Database Design and Development: ET Transport

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Introduction :

ET Transport, founded in 2005, is a reliable trucking company with locations in Ontario and New Brunswick. They operate over 100 trucks and 200 trailers, handling more than 25,000 shipments each year, ensuring goods are delivered safely and on time. Known for their focus on efficiency and reliability, ET Transport uses well-established processes to serve customers across a large area This strong base makes them a great example of providing smooth operations, data accuracy, appropriate fleet utilization and great customer satisfaction.

Mission :

This case study aims to provide a data-based solution for E.T. Transport by creating an efficient and scalable database system the system will help improve in fleet management, reduce costs, ensure deliveries are on time, and increase data accuracy, with this database E.T. Transport will be able to make better decisions based on accurate data.

Objectives:

1. Reduce Fleet Downtime (Fleet downtime means minimizing the time that vehicles are not in use or out of service)
2. Increase Fleet Utilization (Fleet utilization simply refers to how effectively a company's vehicles are used in the perspective of space)
3. Improve On-Time Delivery
4. Reduce Operating Costs per Mile
5. Enhance Data Accuracy
6. Improve Customer Satisfaction Scores

Database Design:

In the database design for E.T. Transportation, I used a snowflake schema that includes key entities like deliveries, vehicles, maintenance, routes, GPS tracking, drivers, customer feedback, and costs. These entities are connected through one-to-one or one-to-many relationships to ensure smooth information flow. The "deliveries" entity. This design will help E.T. Transportation in organizing data effectively, making it easier to track and analyse for their operations and make better business decisions

In the GPS tracking column of the database design for E.T. Transportation, I included longitude and latitude data to provide precise vehicle location tracking. The system allows the

organization to easily monitor the location of vehicles by connecting the ROUTE ID (used as a foreign key) and the GPS ID (used as a primary key). This, combined with the license plate information, ensures efficient and accurate tracking of each vehicle's movement

Table Description :

Table Name	Primary Key	Foreign Keys	Description
Vehicles	License_plate	None	Stores vehicle information
Drivers	License_number	License_plate	Stores driver information
Maintenance	Maintenance_ID	License_plate	Records vehicle maintenance details
Routes	Route_ID	None	Details about transportation routes
Deliveries	Delivery_ID	Route_ID, License_plate, License_number	Information on deliveries made
Customer Feedback	Feedback_ID	Delivery_ID	Captures customer feedback on deliveries
Costs	Cost_ID	License_plate	Tracks costs associated with trips
GPS Tracking	GPS_ID	License_plate, Route_ID	Monitors vehicle locations using GPS

Relationship Types:

| Table	Relationship	Description
Deliveries	One To Many	The delivery entity is linked to customer feedback through the foreign key of the delivery ID, allowing us to track the feedback provided by customers and vendors.
Vehicle	One To Many	One vehicle can be associated with multiple drivers, GPS tracking records, deliveries, and maintenance records
Routes	One To Many	Routes table is linked to the deliveries and GPS tracking tables through the foreign key Route ID,This means that each route can be associated with multiple deliveries and GPS tracking records
Customer Feedback	One To Many	The deliveries table is connected to the customer feedback table through the delivery ID as a foreign key. This allows both customers and vendors to provide feedback on a specific delivery using the same delivery ID. The delivery ID helps track feedback from both parties.

Entity Relationship Diagram :

"Database design involves organizing data based on a specific database model. The designer identifies the data that needs to be stored and defines the relationships between the various data elements"

The Original table has been split into 8 tables which are

Vehicles Drivers , Maintainance , Routes , Delieveries , Customer Feedback, Cost, GPS Tracking

Using the MySQL Workbench, I was able to create the ER Diagram below:
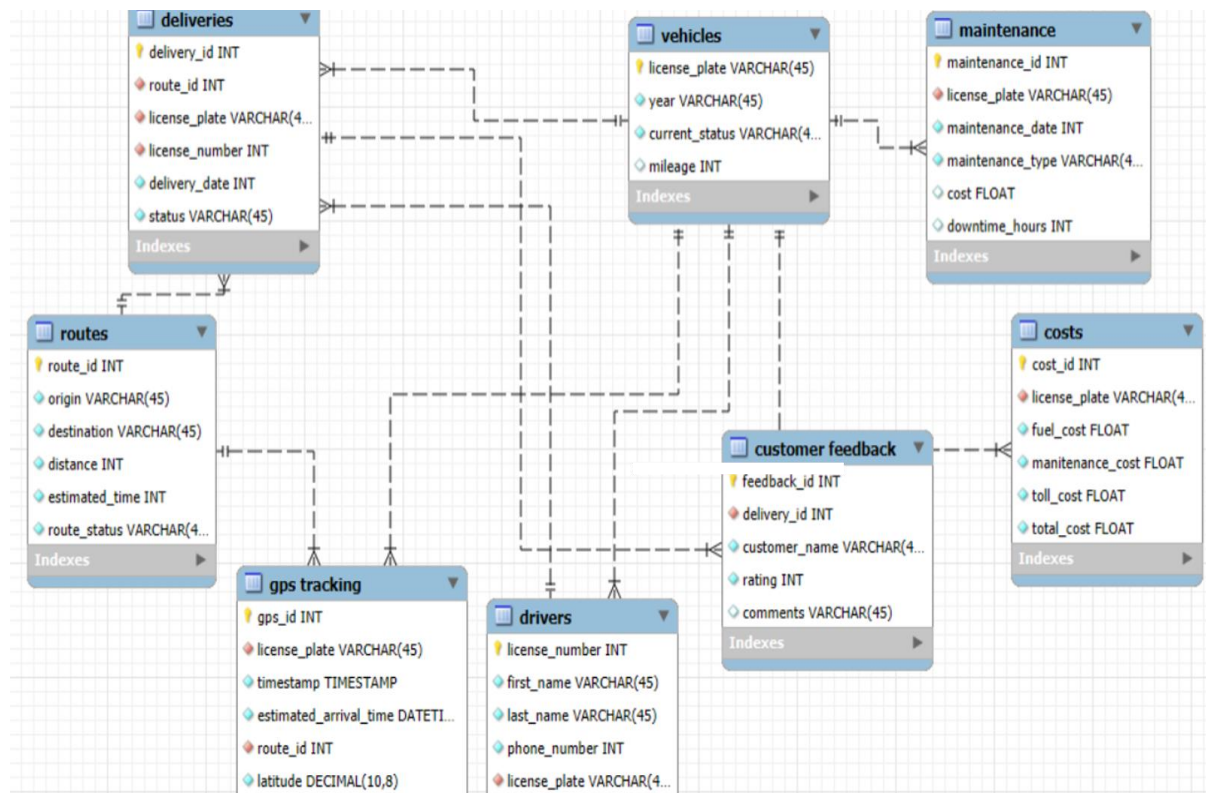
Database Development:

The key queries I used to develop the E.T. Transportation database were "SELECT" and "JOIN" queries, which allowed me to retrieve and combine data from multiple tables effectively. I also utilized VIEW queries to create virtual tables, such as Active Vehicles and Delivery Status, which offer simplified and real-time insights into critical business operations

While building the database for ET Transportation, several SQL queries were used to make operations smoother. For example, views like Active Vehicles and Driver Assignments give up-to-date information on the status of vehicles and driver assignments. The Maintenance Schedule view helps track upcoming maintenance tasks, making sure vehicles stay in good condition. Meanwhile, Delivery Status and GPS Tracking Overview allow for easy tracking of deliveries and real-time vehicle locations.

```sql
1   SELECT Customer_Feedback.Feedback_ID, Customer_Feedback.Rating, Customer_Feedback.Comments, Deliveries.Delivery_date, Routes.Origin, Routes.Destination
2   FROM Customer_Feedback
3   JOIN Deliveries ON Customer_Feedback.Delivery_ID = Deliveries.Delivery_ID
4   JOIN Routes ON Deliveries.Route_ID = Routes.Route_ID;
```

Feedback_ID	Rating	Comments	Delivery_date	Origin	Destination
1	5	Excellent service	20240928	New York	Los Angeles
2	4	Very good experience	20240929	Chicago	Houston
3	3	Average service	20240930	Miami	Atlanta
4	5	Outstanding delivery	20241001	Dallas	Denver
5	2	Needs improvement	20241002	Seattle	San Francisco

```sql
1 • SELECT * FROM et_transportation.gpstrackingoverview;
```

license_plate	timestamp	latitude	longitude	origin	destination
ABC123	2024-09-28 08:00:00	40.71277600	-74.00597400	New York	Los Angeles
PQR678	2024-09-28 13:00:00	39.73923600	-104.99025100	New York	Los Angeles
DEF456	2024-09-28 09:00:00	34.05223500	-118.24368300	Chicago	Houston
STU901	2024-09-28 14:00:00	32.71573600	-117.16108700	Chicago	Houston
GHI789	2024-09-28 10:00:00	41.87811300	-87.62979900	Miami	Atlanta
VWX234	2024-09-28 15:00:00	47.60620900	-122.33206900	Miami	Atlanta
JKL012	2024-09-28 11:00:00	29.76042700	-95.36980400	Dallas	Denver
YZA567	2024-09-28 16:00:00	39.95258300	-75.16522200	Dallas	Denver
MNO345	2024-09-28 12:00:00	33.44837600	-112.07403600	Seattle	San Francisco
BCD890	2024-09-28 17:00:00	30.26715300	-97.74305700	Seattle	San Francisco

#	Time	Action	Message	Duration / Fetch
73	15:54:08	SELECT * FROM et_transportation.deliverystatus LIMIT 0, 2000	5 row(s) returned	0.000 sec / 0.000 sec
74	15:54:21	SELECT * FROM et_transportation.driverassignments LIMIT 0, 2000	10 row(s) returned	0.000 sec / 0.000 sec
75	15:54:34	SELECT * FROM et_transportation.gpstrackingoverview LIMIT 0, 2000	10 row(s) returned	0.000 sec / 0.000 sec

Conclusion:

The database model created for E.T. Transportation will help in improving operations and making decisions based on data by using SQL queries to generate views like Active Vehicles, Driver Assignments and Delivery Status, the company can effectively keep track of vehicle conditions, monitor deliveries, and manage maintenance schedules, The addition of GPS tracking provides real-time insights, and the ability to identify equipment failures and managing inventory will help in enhancing operational stability this design and development of the data model will enable the company to better fulfil its goals of optimizing fleet utilization, supporting operational excellence, boosting performance, minimizing risks, and increasing overall efficiency in its operations.