THE GOVERNMENT OF THE SOCIALIST REPUBLIC OF VIETNAM

HO CHI MINH CITY PEOPLE'S COMMITTEE

Saigon East-West Highway Project Seminar

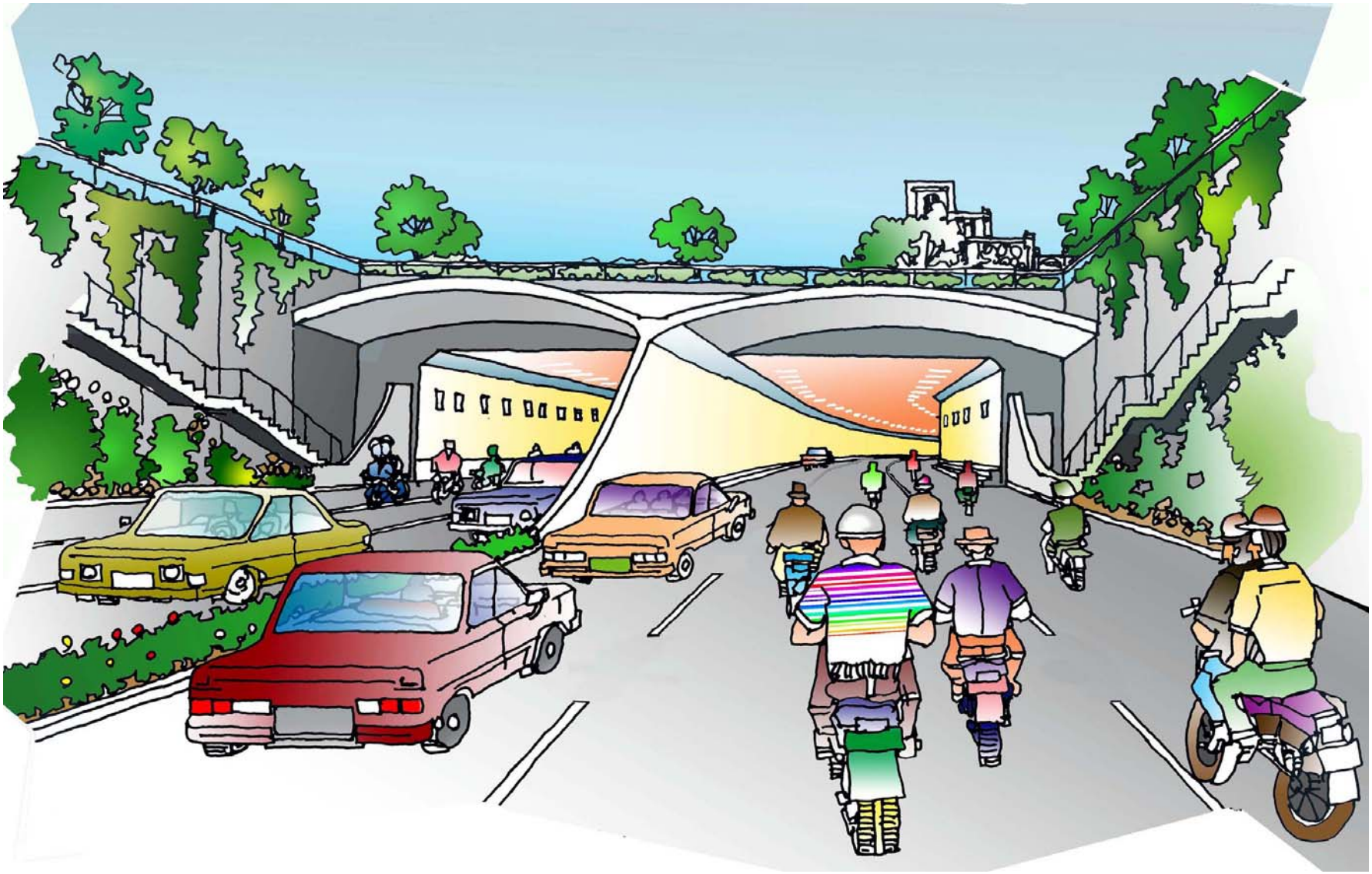
TUNNEL

JAPAN

Official Development Assistance

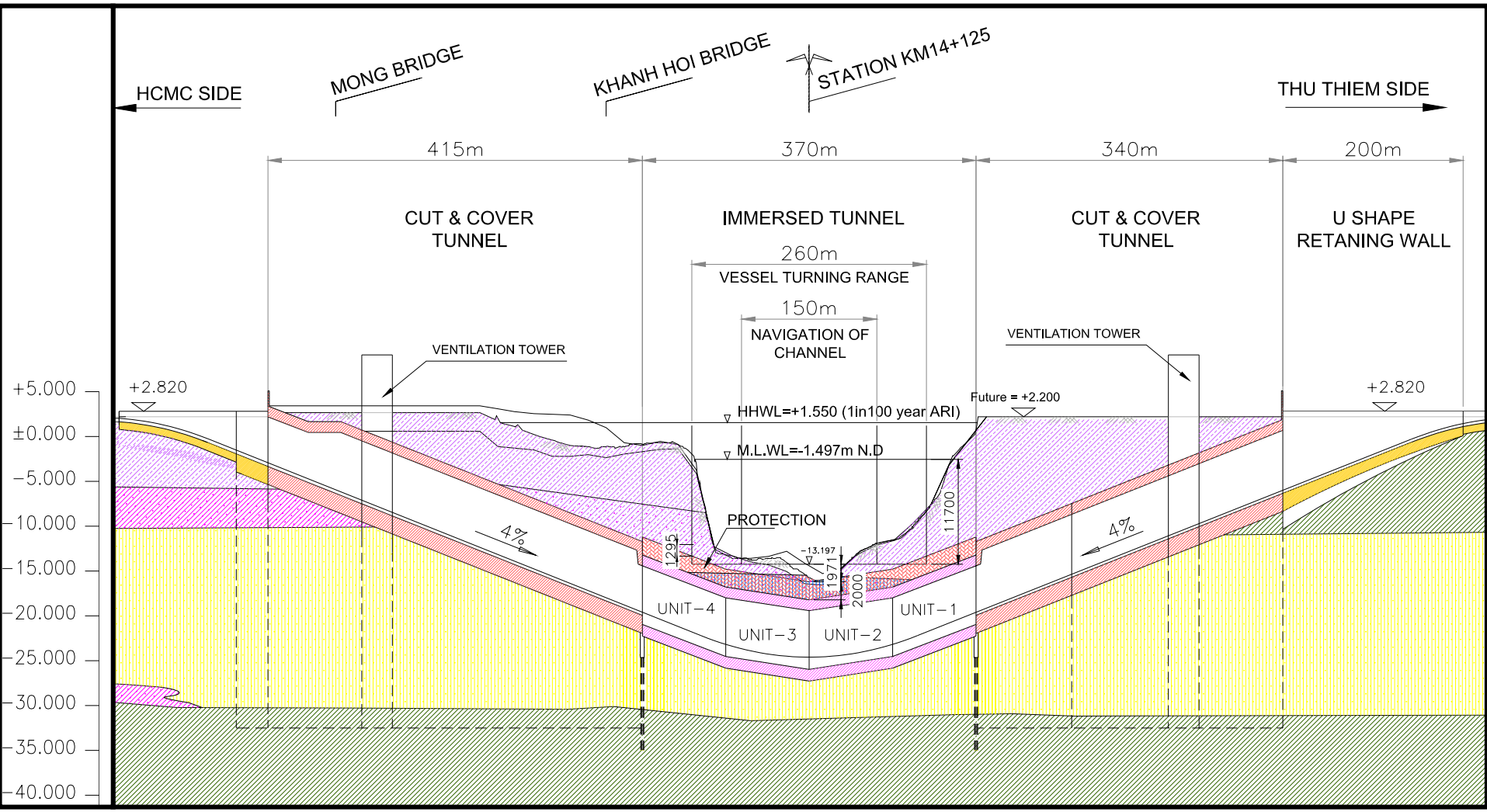
TUNNEL Sub-Sector (Civil)

IMAGE OF TUNNEL ENTRANCE



Traffic in Tunnel (Immersed Section)

PROFILE OF THE TUNNEL



FLOW CHART OF BASIC DESIGN FOR IMMERSED TUNNEL

What are the Concept?

Sound Structure

Structural Safety

Functional Structure

Useful for traffic
Safety for Emergency
Ventilation and Lighting

Aesthetic Structure

Landscape of Tunnel Entrance
View of Inner Space

Which is Better?

Tunnel Cross Section

How to Construct?

RC Type Unit at Casting Basin

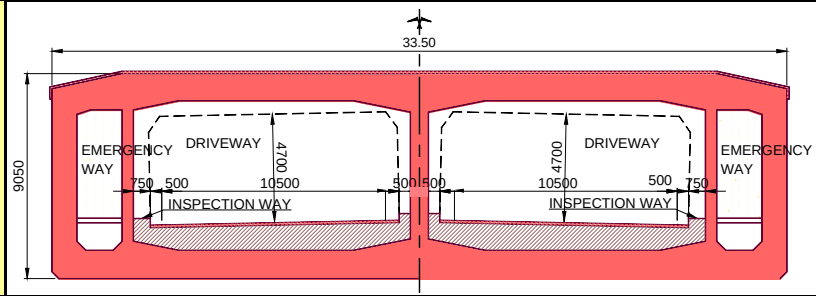
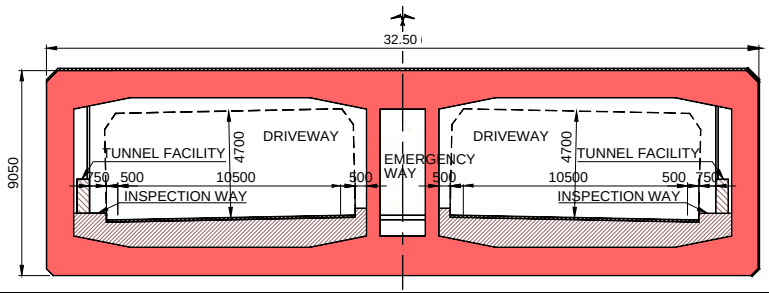
Hybrid type Unit with Floating Fabrication

Where is the most likely?

Just on the Alignment

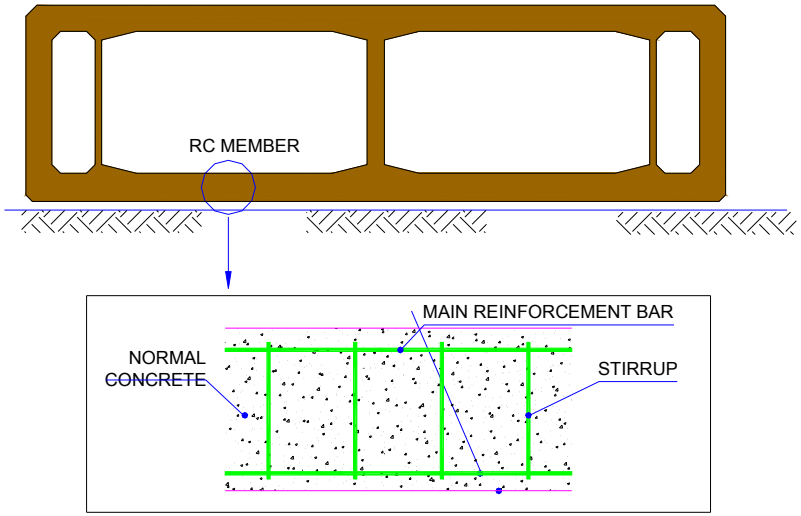
Other than Site

COMPARISON OF IMMERESED TUNNEL CROSS SECTIONS

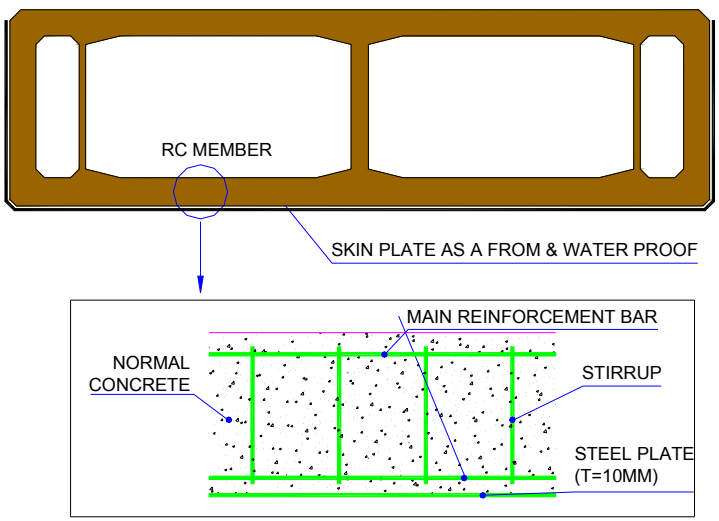
ITEM	BASIC PLAN	ALTERNATIVE PLAN
Cross Section		
Characteristics of Cross Section	• 2m wide Emergency pathway is provided on the both sides. • Vehicles ducts width is 12.25m.	• 2m wide Emergency pathway is provided on the center of cross section. • Same as the left.
Traffic Safety	• The vehicle duct width is enough for motorcycles. * Good.	• Same as the left. * Good.
Serviceability in an Emergency and Maintenance	• Serviceability in the traffic accident, fire accident and maintenance work is good for emergency pass-way duct are on the both sides and enough width. * Good.	• Serviceability is inferior to the Basic Plan for walking pass is narrow long and complicated. * Good.
Construction Cost of Immersed Tunnel	• 74.04 MUS$ (include casting basin) 100%. * Good.	• 71.8 MU$ (include casting basin) 97% * Good.
Others	• This cross section was agreed by the Prime Minister of Vietnam in 5 July, 2000.	
Total Evaluation	* Good. • Serviceability of emergency pass-way is higher than Alternative. • This cross section was agreed by the Prime Minister.	• Alternative is inferior to the Basic Plan.

STRUCTURE TYPES OF IMMERSED TUNNEL

TYPE-1: REINFORED CONCRETE STRUCTURE
CONSTRUCTION AT A CASTING BASIN

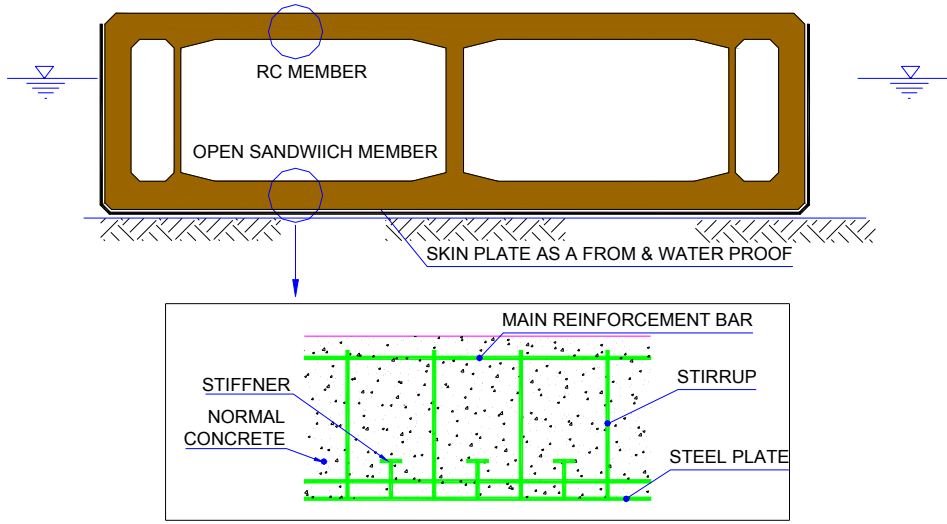


TYPE-2: REINFORED CONCRETE STRUCTURE WITH STEEL SHELL
CASTING CONCRETE AT DRY DOCK YARD



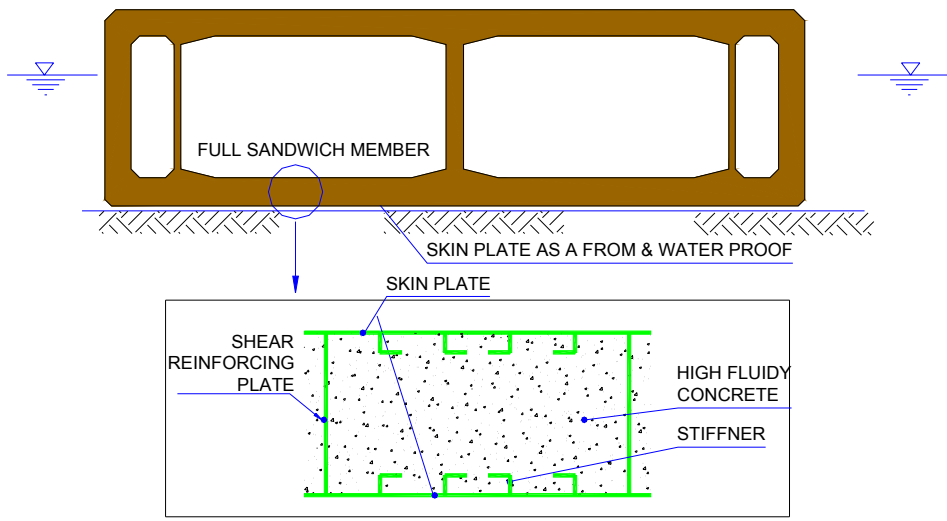
- FABRICATE FULL STEEL SHELL AND PLACING CONCRETE AT THE DOCK

TYPE-3: STEEL-CONCRETE COMPOSITE STRUCTURE (OPEN SANDWICH)
CONSTRUCTION AT A DRY DOCK OR FLOATING CONDITION



- FABRICATE FULL STEEL SHELL AT THE DOCK OR THE WORKS
- STEEL SHELL CAN BE TOWED AS BUILD
- CASTING CONCRETE IN THE DOCK OR CASTING BASIN

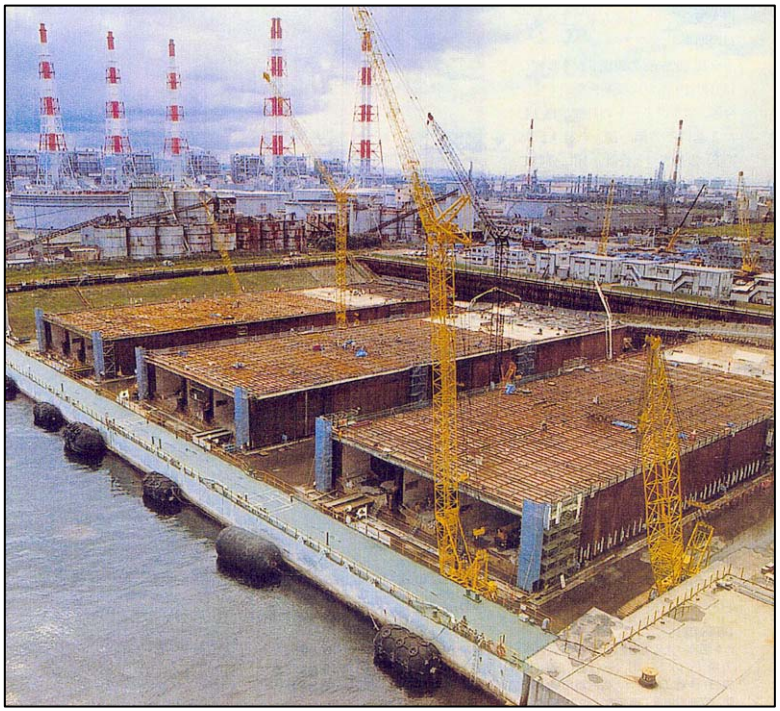
TYPE-4: STEEL-CONCRETE COMPOSITE STRUCTURE (FULL SANDWICH)
CASTING CONCRETE AT A DRY DOCK OR FLOATING CONDITION



- FILLING HIGH FLUDITY CONCRETE UP TO DOUBLE STEEL HULL
  NO REINFORCED BARS
- FABRICATE FULL STEEL SHELL AT THE DOCK
- CASTING CONCRETE AT DRY DOCK OR FLOATING CONDITION

Comparison of Structure Type for Immersed Tunnel

Structure Type	Type-1 Reinforced Concrete	Type-2 Steel Shell	Type-3 Open Sandwich	Type-4 Full Sandwich
Location for Fabrication of Steel Shell	• Non-need	• Dry dock yard	• Same as the left	• Same as the left
Location for Concrete Placing	• Casting Basin	• Dry Dock	• Same as the left	• Same as the left
Kinds of Concrete and Placing	• Normal concrete. • No Problem **Good**	• Normal concrete. • Difficult for Floating Condition **Fair**	• Normal Concrete • Same as the left **Fair**	• Super plasticizer concrete • Same as the left • High concrete technology are needed. **Fair**
Imported Materials	• Not much	• Much (steel)	• Same as the left	• Much (steel, cement) **Not Good**
Maitenance	• Simple.	• Need for Corrosion-Protect of Steel Plate	• Same as the left	• Same as the left
Construction Period	**38 months**	**36 months**	**36months**	**35 months**
Construction Cost	**US$74.0 M (100%) Good.**	**US$81.4 M (110%)**	**US$81.4 M (110%)**	**------**
Construction Cost (Floating)	**---------**	**----------**	**US$78.4 M (106%)**	**US$84.87 M (120%)**
Total Evaluation	**Good.** • Construction cost is the lowest • RC has many construction cases.			• Construction period is the shortest. • Super plasticizer concrete needs high technology.



Placing Concrete at Dry Dock

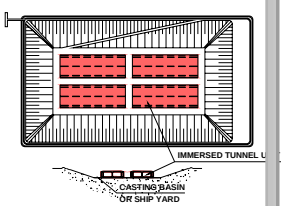
Placing Concrete on Water
(Floating Condition

REINFORCED CONCRETE STRUCTURE

CASTING BASIN

Mobilization

Construction of Casting Basin

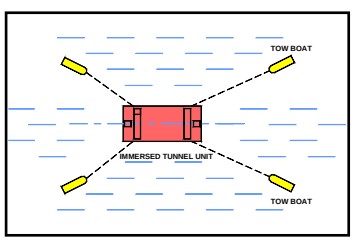


Fabrication of Immersed Tunnel Units

Subtotal

Outfitting

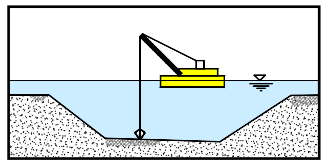
Towing

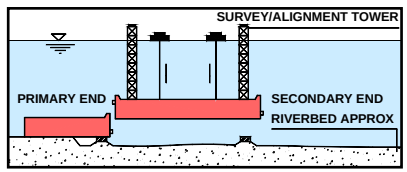


Time	Cost
2 months	
10 months	US$ 16.0 M (US$ 35/m³)
Excavation 6 months	
Bedding Works 4 months	
10 months	US$ 21.4 M (US$ 191/m³)
Structure 6 months	
	US$ 37.4 M
Outfitting	US$ 3.0 M
3 months	US$ 0.5 M

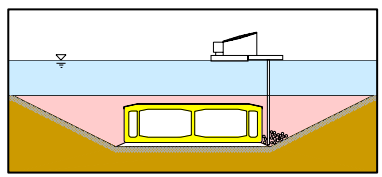
SAIGON RIVER CONSTRUCTION SITE

Trench Dredging





Immersion



Navigation traffic control Measurement, Anchor, etc

Back filling

Inner work

Time	Cost
18 months	US$ 7.8 M (US$ 19/m³)
2.5 months	US$ 21.4 M
6 months	US$ 10.3 M (US$ 36/m³)
	US$ 2.3 M
-------	US$ 66.1 M
-------	US$ 7.9 M
38 months	US$ 74.0 M

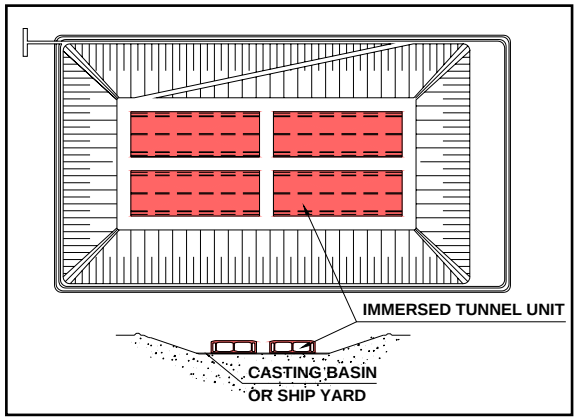
Subtotal

Overhead (12%)

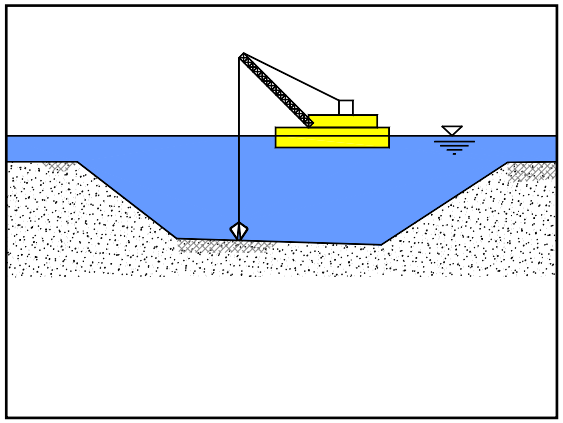
Total

CONSTRUCTION PROCEDURE

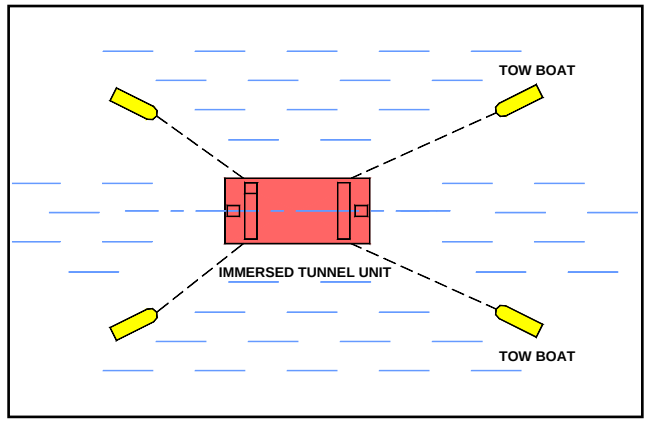
1. Fabrication of Immersed Tunnel Unit



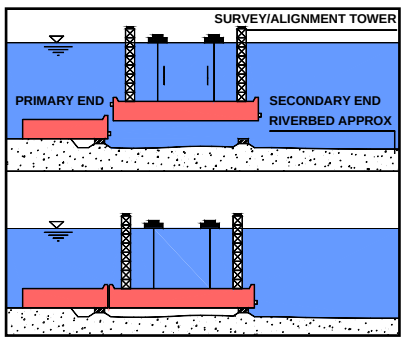
2. Dredging of Trench at the Immersed Tunnel Construction Site



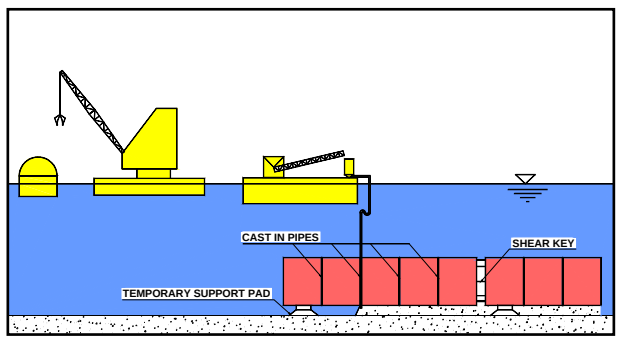
3. Towing



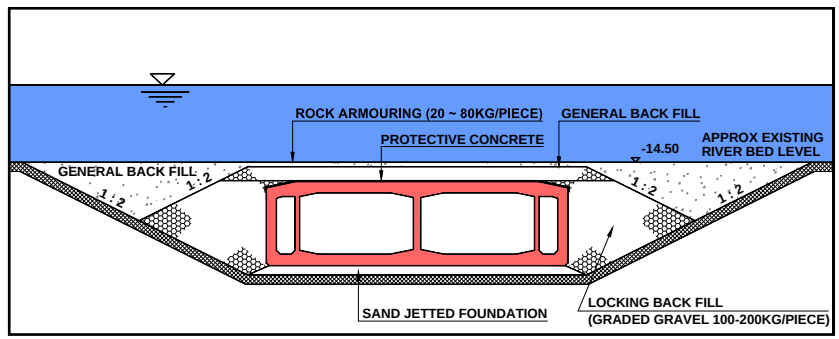
4. Immersion



5. Foundation

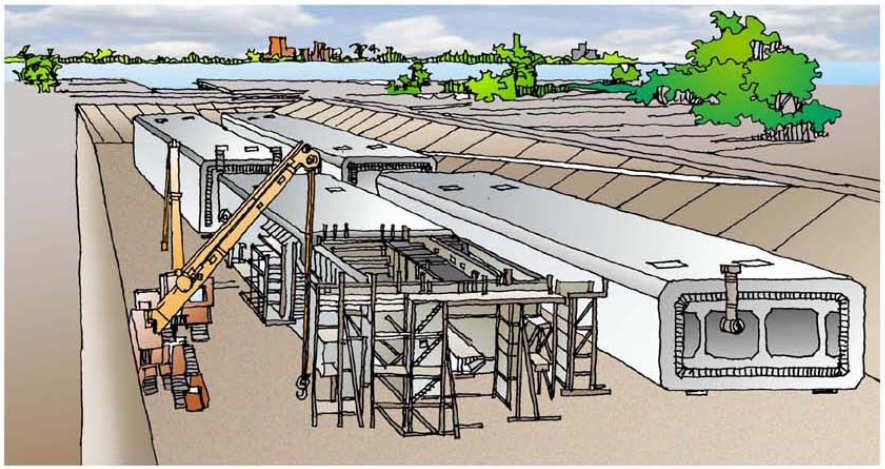


6. Backfilling

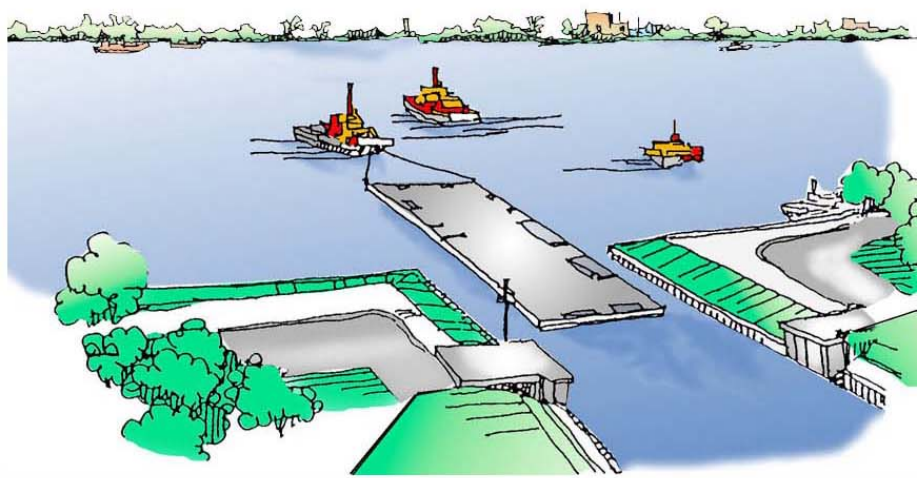


MAIN PROCESSES OF IMMERSED TUNNEL CONSTRUCTION

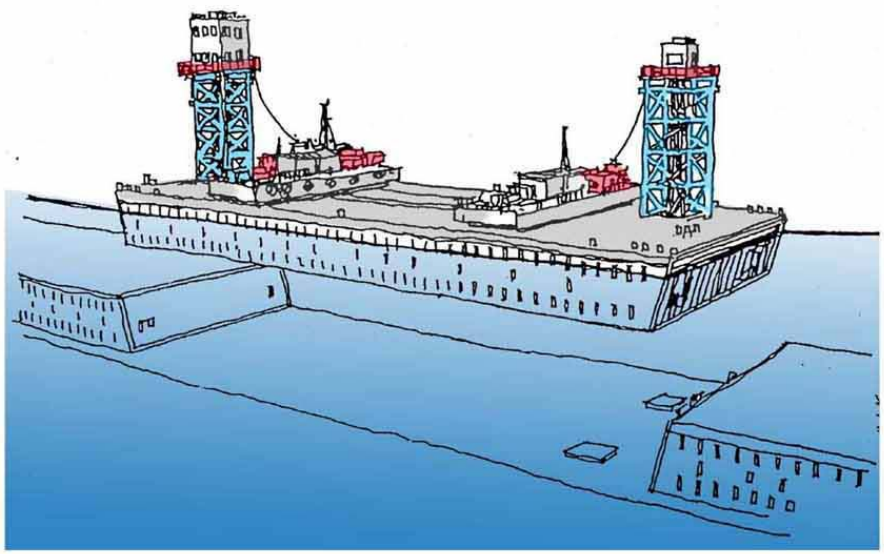
1. Fabrication of Tunnel Element at Casting Position



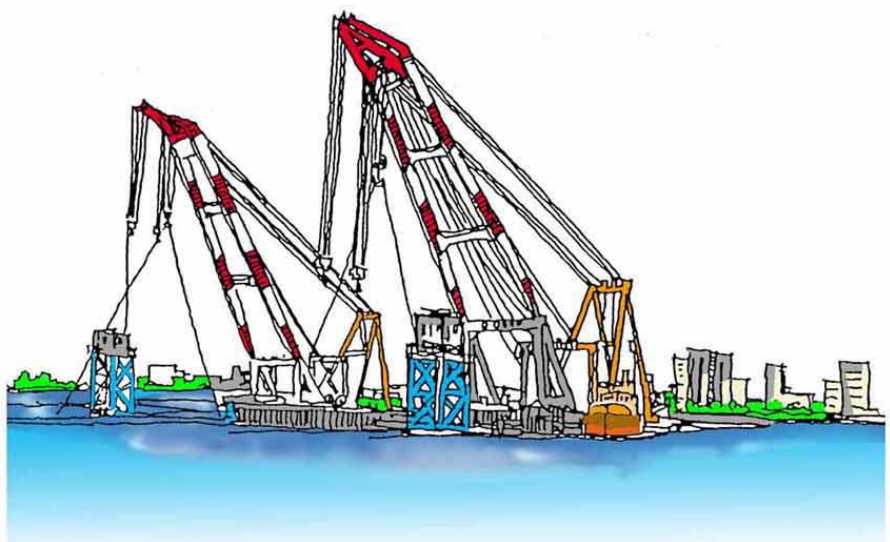
2. Towing Element from Casting Basin



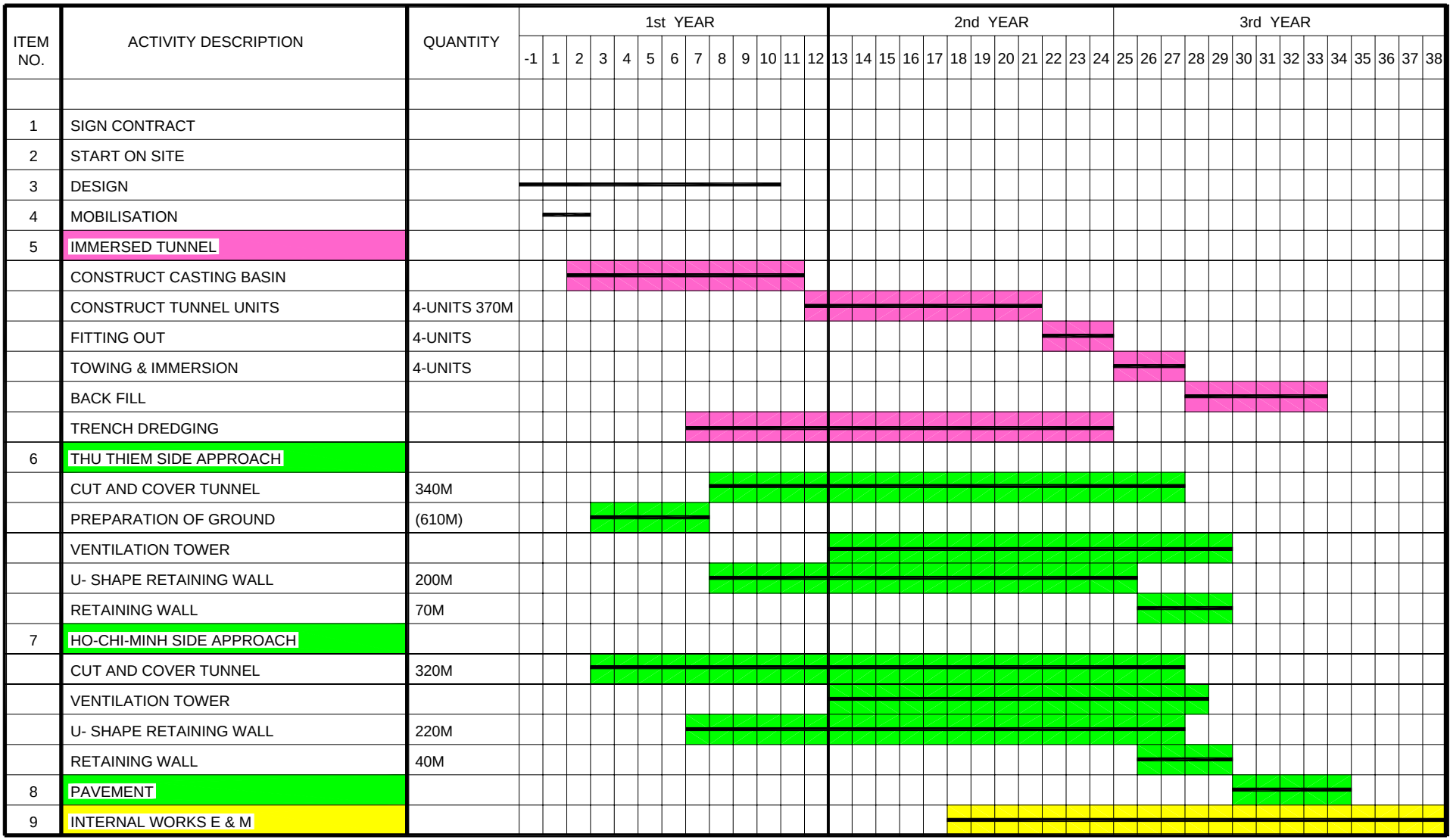
3. Towing & Setting Correct Position



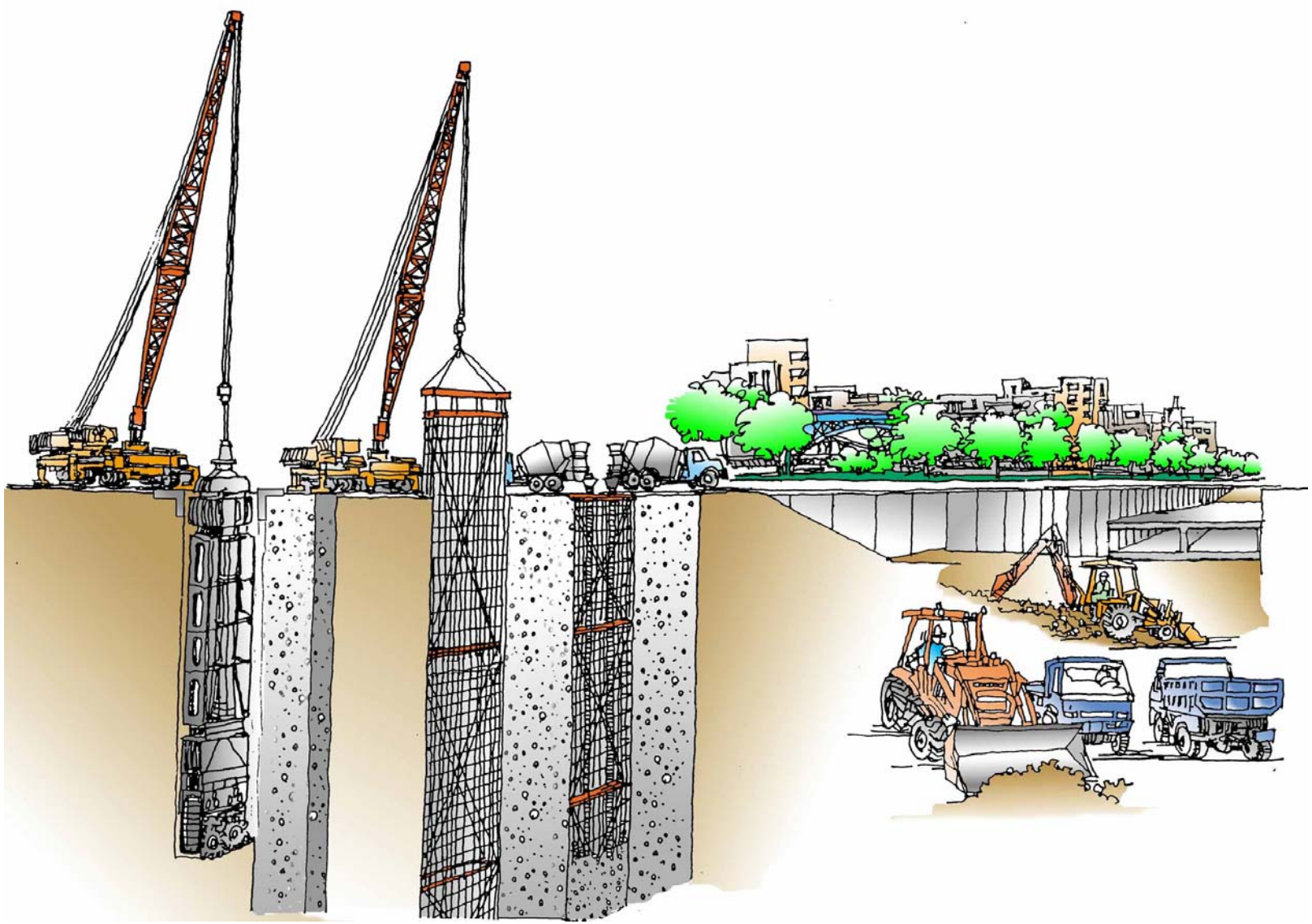
4. Immersion & Joining Elements



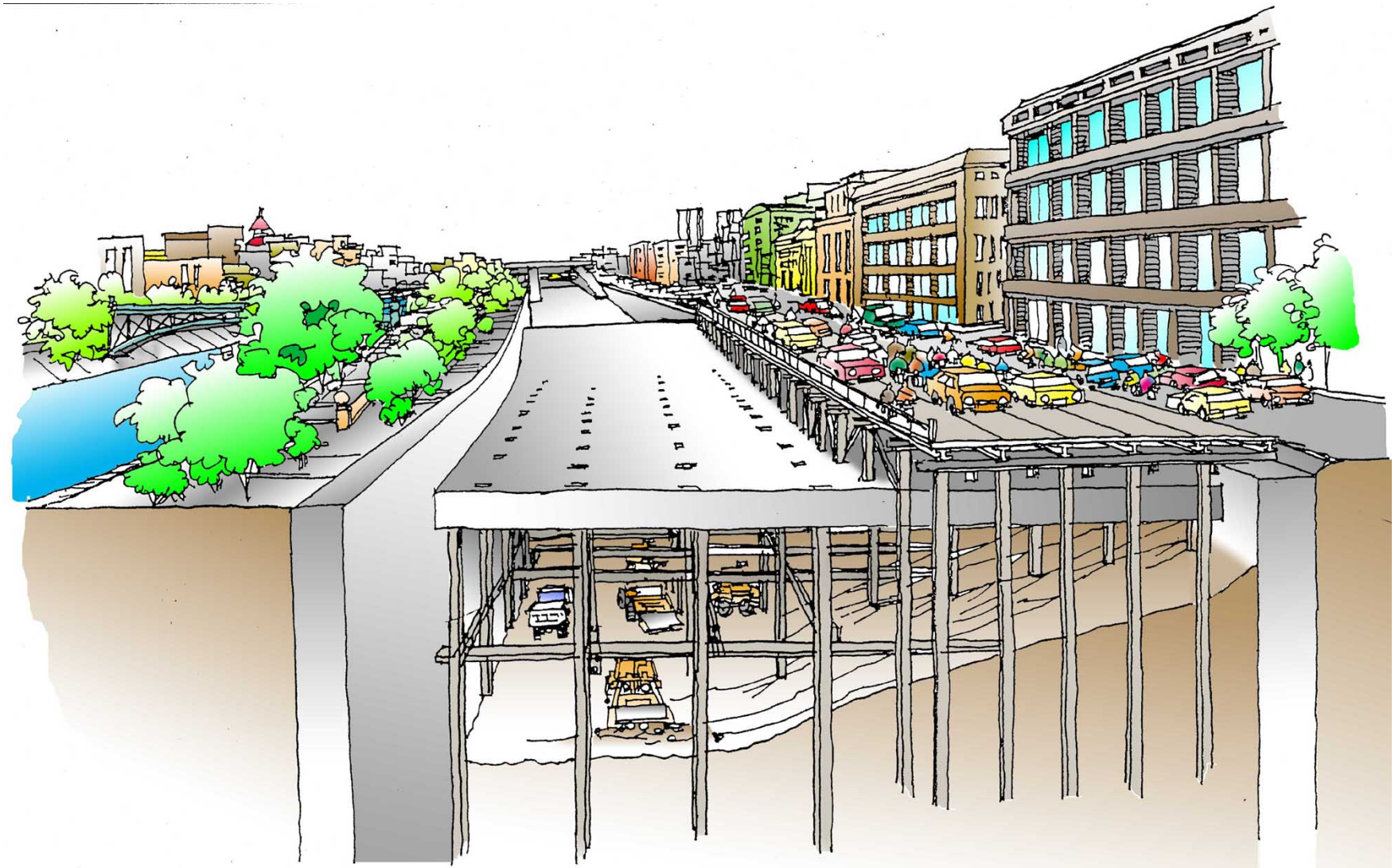
CONSTRUCTION PROCEDURE OF IMMERSED TUNNEL



CONSTRUCTION OF DIAPHRAM WALL

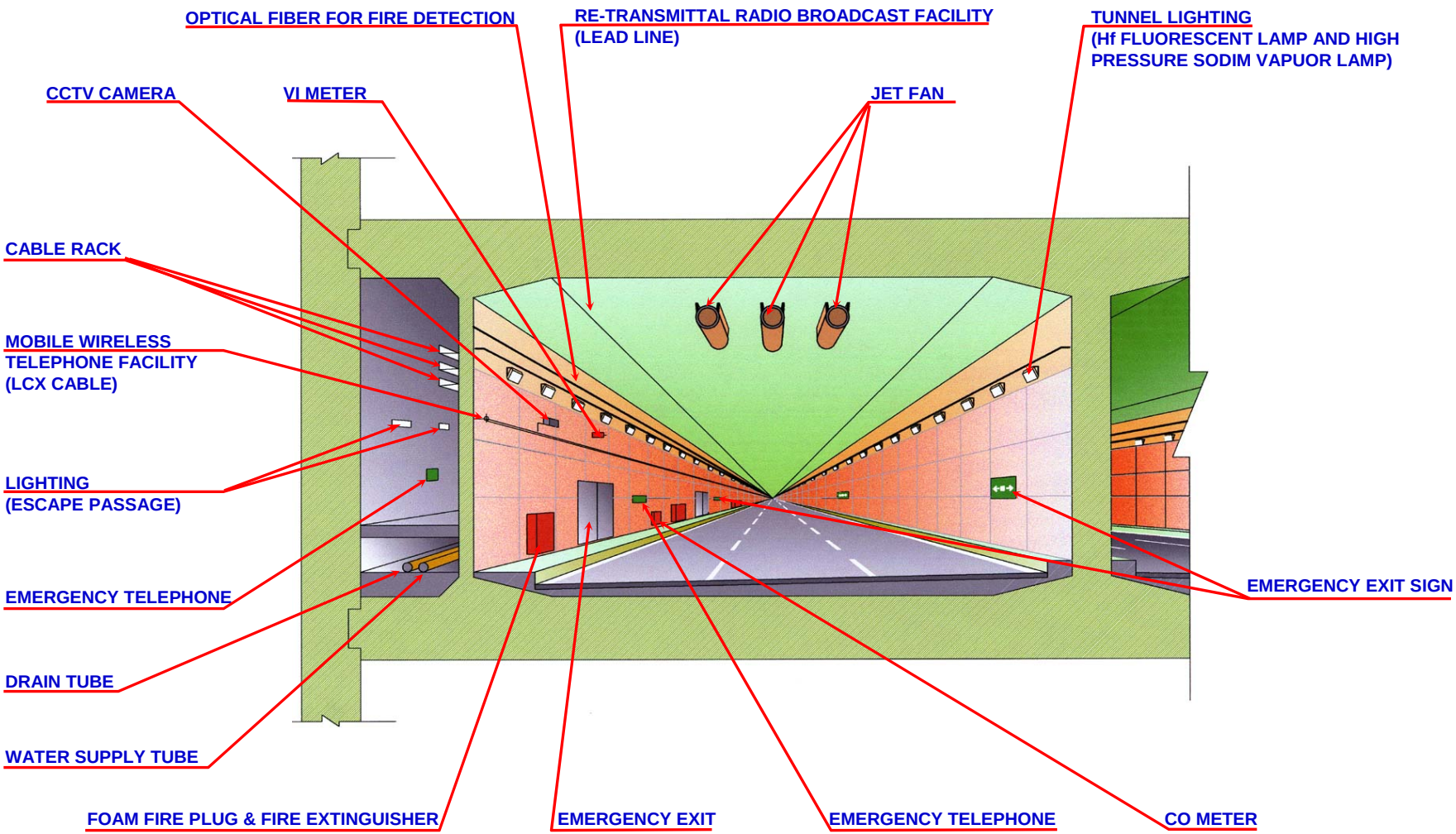


TRAFFIC MANAGEMENT



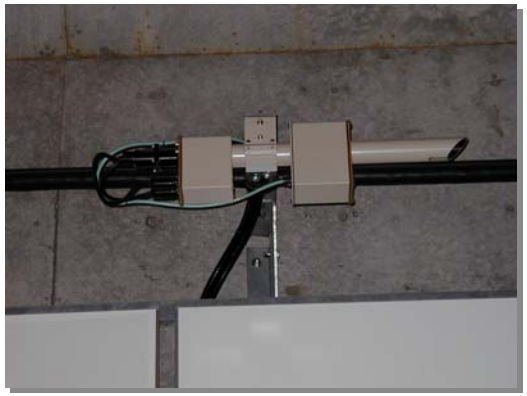
TUNNEL Sub-Sector (E and M)

IMAGE OF TUNNEL E and M (CUT & COVER TUNNEL)



Facilities of tunnel E & M

Electrostatic Precipitator



VI Sensor

Emergency Telephone

Emergency Exit Sign

Silencer (Sound Attenuator)

CCTV Camera

Foam Fire Plug and fire extinguisher

Tunnel E and M

1. Ventilation System:

- Jet Fan
- Exhaust Fan
- Ventilation Control System
- Electrostatic Precipitator
- Sound Attenuator

2. Lighting System:

3. Safety System:

- Emergency Pathway
- Emergency Telephone
- Fire Detector
- Exit Guide
- Radio Broadcasting
- Alarm Button
- Fire Extinguisher
- Laud Speaker

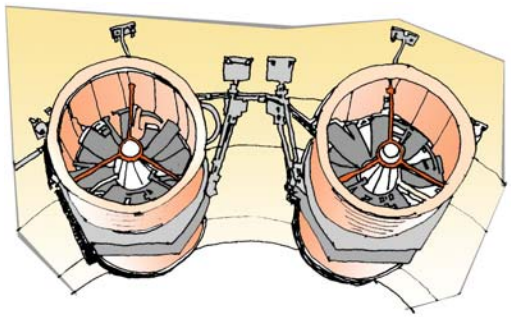
4. Drainage system:

- Pump at Emergency Pathway
- Pump at Ventilation Room

5. Power Supply system

- Public Power Supply
- Stand-by Generator

6. Surveillance and Control system



Jet fans

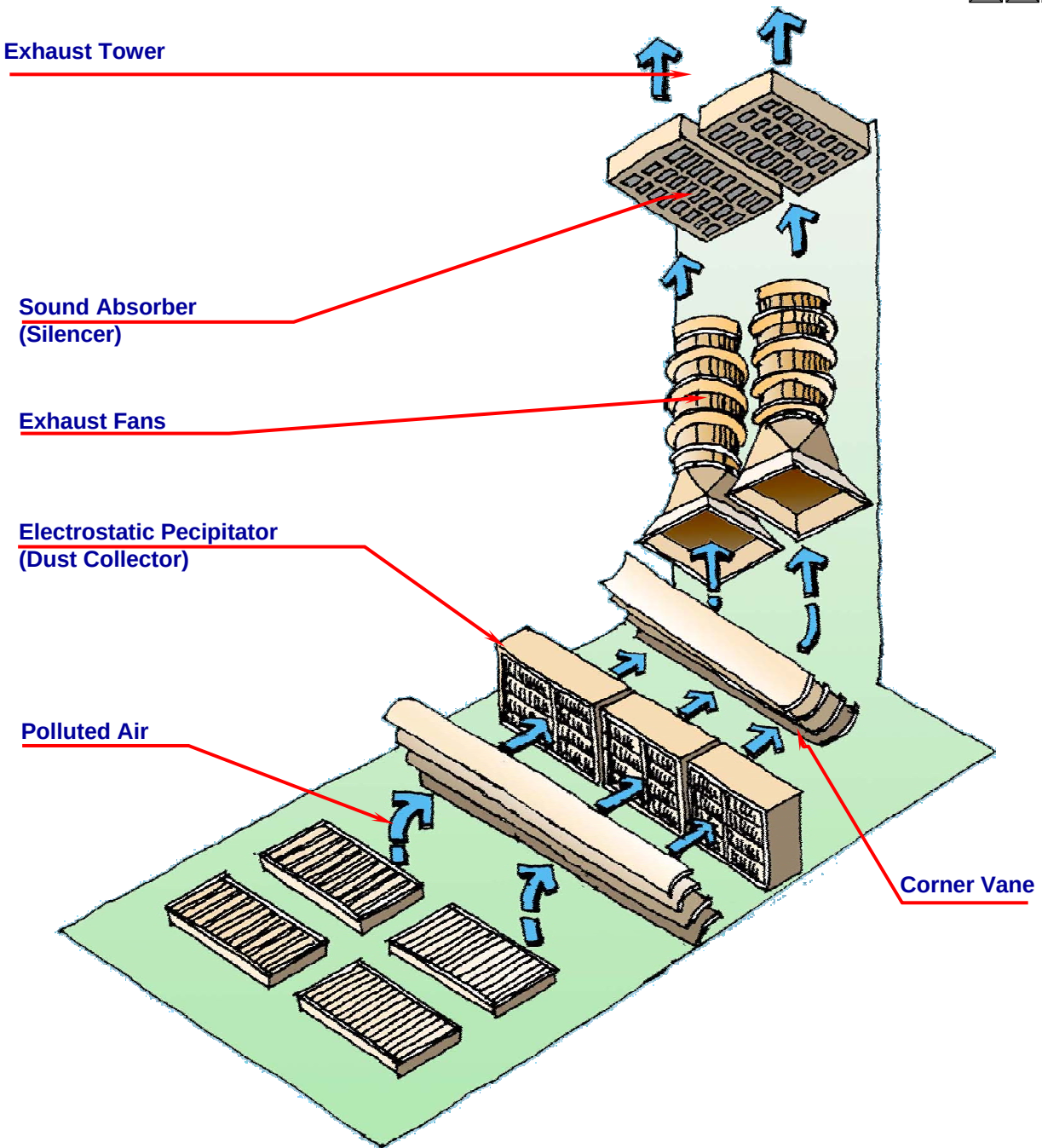
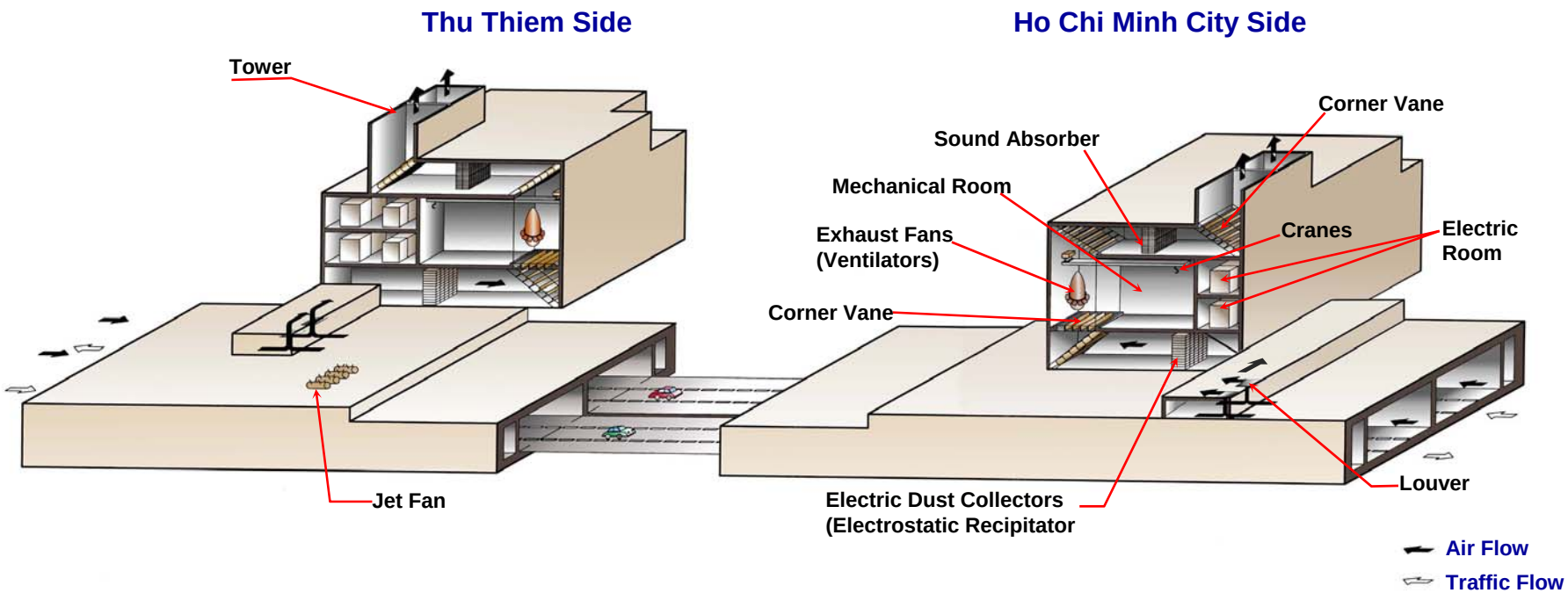
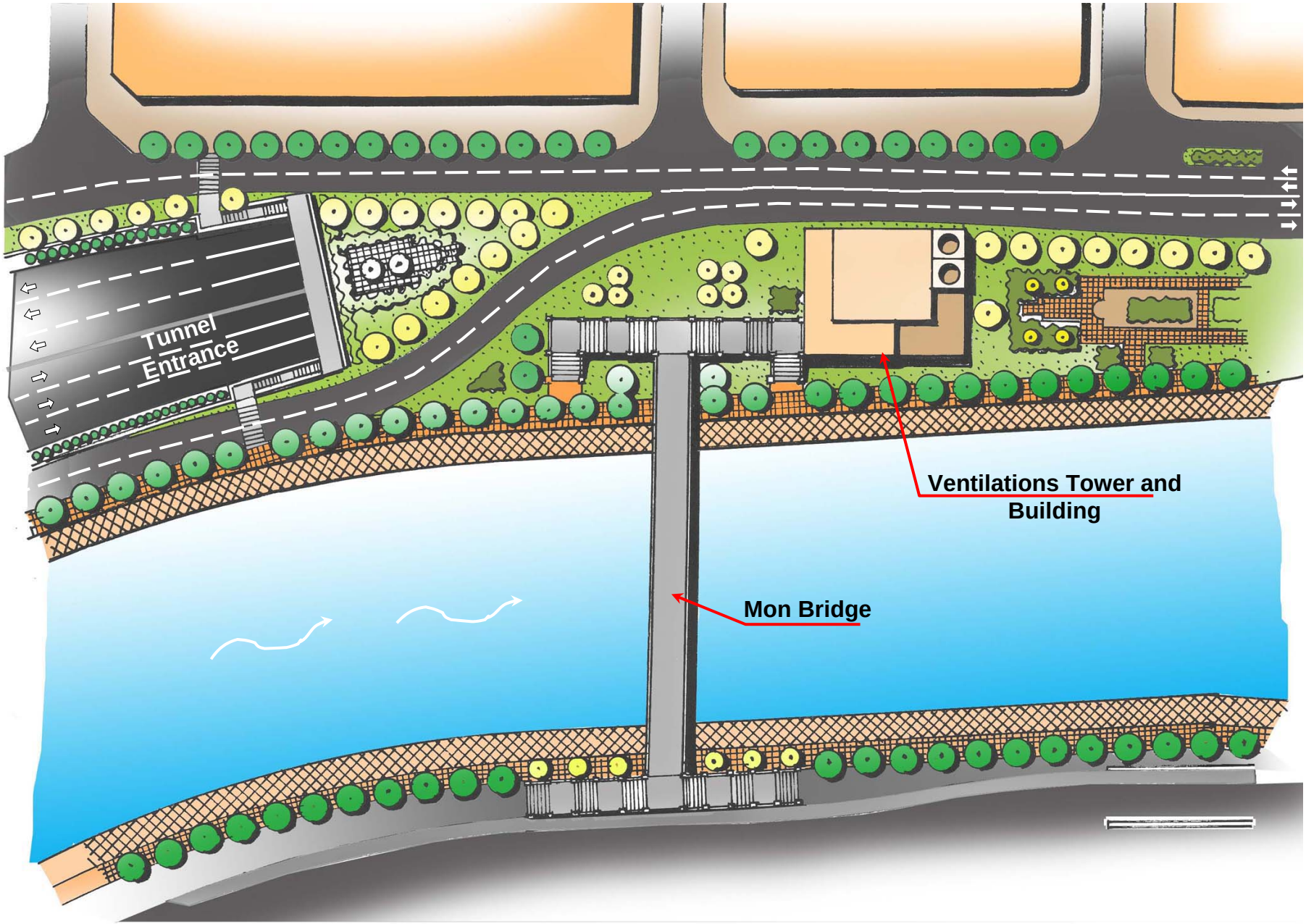


Image of ventilation System

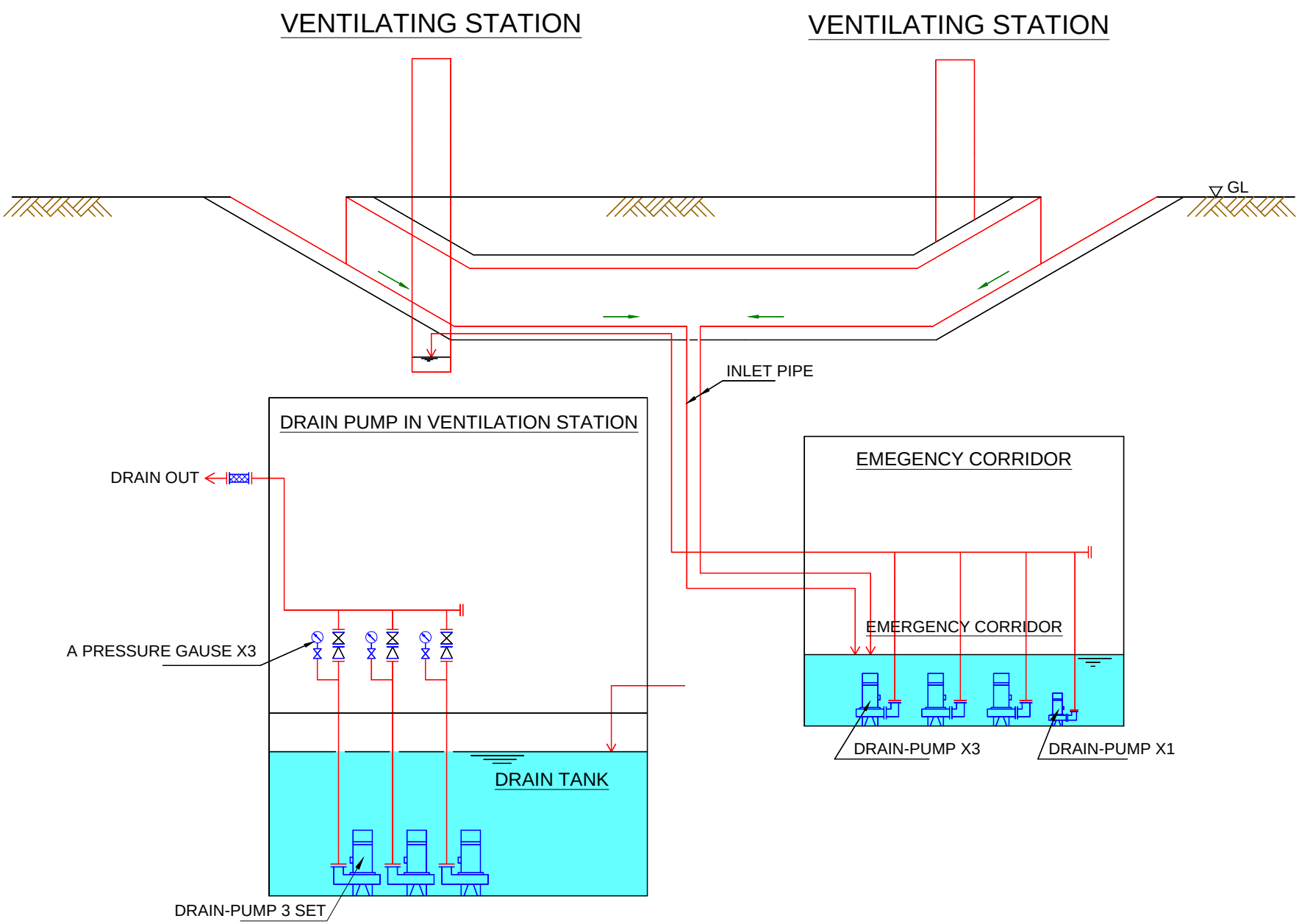
Outline of Ventilation System



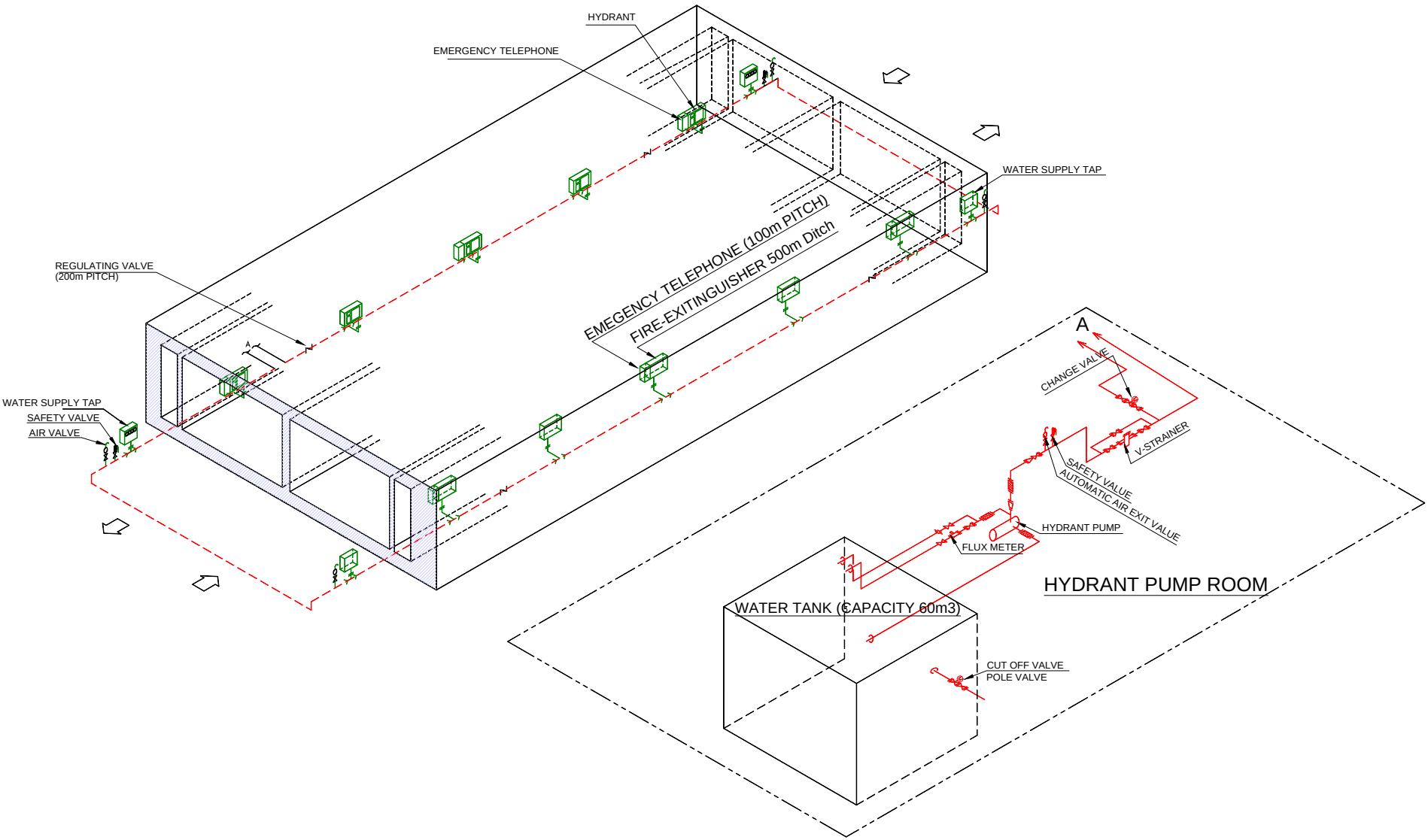
Location of Ventilation Tower and Building (West)



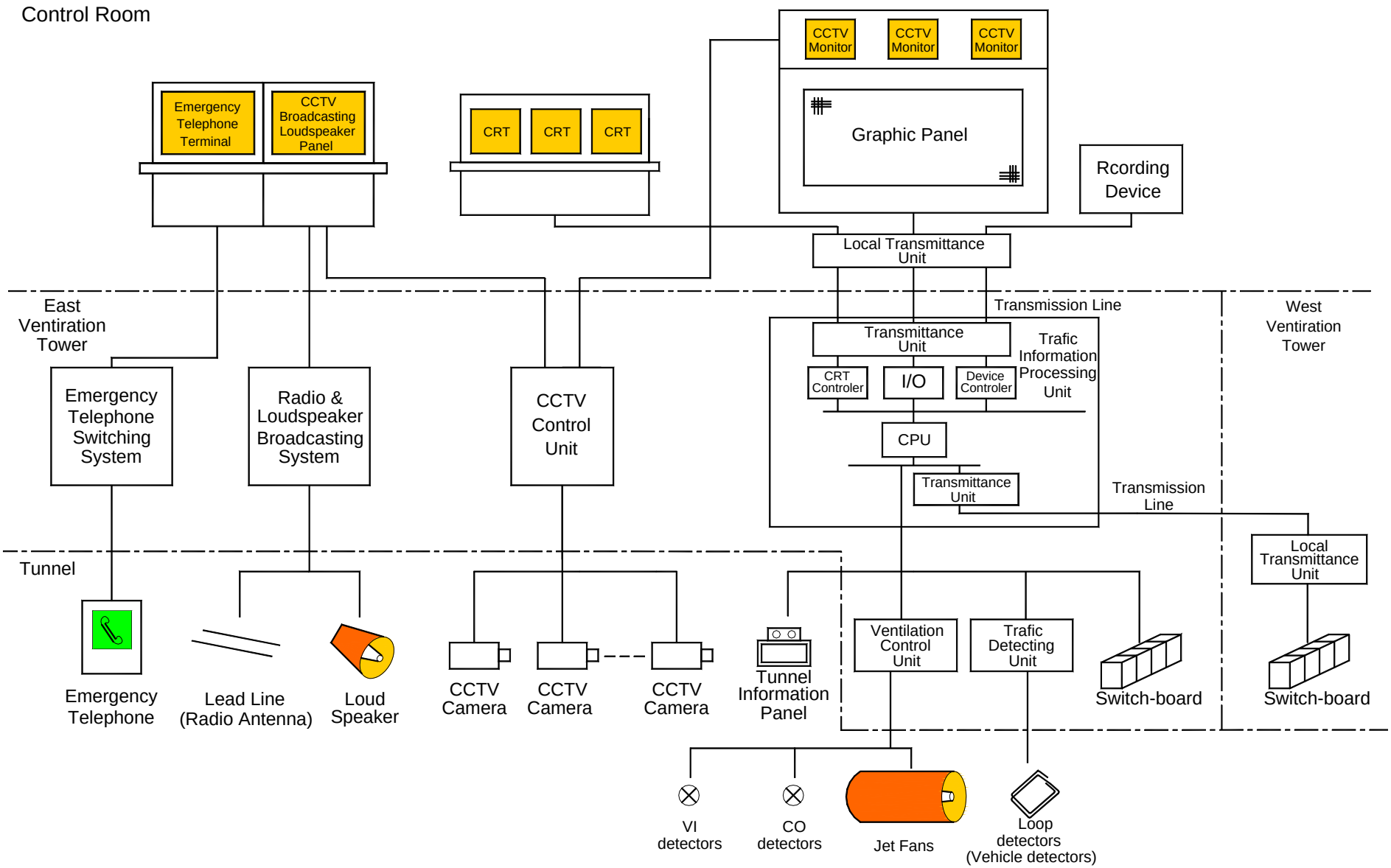
DRAINAGE SYSTEM OF TUNNEL



WATER SUPPLY SYSTEM FOR FIRE HYDRANT



SCHEMATIC DRAWING OF TUNNEL CONTROL AND SUPERVISION SYSTEM



Tunnel Control Room at Maintenance Office

(Surveillance and Control system)