

SHIPMENT DELIVERY ANALYSIS

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Objective

1 Analysis of Shipments that met on-time delivery and that got delayed

2 Notification set-up for Shipments having potential delays in delivery

2 Prediction of delay Likelihood of new shipment bookings



On-Time Delivery Shipments

1

Key Points:

- ❑ **Period:** Shipments between 1st October to 31st December 2023
- ❑ **On-time delivery:** The delivery that has happened within the scheduled delivery window + 30-minute threshold
- ❑ **Objective:** Identification of Percentage of on-time delivery within the defined period

2

Assumptions:

- ❑ **Scheduled Delivery Window:** Between the Earliest Scheduled delivery and Latest Scheduled Delivery
- ❑ **On-Time Delivery Threshold:** Scheduled Delivery Window + 30 minutes
- ❑ **Shipment Delivery Timestamp:** The latest (Maximum) Date-time in the GPS tracking system per shipment
- ❑ **Shipments between 1st October to 31st December 2023:** Extract the Shipment Delivery timestamp within this period
- ❑ **On-time Delivery:** Shipment Delivery timestamp \leq On-Time Delivery Threshold timestamp

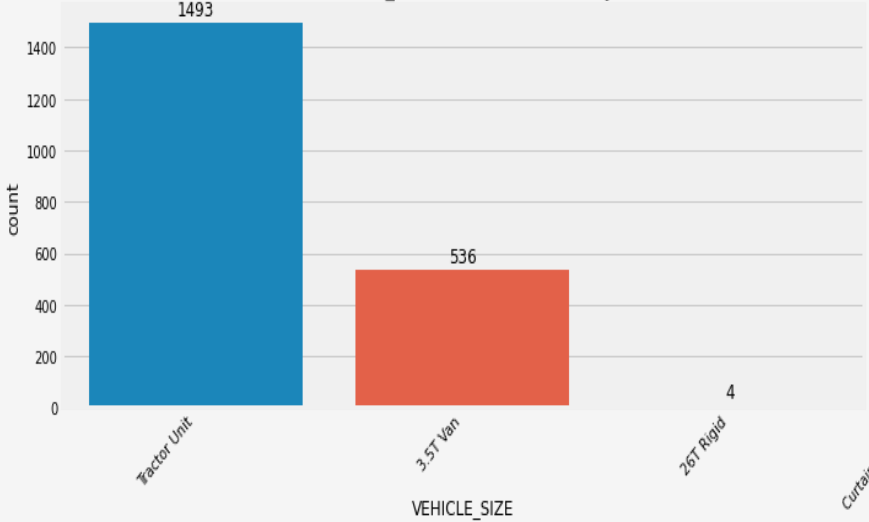
3

Result:

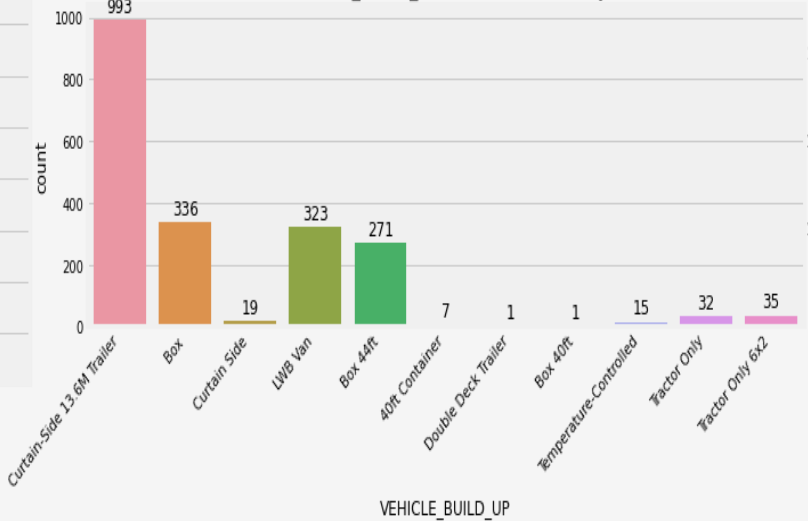
Percentage On-time delivery: **62.65%**
Count On-time delivery: **2033**
Count delay in delivery: **1212**

On-Time Delivery Pattern Analysis

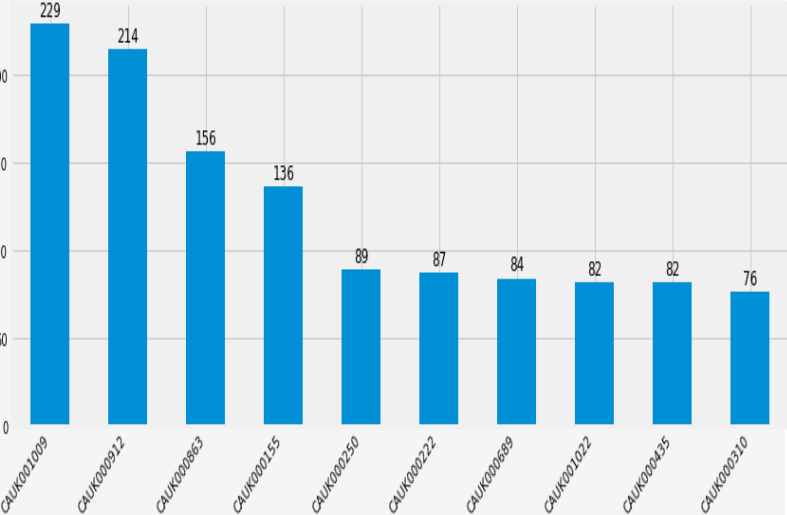
VEHICLE_SIZE for on-time delivery



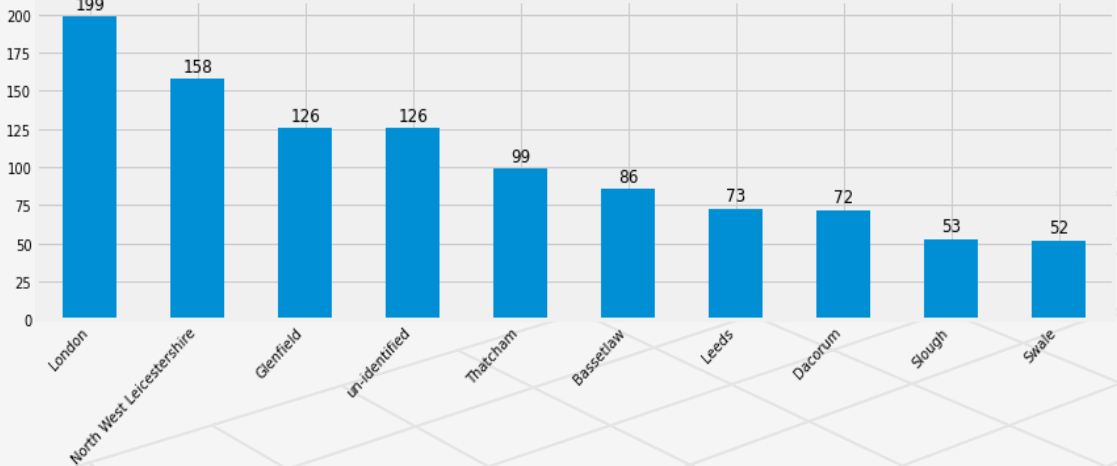
VEHICLE_BUILD_UP for on-time delivery



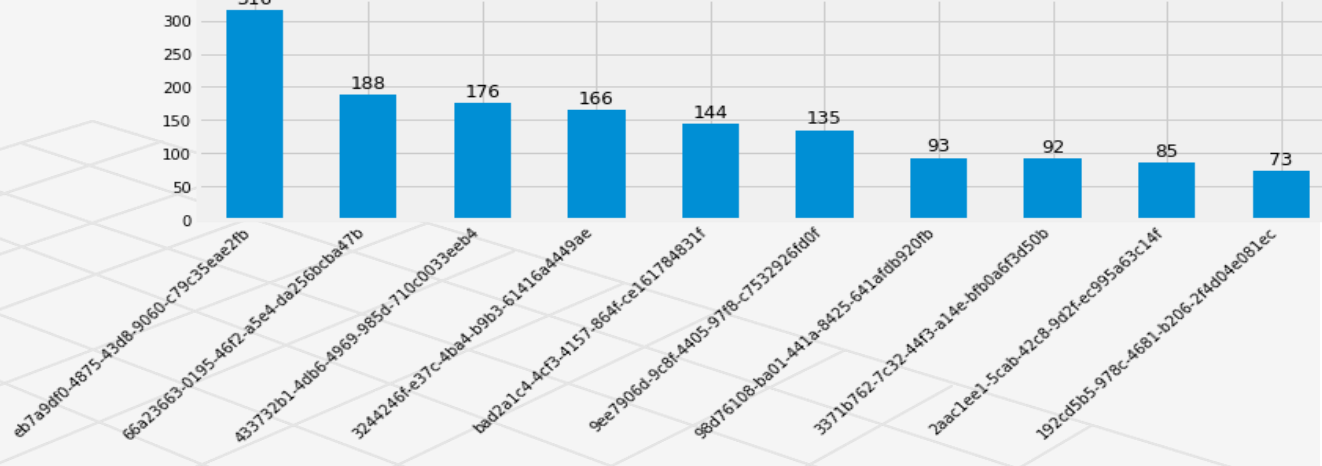
Top carriers with maximum on-time delivery



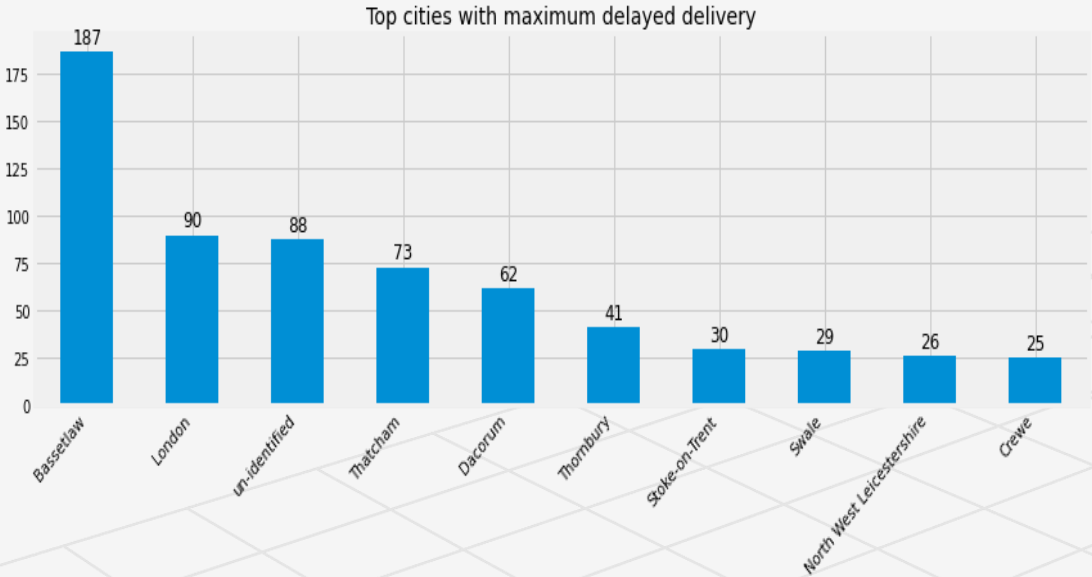
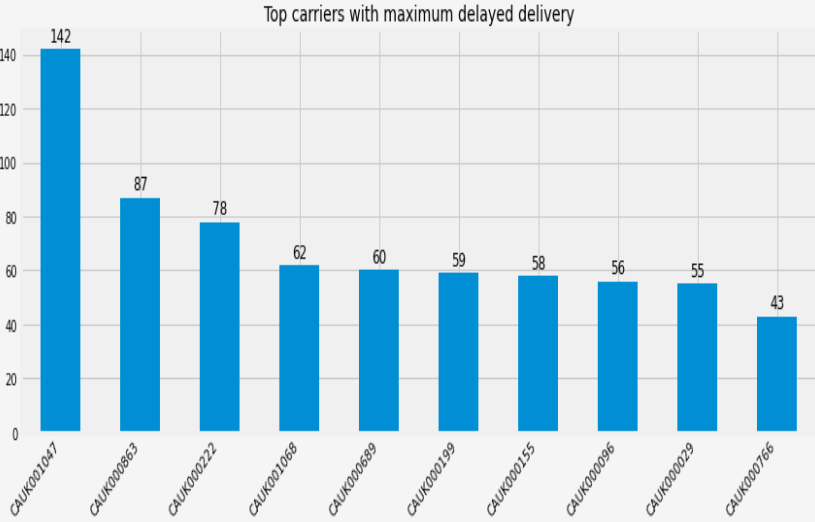
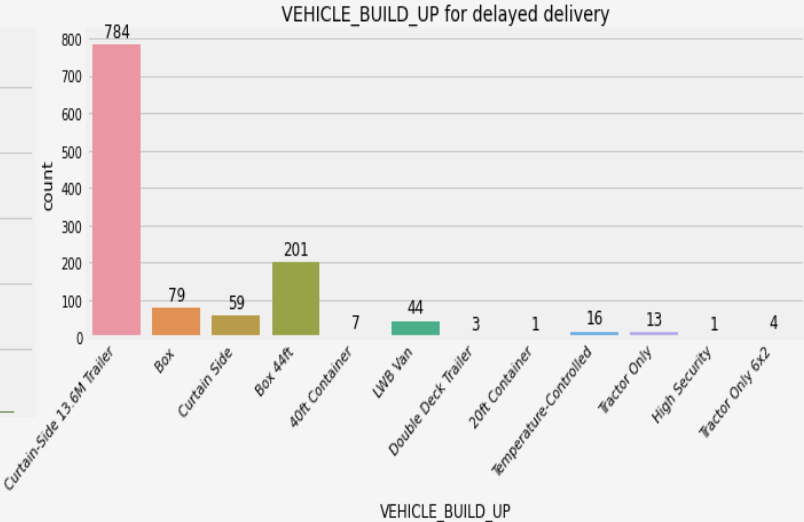
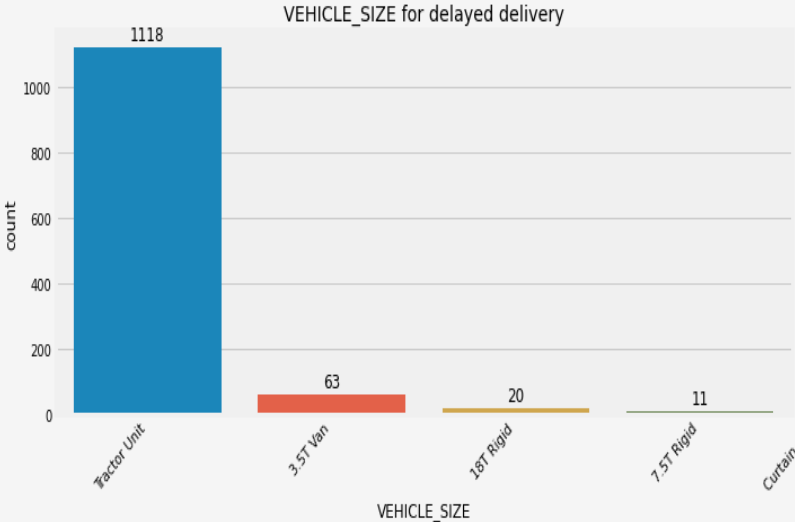
Top cities with maximum on-time delivery



Top shippers with maximum on-time delivery



Delayed Delivery Pattern Analysis



Shipment Potential Delay Notification Summary

- 1 The maximum (latest) date-time for a shipment in the GPS data, is probably the date-time when the delivery has been completed (The actual delivery time), with I assume, the history date-time in the GPS before this shipment delivery date-time being the date-times of the shipment tracking throughout before delivering.
- 2 The notification system must keep checking each live tracking date-time of shipment from GPS to calculate the potential delay and notify accordingly at that respective time. Therefore, to make a data set of only tracking date-time (not when the shipment was delivered), I removed the actual delivery date-time (the maximum one). So, I extracted all the GPS tracking date-time of the shipment. Because at this period, I am considering, that my shipment has not been delivered and I have the live date-time from GPS to notify of a potential delay in delivery.
- 3 Now, I have all the tracking times from GPS before delivering, and I have the latest scheduled delivery date from shipment booking. Here, my goal is to find out potential delays and notify them before getting delayed. So, I want to notify, as soon as the GPS tracking date-time is \geq (latest scheduled delivery time + 20) and $<$ (latest scheduled delivery time + 30). That means I will notify you if the current GPS tracking time has crossed the latest scheduled delivery time at least 20 minutes before and is about to reach the threshold delivery window by notifying you 10 minutes before the delivery threshold (delivery threshold = latest scheduled delivery time + 30).
- 4 I also assume, that if the shipment collection is delayed then there is also a chance of potential delay of delivery. But at this stage, I am only considering the latest delivery schedule date to calculate potential delays.

Example of work on Potential Delay Notification System

Shipment Number: "SEZHUK-231211-272127"

Shipper: "40415fe3-e446-4d1e-b141-3698b0dc47f3"

latest delivery scheduled: "2023-12-13 16:00:00+00:00"

On-time Delivery window threshold should be: ("2023-12-13 16:00:00+00:00" + 30 minutes) = '2023-12-13 16:30:00+0000'

Delay Notification time will be when the GPS tracking date-time was: 2023-12-13 16:20:00+00:00

The total number of such shipments that should have been sent notification: 447

Summary: When the current GPS date-time tracking of the shipment is identified to be within the period of the 10-minute frame before reaching the delivery threshold, the shipper will get the notification of potential delay at that exact track time.

Note: The 10-minute time frame before reaching the delivery threshold for notification can also be changed depending on the business interest!

Likely Delay Of New Bookings (Machine Learning Prediction)

Type of problem: Binary Classification

Data preprocessing: Data Cleaning, Feature Engineering, Categorical Encoding

Target column: "Delayed Delivery" (1: delay, 0: no delay) derived from the analysis of on-time delivery from task-1

Machine Learning Predictive Algorithm: Balanced Random Forest Classifier

History data count: 3245

New bookings count: 1000

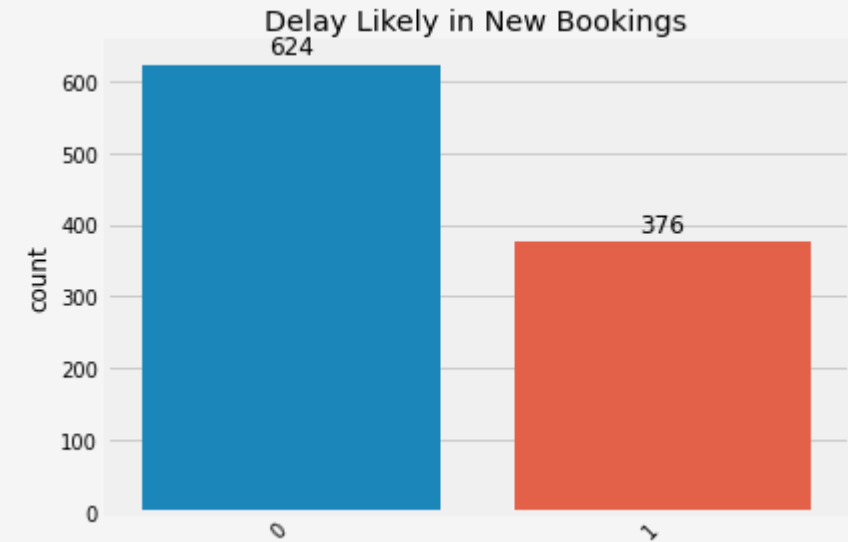
Model Training: Trained on 75% of history data and evaluated on 25%

Metrics: Recall (Low False Negative and High True Positive)

Evaluation Perspective: High numbers of correct identification of True delay shipments

Evaluation result: 83% correct delay prediction on evaluation data

Prediction on new booking: 376 shipments likely to be delayed out of 1000



Analysis Summary and Recommendation

1

We have 62.65% approx. on-time delivery. Therefore, to improve this percentage understanding data patterns is very important.

2

Check why "Bassetlaw City" has more delayed delivery (187 times delay). Need more data for investigation. London has the most on-time delivery.

3

The carrier ID: CAUK001047 has the maximum delay while delivering (142 times). Need more investigation on this carrier service.

4

There is a constant trend of delay in weekdays for the entire period of 1st Oct to 31st Dec from Monday to Friday, with Friday being the highest delay in service. Need to investigate why there is no uniform distribution across the week for the entire 3 months.

5

The Vehicle sizes, 18T rigid and 7.5T rigid are only having service delay. The remaining types of sizes are on both delay and on-time lists. So, more investigation is required for these two types of vehicle sizes (I assume due to heavy weight).

6

The Vehicles build-up type "Curtain side" have a count of 59 service delays whereas only 19 times on-time delivery. This is also a pattern that needs to be checked.

7

Appropriate action of new booked shipments that are likely to be delayed (376). Such as notification, identifying reason behind delays, and taking quick action for a smooth and timely delivery.

