

PROJECT DESCRIPTION

1.1 PROJECT LOCATION AND AREA

1.1.1 Background

The Build! Build! Build! Program is the administration's comprehensive infrastructure development program launched in April 2017 under the ten-point Socio-Economic Agenda that outlines the reforms of the government with the goal of economic growth, job creation, and improvement in the lives of the Filipinos. Among the reforms is to accelerate annual infrastructure spending with public-private partnership playing a key role. The program identified 70 infrastructure flagship projects, 19 of which are located in Mega Manila.

The proposed **NLEX-C5 (Segment 8.2) North Link Project ("Segment 8.2")** forms part of the C5 Northern Arc portion of the Manila North Tollways Project (MNTTP) Phase 2, which will link Carlos P. Garcia Avenue to Segment 8.1 at Mindanao Avenue. This will use a portion of the existing Republic Avenue alignment Right-of-Way (ROW) and the Luzon Avenue within the ROW of the Metro Manila Waterworks and Sewerage System (MWSS) ROW. When completed, the expressway will connect the North Luzon Expressway (NLEX) to Eastern Metro Manila.

1.1.2 Location

Segment 8.2 is part of the High Standard Highways Metro Manila Masterplan. The proposed project is vital in decongesting Metro Manila by providing vehicles an alternative route towards C5. Segment 8.2 is intended to link C.P. Garcia Avenue in Diliman, Quezon City to Segment 8.1 at Mindanao Avenue in Novaliches, Quezon City. The 11.5 km highway will pass through 11 barangays. Ten of these barangays are located in Quezon City: West Fairview, Holy Spirit, Matandang Balara, Culiat, Sauyo, Talipapa, Bagbag, Pasong Tamo, UP Campus, and Pansol. The remaining barangay, Brgy. Ugong, is in Valenzuela City. **Figure 1.1** shows the location map of the proposed project.

1.1.3 Impact Area

The direct impact areas (DIA) which will cover the ROW of the project will have an approximate width of 90 meters and total length of 11.5 kilometers. In terms of the socio-economic impacts, the DIA are the host barangays as project beneficiaries for employment, livelihood, relocation, taxes, and other benefits from the decongestion of the roads. As presented above, the identified direct impact barangays based on the alignment include the following:

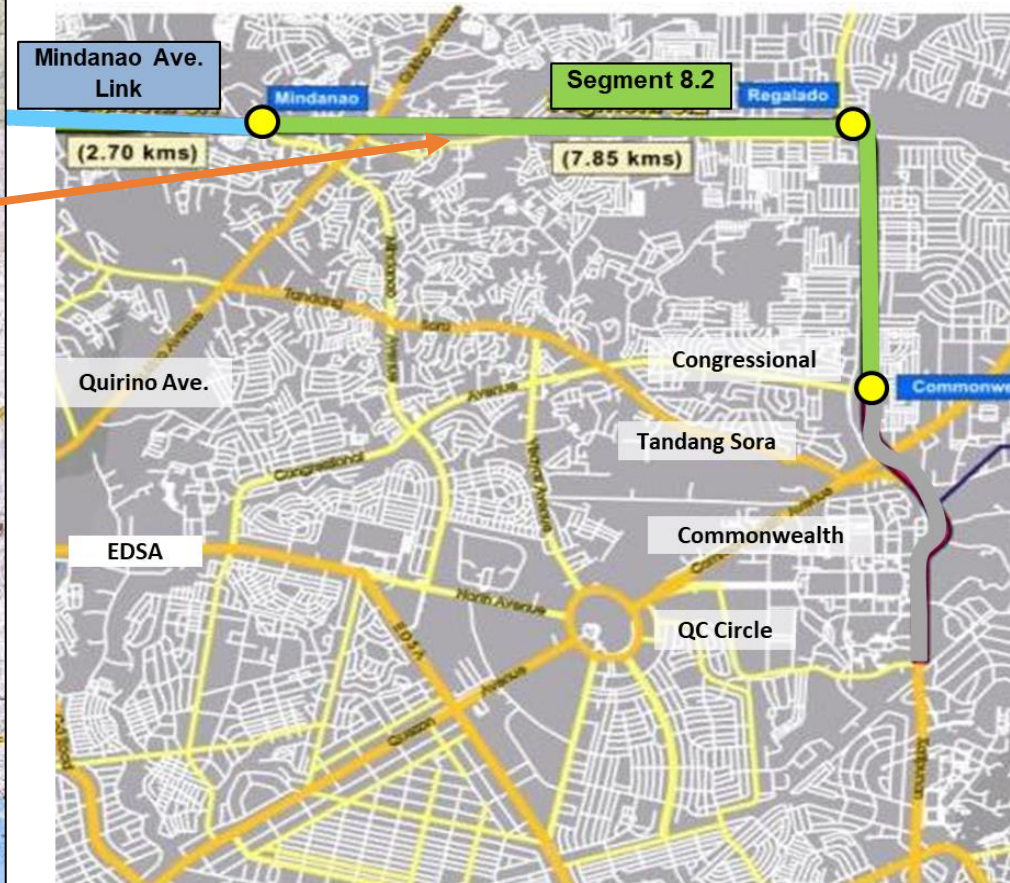


Figure 1.1. Location map of the proposed NLEX-C5 (Segment 8.2) North Link Project



Figure 1.2 NLEX Phase 2 Road Segments

1.2 PROJECT RATIONALE

According to the 2014 report of Japan International Cooperation Agency (JICA) and National Economic Development Authority (NEDA), the traffic demand is at 12.8 million vehicle trips in Metro Manila. On the average, 367,728 vehicles traverse EDSA, Metro Manila's most congested road. The daily commute time takes 90 to 150 minutes. The current traffic volume has already exceeded the capacity of most urban roads. The traffic congestion in Metro Manila has economic consequences. In the same report, it is estimated that the Philippines is losing PhP2.4 billion on 2014, which is more than 10% of the country's gross domestic product (GDP), PhP3.5 billion a day in 2017 and expected to become PhP5.4 billion a day by 2035 given the current situation of roads and infrastructures.

The rapid increase in motor vehicles is the identified root cause. At the same time, very few infrastructures were built. Infrastructure is crucial to improve transport networks and ease traffic congestion in the Philippines, especially in Metro Manila. The Master Plan on the High Standard Highway Network Development in the Philippines (HSH) suggests that building more and wider roads can solve urban congestion. The construction of the 11.5 km Segment 8.2, which is part of the HSH, is expected to reduce traffic congestion in Metro Manila as it is expected to provide a more direct link between NLEX and Eastern Metro Manila.

Travel efficiency and economic development are the expected results of the implementation of Segment 8.2. Decongestion of Metro Manila is one of the primary targets with the availability of alternative access to NLEX through less congested and more direct routes for motorists. The improvements in vehicular efficiency and ease of transport will accelerate economic development in the Northern and Central Luzon as access to and from the region and Metro Manila improves. As economic activities increase along with the reduction of travel time and costs, migration sprawl further north is expected. This will lead to

development of commercial, residential, tourist destinations along and near the periphery of the expressway.

1.3 PROJECT ALTERNATIVES

1.3.1 Expressway Alignment and Viaduct Structure Options

From the boundary of Segment 8.1, the alignment from Mindanao Avenue will traverse the 90-m ROW towards Regalado Avenue. The section from Regalado Avenue to C.P. Garcia has been identified primarily in terms of observed utilities and ROW acquisition.

The design of the elevated viaduct structure is also considered due to the following:

- Existing MWSS aqueduct;
- Katipunan Road open to local traffic along C5 road; and
- Potential conflict on existing Luzon Flyover structure crossing Commonwealth with DPWH-proposed UP-Miriam-Ateneo viaduct (**Figure 1.3**).



Figure 1.3. Proposed UP-Miriam-Ateneo Flyover

The elevated viaduct will follow the existing alignment while taking note of the following:

- After passing the Congressional junction, the alignment will run parallel to the west of the existing Luzon Flyover due to the following reasons:
 - Space occupied by ISFs can be utilized as entry and exit ramps to and from Commonwealth Avenue;
 - Notable establishments will be affected if the alignment is placed on the east side; and
 - Alignment of existing MWSS aqueducts, which is located on the east, shall be avoided whenever possible.
- A provision for extension across Aurora Boulevard of the mainline.

For the viaduct from Congressional Avenue to CP Garcia, two options are considered:

Option 1 (Figure 1.4)

- a. Assuming that the UP-Miriam-Ateneo Flyover will not be implemented, the viaduct will be at second level;
- b. Commonwealth Interchange will have a half-diamond design with the south section as the entry and exit ramps without toll plazas to and from Commonwealth while the north section will have toll plazas; and
- c. On Katipunan, off-ramp will extend across C.P. Garcia and on-ramp will be located after C.P. Garcia without blocking access to UP Town Center and MWSS compound.

Option 2 (Figure 1.5)

- a. Assuming that the UP-Miriam-Ateneo Flyover will not be implemented, the viaduct at Katipunan Avenue will be at third level;
- b. Commonwealth Interchange will have a four-level interchange for traffic access on all directions and toll plazas for all traffic will be located at NB edge of Commonwealth Avenue; and
- c. Since the viaducts are at the third level, the ramps are identified in consideration of the 6% slope, the off-ramp will extend to the widened section along Katipunan Avenue before C.P. Garcia and on-ramp will be located after crossing the existing access road to MWSS compound.



Figure 1.4. Option 1 Alignment of Segment 8.2 Extension



Figure 1.5. Option 2 Alignment of Segment 8.2 Extension

1.3.2 Structure Design Option

1.3.2.1 Interchange Schemes

Regalado Interchange

Six interchange schemes were considered for Regalado Interchange (**Figure 1.6**):

- Option 1: Trumpet-type with semi-directional interchange
- Option 2: Modified Option 1 wherein the overpass is aligned to the existing road
- Option 3: Trumpet-type with semi-directional interchange and third-level overpass
- Option 4: Same as Option 1 but the toll booths is based on MNTC tolling scheme
- Option 5: Modified Option 4 to reduce Row acquisition
- Option 6: Diamond-type

Option 6 was chosen as the scheme for Regalado Interchange.

Mindanao Avenue Interchange

Two options were initially studied for the Mindanao Interchange (**Figure 1.7**):

- Option 1: Half clover leaf to be located at the northeast quadrant
- Option 2: On-grade diamond-type with elevated U-turn for Mindanao-NLEX bound traffic

Option 2 was initially chosen because it is less extensive than the first option. Overpass profile studies based on ideal speed limits confirms the feasibility Mindanao Overpass rather than Expressway Overpass as the former has least volume of embankment and a minimal effect to the proposed Tullahan Bridge near the location of the Mindanao Interchange; however, the preferred option is Expressway Overpass to eliminate the need for the elevated U-turn structure and minimize the disturbance on Mindanao Avenue (**Figure 1.8**).

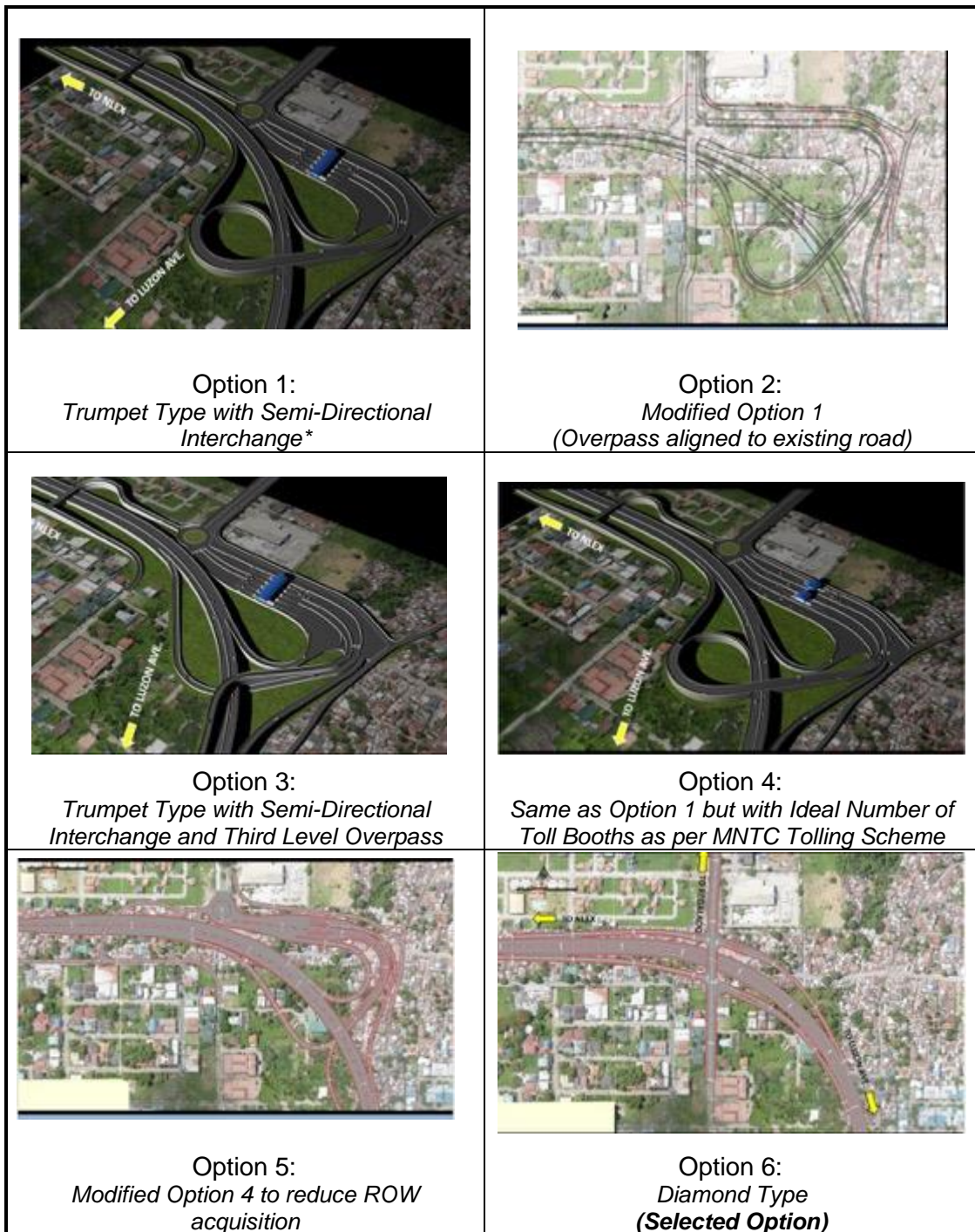


Figure 1.6. Schemes for Regalado Interchange (source: Main Technical Report, 2018)



Option 1:
Half-cloverleaf at North-east Quadrant



Option 2:
*On-grade Diamond Type with Elevated U-turn for Mindanao-NLEX Bound Traffic
(Initially Selected Option)*

Figure 1.7. Schemes for Mindanao Interchange (source: Main Technical Report, 2018)



Figure 1.8. Final Scheme for Mindanao Interchange (source: Main Technical Report, 2018)

1.3.3 Elevated Structures

Table 1.1. Summarized configuration of the elevated structures

| Component/ Item | Mindanao Flyover | Tullahan Bridge | Quirino Overpass | Sauyo Overpass | Chestnut Overpass | Regalado Overpass |
|---|---|--|--|---|---|--|
| Superstructure | | | | | | |
| Spans | 2 spans- 30m each | 1 span - 40m | 2 spans - 25m and 30m | 2 spans - 25m each | 2 spans- 25m each | 2 spans - 25m each |
| Number of lanes | 2 X 3 lanes | 2 X 3 lanes | 2 X 2 lanes | 2 lanes | 2 lanes | 2 X 2 lanes |
| Girder type | Type VI | Type VI | Span 1: Type IV and Span 2: Type VI | Type IV | Type IV | Type IV |
| Skew | 48.01 deg | 14 deg | Abut 1 : 37.49 deg Abut 2: 38.34 deg | 13.5 deg | Abut 1 : 1.82 deg Abut 2: 3.03 deg | 18.11 deg |
| Bearing pads at Abutments (length x width x thickness) | <u>Abut 1:</u> 950 mm x 750 mm x 60 mm <u>Abut 2:</u> 1050 mm x 750 mm x 60 mm | <u>Abut 1:</u> 950 mm x 750 mm x 60 mm <u>Abut 2:</u> 950 mm x 750 mm x 60 mm | <u>Abut 1:</u> 950 mm x 700 mm x 60 mm <u>Abut 2:</u> 950 mm x 750 mm x 60 mm | <u>Abut 1:</u> 1150 mm x 700 mm x 60 mm <u>Abut 2:</u> 950 mm x 700 mm x 60 mm | <u>Abut 1:</u> 1150 mm x 700 mm x 60 mm <u>Abut 2:</u> 950 mm x 700 mm x 60 mm | <u>Abut 1:</u> 950 mm x 700 mm x 60 mm <u>Abut 2:</u> 950 mm x 700 mm x 60 mm |
| Bearing pads at piers (length x width x thickness) | 600 mm x 750 mm x 60 mm | N/A | Span 1: 825 mm x 700 mm x 60 mm Span 2: 825 mm x 750 mm x 60 mm | 600 mm x 700 mm x 60 mm | 600 mm x 700 mm x 60 mm | 600 mm x 700 mm x 60 mm |
| Pier/girder connections | Transverse shear keys and end diaphragm; | Transverse shear keys and end diaphragm | Transverse shear keys and end diaphragm | Transverse shear keys and end diaphragm | Transverse shear keys and end diaphragm | Transverse shear keys and end diaphragm |
| Deck thickness | 220 mm | 220 mm | 220 mm | 220 mm | 220 mm | 220 mm |
| Substructure | | | | | | |
| Abutment wall thickness | <u>Abut 1</u> 1.6m. <u>Abut 2</u> 1.7 m | <u>Abut 1 & 2</u> 1.6 m | <u>Abut 1 & 2</u> 1.6 m | <u>Abut 1</u> 1.8m. <u>Abut 2</u> 1.6 m | <u>Abut 1</u> 1.8m. <u>Abut 2</u> 1.6 m | <u>Abut 1 & 2</u> 1.6 m |

| Component/ Item | Mindanao Flyover | Tullahan Bridge | Quirino Overpass | Sauyo Overpass | Chestnut Overpass | Regalado Overpass |
|--|--|---|---|---|--|---|
| Abutment foundation | Spread Footings: <u>Abut 1 size:</u> 9.5m x 45.8m x 1.8 m thk <u>Abut 2 size:</u> 10.5m x 45.8m x 1.8 m | Bored Pile: <u>Abut 1 & 2</u> 12-1.5m dia (15m length) | Spread Footings: <u>Abut 1 size:</u> 9.4 m x 28.5 m x 1.8 m <u>Abut 2 size:</u> 9.0 m x 28.5 m x 1.8 m | Spread Footings: <u>Abut 1 size:</u> 10.2 m x 13.5 m x 1.8 m <u>Abut 2 size:</u> 8.5 m x 13.5 m x 1.8 m | Spread Footings: <u>Abut 1 size:</u> 10.4 m x 12.0 m x 1.8 m <u>Abut 2 size:</u> 9.0 m x 12.0 m x 1.8m | Bored Pile: <u>Abut 1 & 2</u> 5-1.5m dia. (20m length) |
| Pier coping (base x height x length) | 2.1m x 2.3m x 40.0m | N/A | 2.1m x 2.3m x 22.6m | 2.1m x 1.8m x 11.0m | 2.1m x 1.8m x 10.7m | 2.1m x 1.8m x 18.6m |
| Pier Column | 3-2 m dia | N/A | 2-2m dia | 2-2m dia | 2-2m dia | 2-2m dia |
| Pier foundation | 3-2.5m dia bored piles | N/A | 2-2.5m dia bored piles | 2-2.5m dia bored piles | 2-2.5m dia bored piles | 2-2.5m dia bored piles |
| Expansion joints | At abutments only | At abutments only | At pier only | At abutments only | At abutments only | At abutments only |

1.3.4 Viaduct from Regalado Avenue to C.P. Garcia Avenue

The following options were considered for the design of the viaduct:

- Typical one-section column (**Figure 1.9**)
- Typical three-column section (approaching toll barrier/ramps) (**Figure 1.10**)
- Typical one-column section with ramps (**Figure 1.11**)
- Typical column section with ramps (**Figure 1.12**)

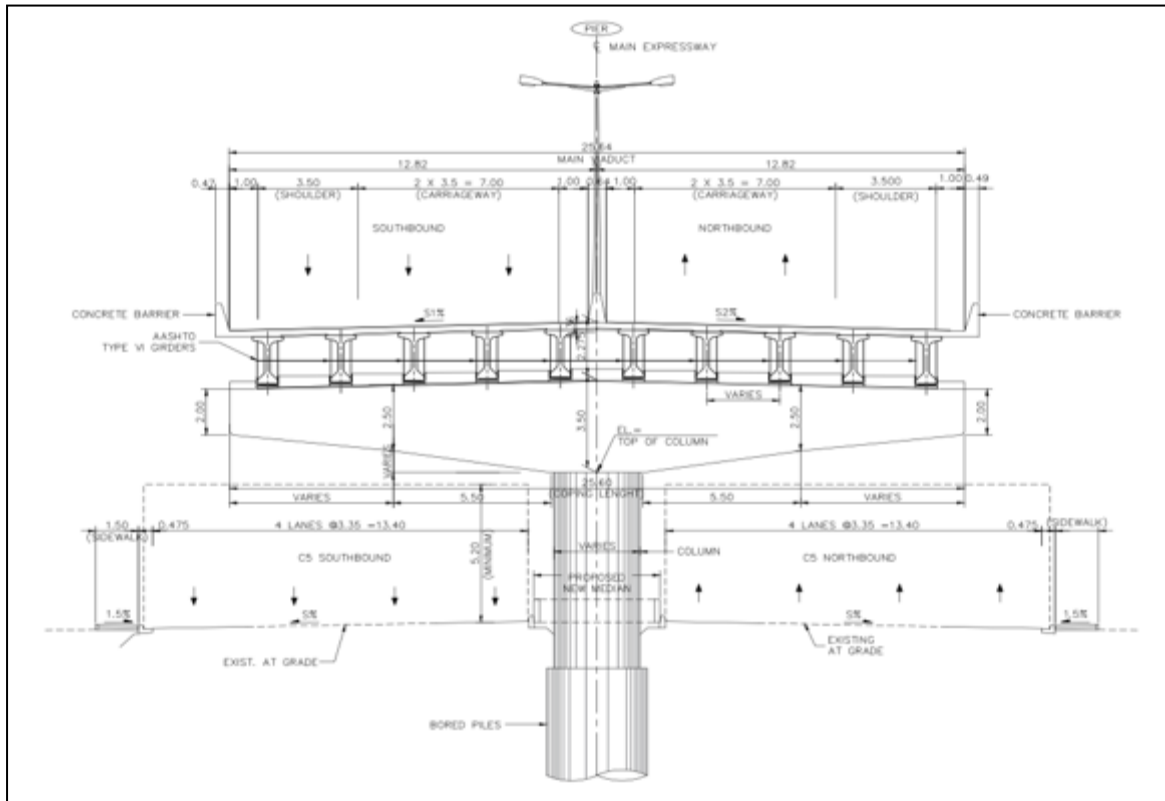


Figure 1.9. Typical one-column section

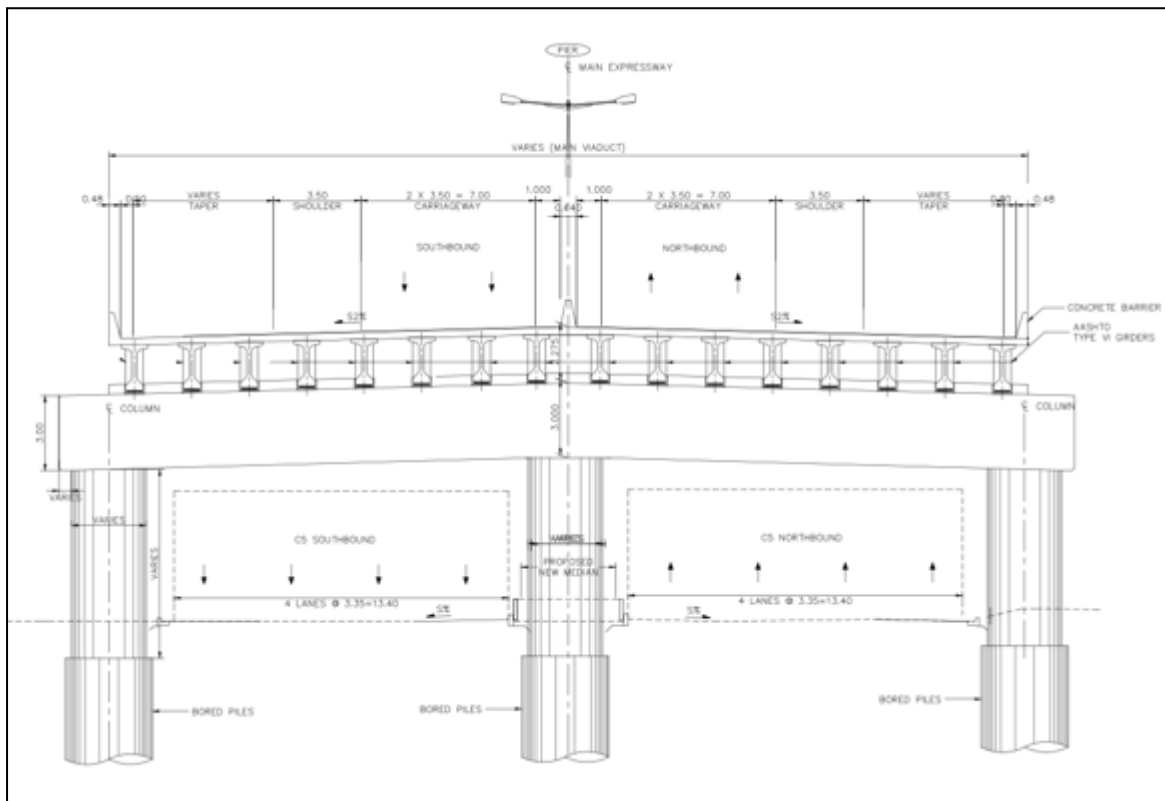


Figure 1.10. Typical three-column section

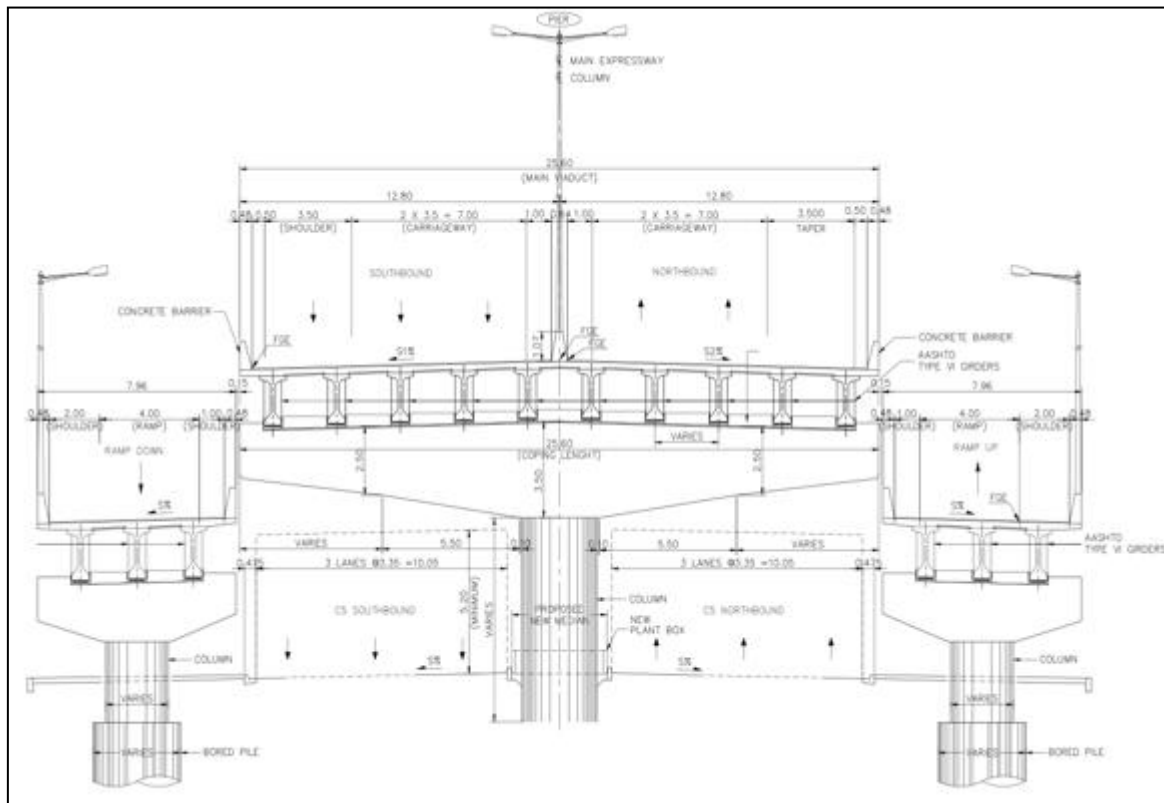


Figure 1.11. Typical one-column section with ramps

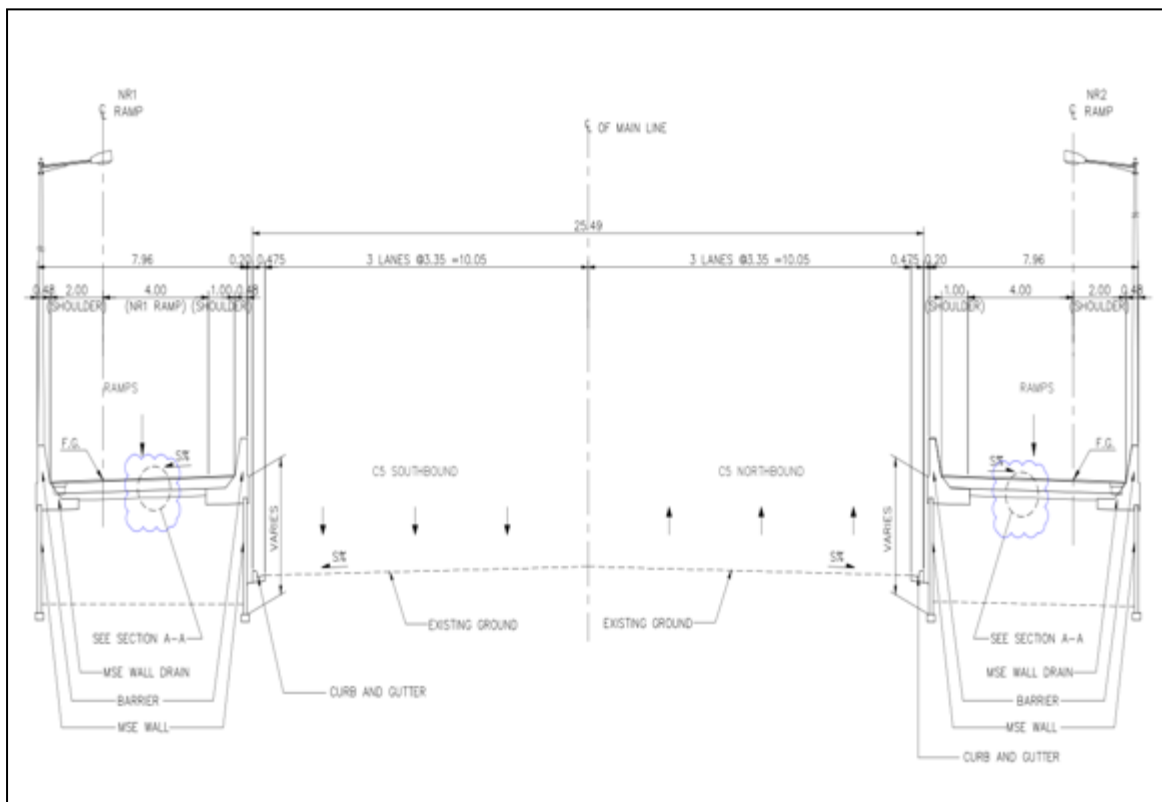


Figure 1.12. Typical section with ramps

1.3.5 Structure crossing Commonwealth Avenue

The viaduct alignment will run parallel from Congressional Avenue towards the west side of the existing Luzon Flyover. Due to the alignment of the MRT 7 Project, no mid-support was proposed at the midspan of the structure crossing Commonwealth Avenue. The structure will span 80m and will consist of steel box girders as superstructure and steel portal frames as piers (**Figure 1.13**).

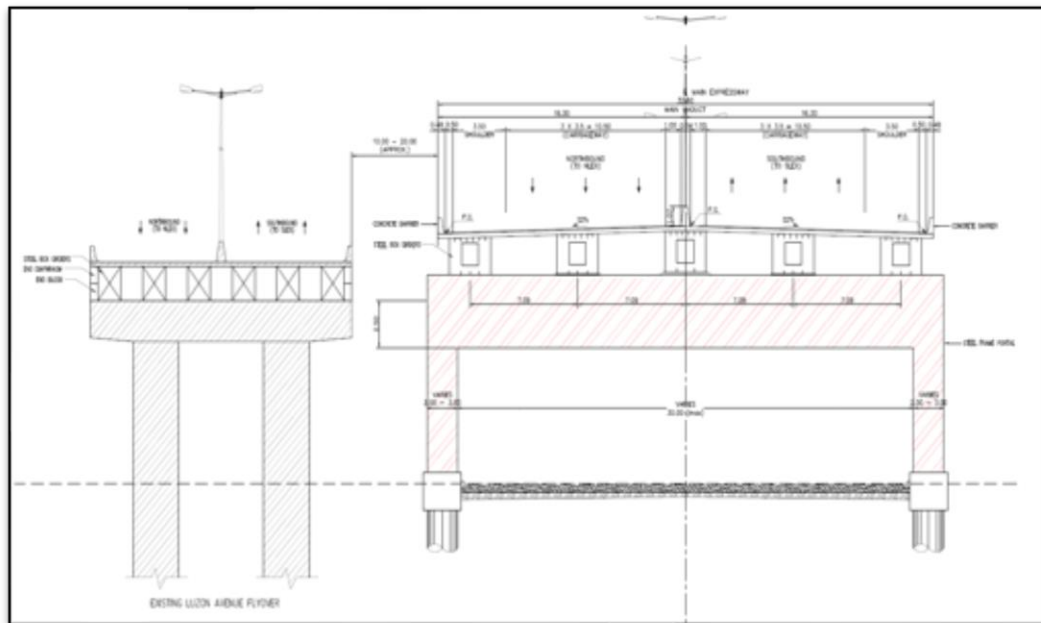


Figure 1.13. Proposed cross-section of structure crossing Commonwealth Ave

1.3.6 Service Roads

Along Regalado Avenue

The service road has a width of 10m to accommodate the roadway width of 6.1m, shoulder width of 1 m at each side and the remaining width for fence and slope for drainage. The area at the south side of the expressway will potentially be the location of the housing facilities; hence, the location of the proposed service road is adjacent to the location to serve as a road network of the residential area and as service road access. No service roads are proposed for the northside of the expressway so the vehicles in the vicinity may use the existing routes leading to Quirino Avenue.

The proposed Regalado Interchange will block the existing road. A diversion road adjacent to the Regalado Interchange ramp is proposed which will be connected to Regalado Avenue. Vehicles can pass through the proposed Chestnut Overpass going to the service road.

Along Luzon Avenue

A viaduct is proposed along Luzon Avenue to avoid the existing MWSS pipeline. The existing roads below the proposed viaduct shall serve as service roads for vehicles that need to access adjacent areas without going to the expressway.

1.3.7 No Project Option

At the current state of the road traffic in Metro Manila, development of Segment 8.2 is imperative; however, if the proposed Project will not push through, rapid increase of motor vehicles will cause further traffic congestion, which in turn, affects the country's economic growth. In addition, the environment in the area will deteriorate due to the traffic congestion and air pollution.

1.4 PROJECT COMPONENTS

The following will be the components of the proposed project:

1.4.1 Interchanges

- a. Mindanao Interchange
- b. Regalado Interchange
- c. Commonwealth Interchange

1.4.2 Structures

- a. Mindanao Flyover (Forming part of Mindanao Interchange)
- b. Tullahan Bridge
- c. Quirino Overpass
- d. Sauyo Overpass
- e. Chestnut Overpass
- f. Luzon Viaduct (from Regalado Ave. to C.P. Garcia)

1.4.3 Utility Requirements

Utility requirements during construction include fuel, power supply, water supply, and construction access. The details of the requirements during construction and operation are described below.

1.4.3.1 Fuel requirement

During Construction

Fuel requirement during construction will be based on the use of heavy equipment, transport and service vehicles. The contractor hired will supply the fuel used in the activities of this phase.

During Operation

It is estimated that the fuel requirement during this phase is 500 liters of diesel for the use of back-up generators during power interruptions and service vehicles.

1.4.3.2 Power requirement

During Construction

Power supply during construction will either be tapped from the nearest electricity source or the use of generator sets.

During Operation

Power supply during operation will be sourced from MERALCO. The estimated power requirement during this phase is 169,520 KWh per year.

1.4.3.3 Water Supply

During Construction

Water for the construction of the project will be taken care of by the contractor. In the absence of a water provider, water will be sourced from ground water after obtaining necessary permit from NWRB.

During Operation

Water supply during operation will be sourced from Maynilad. Water usage is limited to domestic use only. It is estimated that the water requirement during this phase is 220 m³ per month.

1.4.3.4 Construction Access

The project site is located in high-density urban areas; thus, the access to the site will through public roads.

1.4.4 Pollution Control Devices

Noise suppressors and buffers will be installed to minimize noise brought about by earthwork activities and heavy equipment, especially in areas close to noise-sensitive areas such as schools and churches. Drainage structures such as ditches, culverts, and pipe drains will be installed to divert surface water run-off to protect the slopes from erosion.

1.4.4.1 Air Pollution Control Devices

A regular sprinkling of exposed road surfaces will be implemented to mitigate increase in suspended particulates. A canvass cover for trucks will also be placed to mitigate the increase in air emissions during construction. Speed limits for delivery trucks will also be implemented.

1.4.4.2 Wastewater

Turbidity of the waterways may increase during heavy rains due to the construction debris. This may be avoided by installing proper spoils management at the construction site. The toxic materials (e.g. used oils, paints) will not be disposed in the drainage system at the site. Proper disposal of these materials will be ensured.

1.4.4.3 Solid Waste Management System

The over-arching goal is to minimize the amount of waste in the project by optimizing the use of raw materials. Techniques or processes in reusing scrap materials will be introduced. For

the remaining solid wastes, sufficient number and size of dumpsters will be provided to contain these solid wastes that will be generated by the project. The collected litter and debris shall not be placed next to drain inlets and/or watercourses. The storage areas for the solid wastes shall also be located at least 15m from drainages and shall not be placed in flood-prone areas. Also, littering on the ground will also be prohibited.

1.4.5 Temporary Facilities

Toilet facilities will be constructed strategically, and will be regularly maintained by the project proponent.

1.4.6 Existing Utilities within ROW

The utilities found within the ROW of Segment 8.2 include road signs, roadway lighting, traffic lights, pavement, islands, concrete line ditches, fiber optic cables, and CCTVs. These will be relocated and replaced as needed.

1.5 PROJECT TECHNOLOGY

1.5.1 Toll Booth

The MNTC uses the following toll booth technology for their transactions:

- Cash – manual transactions operated by tellers. Due to its nature, the transactions are prone to miscalculations and pilferage; thus, the expressway relies on new forms of technology for its operation;
- Dedicated Short Range Communication System (DSRC) – EZ Pass is a form of DSRC which belongs to the RFID family. This technology uses the microwave frequencies (5.45-5.9 GHz). Due to the cost of the installation of the unit, a shift to passive RFID is currently being done; and
- Radio Frequency Identification (RFID) – RFID stickers are passive tags which are relatively new. Since this is sticker-based, it is anticipated that more users of the expressway will subscribe to RFID.





Figure 1.15. Alignment Section 1 (Mindanao Avenue to Congressional Avenue), STA. 1+400.00 TO STA. 2+800.00



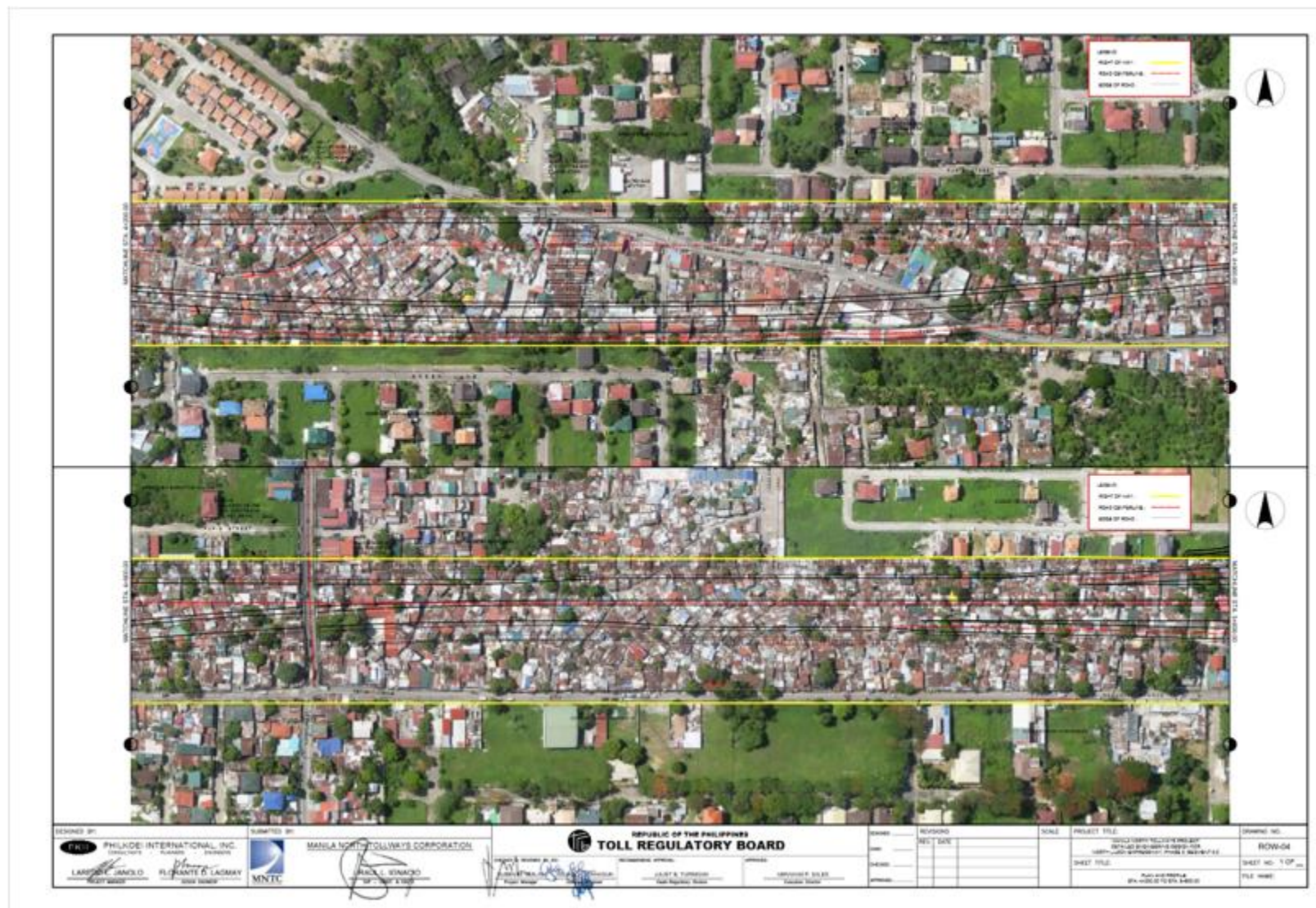


Figure 1.17. Alignment Section 1 (Mindanao Avenue to Congressional Avenue), STA. 4+200.00 TO STA. 5+600.00



Figure 1.18. Alignment Section 1 (Mindanao Avenue to Congressional Avenue), STA. 5+600.00 TO STA. 7+000.00



Figure 1.19. Alignment Section 1 (Mindanao Avenue to Congressional Avenue), STA. 7+000.00 TO End of Section 1



Figure 1.20. Alignment Section 2 (Congressional Avenue to C.P. Garcia), STA. 8+302.37 TO STA. 11+389.03

1.6 PROJECT SIZE

The project will have an approximate width of 90 meters and total length of 11.5 kilometers.

1.7 DESCRIPTION OF PROJECT PHASES

1.7.1 Pre-construction Phase

The pre-construction phase covers the location planning, as the first stage. This mainly involves the study of alignment possibilities or alternatives by means of investigating general corridors, collection of physico-chemical, biological, and socio-economic data, solicitation of public opinion, and preliminary design of the infrastructure.

Detailed engineering design is also done at this stage. The final alignment and design of highways and other structures will be determined, including all engineering specifications, such as the volume and materials and debris that will be generated during clearing, grubbing, and excavation, specification and quality control of materials and supplies to be utilized, and scheduling of construction activities. In designing the final alignment, types of structure that are more appropriate to the natural land form will be carefully considered. It is also during this stage where design features such as temporary ditches and conduits check dams, and earthen beams to minimize soil erosion, and allow animal migration, are incorporated into the project design. All environmental design specifications will be complied with, and included as an important component of contract administration and supervision.

Land acquisition for the project ROW is accomplished at this stage. Relocation of affected residents and securing relevant permits and clearances are also required at this stage. Construction will commence upon completion of this phase.

1.7.2 Construction Phase

Generally, the construction phase will involve conventional earthworks including site clearing, installation of temporary facilities, construction of access roads, mobilization of heavy equipment, foundation investigation, etc.

1.7.2.1 *Site preparation and road diversion*

The current land use in the area is mainly residential, mixed-use with few commercial establishments. Existing vegetation, with exception of trees along the ROW, will be cleared. Trees along the ROW will remain as is. Demolition of existing structures along the alignment will be accomplished. Alternative access roads will be established. Traffic Management Plan will be implemented. Site leveling and grading will commence once the site is stripped of vegetation and cleared of debris.

1.7.2.2 *Civil works*

Civil Works include all roadway works, excluding the electrical works for the roadway lighting. Part of this scope is the removal of obstruction and structures. The underlying ground will be cleared and grubbed to a depth of around 150mm to expose the natural soil

as subgrade. Additional embankment material will be overlaid to the desired depth, upon which the pavement structure will be constructed.

1.7.2.3 Drainage construction

Drainage Works include the construction of structures that will facilitate controlled discharge of excess water on the expressway mainline. This may include Concrete Culverts (Box and/or Pipe), Concrete-Lined Ditch, Earth-Lined Ditch, and Median Drains.

1.7.2.4 Pavement construction

Pavement pertains to the part of the road structure from the subgrade upwards, which carries most of the load from the vehicles. For Segment 8.2, the pavement structure is composed of 250mm of Crushed Aggregate Base Course, 100mm Asphalt Treated Base Course, 40mm Bituminous Binder Course, and 40mm Stone Mastic Asphalt. Individual layers will be laid and compacted to the desired compaction level by a vibratory compactor before being overlain by the next layer. In case of Bituminous layers, asphalt emulsions will be sprayed onto the underlying layer to act as bonding agent before the bituminous layer is laid.

1.7.2.5 Post construction

Post construction activities include demolition of all temporary facilities/structures and decommissioning and removal of construction machinery and equipment from the site. Clean-up activities are needed to be undertaken.

1.7.3 Operation and Maintenance Phase

Traffic Volume

Based on the traffic forecast for 2037 on the main trunk of Segment 8.2, the total vehicle traffic is 38,654 divided into: Class 1 - 29,365, Class 2 – 6,000, and Class 3 – 3,019.

Toll Booth

In 2037, it is suggested that the bulk of the usage for toll booths remain cash (40%) with RFID (40%) and 20% DSRC.

1.7.4 Abandonment Phase

Abandonment is not anticipated as the project site and the adjacent areas are highly urbanized and prime residential areas. Considering the need to reduce traffic and travel time, increase in population, and continuous urbanization, the demand for projects such as this is foreseen.

On the unlikely event that the project will be stopped for an unexpected reason and abandonment is the only option, NLEX will see to it that it will be abandoned with considerations on possible impacts on the environment and that appropriate mitigating measures will be implemented. Although there are no hazardous materials or structures in

the project, mitigation measures will be properly implemented to ensure the safety of adjoining areas.

1.8 PROJECT IMPLEMENTATION SCHEDULE

From the social preparations to the operation, Section 1 of the project will take seven (7) years to be completed. The social preparations, such as continuous Information, Education and Communication (IEC) campaigns and conduct of resettlement planning, started 2018. The relocation, which will take 36 months, is expected to be completed by 2021. The construction of the proposed project will start by 2021 and is expected to be completed by 2023. **Figure 1.22** shows the indicative timeline of the Section 1 of the proposed Segment 8.2 Project.

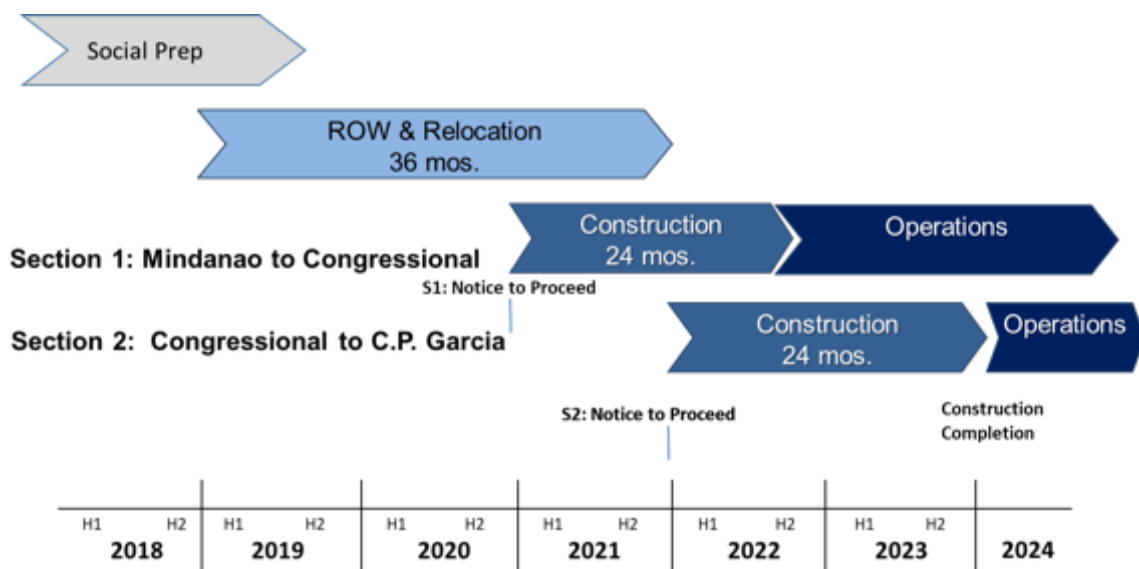


Figure 1.21. Indicative timeline of Section 1 of NLEX-C5 (Segment 8.2) North Link Project

1.9 MANPOWER REQUIREMENTS

The estimated maximum manpower requirement for the proposed project during the construction phase is 150. Manpower requirement ranges from project manager, foreman, engineer, heavy equipment operators, carpenters, masons, laborers and security guard.

During the operation phase, the estimated personnel and staff that will be hired for the entire development will be 60. **Table 1.2** shows the breakdown of the manpower requirements during operation.

Table 1.2. Manpower requirements during operation

| Operation Workforce | Number |
|--|-----------|
| General Management | 3 |
| Toll Management , supervision, and collection | 40 |
| Traffic control, patrols, mechanics, road maintenance crew | 17 |
| TOTAL | 60 |

1.10 PROJECT INVESTMENT COST

Table 1.3 shows the estimated project cost based on December 2016 prices. The proposed project has an estimated construction and development budget amounting to Php8.1 billion.

Table 1.3. Estimated Project Cost

| Description | Total Cost (Millions) | |
|---|---|--|
| | Mindanao to Congressional (Based on DED) | Congressional to C.P. Garcia (Based on Technical Study) |
| Civil Works | 6,528 | 5,676 |
| FOE/Non-FOE | 221 | 251 |
| Others (Provisional Sum and Facilities for Engineer) | 733 | 886 |
| Sub Total Direct Cost | 7,482 | 6,869 |
| Indirect Cost | | 443 |
| Project Development Cost | | 30 |
| Row Cost | | 456 |
| Improvements | | 302 |
| TOTAL COST | | 8,100 |