Traffic Management System Project

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# Assumptions, Entities, Business Rules & ERD

## Assumptions:

1. There will be accurate geospatial records with satellite access for all the attributes requiring a Geo\_Location.
2. The status of each traffic light and traffic incident will be monitored and reported in real-time or within 5 minutes of a status change.
3. There will be access to backup power for all traffic control equipment in need of electricity.
4. There will be a map of all the geolocations and their accompanying attributes that will be updated regularly to ensure accurate information.
5. The focus will be on types of vehicles and numbers of vehicles and not specific registrations, thus the database will not store logs of each vehicle but will be used in real-time to identify what the impact of each incident will be on the traffic flow. The logs will be stored elsewhere to ensure the optimum performance of the database and to minimize redundancy and clutter.
6. The database will be used in conjunction with a smart traffic management API or AI and as such will be used to analyze situations, report to the traffic control center, and propose solutions in a similar manner to google maps driving assistant.
7. The actual management of the traffic and the route suggestions will be done by an external smart system API or AI.
8. The system will have access to instruments that can measure speed, the direction of travel, geolocation, and status of traffic lights and traffic incidents in real-time in order to update the database with the relevant information.

## Entities:

1. **Incident** – A Record of Incidents that have occurred or are occurring.
   * + - 1. Attributes – PK-Incident\_ID, FK-Area\_ID, FK-R\_Inf\_ID, FK-TCE\_ID, FK-P\_ID, Type, Num\_Vehicles, Status
2. **Incident Vehicles** – A record of what Vehicles were/are involved with each Incident.
   * + - 1. Attributes – PK|FK-Incident\_ID, FK-V\_ID
3. **Vehicle**- A Record of all Vehicles and Vehicle types that are involved in the traffic flow.
   * + - 1. Attributes – PK|FK-Incident\_ID, PK-V\_ID
   * **Truck** – A subtype of Vehicles.
     + - 1. Attributes – PK|FK-V\_ID, Num\_Trailers, Type, Colour, Direction\_Travel, Speed, Geo\_Location
   * **Bakkie** – A subtype of Vehicles.
     + - 1. Attributes – PK|FK-V\_ID, Type, Colour, Direction\_Travel, Speed, Geo\_Location
   * **Car** – A subtype of Vehicles.
     + - 1. Attributes – PK|FK-V\_ID, Type, Colour, Direction\_Travel, Speed, Geo\_Location
   * **Motorcycle** – A subtype of Vehicles.
     + - 1. Attributes – PK|FK-V\_ID, Type, Colour, Direction\_Travel, Speed, Geo\_Location
4. **Road\_Infrustructure** – A record of the infrastructure than can be involved in an incident.
   * + - 1. Attributes – PK|FK-Incident\_ID, PK-R\_Inf\_ID
   * **Intersection** – A subtype of Road\_Infrustructure.
     1. Attributes – PK|FK-R\_Inf\_ID, PK-Int\_ID, Num\_Roads, Geo\_Location
        + **Intersect\_Roads** – A Record of all roads that enter an intersection.
          1. Attributes – PK|FK-Int\_ID, FK-Road\_ID,
   * **Road** – A subtype of Road\_Infrustructure
     + - 1. Attributes – PK|FK-R\_Inf\_ID, PK-Road\_ID, Road\_Type, Priority, Road\_Name, Direction, Geo\_Location
   * **Bridge** – A subtype of Road\_Infrustructure
     + - 1. Attributes – PK|FK-R\_Inf\_ID, FK-Road\_ID , Num\_Lanes, CrossUnder\_Road\_ID, Geo\_Location
   * **Offramp** – A subtype of Road\_Infrustructure
     + - 1. Attributes – PK|FK-R\_Inf\_ID, PK-Offramp\_ID, FK-Bridge\_ID, FK-Road\_ID, Num\_Lanes
5. **Pedestrian** – A record of all types of pedestrians that can be involved in an incident.
   * + - 1. Attributes – PK|FK-Incident\_ID, PK-P\_ID, Type, Direction\_Travel, Speed, Geo\_Location
6. **Traffic\_Ctrl\_Equip** – A record of all equipment involved in traffic management.
   * + - 1. Attributes - PK|FK-Incident\_ID, PK-TCE\_ID
   * **Stop\_Street** – A subtype of Traffic\_Ctrl\_Equip
     + - 1. Attributes – PK|FK-TCE\_ID, PK-SS\_ID, FK-Int\_ID, Direction\_Travel, Geo\_Location
   * **Yield\_Sign** – A Subtype of Traffic\_Ctrl\_Equip
     + - 1. Attributes – PK|FK-TCE\_ID, PK-YS\_ID, FK-Int\_ID, Direction\_Travel, Geo\_Location
   * **Traffic\_Light** – A subtype of Traffic\_Ctrl\_Equip
     + - 1. Attributes – PK|FK-TCE\_ID, PK-TL\_ID, FK\_Int\_ID, Direction\_Travel, Geo\_Location, Status
7. **Area** – A Record of the Geographical Area’s and Area Types.
   * + - 1. Attributes – PK|FK-Incident\_ID, PK-Area\_ID
   * **Industrial** – A subtype of Area
     + - 1. Attributes – PK|FK-Area\_ID, Area\_Code, Area\_Name
   * **Urban** – A subtype of Area
     + - 1. Attributes – PK|FK-Area\_ID, Area\_Code, Area\_Name
   * **Sub\_Urban** – A subtype of Area
     + - 1. Attributes – PK|FK-Area\_ID, Area\_Code, Area\_Name
   * **Rural** – A subtype of Area
     + - 1. Attributes – PK|FK-Area\_ID, Area\_Code, Area\_Name

## Business Rules:

1. Each traffic incident will have a unique incident ID
2. Each traffic incident will report the Area ID, Road Infrastructure ID, Traffic Control Equipment ID, Number of Vehicles Involved, and the Status of the Incident (Cleared or still active).
3. Each incident will refer to Table Vehicle, Table Road\_Infrustructure, Table Pedestrian, Table Traffic\_Ctrl\_Equip, and Table Area.
4. Table Vehicle will refer to Table Truck, Table Bakkie, Table Car, and Table Motorcycle.
5. Each Vehicle will have a unique Vehicle ID, V\_ID
6. Table Truck will consist of the V\_ID, number of trailers, type of truck, the color of the truck, the direction of travel, speed, and last known geo\_location.
7. Table Bakkie will consist of the V\_ID, type of Bakkie, the color of Bakkie, the direction of travel, speed, and last known geo\_location.
8. Table Car will consist of the V\_ID, type of Car, the color of the Car, the direction of travel, speed, and last known geo\_location.
9. Table Motorcycle will consist of the V\_ID, type of Motorcycle, the color of Motorcycle, direction of travel, speed, and last known geo\_location.
10. Each Road infrastructure will have a unique ID, R\_Inf\_ID.
11. Table Road\_Infrustructure will refer to Table Intersection, Table Road, Table Bridge, and Table Offramp.
12. Table Intersection will consist of, R\_Inf\_ID, Number of roads joining at the intersection, Intersection ID and Geo\_Location of the Intersection.
13. Table Road will consist of, R\_Inf\_ID, Road Type, Priority, Name, Direction, Road\_ID and Geo\_Location.
14. Table Bridge will consist of, R\_Inf\_ID, Num\_Lanes, CrossUnder road, Road\_ID, Bridge\_ID, Geo\_Location.
15. Table Offramp will consist of, R\_Inf\_ID, Offramp\_ID, Num Lanes, Bridge\_ID, Road\_ID.
16. Each Pedestrian will have a unique ID, P\_ID.
17. Table Pedestrian will consist of Incident\_ID, P\_ID, Type, Direction of Travel, Speed and Geolocation.
18. Each Traffic Control Equipment will have a Unique ID, TCE\_ID.
19. Table Traffic\_Ctrl\_Equip will reference Table Stop\_Street, Table Yield Sign and Table Traffic Light.
20. Table Stop\_Street will consist of the TCE\_ID, Stop Street ID, Intersection ID, Direction of travel and Geo\_Location.
21. Table Yield\_Sign will consist of the TCE\_ID, Yield Sign ID, Intersection ID, Direction of travel and Geo\_Location
22. Table Traffic light will consist of the TCE\_ID, Traffic Light ID, Intersection ID, Direction of travel, Geo\_Location and Status (Red, yellow, Green)
23. Each Area will have a unique Area ID.
24. Table Area will reference Table Industrial, Table Urban, Table Sub-Urban, Table Rural.
25. Table Industrial will consist of an Area ID, Area Code and Area Name.
26. Table Urban will consist of an Area ID, Area Code and Area Name.
27. Table Sub-Urban will consist of an Area ID, Area Code and Area Name.
28. Table Rural will consist of an Area ID, Area Code and Area Name.

## ERD:

