

# Logistics Bottleneck & Delay Analyzer

## Project Report: *Insights from Logistics Bottleneck & Delay Analyzer*

### Project Goal

To analyze **50,000+ simulated delivery records** and uncover the causes of delivery delays by examining patterns across **locations, drivers, routes, vehicles, shifts, and weather** — using interactive, data-driven dashboards.

### Insights Gained


#### Overall Delivery Performance

- Only **~45%** of deliveries were completed on time.
- Around **20%** of deliveries were marked as **failed**, mostly due to **route congestion** or **weather delays**.
- Remaining deliveries were delayed, with an **average delay of 35+ minutes**.

 *This highlights the need for targeted operational improvements and real-time monitoring.*


#### Route-Level Delays

- Top 10 routes (e.g., **Ajmer → Guntur, Durg → Salem**) showed **average delays exceeding 60 minutes**.
- These routes consistently underperformed across time periods and vehicle types.

 *This suggests structural inefficiencies — like road conditions or unrealistic delivery schedules.*

#### Hub-Level & Driver Performance

- A few **origin hubs** contributed to **40% of total delay minutes**.
- Certain **drivers** repeatedly showed **high average delays** and failure counts — potentially due to **shift fatigue**, lack of training, or route unfamiliarity.

 *KPIs helped drill down from hub → route → driver to pinpoint inefficiencies.*

#### Environmental & External Conditions

- **Foggy** and **rainy** weather conditions led to **40–60% higher delays**, especially for **vans and trucks**.
- These conditions also aligned with **higher failure rates** due to unsafe driving conditions.

📌 Weather-aware route planning and predictive delay alerts can significantly improve delivery success.

## 5 Temporal Trends & Shift-Based Delays

- **Night shifts** showed **15–25 minutes more delay** than morning shifts.
- **Weekend deliveries** were less efficient:
  - **On-time % drops**
  - **Failure % increases**

📌 Likely due to fewer staff, lower driver availability, or reduced oversight.

## 6 Vehicle Type + Parcel Size Analysis

- **Bikes** handling **small parcels** had the **lowest delay** and **highest success rates**.
- **Vans and trucks**, especially with **large parcels**, faced the most delays.
  - In some hubs, vans with heavy parcels had **60+ min average delays**.

📌 This supports intelligent parcel allocation and load balancing.

## 📌 Summary of Insights

Focus Area	Key Finding
Overall Performance	Only 45% deliveries on time; ~20% failures
Route	Ajmer → Guntur, Durg → Salem = most delayed routes
Hubs	Top 5 hubs caused 40% of total delay minutes
Driver	Some drivers consistently underperform across multiple hubs
Weather	Fog increases delay by 40–60%, especially for vans
Shift & Weekend	Night/weekend shifts had more delays and failures
Vehicle + Parcel Combo	Bikes + small parcels = best; vans + heavy parcels = worst

## ✓ Final Recommendations

- **Optimize routing** on top delay-prone routes with regular monitoring.
- **Enhance weather response protocols** — especially fog — and reroute heavy parcels during poor conditions.
- **Track driver performance** using delay/failure KPIs; improve shift alignment and training.
- **Deploy predictive alerts** to flag potential delays in real time.
- **Implement parcel-vehicle matching logic** (e.g., assign small parcels to bikes where possible).

## 🔧 Tools Used

- **Tableau Public** – for interactive dashboarding and visual storytelling
- **Python (Pandas + Faker)** – to simulate realistic logistics dataset (50,000+ rows)
- **Canva/Figma** – for layout planning and visual polish