| Business Template  **SUBWAY** |
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# Business Description

## Business background

The subway system is one of the most widely used forms of transportation in the world. It's often an essential part of the urban infrastructure, providing a critical, everyday service for the population.

## Problems. Current Situation

Despite its fundamental role, the subway system operates within a highly complex framework. Managing, storing, and effectively tracking comprehensive data in an organized manner is a challenge. This demands a structured approach to data management for streamlined operations and informed decision-making.

## the Benefits of implementing a database. Project Vision

The aim of building this database system is to ease the challenges of subway's management, solidify its operational framework, to further enhance the metro system overall. The information derived from this data will cover subjects such as: detailed schedule, infrastructure state and development, ticket promotions and more.

# Model description

## Definitions & Acronyms

Headcode: Train identification code

Model: Train model details

Arrival\_Datetime: Train arrival timestamps

Departure\_Datetime: Train departure timestamps

Price: Ticket cost

## Logical Scheme

## Objects

Train Table  
  
Stores details about trains, including identifiers, model, manufacturer.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Train | Train\_id | PK | Int |
| Line\_id | FK | int |
| Headcode | Identification code for the train | varchar |
| Model | Train model details | varchar |
| Manufacturer | Manufacturer of the train | varchar |
| Status | Current status of the train (active/inactive) | varchar |

Relationships:  
Train Schedule: A train has schedules associated with different stations.   
Line: Relates to the line to which the train belongs.   
Train Maintenance: Intermediate table between trains and associated maintenances.

Example Data:

| Train\_ID | Line\_ID | Headcode | Model | Manufacturer | Status |
| --- | --- | --- | --- | --- | --- |
| 15 | 2 | FA123B | HO Scale | Alstom | Active |

Train Schedule Table

Manages train schedules, recording station arrivals and departures for specific trains.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Train\_Schedule | Train\_schedule\_id | PK | Int |
| Train\_id | FK | int |
| Station\_id | FK | int |
| Arrival\_datetime | Date and time of train arrival at the station. | datetime |
| Departure\_datetime | Date and time of train departure at the station. | datetime |
| Line\_Station\_id | FK | int |

Relationships:   
Train: Connects each schedule entry to a specific train.   
Station: Specifies the station associated with each schedule entry.  
Line Station: Specifies the direction in which the train is headed to.

Example Data:

| Train\_schedule\_id | Train\_id | Station\_id | Arrival\_datetime | Departure\_datetime | Line\_Staion\_ID |
| --- | --- | --- | --- | --- | --- |
| 1 | 2 | 4 | 2023-11-24 10:30:00 | 2023-11-24 10:31:00 | 3 |

Promotion Table

Stores information about promotions, including the name and duration.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Promotion | promotion\_id | PK | Int |
| Promotion\_name | Name of the promotion. | varchar |
| Start\_date | Start date of the promotion. | date |
| End\_date | End date of the promotion. | date |

Relationships:  
Promotion Discount: Represents discounts that are applied to each kind of promoted tickets.  
  
Example Data:

| Promotion\_id | Promotion\_name | Start\_date | End\_date |
| --- | --- | --- | --- |
| 1 | Holiday Special | 2023-11-24 | 2023-12-24 |

Transaction Table

Keeps track of transactions for purchasing tickets.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Transaction | Transaction\_id | PK | int |
| Ticket\_id | FK | int |
| Promotion\_id | FK | int |
| Station\_id | FK | int |
| Quantity | How many tickets were purchased at once | int |
| Purchase\_datetime | Datetime of the transaction | datetime |
| Total\_price | Total, final price of the transaction | decimal |

Relationships:

Promotion: Relates to the promotion that has been applied to the purchased ticket(s).   
Ticket: Specifies the tickets associated with the transaction.

Station: Relates to the location of where the tickets were purchased.

Example Data:

| Transaction\_id | Ticket\_id | Promotion\_id | Station\_id | Quantity | Purchase\_datetime | Total\_price |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 13 | 8 | 1 | 2023-11-24 10:30:00 | 1.00 |

Ticket Table  
  
Contains information about ticket types and their respective prices.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Ticket | Ticket\_id | PK | Int |
| Ticket\_type | Description of the ticket type. | varchar |
| Price | Cost of the ticket (without a discount) | decimal |

Relationships:  
Promotion Discount: Connects tickets to specific discount offers.  
  
Example Data:

| ticket\_id | Ticket\_type | Cost |
| --- | --- | --- |
| 1 | Student | 0.5 |

Line Table  
  
Records details about subway lines, such as names, required trains, and employees.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Line | Line\_id | PK | Int |
| Line\_name | Name of the line. | varchar |
| Required\_trains | Count of trains required for the line. | int |
| Required\_employees | Count of employees required for the line. | int |

Relationships:

Station: Stations belonging to specific lines.

Example Data:

| Line\_id | Line\_name | Required\_trains | Required\_employees |
| --- | --- | --- | --- |
| 4 | Station Square | 32 | 10 |

Station Table

Stores information about stations, including names, locations, capacities.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Station | Station\_id | PK | Int |
| Line\_id | FK | int |
| Station\_name | Name of the station. | varchar |
| Station\_lat | Latitude coordinates of the station. | decimal |
| Station\_lon | Longitude coordinates of the station. | decimal |
| Capacity | Maximum passenger capacity of the station. | int |

Relationships:  
Train Schedule: Stations being a part of the train schedules.   
Line: Each station belongs to a specific line.  
Station Maintenance: Intermediate table between stations and associated maintenances.

Example Data:

| Station\_id | Line\_id | Station\_name | Station\_lat | Station\_lon | Capacity |
| --- | --- | --- | --- | --- | --- |
| 15 | 2 | Freedom Square | 49.82380908513249 | 10.8544921875 | 100 |

Line Station Table  
Stores information about the ordering of stations in the lines.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Line\_Station | Line\_station\_id | PK | Int |
| Line\_id | FK | int |
| Station\_id | FK | int |
| Sequence\_number | Sequence number of the station in a specific direction of the line. | int |

Relationships:  
Station: Refers the station related to the record.  
Line: Refers to the line related to the record.  
Table Schedule: Indicating in which direction a schedule entry refers to.

Maintenance Type Table:

Tracks maintenance records for various components like tracks, tunnels, trains, and stations.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Maintenance | Maintenance\_id | PK | Int |
| Maintenance\_Type | Type of maintenance activity. | varchar |

Relationships:  
Track\_Maintenance: Refers to maintenance related to tracks.

Tunnel\_Maintenance: Refers to maintenance related to tunnels.   
Train\_Maintenance: References maintenance records associated with trains.

Station\_Maintenance: Relates to maintenance activities performed at stations.  
  
Example Data:

| Maintenance\_id | Maintenance\_type |
| --- | --- |
| 15 | Emergency |

Track Table

Stores information about tracks, including start and end stations.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Track | Track\_id | PK | Int |
| Start\_station\_id | FK | int |
| End\_station\_id | FK | int |
| Direction | Identifier indicating the direction or orientation of the track. | varchar |

Relationships:  
Station: Refers to the stations which the track connects.  
Track\_Maintenance: Represents maintenance records associated with tracks.  
  
Example Data:

| Track\_id | Start\_station\_id | End\_station\_id | Direction |
| --- | --- | --- | --- |
| 12 | 4 | 5 | Northbound |

Tunnel Table

Manages details about tunnels, including start and end stations.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Tunnel | Tunnel\_id | PK | Int |
| Start\_station\_id | FK | int |
| End\_station\_id | FK | int |

Relationships:

Station: Refers to the stations which the tunnel connects.  
Tunnel\_Maintenance: Represents maintenance records associated with tunnels.  
  
Example Data:

| Tunnel\_id | Start\_station\_id | End\_station\_id |
| --- | --- | --- |
| 12 | 4 | 5 |

Train Maintenance Table  
Intermediate table between tables Train and Maintenance Type, containing information about each maintenance.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Train\_Maintenance | Train\_Maintenance\_id | PK | Int |
| Maintenance\_id | FK | int |
| Train\_id | FK | int |
| Start\_date | Start date of maintenance activity | date |
| End\_date | End date of maintenance activity | date |
| Description | Additional details or notes about maintenance. | varchar |
| Cost | Cost incurred for maintenance activities. | int |

Relationships:  
Maintenance: Represents maintenance type records associated with tunnels.  
Train: Represents trains associated with each maintenance.  
  
Example Data:

| Train\_Maintenance\_id | Maintenance\_id | Train\_id | Start\_date | End\_date | Description | Cost |
| --- | --- | --- | --- | --- | --- | --- |
| 12 | 4 | 5 | 2023-11-24 | 2023-11-29 |  | 100.00 |

Tunnel Maintenance Table  
Intermediate table between tables Tunnel and Maintenance Type, containing information about each maintenance.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Tunnel\_Maintenance | Tunnel\_Maintenance\_id | PK | Int |
| Maintenance\_id | FK | int |
| Tunnel\_id | FK | int |
| Start\_date | Start date of maintenance activity | date |
| End\_date | End date of maintenance activity | date |
| Description | Additional details or notes about maintenance. | varchar |
| Cost | Cost incurred for maintenance activities. | decimal |

Relationships:  
Maintenance Type: Represents maintenance type records associated with tunnels.  
Tunnel: Represents trains associated with each maintenance.  
  
Example Data:

| Tunnel\_Maintenance\_id | Maintenance\_id | Tunnel\_id | Start\_date | End\_date | Description | Cost |
| --- | --- | --- | --- | --- | --- | --- |
| 12 | 4 | 5 | 2023-11-24 | 2023-11-29 |  | 100.00 |

Station Maintenance Table  
Intermediate table between tables Station and Maintenance Type, containing information about each maintenance.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Station\_Maintenance | Station\_Maintenance\_id | PK | Int |
| Maintenance\_id | FK | int |
| Station\_id | FK | int |
| Start\_date | Start date of maintenance activity | date |
| End\_date | End date of maintenance activity | date |
| Description | Additional details or notes about maintenance. | varchar |
| Cost | Cost incurred for maintenance activities. | decimal |

Relationships:  
Maintenance Type: Represents maintenance type records associated with stations.  
Station: Represents stations associated with each maintenance.  
  
Example Data:

| Station\_Maintenance\_id | Maintenance\_id | Station\_id | Start\_date | End\_date | Description | Cost |
| --- | --- | --- | --- | --- | --- | --- |
| 12 | 4 | 5 | 2023-11-24 | 2023-11-29 |  | 100.00 |

Track Maintenance Table  
Intermediate table between tables Track and Maintenance Type, containing information about each maintenance.

| Table Name | Field name | Field Description | Data Type |
| --- | --- | --- | --- |
| Track\_Maintenance | Track\_Maintenance\_id | PK | Int |
| Maintenance\_id | FK | int |
| Track\_id | FK | Int |
| Start\_date | Start date of maintenance activity | date |
| End\_date | End date of maintenance activity | date |
| Description | Additional details or notes about maintenance. | varchar |
| Cost | Cost incurred for maintenance activities. | decimal |

Relationships:  
Maintenance Type: Represents maintenance type records associated with tracks.  
Track: Represents tracks associated with each maintenance.  
  
Example Data:

| Track\_Maintenance\_id | Maintenance\_id | Track\_id | Start\_date | End\_date | Description | Cost |
| --- | --- | --- | --- | --- | --- | --- |
| 12 | 4 | 5 | 2023-11-24 | 2023-11-29 |  | 100.00 |