(8) Kranji Station

Taking into account of existing station plaza, a new station building will be built close to the existing station building. Since this station is expected to have a large number of passengers, two staircases to platform shall be provided.

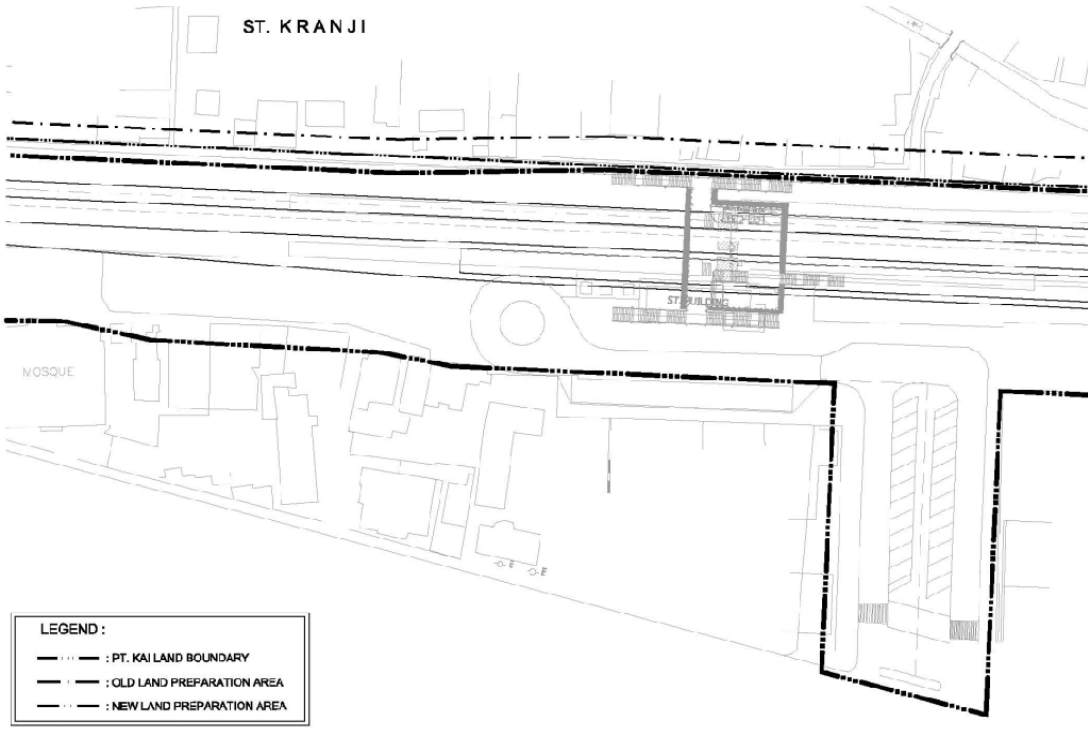

Figure 6.4-15 Kranji Station Layout Boundaries

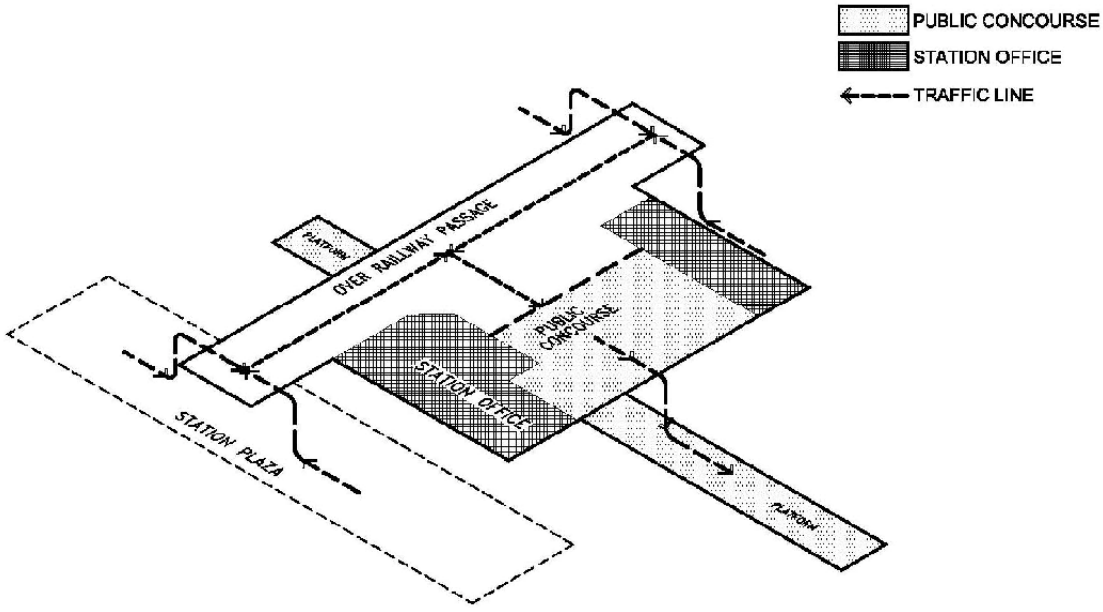

Figure 6.4-16 Kranji Station Passenger Flow

Space Requirements

Table 6.4-8 Calculation Result Based on Basic Requirements (Kranji)

Items				Calculation Results	Proposed
1	Number of Ticket Booths			3	3
2	Ticket Hall			12 m^2	18 m^2
3	Ticket Office			21 m^2	14 m^2
4	Number of Ticket Barrier Passage			3 passages	4 passages
5	Minimum Concourse Area			168 m^2	171 m^2
6	Width of Passenger Passage			2 m	4 m
7	Width of Stairways			2.2 m	4.4 m
8	Toilets	Male	Urinals	3	3
			Closet	2	2
		Female	Closet	2	3
9	Station Office			50 m^2	76 m^2
10	Shop				9.9 m^2
Total Floor Area					1,015 m2

(9) Bakasi Station

This station layout was completely changed from the original Basic Design to meet with the new track plan. There are station plazas on both sides of the existing station. The existing station plaza will be used in the new plan. The station building will be provided with an escalator within existing ROW. Each platform will be provided with an escalator on west side, while at the east side a staircase will be provided.

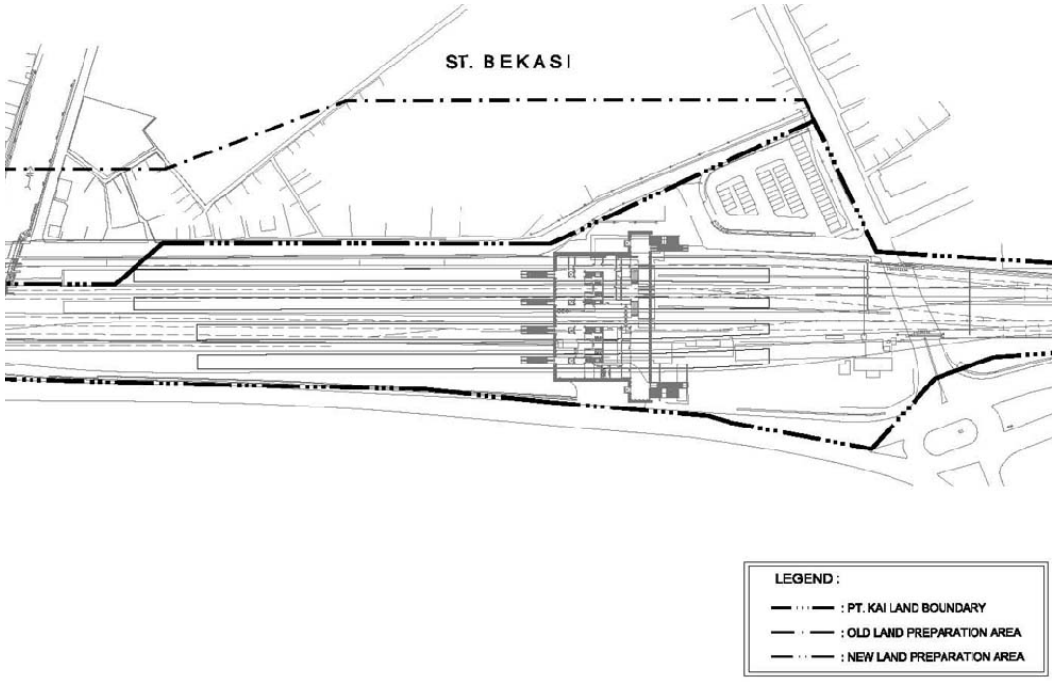

Figure 6.4-17 Bekasi Station Layout Boundaries

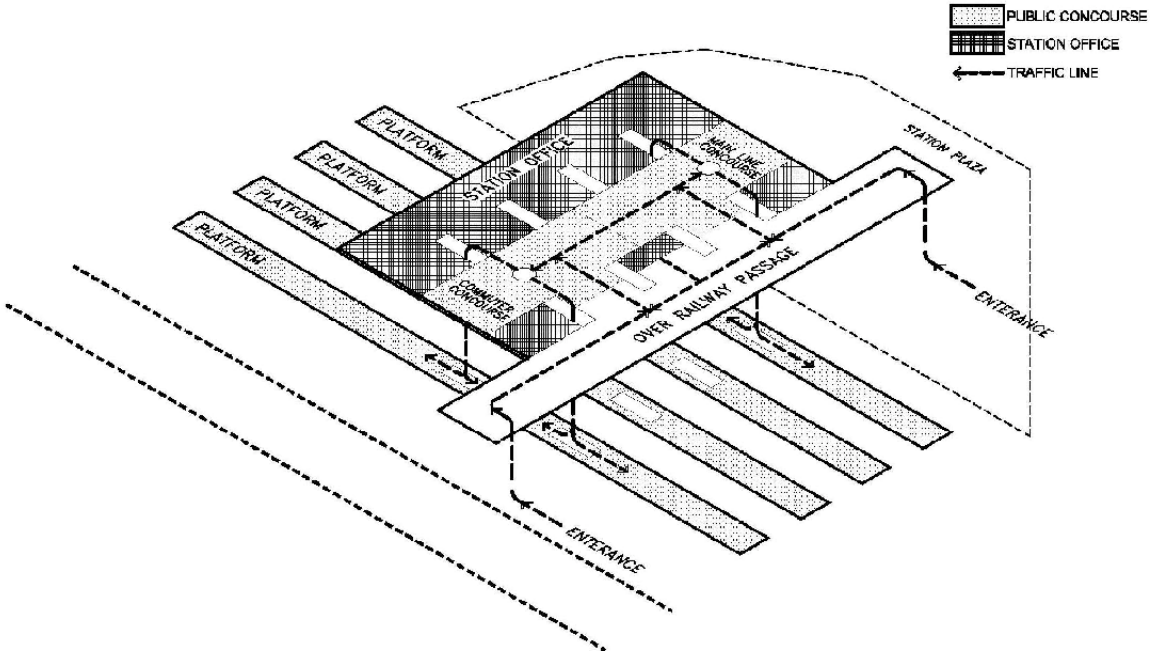

Figure 6.4-18 Bekasi Station Passenger Flow

Space Requirements

Table 6.4-9 Calculation Result Based on Basic Requirements (Bekasi)

Items				Calculation Results	Proposed
1	Number of Ticket Booths			8	18
2	Ticket Hall			35 m^2	82 m^2
3	Ticket Office			35 m^2	65 m^2
4	Number of Ticket Barrier Passage			6 passages	16 passages
5	Ticket Barrier			43 m^2	54 m^2
6	Minimum Concourse Area			182 m^2	1,046 m^2
7	Width of Passenger Passage			4.4 m	9.5 m
8	Width of Stairways			5.3 m	7.8 m
9	Toilets	Male	Urinals	9	13
			Closet	4	8
		Female	Closet	5	11
10	Meeting Room			36 m^2	88 m^2
11	Station Master's Office			21 m^2	35 m^2
12	Station Office			126 m^2	188 m^2
13	Resting Room			31 m^2	47 m^2
14	Staff's Toilets	Male	Urinals	2	2
			Closet	1	1
		Female	Closet	1	2
15	Lounge				52 m^2
16	Over Railway Passage				803 m^2
17	Shop and Restaurant				32 m^2
18	Garbage Place				104 m^2
19	Storage				25 m^2
Total Floor Area					3,440 m2

(10) Bekasi Timur Station

Planning

Bekasi Timur Station is newly established and located between the Bekasi Station and the Tambun Station. The single story station building with floor area of about 282m^2 is located in the south side of railway connecting with the main road towards some industrial estates, and consists of three main functions such as concourse, station office and toilet. Considered as passenger related facilities, the ticket office, the ticket barriers and the telephone booths are compactly put together in the public concourse area. The station is connected to the platforms of the commuter line by the over bridge.

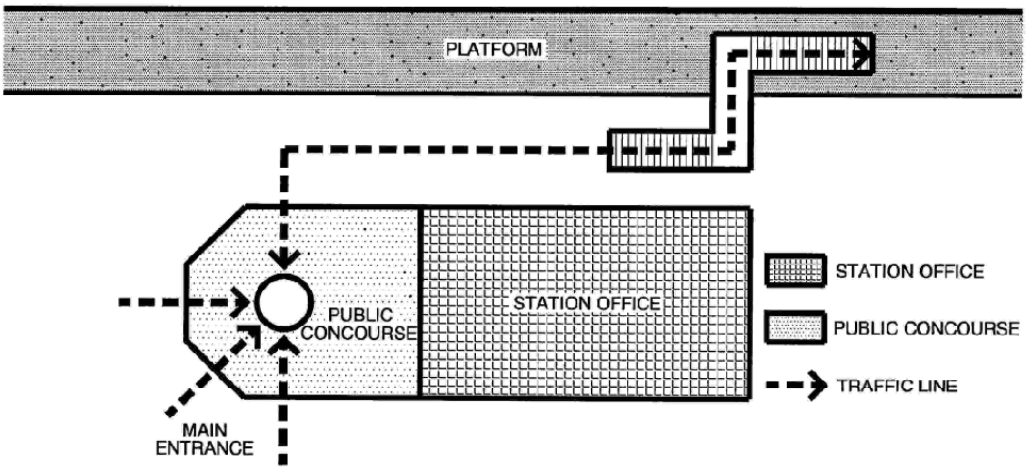

Figure 6.4-19 Bukasi Timur Zoning and Circulation

Design Concept

The focal point of this station building is the octagonal entrance tower which will be high enough for passengers to find the entrance easily and to be smoothly accessible from the plaza. The monumentality is the theme of the architectural design with the local color of the traditional motif of Indonesia, which will make this station unique. However, the tower does not only function as a symbol of the region but also the public concourse with high skylight ceiling taking into consideration the protection from the local climate conditions such as sun, wind, humidity and rain, will provide a good atmosphere to facilitate being a symbol of the region.

Figure 6.4-20 Bekasi Timur Station Elevation

Space Requirements and Design Standards

Proposed space requirements are based on the calculated results of the planning standards.

Table 6.4-10 Calculation Result Based on Basic Requirements (BKS Timur)

Items				Calculation Results	Proposed
1	Number of Ticket Booths			3	4
2	Ticket Hall			17 m^2	17 m^2
3	Ticket Office			12 m^2	17 m^2
4	Number of Ticket Barrier Passage			3 passages	4 passages
5	Minimum Area of Concourse			78 m^2	82m^2
6	Width of Passenger Passage			1.3 m	3.5 m
7	Width of Stairways			1.6 m	3.0 m
8	Toilets	Male	Urinals	4	5
			Closet	2	2
		Female	Closet	3	3
9	Station Office			47 m^2	54 m^2
Total Floor Area					282 m2

(11) Tambun Station

Planning

The Tambun Station is located in a suburban area and categorized as one of the typical small stations with a prototype design. The single story station building with floor area of about 211m^2 is located almost in the centre of the plaza and consists of three main functions such as concourse, station office and toilet. As passenger related facilities, the ticket office, the ticket barriers and the telephone booths are compactly put together in the public concourse area. The station is connected to the platforms of the commuter line by the over bridge.

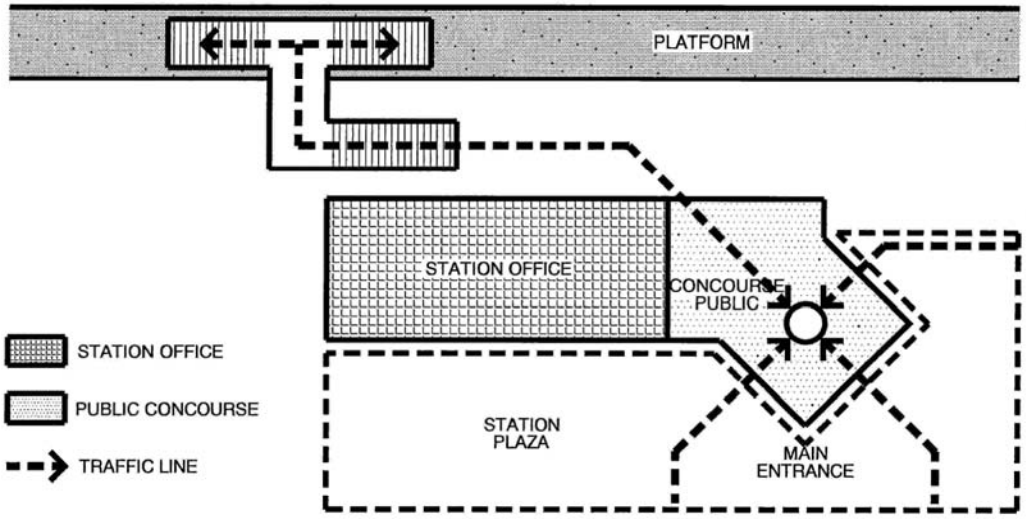

Figure 6.4-21 Tambun Station Zoning and Circulation

Design Concept

The focal point of the station building is the entrance tower as landmark of the public concourse. The tower is high enough for passengers to locate the entrance easily and is smoothly accessible from the plaza. The monumentality is the theme of the architectural design combined with the local color of the traditional motif of Indonesia, and will make this station unique with local flavor and have remarkable atmosphere. However, the tower does not only function as a landmark but creates a symbol of the region and provides good design for the public concourse with high skylight ceiling taking into consideration to provide protection from the local climate conditions such as sun, wind, humidity and rain.

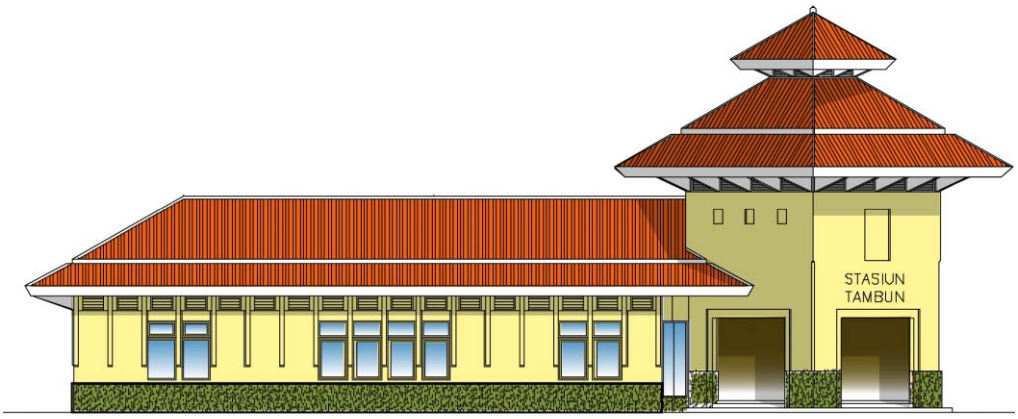

Figure 6.4-22 Tambun Station Elevation

Space Requirements and Design Standards

Proposed space requirements are based on the calculated results of the planning standards.

Table 6.4-11 Calculation Result Based on Basic Requirements (Tambun)

Items				Calculation Results	Proposed
1	Number of Ticket Booths			3	4
2	Ticket Hall			17 m^2	17 m^2
3	Ticket Office			12 m^2	13 m^2
4	Number of Ticket Barrier Passage			3 passages	4 passages
5	Minimum Area of Concourse			55 m^2	67 m^2
6	Width of Passenger Passage			1.4 m	3.0 m
7	Width of Stairways			1.7 m	3.5 m
8	Toilets	Male	Urinals	4	4
			Closet	2	2
		Female	Closet	2	2
9	Station Office			53 m^2	53 m^2
Total Floor Area					211 m2

(12) Cibitung Station

Planning

The Cibitung Station is located in a suburban area and categorized as one of the typical small stations with a prototype design. The single story station building with floor area of about 211m^2 is located almost in the centre of the plaza and consists of three main functions such as concourse, station office and toilet. As passenger related facilities, the ticket office, the ticket barriers and the telephone booths are compactly put together in the public concourse area. The station is connected to the platforms of the commuter line by the over bridge.

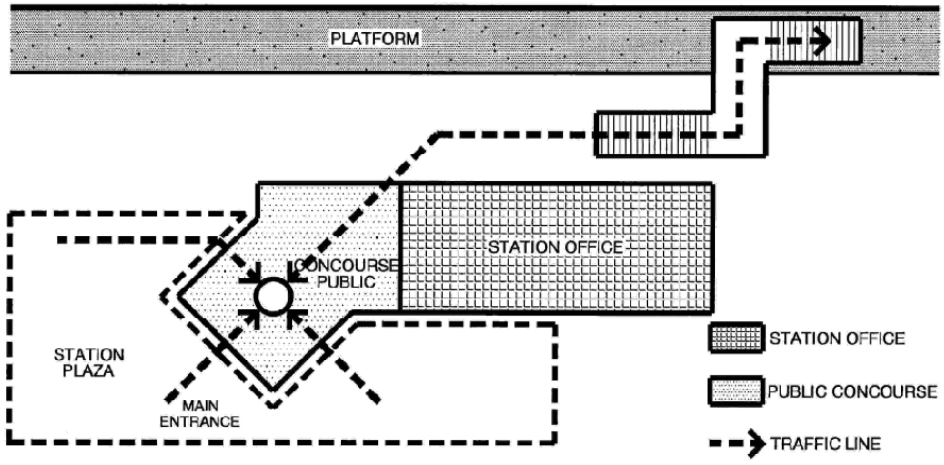

Figure 6.4-23 Cibitung Station Zoning and Circulation

Design Concept

The focal point of the station building is the entrance tower as a public concourse. The tower is high enough for passengers to find the entrance easily and is smoothly accessible from the plaza. The monumentality is the theme of the architectural design with local color of the traditional motif of Indonesia, and will make this station remarkable. However, the tower does not only function as a symbol of the region but is also a design element for the public concourse with high skylight ceiling taking into consideration protection from the local climate conditions such as sun, wind, humidity and rain.

Figure 6.4-24 Cibitung Station Elevation

Space Requirements and Design Standards

Proposed space requirements are based on the calculated results of the planning standards.

Table 6.4-12 Calculation Result Based on Basic Requirements (Cibitung)

Items				Calculation Results	Proposed
1	Number of Ticket Booths			1	4
2	Ticket Hall			6 m^2	17 m^2
3	Ticket Office			5 m^2	13 m^2
4	Number of Ticket Barrier Passage			2 passages	4 passages
5	Minimum Area of Concourse			20 m^2	67 m^2
6	Width of Passenger Passage			0.3 m	2.5 m
7	Width of Stairways			0.3 m	2.5 m
8	Toilets	Male	Urinals	3	4
			Closet	2	2
		Female	Closet	2	2
9	Station Office			53 m^2	53 m^2
Total Floor Area					211 m2

(13) Cikaran Station

Planning

Cikarang Station is located in the major suburban area at the end of the Java Main Line project. The station building is laid out symmetrically in the centre of plaza. The single story building with floor area of 691m^2 consists of the public concourse in the centre, the station office on the east side, and the operation office, the toilet and the shops on the west side. As passenger related facilities, the ticket office, the ticket barriers and the telephone booths are compactly put together in the public concourse area. The station is connected to the platforms of the commuter line by the over bridge.

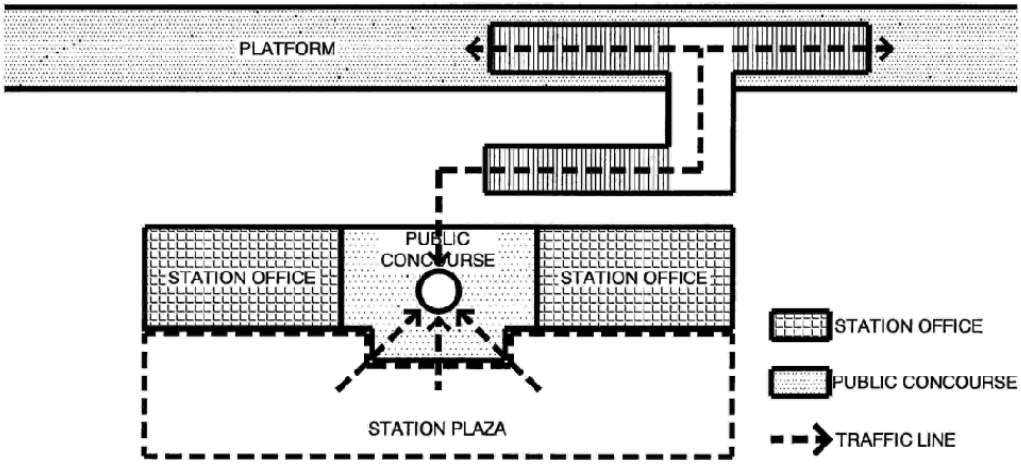

Figure 6.4-25 Cikaran Station Zoning and Circulation

Design Concept

The design concept of the new Cikarang Station has already mentioned in 2.1.3, as introducing the design motif of the old Manggarai Station, built during the Dutch colonial period, which must be removed in connection with improvement of Manggarai Station.
The reasons are as follows:

- Consideration should be given to the people in the design of the new Cikarang Station to preserve, in memory, the image of the old Manggarai Station.
- The preservation of an important old building is taken into consideration as a cultural inheritance.
- The size of the old Manggarai Station is suitable for the future number of passengers to use the Cikarang Station.

Figure 6.4-26 Image of Cikaran Station

Space Requirements and Design Standards

Proposed space requirements are based on the calculated results of the planning standards.

Table 6.4-13 Calculation Result Based on Basic Requirements (Cikarang)

Items				Calculation Results	Proposed
1	Number of Ticket Booths			3	5
2	Ticket Hall			13 m^2	20 m^2
3	Ticket Office			16 m^2	17 m^2
4	Number of Ticket Barrier Passage			3 passages	8 passages
5	Ticket Barrier			27 m^2	36 m^2
6	Minimum Area of Concourse			58 m^2	126 m^2
7	Width of Passenger Passage			2.0 m	3.5 m
8	Width of Stairways			2.1 m	5.0 m
9	Toilets	Male	Urinals	5	5
			Closet	2	2
		Female	Closet	3	3
10	Station Office			72 m^2	72 m^2
11	Station Master's office			21 m^2	30 m^2
12	Resting Room			16 m^2	18 m^2
13	Staff's Toilets		Urinals	1	0
			Closet	1	1
Total Floor Area					708 m^2

6.4.2. Finishing Materials

Finishing materials of 13 stations were selected in consideration of their maintenance and durability.

Table 6.4-14 Finishing Materials for Over-Track Stations

Exterior Finishing Materials			
	External Pavement		Granite Burner and Honed Finishes (Entrance), Interlocking
	External wall		Glass Panel, Limestone, Granite, Fluorocarbon Resin Coating (Steel Beam)
	Roof		Titanium Roof Roll Dull Finish Aluminum Flame Skylight with Tinted Glass
Interior Finishing Material			
	Common Space		
		Floor	Granite Burner and Honed Finishes (Concourse, Passage Way) Marble Honed Finish, Carpet (Lounge) Non slip Ceramic tile (Toilet)
		Wall	Granite and Limestone Honed Finish (Concourse, Over-track Passage) Painted Wooden Panel, Gypsum Board Paint finish (Lounge) Ceramic Tile (Toilet) Fluorocarbon Resin Coating (Steel Column)
		Ceiling	Aluminum Spandrel (Concourse, Passage Way) Acoustical Ceiling Board (Lounge) Calcium Silicate Board (Toilet)
	Station Office Accommodation		
		Floor	Homogeneous Vinyl Tile Carpet (Station Master Room) Non Slip Ceramic Tile (Toilet)
		Wall	Gypsum board paint finish Ceramic Tile (Toilet)
		Ceiling	Acoustical Ceiling Board Calcium Silicate Board (Toilet)

Table 6.4-15 Finishing Materials for Grade Level Stations

Exterior Finishing Materials			
	External Pavement		Interlocking
	External wall		Cement Plaster Trowel / Paint Finish, Marble
	Roof		Ceramic Roof Tile
Interior Finishing Material			
	Common Space		
		Floor	Granite, Marble (Partially)
		Wall	Cement Plaster Trowel / Paint Finish
		Ceiling	Kamper Wood
	Station Office Accommodation		
		Floor	Ceramic Tile
		Wall	Cement Plaster Trowel / Paint Finish
		Ceiling	Acoustical Ceiling Board

6.4.3. Train Operation Related Facilities

Following **Table 6.4-16** shows the summary of the train operation facilities. According to revised land plan prepared by GOI, two Signal Huts at Klender and Klender Baru were deleted, while one Level Crossing Watchmen Shed at Cakung is added. For all stations, one platform operation office is proposed for passenger operations on each platform.

Table 6.4-16 Summary of Train Operation Facilities

Name of Operation Related Facilities	Jatinegara Operation Center	Substation	Signal Cabin	Signal Hut	Telecom, Equipment Room	Level Crossing Watchman Shed	Platform Operation Office
Area / Name of Station	4,522m2	A306m^2 B293m^2 C351m^2	208.7m^2	108m^2	A216m^2 B92.8m^2 C12.3m^2	A6.8m^2 B4.4m^2	A27m^2 B12m^2
1. Manggarai			●		●A		●A×6
2. Matraman							●B
3. Jatinegara	●		●		●B	●A	●A×4
4. Klender					●C		●B
5. Buaran		●A					●B
6. Klender Baru						●A	●B
7. Cakung				●	●C	●B	●B×2
8. Kranji							●B
9. Bekasi			●		●B	●A	●A×4
10. Bekasi Timur		●B				●A×2	●B
11. Tambun				●	●C		●B×2
12. Cibitung		●B				●A×2	●B
13. Cikarang		●C		●	●C		●B×2
Total Number of Building	1	4	3	3	7	8	27

a) Jatinegara Operation Center

Jatinegara Operation Center is a building from which to operate the main lines which mainly consists of train dispatcher room, telecommunication facilities and future electric power dispatcher room.

b) Substation

Substation is located between Buaran station and Klender Baru station to store transformers for the electric power supply. The single story building will be constructed in reinforced concrete.

c) Signal Cabin

3 Signal Cabins are located at Manggarai, Jatenegara and Bekasi to operate the signals. The two story building will be constructed in reinforced concrete.

d) Signal Hut

3 Signal Huts are located at Cakung Tambun and Cikarang to store the signal machines. Single story building will be constructed in reinforced concrete.

e) Telecommunication Equipment Room

7 telecommunication equipment rooms are located at Manggarai, Jatinegara, Klender, Cakung, Bekasi Tambun and Cikarang to store the telecommunication equipment such as optical fiber terminal, PABX and others. Single story buildings will be constructed in reinforced concrete. As a terminal station, Manggarai has the floor area of 216m2. As main line stopping stations, Jatinegara and Bekasi have the floor area of 92.8m2. The others buildings have the minimum floor area of 12.3m2.

f) Level Crossing Watchman Shed

8 Level Crossing Watchman Sheds are located at Jatinegara, Klender Baru, Cakung, Bekasi, Tambun and Cikarang to secure the safety by using the level crossing protection devices. Single story buildings will be constructed in reinforced concrete. The shed at Cakung is smaller than the others by ROW.

g) Platform Operation Office

Platform operation offices (total 27) are located at each platform of all stations to control the train schedules and to facilitate passenger service. As main line stopping stations, Manggarai, Jatinegara and Bekasi have the larger floor area of 27m2 to handle more passengers. The other stations have the smaller floor area of 12m2.

6.5. Building – Landscape Design

6.5.1. Design Concept

The landscape design concepts developed based on:

1) Function

i) Station plaza as a building front yard and public open space

① The passengers approach to and from the station either with various type of vehicle or by walking, causing a requirement of boarding and alighting area as well as the demand of outdoor meeting point and waiting area for passengers who transfer from related transportation mode.

② On the other hand providing a station plaza is also aiming to facilitate the informal sector in an integrated design and well managed system.

ii) Station Plaza as a node of inter-modal transportation

③ As an inter-modal transportation node, station plaza have to be developed to accommodate a parking facility demand, especially for the private and semi-private transportation mode, though the capacity has to be adjusted.

④ As a DGLC regulation stated that public transportation should not enter the station plaza area, then the design of station plaza will not accommodate public transportation stop inside. As a consequence, DGLC should integrate the plan with Local Government in providing new public transportation stop and traffic regulation, to avoid traffic junction and inconvenience to traffic flow surrounding each station.

2) Design

① As station plaza become a part of station building, then the landscape design itself should always be integrated with station building. Either it is line, pattern or material and color selection.

② Considering the modern expression of station building design, landscape design will also be developed in the same theme as architectural design.

3) Integration to surrounding area

① Since there is no setback area around the station to its adjacent land use next to the site, landscape design in station plaza has to be carefully arranged aiming to get a harmonious design with its surrounding.

② Thus it is important to maintain a buffer area along boundary line to avoid unexpected development in the future.

Provide attractive-continuous pedestrian paths and open space that become an attractive link.

6.5.2. Zoning

The zoning in the proposed station plaza is divided into:

a) Plaza area
b) Taxi waiting and alighting - boarding area.
c) Private car parking and alighting – boarding area.
d) Private motorcycle parking area
e) Public transport stop
f) Pedestrian access
g) Buffer area

6.5.3. Design Criteria

Based on the demand and activities, proposed Station Plaza design at each station is prepared based on these criteria which are:

a) To fulfill facilities requirement
b) To fulfill passengers convenience
c) Get the best movement on vehicle and pedestrian circulation
d) Considering the influence on other traffic facilities movement line
e) Efficiency of facilities placement

6.5.4. Development Design Guidelines

Given that the JICA - DD scope of works are excluded in the Station Plaza area, then the future development design guidelines is needed, especially in the area of Station Plaza. The basic development guidelines are:

a) The Station Plaza development design should be integrated to either government regional plan (related to land use plan and traffic plan) or PT. KAI future development plan.
b) New Manggarai Station as a center of inter-modal transportation point in its regional area might function as an access line toward Northern side to Southern side. Therefore the extension of the passageway should follow the future development area.
c) As one of the important supporting facilities for the stations, parking area should develop further. However, the area should be sufficient and the traffic management should be integrated with the regional traffic management plan. The parking area development could be planned horizontally either vertically.

As a reference, following figures are the basic Conceptual Design of Station Plaza for those 13 stations:

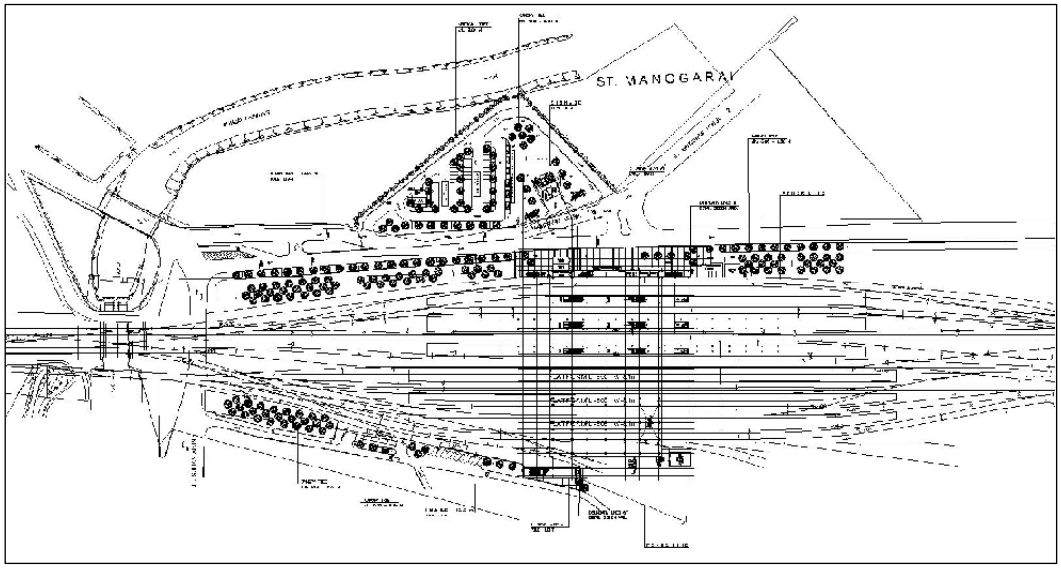

Figure 6.5-1 Manggarai Station

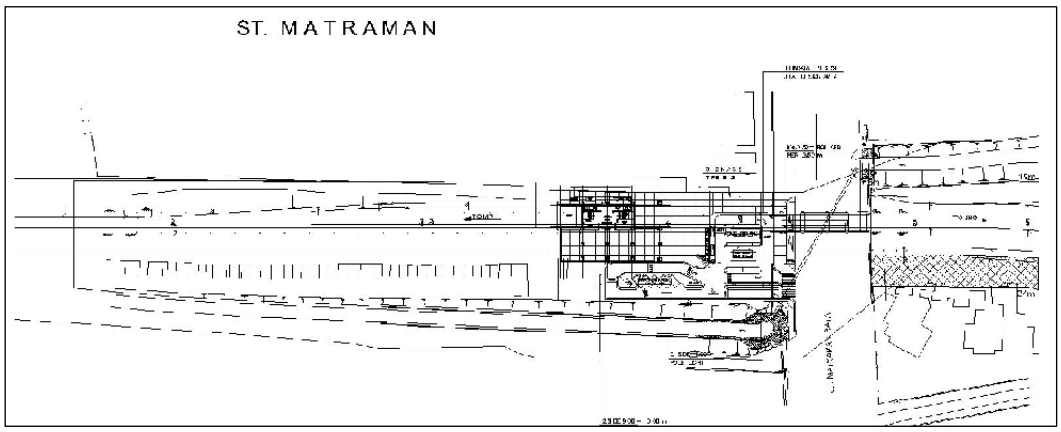

Figure 6.5-2 Matraman Station

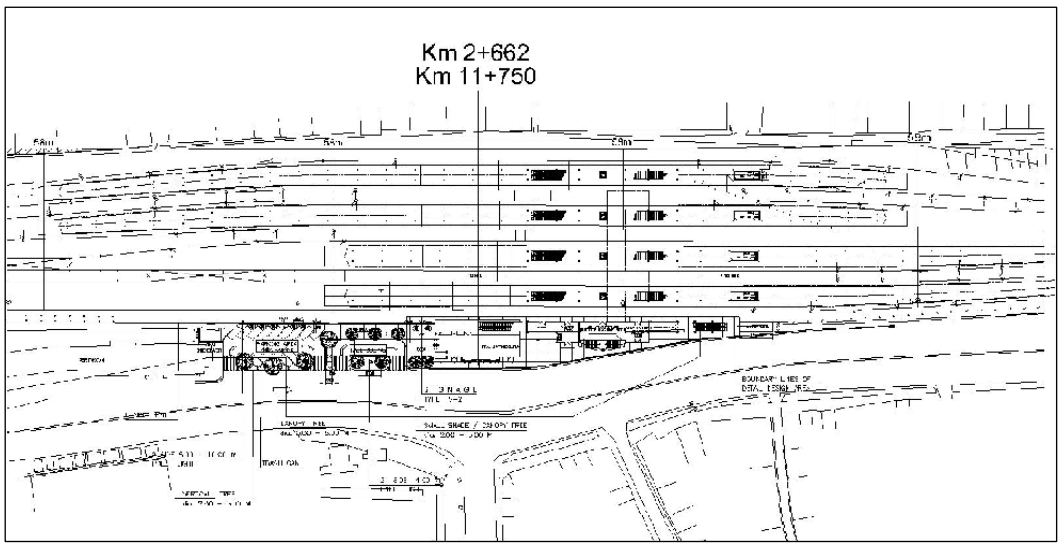

Figure 6.5-3 Jatinegara Station

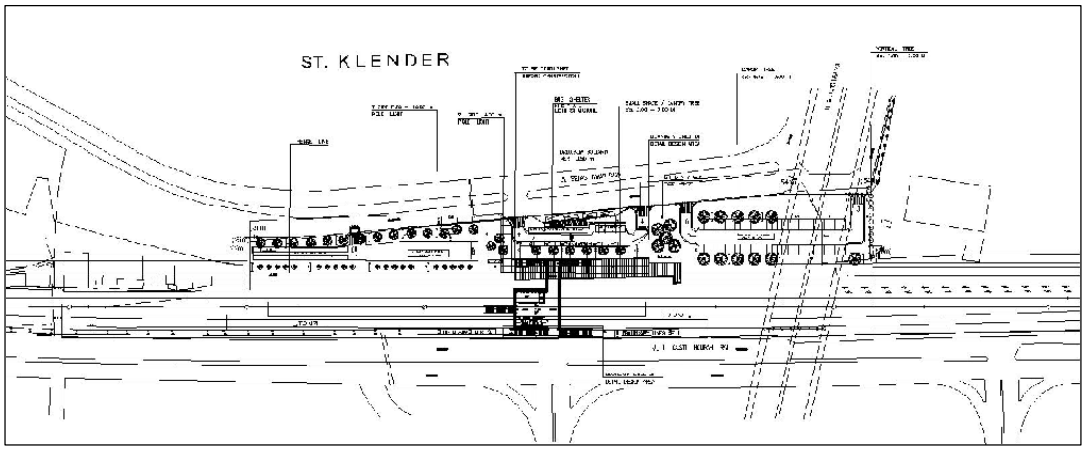

Figure 6.5-4 Klender Station

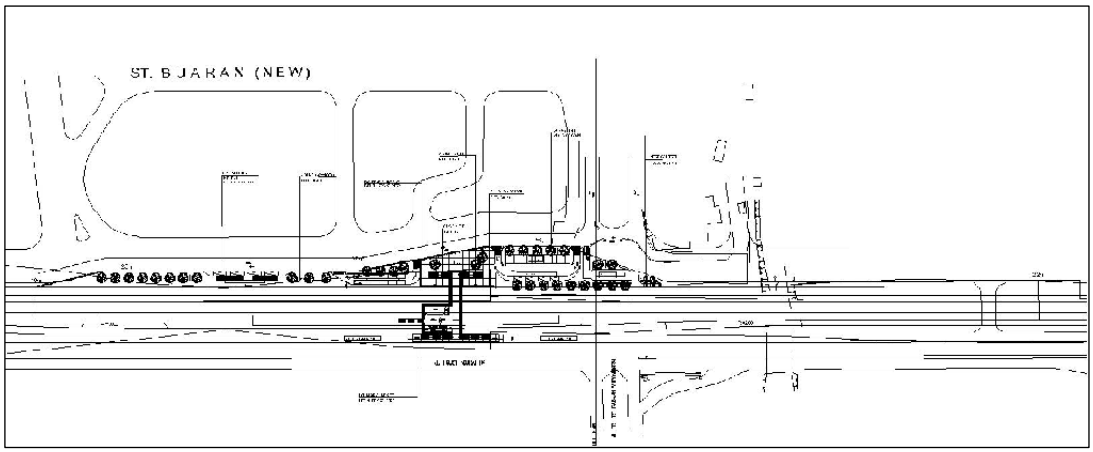

Figure 6.5-5 Buaran Station

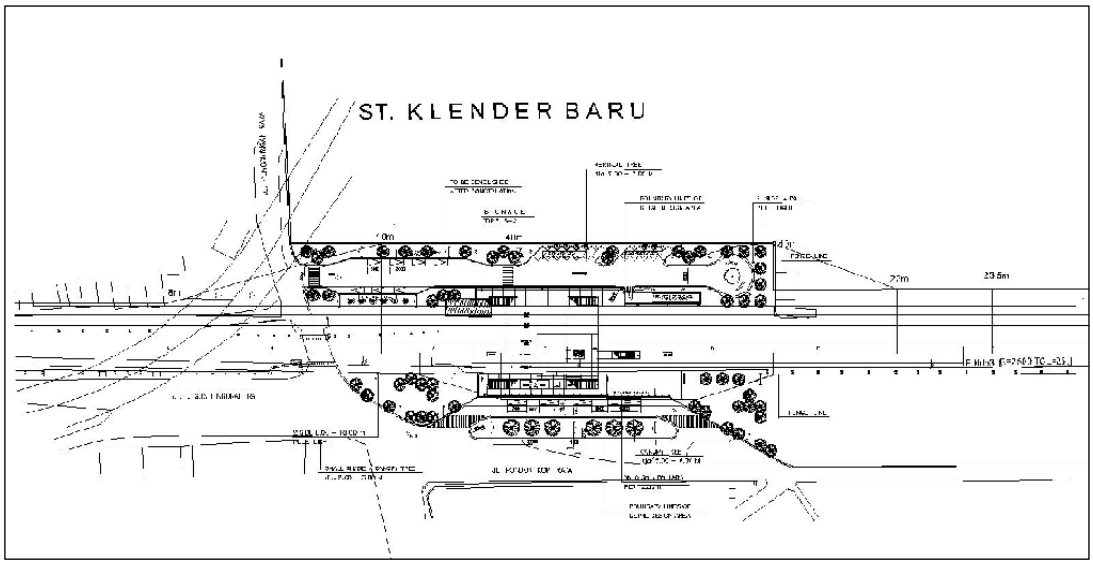

Figure 6.5-6 Klender Baru Station

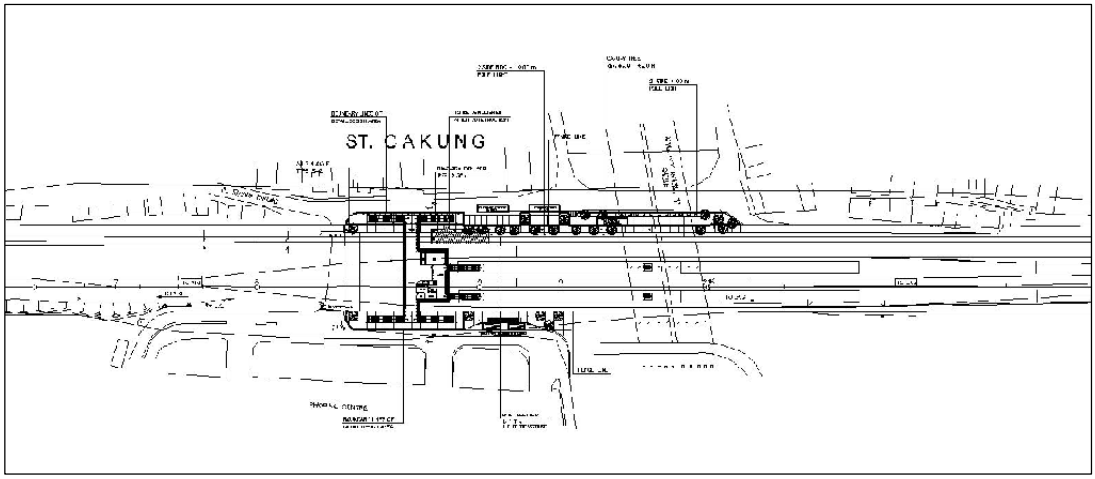

Figure 6.5-7 Cakung Station

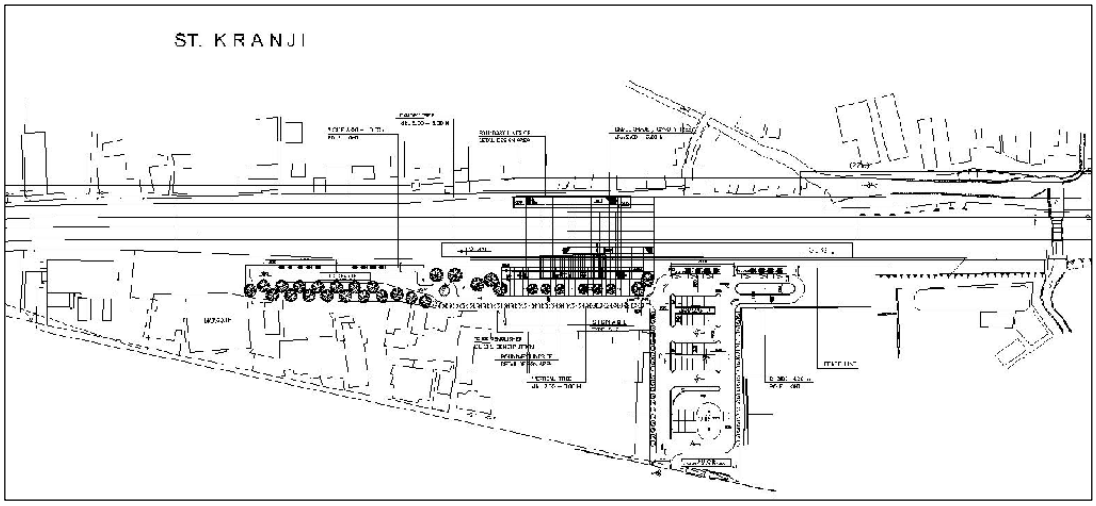

Figure 6.5-8 Kranji Station

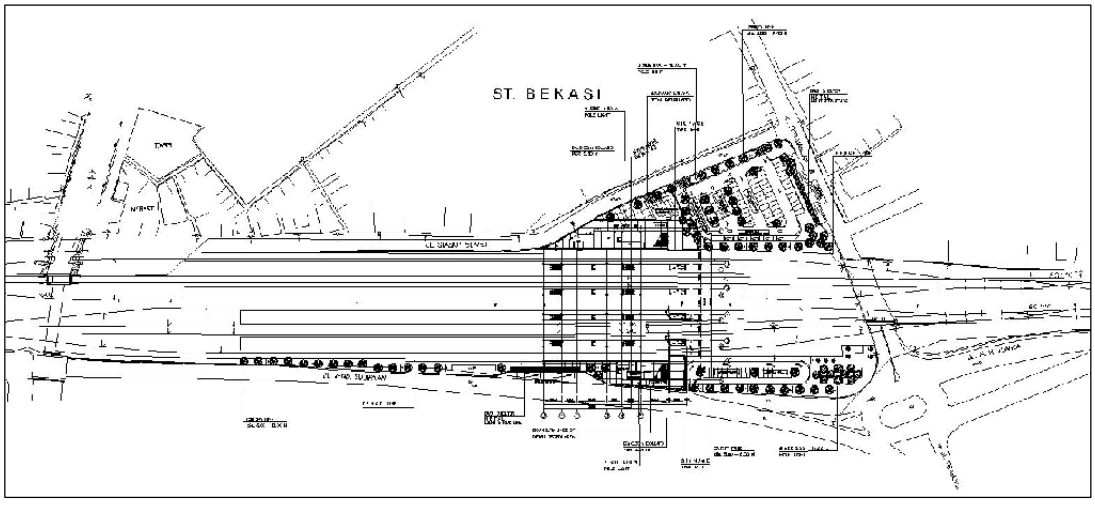

Figure 6.5-9 Bekasi Station

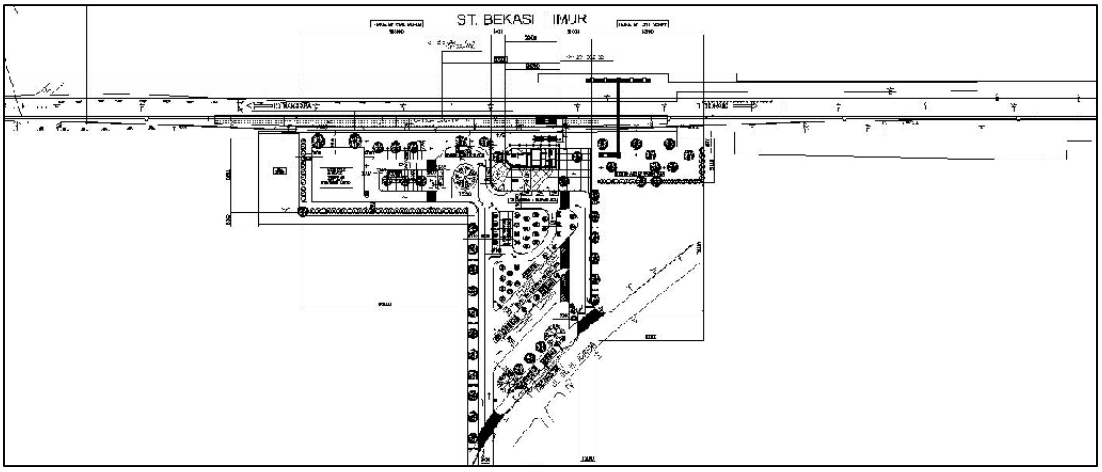

Figure 6.5-10 Bekasi Timur Station

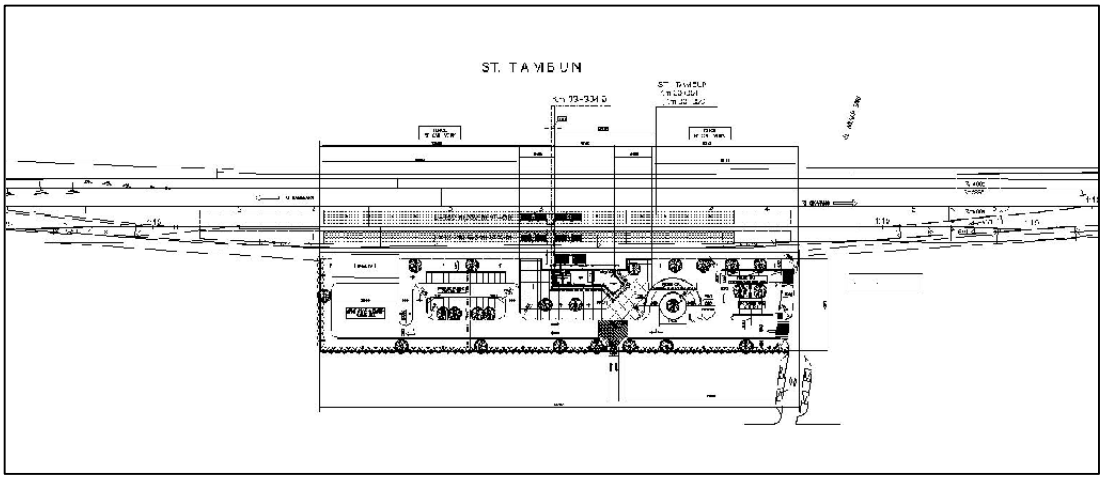

Figure 6.5-11 Tambun Station

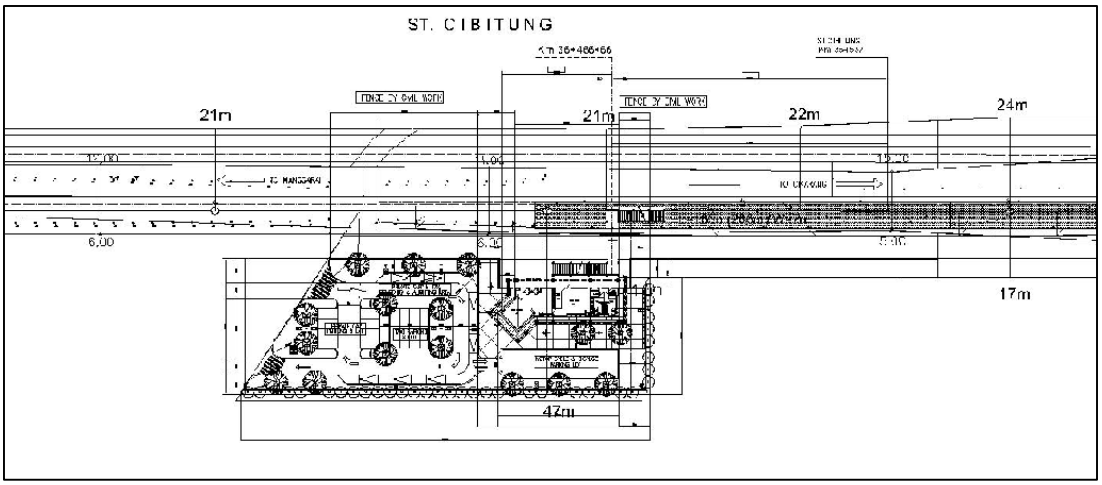

Figure 6.5-12 Cibitung Station

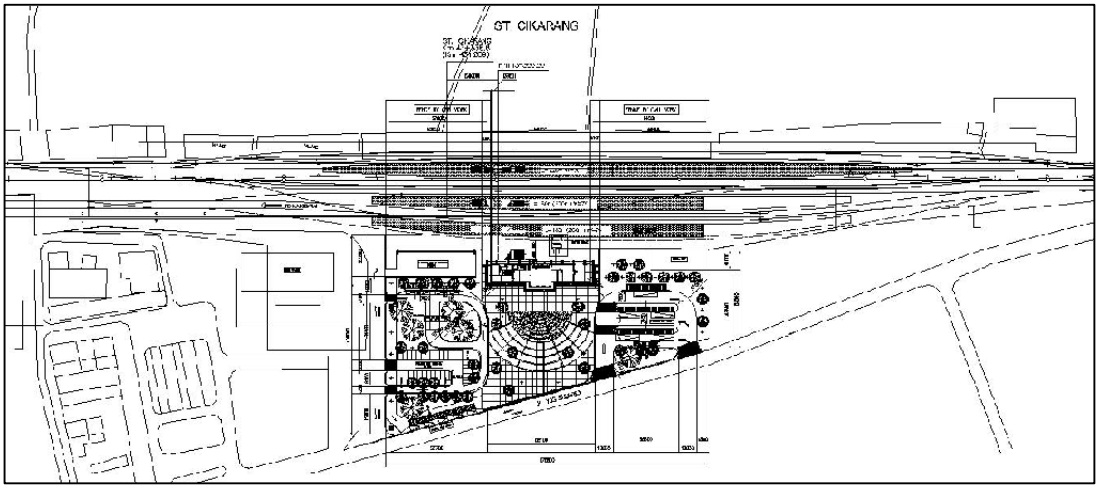

Figure 6.5-13 Cikarang Station

6.5.5. Facility Planning

Table 6.5-1 Facility Planning

No.	STATION	LARGE BUS	SMALL BUS	TAXI WAITING AREA	PRIVATE CAR PARKING	MOTOR CYCLE	OTHER PUBLIC TRANSPORT
1.	MANGGARAI	-	-	26 (B/A = 3)	38 (B/A = 3)	86 M2	-
2.	MATRAMAN	-	-	6 (B/A = 2)	5	71 M2	-
3.	JATINEGARA	-	-	4	14	-	-
4.	KLENDER	-	4	6 (B/A = 5)	56	290 M2	487 M2
5.	BUARAN	-	4	12	15 (B/A = 4)	218 M2	-
6.	KLENDER BARU	-	4	5 (B/A = 3)	7 (B/A = 4)	112 M2	-
7.	CAKUNG	2	-	5	10	261 M2	-
8.	KRANJI	2	2	8 (B/A = 3)	28 (B/A = 3)	462 M2	-
9.	BEKASI	2	2	22	51	170 M2	-
10.	BEKASI TIMUR	6	-	12 (B/A = 3)	32 (B/A = 3)	920 M2	-
11.	TAMBUN	-	-	6	26 (B/A = 3)	225 M2	-
12.	CIBITUNG	-	-	8	8 (B/A = 7)	-	-
13.	CIKARANG	5	-	9 (B/A = 2)	30 (B/A = 2)	-	-

B/A = Boarding and Alighting Area

6.5.6. Detail Design on Building Entrance Yard

a) Pavement

Basically, with its special pattern the broad paved area on each station building entrance yard should become eye-catching elements. This effort is aimed to make station-building frontage as an attractive space for various transit activity as well as for use by the community.

Considering that building frontage will become an area with heavy pedestrian traffic, concrete block pavement is selected to be the material finish on plaza area. A combination of 6 cm thick concrete block type (with compacted sand layer) with 5 cm thick concrete pavement type (with mortar based layer) designed in 4.00 m x 4.00 m geometric shape module, which can be applied either in straight line or in a radiating line following the building orientation. This mortar based concrete pavement will tie in the concrete block pavement. A fine coral stone finish in more flexible pattern placed as an edging in some location.

In order to show off the architectural form, the pavement colour scheme should be neutral, in gradation of grey and semi-red colour as an accent.

To achieve good quality of pavement area, the criteria to be followed are:

- Compacted sub base layer;
- Slope to run surface water;
- Durable pavement type;

Table 6.5-2 Finishing Materials for Pavements

	Material Types	Specification		Module
		Dimension	Color	
1.	Concrete block Rectangular	10.5cm x 10.5cm	Grey	4.00 m x 4.00 m
2.	Concrete block Rectangular	21.5cm x 10.5cm	Grey	As edging
3.	Concrete pave	40cm x 40 cm	Semi red	4.00 m x 4.00 m
4.	Fine coral stone layer	Variable	Black	Variable as edging / filler

b) Fence

A transparent type fence placed between building frontage and platform area, designed from painted cast iron above and low wall below. As the floor level is different between plaza area and platform area, there is a difference in its height; and the minimum height is 2.00 m high from platform area. This is to fulfill the safety and security needs.

In order to create a continuous design on station façade, a finishing material used as in building wall finishes will be applied on the bottom of fence.

c) Lighting

Sufficient light with simple decorative and low pole lighting makes the station-building frontage more attractive. High pole lighting is located along the property line and the continuous pedestrian path, as well as bus stop and parking areas.

Two types of pole light are selected and placed in plaza areas. One is 4.50m – 4.70m high pole light and located on average every 12 m. Another is 10.00m high pole light and located on average every 30 m. These will give an even and sufficient light around building frontage.

Table 6.5-3 Type of Pole Lighting

No	Light Types	Specification		Lamps Type
		Dimension	Color	
1.	Pole light (2 sides)	4.50m–4.70m high	Painted Aluminum Grey Metallic color	HID Lamps type 2 x 150W / 250 W w/ diffused glass
2.	Pole light (2 sides)	10.00m high	Painted Aluminum Grey Metallic color	HID Lamps type 2 X 400W w/ clear glass

d) Plants

Trees are the plants type selected to be installed in building front area, located in several spots with variable distance. This is to keep the building façade easily seen from the main access.

On the other hand trees also function to create shade as well as to create an aesthetic framing to building façade.

The criteria are as follows:

- Have a round to oval canopy shape (4.00m – 6.00 m in diameter)
- Foliage or flowering evergreen
- Have a sufficient foliage density to create shade
- Have a relatively straight main trunk
- Low maintenance cost

To keep integrated with the pavement pattern a steel tree-grate installed in each tree bottom surface. This will also keep the bottom area clean and flat and easy to maintain.

A composition of vertical trees and shrubs underneath will be plants in a row along boundary lines, as a buffer between station area and the other land use on its sides.

The criteria of buffer trees are:

- Vertical shape
- Foliage or flowering evergreen
- Have a sufficient foliage density to create buffering
- Have a relatively straight main trunk

- Low maintenance cost

The criteria of shrubs on buffer boundary area are:

- Foliage or flowering evergreen
- Have a sufficient foliage density
- Low maintenance cost

Table 6.5-4 Variation of Plants

No	Name		Category	Optimum Specification	
	Botanical			Height	Diameter
1.	**Araucaria exelsa**	Cemara Norfolk	Vertical tree	6.00m–8.00m	3.00m
2.	Cassuarina equisetifolia	Cemara Angin	Vertical tree	6.00m–8.00m	4.00m
3.	Cordea sebestena	Jati Mas	Canopy tree	4.00m–5.00m	4.00m
4.	Fillicium decipiens	Kiara Payung	Canopy tree	5.00m–6.00m	5.00m
5.	Ixora javanica	Soka Jawa	Shrubs	0.50m–0.70m	0.50m
6.	Pedylanthus tihtymaloides	Susurubadak	Shrubs	0.50m–0.70m	0.50m
7.	Phyllantus multiflorus	Taiwan beauty	Ground cover	0.30m	0.30m

e) Landscape Furniture

Single roll of bollards located along the station plaza has functions as safety buffer for pedestrian paths. The element of landscape furniture will consist of:

- Signage: Location Name Board and Directory
- Trash bin
- Bollard

Signage

To provide safely access and to facilitate easy orientation toward station building, directory and signage are placed properly, especially in the main entrance and some other entrance-exit points' area.

Table 6.5-5 Signage

No	Items	Specification		Location
		Dimension	Material	
1.	Location Name Board	4.40m X 1.60m (overall)	Fluorescence letter on blue painted steel plate	Main access to plaza area
2.	Directory Board	0.70m X 1.60m (overall)	Fluorescence letter on steel plate	Access to station building, Boarding & Alighting area.

Trash bin

Distribute in a same location as the lighting pole located, to achieve an integrated placement of landscape furniture / element.

Table 6.5-6 Trash Bin

No	Items	Specification		Location
		Dimension	Material	
1.	Trash bin	0.50m diameter 0.80m high	Painted cast iron frame w/ fiber glass can inside	Next to lighting pole

Bollard

To provide safety factor for pedestrian, a row of bollards placed on edge of plaza area, in area where pedestrian meets vehicle access.

Table 6.5-7 Bollard

No	Items	Specification		Location
		Dimension	Material	
1.	Bollard	0.20m diameter 0.80m high	Grey cast iron with fluorescents sign	Plaza area edge

6.6. Building – Structural Design

6.6.1. General Criteria

The structural design must achieve stability, stiffness and strength for the combination of dead load, live load, wind load, seismic load, and crane load, based on the Indonesian Code SKSNI T15-1991-03; SKBI-1.3, 53.1987 UDC:624.042; SKBI-1.3,53.1987 UDC: 699.841; SKBI 1.3, 55.1987 UDC: 693.814.

Some important factors, which should be taken into account in the design, should include soil conditions, existing track layout, adjacent railway structures, maintenance of train operations during construction, and the inconvenience of passengers during construction.

The structures that relate to the train tracks and platforms are designed separately under the scope of Civil engineering works.

6.6.2. Method of Analysis

To determine maximum force in the building structures, maximum combination loading is based on the Indonesian Code SK SNI T15-1991-03.

A Upper Structure

1) Roof

Roof systems consist of space frame truss, plane truss, and gable frame. Space truss is analyzed by using three-dimension method, while plane truss and gable frame are analyzed in two-dimension. Reaction force of roof is transferred to columns and down to foundation.

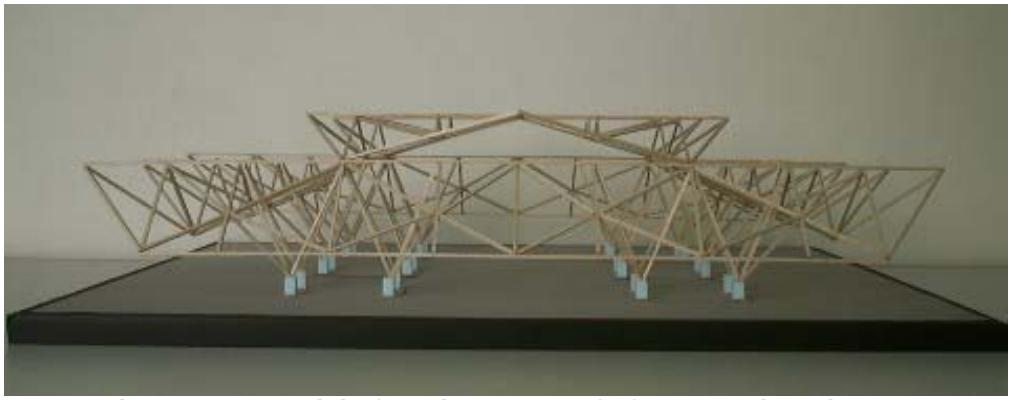

Figure 6.6-1 Model of Keel Truss Roof of Mangarai Station

2) Concourse Structure:

The structural frame is designed as three-dimension bending moment frame system.

B. Substructure

Bearing capacities of bored pile and direct foundation are decided by the formula according to Foundation Analysis and Design (Joseph E. Bowles), and shall be confirmed by Loading Test.

6.6.3. Main Structure of Station

Two kinds of space truss frame are adopted. One is Keel Truss and another is Arch Truss. The model photograph of Manggarai station is shown at Figure 6.6-1 and detail of Truss Post is shown at Figure 6.6-2.

The main structural materials of the station buildings are shown below.

Table 6.6-1 Main Structural Materials of the station buildings

Type of Station	Over Track Stations			Under Viaduct Stations	Grade Level Stations
Name of Station	Manggarai	Jatinegara	Bekasi Klender Buaran Klender Baru Cakung Kranji	Matraman	Bekasi Timur Tambun Cibitung Cikarang
Roof Frame	Steel Keel Truss	Steel Keel Truss	Steel Arch Truss	Steel Bending Moment Frame	Steel Truss
Roof Support	Reinforced Concrete	Steel	Steel	Steel	Reinforced Concrete
Concourse Floor Frame	Steel	Steel	Steel		
Concourse Column	Reinforced Concrete	Steel	Steel		
Foundation	Bored Pile	Bored Pile	Bored Pile	Direct Continuous Footing	Direct Rubble Stone

Note;Floor slab in concourse is pre-cast concrete panel.

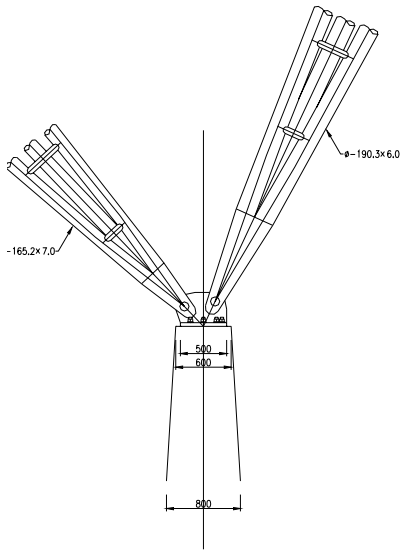

Figure 6.6-2 Detail of Truss Post

6.6.4. Design Load

A. Dead Loads

Weight of material and components are based on the Indonesia Loading Code for Building (SKBI 1987) as follows:

Steel	77.00	kN/m^3
Reinforced Concrete	24.50	kN/ m^3
Mortar	20.50	kN/ m^3
Brick/ Full Brick (satu batu)	4.50	kN/ m^2
Brick/ Half Brick (setengah batu)	2.50	kN/ m^2
Ceiling without Hanger	0.11	kN/ m^2
Ceiling Hanger	0.77	kN/ m^2
Roof Tile Metal	0.10	kN/ m^2
Floor Tile (per cm thickness)	0.24	kN/ m^2
Granite	26.00	kN/ m^3

B. Live Loads

Live loads are basically taken from the Indonesia Loading Code for building (SKBI 1987) and Japan National Railway Building Design Information (1982) as follows:

Concourse	5.0	kN/ m^2
Office	2.5	kN/ m^2
Maintenance Room	2.5	kN/ m^2
Bridge	5.0	kN/ m^2
Signal Device Room	1.5	kN/ m^2

Live loads defined by Japan National Railway Building Design Information (1982) are shown at Table 3.10.2 for reference.

Table 6.6-2 Live Load

Usage	For Slab	For Frame	For Seismic	Note
Roof	1.8	1.3	0.6	
Office	3.0	1.8	0.8	
Concourse	5.0	3.4	2.1	
Corridor Staircase Landing Bridge	5.0	3.4	2.1	Load can be deducted when roof is not used.
(For Reference) Car parking	5.0	3.4	2.1	
	(5.0)	(4.0)	(2.0)	

(unit ; kN/m^2)

C. Loading Combinations

For Permanent Load 1.2 DL +1.6 LL

For Temporary Seismic Load
1.05 (DL + LLR + Ex + 30% Ey)
1.05 (DL + LLR + Ex - 30% Ey)
1.05 (DL + LLR - Ex + 30% Ey)
1.05 (DL + LLR - Ex - 30% Ey)
1.05 (DL + LLR + 30%Ex + Ey)
1.05 (DL + LLR + 30%Ex - Ey)
1.05 (DL + LLR - 30%Ex + Ey)
1.05 (DL + LLR - 30%Ex - Ey)

For Temporary Wind Loading 1.05 (DL + LLR + WL)

※ DL : Dead Load
LL : Live Load
LLR : Live Load Reduction
E : Seismic Load
WL : Wind Load

6.7. Building – Mechanical & Electrical Design

6.7.1. Mechanical Design

(1) Water Supply System

1) A water supply system will be provided at the stations and buildings to meet the requirements of city water demand to use for general purpose for staff, toilet flushing, station washing, make-up water for fire storage tank and the like.

- Each building will be provided with a Water Reservoir and Potable Water Supply Booster System except ground floor stations as of Matraman, Bekasi Timur, Tambun, Cibitung Stations.
- City water supply is directly supplied to this Water Reservoir and then Water Booster Pump Unit shall be distributed to the required places such as toilets, AC make-up water, building cleaning taps, and valve supply for restaurant etc..

2) If there is no city water supply to the buildings and stations, the raw-water must be supplied by deep well. The deep-well water will have at Bekasi Station, Jatinegara Operation Centre, Cipinang Yard Locomotive Depot and Coach Depot.

3) The water reservoir will have a combined capacity for general water use and fire water storage tank.

4) Water supply system will have gravity supply from city main directly or pressure rise pumping system by booster pump.

- The Gravity Type from city main supply directly(no water reservoir and booster pumping unit) will be: Matraman, Bekasi Timur, Tambun, Cipinang Stations and other small buildings such as Signal Cabins, Signal Huts, Level Crossing Watchman Huts, Sub-stations etc.
- The Pressure Rise Booster Pumping System will be at :
  - i) Manggarai Station
  - ii) Jatinegara Station
  - iii) Jatinegara Operation Centre
  - iv) Klender Station
  - v) Buaran Station
  - vi) Klender Baru Station
  - vii) Cakung Station
  - viii) Bekasi Station
  - ix) Cipinang Yard Locomotive Depot and Coach Depot
  - x) And Cikarang Station

Table 6.7-1 The Water Supply Condition

No.	Location	Design Requirement Water Capacity (l/min) (A)*	Existing Water Pressure (kg/cm²)	Enough Water from City Supply (Y or N)	Required Deep Well (Y or N)
1.	Manggarai Station	300(65)	1.5	Y	N
2.	Matraman Station	20 (20)	1.5	Y	N
3.	Jatinegara Station	110 (32)	1.5	Y	N
4	Klender Station	42(20)	1.5	Y	N
5	Buaran Station	21(20)	1.5	Y	N
6	Klender Baru Station	30 (20)	1.5	Y	N
7	Cakung Station	47(25)	1.5	Y	N
8.	Kranji Station	47(25)	1.5	Y	N
9.	Jatinegara Operation Centre	115	-----	N	Deep well
10.	Cipinang Yard: Locomotive Depot	100 (general) 200(washing)	-----	N	Deep well
11.	Cipinang Yard: Coach Depot	35 (general) 160(washing)	-----	N	Deep well
12	Bekasi Station	210		N	Deep well
13.	Bekasi Timur Station	58(25)		Y	N
14.	Tambun station	47(25)		Y	N
15.	Cibitung Station	19(15)		Y	N
16.	Cikarang Station	79(32)		Y	N

The calculation data is based on 98 – 147kpa (1.0~1.5 kgf/cm²) of city water supply at each Location and 40 m lengths of branch pipe from city main. (Legend: Y = Yes, N = No)

Water Booster Pumping System of Cipinang Yard Water Supply will be separate systems such as general use and Locomotive/Coach washing. Also, the system complete will be divided for Locomotive Depot Zone and Coach Yard Zone. (For the Locomotive Depot, two booster pump units will be provided, one booster unit for general use, the other for Locomotive washing use. For the Coach Yard, also two booster pump units will be provided, same type as the Locomotive Depot, one for general, the other for washing.)

Table 6.7-2 Estimated Water Demand of Grade Stations

No.	Station	Passenger in 2015 (person/day)	Max. Water Consumption (litre/hour)
1.	Matraman Station	9,737	1,190
2.	Bekasi Timur Station	30,039	3,442
3.	Tambung Station	23,608	2,795
4.	Cibinaung Station	9,079	1,118

City water supply will be distributed directly to toilet fixtures and faucets byway of water gravity.

Table 6.7-3 Estimated Water Demand of Booster Rise Pumping System

No	Station	Passenger in 2015 person／day	Max. water consumption litre／hour	Capacity of pressure pump (pressure rise pump unit with pressure tank)
1	Manggarai Station	153,500	17,934	150 lit/minx30mx3Nos
2	Jatinegara Station	50,473	6,106	55 lit/minx30mx3Nos
3	Jatinegara Operation Building	230	6,800	60 lit/minx50mx3Nos
4	Klender Station	21,304	2,502	25 lit/minx30mx3Nos
5	Buaran Station	9887	1,206	20 lit/minx30mx2Nos
6	Klender Baru Station	14,277	1,768	15 lit/minx30mx3Nos
7	Cakung Station	23,587	2,773	25 lit/minx30mx3Nos
8	Kranji Station	23,587	2,773	25 lit/minx30mx3Nos
9	Bekasi Station	106,253	12,341	100 lit/minx30mx3Nos
10	Cikaran Station	39,250	4,694	40 lit/minx30mx3Nos

Water demand will be considered as Hourly Demand: Maximum Demand (average x 2): Peak Demand(average x 3).

Pump capacity will meet the Maximum water Demand, and 10 hours operation per day normally.

1 in 3 Pumps is used one for stand-by (2 pumps parallel and 3 pumps alternate operation)

Table 6.7-4 Water Reservoir Capacity

No	Location	Equipment number	Effective capacity (m^3)	Water City/Well	Pressure rise pump for distribution Y or N
1.	Manggarai Station	WT-	63.0	City water	Y
2.	Matraman Station	-----	-----	-----	N
3.	Jatinegara Station	WT-	30.0	As shown	Y
4.	Jatinegara Operation Center	WT-	39.0	As shown, deep well	Y
5.	Klender Station	WT-	6.5	As shown	Y
6.	Buaran Station	WT-	3.0	As shown	Y
7.	Klender Baru Station	WT-	4.5	As shown	Y
8.	Cakung Station	WT-	7.0	As shown	Y
9.	Kranji Station	WT-	7.0	As shown	Y
10.	Bekasi Station	WT-	30.0	As shown	Y
11.	Cipinag, Locomotive	WT-	120.0	As shown	Y
12.	Cipinang, Coach Depot	WT-	350.0	As shown	Y
13.	Bekasi Timur Station	-----	-----	-----	N
14.	Tambun Station	-----	-----	-----	N
15.	Cibitung Station	-----	-----	-----	N
16.	Cikarang Station	WT-	12.0		Y

The capacity of water reservoir will be calculated a half day of one day general use + fire water storage capacity.

(2) Deep Well System

1) Deep Well system will be provided at Jatinegara Operation Centre, Bekasi Station, Locomotive Depot and Coach Depot at Cipinang Yard. Basically no City Water Main will be provided around the site area.
   Each System will provide Water Reservoir and same system to have a half day capacity and booster pump unit.
2) Each deep well should be at least 100m apart, and kept a proper distance away from the boundary line according to local requirements.
3) A deep well to supply the required water from approximate 250m depths will be studied.
4) The pump shall be designed based on the bore well size and the water supply system based on local regulations up to 150 litres/minutes capacity, 8 hours operation per one day maximum. The bore well diameter shall be a minimum of 150 mm.
5) Estimated pump capacity
   50mm diameter x 150 liters/minute x 200 mHead x 9.0kw x 380v x 50Hz
   i) Jatinegara Operation Centre : 1 Deep Well

ii) Bekasi Station : 1 Deep Well
iii) Cipinang Locomotive Depot : 2 Deep Wells
iv) Cipinang Coach Depot : 5 Deep Wells

(3) Drainage System

The drainage system will carry the combined waste from each buildings, such as from toilet flushing, urinal, wash basin, floor drain, building cleaning, kitchen drain etc. The piping will have a gravity drain to waste treatment plant located externally as shown on the drawings. Any waste piping will have the standard slope in 1/100, and closed circulation venting system as shown on the drawings.

(4) Sanitary Fixture System

All sanitary fixtures will be made from first class vitreous China. For the Male and Female toilets, there will be as appropriate:

1) Water Closet:
   i) Western type with cistern, washing tub, fittings
   ii) Arabic type with cistern, washing tub, fittings
   iii) Handicap western type with cistern, washing tub/fittings
2) Urinal: Wall Hung type with cistern
3) Lavatory: Counter top or Wall Hung type
   Faucet: Wall Mounted Type, Counter Mounted Type
4) Floor Drain: Floor Screen, with Trap,
5) Faucet: with vacuum breaker function

(5) Waste Treatment Plant System: (Combined treatment type on site by activated sludge organisms)

All soil and waste water from toilets and other drains will be collected at the waste treatment plant. The System will consist of No-1 Anaerobic Contact Bed, No-2 Anaerobic contact, Bio-Filtration Tank, Treated Water Tank and Discharge Tank with Disinfection Equipment, Discharge Sump Pumps. Also the system will be provided circulation pumps and aeration blowers at proper positions as shown on the drawings. All treatment system has an adjustment tank and/or discharge tank with submersible pumps as shown on the drawings.

1) Manggarai Station

Inflow	Soil/Waste Water	80.7 m^3 /day BOD 300 ppm
Outflow		BOD 10 ppm

2) Jatinegara Station

Inflow	Soil/Waste Water	27.5 M^3/day BOD 300 ppm
Outflow		BOD 10 ppm

3) Matraman Station

Inflow	Soil/Waste Water	5.0 M^3 / day BOD 300 ppm
Outflow		BOD 10 ppm

4) Jatinegara Operation Centre

Inflow	Soil/Waste water	20.0 M^3/ day BOD 300 ppm
Outflow		BOD 10 ppm

5) Bekasi Station

Inflow	Soil waste	55.54M^3 /day BOD 300 ppm
Outflow		BOD 20 ppm

6) Other Stations

Klender Stn.	Soil/Waste Water	111.26 M^3 / day BOD 300 ppm
Buaran Stn.	Ditto	5.43 M^3 / day BOD 300 ppm
Klender Baru	Ditto	7.96 M^3 / day BOD 300 ppm
Cakung Stn.	Ditto	12.48 M^3 / day BOD 300 ppm
Klanji Stn.	Ditto	22.72 M^3 / day BOD 300 ppm
Bekasi Timur	Ditto	15.50 M^3 / day BOD 300 ppm
Tambun Stn	Ditto	12.60 M^3 / day BOD 300 ppm
Cibitung Stn	Ditto	5.10 M^3 / day BOD 300 ppm
Cikaran Stn	Ditto	21.10 M^3 / day BOD 300 ppm
Outflow	All Stations	BOD 20 ppm

7) Cipinang Depot and Coach Yard

Admin/Monthly	20.00 M^3 / day BOD 300 ppm
Daily/Yardman	3.45 M^3 / day BOD 300 ppm
CoachContractor Office/Yardman	4.80 M^3 / day BOD 300 ppm
Cipinang Station.	2.00 M^3 / day BOD 300 ppm
Signal Cabin	1.50 M^3 / day BOD 300 ppm
Bridge Maintenance	3.30 M^3 / day BOD 300 ppm
Outflow	BOD 20 ppm

(6) Incinerator System

The Incinerators will be provided at the main stations such as Manggarai, Jatinegara, Bekasi stations, and also will be provided at Cipinang Coach Yard. The function is to consume in environmentally controlled manner rubbish, litter and other discarded and burnable materials obtained from cleaning and sweeping on the station premises and from the cleaning of the trains.

1) Consumables : Vinyl, Food leftovers, Paper, Book, Waste, Oil etc.
2) Location : Outdoor type
3) Burning fuel : Diesel oil
4) Operation : Fully automatic operation
5) Stack : Stainless steel
6) Environmental Specification : No dioxin emissions, no exhaust smoke
7) Locations and incinerator's capacity within 5 hours a day:

Manggarai Station:

153,500pers/1000x3kg/day/persx50%x1/5hrs,day= 46.05 kg/day

Jatinegara Station:

50,473pers/1000x3kg/day/persx50%x1/5hrs,day= 15.14 kg/day

Bekasi Station:

106,253pers/1000x3kg/day/persx50%x1/5hrs,day= 31.8 kg/day

Cikaran Station:

39,250pers/1000x3kg/day/persx50%x1/5hrs,day = 11.77 kg/day

(7) Fire Protection System

The fire protection system will be provided for large stations and buildings such as Manggarai, Jatinegara, Bekasi stations, Jatinegara Operation Centre and Buildings at Depot Area so that all staff could carryout fire-fighting activity when a fire occurs in the station, building and on the platform. The design will meet the local regulations and requirements.

1) Portable Extinguishers
   a) Platform Housing Area:
      ABC type of CO2 or chemical dry powder over 3.5kg capacities will be located near to staircase.
   b) Station Building:
      ABC type of CO2 or Chemical Dry Powder over 3.5kg capacities will be located at every 20m interval and provided for each room.
   c) Substation:
      BC type of CO2 powder chemical over 25kg-capacity with wheels will be located at every 100m^2 of room area.
   d) Control room, mechanical and electrical room, and kitchen:

ABC type of CO2 or chemical dry powder over 6.0kg capacities

2) Fire Hydrant and Cabinet

The Fire Hydrant System for Building will be provided with fire pump, and distribution piping and Fire Hydrant Valve.

a) Local Regulations:

Manggarai Station, Jatinegara Station, Bekasi Station, Jatinegara Operation Center and Depot Buildings such as Administration, Monthly / Daily Inspection Sheds

b) Location:

The Fire Hydrant will be provided to meet local regulations and requirements or where an area or room exceeds 800m². Every interval to hydrant cabinet will be kept maximum 30m cover lengths.

c) Hydrant Flow Rate:

Water spray capacities of each nozzle to be 150 litres per minute with 40mm diameter size,30m long hose with over 166kpa(approx.1.7 kgf/cm²) and 686kpa (approx. 7 kgf/cm²)maximum discharge pressure. Steel made hydrant cabinet with portable fire extinguishers requirements within same cabinet.

3) Fire Pumps

The fire pump will meet the local regulations and requirements,

4) Fire Water Source

a) The water storage capacity will be required by local regulations and International standard.

b) The required water capacity of water storage tank will be minimum 150liters/minutes, cabinet x 5 cabinets maximum x 20 minutes durations x safety factor(1.2)

(8) Ventilation System

The ventilation system will be provided to circulate and to exchange fresh air supply within the environment of the stations and buildings. The ventilation system is to provide both natural and mechanical methods to achieve positive or negative room pressure according to the requirements.

1) Natural Ventilation with Grille or Louver

This is provided for all standard rooms and for those rooms where air circulation is required.

2) Ventilation Method

Supply and exhaust fans make air movements from outside to inside and inside to outside to circulate the air.

3) Heat Exchanged Exhaust Fan

This equipment will provide exhaust air and fresh air intake at the same time. It will be provided for Air-cooled rooms for energy saving purpose. The equipment schedule will be

shown in the drawings.

(9) Air-Conditioning System

The AC system is to provide convenience and comfortable working atmosphere for station staff and an agreeable atmosphere for passengers and visitors. For the limited rooms within the large station such at Manggarai Station etc., there must be adequate air conditioning. Design Criteria for AC Load Calculation will be as :

1) Geographical Condition

Latitude : 06° 12' 35" S
Longitude : 106° 50' 45" E
Sea Level : 13.70 m

2) Outdoor average temperature at Jakarta will be:

DB : 32.9°C
RH : 69%
Wind : Average 4 knot (7.4km/ hr), Max. Average 15 knot

3) Indoor condition for air conditioning

DB : 25°C

The system will be considered to provide different rooms and operations.

i) Air-Cooled Heat Pump and Water Chillier + Fan Coil Unit --- For Large Area or synchronized Operations ---such as Station Master, Station Office, Station Meeting Rooms etc..

ii) Air-Cooled Separate type Air-Conditioner --- Limited Area such as Lounge,

iii)Heat Pump Multi-Type Air Conditioner

Each station's cooling load will be calculated.

6.7.2. Electrical Design

(1) Power Supply System.

1) Supply Voltage and Back-up Power Supply

The primary AC (alternating current) electrical power will be supplied to each station and building by PT.PLN switching station. Power supply for Manggarai, Jatinegara and Bekasi Stations and Jatinegra Operation Center are mainly medium voltage. Also will be provided by back-up sources of generator. Power supply for Matraman, Klender, Buaran, Klender Baru,Cakung, Kranji, Bekasi Timur, Tambun, Cibitung and other small buildings such as signal cabin, signal hut, level crossings etc. will be supplied by PLN switching equipment only.

2) Main and Back-up Power Supply Capacity

Power supply capacity will be calculated based on the maximum demand and required

load analysis. The details are in the following table:

Table 6.7-5 Main and Back-up Power Supply Capacity

	Building	Maximum Demand KVA	Generator Load KVA	Emergency Load KVA	PLN Capacity KVA	Generator Capacity KVA
1	Manggarai	452.3	240.26	90.43	485	250
2	Matraman	35.55	None	None	41.5	None
3	Jatinegara	356.4	207	97.7	380	200
4	Klender	46.19	None	None	53	None
5	Buaran	48.4	None	None	53	None
6	Klender Baru	51.4	None	None	53	None
7	Cakung	62.45	None	None	66	None
8	Kranji	55.95	None	None	66	None
9	Bekasi	370.95	218	102	380	200
10	Buaran	23.1	By others	By others	23.1	By others
11	Cakung Signal Hut	17.6	None	None	17.6	By others
12	Jatinegara Operation Centre	706	458	17	725.0	500
13	Manggarai, Jatinegara & Bekasi Signal Cabin	17.6	None	None	17.6	By others
14	Telcom Equipment Room	10.0	By station	10.0	By station	By station
15	Level Crossing Watchman	2.2	None	None	2.2	None
16	Platform Operation Office	1	1	1	By station	By station
17	Bekasi Timur	33.98	None	None	41.5	None
18	Tambun	25.87	None	None	33	None
19	Cibitung	20.53	None	None	23	None
20	Cikarang	48.92	None	None	53	None
21	Cikarang Sub Station	12.87	None	None	13.2	By others
22	Belksi Timur Sub Stn	12.87	None	None	13.2	By others
23	Cibitung Sub Station	12.87	None	None	13.2	By others
24	Tambun Signal Cabin	4.0	None	None	6.6	By others
25	Cikarang Signal Hut	4.0	None	None	6.6	By others

3) Main Distribution Electrical Switchboard (MV-MDB)

MV (Medium-Voltage)-MDB for 20kV switching with protection devices will be provided in Medium Voltage room. The protection device in MVMDB will be such as:

-Under Voltage
-Over Voltage
-Over Current
-Ground Fault

The circuit breaker will be Vacuum Circuit Breaker. MV-MDB will be provided with Lightning

arrester to protect surge through PLN power supply network.

4) Low Voltage Supply

PLN main power of medium voltage 20 KV and 50 Hz is transformed to resist the medium voltage to 400 V, 50 Hz. All electric equipment and accessories for related to uninterrupted operation, the electrical supply system will have as follows:

a) Primary incoming of Transformer: 3 Phase, 3Wire, 20 KV +/- 5 %
b) Secondary outgoing of Transformer:3 Phase, 4 wire, 400/230 V, solid-earthed neutral TT-System
c) Generator Output: 3 Phase, 4 wire,400/230 V, solid-earthed neutral
d) Distribution Voltage: 3 Phase, 4 wire,400/230 V, solid-earthed neutral
e) Final point Voltage: 3 Phase, 4 wire,361/209 V minimum
f) (5% drop to system voltage)

5) Transformer Capacity

The dry type will be provided, which is low maintenance and high efficiency. The transformer will carry supply to Low Voltage Main Distribution Electrical Switchboard.

Table 6.7-6 Transformer Capacity

No	Building	Capacity	Number
1	Manggarai Station	500 KVA, 20kV/380 V, 50 Hz	1
2	Jatinegara Station	400 KVA, 20kV/380 V, 50 Hz	1
3	Bekasi Station	400 KVA, 20kV/380 V, 50 Hz	1
4	Jatinegara Operation Center	500 KVA, 20kV/380 V, 50 Hz	2

6) Low Voltage Main Distribution Electrical Switchboard (LV-MDB)

LVMDB will be installed at to secondary connection from medium voltage transformer.

The switchboard will provide automatic change-over switches for control over emergency load supply by generator. Generator with supply the electric load when PLN supply fails or during emergency conditions.

7) Protection Devices in LVMDB

Electrical circuit, which includes feeders and distribution equipment, will be provided with protection device to limit their rated capacity, which may occur such as:

a) Over-current, due to mechanical over load and short circuit
b) Over-Voltage, due to short circuit between primary and secondary wiring or lightning strike
c) Earth leakage, due to cable isolation damage.

The protective device will be provided at strategic position on top feeder, branch circuits or equipment such as relay, circuit breaker or fuse.

Shorting fault levels are:

a) PLN 20 KV receiving point : 500 MVA
b) Medium Voltage Main Switchboard : 16 KA
c) Low Voltage Main distribution Board : 36 KA
d) Sub-Distribution board : 18 KA
e) Final distribution board : 10 KA

8) Electrical Switchboard

Electrical Switchboard will fabricated from galvanized plate cover metal Clad form 2b IP 305. The switchboard is provided with air ventilation and space heater to keep temperature and humidity at a constant level.

(2) Generator system

The emergency power will be supplied to exit light, emergency light, fire pump, Public Address (PA) and Fire Alarm Control Unit. In case of PLN fail, Generator system will supply within 45 seconds.

Table 6.7-7 Generator system

	Case	Required services	Charge Capacity (%)
1	Required local regulation	Electric Fire Pump	100
		Emergency light	100
		Exit Light	100
2	Live saving during PLN Fail	Fire Alarm Control Unit & Detection	100
		PA for Evacuation/intercom	100
		Platform lighting	50
		General Lighting	50
		Concourse Light	50
		Signboard Light	100
		Booster Pump	100
		WWTP	100
		Submersible Pump	100
		Incinerator	100
		Escalator	20
		Lift	20
		FCU	100
		Exhaust Fan	100
		Light and Mach.Room	100
		Tenants	100

(3) Distribution System

Power supply will be two categories for distribution system, which are emergency power supply during an emergency event and normal power supply.

1) The emergency power distribution is for:
    - Electric Fire Pump
    - Fire alarm and detection system
    - Public Address
    - Intercom
    - Track Yard Lighting
    - Telecom equipment
    - Operation Platform Office
    - Emergency spotlight
    - Lighting and Exhaust Machine Room

2) Normal Power distribution is for:
    - General Light and Outlet Receptacle
    - Concourse Light and Decoration Light
    - Lift
    - Escalator
    - WWTP
    - Booster Pump
    - Submersible Pump
    - Chiller
    - Chiller water Pump
    - Incinerator
    - Outdoor light

(4) Lighting Fixture System;

The illumination will follow the requirement of standard (IES). The platform and a part of concourse lighting has the circuit with photoelectric sensor which turns on/off automatically and time switch with 24 hours/day setting, which will be operated depending on the activities of stations.

Table 6.7-8 General Lighting Schedule

No	Location	Illumination (Lux)	Typical Fitting
1	Office Area	300	Fluorescent
2	Corridor	100	Fluorescent, Down Light.
3	Toilet	100	Fluorescent, Down Light, Wall bracket,
4	Restaurant	200	Fluorescent, Down Light, Incandescent
5	Lobbies	150	Down Light, Incandescent
6	Generator	200	Fluorescent TLX (Expl. Proof)
7	Locker	100	Fluorescent
8	Kitchen	200	Fluorescent
9	Dinning	200	Fluorescent, Down Light, Incandescent
10	Store	100	Fluorescent, Down Light
11	Clinic	200	Fluorescent
12	Switch Board	200	Fluorescent
13	Entrance Hall	300	Fluorescent, Down Light, Incandescent
14	Transformer	200	Fluorescent
15	Stairs	100	Fluorescent
16	Bedroom	100	Fluorescent, Down Light, Incandescent
17	Prayer room	100	Fluorescent
18	MDF	200	Fluorescent
19	Parking Area	50	HPS/Mercury
20	Reception areas (desk) booking office	300	Fluorescent, Down Light, Incandescent
21	Concourse	400	Mercury, Flood light, Spot Light
22	Wartel	100	Fluorescent
23	Laundry	100	Fluorescent
24	Training	300	Fluorescent
25	Storage	100	Fluorescent
26	Driver waiting	100	Fluorescent
27	Meeting	300	Fluorescent
28	VIP Lounge	300	Fluorescent, Down Light, Incandescent
29	Rest Room	100	Fluorescent, Down Light, Incandescent
30	Ticket Selling	300	Fluorescent
31	Platform	200	Fluorescent
32	Security	200	Fluorescent

(5) Fire Detection and Alarm System

1) Fire Detector

4 large station buildings such as Manggarai, Jatinegara, Bekasi stations and Jatinegara Operation Centre will be provided the Fire Detection and Alarm System.

Table 6.7-9 Type of Fire Detector

Building	Room	Fire Detector Type
Station Building	Corridor & Entrance Hall, Pray, MDF, Toilet & Electrical, Switchboard	Heat
	Storage, Locker, Resting, Training, Security, Clinic, Kitchen, Station Master, Station Office, Rest Room, Toilet	Smoke & Rate of Rise (ROR)

2) Function of Fire Detection and Alarm System

The fire or smoke detector will transfer the electric signal to the Fire Alarm Control Panel automatically.

Manual push button on each hydrant box and fire alarm panel, to be provided in each area, transmit the signal to Fire Alarm Control Panel with the alarm light flashing and audible 90 dB alarm signal.

The fire alarm control panel with indication of the alarm will provide warning to staff.

3) Manual Alarm Push Button

Manual alarm push buttons of fire protection services will activate the alarm system, such as bells and flashing lights. The switch button is covered by glass to avoid accidental operation.

4) Signal devices

Signal devices will be audio and video devices which satisfy the intended function.

The devices commonly used are the following :

a) Light Signal: Flashing strobe light or steady illuminating light

b) Ringing Bell: Device works continuously as long electrical power is connected.

(6) Telephone and Intercom System

Communication system as telephone and intercom are provided in station buildings. Main telephone lines are connected by PT. Telkom and internal communication services by intercom.

(7) Lightning Protection;

Buildings will be provided with protection against lightning strike based on IEC 61024-1 1990. The grounding wire will be inside a 50mm sq. conduit for lightning protection will be provided to top of the roof for possibility of lightning strike. The grounding resistance will be less than 2 Ohms. Franklin rod will be provided on top of building in Jatinegara Operation Center, Signal Cabins and Signal Huts. Coverage area of air terminal is 60 deg, and then minimum size of all down conductor is 50 mm2.

(8) Grounding System.

TT-System will provide for whole building. The grounding wire depth is 1 (meter) below the foundation. Electrical grounding system is separate to Lightning grounding system.

(9) Monitoring System

Monitoring electrical board will be provided to indicate power status of electrical main equipment such as:

- Electric Fire Pump
- Booster Electric Pump
- WWTP
- Chiller Equipment
- Water Chiller Pump
- Fire Alarm Control Unit