Department of Public Works and Highways

DAVAO Region Online Business Seminar on Transportation Infrastructure and Energy

JICA

Introduction of the Davao City Bypass Construction Project

Joint Venture of:

NK KEI NE

in Association with:

PKII

Self-Introduction

Speaker : Wako NOTO (Date of Birth: 20th November 1968)

Education : B.En., Civil Engineering, Faculty, Kansai University, Japan, 1991

Licentiate : Professional Engineer (Civil Engineering Tunnel)-Japan

Specialty : Underground Space Development Specialist, Civil Engineer

Employment record : **2013 to Date Nippon Civic Consulting Engineers Co., Ltd.**

2009 to 2013 Nippon KOEI Co., Ltd

1991 to 2009 Nippon Civic Consulting Engineers Co., Ltd.

Project Involved in Philippines

Acting Project Manager: Detailed Design and Construction Supervision

Davao City Bypass Construction Project

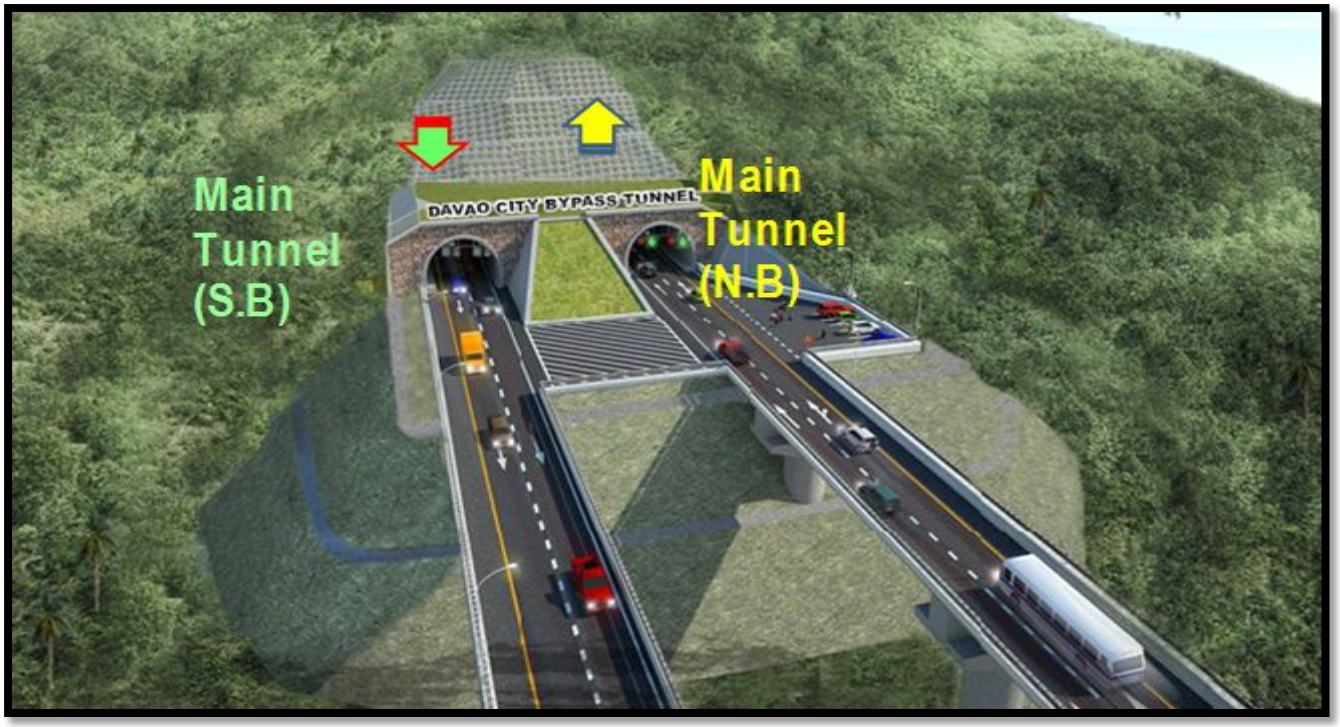
Tunnel Planner: Preparatory Survey for Dalton Pass East Alternative Road

Tunnel Adviser: Subic Freeport Expressway (SFEX) Capacity Expansion Project

PROJECT PROFILE

PROJECT DESCRIPTION

Improvement of the transport logistics and mitigation of congestion in the Davao City urban center to contribute to the economic and social development of Mindanao. The bypass tunnel will have an important role to unite the east and west side communities, existing and under development, which are currently separated by a mountain.



PROJECT PROFILE

PROJECT OBJECTIVE

- Hasten interregional transport of goods and services passing through Davao City;
- Reduce transport cost of products to customers;
- Mitigate congestion in the urban center of Davao City where average travel speed is less than 20 km/hr; as a result, the exhaust gas is also reduced.
- Provide a more reliable, more efficient and unimpeded flow of goods and services and support to the growing agro-industrial sector;
- Manage urbanization in Davao City and its periphery; and,
- Provide better access to/from major ports in the Davao Gulf including Sasa Port in Davao City and the Davao International Container Port in Panabo City.

PROJECT PROFILE

BACKGROUND

- The Japan International Cooperation Agency (JICA) conducted Preparatory (Feasibility) Survey for Southern Mindanao Economic Corridor Improvement (Davao City Bypass Construction) Project in 2013 – 2015.
- The Project Implementing Agency is Department of Public Works and Highways (DPWH) and the Implementation Office is Road Management Cluster 1 (Bilateral) of Unified Project Management Office (RMC1-UPMO).
- Consulting Services

1) Detailed Design & Tender Assistance; Feb. 2017 – Dec. 2020

2) Capacity Development of DPWH Staff for Tunnel Operation and Maintenance and Tender Documents Preparation for Procurement of O&M Company of the Davao City Bypass Tunnel; will be started Nov. 2021

3) Construction Supervision; Package I-1 started 21st Dec. 2020

PROJECT PROFILE

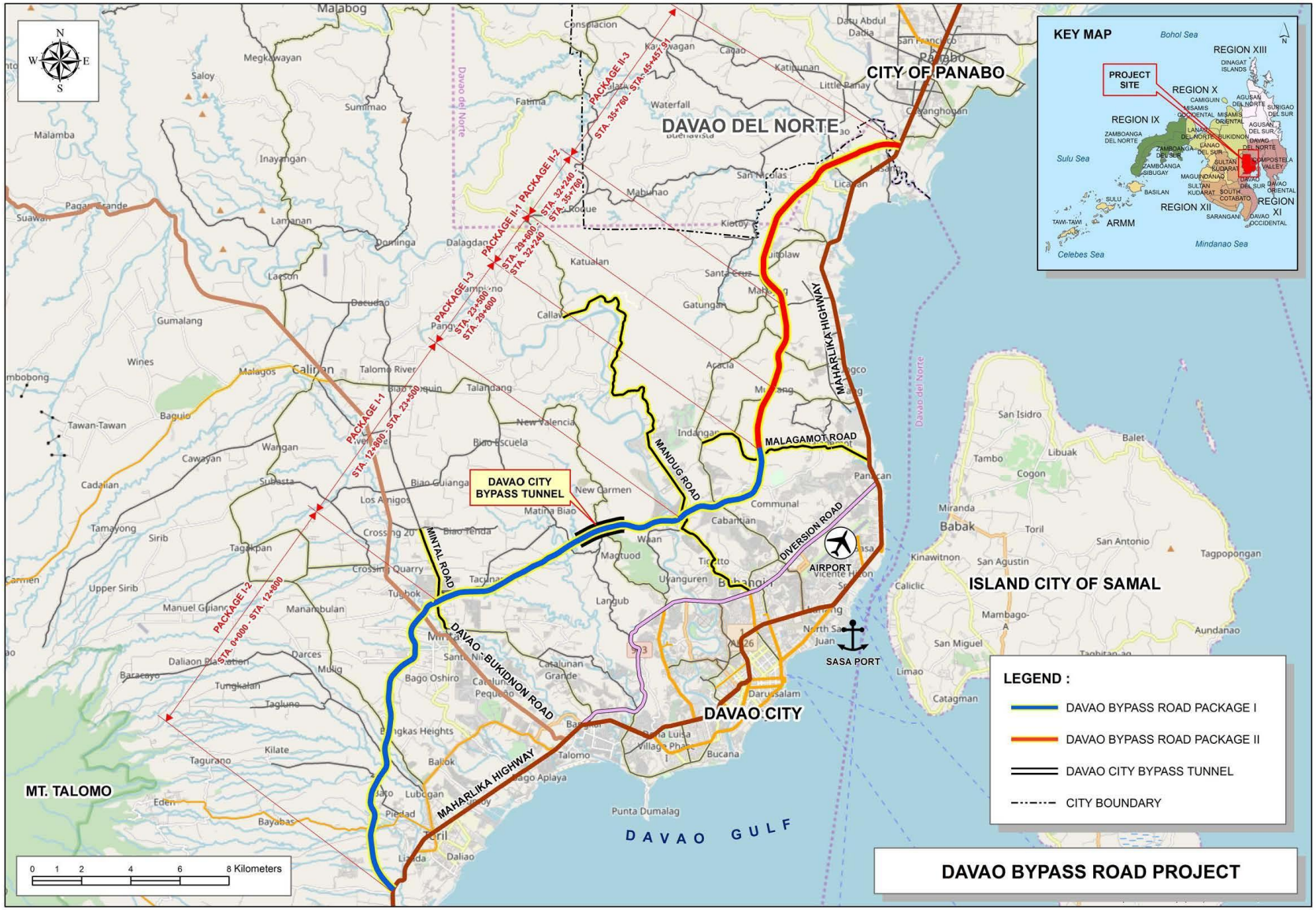
BUDGET OF PROJECT

- JICA STEP LOAN is applied for project implementation of Davao City Bypass Package I. GOP budget is applied for Package II.

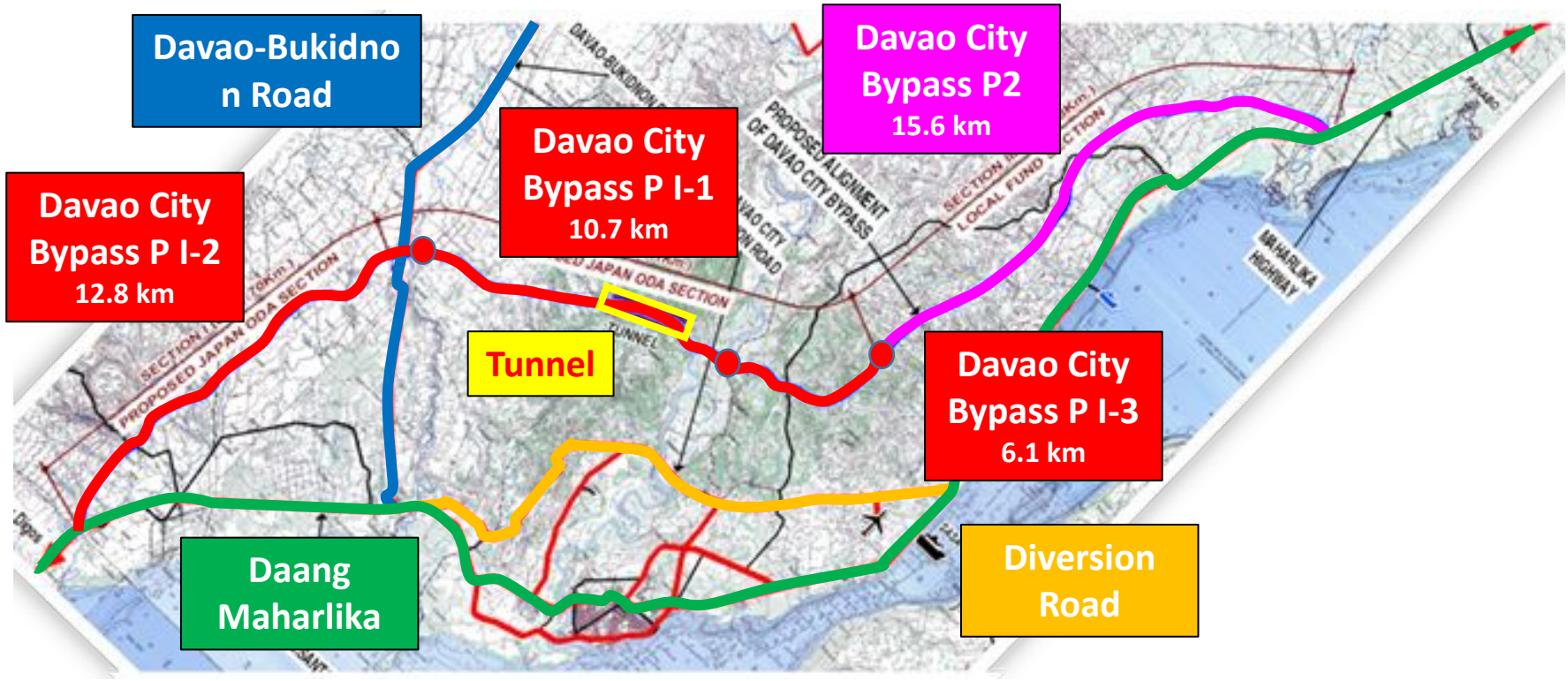
Loan Agreement No. PH-P261, Aug. 2015; TWENTY THREE BILLION NINE HUNDRED SIX MILLION JPY (\23,906,000,000), 10,628 MILLION PHP

Loan Agreement No. PH-P273, Jun. 2020; THIRTY FOUR BILLION EIGHT HUNDRED THIRTY MILLION JPY (\34,830,000,000), 15,890 MILLION PHP

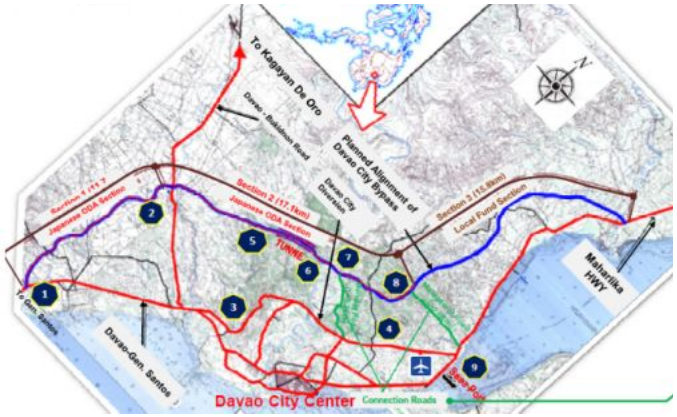
LOCATION MAP FOR OVERALL PROJECT

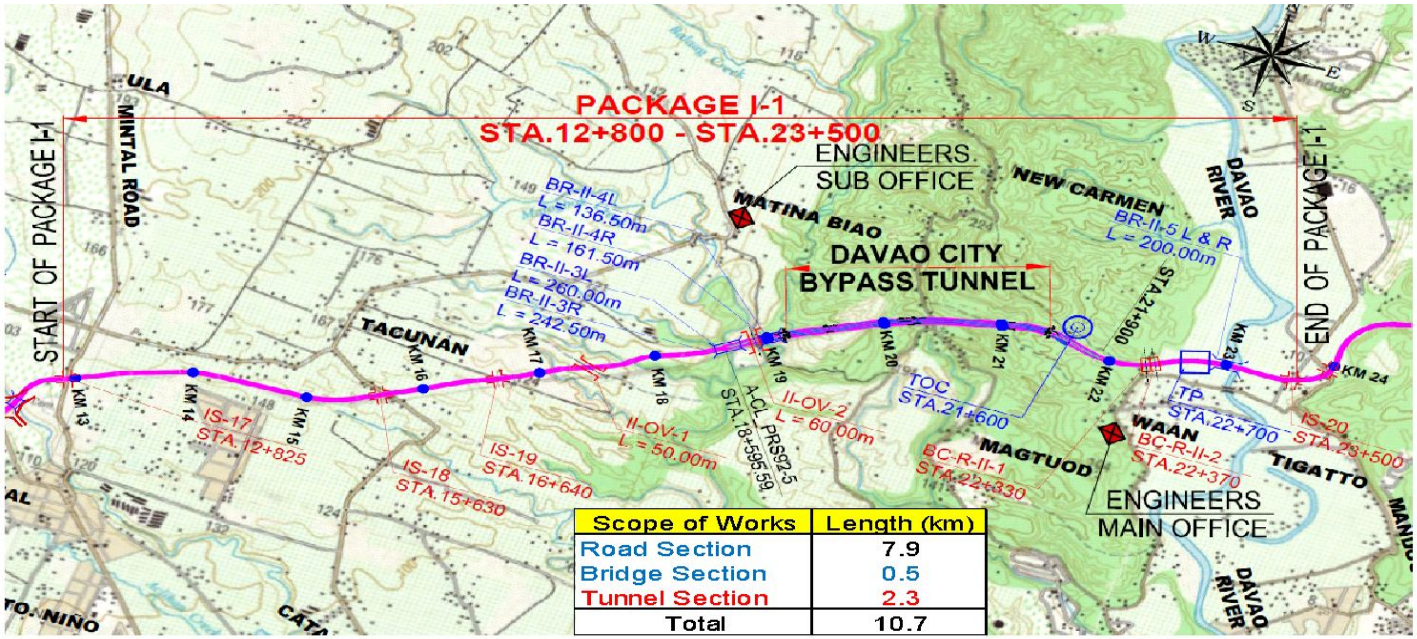


LOCATION MAP



LOCATION MAP (Package I-1)



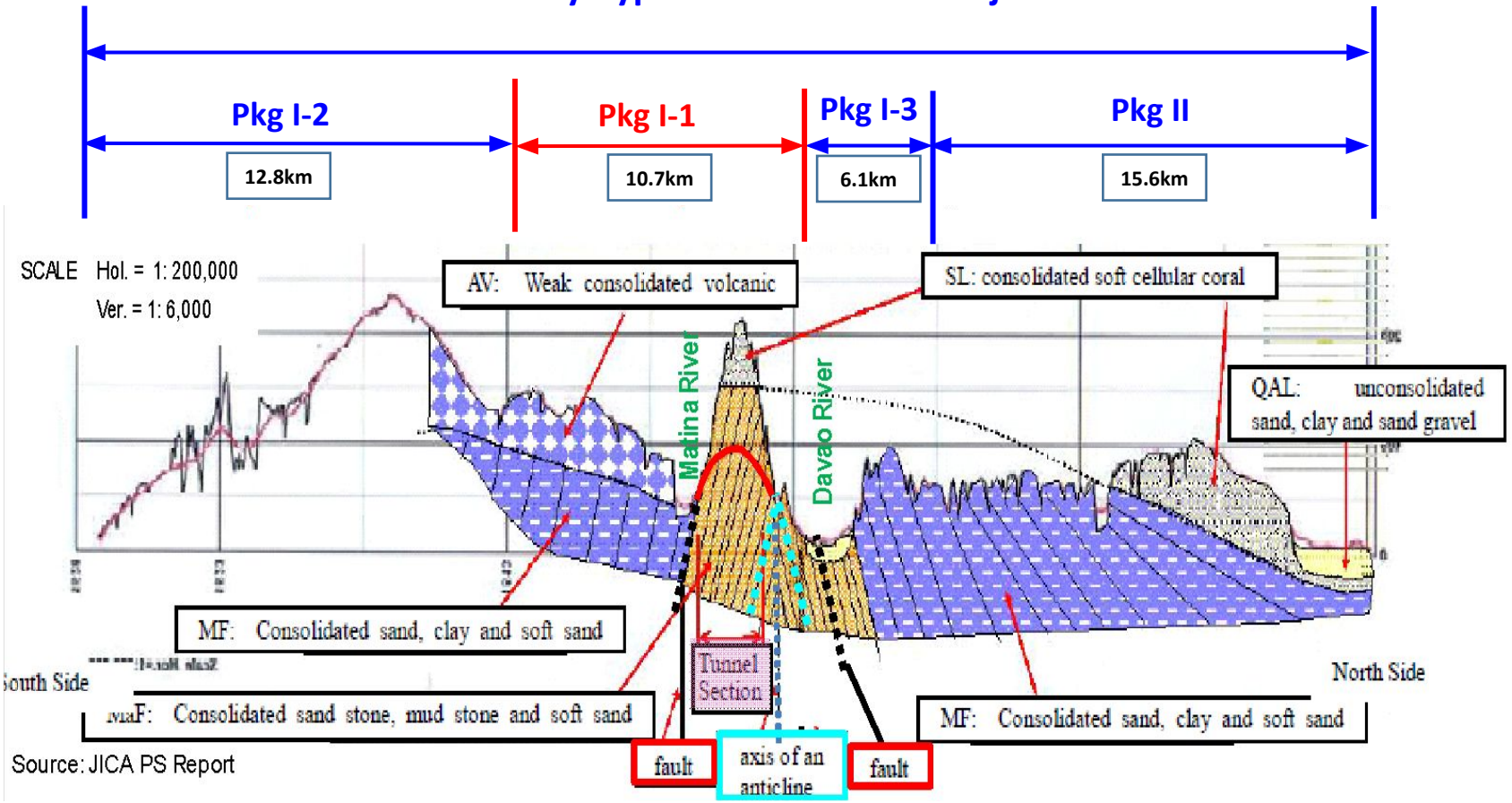


Scope of Works	Length (km)
Road Section	7.9
Bridge Section	0.5
Tunnel Section	2.3
Total	10.7

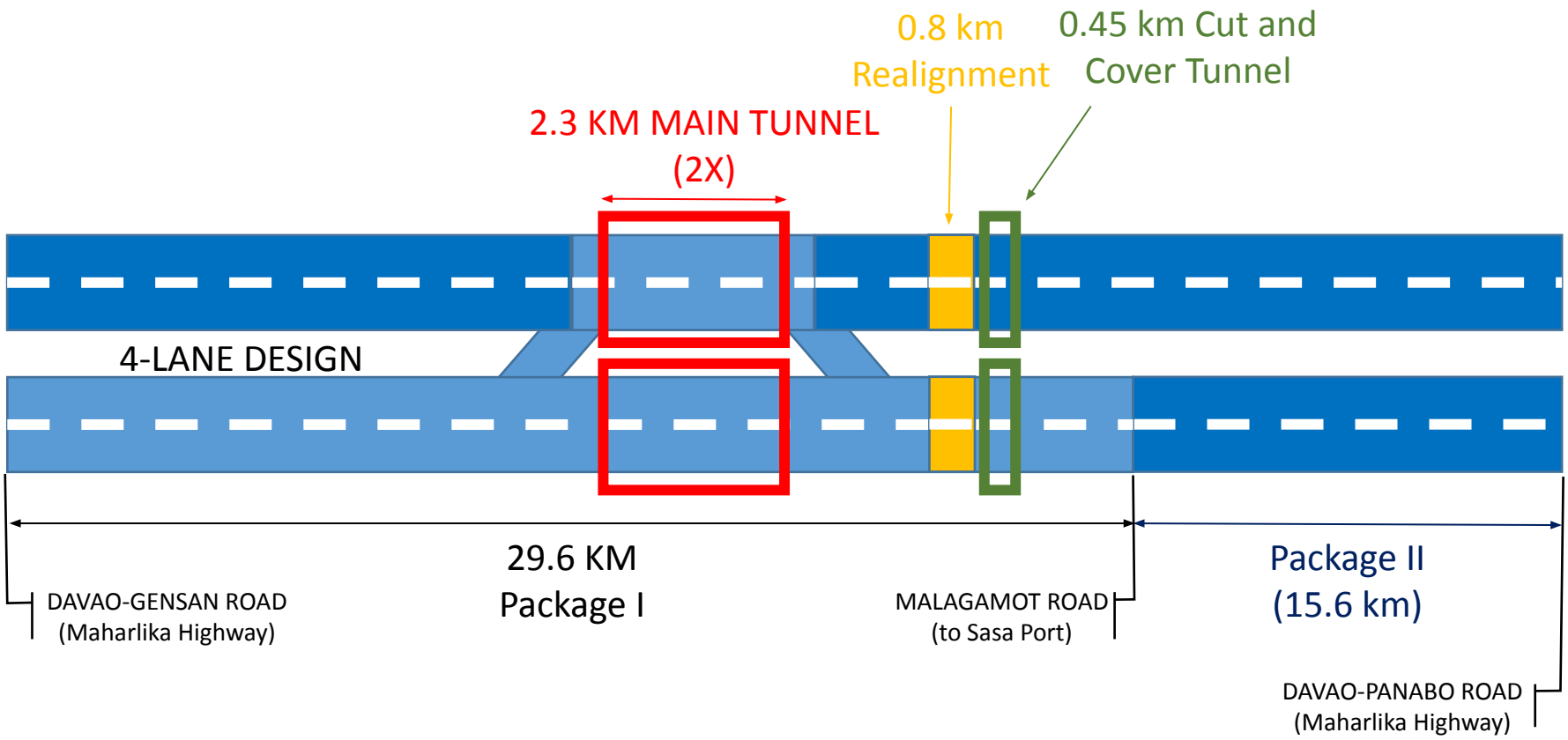
TOPOGRAPHICAL & FGEOLOGICAL CONDITIONS

The Project road is located at rolling to mountainous terrains except some limited flat sections. It passes under a hill of 210m height by a tunnel of 2,280m long.

Davao City Bypass Construction Project

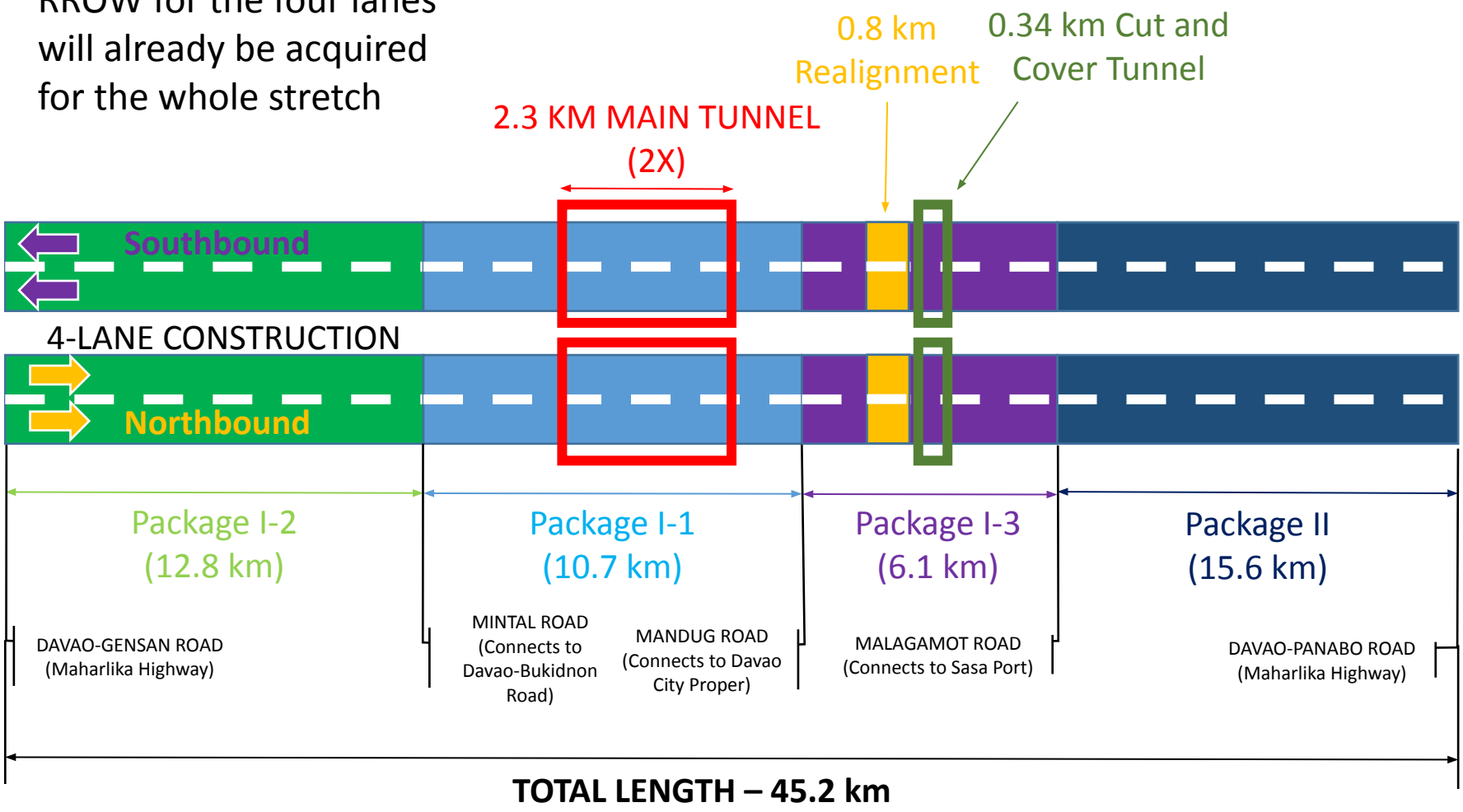


APPROVED RESTRUCTURING OF SCOPE OF WORKS (DETAILED DESIGN)



APPROVED RESTRUCTURING OF SCOPE OF WORKS (CIVIL WORKS)

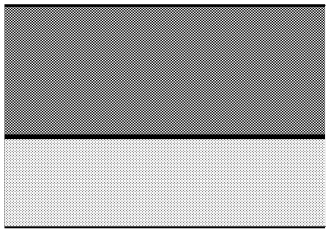
RROW for the four lanes will already be acquired for the whole stretch



ROADWAY CONSTRUCTION (4-LANE BYPASS)

Normal Section

PAVEMENT STRUCTURE



PCCP Thickness
T= 30.0 cm

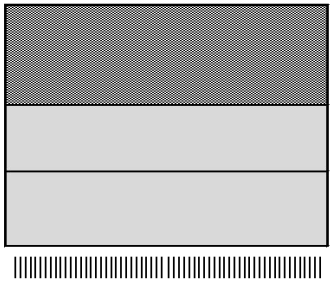
Prime Coat

Aggregate Sub-Base
(CBR 30%) T= 20.0 cm

Subgrade CBR = 7.0%

Tunnel Section

PAVEMENT STRUCTURE



PCC Thickness
T= 33 cm

Subbase CBR = 30.0%
T= 15 cm

Subbase CBR = 30.0%
T= 15 cm

Sub-grade CBR= 7%
(MR = 7,550 psi)

Naga-Toledo Road Project, Cebu

Slip Form Paver with Dowel Bars

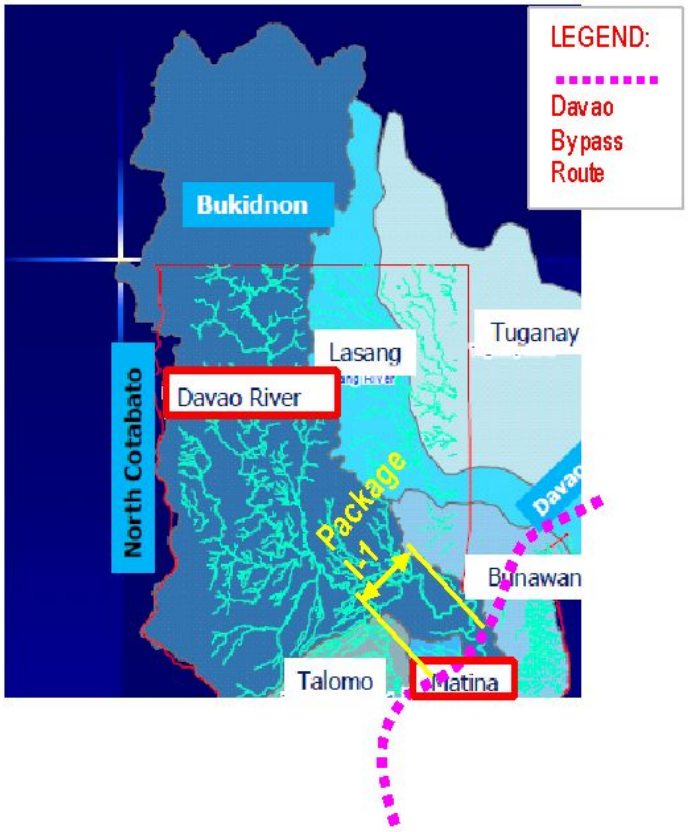
Slip Form Paver with Dowel Bars

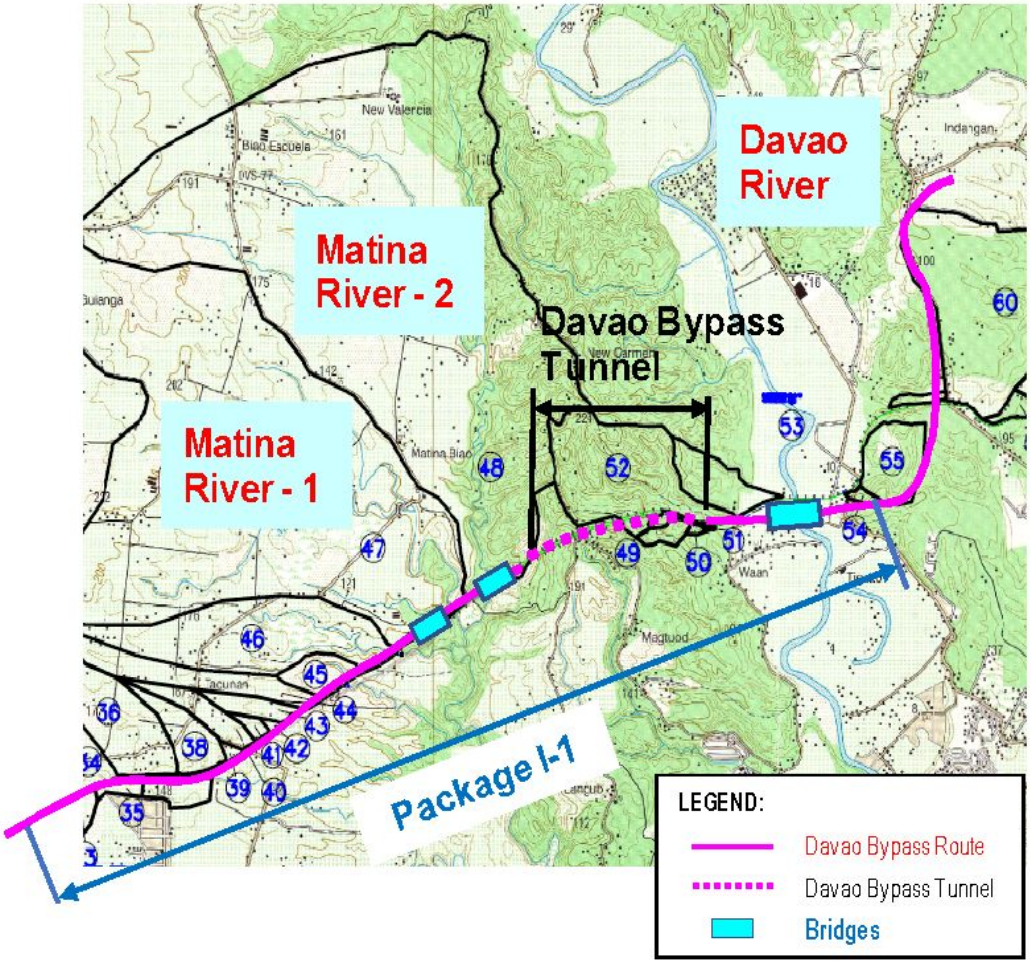
ROADWAY CONSTRUCTION (4-LANE BYPASS)

Slope Compaction by Bulldozer (21 ton)

Slope Compaction by Hydraulic Excavator (Long-Arm)

BRIDGE CONSTRUCTION

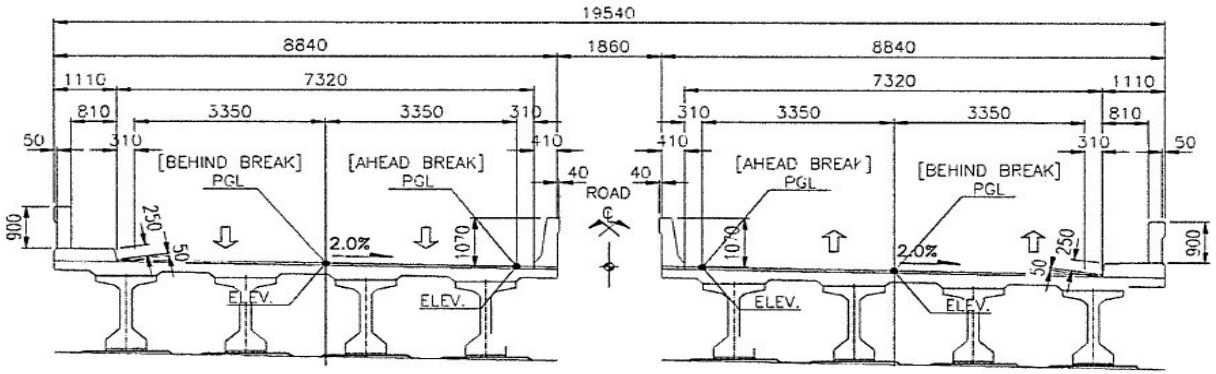




BRIDGE CONSTRUCTION

Item	Bridge Name	Abut.-A Station	River Name	Span Arrangement	Bridge Length	Width	Horizontal Curve (m)	Skew Angles (degree)	Foundation Pie (%)	Bridge Type	Girder Type	Girder Depth	Free Board
1	Br. 1L (S.Bound)	18+427.00	Matina River 1	7 (30+5@40+30)	260.00 m	8.84 m	linear	0	Bored Piles & Shinso*	PSCG	Type VI	1.829 m	19.006 m
2	Br. 1R (N.Bound)	18+427.00	(Do)	7 (30+6@40)	270.00 m	8.84 m	linear	0	Bored Piles & Shinso*	PSCG	Type VI	1.829 m	18.993 m
3	Br. 2L (S.Bound)	18+910.00	Matina River 2	2 (2@35)	70.00 m	8.84 m	linear - R=2116	0	Bored Piles	PSCG	Type V	1.600 m	11.726 m
4	Br. 2R (S.Bound)	18+910.00	(Do)	2 (2@35)	70.00 m	8.84 m	R=3711	0	Bored Piles	PSCG	Type V	1.600 m	11.724 m
5	Br. 3L (S.Bound)	22+025.00	Davao River	5 (5@40)	200.00 m	9.54 m	R=1200	0	Bored Piles	PSCG	Type VI	1.829 m	3.131 m
6	Br. 3R (N.Bound)	22+025.00	(Do)	5 (5@40)	200.00 m	9.54 m	R=1200	0	Bored Piles	PSCG	Type VI	1.829 m	3.131 m
	Total				870.00 m								

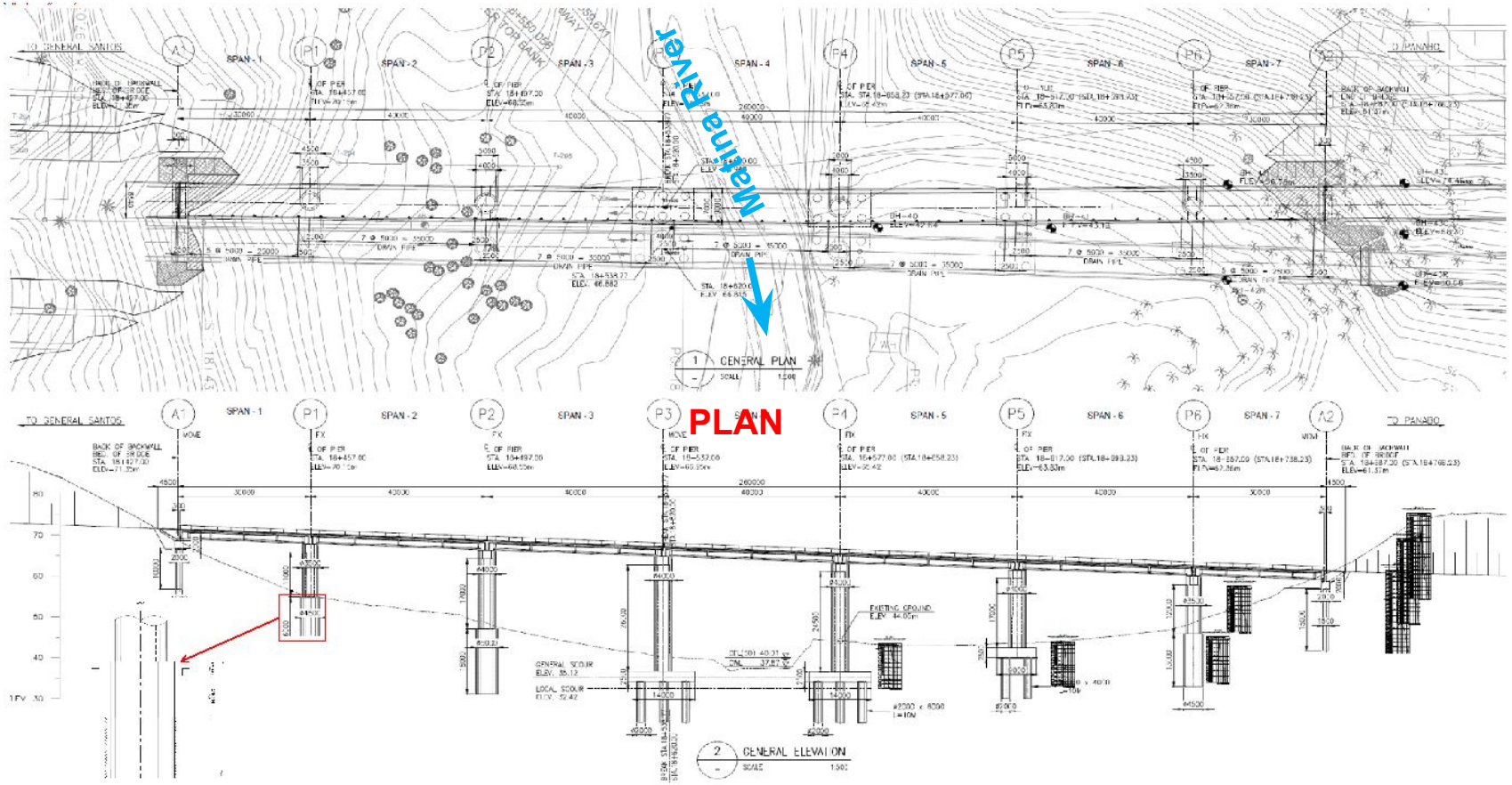
Note: * Shinso (Open Cason with steel plate liners)



Typical Section of PSCG

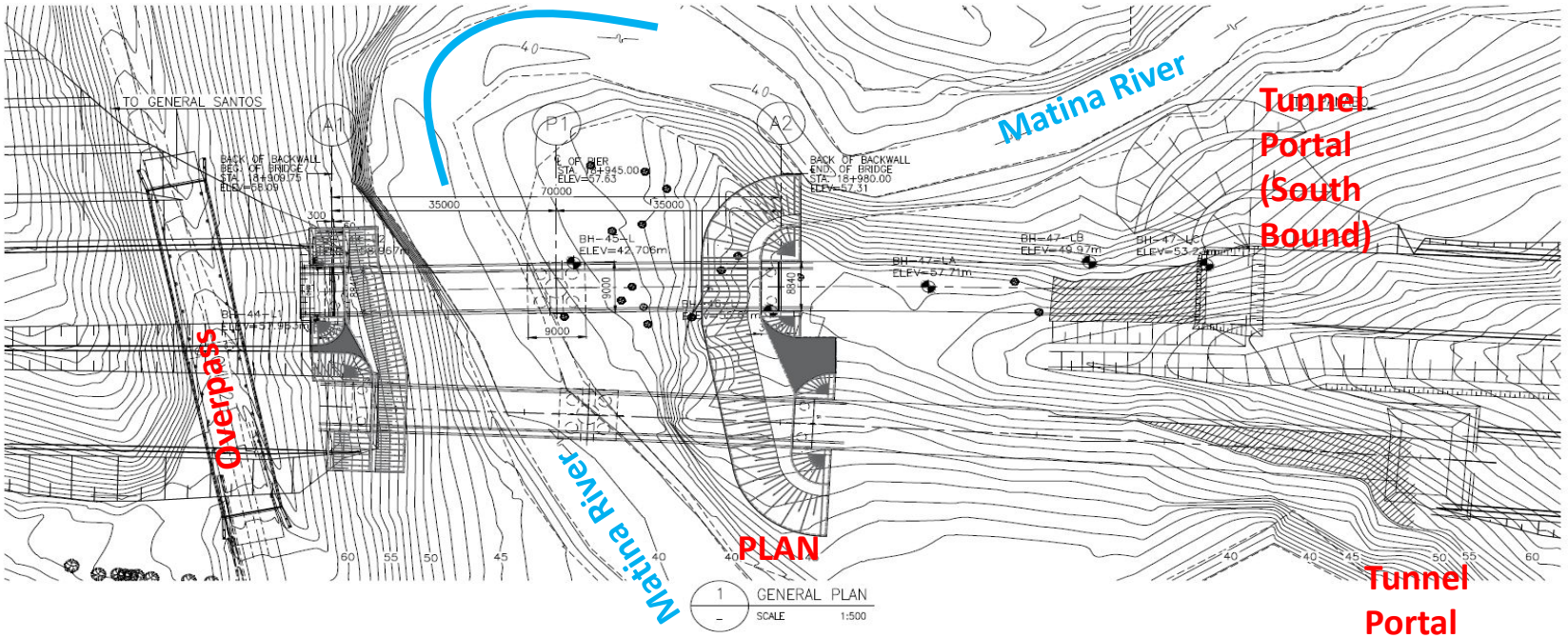
BRIDGE CONSTRUCTION

1). Matina River Bridge 1
(Bored Piles and Shinso Foundations)



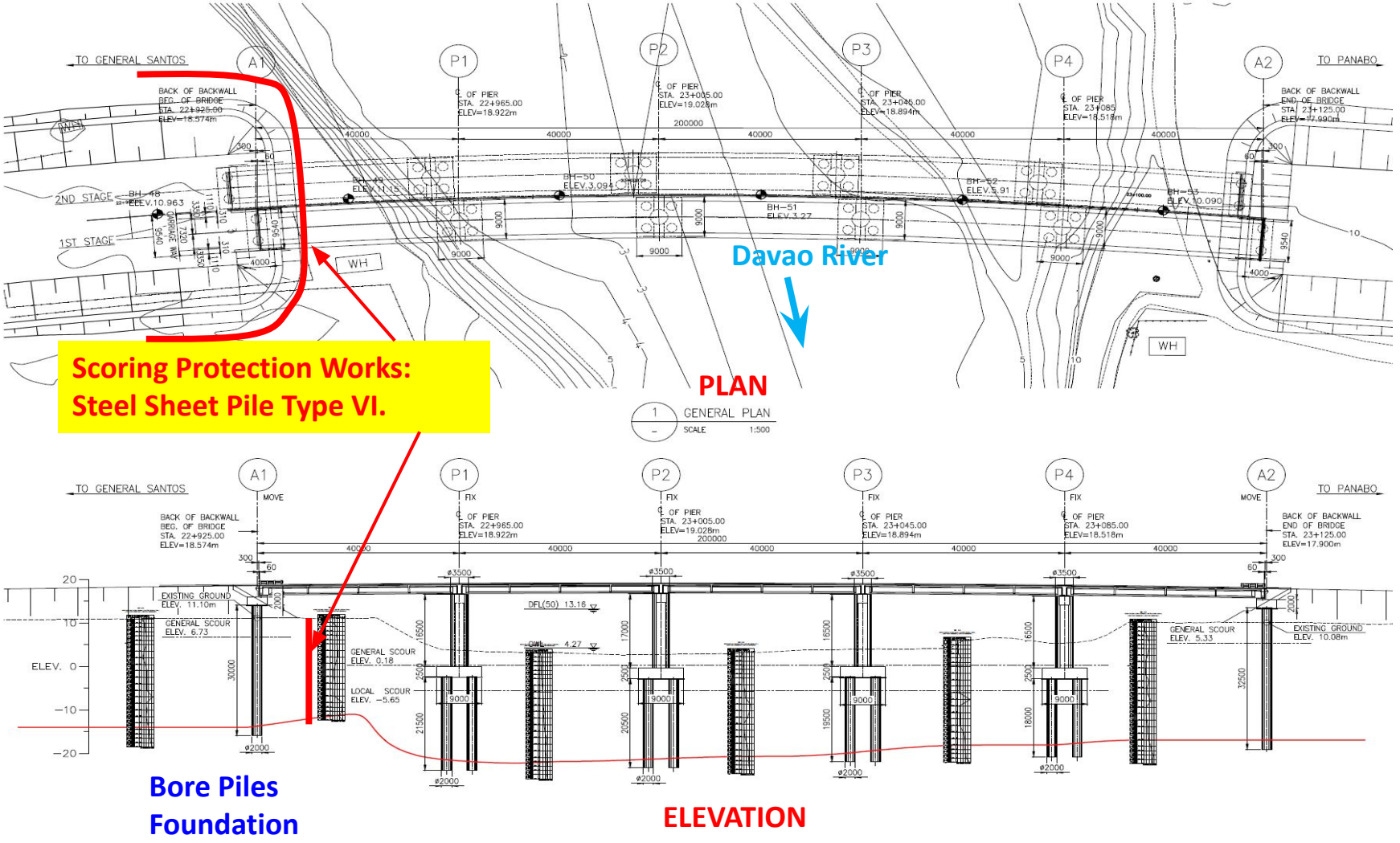
BRIDGE CONSTRUCTION

2) Matina River Bridge 2



BRIDGE CONSTRUCTION

3) Davao River Bridge

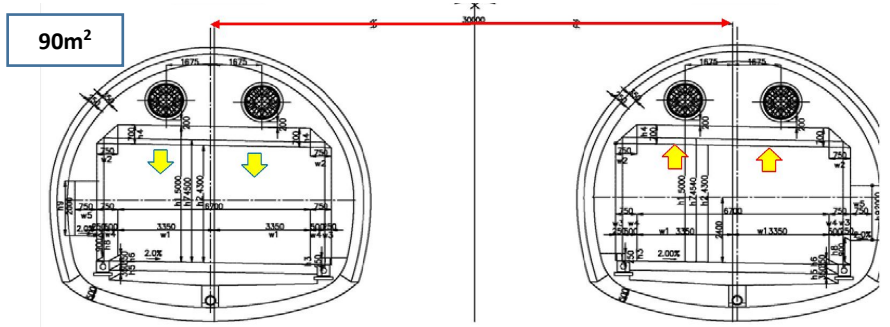


TUNNEL PLAN AND DESIGN

(1) Scope of Tunnel Works (L=2.3km x 2 number)

DPWH changed to construct two (2) main tunnels (1 for north and 1 for south bound traffic)

Image of Tunnel South Portal



Main Tunnel (2-lanes)
(Southbound)

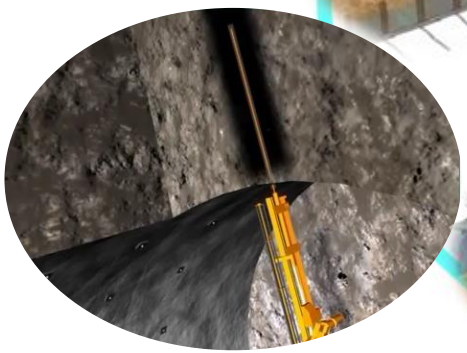
Main Tunnel (2-Lanes)
(Northbound)

TUNNEL PLAN AND DESIGN

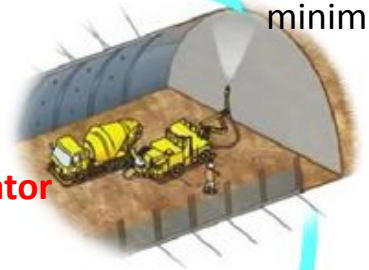
(2) NATM (New Austrian Tunneling Method)

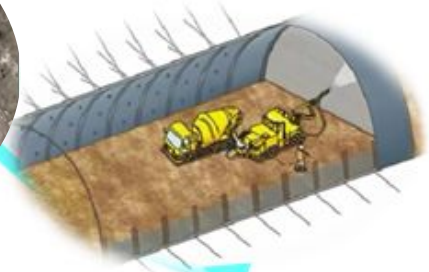
1st Shotcrete protection – applying a thin layer of shotcrete immediately after face advance, loosening and excessive rock deformation be minimized.

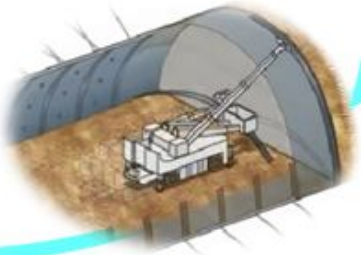
Strengthened by **Rock Bolts**



Free Section Excavator







Strengthened by 2nd **shotcrete**

Support by **steel ribs**

TUNNEL PLAN AND DESIGN

(3) Standard Tunnel Structures and Support Patterns

Geological Class	Support Pattern [1]	Std Unit Excavation Length (m)	Rock Bolt: Length (m)	Rock Bolt: Pitch (c.t.c) Periphery (m)	Rock Bolt: Pitch (c.t.c) Longitudinal (m)	Rock Bolt: Installation Area	Shotcrete: Thick-ness (cm)	Shotcrete: Layer	Shotcrete: Application	Shotcrete: Steel Mesh [2]	Steel Support: Upper Half	Steel Support: Lower Half	Steel Support: Pitch (c.t.c) (m)	Lining Concrete: Arch / Side Wall (cm)	Lining Concrete: Invert [3] (Bottom) (cm)
B	B-a	2.0	3.0	1.5	2.0	Upper 120°	5.0	1		-	-	-	-	30.0	0.0
CI	CI-a	1.5	3.0	1.5	1.5	Upper Half	10.0	1		-	-	-	-	30.0	(40)
CII	CII-a	1.2	3.0	1.5	1.2	All-round	10.0	2	Upper/Side	-	-	-	-	30.0	(40)
	CII-b										H125		1.2		
DI	DI-a	1.0	3.0	1.2	1.0	All-round	15.0	2	All-round	Upper Half	H125	H125	1.0	30.0	45.0
	DI-b	1.0	4.0												
DII	DII-a	< 1.0	4.0	1.2	< 1.0	All-round	20.0	2	All-round	Upper/Side	H150	H150	< 1.0	30.0	50.0
Portal	DIII	< 1.0	4.0	1.2	< 1.0	All-round	25.0	2	All-round	Upper/Side	H200	H200	< 1.0	30.0	50.0

Notes: 1). "a" will be used for all types of rock in principle.mud stone, clay stone, tuff, etc,
"b" will be used for mud stone, clay stone, tuff, etc, of which deformation is large.
2). Steel mesh is not required if Steel fiber mixed concrete (SFRC) is used for shotcrete.
3). Figures in ( ) is used for mud stone, clay stone, tuff, etc, formulated in the tertiary period
4). Applicable for Davao City Bypass Tunnel

Source: Road Tunnel Technical Standards, Japan Road Association

Davao Bypass Project

Geological Class and Type of Rock

Hard Rock

Soft Rock

Class	Type of Rock	Characteristics
B	Massive rock, granite, andesite, basalt, etc.	Hard
CI	Massive to weathered rock, Granite, andesite, basalt, conglomerate, sandstone, etc.	Relatively hard
CII*	Tertiary clay stone and mudstone	Soft rock and stable
DI*	Tertiary clay stone and mudstone with gravel and sand mix	Relatively stable
DII*	Mixture of soil, gravel and sand	Unstable

Note: * Rock Types for the Davao Bypass Tunnel excavation.

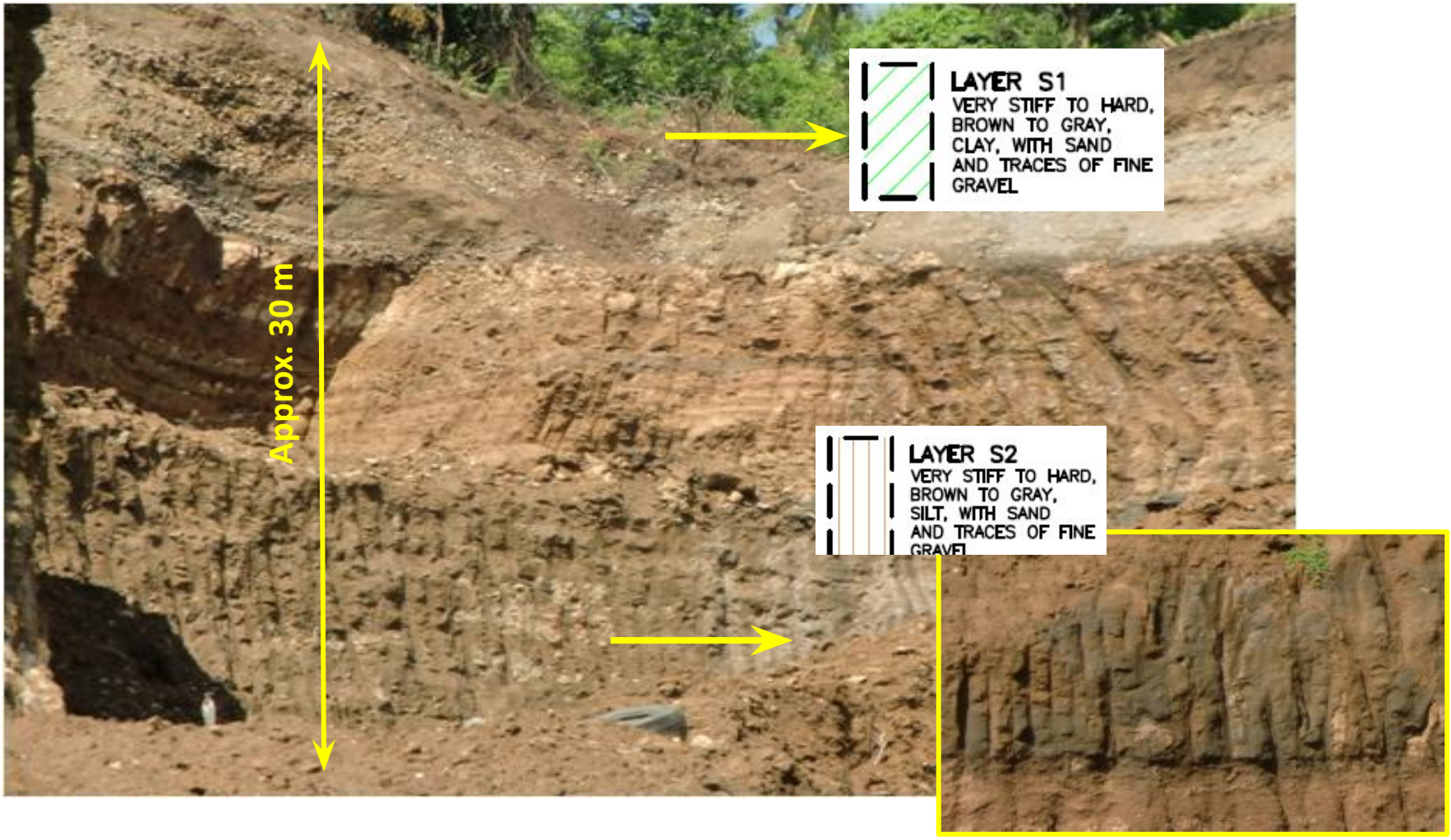
TUNNEL PLAN AND DESIGN

(4) Ground Classification and Section Length of DCBCP Tunnel

Southbound Tunnel			Northbound Tunnel		
Ground Classification	Length (m)	Ratio (%)	Ground Classification	Length (m)	Ratio (%)
DI	1,664	73.99	DI	1,644	73.39
DI Large	96	4.27	DI Large	96	4.29
DII	390	17.34	DII	430	19.20
DII Large			DII Large		
DIII(Portal)	89	3.97	DIII(Portal)	60	2.69
Portal work	10	0.43	Portal works	10	0.43
Total	2,249	100.00	Total	2,240	100.00

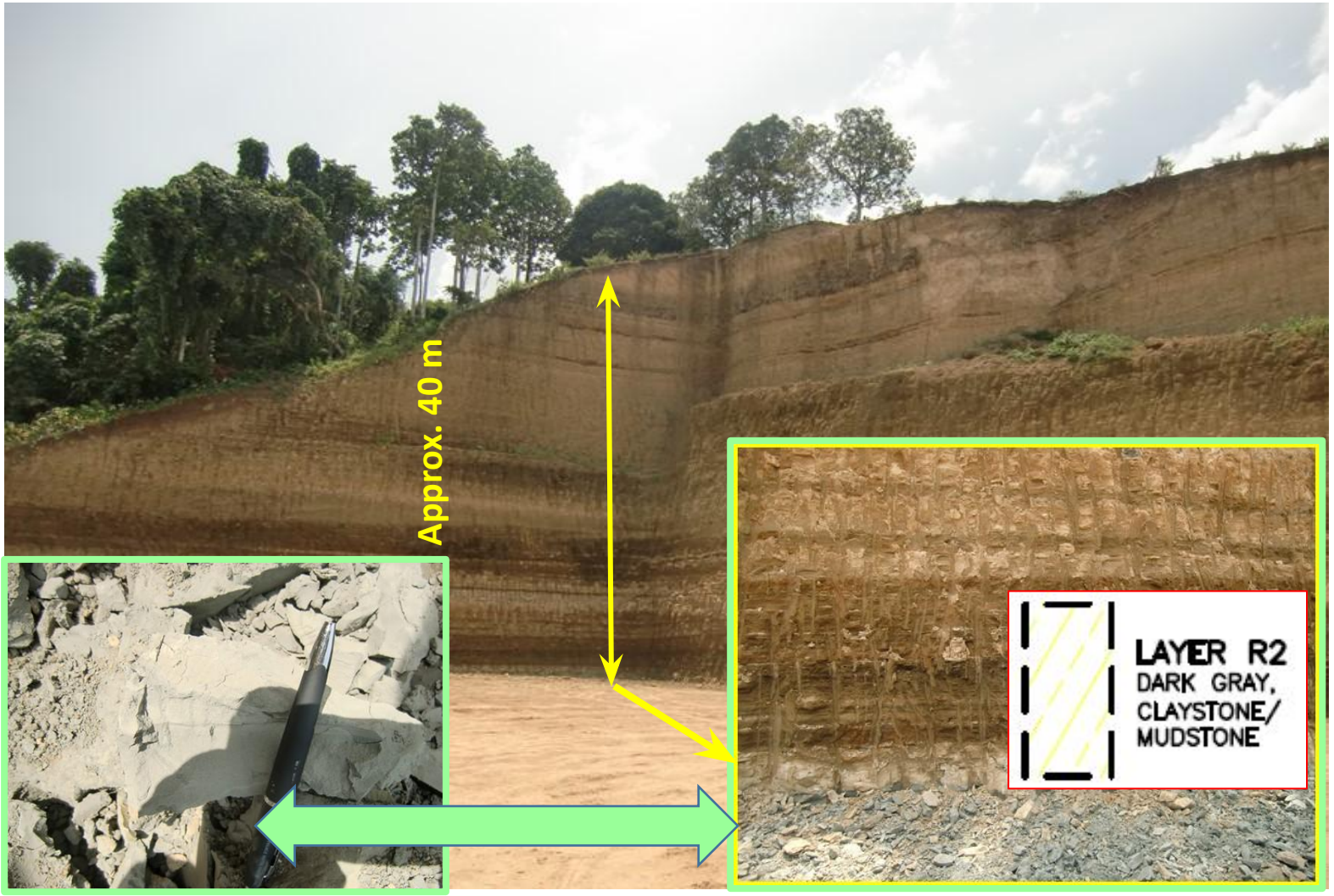
TUNNEL PLAN AND DESIGN

(6) Typical Geographic Layers at North Portal (Quarry at 2.3km from Tunnel)



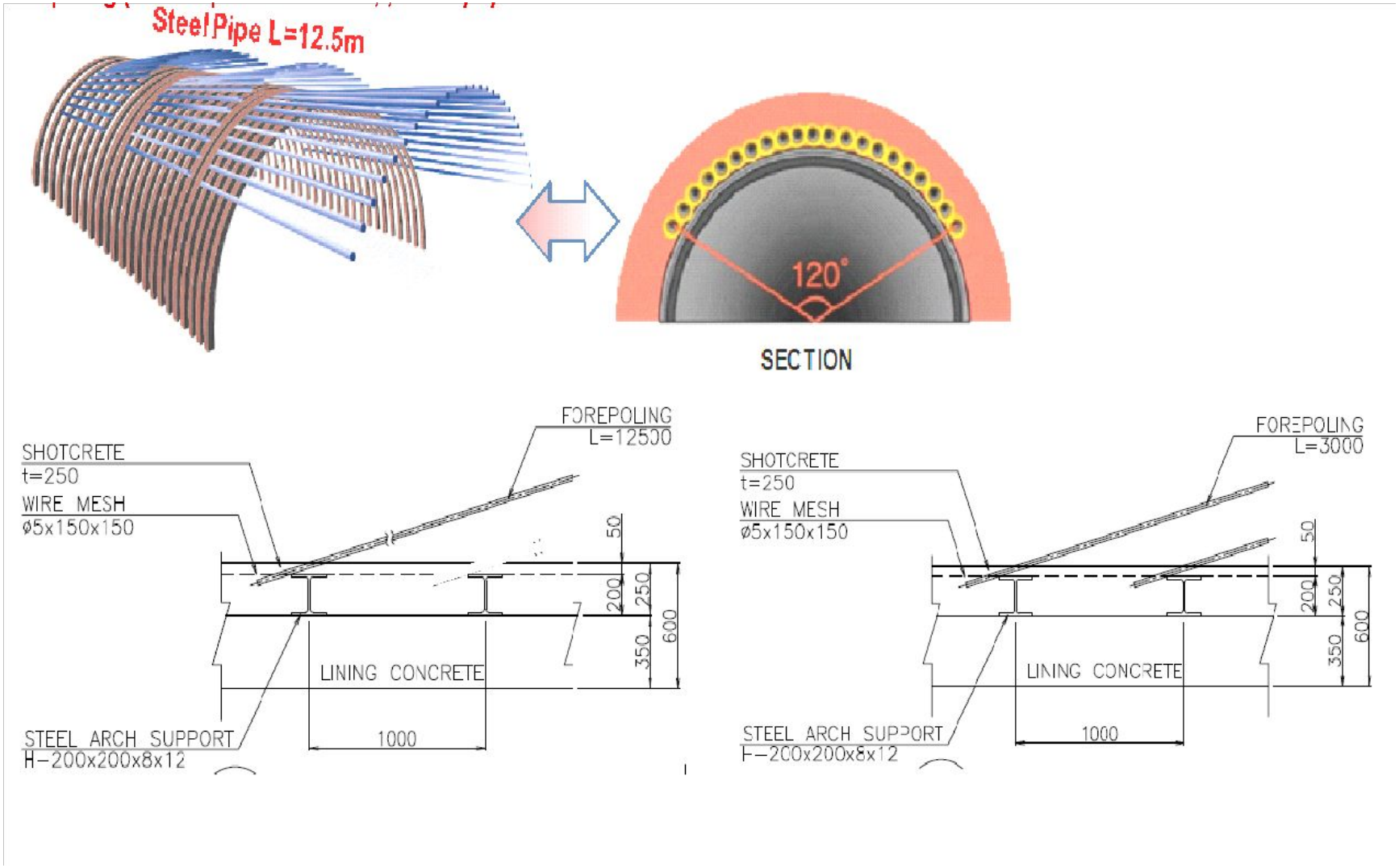
TUNNEL PLAN AND DESIGN

(ctd.)



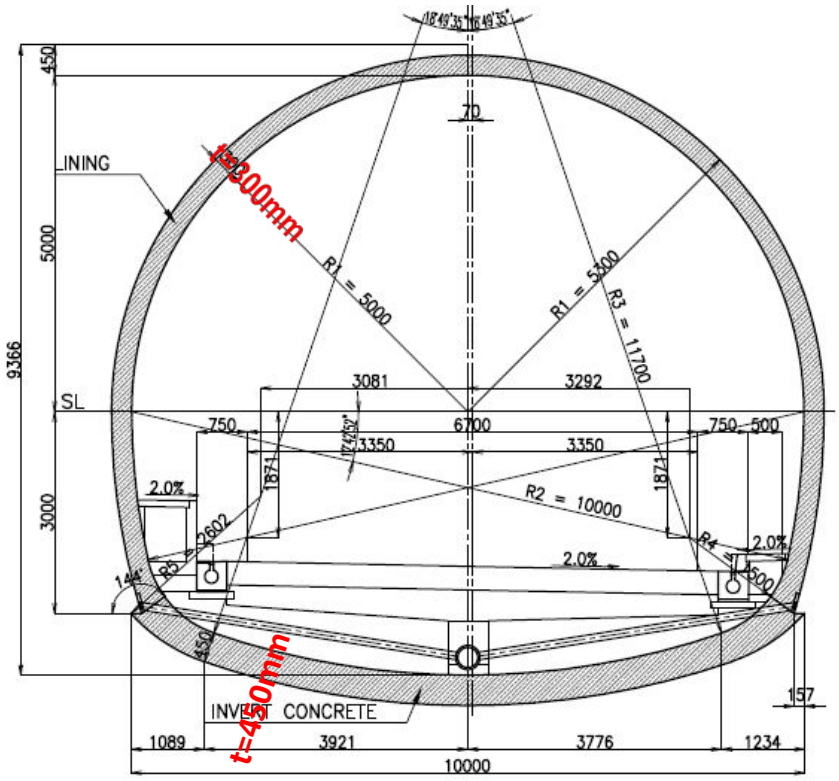
TUNNEL PLAN AND DESIGN

(7) Portal Work and Auxiliary Methods for Tunnel Portal Sections

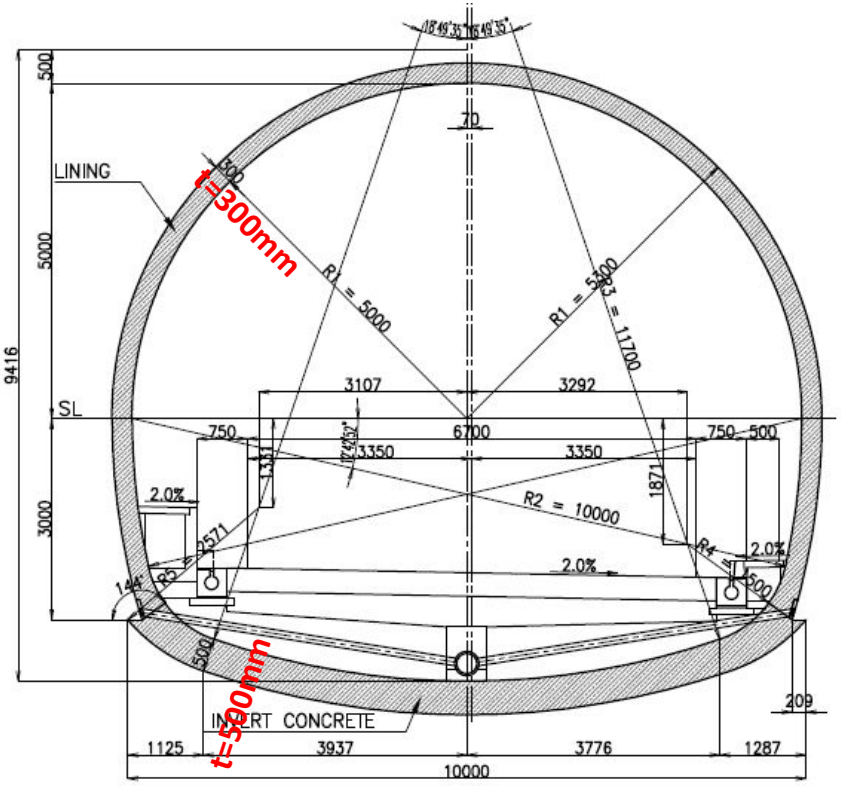


TUNNEL PLAN AND DESIGN

(8) Standard Tunnel Sections



Class DI (21 Mpa)

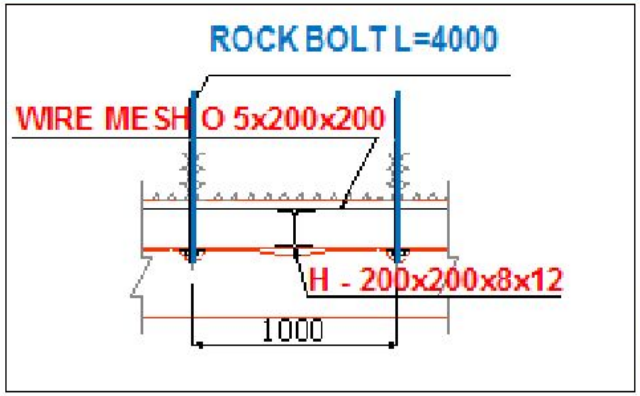


Class DII (21 Mpa)

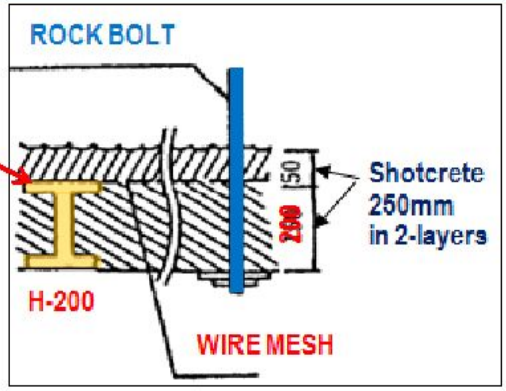
Note: S.L. (Spring Line)

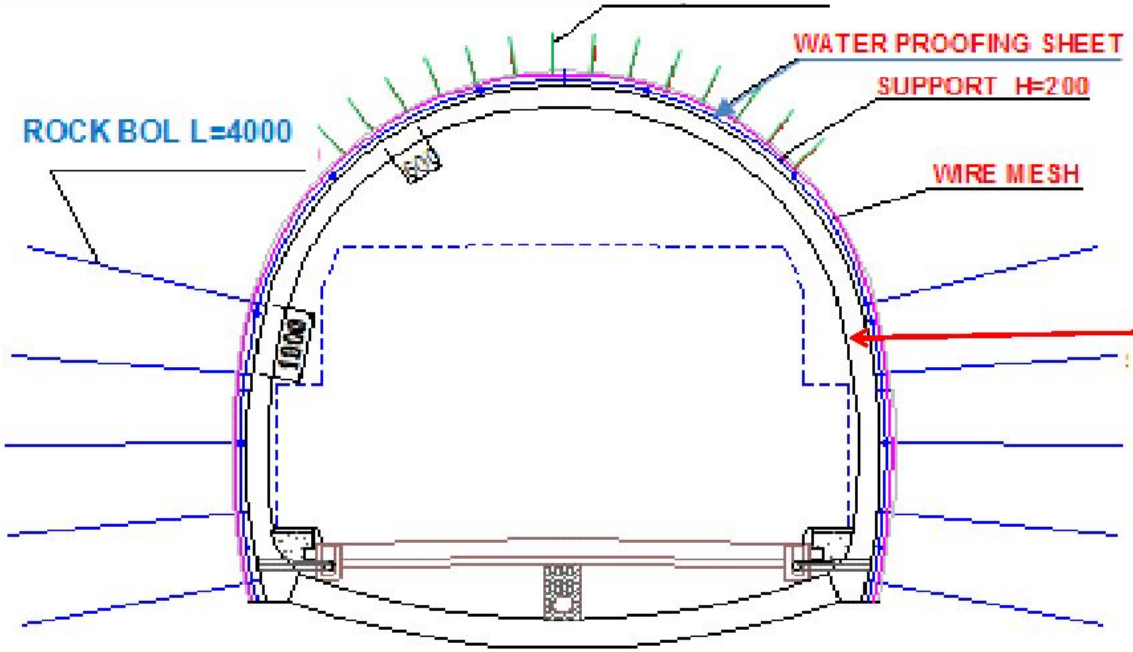
TUNNEL PLAN AND DESIGN

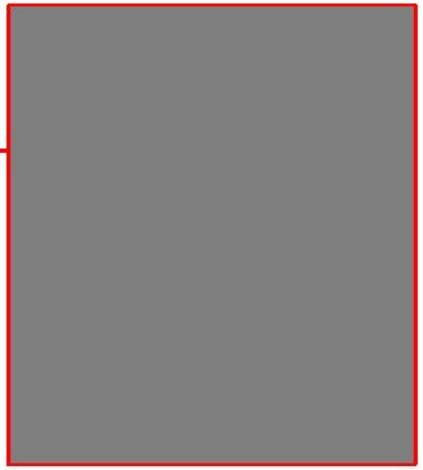
(9) Tunnel Support Works (Class III: Portal Section)



Forepoling
(Steel Bar or Pipe)



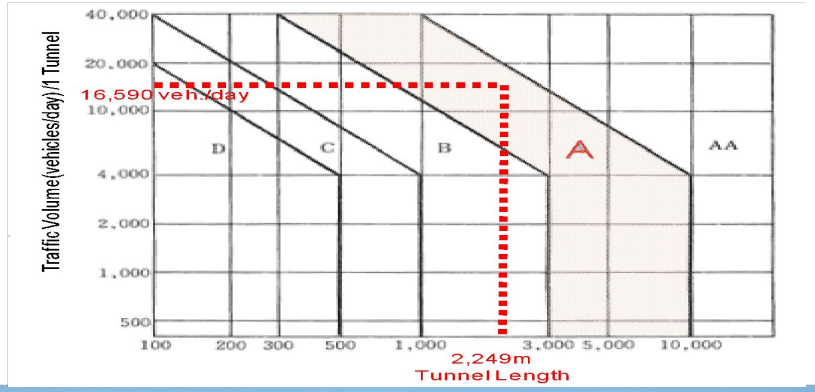


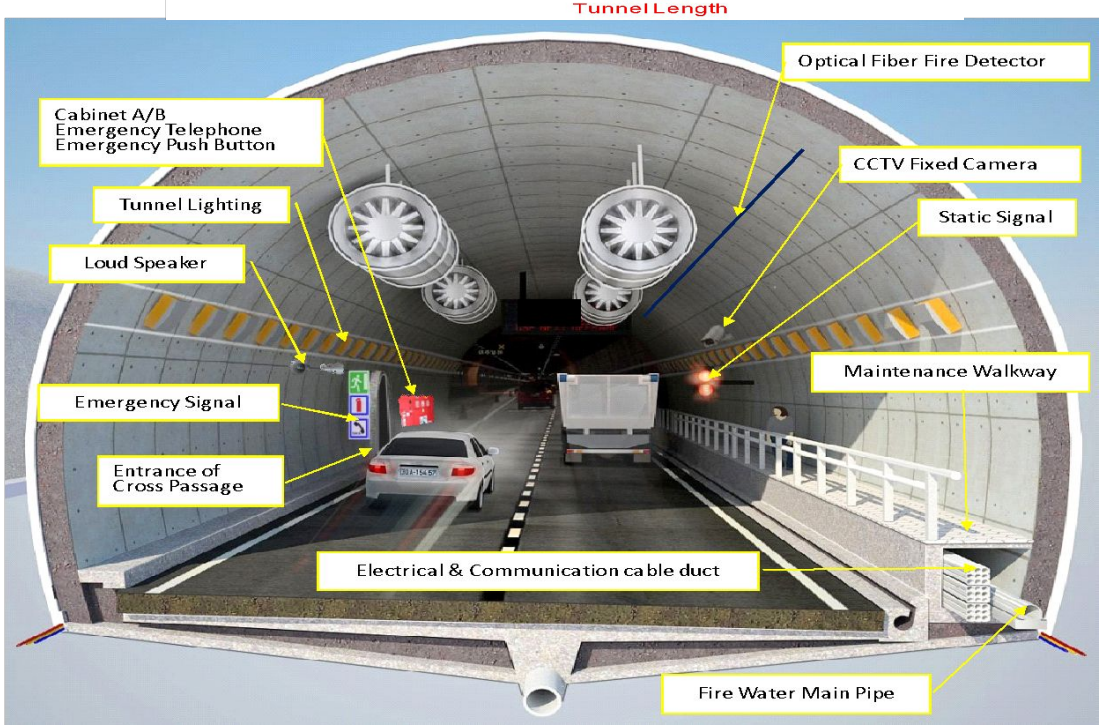


TUNNEL O&M FACILITIES

(1) Component of Tunnel Facilities

Item	Description
Communication System	
101	Operation Control Center System
102	Network Communications
103	CCTV System
104	Safety System
105	Information System
106	Weigh-in-Motion System
107	Toll Collection System
Water Supply System	
108	Water Supply System
Ventilation System	
109	Ventilation System
Emergency Exits	
110	Emergency Exit Facilities
Electrical Facilities	
111	Power Distribution System



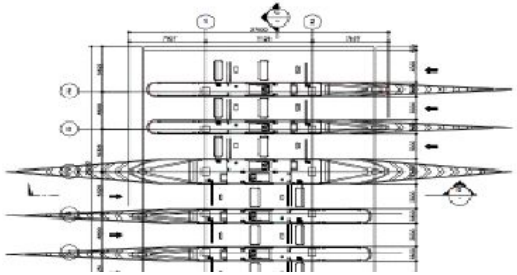


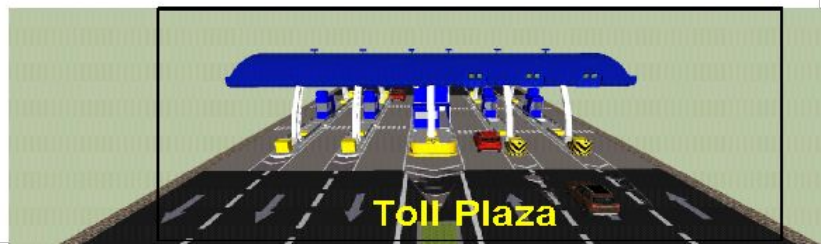
TUNNEL O&M FACILITIES

(2) Tunnel Facility Layout at North Portal

Tunnel Control Center

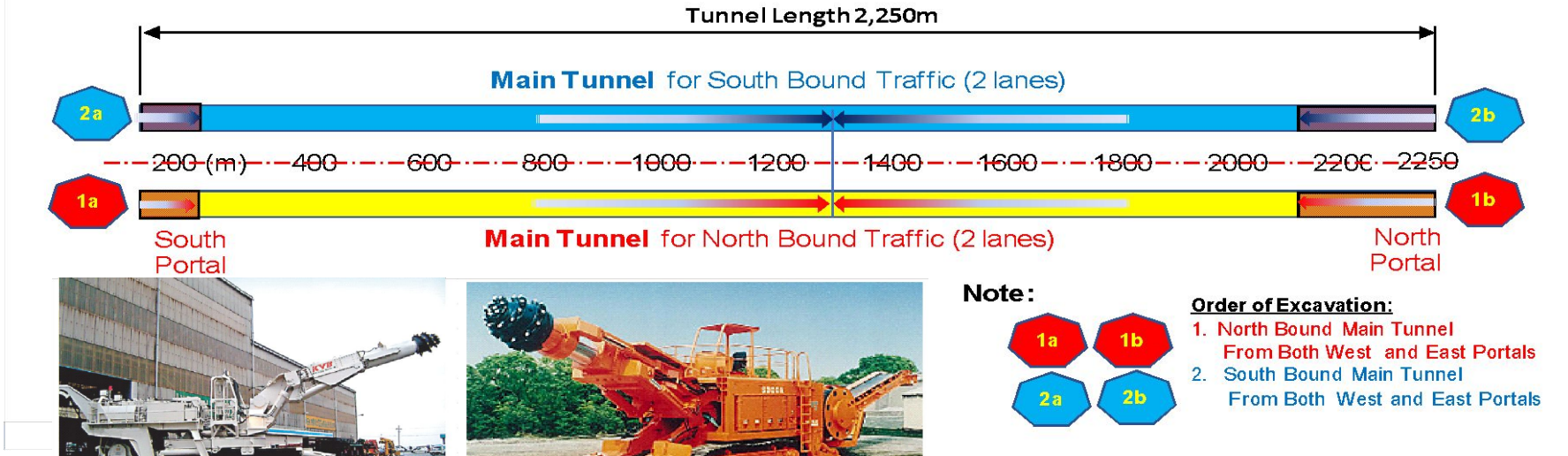
Operation Control Center at North Portal (Image)





TUNNEL CONSTRUCTION (EXCAVATION FROM BOTH PORTALS)

(1) Excavation From Both Portals to Complete within 37 Months



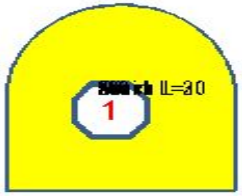
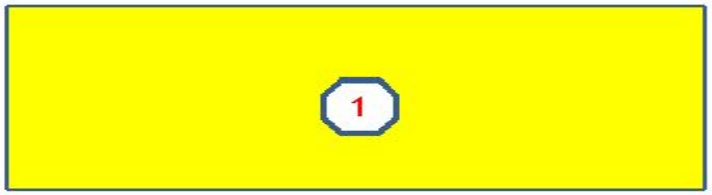
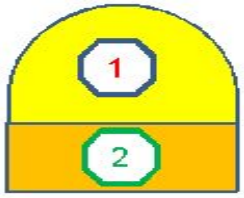
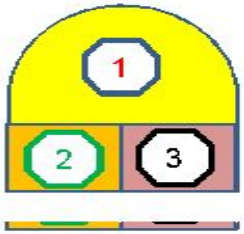
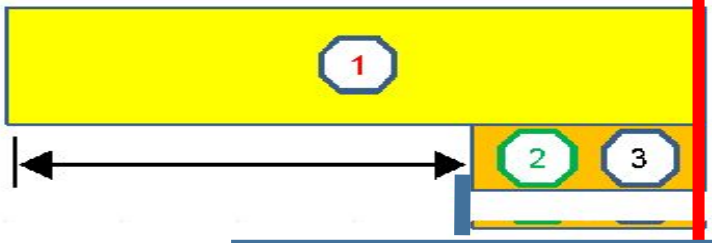
Note:

Order of Excavation:

1. North Bound Main Tunnel
   From Both West and East Portals
2. South Bound Main Tunnel
   From Both West and East Portals

TUNNEL CONSTRUCTION (EXCAVATION FROM BOTH PORTALS)

(2) Typical Mountainous Tunnel Excavation Methods

	Method	Section	Elevation
(a)	Full Section Method		
(b)	Full Section & Mini-Benching (To be adopted) Mini- Benching		
(c)	Top-Half Heading & Benching		

Note: Order of Excavation

Note: Refer to Animation Video as to NATM & Excavation Method

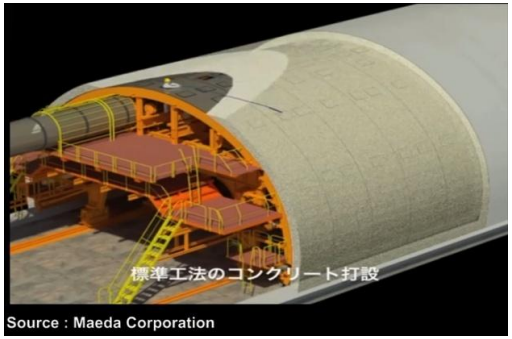
Davao City Bypass Tunnel

TUNNEL CONSTRUCTION (EXCAVATION FROM BOTH PORTALS)

(3) Tunnel Construction Special Equipments

Steel Rib (H-Beam)

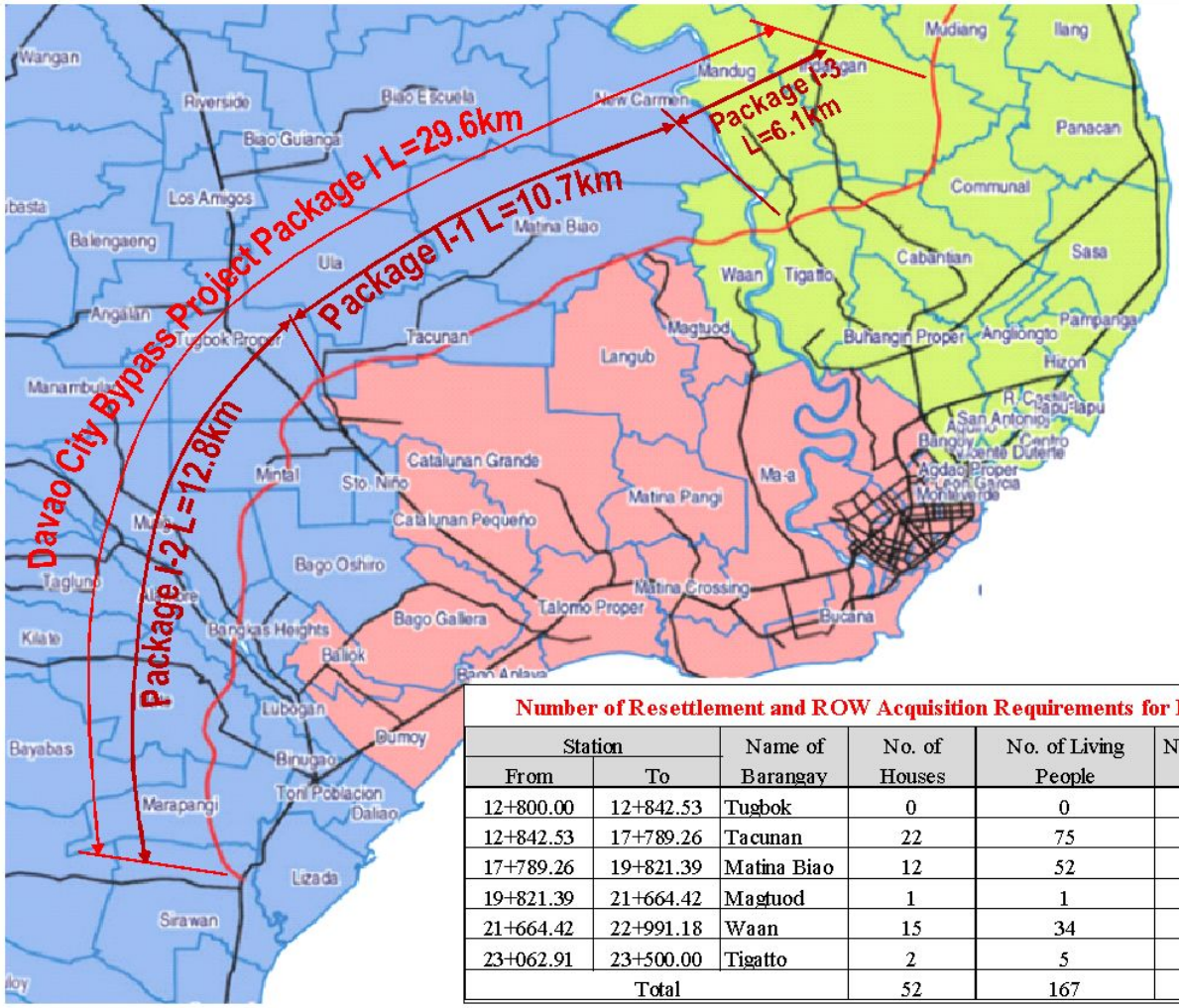
Waterproofing Sheet Fixing Plat From



Slide Steel Form

RAP AND LAND ACQUISITION

(1) Affected Structures and Land

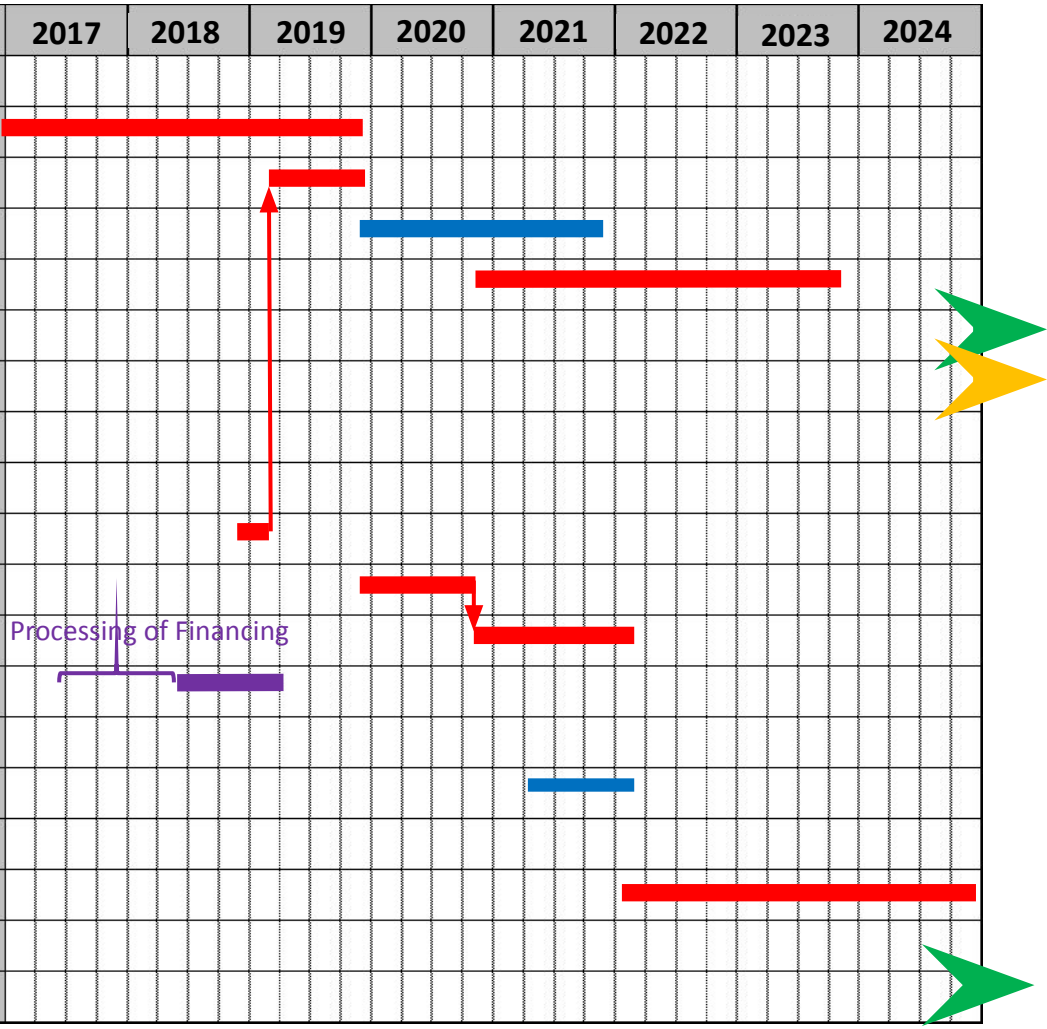


Number of Resettlement and ROW Acquisition Requirements for Package I-1

Station		Name of Barangay	No. of Houses	No. of Living People	No. of Plots (lands) Traversed
From	To				
12+800.00	12+842.53	Tugbok	0	0	4
12+842.53	17+789.26	Tacunan	22	75	85
17+789.26	19+821.39	Matina Biao	12	52	11
19+821.39	21+664.42	Magtuod	1	1	7
21+664.42	22+991.18	Waan	15	34	36
23+062.91	23+500.00	Tigatto	2	5	10
Total			52	167	153

IMPLEMENTATION SCHEDULE

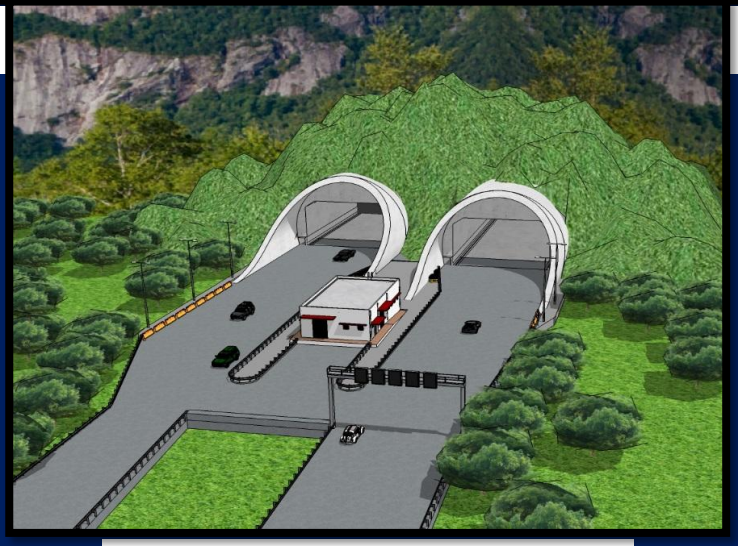
Description	2017	2018	2019	2020	2021	2022	2023	2024
Package I-1 (4-Lane)								
1.1 Detailed Engineering Design								
1.2 Tender Assistance								
1.3 RROW Acquisition and RAP Implementation								
1.4 Construction (37 months)								
1.5 Open to Public								
1.6 O & M Tunnel Facility								
Package I-2, I-3 and Package II (4-Lane)								
2.1 Detailed Engineering Design								
2.1.1 Package I-1*								
2.1.2 Package I-2, I-3 & Package II								
2.2 Tender Assistance								
2.2.1 Package I-2, I-3 & Package II								
2.3 RROW Acquisition and RAP Implementation								
2.3.1 Package I-2, I-3 & Package II								
2.4 Construction								
2.4.1 Package I-2, I-3 & Package II (24 months)								
2.5 Open to Public								
2.5.1 Package I-2, I-3 & Package II								



PERSPECTIVES

Cut and Cover Tunnel

Toll Plaza



South Portal of Tunnel

DAGHANG SALAMAT!