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Database Systems project:

Database For Train Station

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Introduction

This work designs a database that contains information about Train Station. The main purpose of this database is to show the work of the train station and to show the work of its different parts. It's based on following assumptions:

- Each train can be stored in one railway station
- Wagon/s belong to one owner.
- Services are held at one depot.
- Each employee maintain one or many maintenance details.
- Each train is driven by one locomotive.
- Each train is managed by one train driver.
- Each service has one or many maintenance details.

This project does not address the problem of people transportation and booking system. It's only cargo transportation, it also ignores several important attributes that would be required in real world system.

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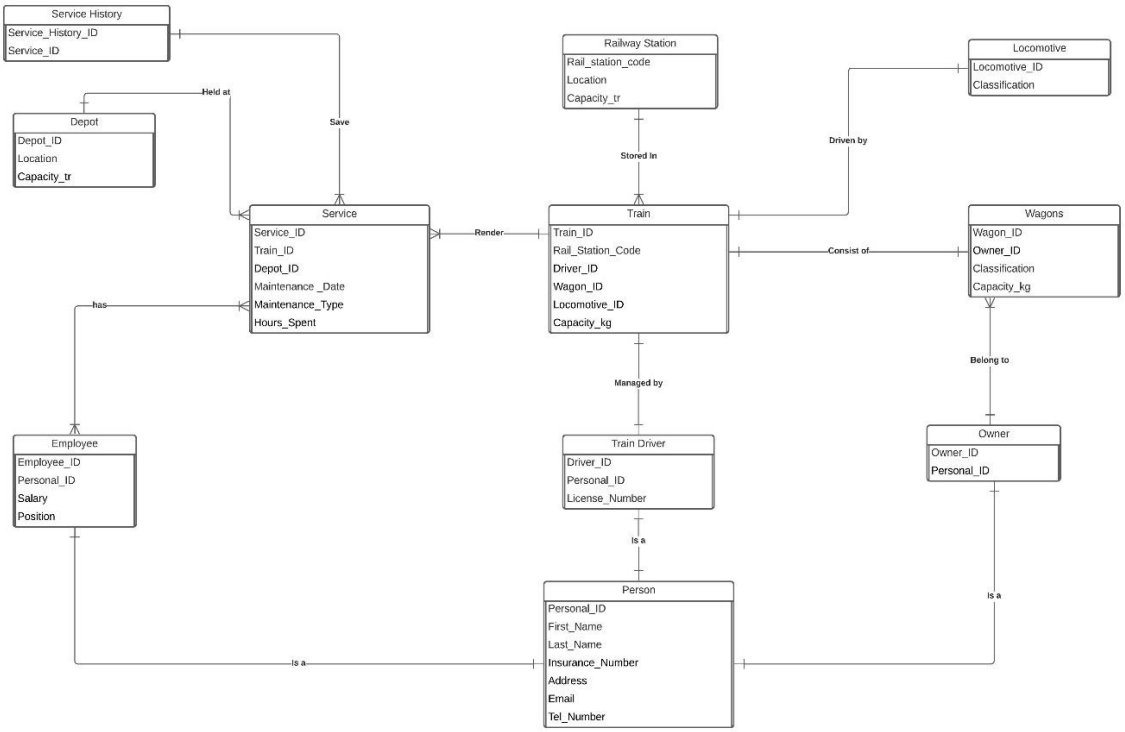
1. Possible Use Cases for the model

- Find all drivers names, their driving ID, licence numbers and Train ID where are they working.
- Find all trains ID, their Locomotives, Wagons ID and their classifications.
- Find when and what services trains had and get information about the employees which performed these works.
- Find out which train stored in Railway Station With Code 'CZ2' and where is it.
- Find out who is the owner of Wagon with ID ‘W118’ and get information about him/her.
- Find all basic information about train with id 'TR145'
- Find all basic information about all trains.

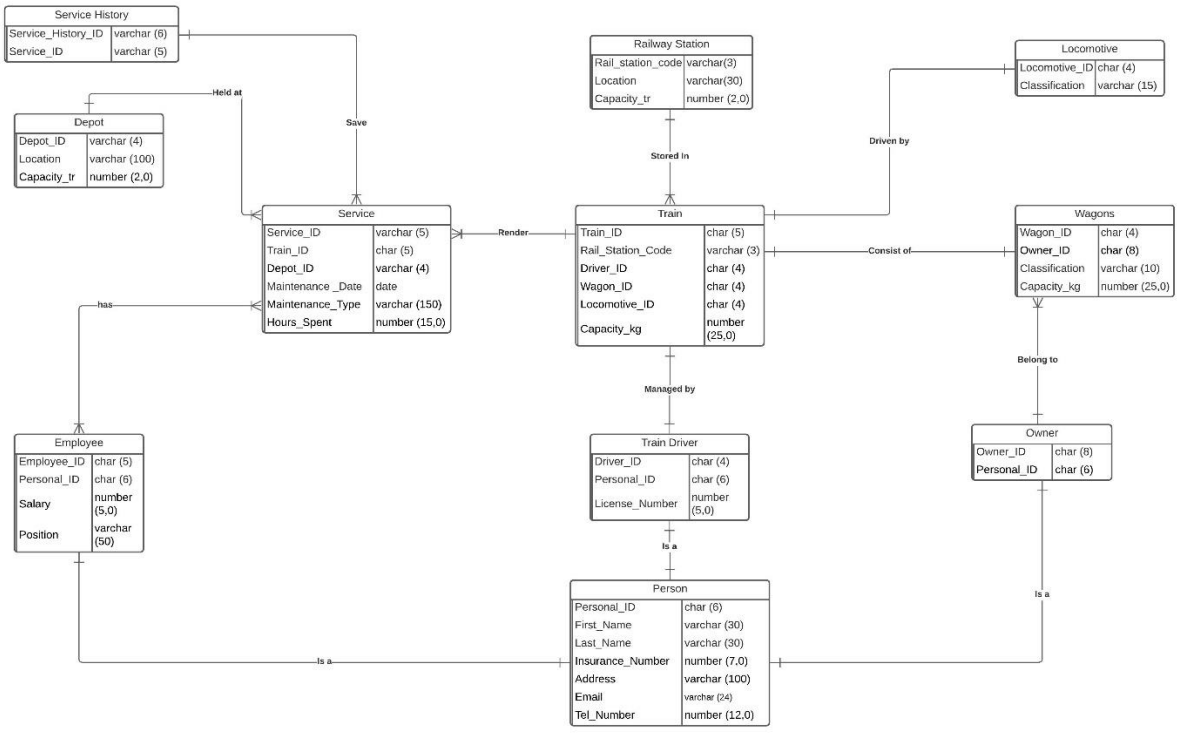
2. Entity Relationship diagrams

Following section captures the proposed structure of database using entity relationship diagram. The diagrams were created on Lucidchart.com.

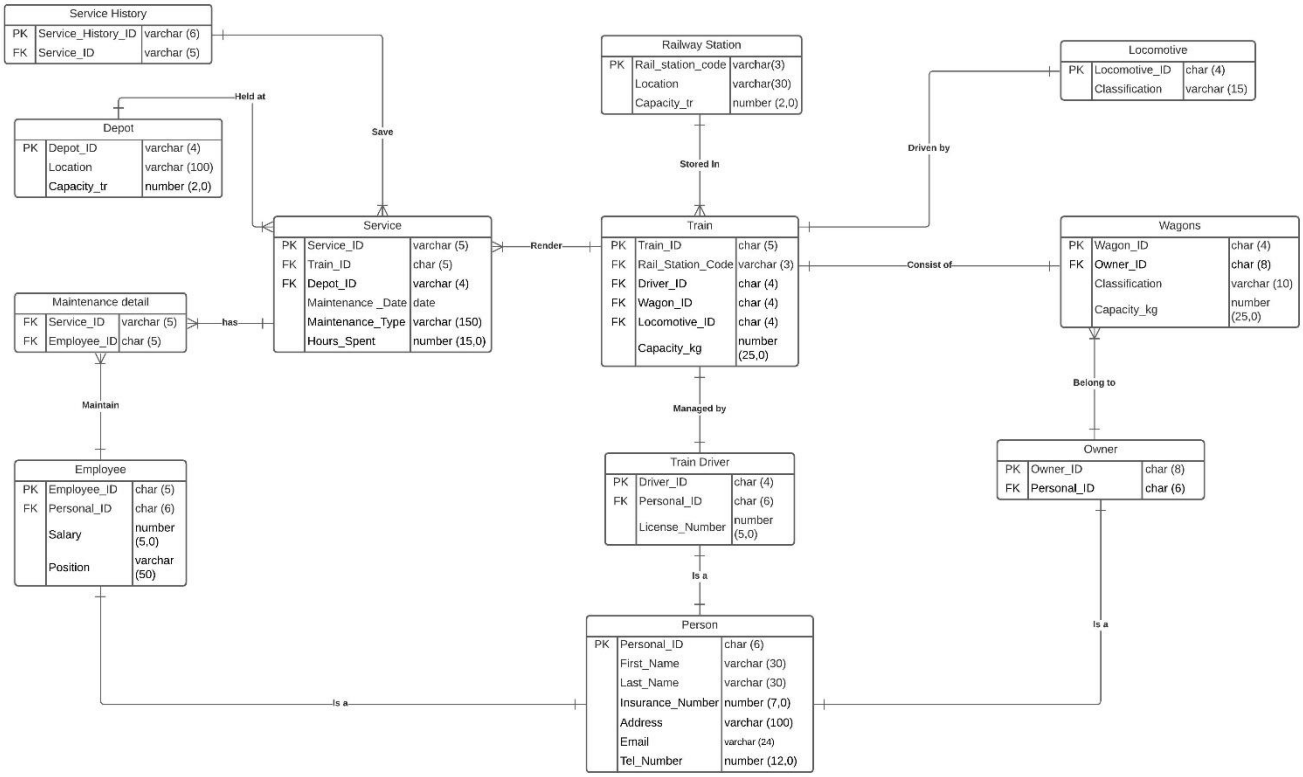
2.1. Conceptual ERD



2.2. Logical ERD



2.3. Physical ERD



3. SQL Implementation

The database was implemented in Oracle Application Express, which uses Oracle APEX Release 20.2.0.00.20 as a DBMS.

3.1. DDL: Defining

```
CREATE TABLE TRAIN (Train_ID char(5), Rail_Station_Code varchar(3), Driver_ID
char(4), Wagon_ID char(4),Locomotive_ID char(4), Capacity_kg number (25) NOT
NULL,
PRIMARY KEY (Train_ID));

CREATE TABLE RAILWAY_STATION (Rail_Station_Code varchar(3), Location varchar
(30) NOT NULL, Capacity_tr number (2),
PRIMARY KEY (Rail_Station_Code));

CREATE TABLE TRAIN_DRIVER (Driver_ID char(4), Personal_ID char(6),Licence_Num
ber number (5) NOT NULL,
PRIMARY KEY (Driver_ID));
```

```
CREATE TABLE LOCOMOTIVE (Locomotive_ID char(4), Classification varchar(15) NO
T NULL,
PRIMARY KEY (Locomotive_ID));

CREATE TABLE WAGONS (Wagon_ID char(4), Owner_ID char(5), Classification varch
ar(10) NOT NULL, Capacity_kg number (25),
PRIMARY KEY (Wagon_ID));

CREATE TABLE OWNER (Owner_ID char(5), Personal_ID char(6),
PRIMARY KEY (Owner_ID));

CREATE TABLE SERVICE (Service_ID varchar(5), Train_ID char(5), Depot_ID varch
ar(4), Maintenance_Date date NOT NULL, Maintenance_Type varchar(150) NOT NULL
, Hours_Spent number (15) NOT NULL,
PRIMARY KEY (Service_ID));

CREATE TABLE SERVICE_HISTORY (Service_History_ID varchar (6), Service_ID varc
har(5),
PRIMARY KEY (Service_History_ID));

CREATE TABLE DEPOT (Depot_ID varchar(4), Location varchar(100) NOT NULL, Capa
city_tr number (2),
PRIMARY KEY (Depot_ID));

CREATE TABLE MAINTENANCE_DETAIL (Service_ID varchar(5), Employee_ID char(5),
PRIMARY KEY (Service_ID, Employee_ID));

CREATE TABLE EMPLOYEE (Employee_ID char(5), Personal_ID char(6), Salary numbe
r(5) NOT NULL, Position varchar(50) NOT NULL,
PRIMARY KEY (Employee_ID));

CREATE TABLE PERSON (Personal_ID char(6), first_name varchar(30) NOT NULL, la
st_name varchar(30) NOT NULL, insurance_number number(7) NOT NULL, address va
rchar(100) NOT NULL, email varchar(24), tel_number number(12),
PRIMARY KEY (Personal_ID));
```

Constraints:

```
ALTER TABLE TRAIN ADD CONSTRAINT "Stored in" FOREIGN KEY (Rail_Station_Code) REFE
RENCES RAILWAY_STATION (Rail_Station_Code);

ALTER TABLE TRAIN ADD CONSTRAINT "Managed by" FOREIGN KEY (Driver_ID) REFERENCES
TRAIN_DRIVER (Driver_ID);

ALTER TABLE TRAIN ADD CONSTRAINT "Consist of" FOREIGN KEY (Wagon_ID) REFERENCES W
AGONS (Wagon_ID);
```

```
ALTER TABLE TRAIN ADD CONSTRAINT "Driven by" FOREIGN KEY (Locomotive_ID) REFERENC
ES LOCOMOTIVE (Locomotive_ID);

ALTER TABLE SERVICE ADD CONSTRAINT "Render" FOREIGN KEY (Train_ID) REFERENCES TRA
IN (Train_ID);

ALTER TABLE SERVICE ADD CONSTRAINT "Held at" FOREIGN KEY (Depot_ID) REFERENCES DE
POT (Depot_ID);

ALTER TABLE SERVICE_HISTORY ADD CONSTRAINT "Save" FOREIGN KEY (Service_ID) REFERE
NCES SERVICE (Service_ID);

ALTER TABLE EMPLOYEE ADD CONSTRAINT "FKEmployee547869" FOREIGN KEY (Personal_ID)
REFERENCES PERSON (Personal_ID);

ALTER TABLE TRAIN_DRIVER ADD CONSTRAINT "FKDriver153424" FOREIGN KEY (Personal_ID
) REFERENCES PERSON (Personal_ID);

ALTER TABLE OWNER ADD CONSTRAINT "FROwner198567" FOREIGN KEY (Personal_ID) REFERE
NCES PERSON (Personal_ID);

ALTER TABLE WAGONS ADD CONSTRAINT "Belong to" FOREIGN KEY (Owner_ID) REFERENCES O
WNER (Owner_ID);

ALTER TABLE MAINTENANCE_DETAIL ADD CONSTRAINT "Maintain" FOREIGN KEY (Employee_ID
) REFERENCES EMPLOYEE (Employee_ID);

ALTER TABLE MAINTENANCE_DETAIL ADD CONSTRAINT "Has" FOREIGN KEY (Service_ID) REFE
RENCES SERVICE (Service_ID);
```

3.2. DML: Inserting the data (examples)

```
INSERT INTO PERSON(Personal_ID, first_name, last_name, insurance_number, address,
email, tel_number) VALUES ('NC9454', 'Johny', 'Silverhand', 2233145, 'Night City'
, 'johnyboy@gmail.com', 178457948884);

INSERT INTO PERSON(Personal_ID, first_name, last_name, insurance_number, address,
 email, tel_number) VALUES ('CZ4412', 'Petr', 'Hanzlik', 7845754, 'Prague', 'hanz
likp@pef.czu.cz', 420778954612);

INSERT INTO PERSON(Personal_ID, first_name, last_name, insurance_number, address,
 email, tel_number) VALUES ('CZ8889', 'Eva', 'Miovska', 4123487, 'Plzen', 'evachk
am1o@gmail.com', 420415145188);
```

```
INSERT INTO PERSON(Personal_ID, first_name, last_name, insurance_number, address,
 email, tel_number) VALUES ('CZ9745', 'Jan', 'Vesely', 2264511, 'Prague', 'vesely
jan@gmail.com', 420154987478);

INSERT INTO PERSON(Personal_ID, first_name, last_name, insurance_number, address,
 email, tel_number) VALUES ('GB4466', 'Elizabeth', 'Hammond', 3514151, 'London',
'lizziwizzy@gmail.com', 448451224555);

INSERT INTO PERSON(Personal_ID, first_name, last_name, insurance_number, address,
 email, tel_number) VALUES ('GB2544', 'Anna', 'Lipton', 8848755, 'Sheffield', 'li
ptonlikeatea@gmail.com', 445413254936);

INSERT INTO PERSON(Personal_ID, first_name, last_name, insurance_number, address,
 email, tel_number) VALUES ('GB7776', 'Conor', 'May', 1115456, 'Manchester', 'may
conor11@gmail.com', 445413254936);



INSERT INTO Train_Driver(Driver_ID, Personal_ID, Licence_Number) VALUES ('D546',
'CZ4412', 99411);
INSERT INTO Train_Driver(Driver_ID, Personal_ID, Licence_Number) VALUES ('D112',
'GB4466', 56778);



INSERT INTO EMPLOYEE (Employee_ID, Personal_ID, Salary, Position) VALUES ('E4216'
, 'GB7776', 2500, 'Engineer');
INSERT INTO EMPLOYEE (Employee_ID, Personal_ID, Salary, Position) VALUES ('E1113'
, 'CZ8889', 2000, 'Engineer');


INSERT INTO OWNER (Owner_ID, Personal_ID) VALUES ('OW111', 'NC9454');
INSERT INTO OWNER (Owner_ID, Personal_ID) VALUES ('OW457', 'CZ9745');
INSERT INTO OWNER (Owner_ID, Personal_ID) VALUES ('OW232', 'GB2544');


INSERT INTO WAGONS (Wagon_ID, Owner_ID, Classification, Capacity_kg) VALUES ('W01
8', 'OW457', 'Freight', 60000);
INSERT INTO WAGONS (Wagon_ID, Owner_ID, Classification, Capacity_kg) VALUES ('W11
8', 'OW111', 'Freight', 68000);
INSERT INTO WAGONS (Wagon_ID, Owner_ID, Classification, Capacity_kg) VALUES ('W51
6', 'OW232', 'Freight', 69000);


INSERT INTO LOCOMOTIVE (Locomotive_ID, Classification) VALUES ('L015', 'Nonautono
mous');
INSERT INTO LOCOMOTIVE (Locomotive_ID, Classification) VALUES ('L114', 'Autonomou
s');
INSERT INTO LOCOMOTIVE (Locomotive_ID, Classification) VALUES ('L215', 'Autonomou
s');
```

```
INSERT INTO RAILWAY_STATION (Rail_Station_Code, Location, Capacity_tr) VALUES ('C
Z2', 'Prague', 15);
INSERT INTO RAILWAY_STATION (Rail_Station_Code, Location, Capacity_tr) VALUES ('G
B1', 'London', 20);


INSERT INTO TRAIN (Train_ID, Rail_Station_Code, Driver_ID, Wagon_ID, Locomotive_I
D, Capacity_kg) VALUES ('TR441', 'CZ2', 'D546', 'W018', 'L015', 120000);
INSERT INTO TRAIN (Train_ID, Rail_Station_Code, Driver_ID, Wagon_ID, Locomotive_I
D, Capacity_kg) VALUES ('TR145', 'GB1', 'D112', 'W516', 'L215', 141000);


INSERt INTO DEPOT (Depot_ID, Location, Capacity_tr) VALUES ('DP06', 'Prague', 10)
;
INSERt INTO DEPOT (Depot_ID, Location, Capacity_tr) VALUES ('DP29', 'Manchester',
 6);


INSERT INTO SERVICE (Service_ID, Train_ID, Depot_ID, Maintenance_Date, Maintenanc
e_Type, Hours_Spent) VALUES ('SRV59', 'TR441', 'DP06', '01/01/2021', 'Replacing t
he control system', 254);
INSERT INTO SERVICE (Service_ID, Train_ID, Depot_ID, Maintenance_Date, Maintenanc
e_Type, Hours_Spent) VALUES ('SRV03', 'TR145', 'DP29', '07/24/2019', 'Complete bo
dy replacement', 517);


INSERT INTO SERVICE_HISTORY(Service_History_ID, Service_ID) VALUES ('SRVH28', 'SR
V03');
INSERT INTO SERVICE_HISTORY(Service_History_ID, Service_ID) VALUES ('SRVH04', 'SR
V59');


INSERT INTO MAINTENANCE_DETAIL(Service_ID, Employee_ID) VALUES ('SRV59', 'E1113')
;
INSERT INTO MAINTENANCE_DETAIL(Service_ID, Employee_ID) VALUES ('SRV03', 'E4216')
;
```

3.3.SQL Queries

- **Find all drivers names, their driving ID, licence numbers and Train ID where are they working.**

```
SELECT TRAIN.Train_ID, TRAIN_DRIVER.Driver_ID, TRAIN_DRIVER.Licence_Numbe
r, PERSON.first_name, PERSON.last_name, PERSON.tel_number FROM TRAIN
INNER JOIN TRAIN_DRIVER ON TRAIN.Driver_ID = TRAIN_DRIVER.Driver_ID
INNER JOIN PERSON ON TRAIN_DRIVER.Personal_ID = PERSON.Personal_ID;
```

- **Find all trains ID, their Locomotives, Wagons ID and their classifications.**

```
SELECT TRAIN.Train_ID, LOCOMOTIVE.Locomotive_ID, LOCOMOTIVE.Classificatio
n, WAGONS.Wagon_ID, WAGONS.Classification FROM TRAIN
INNER JOIN LOCOMOTIVE ON TRAIN.Locomotive_ID = LOCOMOTIVE.Locomotive_ID
INNER JOIN WAGONS ON TRAIN.Wagon_ID = WAGONS.Wagon_ID;
```

- **Find when and what services trains had and get information about the employees which performed these works.**

```
SELECT TRAIN.Train_ID, SERVICE.Service_ID, SERVICE.Maintenance_Type, SERV
ICE.Maintenance_Date, EMPLOYEE.Employee_ID, EMPLOYEE.Position, PERSON.fir
st_name, PERSON.last_name, PERSON.insurance_number FROM SERVICE
INNER JOIN TRAIN ON SERVICE.Train_ID = TRAIN.TRAIN_ID
INNER JOIN MAINTENANCE_DETAIL ON SERVICE.SERVICE_ID = MAINTENANCE_DETAIL.
SERVICE_ID
INNER JOIN EMPLOYEE ON MAINTENANCE_DETAIL.Employee_ID = EMPLOYEE.Employee
_ID
INNER JOIN PERSON ON EMPLOYEE.Personal_ID = PERSON.Personal_ID;
```

- **Find out which train stored in Railway Station With Code 'CZ2' and where is it.**

```
SELECT TRAIN.TRAIN_ID, RAILWAY_STATION.Rail_Station_Code, RAILWAY_STATION
.Location FROM TRAIN
INNER JOIN RAILWAY_STATION ON TRAIN.Rail_Station_Code = RAILWAY_STATION.R
ail_Station_Code WHERE RAILWAY_STATION.Rail_Station_Code = 'CZ2';
```

- **Find out who is the owner of Wagon with ID ‘W118’ and get information about him/her.**

```
SELECT WAGONS.Wagon_ID, OWNER.Owner_ID, PERSON.first_name, PERSON.last_na
me, PERSON.email, PERSON.tel_number FROM WAGONS
INNER JOIN OWNER ON WAGONS.Owner_ID = OWNER.Owner_ID
INNER JOIN PERSON ON OWNER.Personal_ID = PERSON.Personal_ID WHERE WAGONS.
Wagon_ID = 'W118';
```

- **Find all basic information about train with id 'TR145'**

```
SELECT TRAIN.TRAIN_ID, TRAIN.Capacity_kg, RAILWAY_STATION.Rail_Station_Co
de, RAILWAY_STATION.Location, LOCOMOTIVE.Locomotive_ID, LOCOMOTIVE.Classi
fication, WAGONS.Wagon_ID, WAGONS.Classification, OWNER.Owner_ID, TRAIN_D
RIVER.Driver_ID, SERVICE.SERVICE_ID, SERVICE.Maintenance_Type, SERVICE.Ma
intenance_Date, SERVICE.Hours_Spent, SERVICE_HISTORY.Service_History_ID,
DEPOT.Depot_ID, DEPOT.Location, EMPLOYEE.Employee_ID, EMPLOYEE.Position,
PERSON.first_name, PERSON.last_name, PERSON.insurance_number, PERSON.emai
l, PERSON.tel_number FROM TRAIN
INNER JOIN RAILWAY_STATION ON TRAIN.Rail_Station_Code = RAILWAY_STATION.R
ail_Station_Code
INNER JOIN LOCOMOTIVE ON TRAIN.Locomotive_ID = LOCOMOTIVE.Locomotive_ID
INNER JOIN WAGONS ON TRAIN.Wagon_ID = WAGONS.Wagon_ID
INNER JOIN OWNER ON WAGONS.Owner_ID = OWNER.Owner_ID
INNER JOIN TRAIN_DRIVER ON TRAIN.Driver_ID = TRAIN_DRIVER.Driver_ID
INNER JOIN SERVICE ON TRAIN.TRAIN_ID = SERVICE.Train_ID
INNER JOIN SERVICE_HISTORY ON SERVICE_HISTORY.SERVICE_ID = SERVICE.SERVIC
E_ID
INNER JOIN DEPOT ON SERVICE.Depot_ID = DEPOT.Depot_ID INNER JOIN MAINTENA
NCE_DETAIL ON SERVICE.SERVICE_ID = MAINTENANCE_DETAIL.SERVICE_ID
INNER JOIN EMPLOYEE ON MAINTENANCE_DETAIL.Employee_ID = EMPLOYEE.Employee
_ID
INNER JOIN PERSON ON EMPLOYEE.Personal_ID = PERSON.Personal_ID WHERE Trai
n.Train_ID = 'TR145';
```

- **Find all basic information about all trains.**

```
SELECT TRAIN.TRAIN_ID, TRAIN.Capacity_kg, RAILWAY_STATION.Rail_Station_Co
de, RAILWAY_STATION.Location, LOCOMOTIVE.Locomotive_ID, LOCOMOTIVE.Classi
fication, WAGONS.Wagon_ID, WAGONS.Classification, OWNER.Owner_ID, TRAIN_D
RIVER.Driver_ID, SERVICE.SERVICE_ID, SERVICE.Maintenance_Type, SERVICE.Ma
intenance_Date, SERVICE.Hours_Spent, SERVICE_HISTORY.Service_History_ID,
DEPOT.Depot_ID, DEPOT.Location, EMPLOYEE.Employee_ID, EMPLOYEE.Position,
PERSON.first_name, PERSON.last_name, PERSON.insurance_number, PERSON.emai
l, PERSON.tel_number FROM TRAIN
INNER JOIN RAILWAY_STATION ON TRAIN.Rail_Station_Code = RAILWAY_STATION.R
ail_Station_Code
INNER JOIN LOCOMOTIVE ON TRAIN.Locomotive_ID = LOCOMOTIVE.Locomotive_ID
INNER JOIN WAGONS ON TRAIN.Wagon_ID = WAGONS.Wagon_ID
INNER JOIN OWNER ON WAGONS.Owner_ID = OWNER.Owner_ID
INNER JOIN TRAIN_DRIVER ON TRAIN.Driver_ID = TRAIN_DRIVER.Driver_ID
INNER JOIN SERVICE ON TRAIN.TRAIN_ID = SERVICE.Train_ID
INNER JOIN SERVICE_HISTORY ON SERVICE_HISTORY.SERVICE_ID = SERVICE.SERVIC
E_ID
INNER JOIN DEPOT ON SERVICE.Depot_ID = DEPOT.Depot_ID
INNER JOIN MAINTENANCE_DETAIL ON SERVICE.SERVICE_ID = MAINTENANCE_DETAIL.
SERVICE_ID
INNER JOIN EMPLOYEE ON MAINTENANCE_DETAIL.Employee_ID = EMPLOYEE.Employee
_ID
INNER JOIN PERSON ON EMPLOYEE.Personal_ID = PERSON.Personal_ID;
```

4. Conclusion

This project contains a basic proposal for a database, which can be used in a Train station information system. It contains definitions of essential database objects, and examples of possible use cases realised in the form of SQL queries. This project is an essential part of a possible implementation of full scale systems.