

### **ER Diagram:**

The ER diagram contains several entities such as Vehicle, Emissions, and Repeated Costs. Among these entities, some of them are classified as strong and weak entities. For example, a “vehicle” is a strong entity as its existence does not depend on any other entities. Every strong entity has a primary key as it is used to uniquely identify that tuple in a given relation. Since a “vehicle” entity is labeled as a strong entity, it has a primary key called “VIN number” to identify each car uniquely. The attributes of the Vehicle entity are Current\_year, Cuurent\_make, Current\_model, Department\_Name, future-year, future\_make, future\_model, vehicle\_type, initia\_cost, and VIN. The weak entities in the ER are Repeated\_Costs and Emissions. The attributes for the Repeated\_Costs entity are tires\_cost, repairs-cost, fuel\_cost, Insurance\_cost, maintenance\_cost, and invoice number

The relationship between two strong entities is represented by a diamond symbol. The relationship between one strong entity and a weak entity set is shown by a double diamond symbol. For instance, the relationship between vehicle and Emissions entities have a double diamond symbol

The ER diagram also contains subclass and superclass relations. A subclass is a class derived from the superclass and inherits all the properties of the superclass. For current\_vehicle and future\_vehicle are subclasses of the superclass Vehicle. They all inherit common attributes from Vehicle such as department\_name, VIN\_number, and etc.,

The ER diagram has a cardinality of 1:1 between Vehicle and Emission entities because no other cardinality such as 1:N or M:N would best match the given relation between these two entities. Another cardinality of 1: N is between Vehicle and Repeated\_Costs entities; each vehicle has multiple maintenance costs, repairs, and fuel costs.

The Vehicle entity has total participation because every vehicle has costs that are necessary for the functioning of the vehicle such as fuel cost, maintenance costs, etc. Likewise, the Repeated\_Costs entity also has a total participation constraint because every cost (fuel, maintenance) is associated with some vehicle. Additionally, the ER contains an Emissions entity which has a partial participation. The total participation between Vehicle entity and disjointness constraint indicates that all vehicles belong to at least one of the categories of the subclasses. All the total participation constraints are shown by a double line; partial participation constraint is shown by a single line

The subset sign denoted as “U” in ER specifies all the subtypes such as Current\_Vehicle and Future\_Vehcile are all the subsets of the supertype Vehicle.

### **Relational Schema:**

1. A relational schema contains a set of modified relational tables with its attributes. The schema can portray relationships between several tables. It also shows primary and foreign key relationships as well.
2. The *Vin\_Number* attribute in the *Repeated\_Costs* table is a foreign key connecting it to the *Vin\_Number* attribute (primary key) in the *VEHICLE* table
3. The *VIN\_Number* attribute in the *Emissions* table is a foreign key connecting it to the *VIN\_Number* attribute (primary key) in the *Vehicle* table
4. The *VIN\_Number* in the *Vehicle* entity is a primary key

### **Estimates:**

Database Size: Since there are currently 97 fleet vehicles logged on the fleet vehicle spreadsheet, there will be a total of 97 fleet vehicle entries in the database. As this is an estimated approximation, this may change in future if more data is added into the database