**Solution Design Document**

**NYC Taxi Trip Analysis**

**1. Project Overview**

**Objective:**  
Develop an interactive Power BI dashboard to analyze NYC taxi trips. The dashboard will provide insights into trip patterns, fare distribution, and customer behavior using advanced DAX calculations and visualization techniques.

**Scope:**

* Analyze trip trends based on time, distance, and payment types.
* Implement time intelligence measures for performance tracking.
* Provide interactive reports with field parameters and slicers.

**Data Sources:**

* Fact\_TripData (trip-level details)
* Dim\_Date (date dimension table)
* Dim\_taxi\_zone\_lookup (geographical mapping)

**2. Key Metrics & Calculations**

**Essential Measures**

* **Total Trips:** COUNT(Fact\_TripData[tpep\_pickup\_datetime])
* **Total Fare Amount:** SUM(Fact\_TripData[total\_amount])
* **Average Trip Distance:** AVERAGE(Fact\_TripData[trip\_distance])
* **Average Tip Amount:** AVERAGE(Fact\_TripData[tip\_amount])
* **Average Tip %:**

VAR TotalFare = SUM(Fact\_TripData[fare\_amount])

VAR TotalTip = SUM(Fact\_TripData[tip\_amount])

RETURN IF(TotalFare > 0, DIVIDE(TotalTip, TotalFare, 0) \* 100, BLANK())

**Advanced DAX Calculations**

* **Peak Hours:** Compute trip count and duration per hour.
* **Popular Routes:** Identify top pick-up and drop-off locations.
* **Trip Distance Distribution:** Categorize trips based on distance.
* **Profitability by Location:** Analyze fares and tips across zones.

**Time Intelligence Metrics**

* **Year-to-Date (YTD):**

YTD Trips = TOTALYTD([Total\_Trips], Dim\_Date[Date])

* **Month-to-Date (MTD):**

MTD Trips = TOTALMTD([Total\_Trips], Dim\_Date[Date])

* **Previous Year (PY):**

PY Trips = CALCULATE([Total\_Trips], SAMEPERIODLASTYEAR(Dim\_Date[Date]))

* **Same Period Last Year (SPLY):**

SPLY Trips = CALCULATE([Total\_Trips], PARALLELPERIOD(Dim\_Date[Date], -12, MONTH))

**3. Visualization Design**

**Dashboard Overview**

* **KPIs:** Total Trips, Fare Amount, Avg Trip Distance, Avg Tip Amount
* **Visuals:**
  + Total Trips by Payment Type (Donut Chart)
  + Trips by Day & Time (Bar Chart & Line Chart)
  + Popular Routes (Table)
  + Average Fare & Tips by Zone (Map Visualization)
  + Total Trips by Distance Category (Bar Chart)

**4. Implementation Approach**

**Data Modeling**

* Integrate Fact\_TripData with Dim\_Date for time intelligence calculations.
* Use Dim\_taxi\_zone\_lookup for geographical analysis.

**DAX Implementation**

* Define measures within a dedicated measure table.
* Optimize calculations for performance.

**Calculation Groups**

* Develop calculation groups for time-based metrics (YTD, MTD, PY, SPLY) to streamline measures.

**5. Conclusion & Next Steps**

* Validate all measures and visualizations.
* Optimize performance by reducing unnecessary calculations.
* Implement additional insights based on stakeholder feedback.
* Publish and share interactive reports.

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**Date: 3** March 2025