Normalization 1:

UNF

TRANSPORT\_VEHICLE (vehicle\_id, vehicle\_registrationnumber, vehicle\_make, vehicle\_model, vehicle\_year, vehicle\_odometer, vehicle\_passengers, features)

FDs:

* **vehicle\_id ->** vehicle\_registrationnumber, vehicle\_make, vehicle\_model, vehicle\_year, vehicle\_odometer, vehicle\_passengers, features
* vehicle\_registrationnumber **->** vehicle\_make, vehicle\_model, vehicle\_year, vehicle\_odometer, vehicle\_passengers, features
* **vehicle\_model, vehicle\_year->vehicle\_make**
* **vehicle\_make, vehicle\_model, vehicle\_year->features**

1NF

TRANSPORT\_VEHICLE (vehicle\_id, vehicle\_registrationnumber, vehicle\_make, vehicle\_model, vehicle\_year, vehicle\_odometer, vehicle\_passengers)

CKs:

* vehicle\_id
* vehicle\_registrationnumber

Partial dependencies:

**vehicle\_model, vehicle\_year->vehicle\_make**

**vehicle\_make, vehicle\_model, vehicle\_year->features**

2NF

TRANSPORT\_VEHICLE (vehicle\_id, vehicle\_registrationnumber, vehicle\_model, vehicle\_year, vehicle\_odometer, vehicle\_passengers)

FEATURES (vehicle\_make, vehicle\_model, vehicle\_year,features)

Transitive dependencies:

No transitive dependencies in TRANSPORT\_VEHICLE and FEATURES table

3NF

TRANSPORT\_VEHICLE (vehicle\_id, vehicle\_registrationnumber, vehicle\_model, vehicle\_year, vehicle\_odometer, vehicle\_passengers)

Full Dependencies:

vehicle\_id --> vehicle\_registrationnumber, vehicle\_model, vehicle\_year, vehicle\_odometer, vehicle\_passengers

FEATURES (vehicle\_make, vehicle\_model, vehicle\_year,features)

Full Dependencies:

**vehicle\_make, vehicle\_model, vehicle\_year->features**

Normalization 2:

UNF

TRIP(trip\_id, assigned\_vehicle\_id, assigned\_rego, assigned\_driver\_ID, assigned\_driver\_name, booked\_official\_ID, booked\_official\_name, no\_of\_vehicle\_passengers, pick\_up\_location\_ID, pick\_up\_location\_name, pick\_up\_location\_type, pick\_up\_location\_address, intended\_pick\_up\_time, actual\_pick\_up\_time, drop\_off\_location\_ID, drop\_off\_location\_name, drop\_off\_location\_type, drop\_off\_location\_address, intended\_drop\_off\_time, actual\_drop\_off\_time)

Fds:

assigned\_vehicle\_id --> assigned\_rego\*

assigned\_rego --> assigned\_vehicle\_id\*

assigned\_driver\_ID --> assigned\_driver\_name

booked\_official\_ID --> booked\_official\_name

pick\_up\_location\_ID --> pick\_up\_location\_name, pick\_up\_location\_type, pick\_up\_location\_address

drop\_off\_location\_ID --> drop\_off\_location\_name, drop\_off\_location\_type, drop\_off\_location\_address

1NF

TRIP(trip\_id, assigned\_vehicle\_id, assigned\_rego, assigned\_driver\_ID, assigned\_driver\_name, booked\_official\_ID, booked\_official\_name, no\_of\_vehicle\_passengers, pick\_up\_location\_ID, pick\_up\_location\_name, pick\_up\_location\_type, pick\_up\_location\_address, intended\_pick\_up\_time, actual\_pick\_up\_time, drop\_off\_location\_ID, drop\_off\_location\_name, drop\_off\_location\_type, drop\_off\_location\_address, intended\_drop\_off\_time, actual\_drop\_off\_time)

CKs:

* trip\_id

Partial dependencies:

No partial dependencies present

2NF

TRIP(trip\_id, assigned\_vehicle\_id, assigned\_rego, assigned\_driver\_ID, assigned\_driver\_name, booked\_official\_ID, booked\_official\_name, no\_of\_vehicle\_passengers, pick\_up\_location\_ID, pick\_up\_location\_name, pick\_up\_location\_type, pick\_up\_location\_address, intended\_pick\_up\_time, actual\_pick\_up\_time, drop\_off\_location\_ID, drop\_off\_location\_name, drop\_off\_location\_type, drop\_off\_location\_address, intended\_drop\_off\_time, actual\_drop\_off\_time)

Transitive dependencies:

assigned\_vehicle\_id --> assigned\_rego\*

assigned\_rego --> assigned\_vehicle\_id\*

assigned\_driver\_ID --> assigned\_driver\_name

booked\_official\_ID --> booked\_official\_name

pick\_up\_location\_ID --> pick\_up\_location\_name, pick\_up\_location\_type, pick\_up\_location\_address

drop\_off\_location\_ID --> drop\_off\_location\_name, drop\_off\_location\_type, drop\_off\_location\_address

3NF

TRIP(trip\_id, assigned\_vehicle\_id, assigned\_driver\_ID, booked\_official\_ID, no\_of\_vehicle\_passengers, pick\_up\_location\_ID, intended\_pick\_up\_time, actual\_pick\_up\_time, drop\_off\_location\_ID, intended\_drop\_off\_time, actual\_drop\_off\_time)

DRIVER(assigned\_driver\_ID, assigned\_driver\_name)

OFFICIAL(booked\_official\_ID, booked\_official\_name)

PICK\_UP\_LOCATION(pick\_up\_location\_ID, pick\_up\_location\_name, pick\_up\_location\_type, pick\_up\_location\_address)

DROP\_OFF\_LOCATION(drop\_off\_location\_ID, drop\_off\_location\_name, drop\_off\_location\_type, drop\_off\_location\_address)

Full Dependencies:

trip\_id --> assigned\_vehicle\_id, assigned\_driver\_ID, booked\_official\_ID, no\_of\_vehicle\_passengers, pick\_up\_location\_ID, intended\_pick\_up\_time, actual\_pick\_up\_time, drop\_off\_location\_ID, intended\_drop\_off\_time, actual\_drop\_off\_time

assigned\_driver\_ID --> assigned\_driver\_name

booked\_official\_ID --> booked\_official\_name

pick\_up\_location\_ID --> pick\_up\_location\_name, pick\_up\_location\_type, pick\_up\_location\_address

drop\_off\_location\_ID --> drop\_off\_location\_name, drop\_off\_location\_type, drop\_off\_location\_address

Attribute Synthesis:

Combined PICK\_UP\_LOCATION and DROP\_OFF\_LOCATION into LOCATION(location\_ID, location\_name, location\_type, location\_address)

FINAL 3NF Relations:

TRIP(trip\_id, assigned\_vehicle\_id, assigned\_driver\_ID, booked\_official\_ID, no\_of\_vehicle\_passengers, pick\_up\_location\_ID, intended\_pick\_up\_time, actual\_pick\_up\_time, drop\_off\_location\_ID, intended\_drop\_off\_time, actual\_drop\_off\_time)

DRIVER(assigned\_driver\_ID, assigned\_driver\_name)

OFFICIAL(booked\_official\_ID, booked\_official\_name)

LOCATION(location\_ID, location\_name, location\_type, location\_address)

Joining 3NF from Normalization 1 and Normalization 2:

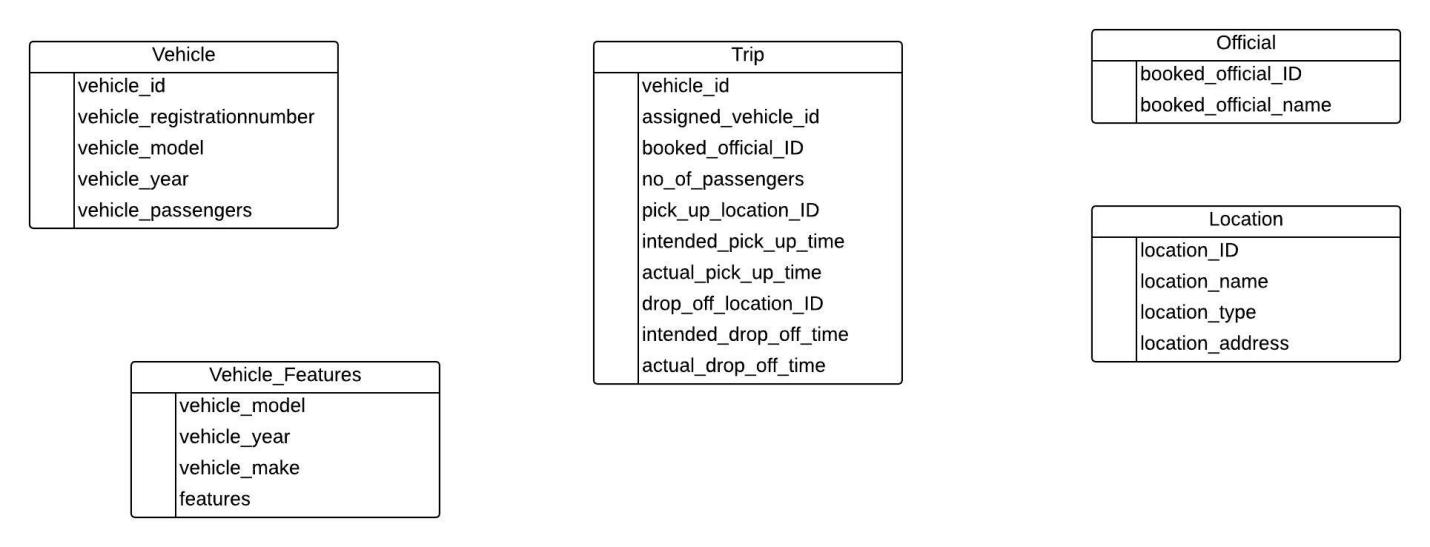
* TRANSPORT\_VEHICLE (vehicle\_id, vehicle\_registrationnumber, vehicle\_model, vehicle\_year, vehicle\_odometer, vehicle\_passengers)
* FEATURES (vehicle\_model, vehicle\_year, vehicle\_make, features)
* TRIP(trip\_id, assigned\_vehicle\_id, assigned\_driver\_ID, booked\_official\_ID, no\_of\_vehicle\_passengers, pick\_up\_location\_ID, intended\_pick\_up\_time, actual\_pick\_up\_time, drop\_off\_location\_ID, intended\_drop\_off\_time, actual\_drop\_off\_time)
* DRIVER(assigned\_driver\_ID, assigned\_driver\_name)
* OFFICIAL(booked\_official\_ID, booked\_official\_name)
* LOCATION(location\_ID, location\_name, location\_type, location\_address)

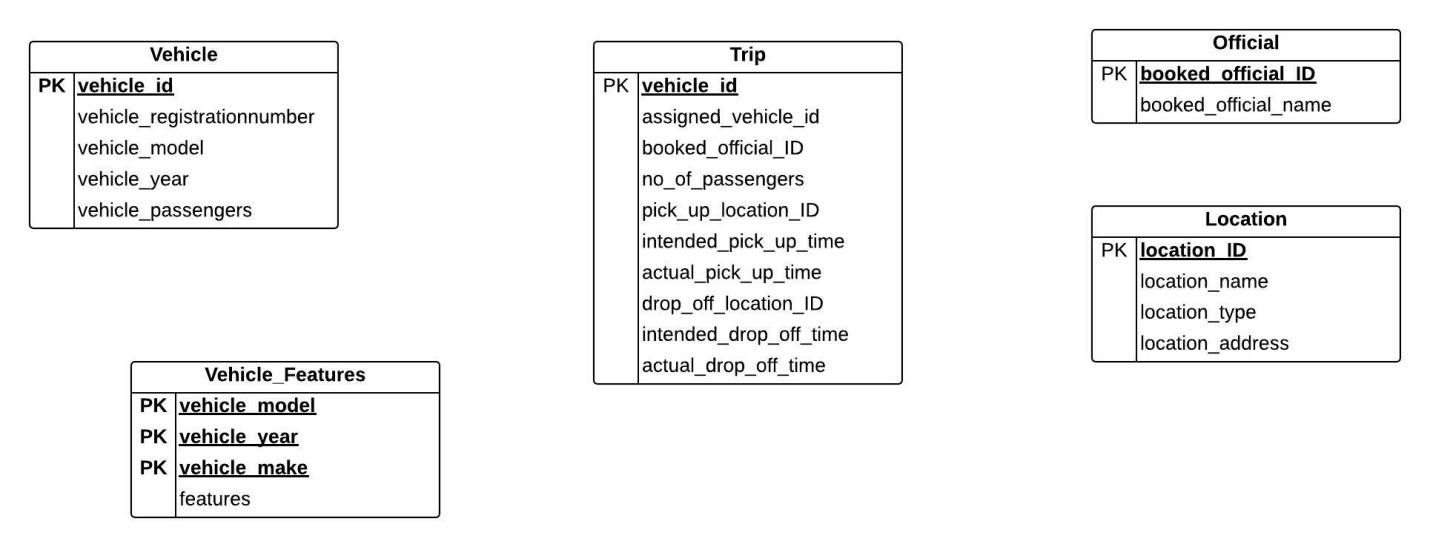
ASSUMPTIONS:

* One vehicle can have zero or many features.
* One vehicle can be booked for either no or many trips.
* Each official must have gone for one or many trips.
* There is the possibility that some locations never got to be the drop off locations and some locations never got to be pickup locations and it is also possible that some locations got to be drop off locations multiple times and some locations got to be pick up locations multiple times.
* One assigned vehicle for the trip can have only one registration number so there is no need of a separate table.

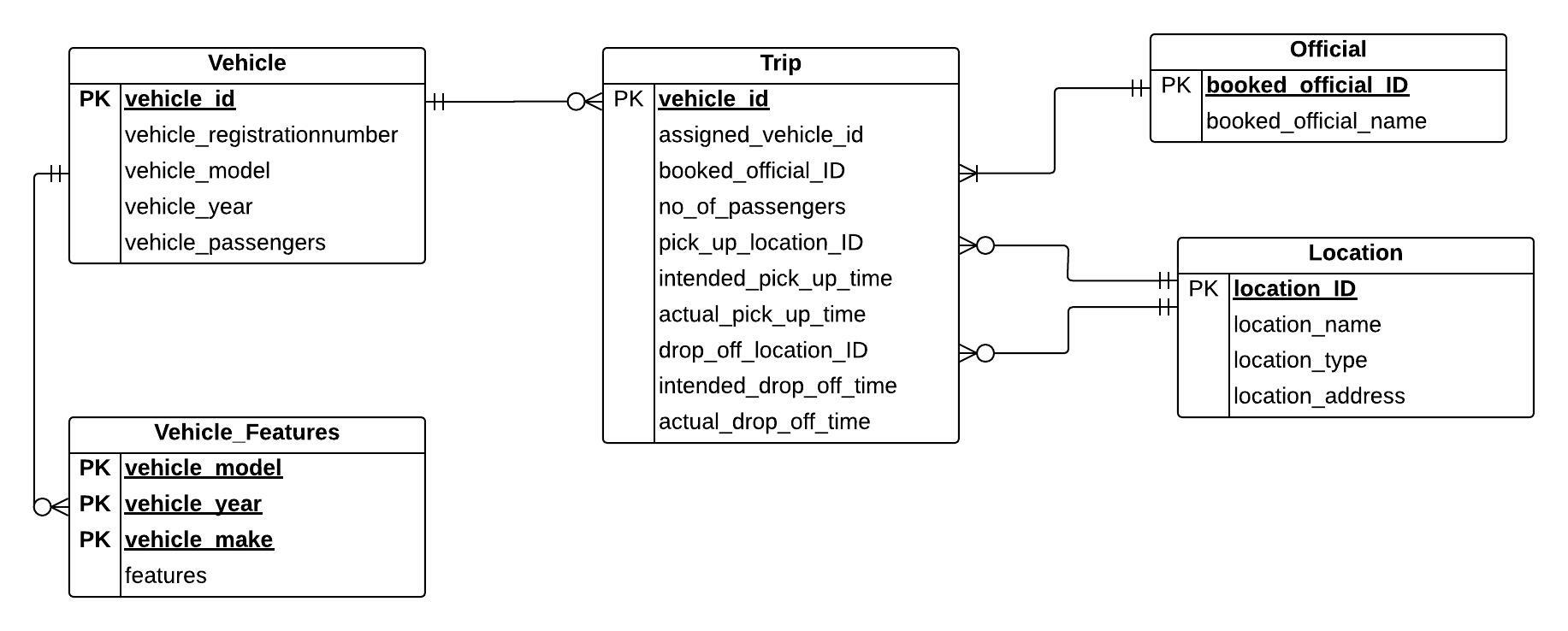
**Logical Design:**

Draft1:



Draft2: 

Draft3:



Draft4 (final):

