

Entity-Relationship Diagram (ERD)

The following entities are identified for database design:

- **Passengers** (Passenger_ID, Name, Age, Gender)
- **Tickets** (Ticket_ID, Passenger_ID, Train_ID, Class, Price, Purchase_Date)
- **Trains** (Train_ID, Train_Name, Route_ID, Capacity)
- **Routes** (Route_ID, Start_Station, End_Station, Distance, Duration)
- **Stations** (Station_ID, Station_Name, Location)
- **Transactions** (Transaction_ID, Ticket_ID, Payment_Method, Transaction_Date, Amount)

Logical & Physical Schema

1. Passengers Table

- Passenger_ID (Primary Key)
- Name (VARCHAR)
- Age (INTEGER)
- Gender (VARCHAR)

2. Tickets Table

- Ticket_ID (Primary Key)
- Passenger_ID (Foreign Key → Passengers)
- Train_ID (Foreign Key → Trains)
- Class (VARCHAR)
- Price (DECIMAL)
- Purchase_Date (DATE)

3. Trains Table

- Train_ID (Primary Key)
- Train_Name (VARCHAR)
- Route_ID (Foreign Key → Routes)
- Capacity (INTEGER)

4. Routes Table

- Route_ID (Primary Key)
- Start_Station (Foreign Key → Stations)
- End_Station (Foreign Key → Stations)
- Distance (DECIMAL)
- Duration (TIME)

5. Stations Table

- Station_ID (Primary Key)
- Station_Name (VARCHAR)
- Location (VARCHAR)

6. Transactions Table

- Transaction_ID (Primary Key)
- Ticket_ID (Foreign Key → Tickets)
- Payment_Method (VARCHAR)
- Transaction_Date (DATE)
- Amount (DECIMAL)

Normalization Considerations

- The schema follows **3rd Normal Form (3NF)** to eliminate redundancy.
- Passenger details are stored separately from tickets to maintain integrity.
- Routes and Stations are separate entities to facilitate route expansion.
- Transactions are linked to tickets to track payments independently.