CHAPTER THREE

Project Components

Spaces study

Functional Relationships

Motion Charts

Study & Analysis the Site

Planning & Design Indicators

Zoning
Tram Station of New Khartoum Airport

**Project Components**

- Activity component
- Human component
- Spaces component

**Activity component**

- Supported activities
  - services
  - Administration
  - Tourist
  - Commercial & Entertainment
- Basic activities
  - Sub-transportation (From station to Airport)
  - Main transportation (From city to station)

**Supported activities**

- Administration
  - Public Relations Management
  - Sales Management
  - Personnel Management
  - Engineering Management
  - Financial management
  - General Administration
  - Tourism Management
  - Management of transmission lines

**Human component**
Study of human and non-human components and spaces

Human component:

The airport receives an average number of passengers (3000-3600) passengers per day (departures - Arrivals).

The station receives 60% of passengers (1800-2200) (departures - Arrivals).

70% use buses and 30% use taxis.

The total number of passengers is estimated at peak hour (1200) passengers.
**Track Installations**

Curved radii (to the centre-line of the track), R:
- for direct main line fast track: \( \geq 300 \text{ m} \)
- for sidings in stations: \( \geq 180 \text{ m} \)
- for branch lines with main line rolling stock: \( \geq 180 \text{ m} \)
- without main line rolling stock: \( \geq 160 \text{ m} \)
- for sidings, used by main line engines: \( \geq 140 \text{ m} \)
- for sidings, not used by mainline engines possibly: \( \geq 100 \text{ m} \)
- minimum: \( \geq 35 \text{ m} \)

Note that if \( 100 \text{ m} > R \geq 35 \text{ m} \) carriages should only be pulled. In addition, \( R > 130 \text{ m} \) might not be suitable for all rolling stock so the types involved should be checked at an early stage.

Radii for narrow gauge railways:
- for 1.00m gauge track: \( \geq 50 \text{ m} \)
- for 0.75m gauge track: \( \geq 40 \text{ m} \)
- for 0.60m gauge track: \( \geq 25 \text{ m} \)

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**Table for branch lines and normal sidings (m)**

<table>
<thead>
<tr>
<th>R</th>
<th>l</th>
<th>m</th>
<th>ramp gradient</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-200</td>
<td>40</td>
<td>0.370</td>
<td>1.320</td>
</tr>
<tr>
<td>250-350</td>
<td>30</td>
<td>0.333</td>
<td>1.320</td>
</tr>
<tr>
<td>400-2000</td>
<td>20</td>
<td>0.190</td>
<td>1.300</td>
</tr>
</tbody>
</table>

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**Simple set of points**

**Canted curve and transition curve**

**Layout of a set of points**

**Oblique angled crossing (wheel guide as in 4 + 5)**

**Track radius (for turning round) in sidings**

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59
**Tram Station of New Khartoum Airport**

### Display Symbols

<table>
<thead>
<tr>
<th>Set of Points</th>
<th>Radius (m)</th>
<th>Pitch Ratio</th>
<th>Overall Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 49</td>
<td>215</td>
<td>1:4.8</td>
<td>22.100</td>
</tr>
<tr>
<td>(b) 49</td>
<td>190</td>
<td>1:7.5</td>
<td>30.039</td>
</tr>
<tr>
<td>(c) 49</td>
<td>190</td>
<td>1:9</td>
<td>27.138</td>
</tr>
<tr>
<td>(d) 49</td>
<td>190</td>
<td>1:9</td>
<td>33.230</td>
</tr>
<tr>
<td>(e) 49</td>
<td>190</td>
<td>1:9</td>
<td>37.661</td>
</tr>
</tbody>
</table>

### Dimensions for Sets of Points

<table>
<thead>
<tr>
<th>Half the Radius of the Curve (m)</th>
<th>Dimensions of Half the Width of the Upper Limit of the Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 250</td>
<td>1445</td>
</tr>
<tr>
<td>225</td>
<td>1455</td>
</tr>
<tr>
<td>200</td>
<td>1465</td>
</tr>
<tr>
<td>180</td>
<td>1475</td>
</tr>
<tr>
<td>150</td>
<td>1495</td>
</tr>
<tr>
<td>120</td>
<td>1525</td>
</tr>
<tr>
<td>100</td>
<td>1555</td>
</tr>
</tbody>
</table>

### Other Dimensions: European Standards (Germany)

For entrance doorways, the clear width should be ≥3.35m and for new structures ≥4.00m.

For tunnels, the extra clearance needed beyond the trains’ kinematic envelope clearance to the wall for a single-track stretch of line is 0.40m; for a double-track stretch of line it is 0.50m.

There are minimum distances required between buildings and railway tracks for new structures. These vary according to location. Typical examples are: a fire-resistant structure with suitable cladding must be separated by ≥7.5m from railway land; the corresponding distance for soft covered structures that are not fire-resistant is ≥15.0m. The latter also applies to structures in which combustible materials are stored.

Platform heights vary from country to country, and can be as small as 0.38m. However, access to platforms must not involve passengers having to cross the track. This requires tunnels or bridges, which should have a width of 2.5–4.0m. If there is circulation in both directions, 4.00–8.00m is desirable. Steps on bridges or in tunnels should be the same width as the bridge or tunnel.
Passenger diminutions

Means of movement

tactical details
height of delivery: 4.20 m
conveyor length: 4.20 m
angle of incline: 27-30°
speed of travel: 0.3-0.5 m/s

Passenger tram diminutions

old and new rolling stock as an example of minimum space requirements for passenger transport
Check – In Installation Type

3.13 Typical space calculation
This is based on 2000 originating passengers/hour at a central security check, 30.12.
Assume two items of baggage or hand baggage per passenger.
One set of equipment consisting of a personnel metal detector and two 2 X-ray units can handle 600 passengers per hour.
2000 passengers per hour, excluding transfers, require 4 sets.

Luggage lockers: four standard compartments
Luggage lockers: three large compartments
The Main Tram station Hall

The tram serves passengers traveling to and from the city.

It is the main hall of the station, and transport procedures by trams are take place there.

The number of passengers using the tram at peak hour = 500

Single tram capacity = 250 passengers

Number of trams = 2 tram = 250 * 2 = 500 passengers.

Calculate the total area of the main hall:

1/ Reception hall = (Per capita area + area of movement) * Number of individuals = 2200 * 0.7 = 1540 m².

2/ Waiting area (Per capita area + area of movement) * Number of individuals = 2 * (250 * 1.2) = 600 m².

3/ Departure Sidewalk (Per capita area + area of movement) * Number of individuals = 2 * (250 * 0.7) = 350 m².

4/ Arrival Sidewalk (Per capita area + area of movement) * Number of individuals = (500 * 0.7) = 350 m².

5/ tram track: Single tram area * Number of trams = (2.50 * 50) * 2 = 250 m².

6/ Ticket counter 1 per 50 people = 10 counters with 1.2 m² per unit. The area of the counters = 10 * 1.2 = 12 m².

7/Cafe with capacity of 50 people (1.2 m² per person) = 1.2 * 50 = 75 m².

8/Bathrooms: Bath per 50 people = 10 baths per m² = 10 * 2 = 20 m².

9/Green spaces: 0.05 m² per person = (0.05 * 500) = 25 m².

10/ Means of movement: 1 Ladders and 2 escalators with an area of 40 m².
**The Buses station**

Buses serve passengers heading to the airport.

The number of passengers using buses is 70% of the total number at peak hour = 350 passengers.

The bus capacity is 21 people

Total buses = 40 buses.

Calculate the total area of the bus station:

1/ Reception Hall (Per capita area + area of movement) * Number of individuals = 1.2 * 500 = 600 m².

2/ The query counter is one for every 200 people = 4 counters with an area of 5.3 m² = 15 m²

3/ Waiting Hall (Per capita area + area of movement) * Number of individuals = 1.2 * 500 = 600 m²

5/ Ticket counter 1 per 50 people = 16 counters with 1.2 m² per unit. The area of the counters = 16 * 1.2 = 20 m²

6/ Cafe with capacity of 50 people (1.2 m² per person) = 1.2 * 50 = 75 m².

7/ Bathrooms: Bath per 50 people = 10 baths per 2 m² = 10 * 2 = 20 m².

8/ Green spaces: 0.05 m² per person = (0.05 * 500) = 42 m².

9/ Means of movement (rams) with an area of 600 m².
**The Taxi station**

Taxies serve passengers heading to the airport.

The number of passengers using buses is 30% of the total number at peak hour = 150 passengers.

Average number of Taxies for 150 passengers = 100 taxis.

**Calculate the total area of the Taxi station:**

1/Reception Hall (Per capita area + area of movement) * Number of individuals = 0.7 * 150 = 105 m²

2/The query counter is one for every 200 people = 2 counters with an area of 5.3 m² = 10 m².

3/Witting Hall (Per capita area + area of movement) * Number of individuals = 1.2 * 150 = 180 m²

4/Ticket counter 1 per 50 people = 3 counters with 1.2 m² per unit. The area of the counters = 7 * 1.2 = 8.4 m²

6/Green spaces: 0.05 m² per person = (0.05 * 180) = 9 m²

7/ Means of movement (rams) with an area of 600 m².
The outside area study

[Diagrams of bus stations and parking areas, with measurements and annotations]

Bus/coach parking at 90° (m)

90° parking for medium sized cars
The outside area of the bus station:

1/ Sidewalk (Per bus) * 3 * 7 (bus length * pavement width) Number of buses at rush hour = 40 buses
2/ The pavement area = (3 * 7 * 40) = 600 m² (the lowest width of the pavement is 2.6 meters.
3/ Bus parking: Bus dimensions (7 * 3) m * Number of buses total 40 Bus + 20% Area of movement = 1000 m²
4/ External seats: 20 seat-out seat 4 persons Seat dimensions (0.45 m²)
Total external seats space = 20 * 0.45 = 20 m²

The outside area of the Taxi station:

1/ Sidewalk (Per bus) * 3 * 5 (bus length * pavement width) Number of Taxi at peak hour = 26 buses
2/ The pavement area = (3 * 5 * 26) = 390 m² (the lowest width of the pavement is 2.6 meters.
3/ Taxi parking: Taxi dimensions (5 * 3) m * Number of total taxis 26 + 20% Area of movement = 468 m².
**The Main Restaurant**

The main restaurant is 400 people

The area of the individual is 1.2 m²

Total area of the restaurant = 1000 m² including the area of movement.

**Bathrooms and Laundries**

Bathroom area 2 m² (bath per 75 people = 6 bathrooms)

Total area of the baths = 6 * 2 = 12 m²

Single wash area 0.8 m² (laundry per 75 people = 6 laundries)

Total wash area = 6 * 0.8 = 5 m².
The Open cafe

The main cafe is 200 people
The area of the individual is 1.2 m²
Total area of the cafe = 500 m² including the area of movement.

Bathrooms and Laundries

Bathroom area 2 m² (bath per 75 people = 2 bathrooms)
Total area of the baths = 2 * 2 = 4 m²
Single wash area 0.8 m² (laundry per 75 people = 2 laundries)
Total wash area = 2 * 0.8 = 1.6 m².
The Restaurant tram

GENERAL INFORMATION

The cost is fully inclusive of all food and beverages from our fully stocked restaurant.

Maximum size is (36 passengers per tram).

Pre-payment is required for all reservations.

Dietary requirements must be advised no later than 24 hours in advance.

Smoking is not permitted

Passengers must arrive no later than 15 minutes prior to the departure time.

2-seater booth
4-seater booth
Rest room
Kitchen
Services

Seating Plan

http://www.thewhatchoguy.in
One of the important spaces in the station is a source of attraction for visitors and its size is calculated according to the size of the building and the number of users.

Shops and galleries sell all the needs of arrivals and departures from the station as well as visitors.

The commercial center is also usable by neighborhoods adjacent to the station. It has shops and galleries linked to the main halls.

There is a small supermarket on the ground floor for daily food need.

**Calculate the area of the commercial center**

Shops: 40 shops (40m² per shops).
Total area of shops = 40 * 40 = 1600 m².

galleries: 14 galleries (50 m² per galleries).
Total area of galleries = 14 * 50 = 840 m².

Hypermarket: one hypermarket with an area of 700 m².
Hypermarket:

There is a small supermarket on the ground floor for daily food need. with an area of 700 m².
The Tourist Exhibition

Gives a profile of tourists and visitors about Sudan and the important tourist areas in Sudan by presenting three-dimensional images and miniatures of these areas with a brief history of Sudan.

The size of the individual in the exhibition = 1.6 m² Number of visitors = 1000 visitors
Add the motion area = 2000 m²
The management department

Administrative spaces are of great importance in all buildings, especially public ones, and the administration of the station is divided into 8 sections:

1/ General Administration: Including the Director-General, his Deputy and the Secretary.

2/ Financial management: Including the Chief Financial Officer, his deputy, secretary and accountants.

3/ Engineering Management: Including the engineering director, his deputy, the secretary and the engineers, Responsible for maintenance and repair of faults.

4/ Personnel Management: Including the Director of Public Relations, his Deputy, the Secretary and the staff.

5/ Public Relations Management: Including the Director of Personnel, his deputy, the secretary and the staff responsible for all employees of the station.

6/ Management of transmission lines: Including the director of the movement, his deputy, the secretary and the officials responsible for the tram, bus and taxi lines.

7/ Tourism Management: Including a tourism manager, his deputy, secretary and tour guides.

8/ Sales Management: Includes sales manager and sales staff.

Study of administrative spaces

The departments include the office of a director, deputy director and secretary, as well as staff offices and a meeting room.

1/ General Director Office: It is better to have a closed port because it is characterized by high efficiency and privacy, there are communication devices between it and the staff.

A single space and separators are created separating the office, the sitting set, the bathroom and your private buffet with an area of 100m².
2/ Staff Office: It is best to be open-minded because it is characterized by high efficiency and ease of communication between staff, and the open project is highly flexible construction where a vacuum is created without breaks.

Office Personnel Area in Management = $2.25 \times 15 = 33.75 \text{ m}^2$

In addition to the area of movement of 40% of the space = $13.5 \text{ m}^2$

Staff Area = $47.25 \text{ m}^2$.

Management has 8 staff offices.

Total office space = $8 \times 47.25 = 378 \text{ m}^2$.
3/ Archive room: The archive room is used to store important and confidential files and documents for buildings with an area of 30 m².

4/ Counter queries: The query counter is one for every 200 people with an area of 5.3 m².
5/ Meeting room: It is the meeting place of the administrators. The conference room space = 50 m² is divided into two rooms.

Bathrooms
One of the most important services in public buildings. One toilet per 75 people.
Tram Station of New Khartoum Airport

**Chapel prayer**
One of the most important services in public buildings.
With an area of 140 m² including the area of movement.

**Parking**
One of the most important services in public buildings.
With an area of 12.50 m² including the area of movement.