APPENDIX 1
PRELIMINARY WORK FOR BASIC DESIGN STAGE

APPENDIX 1 PRELIMINARY WORK FOR BASIC DESIGN STAGE

1.1 General

For the smooth implementation of Metro Line 4 basic design, JICA Study Team (JST) carried out preliminary work with remarks for the following items:

- Disaster/Emergency Incidents Management Plan;
- Phase 1B Route with HVS Location and Workshop/Depot Layout;
- Track Layout on Station No.1, No. 5 and No. 9;
- Preliminary Power Supply Simulation with 3rd Rail System; and
- Tunnel Diameter with 3rd Rail System.

1.2 Disaster/Emergency Incidents Management Plan

The applicable standards and regulations especially for fire fighting, smoke management, and tunnel safety needs to be determined at the early stage of the basic design in order to define the size of station facilities and platform width.

Based on the Japanese disaster/emergency incidents management regulation, this has been basically approved by NAT at the meeting on 11th March 2010. The standard station width can be reduced by 2 metre to 3 metre from the proposed station size in the Report 3/4. Figure 1.1 shows the cross section of the standard station based on Japanese regulation as preliminary study result.

In addition to this, disaster/emergency incidents management (Japanese standard and practices) presentation materials presented on 16th March 2010 are also attached after Figure 1.1.

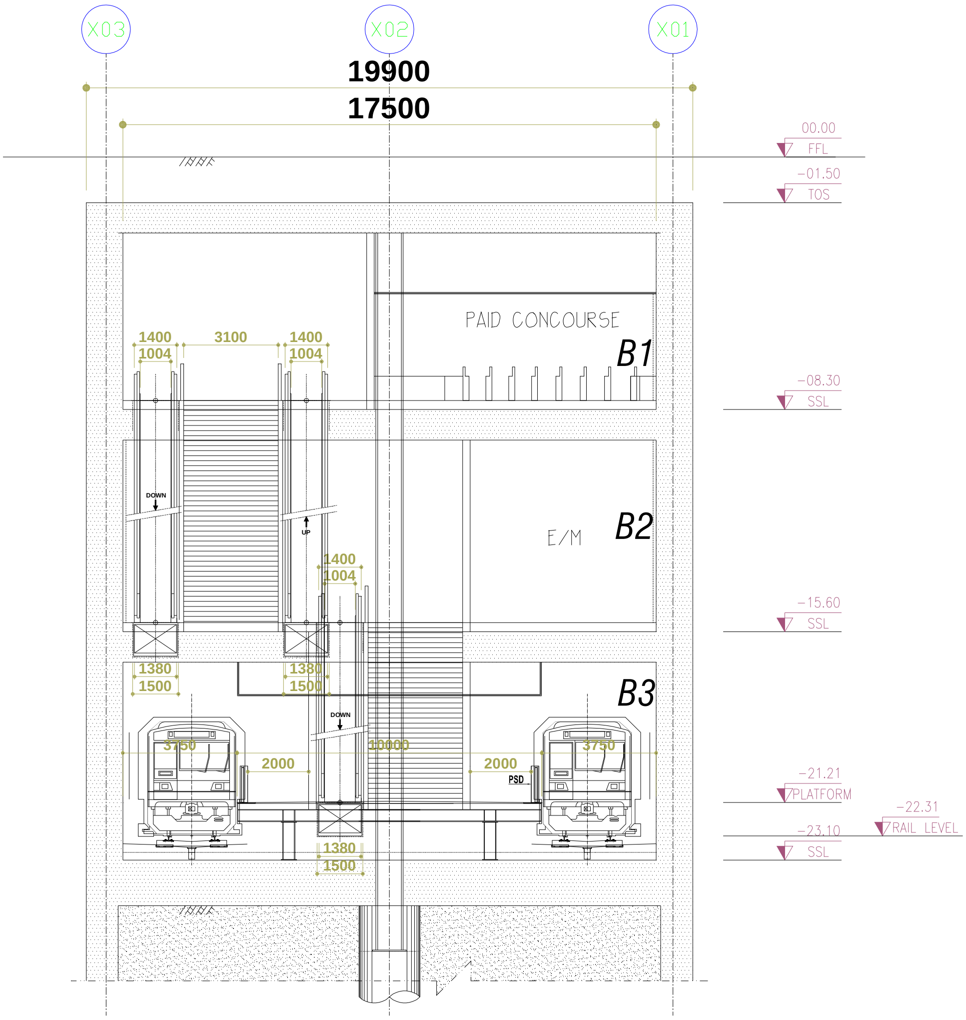


Figure 1.1 Typical Cross Section of Standard Station

Disaster/Emergency Incidents Management Japanese Standard and Practices

JICA Preparatory Survey
on Greater Cairo Metro Line No.4

JICA Study Team

16th Mar. 2010

CONTENT

- ***Fire Safety Management***
- ***Flood and High Water Management***
- ***Strong Wind, Power Failure, etc.***
- ***Required Measures other than Infrastructures***

1. Fire Safety Management

1.1 History of Standard for Fire Safety Management in Japan

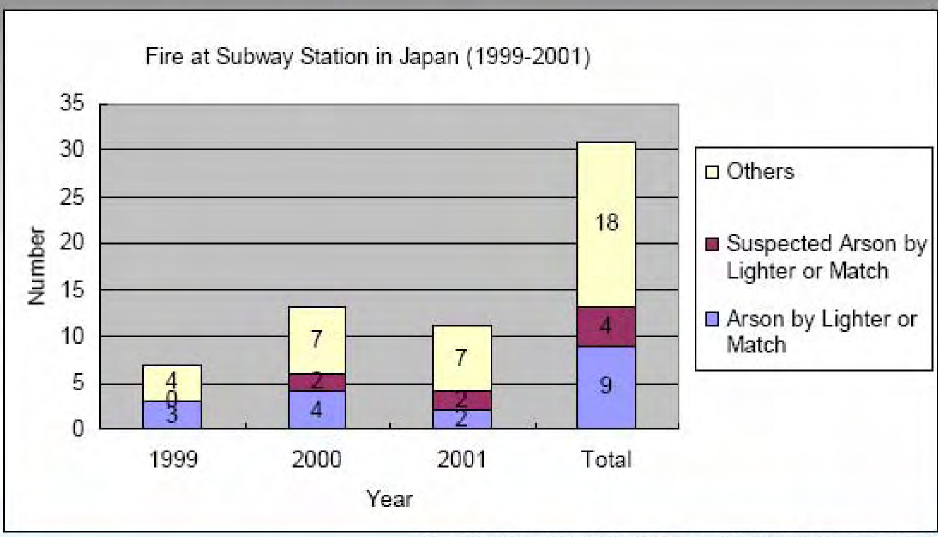
1. Fire accident at Kamiyatyo Station of Hibiya subway line was occurred in 1968 and 11 persons were injured.
2. The fire safety management was totally reviewed, especially, use of the nonflammable material.
3. In 1975, "the Standard of Fire Safety Management for Subway Station, etc" was issued by the Ministry of Land Infrastructure, Transport and Tourism (MLIT).
4. Fatal fire accident by arson was occurred at subway of Dague, South Korea in 2003 and 192 persons were killed and 148 persons were injured.
5. The standard was reviewed and new standard which add fire load by arson with 4 litter gasoline was issued in 2004.

Fatal Fire by Arson in Subway, Daegue, S.Korea

Fire in Subway, Daegue City, South Korea, 2003

Source: Fire and Disaster Management Agency, Japan

1.2 Fire of Underground Station in Japan (1999-2001)



Source: Fire and Disaster Management Agency, Japan

1.3 Assumed Fire and Evaluation Method

Normal Fire

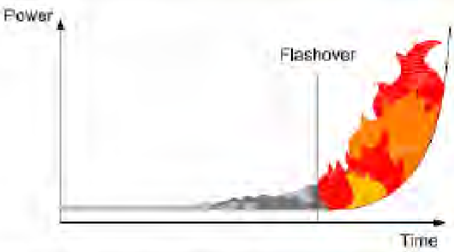
1. Under floor from Rolling Stock
2. Arson to KIOSK

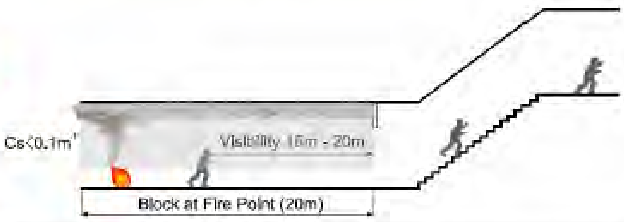
Fire by Arson (with Fuel)

1. Arson with Fuel to Rolling Stock
2. Arson with Fuel to KIOSK

Assumed Fire	Type	Origin of Fire
Normal Fire	Rolling Stock	Fire from underneath of Rolling Stock
	KIOSK	Arson by Lighter
Fire by Arson	Rolling Stock	Arson equivalent to 4 litter gasoline
	KIOSK	Arson equivalent to 4 litter gasoline

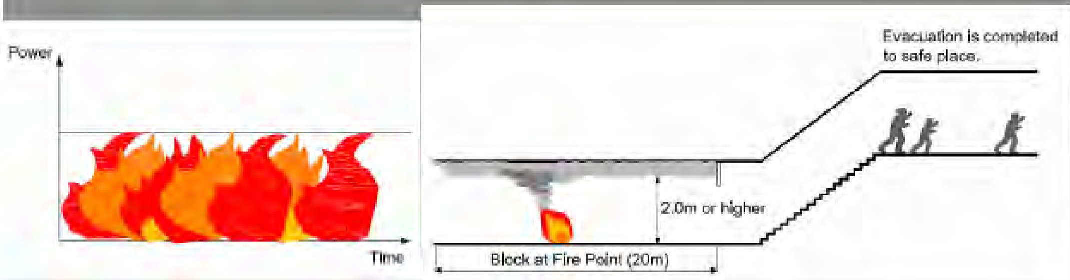
Normal Fire and Evaluation of Smoke





1) Power is small and temperature is low in begging until flashover occur. The smoke from normal fire diffuse evenly and widely.
2) For the smooth evacuation of the passengers, the visibility must be secured. Smoke density (Cs) must be less than 0.1(1/m) to ensure 15-20 m visibility.

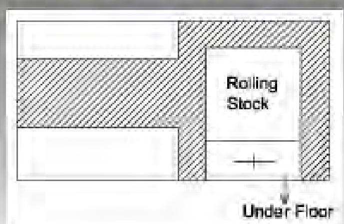
Fire by Arson with Fuel and Evaluation of Smoke



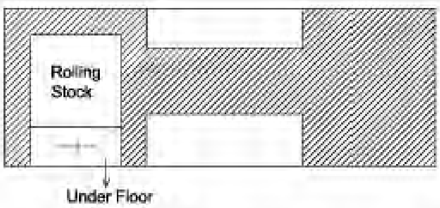
1) Power is relatively large and temperature is high from beginning and constant. Smoke will move as strata along the ceiling and it will descend.
2) For the safe evacuation of the passengers, the descending of smoke is factor. The height to the smoke stratification must be higher than 2.0m for the space of evacuation.

Block at Fire Point

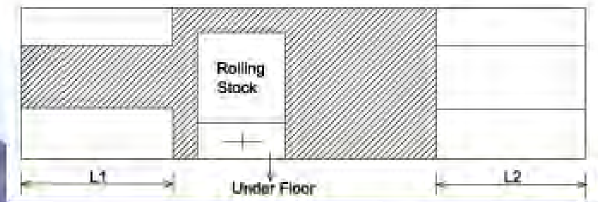
Block at Fire Point of Normal Fire on Rolling Stock



Block at Fire Point of Fire by Arson on Rolling Stock



Block at Fire Point of Fire by Arson in KIOSK on Platform

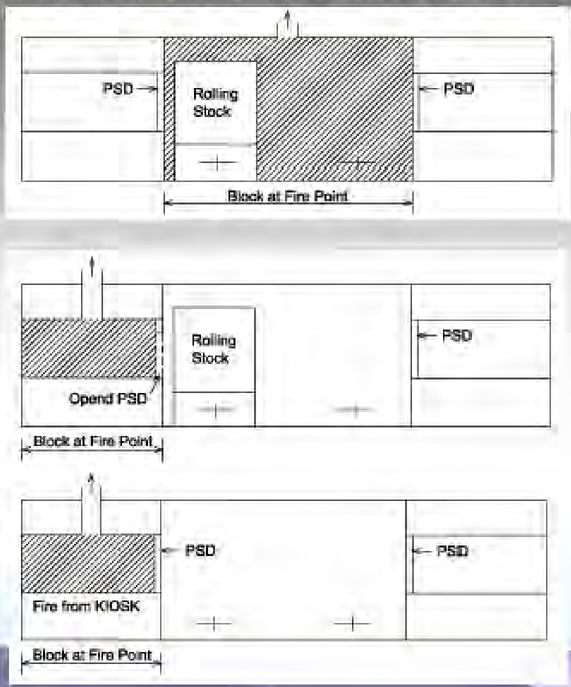


Block at Fire Point with PSD

Block at Fire Point of Normal Fire on Rolling Stock with PSD

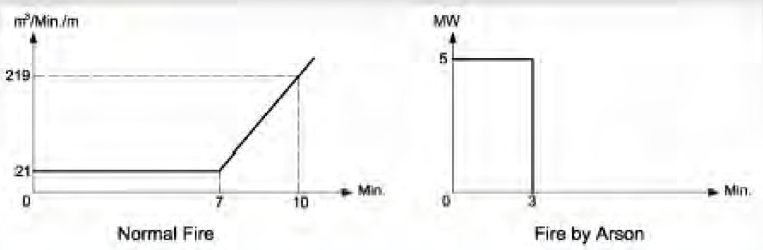
Block at Fire Point of Fire by Arson on Rolling Stock with PSD

Block at Fire Point of Fire by Arson in KIOSK on Platform with PSD



Fire Load of Rolling Stock

Item	Assumed Fire	
	Normal Fire	Fire by Arson
Parameter Fire Load	Smoke Speed C (m3/min./m)	Fire Power Q (MW)
Fire Model	C=21 (m3/min./m), 0≤t≤7min. =21+66(t-7) (m3/min./m), 7<min.	Q=5 (MW), 0≤t≤3min. =0 (MW), 3<t



Formula for Fire Load of Rolling Stock on Platform

Normal Fire

$$Cs = 21 \cdot (1 - e^{-Ve \cdot t/V}) / Ve \quad (0 < t < 7\,\text{min.})$$

$$Cs = (66 \cdot V \cdot e^{-Ve(t-7)/V} - 21 \cdot Ve \cdot e^{-Ve \cdot t/V} + 66 \cdot Ve \cdot t - 441 \cdot Ve - 66V) / Ve^2 \quad (7\,\text{min.} < t)$$

Cs: Smoke Density (m-1)
V: Volume of Block at Fire Point (m3)
t: Evacuation Time (min.)
Ve: Air Volume of Ventilation Facilities per Volume of Block at Fire Point (m3)

V= (Ao-Av) x 20
Ao= (Va-Vm)/L

V: Volume of block at fire point (m3)
Ao: Cross section area of block at fire point (m2)
Av: Cross section area of rolling stock including area under floor (m2)
Va: Total volume of platform in effective length (m3)
Vm: Volume of the place, such as column, stair, etc. where smoke does not diffuse
L: Effective length of platform (m)

Formula for Fire Load of Rolling Stock on Platform

Fire by Arson

$$t_o = V_E / (Vs - Ve')$$

$$V_E = (A_E - A_V') \times L$$

$$Ve' = Ve \times (A_E - Av') / (Ao - Av)$$

VE: Effective volume of platform above 2.0m from floor of platform (m3)

Vs: Smoke volume=300 (m3)

Ve': Effective smoke exhaust volume in VE (m3/min.)

AE: Cross section area above 2.0m from floor of platform excluding volume of the place where smoke does not diffuse, such as column, stair, etc. (m2)

Av': Cross section area of rolling stock above 2.0m from floor of platform (m2)

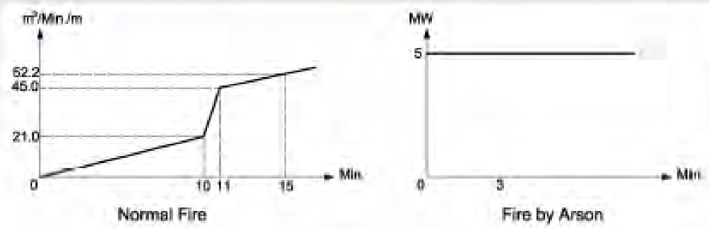
Ve: Capacity volume of smoke exhaust facility on platform (m3/min.)

Ao: Cross section area of block at fire point (m2)

Av: Cross section area of rolling stock including area under floor (m2)

Fire Load of KIOSK

Item	Assumed Fire	
	Normal Fire	Fire by Arson
Parameter Fire Load	Smoke Speed C (m3/min./m)	Fire Power Q (MW)
Fire Model	C=2.1 (m3/min./m), 0≤t≤10min. =24.0t-219 (m3/min./m), =1.8t+25.2 (m3/min./m),11<t	Q=5 (MW)



Formula for Fire Load of KIOSK

Normal Fire

$$Cs = 2.1 \cdot (Ve \cdot t - V + V \cdot e^{-Ve \cdot t/V}) / Ve^2 \qquad (0 < t < 10\,\mathrm{min.})$$

$$Cs = (66 \cdot V \cdot e^{-Ve(t-7)/V} - 21 \cdot Ve \cdot e^{-Ve \cdot t/V} + 66 \cdot Ve \cdot t - 441 \cdot Ve - 66V) / Ve^2 \quad (10 < t < 11\,\mathrm{min.})$$

$$Cs = ((1.8 \cdot V - 45 \cdot Ve) \cdot e^{-Ve(t-11)/V} + 1.8 \cdot Ve \cdot t + 91.2 \cdot Ve - 27.9 \cdot V + 2.1 \cdot V \cdot e^{-10Ve/V} + (24 \cdot V - 21 \cdot Ve) \cdot e^{-Ve/V}) / Ve^2 \qquad (11\,\mathrm{min.} < t)$$

Cs: Smoke Density (m-1)
V: Volume of Block at Fire Point (m3)
t: Evacuation Time (min.)
Ve: Air Volume of Ventilation Facilities per Volume of Block at Fire Point (m3)

V= (Ao-Av) x 20
Ao= (Va-Vm)/L

V: Volume of block at fire point (m3)
Ao: Cross section area of block at fire point (m2)
Av: Cross section area of rolling stock including area under floor (m2)
Va: Total volume of platform in effective length (m3)
Vm: Volume of the place, such as column, stair, etc. where smoke does not diffuse
L: Effective length of platform (m)

Formula for Fire Load of KIOSK on Concourse

Fire by Arson

$$T_s = V'/(V - Ve')$$

$$V' = (Af - At) \times (H - 2)$$

$$Ve' = Ve \times (H - 2)/H$$

V': Smoke storage volume excluding smoke volume exhausted by smoke exhaust facilities
Vs: Smoke volume=300 (m3)
Ve': Effective smoke exhaust volume (m3/min.)
Af: Area of floor of concourse (m2)
At: Area of the place where smoke does not diffuse, such as column (m2)
H: Height from floor to ceiling of concourse
Ve: Capacity volume of smoke exhaust facility on concourse (m3/min.)

2.4 Calculation of Evacuation Time

T=Q/(NxB)

T: Queue Time (sec), Q: Number of Evacuator (persons),

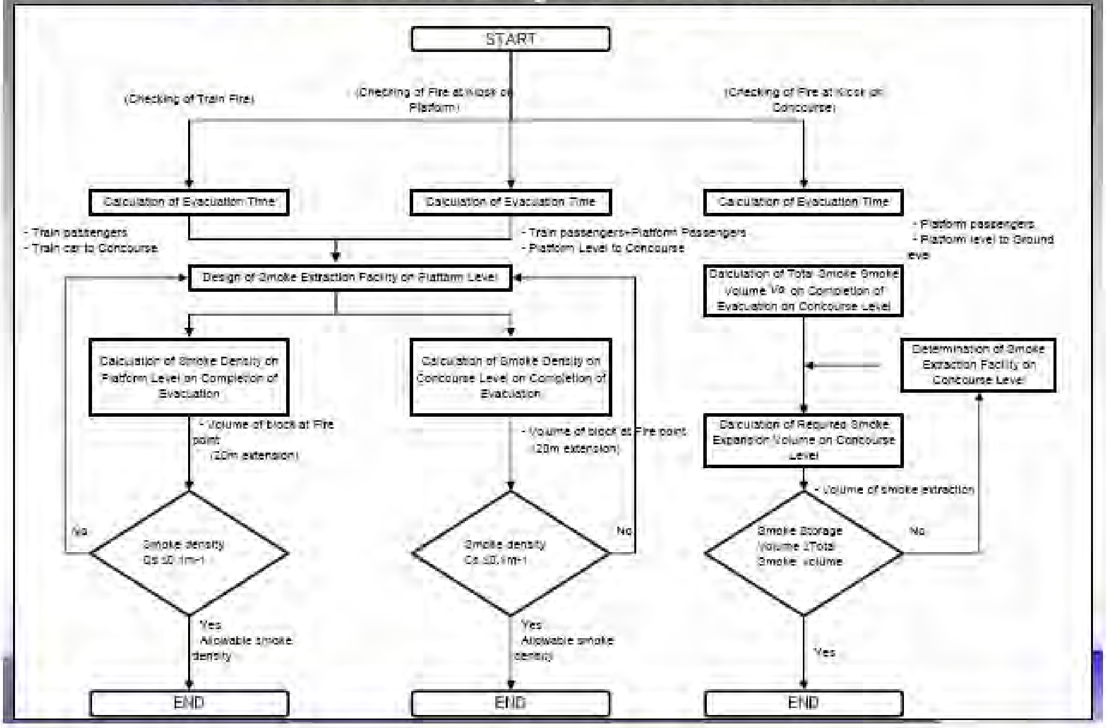
N: Runoff Coefficient of Crowd (person/m/sec.), B: Width of Stair (m)

In order to calculate walking time t and queue time T, the walking speed and runoff coefficient of crowd is defined as follows.

Walking Speed: Flat area 1.0 (m/s), Stair area 0.5 (m/s)

Runoff Coefficient: Flat area 1.5 (person/m/sec), Stair area 1.3 (person/m/sec)

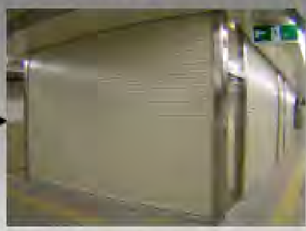
Flow Chart of Study of Safe Evacuation



2.5 A Point of Safety for the Passenger

Normal Operation

During Evacuation (Smoke Curtain)



Fire Protection Compartment

Source: Osaka City Transportation Bureau, Japan

Fire Protection Compartment will be installed between Platform and Concourse.

1) In case of fire in Tunnel or Platform, Concourse is safe haven.

2) In case of fire in Concourse, Ground Level is a point of safety.

2.6 Fire Location and Target Passenger for Evacuation Study

Place of Fire			Assumed Fire	Target Evacuator	Evacuation Route and Safe Haven: Step	Evacuation Route and Safe Haven: Place	Study of Evacuation Time	Remark
Rolling Stock	Between Station	Impossible to Run and Stop in Tunnel	a. Normal fire b. Fire by Arson	Train Passengers	1	From Rolling Stock	Not Required	Case 5
					2	to Tunnel		
					3	to Platform Level		
					4	to Concourse Level (Safe Haven)		
					5	to Ground level		
		Run to next Station	a. Normal fire *1 b. Fire by Arson *2	Train Passengers	1	From Rolling Stock	Required	Case 1
					2	to Platform Level		
					3	to Concourse Level (Safe Haven)		
					4	to Ground Level		
	At Station	Stop	a. Normal fire *3 b. Fire by Arson *4	Train Passengers Passengers on Platform	1	From Rolling Stock	Required	Case 2
					2	to Platform Level		
					3	to Concourse Level (Safe Haven)		
					4	to Ground Level		
Station	KIOSK on Platform		a. Normal fire b. Fire by Arson	Train Passengers Passengers on Platform	1	From Platform Level	Required	Case 3
					2	to Concourse Level (Safe Haven)		
					3	to Ground level		
	KIOSK on Concourse		a. Normal fire b. Fire by Arson	Passengers on Platform	1	From Platform level	Required	Case 4
					2	to Concourse Level		
					3	to Ground Level (Safe Haven)		
Tunnel	Between Station	Impossible to Run and Stop in Tunnel	c. Cable fire	Train Passenger	1	From Rolling Stock	Not Required	Case 5
					2	to Tunnel		
					3	to Platform Level		
					4	to Concourse Level (Safe Haven)		
					5	to Ground Level		

Case 1

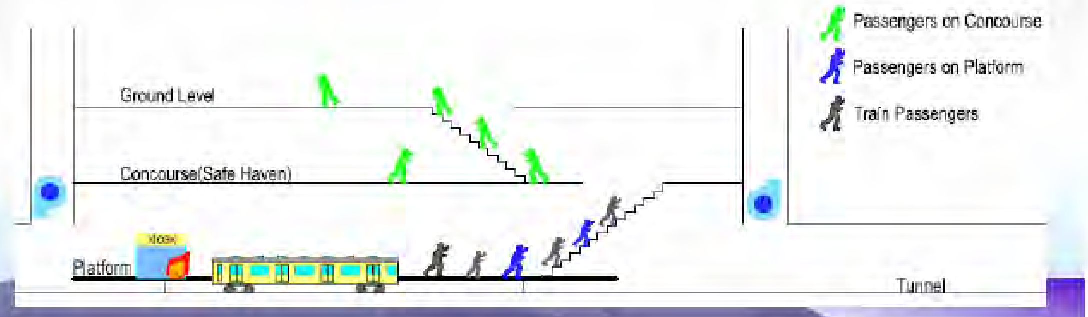
Place			Fire Load		Target Passenger of Evacuation	Study of Evacuation	Remark
Rolling Stock	Between Station	Run to next Station	a	Normal Fire	Train Passengers	Required	It is assumed that the evacuation of passengers on platform are completed by the guide of the station staff before arriving of the train on normal fire.
			b	Fire by Arson	Train Passengers	Not Required	Target is only train passenger. Study of Case 2-b covers this study.

Case 2

Place			Fire Load		Target Passenger of Evacuation	Study of Evacuation	Remark
Rolling Stock	Station	Stop at Station	a	Normal Fire	Train Passengers	Not Required	Passenger on platform evacuates early because normal fire is small in the beginning. Therefore this case could be covered by case1-a.
			b	Fire by Arson	Train Passengers Passenger on Platform	Required	

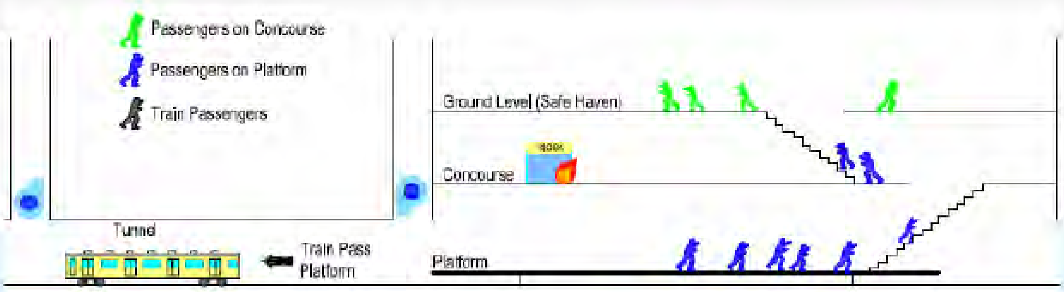
Case 3

Place	Fire Load		Target Passenger of Evacuation	Study of Evacuation	Remark
Platform	a	Normal Fire	Train Passengers Passenger on Platform	Required	
	b	Fire by Arson	Train Passengers Passenger on Platform	Required	



Case 4

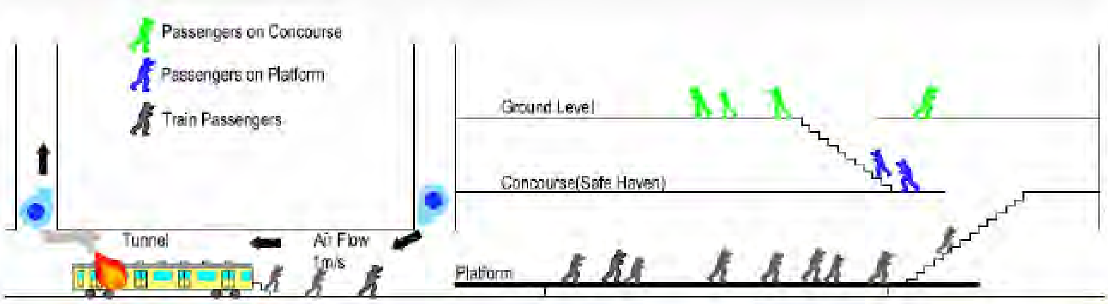
Place	Fire Load		Target Passenger of Evacuation	Study of Evacuation	Remark
Concourse	a	Normal Fire	Passenger on Platform	Required	Train Pass Platform.
	b	Fire by Arson	Passenger on Platform	Required	Train Pass Platform.



Case 5

Place	Fire Load		Target Passenger of Evacuation	Study of Evacuation	Remark
Tunnel	a	Normal Fire	Train Passengers	Not Required	It is assumed that the height of the smoke stratification is kept in a certain level by the ventilation system and the space for the evacuation is secured.
	b	Fire by Arson			
	c	Cable Fire			

If the train stops in tunnel, principle of the evacuation in tunnel is to walk to next station of the windward.



Target Passengers

Three Largest Metropolitans Area (Tokyo, Osaka, Nagoya)

a. Island Platform

Assumed Fire		Density of Ridership (%)			Total Density of Ridership (%	
		Passenger	Passenger on Platform		A	B
		Train	A	B		
Rolling Stock	Normal Fire	200	-	-	200	200
	Fire by Arson	200	75 (150)	125 (200)	275 (350)	325 (400)
Platform	Normal Fire	200	75 (150)	125 (200)	275 (350)	325 (400)
	Fire by Arson	200	75 (150)	125 (200)	275 (350)	325 (400)
Concourse	Normal Fire	-	75 (150)	125 (200)	75 (150)	125 (200)
	Fire by Arson	-	75 (150)	125 (200)	75 (150)	125 (200)

b. Side Platform

Assumed Fire		Density of Ridership (%)			Total Density of Ridership (%	
		Passenger	Passenger on Platform		A	B
		Train	A	B		
Rolling Stock	Normal Fire	200	-	-	200	200
	Fire by Arson	200	50 (100)	100 (200)	250 (300)	300 (350)
Platform	Normal Fire	200	50 (100)	100 (200)	250 (300)	300 (350)
	Fire by Arson	200	50 (100)	100 (200)	250 (300)	300 (350)
Concourse	Normal Fire	-	50 (100)	100 (200)	50 (100)	100 (150)
	Fire by Arson	-	50 (100)	100 (200)	50 (100)	100 (150)

2.7 Use of Nonflammable Material

(1) Use of Nonflammable Materials for Structure, etc.

Use of nonflammable material for structure and rolling stock is basic principle of fire protection.

Bench in Station

(2) Shops

Convenience store must be protected by fire protection compartment. KIOSK must be nonflammable as much as possible.

Convenience Store

KIOSK

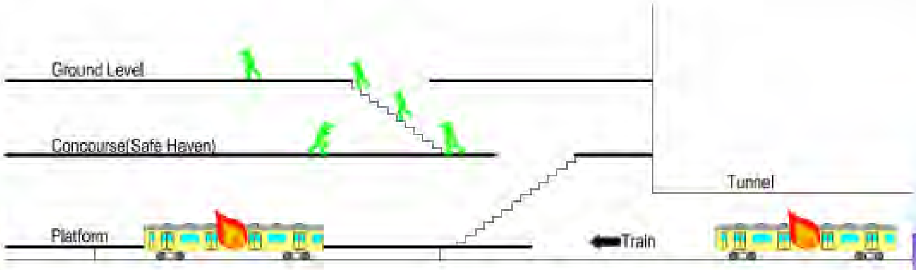
Source: MLIT

2.8 Principle of Train Operation on Fire

(1) The basic principle of operation for the train on fire is to drive the train to the next platform of the station or outside tunnel.

(2) Other train shall be stopped in the proximity station and shall not be departed.

(3) If the train on fire stops in the station or the station is burn, other trains shall not be stopped in same station.



2.9 Evacuation from Train if Stopped between Stations

(1) The basic principle of evacuation from train is to get down from the end of train (front or rear).

(2) Walk on the track bed to the next station.

Source: Tokyo Metro, Japan

2.10 Ventilation Facility and Duct

Centrifugal Tunnel Ventilation Fan
Source: Rinkai Line, Japan

Exhaust Duct in Tunnel
Source: Sendai City Transport Bureau, Japan

Duct in Platform
Source: Tokyo Metropolitan Gov. Bureau of Transportation

2.11 Emergency Facility and Measures

Fire Detection and Monitoring

Smoke Detector and Heat Detector

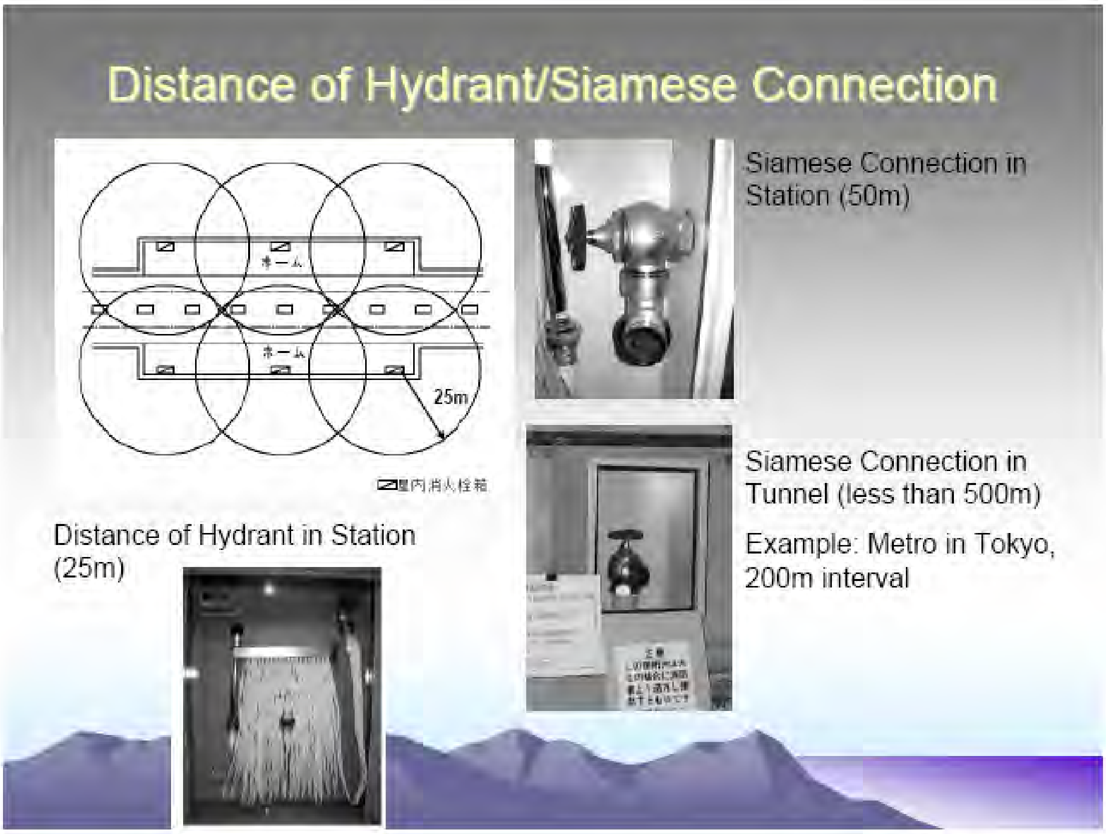
Push Button Alarm

CCTV

Sprinkler Head

Source: Rinkai Line and MLIT

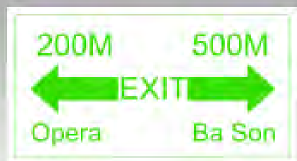

Emergency Facilities and Measures
Extinguisher, Hydrant and Siamese Connection for Fire Fighting
Inner Hydrant in Station
Siamese Connection in Tunnel
Air Tank (Respirator)
Fire Extinguisher in Train
Source: Osaka City Transportation Bureau, Sendai City Transportation Bureau and MLIT, Japan


Distance of Hydrant/Siamese Connection
25m
Distance of Hydrant in Station (25m)
Siamese Connection in Station (50m)
Siamese Connection in Tunnel (less than 500m)
Example: Metro in Tokyo, 200m interval

Emergency Facilities and Measures

Evacuation Guide

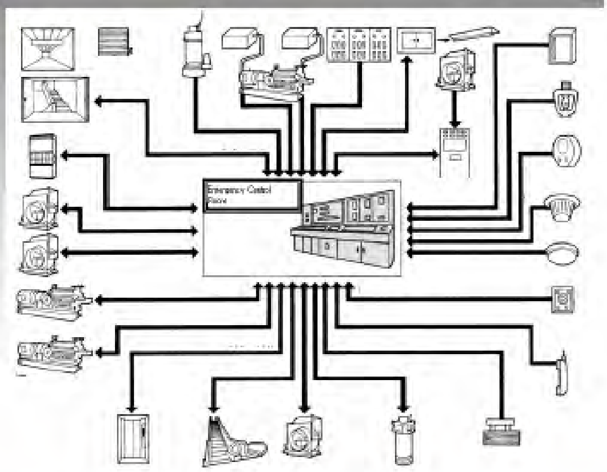
Guide Lighting for Exit



Direction and Distance Sign Board

Emergency Control Room

Monitor, Telephone and Public Address



Source: Rinkai Line and MLIT

Emergency Power in case of Fire

Emergency Power Generator

Source: Rinkai Line, Japan

(1) It is assumed that the fire accident occurs in one place and not occurred in two places or more in same time.

(2) Emergency power generator will be located in one place and could distribute power mainly for fans in case of power failure due to fire.

(3) UPS in each stations will supply power to emergency lighting system for two hours and 30 minutes for communication system in case of power failure due to fire.

Provision of Evacuation Passages in Station

(1) The effective width of evacuation passage shall be 1.5m or wider in principle.

(2) In principle, the evacuation passage from platform to ground level shall be the route which has only ascending stairs.

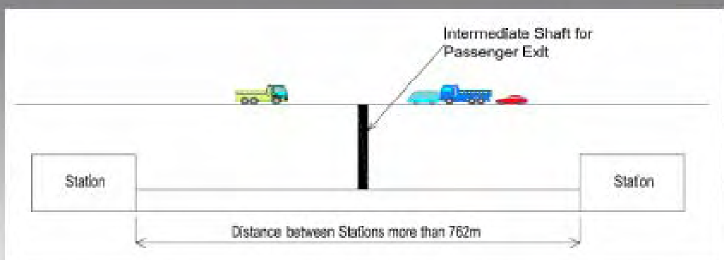
(3) Evacuation passages shall be provided at least for two different direction.

Use of Hand Car in case of Emergency Incidents

Source: MLIT

In the design standard of MLIT, the use of small hand car is not regulated but introduced as effective tool for the evacuation of passenger who delays and is handicapped. Moreover, it is effective to carry materials and equipments for fire fighting.

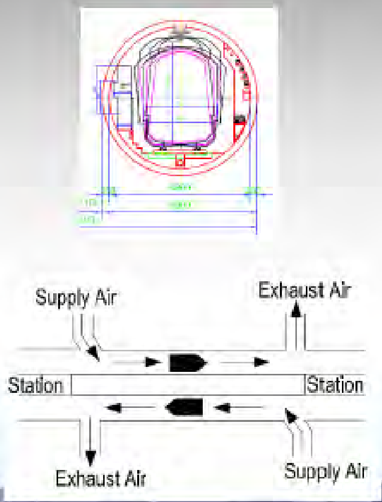
2.12 Intermediate Shaft (NFPA 130)



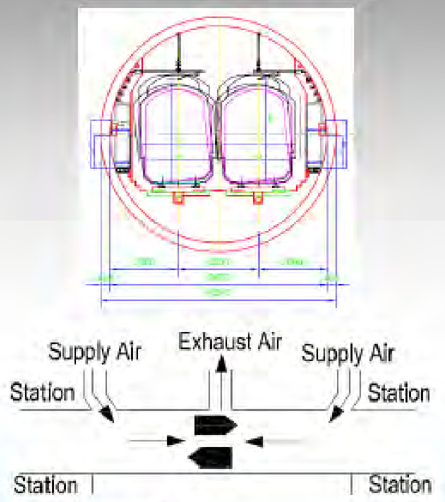
Intermediate shaft if distance between stations exceeds 762m.

Requirement of Ventilation Shaft

Single Track Double Tunnel



Double Track Single Tunnel



2.13 Cross Passage between Tunnels (NFPA130)

City, Country	Cross Passage	Max. Distance between Station/Access
Brussels, Belgium	No	750m
Copenhagen, Denmark	No	600m
Paris, France	No	800m
Rennes, France	No	600m
Helsinki, Finland	No	-
Prague, Czeck Rep.	No	2140m
Milan, Italy	No	-
Stockholm, Sweden	No	-
Hamburg, Germany	No	1000m
Berlin, Germany	No	1700m
Munich, Germany	No	1717m
Rotterdam, Netherlands	No	-
Lisborn,Portugal	No	1300m
Barcelona, Spain	No	800m
Madrid, Spain	No	1000m
Vienna, Austria	No	600m
Moscow, Russia	No	600m
London, UK	No	-
USA (NFPA130)	244m or 381m in other tunnel	381m

Source: FIT (Fire in Tunnel)

- Cross passage for subway between tunnels is obligatory only in USA (NFPA130)

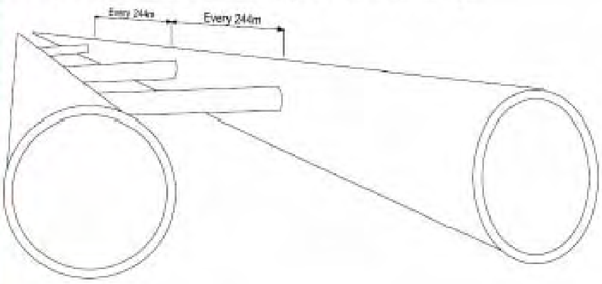
- No freight/goods train pass in subway.

- Material in tunnel and rolling stocks are nonflammable material in principle.

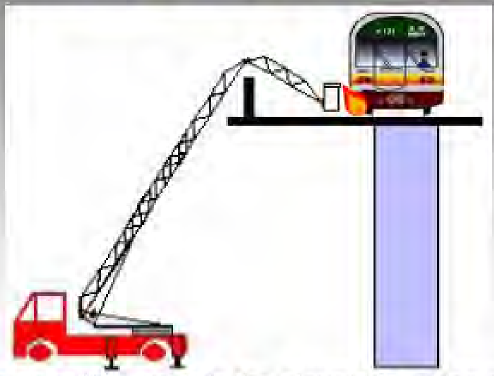
- Distance between stations is relatively short in subway.

- Provision of cross passage raises the construction cost drastically.

- Therefore, it is not recommended to construct cross passages for subway.



2.13 Fire on Elevated Section



(1) If fire occurs on rolling stock in the elevated section and stops between station, the procedure for the passenger is as same as that of tunnel.

(2) Fire fighting by the fire engine with high ladder is assumed for the elevated section but it should be discussed with the fire department.

3. Flood and High Water Management

3.1 Water Stop at Station

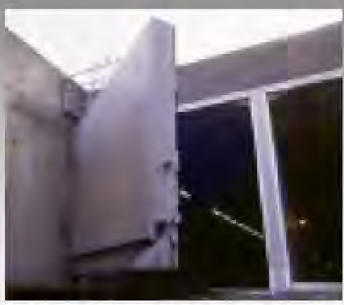
Water Stop Panel at the Entrance of Station

Water Stop Flap Door at the Passage Way

- Water stop panel will be prepared at the entrance of each underground stations. Water stop flap door will be considered if it is necessary from the result of hydraulic survey.

Source: Osaka City Transportation Bureau and Rinkai Line, Japan

3.2 Water Stop at Entrance of Tunnel



Water Stop Iron Door at the Entrance of Tunnel

Water Stop High Retaining Wall

- Between the tunnel section and elevated section, the track will be protected by the high water retaining wall. It is more economical and not necessary to shift overhead line equipment in case of flood.

Source: Osaka City Transportation Bureau and Cabinet Office, Japan

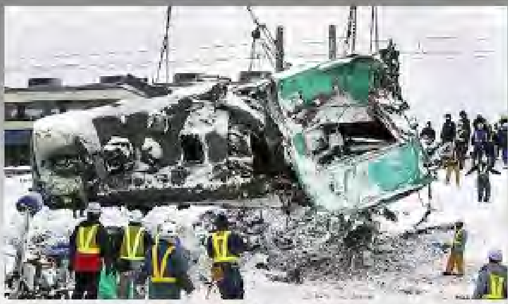
4. Strong Wind, Power Failure, Earthquake, etc.

4.1 Strong Wind

Derailment Accidents caused by Strong Wind in Japan

Year	Line	Remark
1978	Tosai Line, Minamisuna-Kasai Section	Trains were blown by the twister on the bridge. 3 rolling stocks were derailed. 21 persons injured.
1986	Sanin Line, Yoroi-Amarube Section	Trains were blown by the strong wind and fallen from bridge to the factory on the ground. 6 persons dead and 6 persons injured.
1994	South Ria Line, Koishihama-Horei Section	Under the control of speed limit 30km/h, trains were derailed on embankment section. 5 persons
1994	Nemuro Line, Nishishintoku-Hirouchi Section	Due to the strong wind, trains reduced the speed to 50km/h. However, trains were blown on embankment section and derailed. 28 person
1995	Tikuhi Line, Imajyuku Station	Before arriving to the station, the trains reduced speed to 60km/h, then, trains were blown by strong wind. Trains derailed and 3 persons injured.
2005	Uetsu Line, Sagoshi-Kitaamarume Section	During passng on the bridge, trains were blown suddenly by the twister or downburst. 5dead and 32 injured.

Measure in case of Strong Wind


Derailment by Strong Wind of Uetsu Line, 2005


Anemometer

Wind velocity is measured by anemometer.

(1) Wind Velocity 25m/sec to 30m/sec

Train speed shall be decelerated to 25km/h.

(2) Wind Velocity 30 m/sec or faster

Trains between stations shall be decelerated to 25km/h and drive to next platform of the station. Then, all train operation shall be stopped.

4.2 Power Failure

(1) In case of power failure, the operation of train is stopped in principle. If power failure is occurred by the fire accident, the emergency power shall be supplied for one station or equivalent to operate fans for smoke exhaust.

(2) UPS is prepared for each underground stations for emergency lighting and communication system

(3) If train is stopped in the middle of tunnel, the passenger shall be evacuated from the end of train. The passenger walk on the track to the next station.

4.3 Earthquake

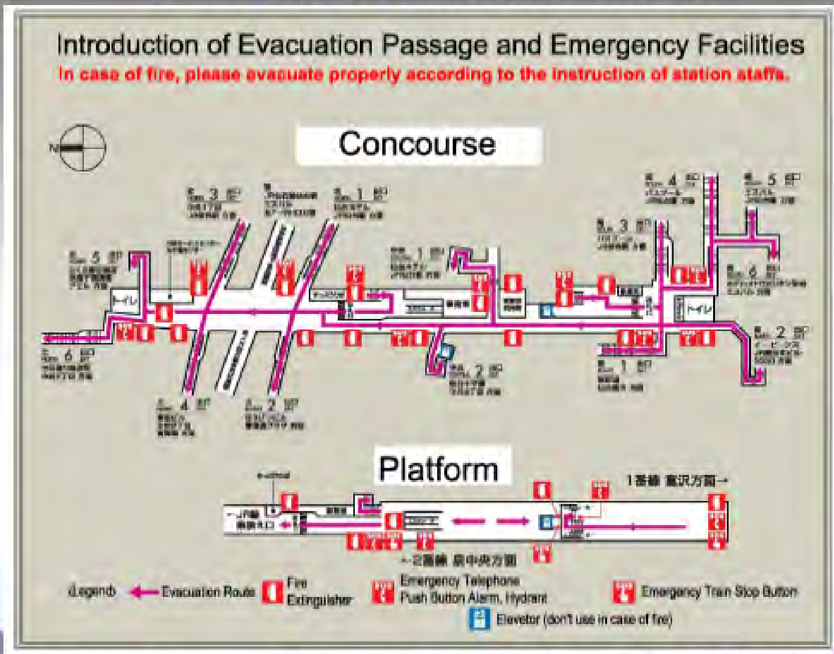
Earthquake is rare in Egypt and special measure is not prepared. However, if the earthquake which is perceived by people, the following measures shall be taken.

(1) Train operator direct that train shall be stopped or decelerate the speed and stop at the next station.

(2) Check the facilities, equipment and structure. Don't drive train until the inspection is completed.

5. Required Measures other than Infrastructure

5.1 Public Announcement



Source: Sendai City Transport Bureau, Japan

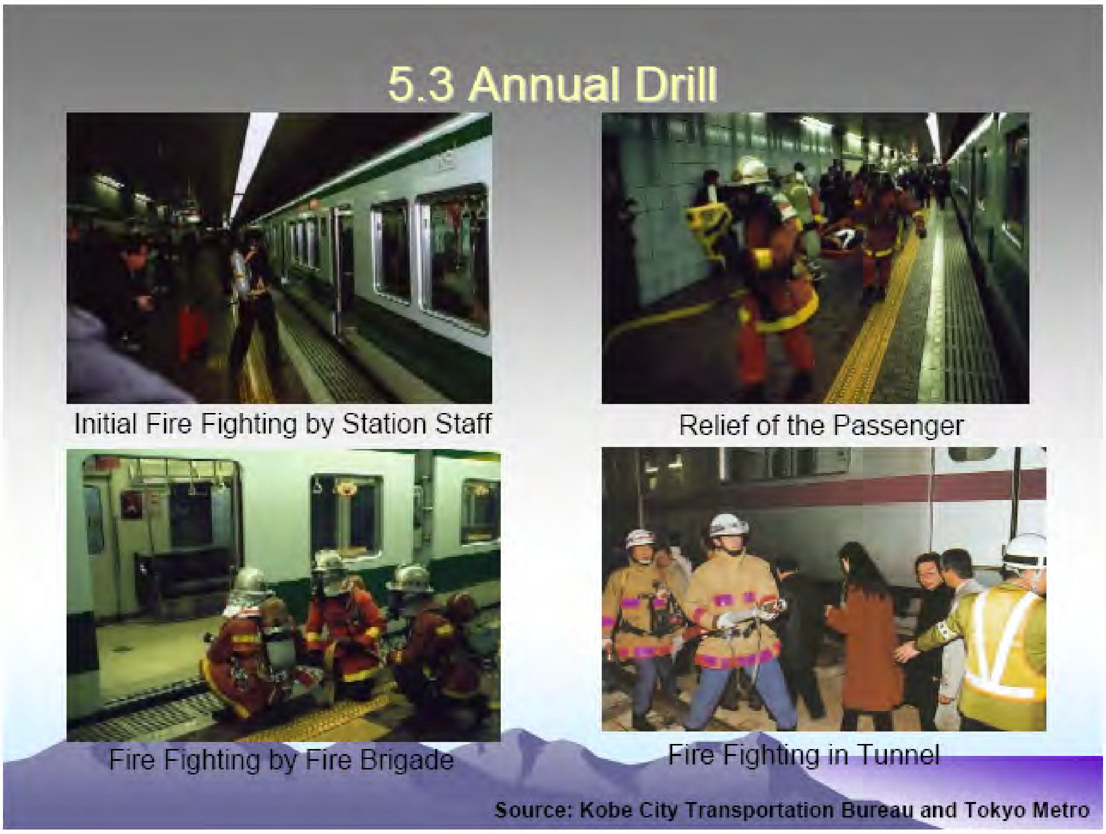
5.2 Communication with Other Agencies

In order to execute proper action in case of disaster/emergency incidents, communication and cooperation between the metro operator and other agencies, such as the fire department, police and army is very important. It is recommended to start discussion about following matters.

(1) Constitution and establishment of the framework and manual with other agencies in case of disaster/emergency incidents.

(2) Execution of the annual drills for disaster/emergency incidents with other agencies.

(3) Holding of the annual meeting for exchange of opinion and share of information.


5.3 Annual Drill
Initial Fire Fighting by Station Staff
Relief of the Passenger
Fire Fighting by Fire Brigade
Fire Fighting in Tunnel
Source: Kobe City Transportation Bureau and Tokyo Metro


Annual Drill
Training for Recovery of Derailment
Evacuation Guidance in Tunnel
Installation for Water Stop
Source: Tokyo Metro, Tokyo Metropolitan Gov. Bureau of Transportation, Japan

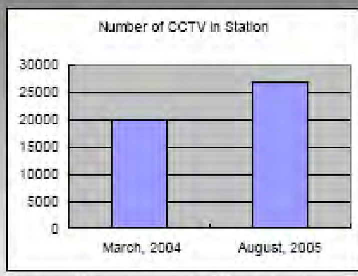
5.4 Measures for Terrorism in Japan

Anti-Terrorism for the Train Operation in Japan

1. Terrorism by chemical weapon was occurred in Tokyo Metro in 1995.
2. Measures for terrorism in station were considered and taken by MLIT and other train operators after the bomb terrorism at Spain in 2004.
3. Establishment of the conference for anti-terrorism by MLIT and other train operators in 2005 after the bomb terrorism at London, UK in 2005.

Measures in Station

Surveillances by Police, Security Officer and Station Staff



Strengthening of Monitoring by CCTV

Installation of Visible Trash Box or Remove of Trash Box

Source: MLIT, Japan

Distribution of Card

Distribution of Card

"If you find something suspicious, please notify to police or station staff. The principle is " Don't touch, don't sniff and don't move when you find it".

Thank you for your attention.

1.3 Phase 1B Route with HVS Location and Workshop/Depot Layout

Figure 1.2 shows the new Phase 1B route with station location while Figure 1.3 shows the new location of HVS including the administration buildings. In the basic design stage, JST needs to pay attention on the building height restriction. In case building height could not clear the restriction, one-underground-storey or semi-underground HVS building should be adopted.

Figure 1.4 shows the general layout plan for workshop/depot based on the new defined area with restriction provided by NAT. JST will study in detail in the basic design stage with consideration of manoeuvring method inside the depot and the facilities and equipment to be used in terms of the 3rd rail system.

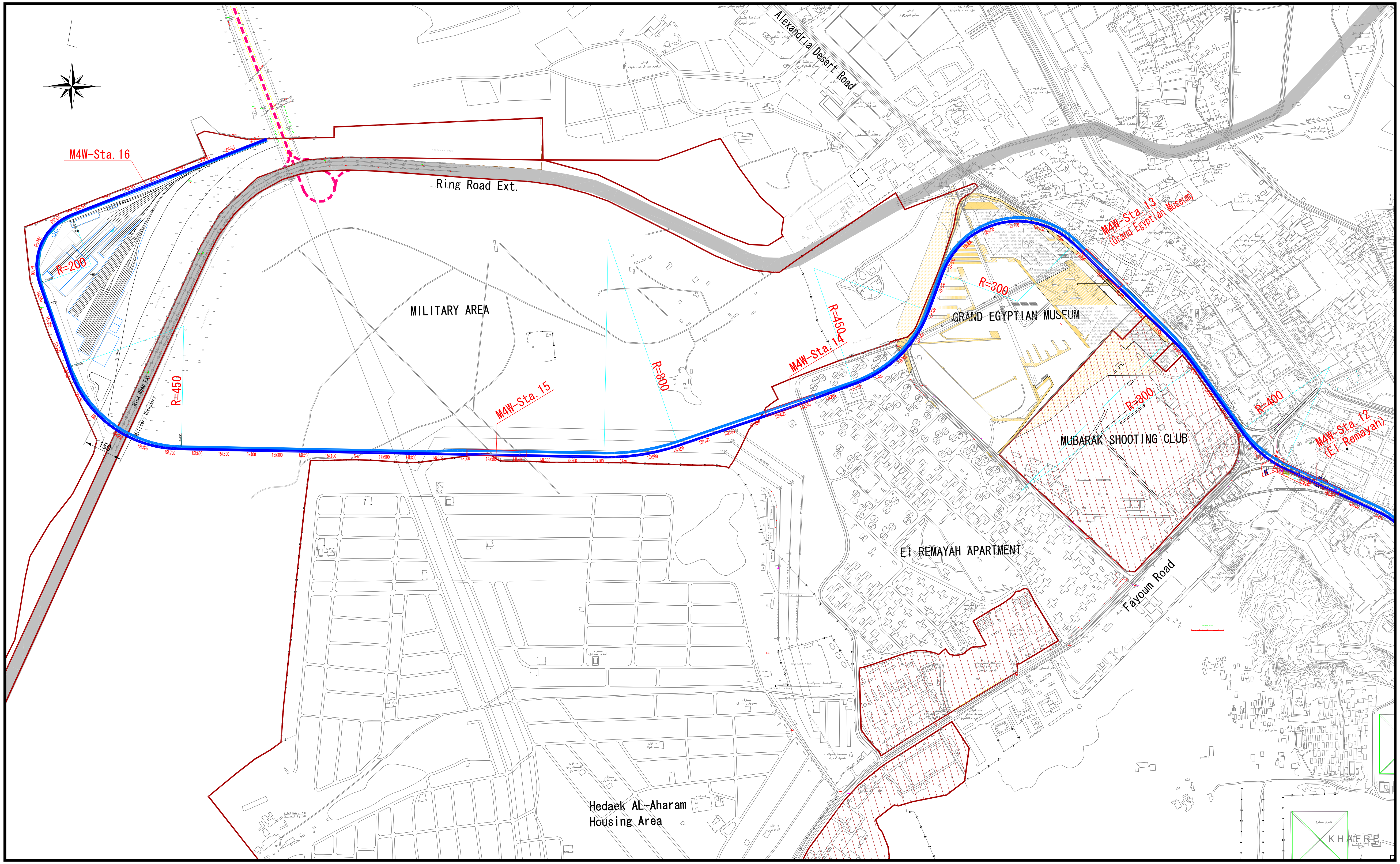


Figure 1.2 New Phase 1B Route with Station Location

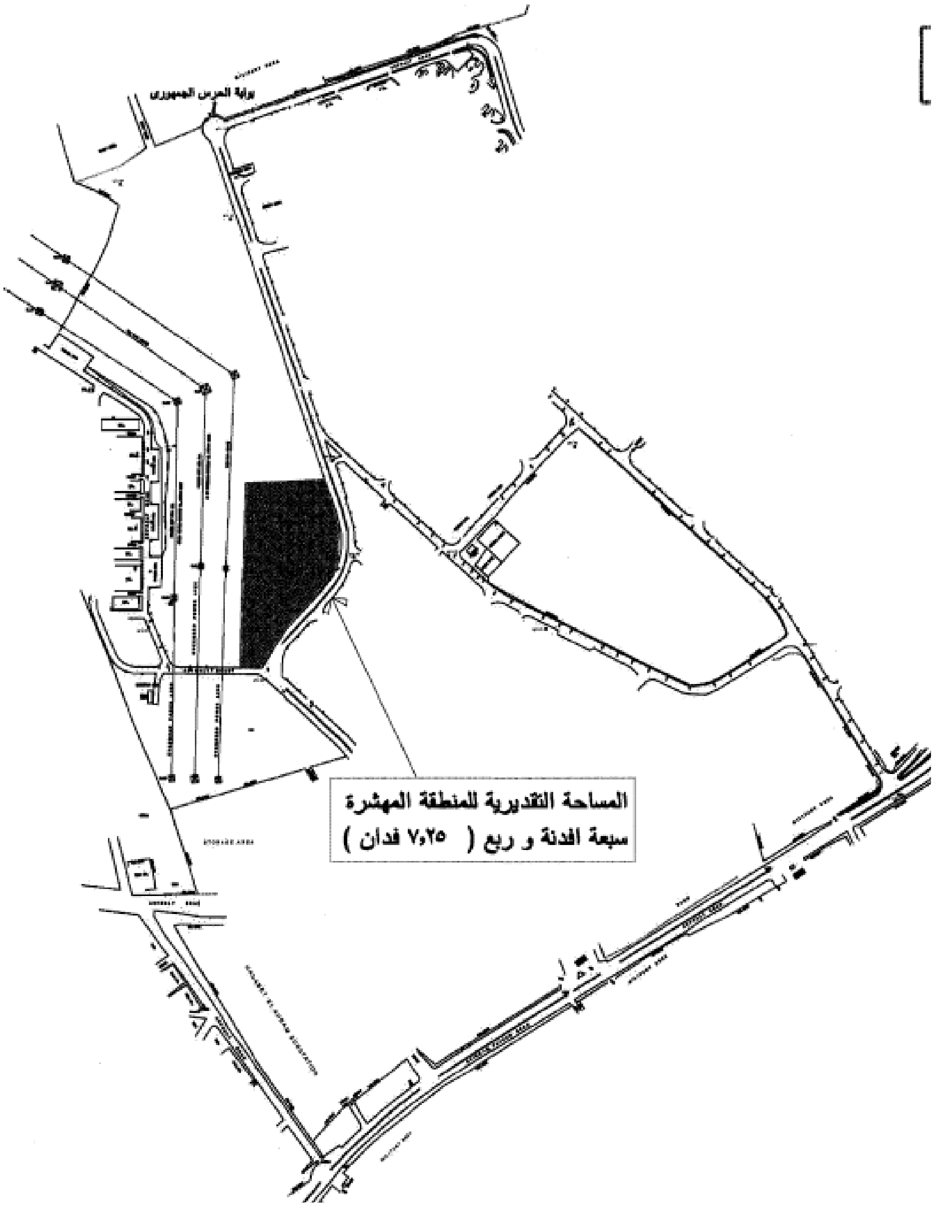


Figure 1.3 New Location of HVS and Administration Building

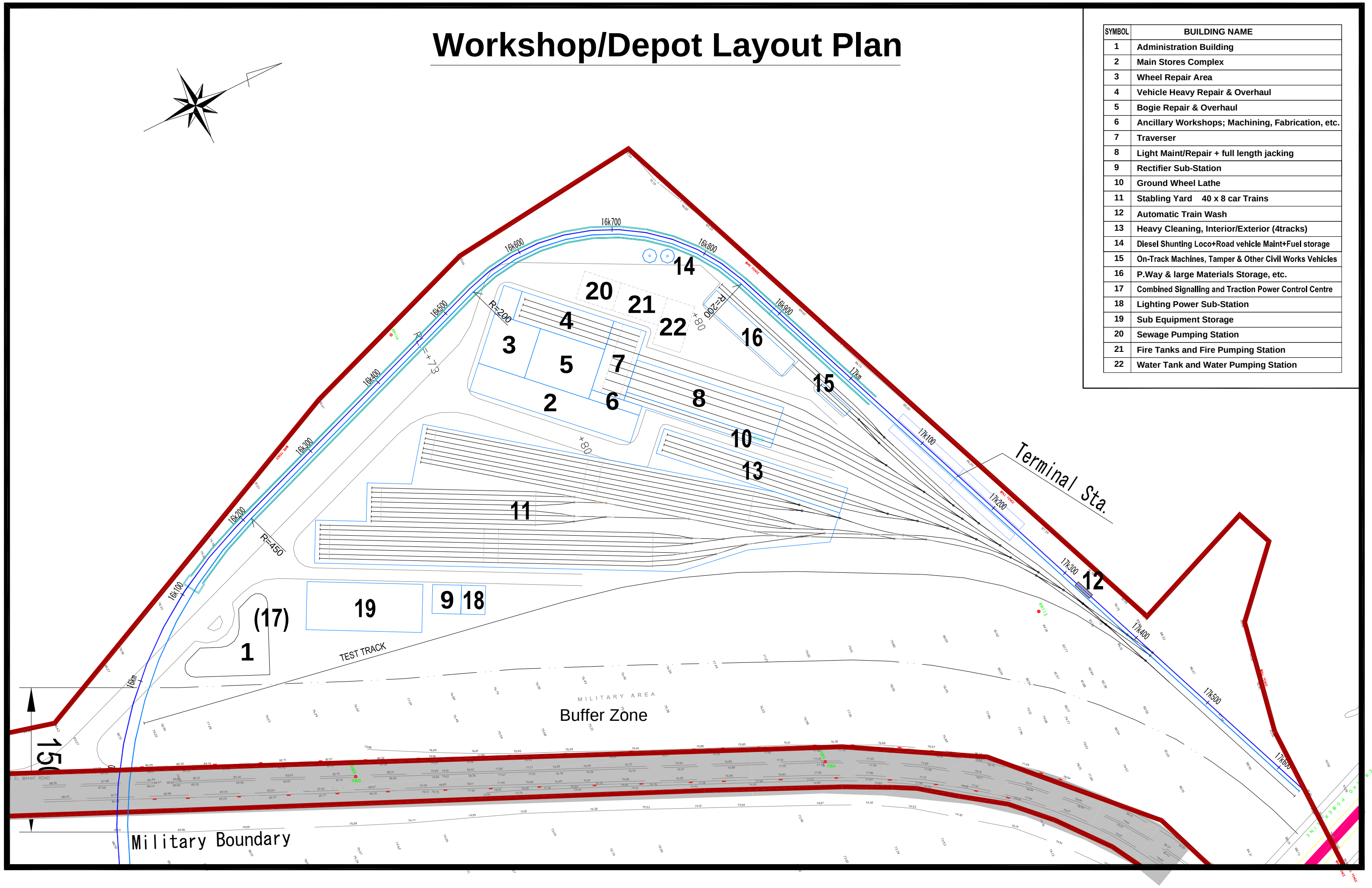


Figure 1.4 Workshop/Depot Layout Plan

1.4 Track Layout on Station No. 1, No. 5, and No. 9

JST will study in detail Station No. 1 (El Malek El Saleh Station) in consideration of connections with the Northern and Eastern Routes. In addition to this, a passenger connection between Metro Line 4 and Metro Line 1, and shunting plan in terms of suitable train operation method will also be considered. This study has been carried out by concerned engineers from NAT and JST. The following drawing is the image of the passenger connection between Metro Line 1 and Metro Line 4.

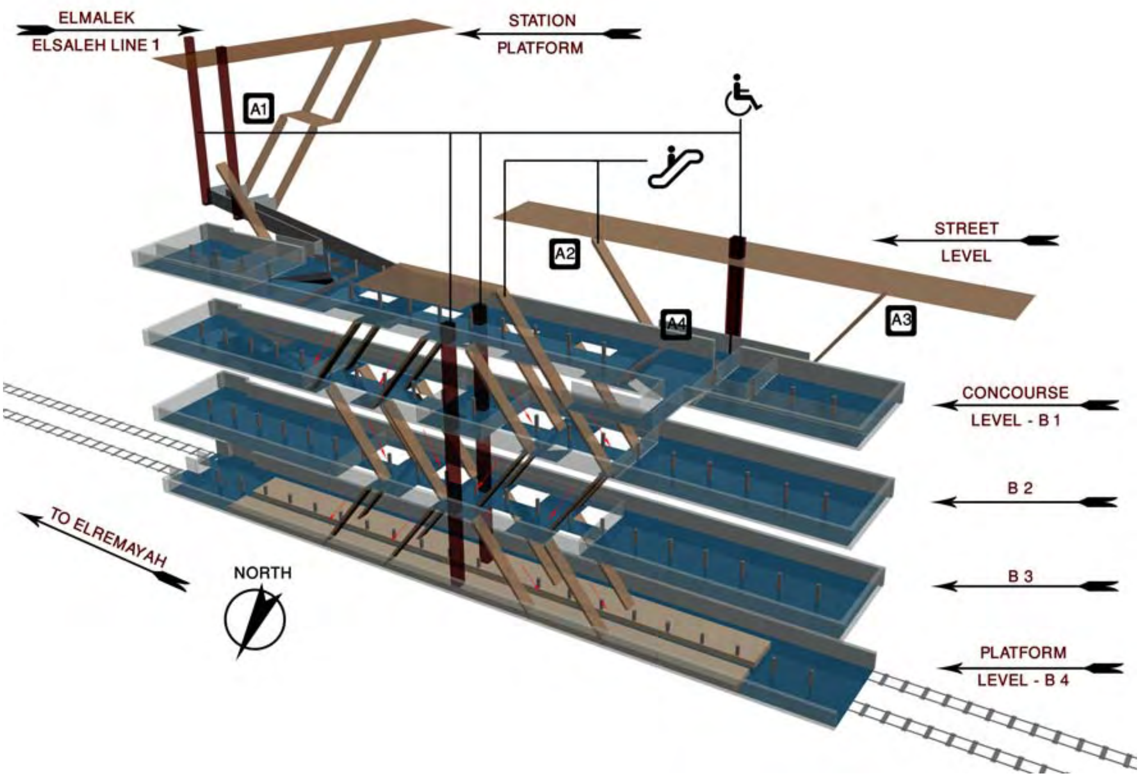


Figure 1.5 Passenger Connection between Line 1 and Line 4 (Image)

As for Stations No. 5 (El-Mesaha Square Station) and No. 9 (Hassan Mohammed Station), JST has examined the track layout based on the request during the site visit on 22nd February 2010. Figure 1.6 shows the sketch of the track layout which describes the difference between the original "Y" track and the new "Double Y" track. Double Y track has been selected by NAT in the meeting held on 11th March 2010, and JST has agreed to carry out further study in the basic design stage with consideration of Japanese disaster/emergency incidents management regulation.

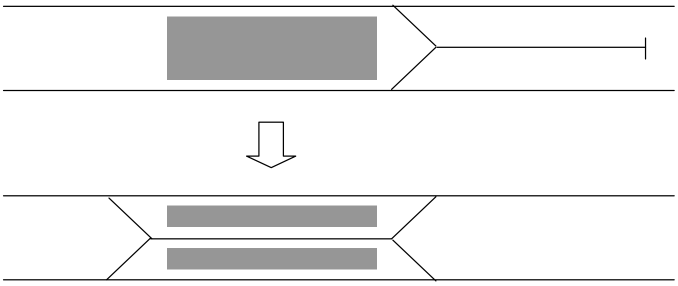


Figure 1.6 Revision of Y Track at Stations No. 5 and No. 9

1.5 Preliminary Power Supply Simulation with 3rd Rail System

1.5.1 Proposed Locations of RS

The proposed locations of RS based on the Preliminary Power Simulation on 750 V DC 3rd rail system are shown in Table 1.1. The maximum interval between RSs is 1.54 km (between M4W-Sta. 13 and M4W-Sta. 14). Every passenger station will have RS room, and additional places for RS will be required between M4W-Sta. 15 and 16, M4N-Sta. 16 and 17 that have longer distances from each other. It was verified that the contact line voltage between these sections will be higher than the permissive lowest voltage even in one RS failure case as mentioned in the following sections.

Table 1.1 Proposed Locations of RS

		Station Name	Location Name /Land Mark	Kilo post (km)	Distance (km) from previous Sta.	RS installation	RS interval
		M4 W - Sta.16		17.147	2.680	Yes	1.340
		RS between Sta.15 and 16		15.807		Yes	1.340
Phase-1	↑	M4 W - Sta.15		14.467	1.128	Yes	1.128
Phase-1		M4 W - Sta.14		13.339	1.542	Yes	1.542
Phase-1		M4 W - Sta.13	GEM	11.797	1.145	Yes	1.145
Phase-1		M4 W - Sta.12	El-Remayah Sq	10.652	0.872	Yes	0.872
Phase-1		M4 W - Sta.11		9.780	1.295	Yes	1.295
Phase-1		M4 W - Sta.10		8.485	0.990	Yes	0.990
Phase-1		M4 W - Sta.9		7.495	0.950	Yes	0.950
Phase-1		M4 W - Sta.8		6.545	0.925	Yes	0.925
Phase-1		M4 W - Sta.7		5.620	0.915	Yes	0.915
Phase-1		M4 W - Sta.6		4.705	0.890	Yes	0.890
Phase-1		M4 W - Sta.5		3.815	1.081	Yes	1.081
Phase-1		M4 W - Sta.4	El Giza	2.734	0.991	Yes	0.991
Phase-1		M4 W - Sta.3	El Nile	1.743	1.011	Yes	1.011
Phase-1		M4 W - Sta.2	El Rauda	0.732	0.732	Yes	0.732
Phase-1	Phase-2	M4 WN - Sta.1	El Malek El Saleh	0.000		Yes	0.000
↓	Phase-2	M4 N - Sta.2		1.076	1.076	Yes	1.076
	Phase-2	M4 N - Sta.3		2.383	1.307	Yes	1.307
	Phase-2	M4 N - Sta.4		3.395	1.012	Yes	1.012
	Phase-2	M4 N - Sta.5		4.240	0.845	Yes	0.845
	Phase-2	M4 N - Sta.6	Bab El Sharya	5.442	1.202	Yes	1.202
	Phase-2	M4 N - Sta.7		6.148	0.706	Yes	0.706
	Phase-2	M4 N - Sta.8	Ghamra	6.848	0.700	Yes	0.700
	Phase-2	M4 N - Sta.9		7.991	1.143	Yes	1.143
	Phase-2	M4 N - Sta.10		8.991	1.000	Yes	1.000
	Phase-2	M4 N - Sta.11		9.941	0.950	Yes	0.950
	Phase-2	M4 N - Sta.12		10.800	0.859	Yes	0.859
	Phase-2	M4 N - Sta.13	El Sawah Sq	11.600	0.800	Yes	0.800
	Phase-2	M4 N - Sta.14		13.120	1.520	Yes	1.520
	Phase-2	M4 N - Sta.15		14.173	1.053	Yes	1.053
	Phase-2	M4 N - Sta.16		15.500	1.327	Yes	1.327
	Phase-2	RS between Sta.16 and 17		16.550		Yes	1.050
↓	Phase-2	M4 N - Sta.17	Ring Rd Ex No.18	17.600	2.100	Yes	1.050

Source: JICA Study Team

1.5.2 Capacity of Rectifier

The capacity of the rectifier in RS was calculated based on the condition mentioned in the previous section and on the assumptions as shown in Table 1.2 and Table 1.3.

Table 1.2 Key Assumptions for Determining Capacity of Rectifier (1)

Item	Value
Nominal voltage rectifier	750 [V]
Acceleration current of Rolling Stock	4,949 [1] [A]
Current of auxiliary circuit of Rolling Stock	288[1] [A]
Rate of power consumption for driving	48[1] [kWh per 1000t·km]
Weight of train (Rolling stock + passenger)	406.6[2] [t]

Source: [1] Specifications of commuter train in JR East, [2] JICA Study Team

Table 1.3 Key Assumptions for Determining Capacity of Rectifier (2)

Year	2020- 2022	2023 - 2027	2028 - 2050	After 2050
Number of trains per hour (both directions)	30	52	54	56

Source: JICA Study Team

Table 1.4 Estimated Maximum Power per Hour for One RS and Rated Capacity of Rectifier

Year		2020- 2022	2023 - 2027	2028 - 2050	After 2050	Rated rectifier capacity [MW]
Required power for a RS in Phase 1 [MW]	Normal operation	1.2	2.0	2.1	2.2	4.0
	Next RS failure	1.8	3.1	3.1	3.2	

Source: JICA Study Team

1.5.3 Calculation of Voltage Drop in Contact Line

(1) Current flow and RS interval

Figure 1.7 shows the simplified three RS model considering the maximum RS interval of 1.5 km and current flow derived from the operation plan in Line 4 under the assumptions of the train operation head way of 2:13 from the year 2027 to 2050. In Figure 1.7, each arrow shows the rolling stock's direction and its location from RS-c. The captions on the arrows show that the consumption of current (ampere) and status of the rolling stocks ("Accel" and "Stop" mean the accelerating and stopping train set, respectively.).

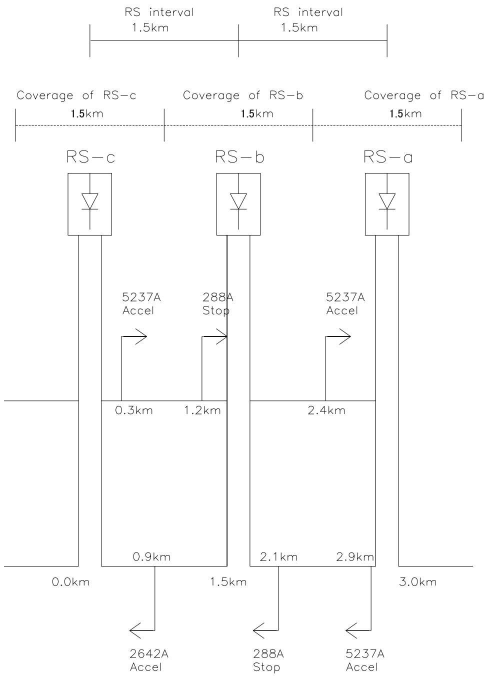


Figure 1.7 Assumptions for Current Flow and RS Interval in Normal Operation

Figure 1.8 illustrates the case when RS-b has a failure. The contact line voltage must exceed the permissive lowest voltage for rolling stocks to maintain the normal operation even if one RS has a failure. The permissive lowest voltage is 500V DC according to IEC standard 60850.

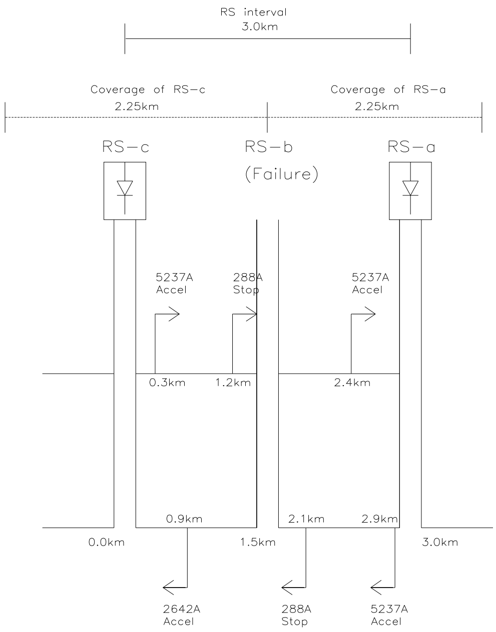


Figure 1.8 Assumptions for Current Flow and RS Interval in RS Failure Situation

(2) Results of the calculation

Figure 1.9 shows the results of the calculation of the contact line voltage. This figure proves that the contact line voltage exceeds the 500V permissive lowest voltage even if RS-b cannot supply the power to the contact line. Therefore, 1.5 km of RS interval is feasible.

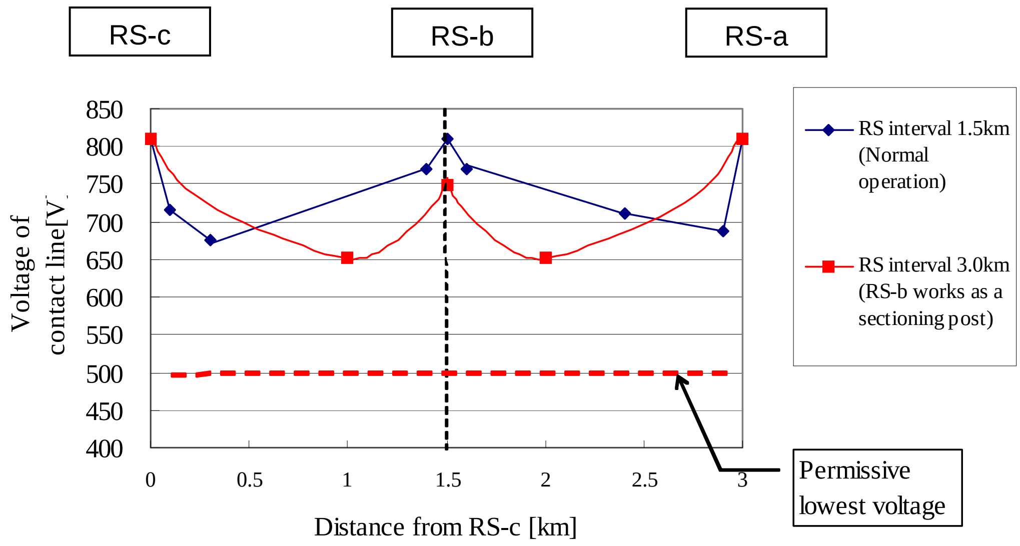


Figure 1.9 Result of the calculation of Contact line voltage

a) Specifications of RS based on the result of Preliminary Power Simulation on 750V DC 3rd rail system

- Number of RS: 17 RSs for Phase-1 and 17 RSs for Phase-2
- Maximum interval between RSs: 1.5 km
- Rectifier capacity installed in each RS: 4.0 MW for one RS
- Passenger stations where RS will be located: As shown in Table 1.1 in the Preliminary Power Simulation on 750V DC 3rd rail system. Places for RS will be required outside of passenger station between M4W-Sta. 15 and 16, M4N-Sta. 16 and 17.
- Required area for RS room in a passenger station: Approx. 250 m^2

b) Specifications of contact line

- Protection against accidental contact to 3rd rail: Must be equipped with protective boards to prevent accidental contact to 3rd rail, because 3rd rail is mounted on the level vicinity to running rails unlike ORG mounted on the ceiling of tunnel.
- Interval of supporting structure: The weight of the 3rd rail is generally heavier than ORG (For example, ORG: 15 kg/m, 3rd rail: 50 kg/m). The interval of

supporting structure in the 3rd rail system (approx. 2.0 to 2.5 m) will be shorter than that in the ORG system (approx. 5 m).

1.6 Tunnel Diameter with 3rd Rail System

Figure 1.10 shows the tunnel diameter with 3rd rail system. Based on the preliminary design, the diameter will be reduced by 400 mm from the overhead rigid conductor system.

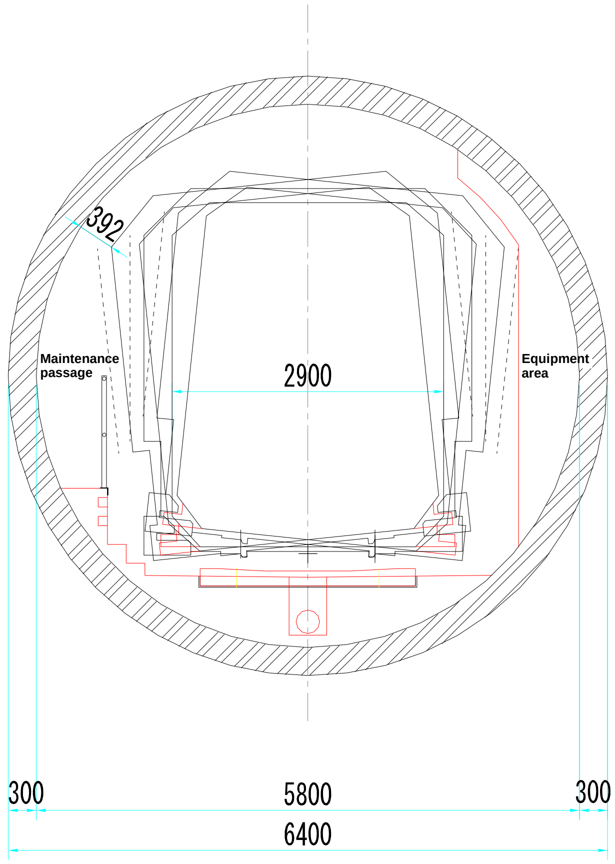


Figure 1.10 Cross Section of Tunnel based on the 3rd Rail System