

Problem: Why are deliveries taking longer than expected?

Executive Summary

Our comprehensive analysis of 43,862 delivery orders reveals **critical performance gaps** with 24.7% of deliveries exceeding acceptable timeframes. The analysis identifies **five key factors** driving delivery delays, with festivals and multiple deliveries presenting the most significant operational challenges.

Key Performance Metrics

- **Average Delivery Time:** 26.29 minutes
- **Delayed Orders:** 10,842 orders (24.7% failure rate)
- **Performance Range:** 10-54 minutes
- **Critical Threshold:** 32 minutes (75th percentile)

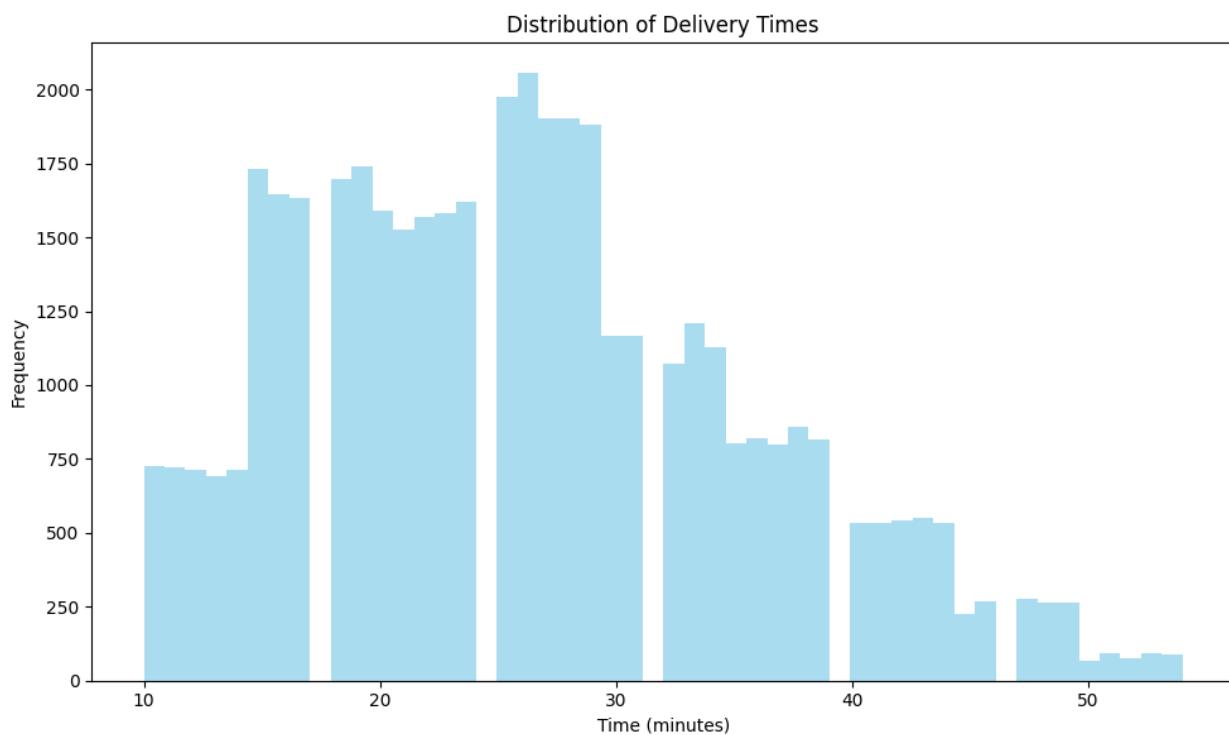


Fig: Distribution of Delivery Time

Critical Findings & Impact Analysis

1. MULTIPLE DELIVERIES - HIGHEST IMPACT FACTOR

Impact: 25.11 minutes difference | **Severe efficiency degradation**

- **3 deliveries per trip:** 47.82 minutes (100% delay rate)
- **2 deliveries per trip:** 40.43 minutes (97.7% delay rate)
- **Single deliveries:** 26.8 minutes (14.5% delay rate)
- **Critical Issue:** Multiple delivery strategy is fundamentally broken

Multiple Deliveries	Average Time Taken (min)
0	22.86
1	26.86
2	40.43
3	47.82

2. FESTIVALS - SECOND HIGHEST IMPACT

Impact: 34.32 minutes difference | **100% delay rate during festivals**

- **Festival periods:** 45.50 minutes average (100% delays)
- **Normal periods:** 25.91 minutes average (23% delays)
- **Business Impact:** Complete service breakdown during peak demand periods

Festival	Average Time Taken (min)
No	25.91
Yes	45.50

3. TRAFFIC DENSITY - THIRD HIGHEST IMPACT

Impact: 9.87 minutes difference | **Predictable but unmanaged**

- **Traffic Jams:** 31.15 minutes (44% delay rate)
- **Low Traffic:** 21.28 minutes (6.4% delay rate)
- **Opportunity:** Most controllable factor through route optimization

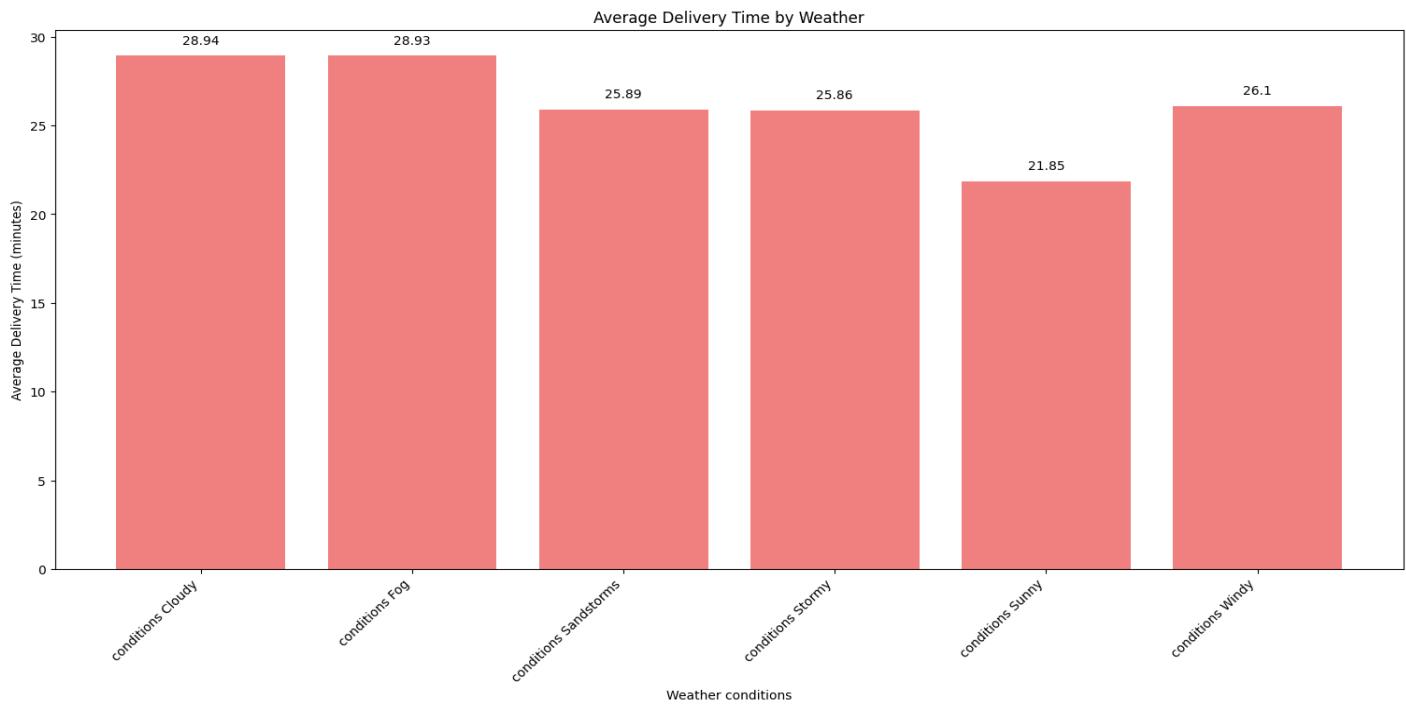
Road Traffic Density	Average Time Taken (min)
High	27.21
Jam	31.15
Low	21.28
Medium	26.72

4. WEATHER CONDITIONS - FOURTH HIGHEST IMPACT

Impact: 7.09 minutes difference | **Environmental dependency**

- **Worst Performers:** Fog (38.2% delays), Cloudy (37.6% delays)
- **Best Performer:** Sunny (10.1% delays)
- **Pattern:** Clear weather dependency affecting service consistency

Weather Condition	Average Time Taken (min)
Cloudy	28.94
Fog	28.93
Sandstorms	25.89
Stormy	25.86
Sunny	21.85
Windy	26.10



5. VEHICLE CONDITION - FIFTH HIGHEST IMPACT

Impact: 5.68 minutes difference | **Maintenance issues**

- **Poor Condition (0):** 30.05 minutes (36.4% delays)
- **Good Condition (1-2):** ~24.4 minutes (~19% delays)
- **Maintenance Gap:** 36% of fleet in poor condition

Vehicle Condition	Average Time Taken (min)
0	30.05
1	24.37
2	24.47

High-Risk Scenarios Identified

Catastrophic Combinations

1. **Fog + Traffic Jams:** 36.80 minutes (affects 2,377 orders)
2. **Cloudy + Traffic Jams:** 36.70 minutes (affects 2,289 orders)
3. **Festival Periods:** 45.50 minutes (100% failure rate)

Human Factor Analysis

- **Low-rated delivery personnel (≤ 3.5):** 81% delay rate
- **Older delivery personnel (36-45):** 34.5% delay rate
- **Younger personnel (18-25):** Only 14.5% delay rate

Which cities/states are fastest or slowest?

City Performance Insights

Performance Hierarchy

1. **Urban areas are most efficient** - 23.00 min average delivery time
2. **Metropolitan areas are moderate** - 27.31 min average delivery time
3. **Semi-Urban areas are slowest** - 49.74 min average delivery time

Key Finding: There's a dramatic **116% increase** in delivery time from Urban to Semi-Urban areas, indicating significant infrastructure and logistics challenges in smaller cities.

State Performance Rankings

Top Performing States (Fastest Delivery)

1. **Goa** - 26.01 minutes
2. **Karnataka** - 26.04 minutes
3. **Western region** - 26.08 minutes
4. **Madhya Pradesh** - 26.18 minutes
5. **Maharashtra** - 26.18 minutes

Delivery State	Avg Time (min)	Median Time (min)	Std Dev (min)	Total Orders
Goa	26.01	26.0	8.98	587
Karnataka	26.04	25.0	9.30	5,949
Western	26.08	25.0	9.40	3,509
Maharashtra	26.18	25.0	9.28	6,599
Madhya Pradesh	26.18	26.0	9.37	3,500
Punjab	26.28	26.0	9.50	665
Gujarat	26.29	25.0	9.24	4,585
Kerala	26.30	26.0	9.33	679
West Bengal	26.34	26.0	9.24	675
Tamil Nadu	26.37	26.0	9.38	6,081

Underperforming States (Slowest Delivery)

1. **Uttar Pradesh** - 26.75 minutes
2. **Rajasthan** - 26.69 minutes
3. **Uttarakhand** - 26.68 minutes
4. **Jharkhand** - 26.46 minutes
5. **Telangana** - 26.42 minutes

Delivery State	Avg Time (min)	Median Time (min)	Std Dev (min)	Total Orders
Punjab	26.28	26.0	9.50	665
Gujarat	26.29	25.0	9.24	4,585
Kerala	26.30	26.0	9.33	679
West Bengal	26.34	26.0	9.24	675
Tamil Nadu	26.37	26.0	9.38	6,081
Telangana	26.42	26.0	9.49	3,065
Jharkhand	26.46	26.0	9.54	2,455
Uttarakhand	26.68	26.0	9.71	462
Rajasthan	26.69	26.0	9.56	3,331
Uttar Pradesh	26.75	26.0	9.49	1,720

Key Finding: The performance gap between fastest and slowest states is relatively small (0.74 minutes), suggesting consistent service levels across India.

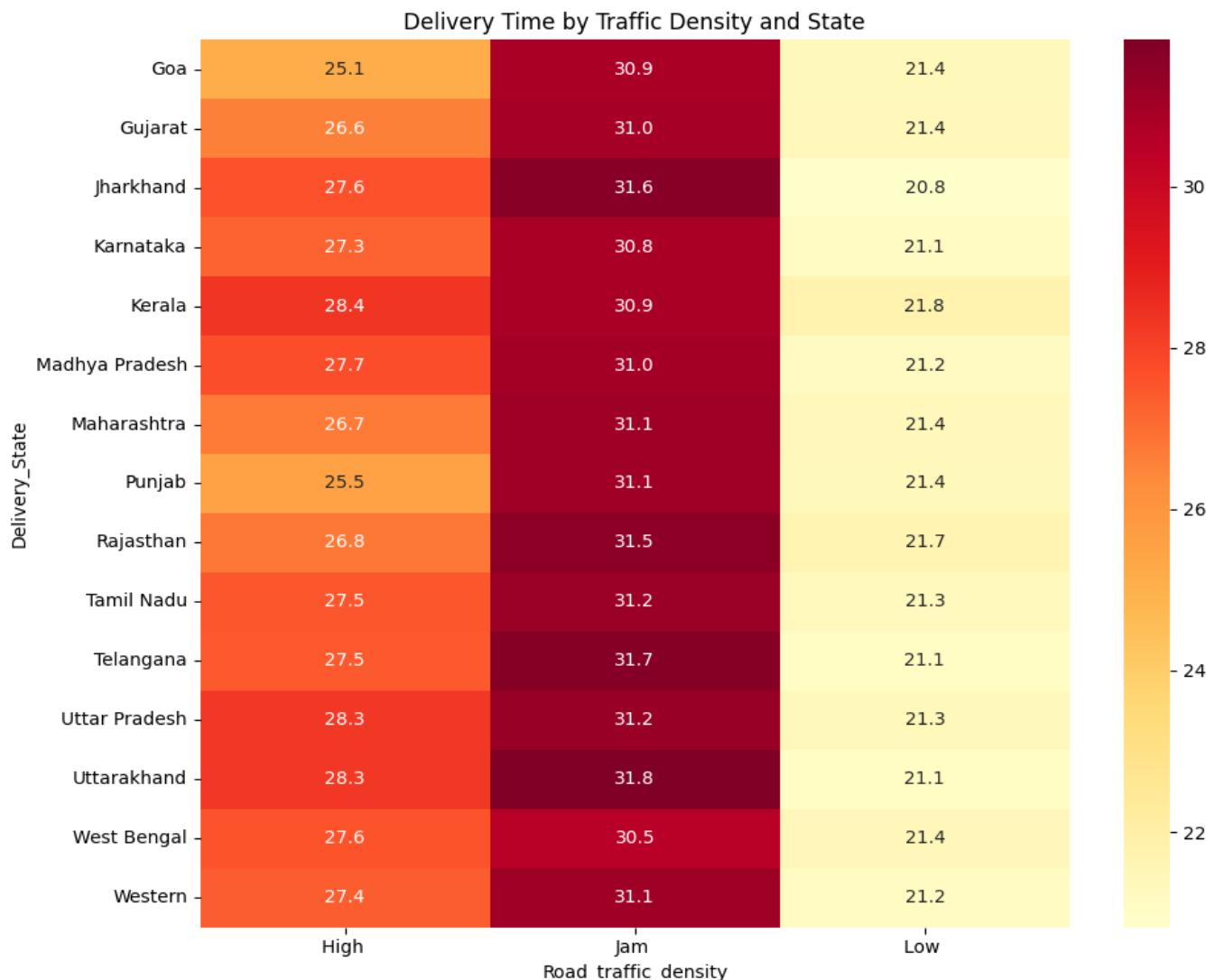
Are certain states more affected by traffic or weather?

Traffic-Sensitive States

Most affected by traffic jams:

- Uttarakhand: 10.73 min increase (Low to Jam)
- Telangana: 10.54 min increase
- Rajasthan: 9.82 min increase

Key Finding: Traffic creates a **consistent 45-50% increase** in delivery time across all states when conditions go from Low to Jam.



Weather Sensitivity Rankings

Most weather-affected states:

1. **Uttarakhand** - 10.29 min variation between weather conditions
2. **West Bengal** - 8.36 min variation
3. **Rajasthan** - 8.18 min variation
4. **Uttar Pradesh** - 8.07 min variation
5. **Telangana** - 7.96 min variation

Which weather conditions increase delivery time?

Impact: 7.09 minutes difference | **Environmental dependency**

- **Worst Performers:** Fog (38.2% delays), Cloudy (37.6% delays)
- **Best Performer:** Sunny (10.1% delays)
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Are certain vehicle types more affected?

Impact: 5.68 minutes difference | **Maintenance issues**

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Do higher-rated delivery persons deliver faster?

Age Group Performance Analysis

Age Group	Mean Delivery Time (mins)	Median Time	Count	Delay Rate (%)
18–25	22.97	22.0	12,956	14.5%
26–35	26.97	26.0	21,842	26.8%
36–45	29.48	29.0	8,850	34.5%

Observation:

- Younger delivery personnel (18–25) show **faster average delivery times and lowest delay rate.**
- As age increases, both **mean delivery time and delay rate increase.**
- Delay rate nearly doubles between the 18–25 and 36–45 groups (14.5% → 34.5%).

Do younger or older delivery people perform better (based on age group buckets)?

Rating Group Performance Analysis

Rating Group	Mean Delivery Time (mins)	Median Time	Count	Delay Rate (%)
Low (≤ 3.5)	36.85	36.0	472	81.1%
Medium (3.5–4.0)	35.88	35.0	1,934	73.3%
Good (4.0–4.5)	30.56	32.0	8,921	45.0%
Excellent (4.5–5.0)	24.38	24.0	32,267	15.4%

Observation

- **Higher-rated delivery persons (4.5–5.0)** complete deliveries significantly faster and with fewer delays.
- Delivery time **drops by ~12.5 minutes** from the lowest-rated to highest-rated group.
- Delay rate reduces drastically as rating increases, from **81.1% to 15.4%**.

Conclusion

- **Yes, higher-rated delivery persons deliver faster and more reliably.** They exhibit **lower mean delivery times** and **much lower delay rates**, indicating a strong correlation between rating and performance.
- **Younger delivery personnel (18–25)** are generally **more efficient** than older counterparts, delivering faster and with fewer delays. This could be attributed to **better physical agility, energy, and adaptability**.

Are certain types of vehicles slower or less efficient?

Vehicle Delay Rate Overview

Vehicle Type	Average Delay Rate (%)
Motorcycle	28.79%
Scooter	19.20%
Electric Scooter	18.17%

Note: A lower delay rate indicates better on-time performance.

Recommendations

- **Prioritize electric scooters** for delivery fleets to improve on-time performance and reduce delays.

Are delivery times significantly affected during festivals?

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Which areas (lat/lon) are consistently causing delays?

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Peak hours vs off-peak performance.

Peak vs Off-Peak Performance

Order Counts by Time of Day:

Time of Day	Orders	Category
Morning	7,718	Off-Peak
Afternoon	8,327	Off-Peak
Evening	27,387	Peak
Night	430	Off-Peak

- **Peak Hours:** Evening (dominates with ~62.5% of total orders)
- **Off-Peak:** Morning, Afternoon, Night
- Evening time exhibits the highest demand, suggesting staffing and resource allocation should be optimized for that period.

Time of day/week/month patterns in delivery times.

Delivery Patterns by Day of the Week

Note: Order Distribution Across Weekdays (0 = Monday, 6 = Sunday):

Day	Orders
Wednesday	6,816
Friday	6,766
Thursday	6,113
Tuesday	6,105
Saturday	6,064
Sunday	6,022
Monday	5,976

- **Most Active Days:** Mid-week — Wednesday and Friday
- **Least Active Day:** Monday
- The activity is relatively balanced across the week, with a slight mid-week spike.

Delivery Patterns by Month

Monthly Order Distribution:

Month	Orders
March	30,766
February	6,970
April	6,126

- **March dominates** with ~69% of total orders — possibly due to promotions, seasonal trends, or expanded operations.
- February and April show comparatively normal traffic.