**ERD Description**

This document presents an Entity-Relationship Diagram (ERD) for a transportation management system. The ERD visually represents the system's key entities, their attributes, and the relationships between them. It serves as a blueprint for designing a database that manages various aspects of transportation operations, including personnel, scheduling, maintenance, and passenger services. Each entity, such as Person, Bus, and Route, is detailed with its primary attributes and linked through foreign keys to illustrate how data is interconnected within the system. This structured approach ensures efficient data organization and retrieval, supporting the overall functionality of the transportation network.

**Entities**

1. **Person**

Attributes:

person\_id (PK): Unique identifier

first\_name: First name

last\_name: Last name

gender: Gender

date\_of\_birth: Birthdate

street\_address: Street address

city\_address: City address

province: Province

occupation: Occupation

1. **ContactInformation**

Attributes:

contact\_id (PK): Unique identifier

person\_id (FK): Links to Person

contact\_type: Type of contact

contact\_number: Contact details

1. **Stop**

Attributes:

stop\_id (PK): Unique identifier

stop\_name: Name of the stop

1. **Site**

Attributes:

site\_id (PK): Unique identifier

stop\_id (FK): Links to Stop

site\_address: Address

site\_name: Name

phone\_number: Contact number

capacity: Capacity

category: Category

1. **Event**

Attributes:

event\_id (PK): Unique identifier

site\_id (FK): Links to Site

event\_time: Time of event

event\_date: Date of event

number\_of\_participants: Participants count

event\_name: Name of event

1. **MaintenanceRecord**

Attributes:

mr\_id (PK): Unique identifier

maintenance\_id (FK): Links to MaintenancePersonnel

bus\_id (FK): Links to Bus

repair\_date: Date of repair

1. **MaintenancePersonnel**

Attributes:

maintenance\_id (PK): Unique identifier

person\_id (FK): Links to Person

specialization: Area of expertise

years\_of\_service: Years in service

mp\_level: Rank or level

salary: Salary

1. **Passenger**

Attributes:

passenger\_id (PK): Unique identifier

person\_id (FK): Links to Person

passenger\_type: Type of passenger

1. **BusDriver**

Attributes:

driver\_id (PK): Unique identifier

person\_id (FK): Links to Person

salary: Salary of driver

years\_of\_service: Years driving buses

incidents\_occurred: Number of incidents

1. **Route**

Attributes:

route\_id (PK): Unique identifier

route\_name: Name of the route

1. **Bus**

Attributes:

bus\_id (PK): Unique identifier

route\_id (FK): Links to Route

years\_in\_operations: Years the bus has been in operation

number\_of\_seats: Number of seats available in the bus

manufacturer\_name: Manufacturer of the bus

advertising\_revenue: Revenue generated from advertisements

fuel\_type: Type of fuel used by the bus

1. **Schedule**

Attributes:

schedule\_id (PK): Unique identifier

route\_id (FK): Links to Route

stop\_id (FK): Links to Stop

bus\_id (FK): Links to Bus

arrival\_time: Scheduled time of arrival

arrival\_date: Scheduled date of arrival

1. **Fare**

Attributes:

fare\_id (PK): Unique identifier

passenger\_id (FK): Links to Passenger

amount: Fare amount

fare\_type: Type of fare (e.g., adult, student, senior)

1. **Infraction**

Attributes:

infraction\_id (PK): Unique identifier

driver\_id (FK): Links to BusDriver

infraction\_type: Type of infraction (e.g., speeding, red light violation)

date\_of\_occurrence: Date when the infraction occurred

demerit\_points: Demerit points assigned for the infraction

penalty: Penalty imposed for the infraction

**Constraints**

* Primary Keys (PK): Ensure each record in a table is unique (person\_id, etc.).
* Foreign Keys (FK): Establish relationships between tables, ensuring referential integrity (person\_id, linking ContactInformation to Person).

**Relationships and Associations**

* A person can have multiple contact information entries (1:N) with **ContactInformation (ContactInformation.person\_id -> Person.person\_id).**
* Sites are associated with stops (1:N) with **Site (Site.stop\_id -> Stop.stop\_id)**.
* Events occur at specific sites (1:N) with **Event (Event.site\_id -> Site.site\_id)**.
* Maintenance records link personnel and buses (1:N) with **MaintenanceRecord (MaintenanceRecord.maintenance\_id -> MaintenancePersonnel.maintenance\_id,  and  MaintenanceRecord.bus\_id -> Bus.bus\_id).**
* Maintenance personnel, passengers, and bus drivers are linked to persons (1:1) with respective **entities (MaintenancePersonnel.person\_id -> Person.person\_id, etc.).**
* Buses operate on routes and have schedules (1:N) with **Route and Schedule (Bus.route\_id -> Route.route\_id,  schedule.route\_id -> Route.route\_id, etc.).**
* Passengers pay fares linked to their IDs (1:N) with **Fare (Fare.passenger\_id -> Passenger.passenger\_id).**
* Infractions are associated with drivers (1:N) with **Infraction (Infraction.driver\_id -> BusDriver.driver\_id).**

**Cardinality**

* Each person can have multiple contact information entries but belongs to only one person record (1:N).
* A site can be linked to only one stop, but a stop can have multiple sites associated with it (1:N).
* Each maintenance record involves one bus and one maintenance personnel, but each bus and personnel can be involved in multiple records over time (1:N).
* Each bus follows a single route but can appear in multiple schedules for different stops and times (1:N).

These elements ensure data integrity and efficient management within the transportation system's database structure.