (Policy, Plan and Program).


**Mr. Tomoaki Tanabe, JICA Study Team**

On his presentation, he emphasized the objectives and benefits of SEA which is to 1) make the formulation process of the development plan more effective during the decision-making, 2) evaluate the development alternatives from a wide range of viewpoints, 3) avoid and/or minimize significant negative impacts and to enhance positive impacts at an early stage and 4) avoid unnecessary revision of the project plan in the implementation stage. He also specified the process of SEA from screening, scoping,

assessment, reports and review, decision making and monitoring of impacts of the strategic actions.

In terms of legal framework in the Philippines, Mr. Tanabe stressed out that the SEA system has not been legislated in the Philippines however, there is a relevant House Bill (No. 4800, Year 2014) being proposed, the Philippine Environmental Assessment System Act. In addition, he mentioned that JICA applies a Strategic Environmental Assessment (SEA) when conducting Master Plan Studies and encourages project proponents to ensure environmental and social considerations from an early stage to the monitoring stage. This is adopted in the formulation of HSH Phase 2.

Mr. Tanabe also discussed the preliminary scoping that is carried out based on the general highway project components and existing secondary environmental and social information in the Philippines. The phases and affective activities by general highway development that includes the major activities which will affect to the surrounding environment and social condition. He presented the potential negative impact by road projects particularly in pollution, natural environment, social environment, public health and Safety Risk, and emergency risk and others. He also highlighted the specific environmental and social problems/issues in road development that includes protected area, Indigenous People, Land acquisition and resettlement, and Public Health and Safety and Pollution Issue.

***Presentation on Road/Traffic Problems, Traffic Congestion, Road Closure by Mr. Ryuichi Oikawa, JICA Study Team***

Mr. Ryuichi Oikawa shared the current road and traffic condition as well as issues identified on their study. He discussed that the existing arterial road network consist of Primary, Secondary and Tertiary national roads. The basic network was completed. He added that as new road network, expressways have been developed in Metro Manila and nearby areas only. According to him, The Philippines is in economic growth phase and population increase is continuing. For further economic promotion, the development of high-speed transportation network is essential. He mentioned that National Development Plan calls for promotion of developing regional centers and enhance their connectivity. He believed that the key infrastructure to enhance the connectivity is HSH network. He presented the present road network international comparison which development of expressways in Philippines is slow compared with other Eastern Asia countries. He stressed out that it is required to promote expansion of HSH network nationwide. Also, he mentioned that roads have contributed to the development of every country as an essential transportation infrastructure.


**Mr. Ryuichi Oikawa, JICA Study Team**

He presented the current traffic condition low level travel speed in Northern Luzon, Manila bound at AM peak hour. He provided an example which is the San Rafael-Cabanatuan Section. Also, he discussed the increasing traffic demand such as traffic volume on major road section is certainly increasing and average annual growth rate is 4.8% from 2010 to 2018. To

correspond to this situation, he suggested the development of a new high-standard highway network that bypasses urban areas.

Next is the situation of trip length. It is the result of roadside OD survey, the average trip distance is more than 80km. A long trip distance of 100 km or more has increased by 25%. People's movements and logistics are wide-area, and it is expected to expand in the future.

He also discussed the connectivity issues which is a very important aspect of road development outcomes and benchmarks. For example, regarding the connectivity to the Metropolitan center, the metropolitan center has a high concentration of urban functions. He emphasized the importance of access in terms of life and business. One day access area, 3 hour access area, is limited. Accessible population is only 50%. If HSH road network is developed, the exchange population is expected to expand to 68%.

Next is connectivity to the regional center. He emphasizes the importance of regional center development which is the core city of the regional living area. He mentioned that regional centers are regional markets and urban service centers: administrative centers, international gateway and tourism hub. He said that they are thinking high accessibility to the regional center within 1.5 hour is important for improving quality of life. Accessible population is 65% and he suggested that it should be expand this area to almost 100% by HSH network development.

He highlighted that the development of high-standard highway networks is necessary to overcome the basic issues of natural conditions. Firstly, it is required to secure durability, resiliency and redundancy to natural disasters. He presented the typhoon's passage route which covers the whole islands of the Philippines. It resulted to landslide and floods along the roads. He presented the mountain crossing road section from Cagayan Valley-Central Luzon plain. He mentioned that mountain area is a hindrance to smooth transportation and accessibility of the areas. As a result, regional development is limited. Also, he shared that most islands have difficulty in creating road networks.

Lastly, he presented the result of the observation for road network, traffic condition and connectivity.

***Issues and Concern at the Open Forum***

The following are opinion, issues and concerns raised during the open forum:

| Major Questions and Answer | | | |
|---|---|---|---|
| **Name/Position** | **Question** | **Name** | **Answer** |
| Ressie Estrella, Provincial Engineer, La Union | We are requesting to include in the design the tunnel since in our region there are so many mountain. | Mr. Ryuichi Ueno, Team Leader, JICA Study Team | Yes, we will consider your suggestion in the master plan. |
| Edgardo Sabado, PPDO, PLGU Nueva Vizcaya | I think we need to include National Commission of Indigenous Peoples on the Technical Working Group (TWG). We observed that in the TWG, NCIP did not included, we believed that the role of NCIP is very critical especially for the ancestral domains areas. | Dir. Constante Llanes, Director Planning Service, DPWH Central Office | Yes, we will include in the NCIP in the TWG. We will discuss to the management regarding your concerns. We strongly agreed that NCIP to be included. |
| Gigi Simbulan, Regional Governor, PCCI-Region III | In Balagtas-Plaridel-Bustos to North, it has been traffic congested due to some vehicles such as trucks they used as parking lot | Dir. Constante Llanes, Director Planning Service, DPWH Central Office | This issue will be resolved in the LGU level. The LGUs need to control the illegal parking in national road. It is their jurisdiction. We need the intervention of the LGU on the policy for parking. |
| | Can we include the development of Bulacan coastal road and the interior roads of Bulacan? | Dir. Constante Llanes, Director Planning Service, DPWH Central Office | These issues were covered by the DPWH. |
| | We have an on-going project about Bulacan Airport. With this, it is possible for the connectivity of Bulacan Airport to Clark Airport? | Dir. Constante Llanes, Director Planning Service, DPWH Central Office | Yes, there is a possibility of the road network for the connectivity of both airports. |

***Group Discussions and Presentations***

The participants were divided into 4 groups. Each group will (i) discuss the perception and issues which might affect the study, (ii) social and economic issues in their region and (iii) share ideas and recommendations (iv) if they have other suggestions, each will elect a facilitator and team leader who will present the output of the group. Groupings are based on Regions and are provided with four (4) questions to answer.

The following are the outputs of group discussions:

**Group I – Region III**

**Group Member list**

| No. | Name | Designation, office |
|---|---|---|
| 1 | Susana S. Santiago (**F**) | CDS, NEDA, R3 |
| 2 | Gregoria G. Simbulan (**T**) | Regional Governor, PCCI R3 |
| 3 | Marciano M. Franco | CDS, NEDA, R3 |
| 4 | Dominador Bagada Jr. | PEZA |
| 5 | Jeffrey Francisco | DMO III, DENR-R3 |
| 6 | Leonor Labung | Engr. IV, DPWH, R3 |
| 7 | Yaney Brian Sibulo | Engr. II, DPWH, R3 |
| 8 | Raymond Paulo Masbang | Engr. II, DPWH, R3 |
| 9 | Enrico T. Yuzon | Provincial Engineer, PEO, LGU Bataan |
| 10 | Rico B. Ancheta | PGT, LGU Tarlac |
| 11 | Dante M. Cardona | PGT, LGU Tarlac |
| 12 | Ariel P. Costa | PEO, LGU Aurora |
| 13 | Alfredo E. Penzon | PEO, LGU Aurora |
| 14 | Ronald Turaja | PEO, LGU Aurora |
| 15 | Janice Gracilla | Metro Pacific Toll/NLEX |
| 16 | Ronald Mangilin | PEO III, PPP Center |
| 17 | Imari Kate Galvez | PDO III, PPP Center |

(F): Facilitator
(T): Team leader who also presented the output

The group was facilitated by Susana Santiago of NEDA Region 3 and presented by Gregoria Simbulan of PCCI, Region 3.

Ms. Santiago informed the group to prioritize the short term, medium and long term on issues and concern.

Mr. Dominador Bagada Jr. of PEZA suggested on linking of economic zones and potential economic zones in HSH (with emphasis in PEZA, Clark, Subic, Aurora & Bataan Freeport Economic Zones) must be included in the study. Potential investors are limited due to limited road network specifically in Aurora Pacific Economic Zone. Dr. Sinarimbo concurred with this observation and informed the body that based on the result of Logistics Survey, one of the concerns of investors is the connectivity to expressway from economic zones. Mr. Bagada Jr. informed the group that there was an instruction to PEZA to develop and urbanize rural areas per AO 18 from President Duterte issued recently. Further to this order, for every region, there should have economic zone. Potential economic zones locations will be coordinated with LGUs. He believed that if there is an infrastructure, there is progress. JICA study is very important in the growth of economic zones. Ms. Santiago mentioned the existing eco zones in region 3 which are the Clark Freeport Zone, Subic and Bataan Freeport Zones.

LGUs should be included in the planning. It needs full coordination. Mr. Ronald Mangilin of PPP Center requested to provide update, status of existing projects in Phase I and the funding source of projects.

Aurora Economic Zone in Casiguiran – is an active and private ecozone; only few are registered at PEZA. Mr. Bagada Jr. emphasized that one major issue among economic zones is the logistics because of import/export activities.

Ms. Santiago commented on limited HSH on east-west lateral of the region. She also suggested to have provisions for Transit Oriented Development (TOD);

Ms. Gigi Simbulan commented on LGUs' CLUPs and land use need to be revisited and updated because some of them are outdated. LGUs connect commercial, industrial development to main national roads. Dr. Sinarimbo informed the group that DPWH has the control of the development within the Righ-of-way (ROW) but has no authority on land use classification and zoning.

Ms. Gigi Simbulan suggested that by-pass roads must be elevated to limit access to motorists.

Provisions for service roads in expressways (Sindalan area, San Fernando, vehicles exiting at NLEX-Mexico), limitations of service roads which will slow down transport of goods. This will prevent encroachment of establishments because of buffer zones in both service roads.

Dr. Sinarimbo asked about status of New Clark City (NCC). BCDA development is 9,450 hectares, 3600 hectares will be developed which is composed of sports complex, government buildings, light industrial parks, golf course, commercial and residential buildings. For road Network development, there will be four road opening connecting to expressway (SCTEX), McArthur Highway and Clark.

Proposed NLEX-east alignment is new as per Janice Gracilla of NLEX.

Ms. Santiago commented that Manila-Bataan coastal road and Manila Bay expressway are not implemented under Phase I. Dr. Sinarimbo informed that perhaps one of the issues is the low traffic demand and the planned construction of new international airport in Bulacan will surely generate new traffic which would make this road important.

Ms. Santiago raised one problem on traffic congestion which is the road quality due to poor maintenance examples are the major arterial roads from Pampanga to Bulacan. Furthermore, the group raised issues on quality of construction materials use for road construction are sub-standard compared in other regions especially Bulacan (eg Ilocos Region). Ms. Simbulan suggested to be vigilant in elevating the concerns on poor quality of road constructions. McArthur Highway from Manila traversing Bulacan to Pampanga, Doña Remedios Highway, Bulacan)

Presence of IPs (Angeles City,Mabalacat -Pampanga, Bamban, Capas-Tarlac, Aurora, Iba, Botolan, Candelaria, Sta. Cruz - Zambales, Dinalupihan, Hermosa – Bataan; there should have proper coordination of NCIPs.

Another issue raised but an isolated concern is insurgency (example in Tarlac – issue on Balog Balog dam). Office of Presidential Assistance for Peace Process (OPAPP) has the list of areas with insurgency problems.

Issues on FPIC permit, slow processing (North Eastern Luzon Expressway); lack the database from NCIP; difficulty in locating CADT boundaries are raised.

Vulnerable areas in Region 3 such as flooding in low lying areas in Pampanga, Bataan, Bulacan, Tarlac, Nueva Ecija, landslide in Aurora-San Luis-Bongabon Road Nueva Ecija,

Zambales are raised. Lastly, land subsidence in Pampanga, Bataan (coastal areas). Economic activities slow down due to geohazard problems (flooding/typhoons).

Mr. Enrico Yuzon of LGU suggested Bataan-Cavite Interlink Road. Other suggestions for most suitable locations are presented in the maps.

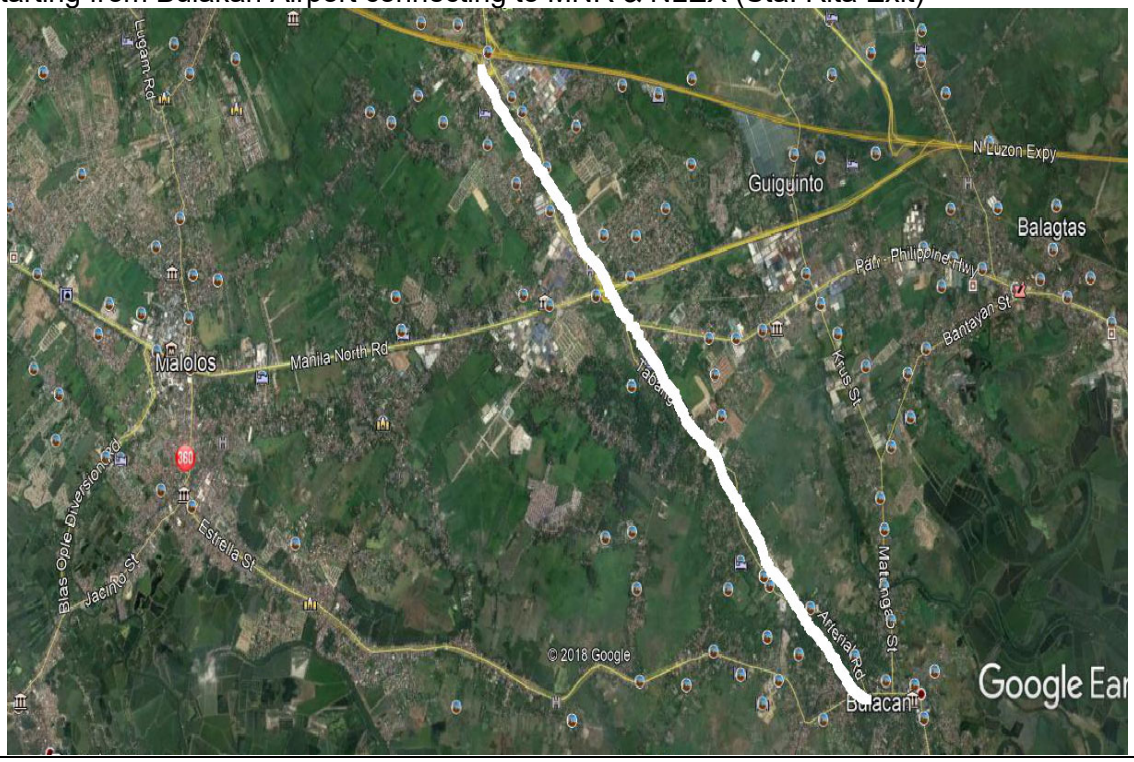
**Summary of Answers based on questions asked.**

| **Question 1. After listening to the presentation and seeing the scope of the study, what are the issues/things you want to advice/share to the Study Team to ensure success of this study?** |
|---|
| • Provisions for Transit Oriented Development (TOD);<br>• Involvement of LGUs in planning and implementation stages<br>• Road and Bridge safety programs<br>• Linking of economic zones in HSH (with emphasis in PEZA, Clark, Subic, Aurora & Bataan Freeport Economic Zones)<br>• Provide updates/status of Phase I projects of HSH (including classification, fundings) – for PPP<br>• LGUs need to update CLUPs; integrate HSH road network plan to CLUP<br>• Active mobility which includes bicycle lanes, sidewalks should be included in HSH<br>• provisions for service roads (Sindalan area, San Fernando, vehicles exiting at NLEX-Mexico), limitations of service roads which will slow down transport of goods<br>• Encroachments of establishments (City of San Fernando)<br>• Traffic congestions due to increased volume of vehicles;<br>• Road quality should be improved and maintained (i.e. McArthur Highway from Manila traversing Bulacan to Pampanga, Doña Remedios Highway, Bulacan) |
| **Question 2. In your region, identify (and indicate location) most serious issues/problems which hamper social and economic development.** |
| • Road Right of Way (RROW);<br>• Issues on politics<br>• IPs (Angeles City,Mabalacat -Pampanga, Bamban, Capas-Tarlac, Aurora, Iba, Botolan, Candelaria, Sta. Cruz - Zambales, Dinalupihan, Hermosa – Bataan<br>• Coordination of NCIPs<br>• Isolated concern in insurgency (example in Tarlac – issue on Balog Balog dam)<br>• Issues on FPIC permit, slow processing (North Eastern Luzon Expressway); lack the database from NCIP; difficulty in locating CADT boundaries<br>• Flooding (Low lying areas in Pampanga, Bataan, Bulacan, Tarlac, Nueva Ecija)<br>• Landslide (Aurora-San Luis-Bongabon Road Nueva Ecija, Zambales)<br>• Provision for resilient Roads to address geohazard problems<br>• Land subsidence in Pampanga, Bataan (coastal areas)<br>• Business/commercial establishments (malls) – issues on traffic due to proximity along main/service roads; problems on set-back/easement in the main road |

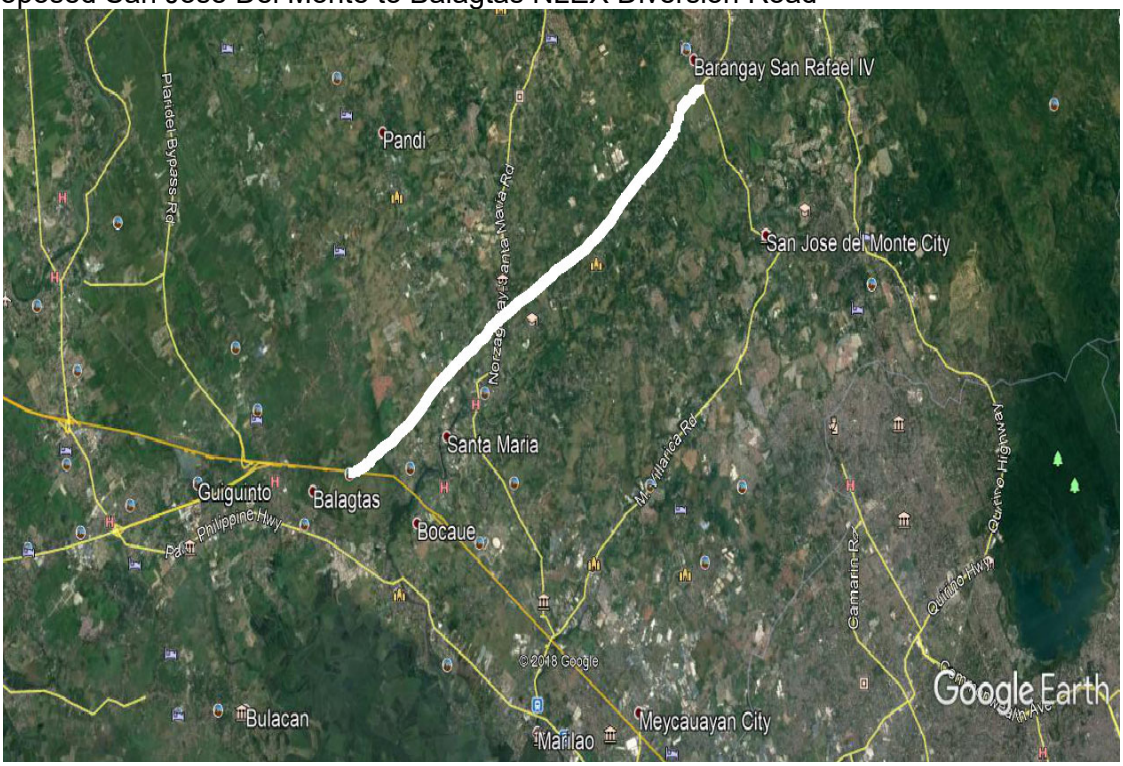
**Question 3. If constructing expressway/s is helpful in pushing forward your region, where are the suitable locations?**

- Bulakan Airport Expressways:
  * Proposed Access Road from Caloocan to Bulakan, Bulakan (traversing Obando); provision either coastal road, viaduct and interchange

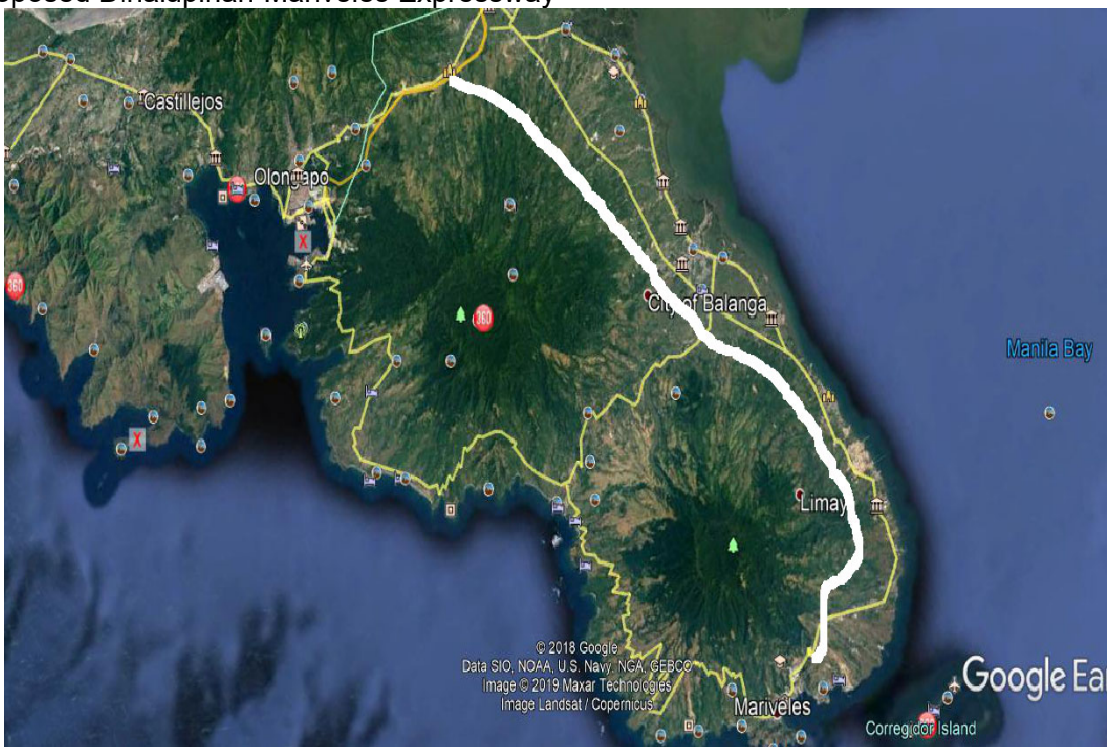

Bulakan Airport Expressways:
Starting from Bulakan Airport connecting to MNR & NLEX (Sta. Rita Exit)



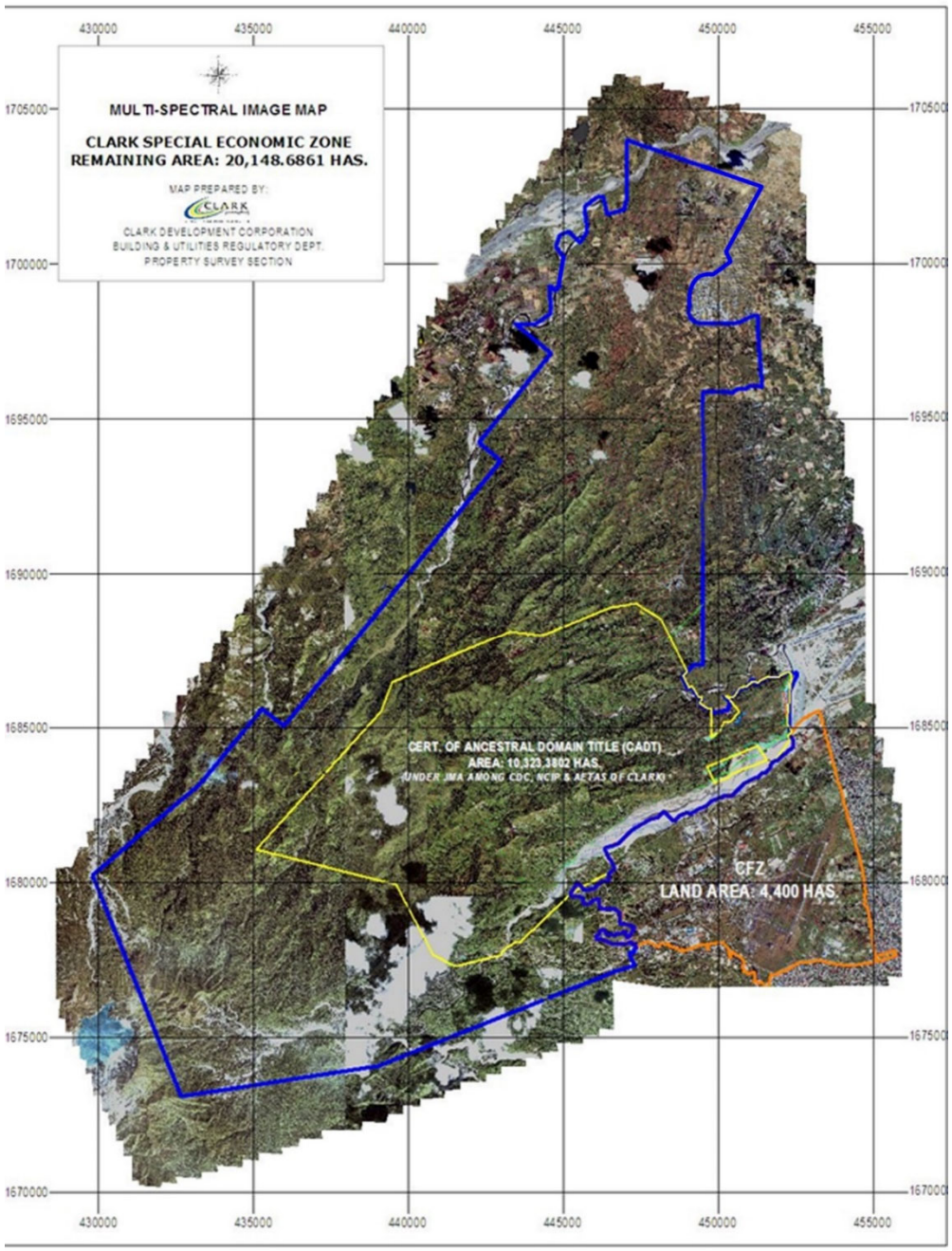
Proposed San Jose Del Monte to Balagtas NLEX Diversion Road




Proposed Dinalupihan-Mariveles Expressway



Proposed San Marcelino-Dinalupihan By-pass Road




The following are questions/clarifications/answers from the Group Presentations:

| Question/Comment/Clarification | | Answer | |
|---|---|---|---|
| **Name/Position** | **Question** | **Name/Position** | **Answer** |
| Gigi Simbulan, Regional Governor, PCCI- Region III | May we suggest to the JICA or DPWH team regarding the venue for the next stakeholder meeting on November 2019 will be held in Region III. It is very hard to us to travel in Metro Manila due to traffic. | Ryuichi Ueno, Team Leader, JICA Study Team | We will discuss to the team for the consideration of the venue |

**Group II – Region II**

**Group Member list**

| No. | Name | Designation, office |
|---|---|---|
| 1 | James B. Rodrigo (**T**) | Sr. EDS, NEDA, R2 |
| 2 | Nelson S. Tumaliuan (**F**) | HEA, DENR R2 |
| 3 | Manolo C. Norial | Provincial Engineer, Nueva Vizcaya |
| 4 | Virgilio P. Miguel Jr. | Planning, PEO, Quirino Province |
| 5 | George M. Natividad | PNREO, LGU Quirino Province |
| 6 | Jose P. Maltu Jr. | PEO, LGU Isabela |
| 7 | Cosme P. Aggabao Jr. | PEO, LGU Isabela |
| 8 | Edgardo D. Sabado | PPDO, LGU Nueva Vizcaya |

(F): Facilitator
(T): Team leader who also presented the output

The group was facilitated by Nelson Tumaliuan of DENR Region 2, lead and presented by James Rodrigo of NEDA Region 2.

The first issue to be raised was on the delay in securing the Free Prior Informed Consent (FPIC), which is a NCIP requirement for any project to commence. Mr. Oikawa asked the team what the purpose of FPIC is. According to Mr. Tumaliuan, it is a requirement of the NCIP (National Commission on Indigenous People) before undertaking any project. It was recommended that a representative from NCIP should be a member of the TWG in any road projects.

Another issue was on the negative impact of road to cultural heritage preservation. According to Mr. Tumaliuan, the DPWH has released a memorandum on consideration of cultural sites in their road projects. One example cited was the Old Dampol Bridge in Nueva Vizacaya was supposed to be replaced however, the community reacted because it is a heritage bridge considering its years of existence (more than 100 years bridge) and was awarded by the National Heritage Commission. Thus, a bypass road was recommended instead.

Issue on limited implementation of DAO 2017-1 (Participatory Process in the Preparation of Environmental Impact Statement) was raised by Mr. Norial. This is a department order signed by then DENR Secretary Gina Lopez.

Mr. Virgilio Miguel Jr. reminded the team to focus on alignment of the road networks. So if the mentioned issues does not affect the alignment it might be better to move to other concerns.

The team also discussed on the economic impact on growth centers due to the realignment of roads. For example, the east-west lateral roads will go directly to Quirino, so there will be a lessening of traffic along the Maharlika Highway.

Issue on Right of Way Acquisition also came out during the discussion. There are projects where payment to owners are not being made, thus the land owner won't leave their land causing delay in the project or sometimes discontinue for many years. However, the team also have discussed that it is not solely the government's problem because, especially in the province sometimes the landowners have the problem. Such as they really own the land or they share the land with other relative who would not want to sell their land.

Another issue on the inclusiveness of study to consider the framework plans of national, regional, and sub-regional plans in the provinces. The team suggested to include in the plan

the national mass transport system masterplan, where location of airports, seaport, and trail system are included.

Non-consideration of biodiversity corridors of Cordillera and Sierra Madre, presence of insurgency, conversion of land use (from agricultural to residential), closure of roads due to landslide and accidents, Erosion (soils and rocks) are other issues raised by the group.

Mr. Oikawa asked the group if there are issues on the Dalton Pass, according to the team the usual problem being encountered in Dalton Pass is traffic and closure of road due to landslide or self-inflicted accidents. Mr. Oikawa also asked for the last 5 years if there are typhoon or earthquake that leads to closure of the road. According to the team, there is closure but not long, it only took one day. The longest road closure in the area was during the July 1991 earthquake. The roads were close for a month.

The team strongly suggest construction of bypass roads, tunneling, viaduct, bio bridge, alternate route, and usage of Slope stabilization, Debris Catcher, Rock Shed (Mountainous areas). The proposed roads from TPLEX (Urdaneta City) to Sta Fe to Santiago and Cabarroguis to Tuguegarao to Sta. Ana is mainly to avoid traffic congestion and to have alternate route going to Northern Part of Luzon (Pangasinan, Ilocos). Moreso, having this proposed roads will shorten the travelling time.

**Summary of Answers based on questions asked.**

**Question 1. After listening to the presentation and seeing the scope of the study, what are the issues/things you want to advice/share to the Study Team to ensure success of this study?**

| Issues/Concerns | Location | Recommendation |
|---|---|---|
| 1. Delay in securing of FPIC (Free Prior Informed Consent) - NCIP Requirement | Regionwide | Early acquisition of FPIC |
| 2. Negative impact of road to cultural heritage | Regionwide | Alternate route |
| 3. Limited implementation of DAO 2017-1 (Participatory Process in the Preparation of Environmental Impact Statement) | Regionwide | Ensure participation of all concern stakeholders<br>Strict implementation of DAO 2017-1 |
| 4. Socio economic impact of new alignment existing growth centers | Regionwide | Consider in the study the pros and cons of new alignment |
| 5. Late payment of properties prior to implementation | Regionwide | Settlement of right of way payment before any implementation |
| 6. Limited inclusiveness of study to consider national, regional, and sub-regional plans | Regionwide | Gather the different plans for review and inclusion |
| 7. Roads are not inclusive for all (e.g. limited only to 4-wheeled vehicles) | Regionwide | Include other vehicle (e.g. bike lanes<br>Provide pedestrian and PWDs lanes<br>Provide restrooms |
| 8. Limited and non-consideration to biodiversity corridors | Sierra Madre Corridor | Tunneling, viaduct, or biobridges |

| | | |
|---|---|---|
| | Sierra Madre – Cordillera Corridor | |
| 9. Presence of insurgency (e.g. NPAs) | Regionwide | Full implement EO 70 (Ending Local Communist Armed Conflict) |
| 10. Conversion of land use | Regionwide | Grade separation or expressway |
| 11. Closure of roads due to landslide, accidents | Dalton Pass Oriwong | Completion of Dalton Pass East Alternate Route Alternate route |
| 12. Erosion (soils and rocks) | Mountainous area | Slope stabilization<br>Debris Catcher<br>Rock Shed |

**Question 2. In your region, identify (and indicate location) most serious issues/problems which hamper social and economic development.**

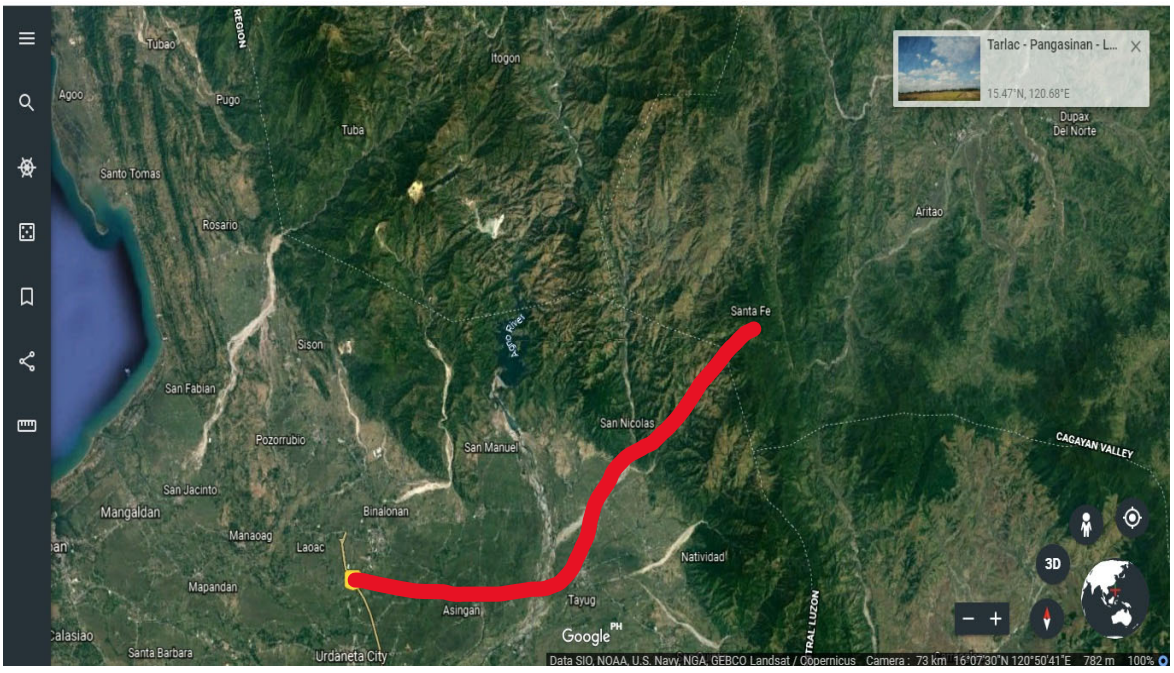
- Regional Development Council endorsement for Feasibility Study

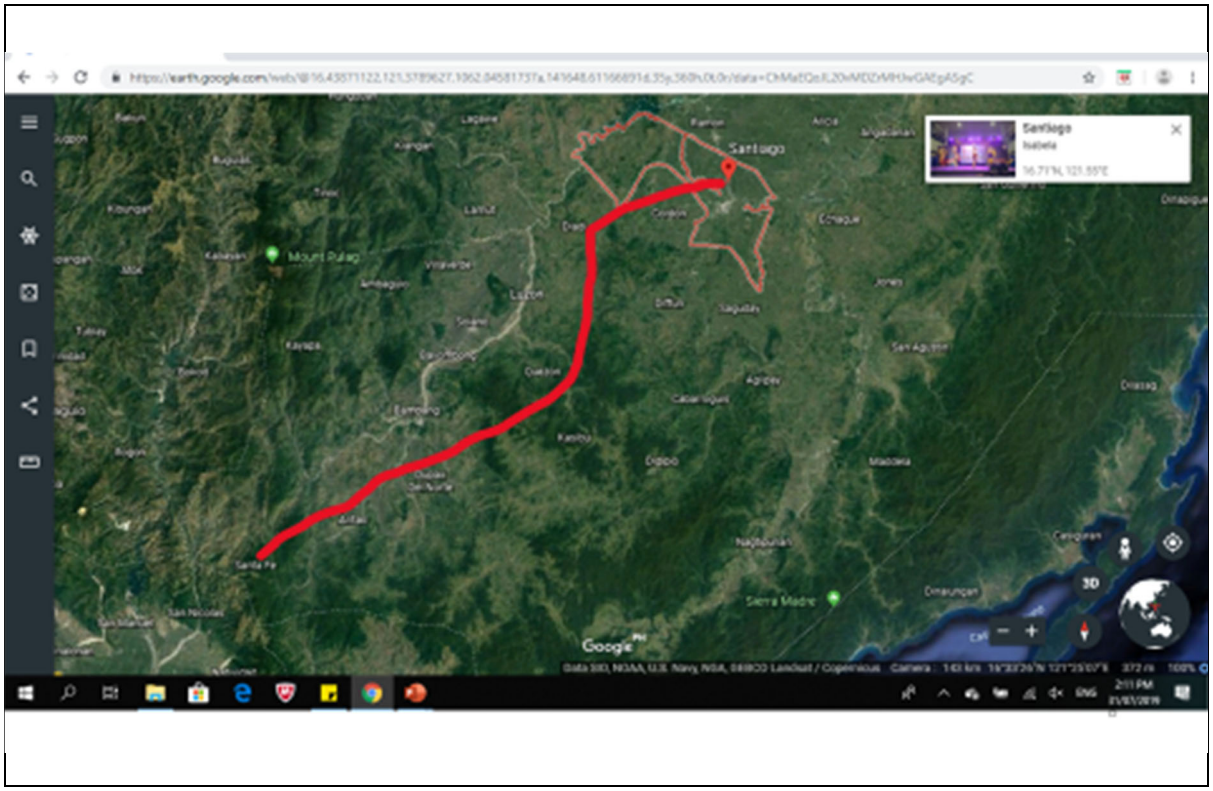
Affected Provinces:

- Nueva Vizcaya
- Isabela
- Cagayan
- Quirino

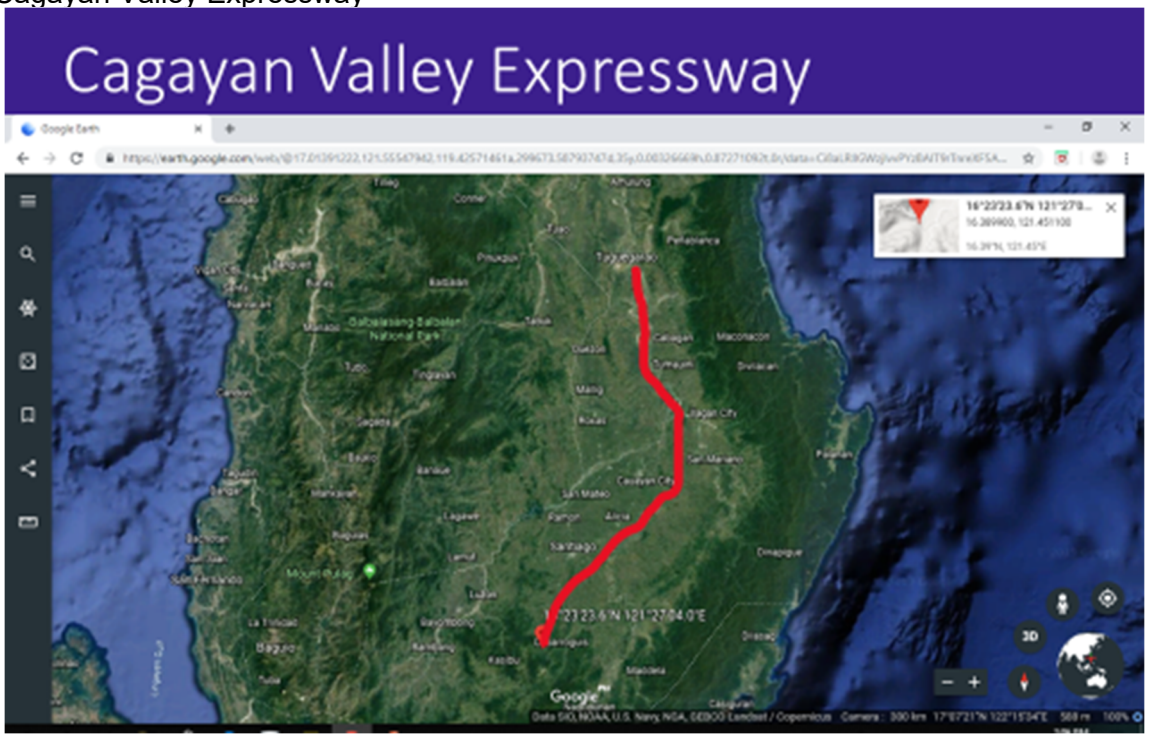
**Question 3. If constructing expressway/s is helpful in pushing forward your region, where are the suitable locations?**

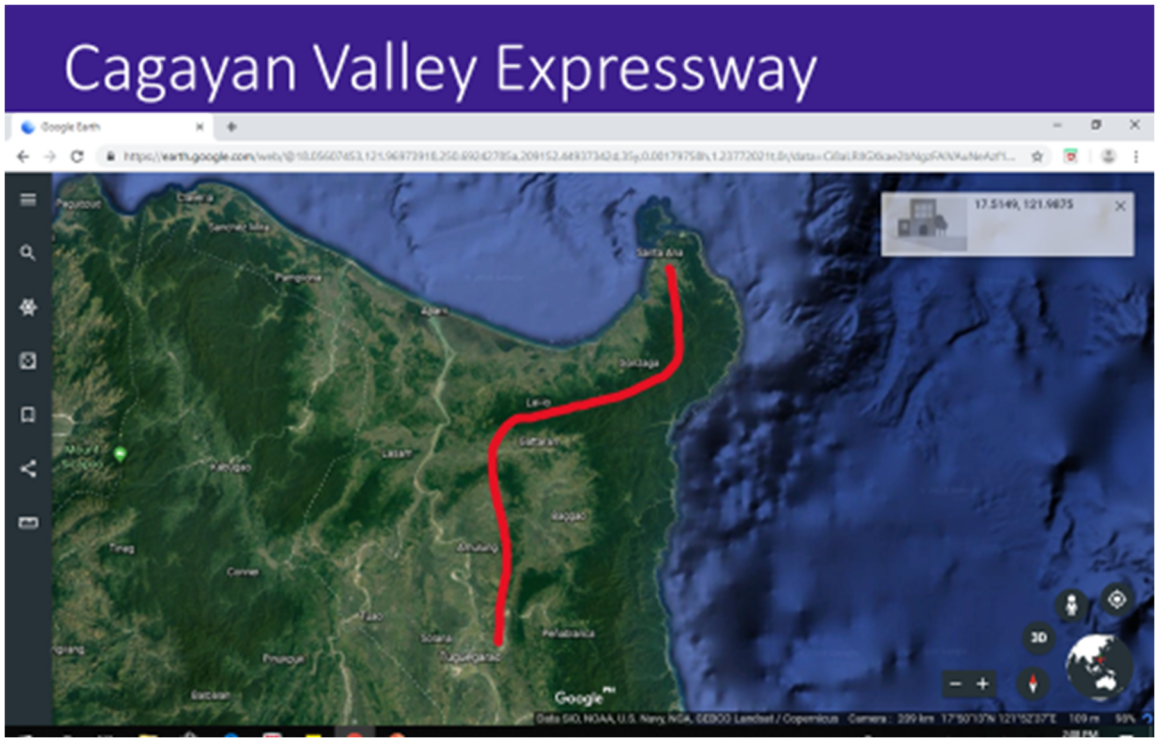
TPLEX – Sta. Fe Express




Santiago
Mount Pulag
Sierra Madre
Google

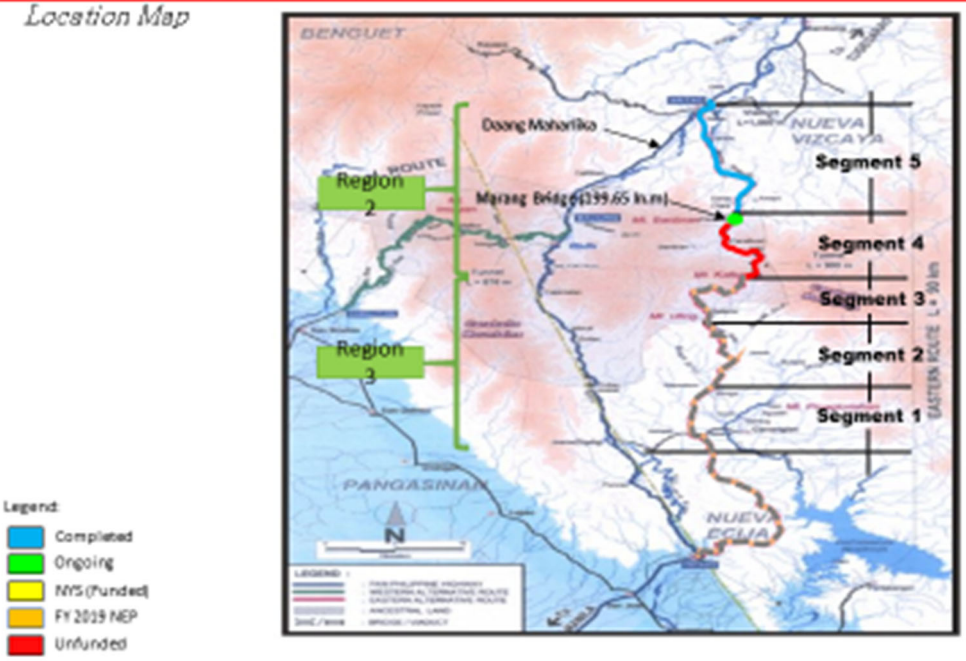
Cagayan Valley Expressway



On-going Project:

*DALTON PASS EAST ALTERNATE ROUTE*
*Location Map*




*LUZON EASTERN SEABOARD*
*Location Map*


*** Actual Alignment and length of the road network would be determined after completion of the Master Plan.**