Use of Telematics Data in Fleet Management

Our Team

Vandana Agrawal

Rishabh Arora

Anil Joshi

Jessie Le

Yiwen Liang

Connie Zhang

DREXEL UNIVERSITY
LeBow
College of Business

COMCAST

Agenda

- **Project Scope**
- **Industry Research and Telematics Use Case Studies**
  - Data Collection Methods
  - KPI Metrics
  - Case Studies:
    - Government Sector
    - Utility Industry
- **Data Analysis**
  - Telematics Data on Idle Time
  - Maintenance Records
  - Fuel Records

Project Scope

The study will answer the following questions:

- How do other organizations use telematics data?
- What are the critical factors required to achieve the benefits of leveraging telematics data?
- What are the key performance indicators that other organizations are using?
- What are the best practices for the use of telematics data?

Industry Research and Telematics Use Case Studies

Data Collection Method: OEM OBD-II Port

Device Installation

- Temporary system (smart phone)
- Aftermarket telematics system

Subaru Forester OBD-II Port (left) and Telematics Device (right)

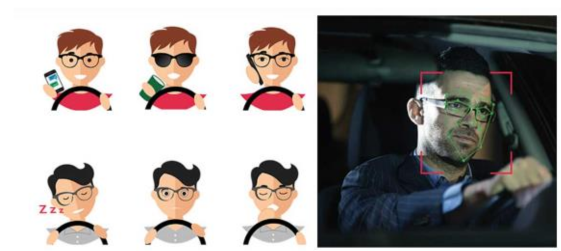
Methods of Data Capture

- Automatic Vehicle Location
    - Optimize routes, minimize vehicle overlap
    - Find vehicles in unexplained locations, stolen vehicles
- OBD-II Engine Data
    - Vehicle miles travelled
    - Assess engine issues, coolant temperature, brake issues
    - Calculate fuel consumption through fuel flow meter and fuel level sensor

Data Collection Method: Real-Time Video Camera

Device Installation

- Can monitor both road and driver
- Record incidents, transmit to online database, understand nature of event
- Allow supervisors to log coaching efforts, enabling tracking effectiveness



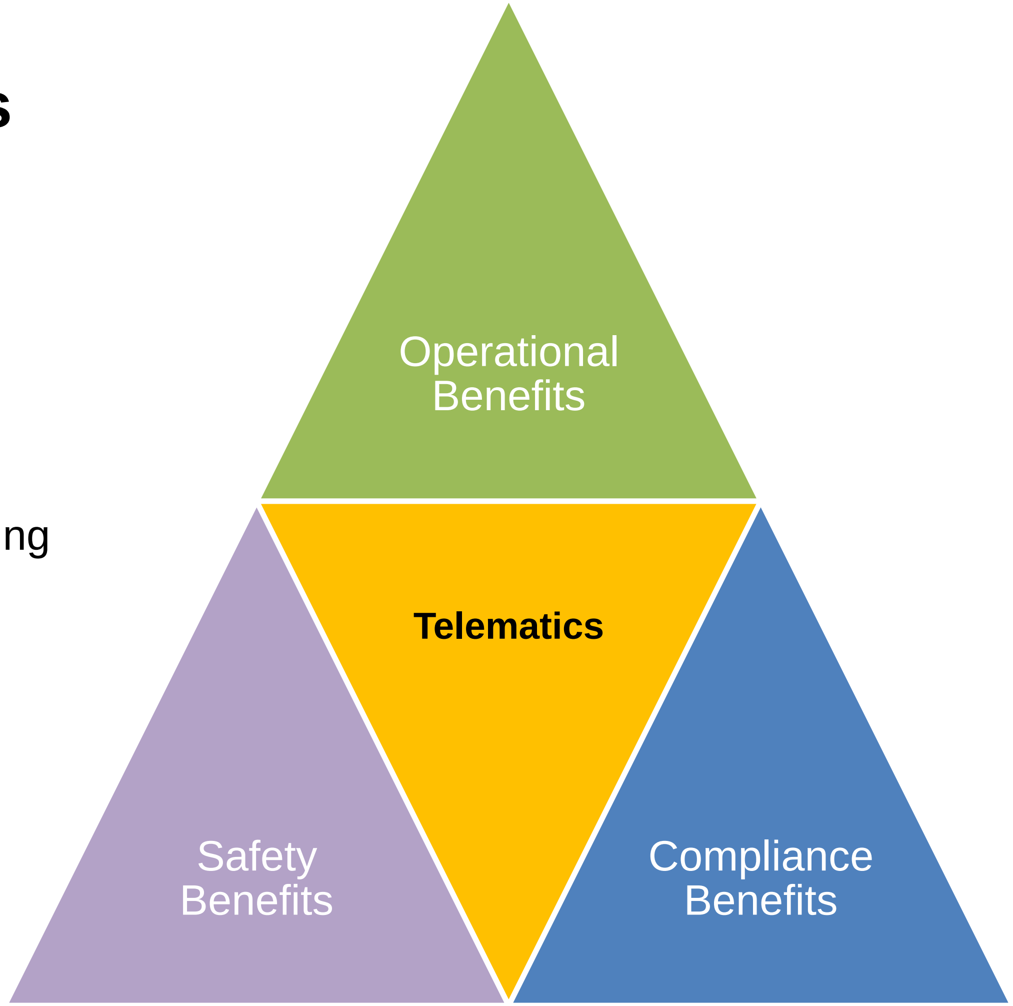
Methods of Data Capture

- Driver-specific measures:
  - Camera recognition for drivers using cell phones, smoking cigarettes, and dozing off while driving
- Vehicle-specific measures:
  - Airbag deployment, vehicle collision occurrence

Telematics Overview

Benefits to Stakeholders

- **Vehicle and Driver**
  - Improved Road Safety
  - Increased Productivity
- **Fleet Managers**
  - Predictive Maintenance
  - Vehicle Acquisition & Right-sizing
  - Route Optimization
- **Enterprise**
  - Lower Operational Costs
  - Lower Insurance Rates
  - Records for Legal Disputes
  - Sustainability Improvements



DREXEL UNIVERSITY LeBow College of Business

COMCAST

Key Performance Indicators

Efficiency & Productivity	Idle time, Miles driven, Fuel efficiency, Number of days out of service
Driver Safety	Speed against posted limit, Hard acceleration/ breaking/cornering, Seatbelt usage
Fleet Acquisition & Maintenance Cost	Vehicle utilization, Engine codes, Odometer readings
Route Guidance & Compliance	Vehicle location, GPS services
Service Level	Response time to service calls
Sustainability	Carbon emissions and environmental impact

DREXEL UNIVERSITY LeBow College of Business

COMCAST

Telematics Use Case Studies

Improvements in Operations: State of Utah

- **Fleet size:** 4,500
- **Timeline of pilot rollout:** January 2017 – July 2018
- **Scope of pilot rollout:** 25% of the fleet
- **Fuel savings:**
  - Measured idle time and speed
    - Prior to installation: 22 mpg
    - End of installation: 26 mpg
    - One year later: 28 mpg
  - Provided in-cab real-time driver alerts
    - Idling more than 3 minutes
    - Speed greater than 85 mph or 20 mph over posted speed limit
    - 10 mph over posted speed limit for more than a minute

Improvements in Operations: State of Utah

- **Maintenance savings:**
  - Managed check engine light alerts and low battery notifications
  - 20% improvement in the cost of work orders in 1.5 years after installation
- **Safety impact:**
  - Monitored seat belt usage and provided alerts for harsh braking, harsh cornering and hard acceleration
  - Improved seat belt usage from 96% to 99% of the total distance travelled

DREXEL UNIVERSITY
LeBow
College of Business

COMCAST

Improvements in Operations: PECO

- **Fleet size:** 1,420
- **Timeline:** 2013 – 2016
- **KPIs Measured:**
  - Collected data on engine hours, idle time, location, active fault codes, miles driven
  - Focused on 5 most troublesome fault codes
- **Maintenance Success Metrics:**
  - Maintenance schedule based on actual miles driven and fault codes, rather than calendar
  - Average days out of service < 32 days
  - Response time to service calls < 90 mins
  - Preventive maintenance schedule adherence > 96%

Improvements in Safety and Compliance: Marine Corps

- Contracted Lytx to install DriveCam video systems in more than 7000 vehicles
- Reduced speeding by 40%
- Helped reduce accident damage by 35% in a 2-year period
- Helped reduce fuel use, carbon emissions, and idle time by up to 60% in southwestern region
- Telematics video evidence helped exonerate Marine drivers in disputed cases
- Reclaim 80% of costs associated with vehicle abuse, determining responsibility and collecting payment

Industry Research Takeaways

- Case studies show that fleets do demonstrate operational, safety, and compliance benefits through the use of telematics.

- Benefits are realized along the spectrum of telematics deployment.

- Individual KPIs may lead to multiple types of improvements.

Telematics Data Analytics

Idle Time Data Summary

- Data points: 10,733 vehicles from 4/27/2019 to 5/31/2019

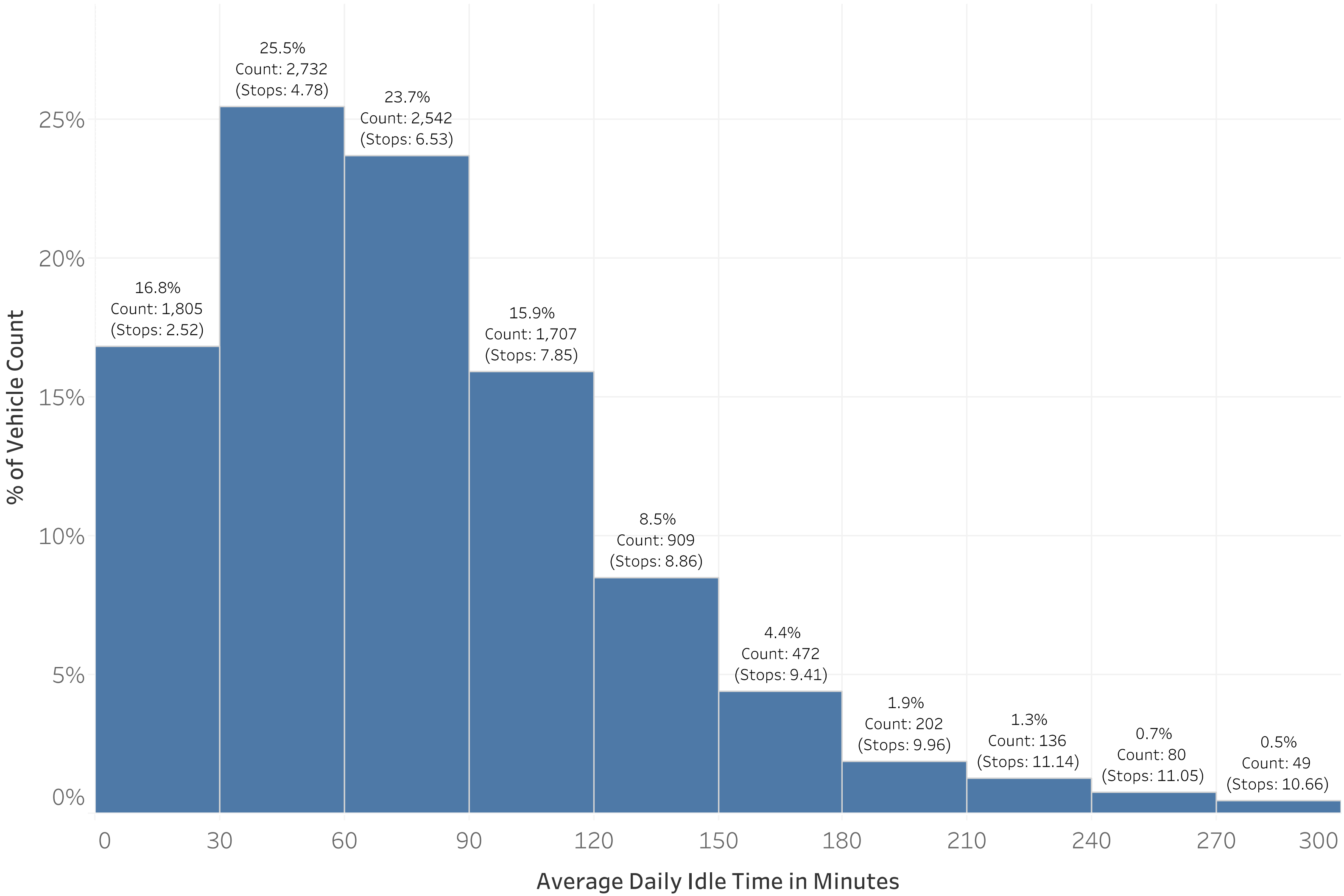
Installation Technicians	10669
Installation Managers	49
Maintenance Technicians	21
Site Construction	2
XFINITY Store Manager	1
Unknown	36

Van	10466
Pickup	89
Bucket	35
Null	143

Central Division	4164
Northeast Division	4450
West Division	2121

- Idle time per vehicle goal: 30 minutes/day
- Grouped by: Date, Region, Job Type, Vehicle Make/Model/Type
- May help to also know: truck equipment usage, cabin temperature

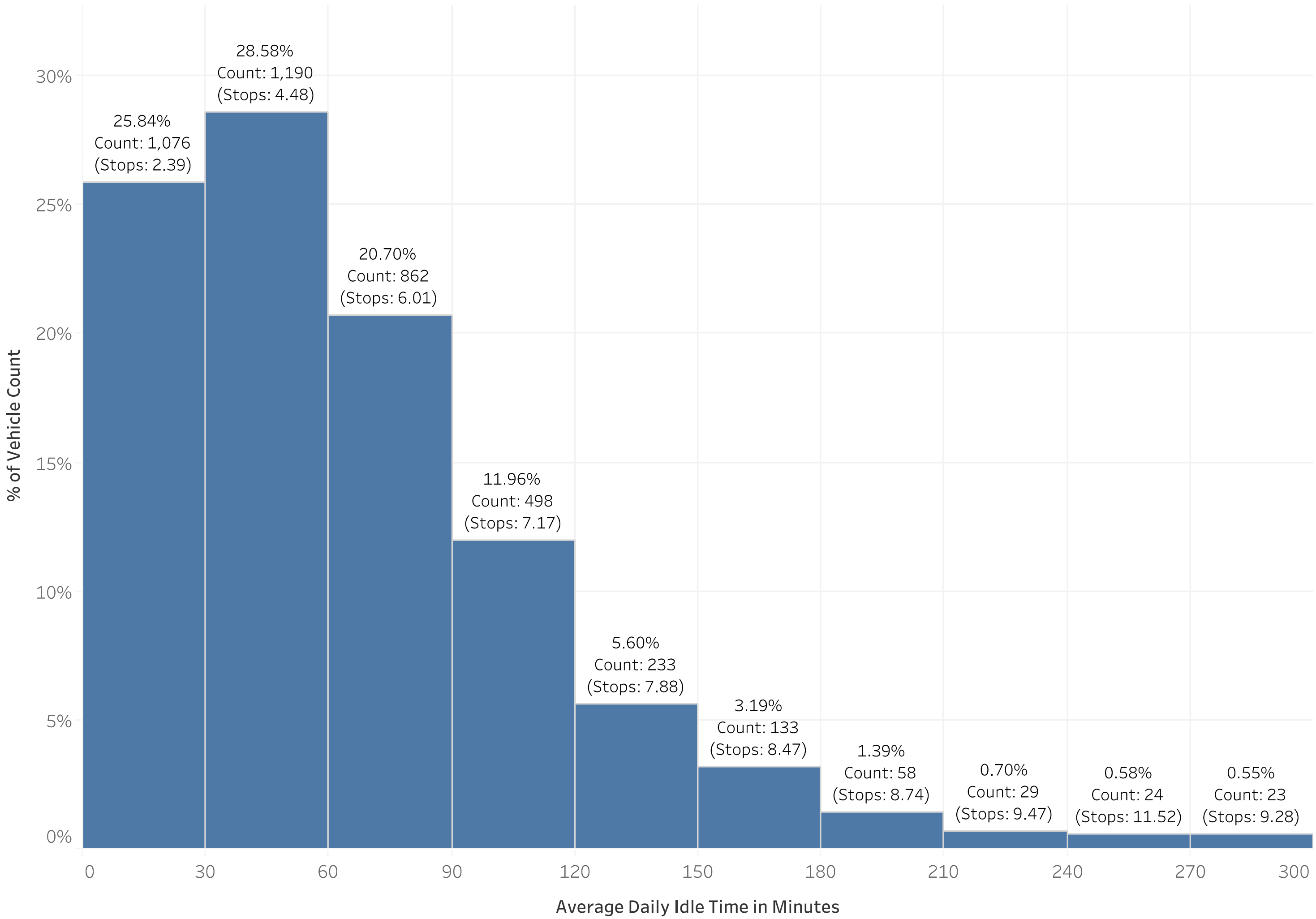
Idle Time Per Day Distribution



LeBow College of Business

COMCAST

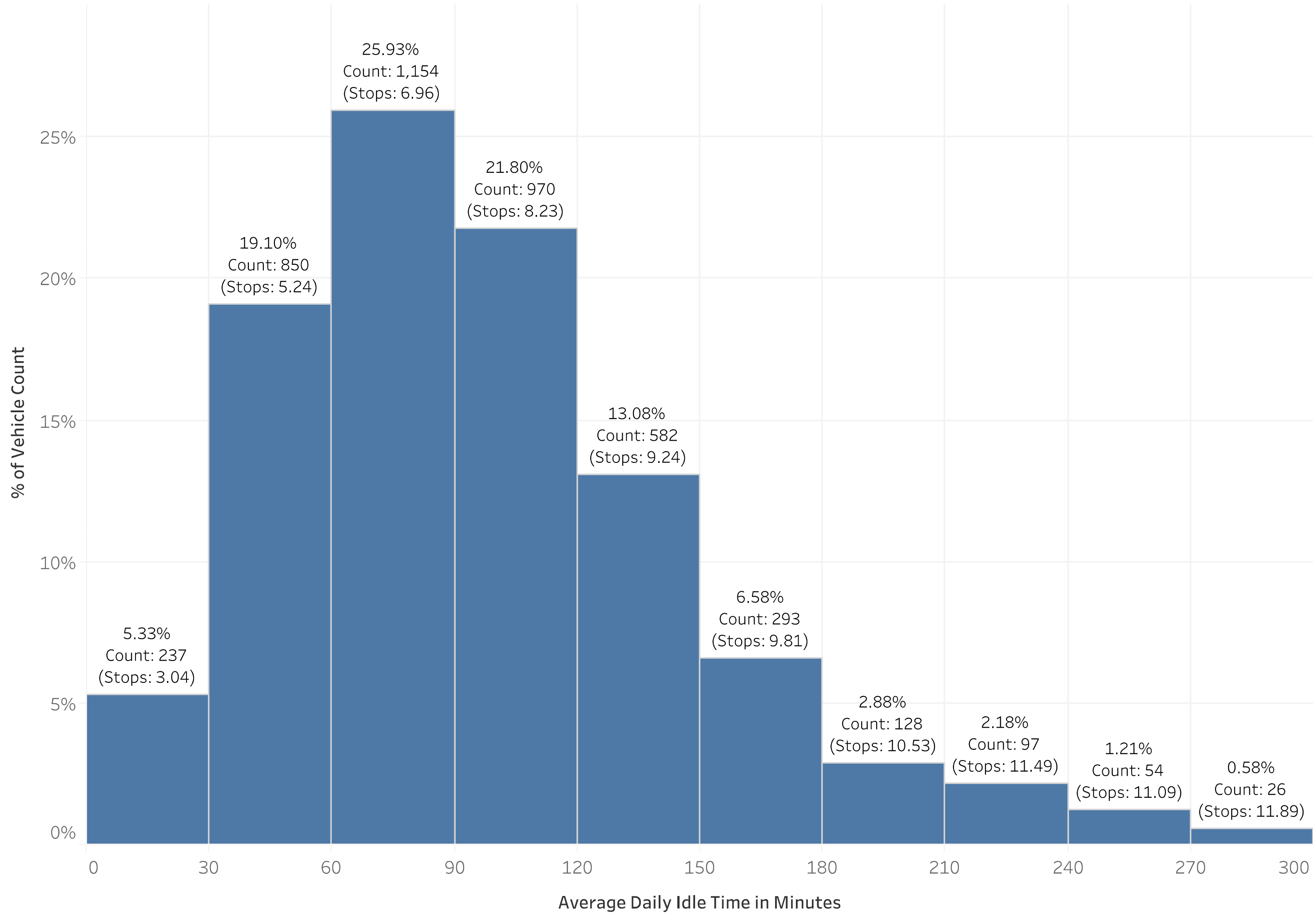
Idle Time Per Day Distribution - Central Division



DREXEL UNIVERSITY LeBow College of Business

COMCAST

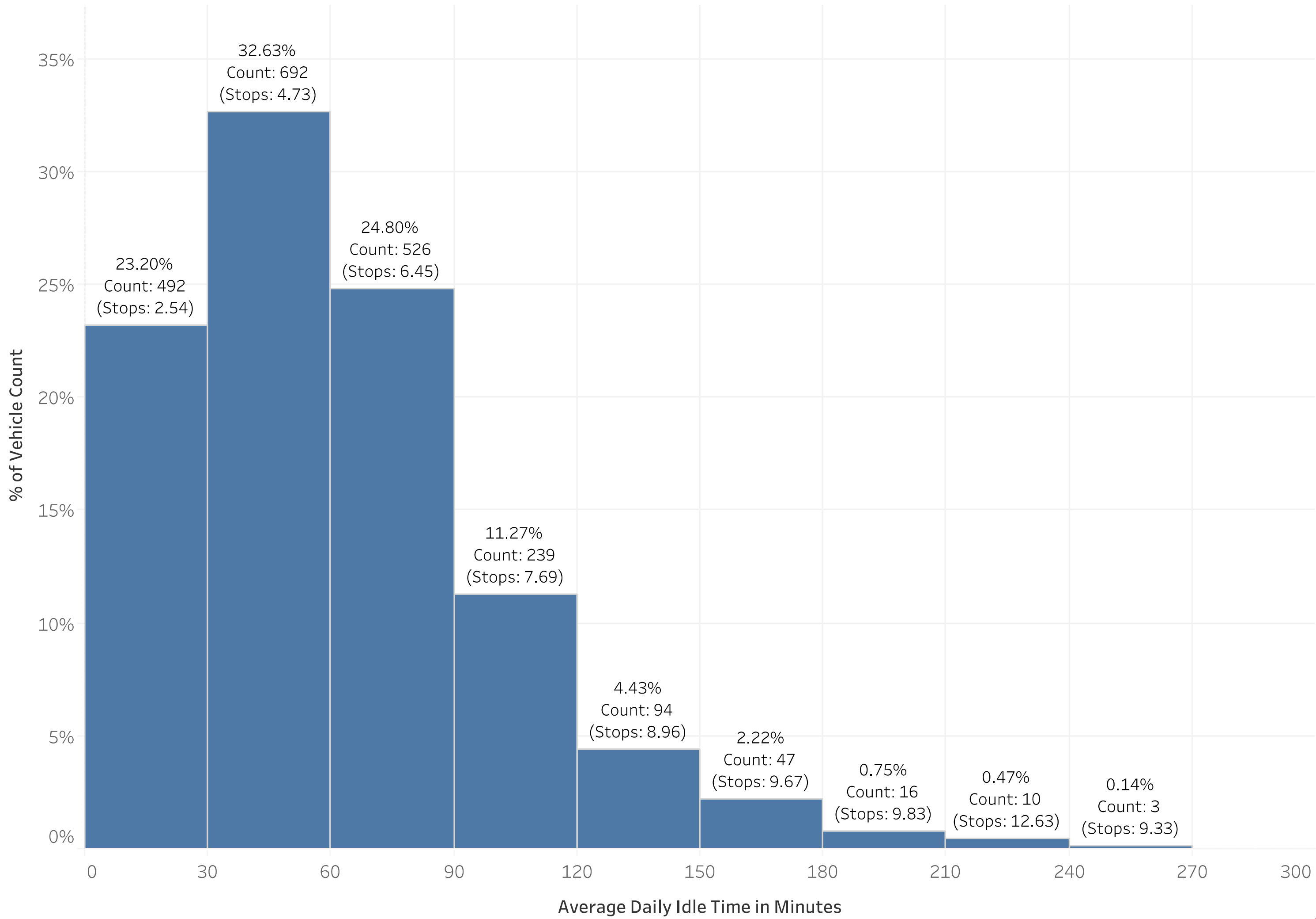
Idle Time Per Day Distribution - Northeast Division



DREXEL UNIVERSITY LeBow College of Business

COMCAST

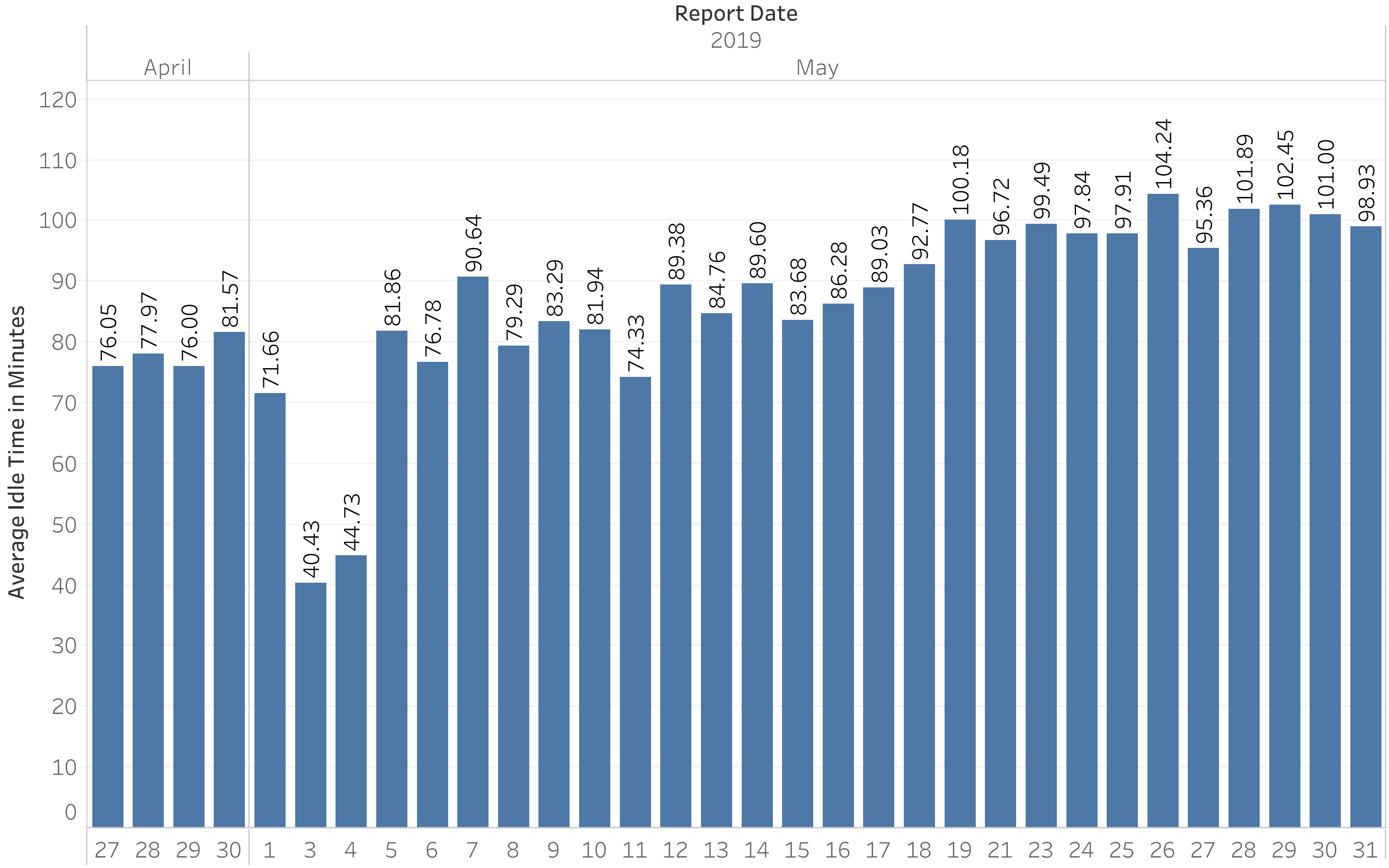
Idle Time Per Day Distribution - West Division



DREXEL UNIVERSITY
LeBow
College of Business

COMCAST

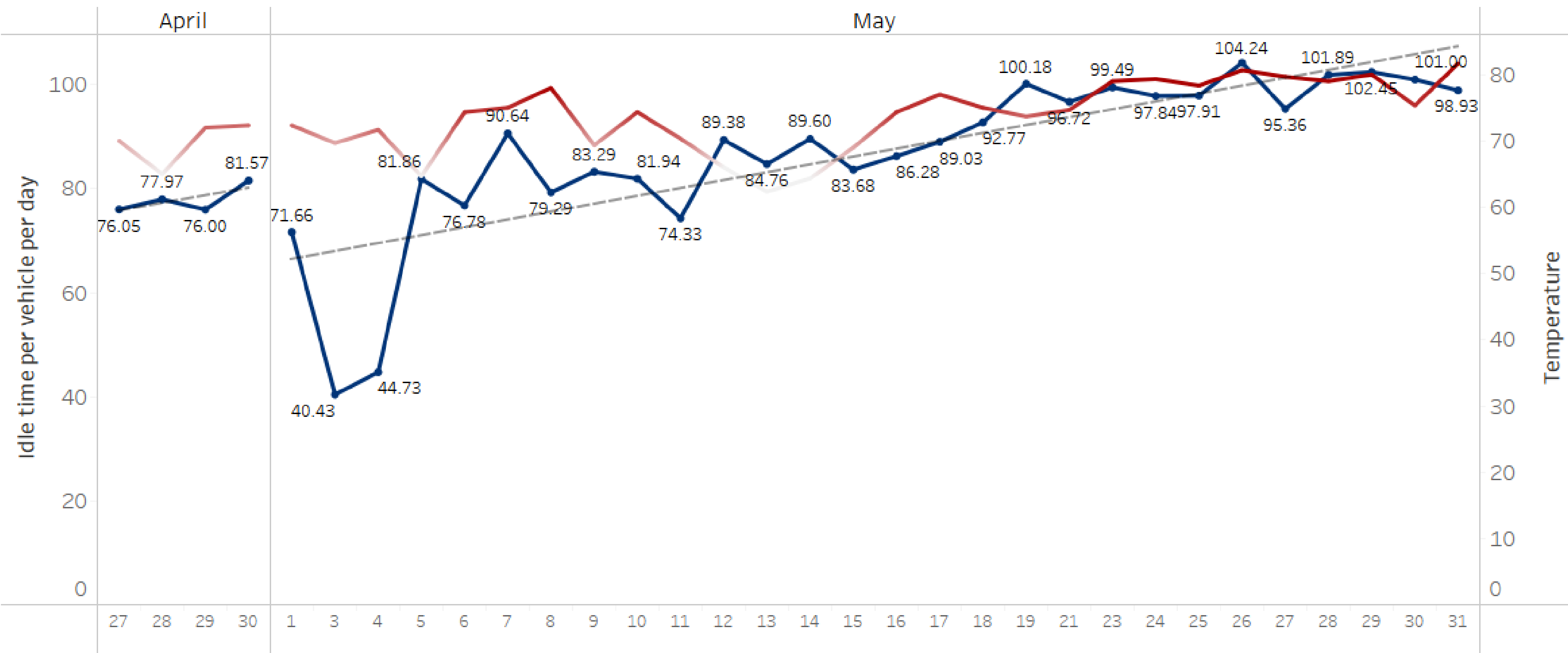
Idle Time by Date



DREXEL UNIVERSITY LeBow College of Business

COMCAST

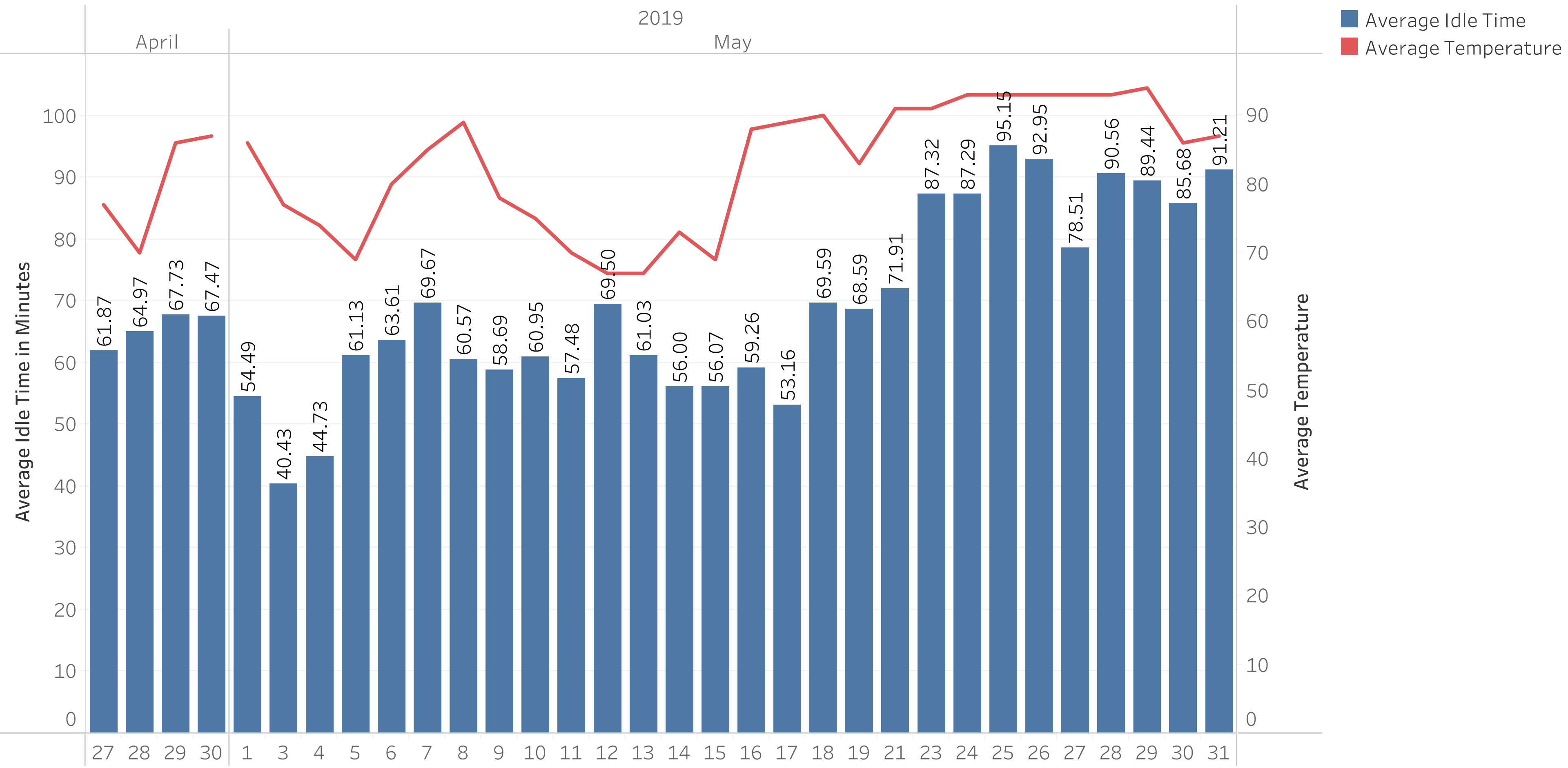
Idle Time by Date



DREXEL UNIVERSITY
LeBow
College of Business

COMCAST

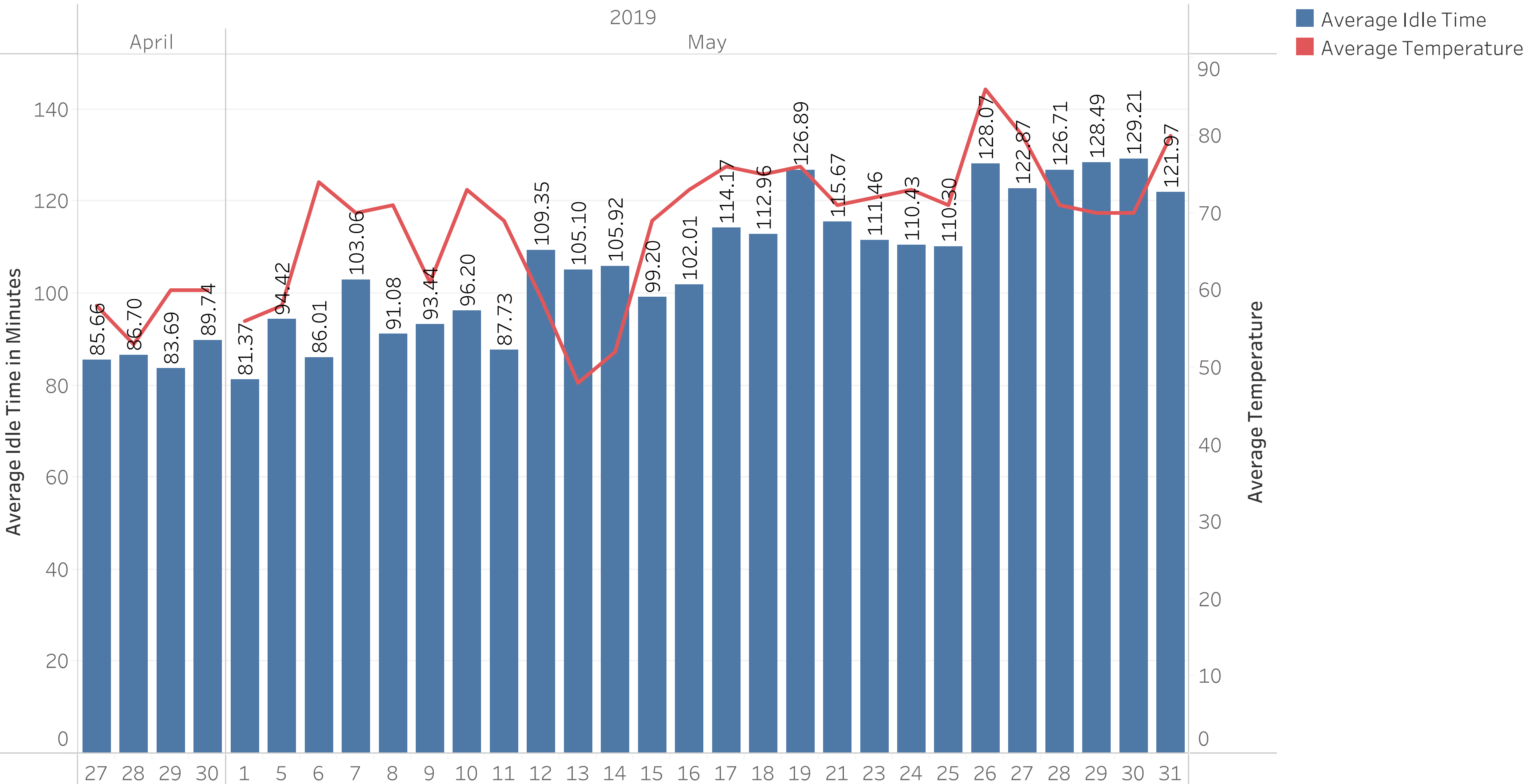
Idle Time by Date – Central Division



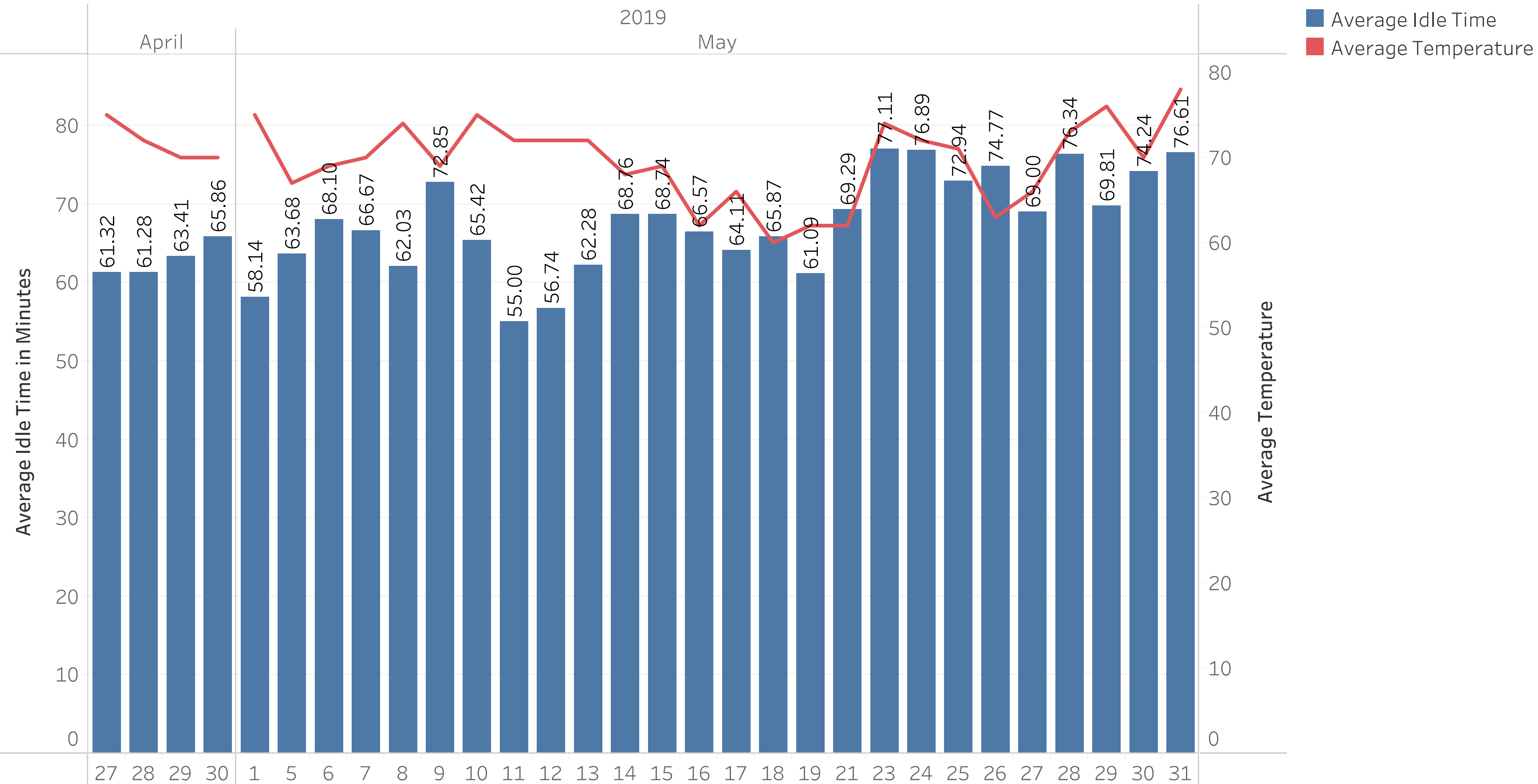
DREXEL UNIVERSITY
LeBow
College of Business

COMCAST

Idle Time by Date – Northeast Division



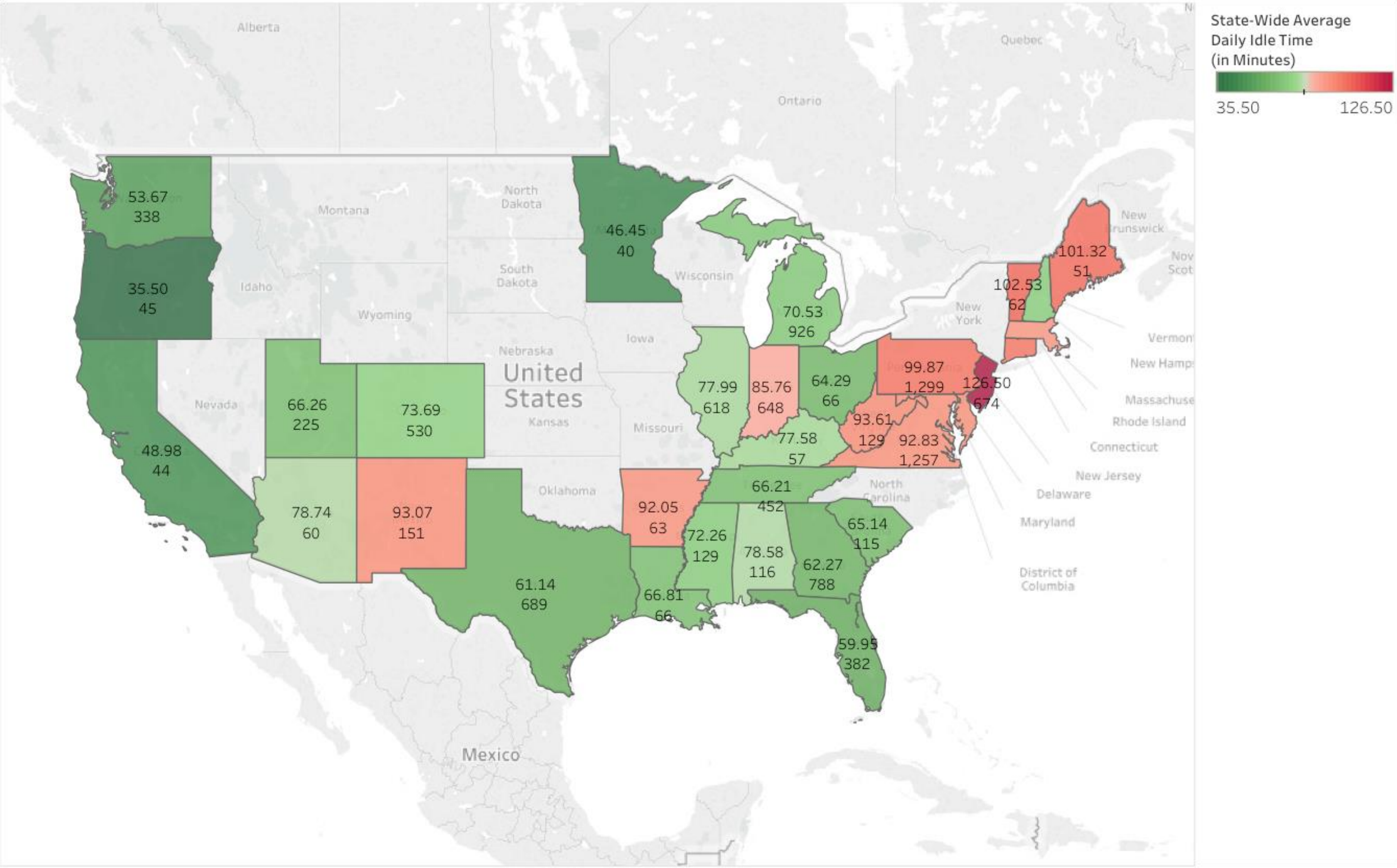
Idle Time by Date – West Division



DREXEL UNIVERSITY LeBow College of Business

COMCAST

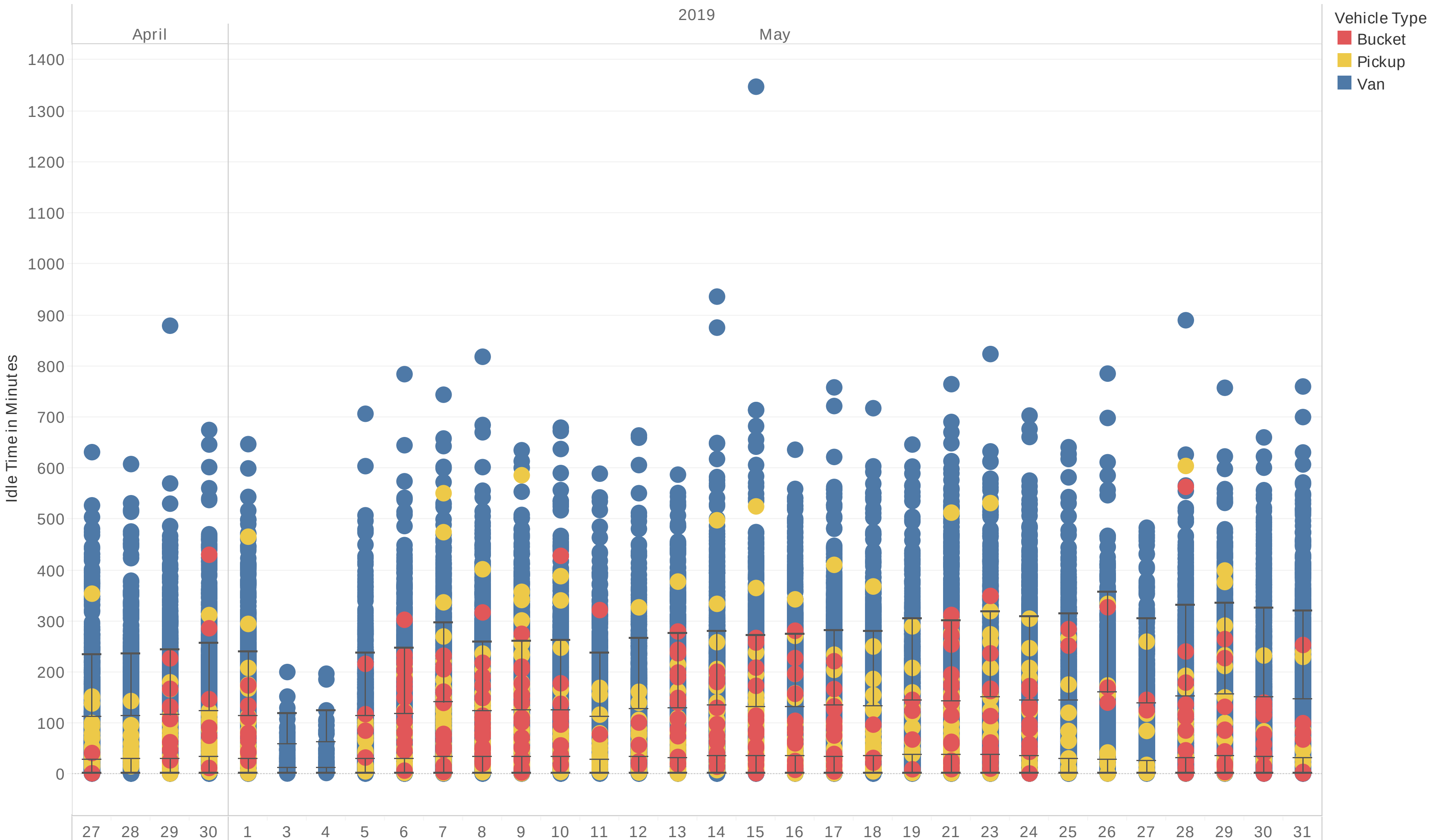
Idle Time by State



DREXEL UNIVERSITY
LeBow
College of Business

COMCAST

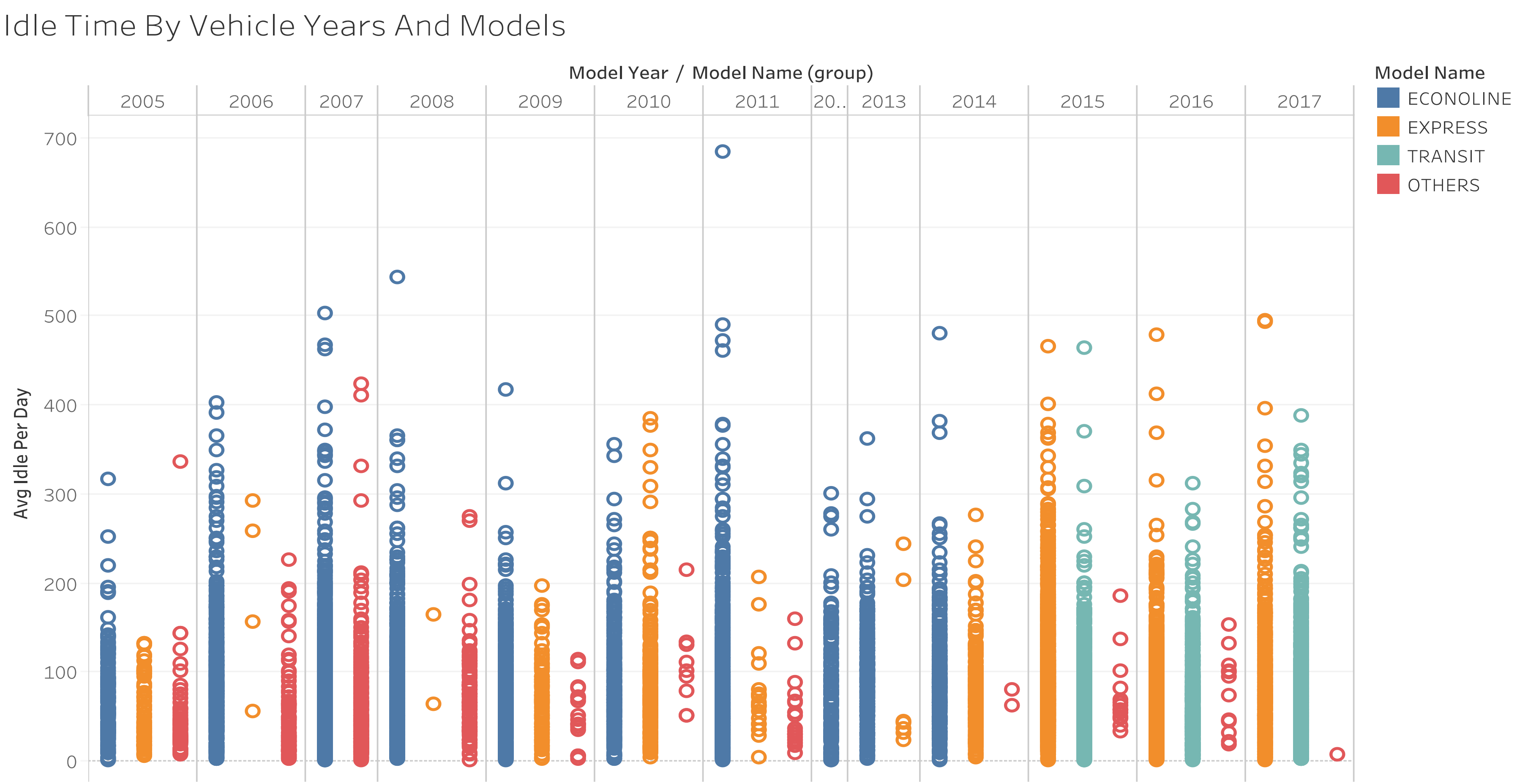
Idle Time By Date: Outliers



DREXEL UNIVERSITY LeBow College of Business

COMCAST

Idle Time Analysis by Van Models



DREXEL UNIVERSITY LeBow College of Business

COMCAST

Idle Time Analysis by Van Models and Division

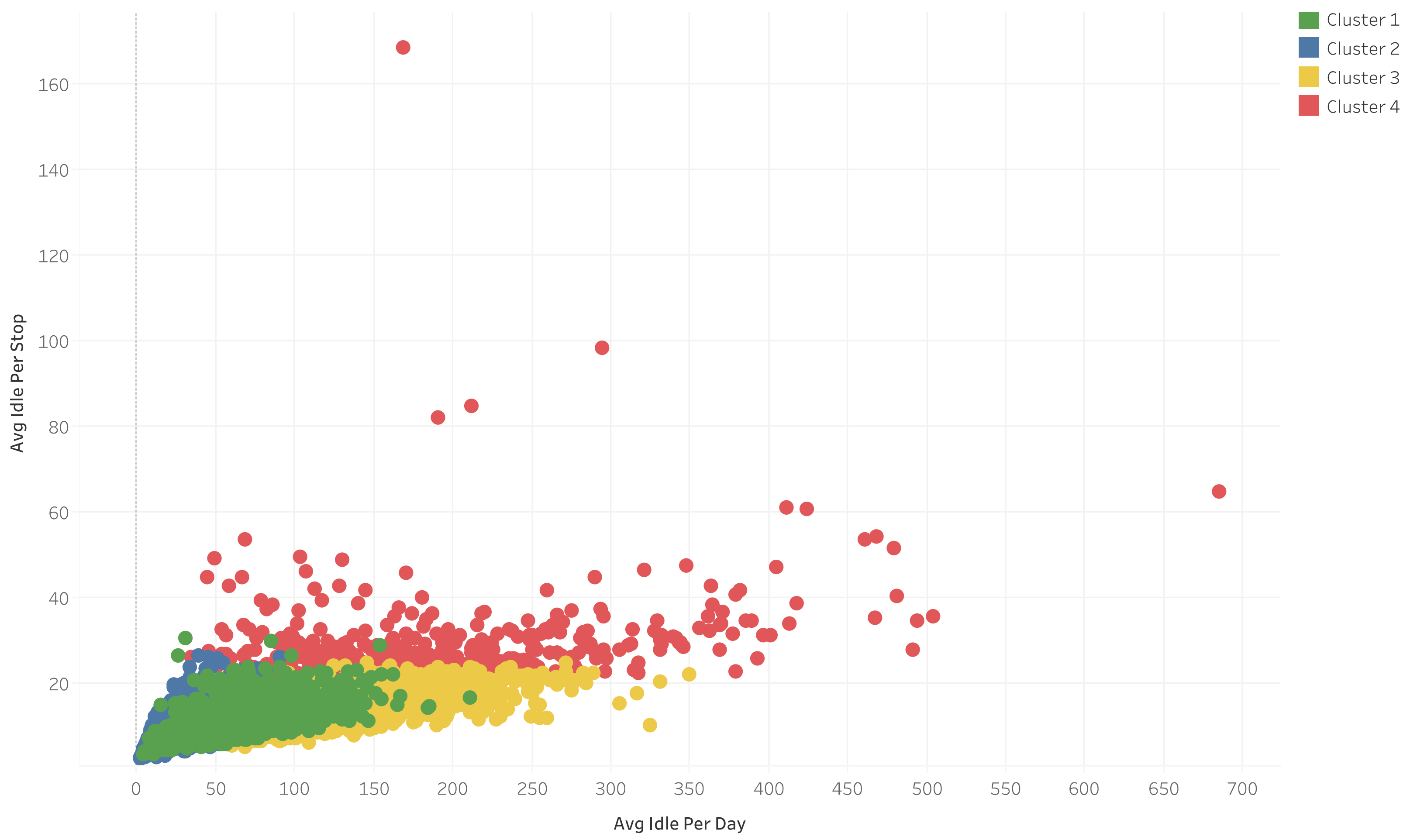
	Central	Northeast	West
Econoline	85.00	108.04	71.14
Express	75.15	104.73	64.95
Transit Van	59.99	87.78	60.68

- Daily idle times differ by type of vehicle and location.
  - Econolines have higher idle times than Expresses, followed by Transit Vans.
  - Vehicles in the Northeast have uniformly higher idle times than the other two regions.
  - The Northeast has a different distribution of vehicle models than the other two regions, but the overall higher idle times in the Northeast cannot be attributed solely to this different distribution.

Clustering Visualization

Cluster	Average Idle Time (minute)	Average Number of Stops	Average Idle Time Per Stop (minute)
Cluster 1	40	4.21	9.62
Cluster 2	67	5.88	11.5
Cluster 3	121	9.10	13.5
Cluster 4	175	6.21	29.2

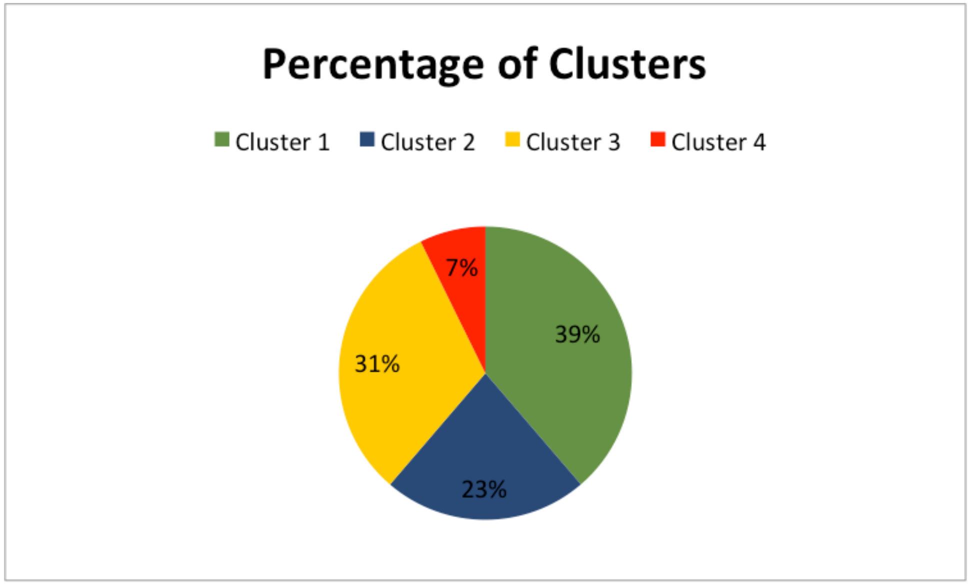
Clustering Visualization

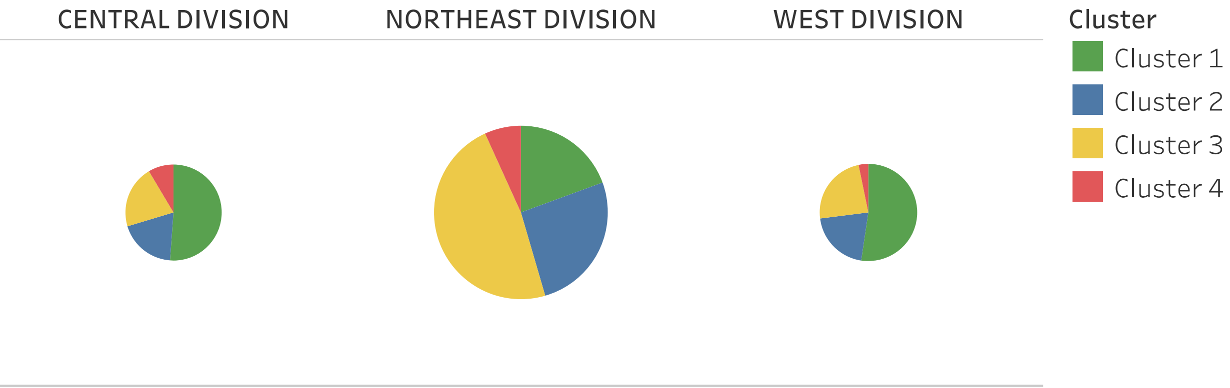


DREXEL UNIVERSITY
LeBow
College of Business

COMCAST

Clustering Visualization

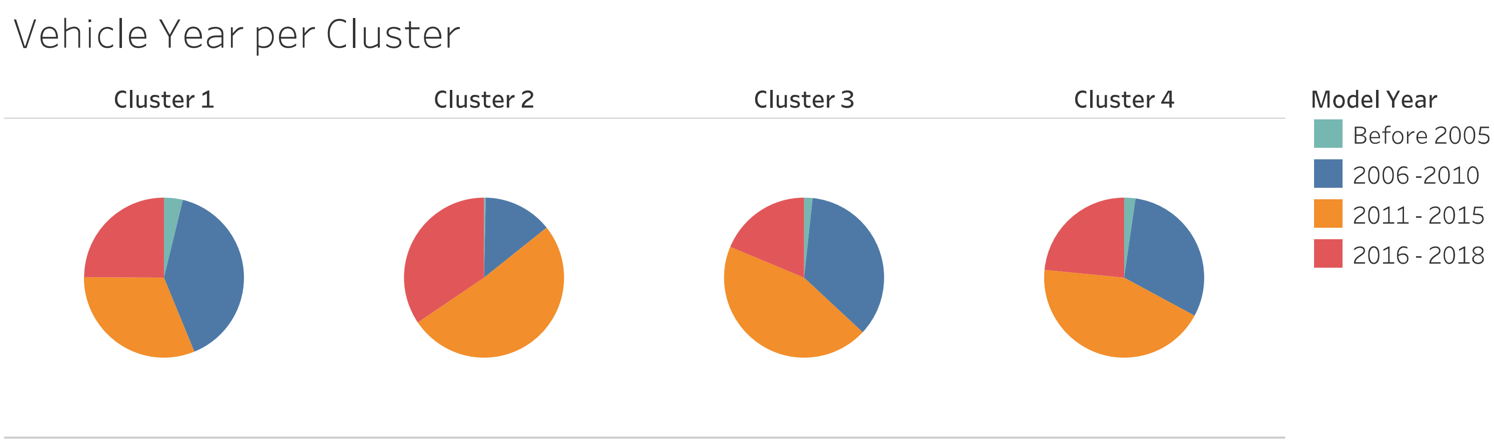


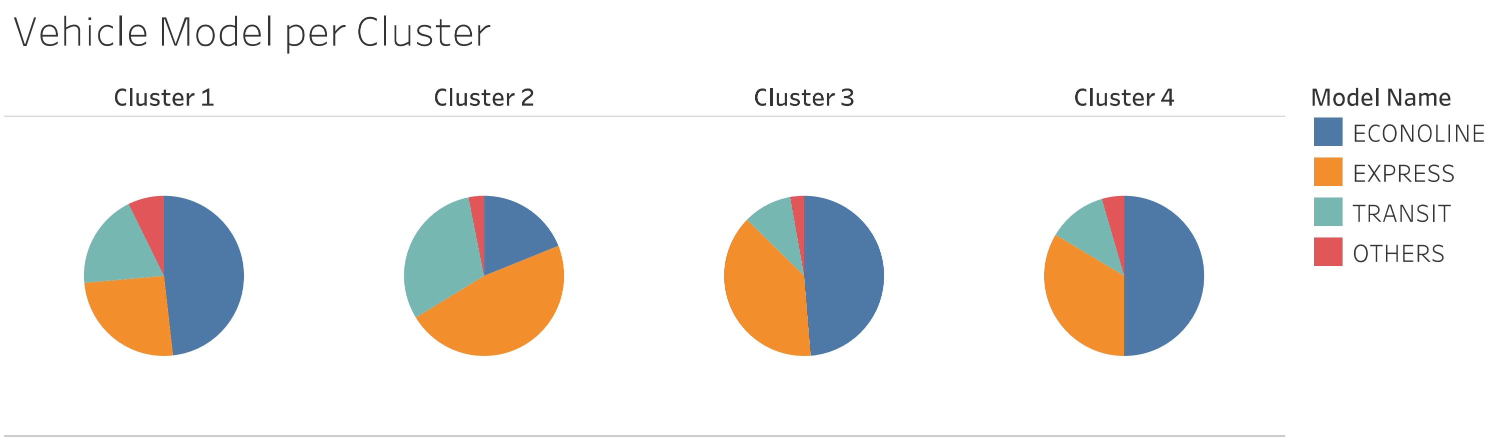


DREXEL UNIVERSITY
LeBow
College of Business

COMCAST

Clustering Visualization





DREXEL UNIVERSITY LeBow College of Business

COMCAST

Idle Time Special Case Selection

- Average daily idle time > 30 minutes and minimum idle time < 30 minutes
  - 6573 vehicles
  - Average daily idle: 77 minutes
  - Average minimum idle: 10 minutes
  - Average stops per day: 6 stops
  - Sample VINs: 1FTNR1ZM0FKA45850, 1GTGG25V171182757
- Average daily idle time < 30 minutes and maximum idle time > 30 minutes
  - 932 vehicles
  - Average daily idle: 22 minutes
  - Average maximum idle: 62 minutes
  - Average stops per day: 3 stops
  - Sample VINs: 1FTNE24L37DA44083, 1FTNE24L77DA84487

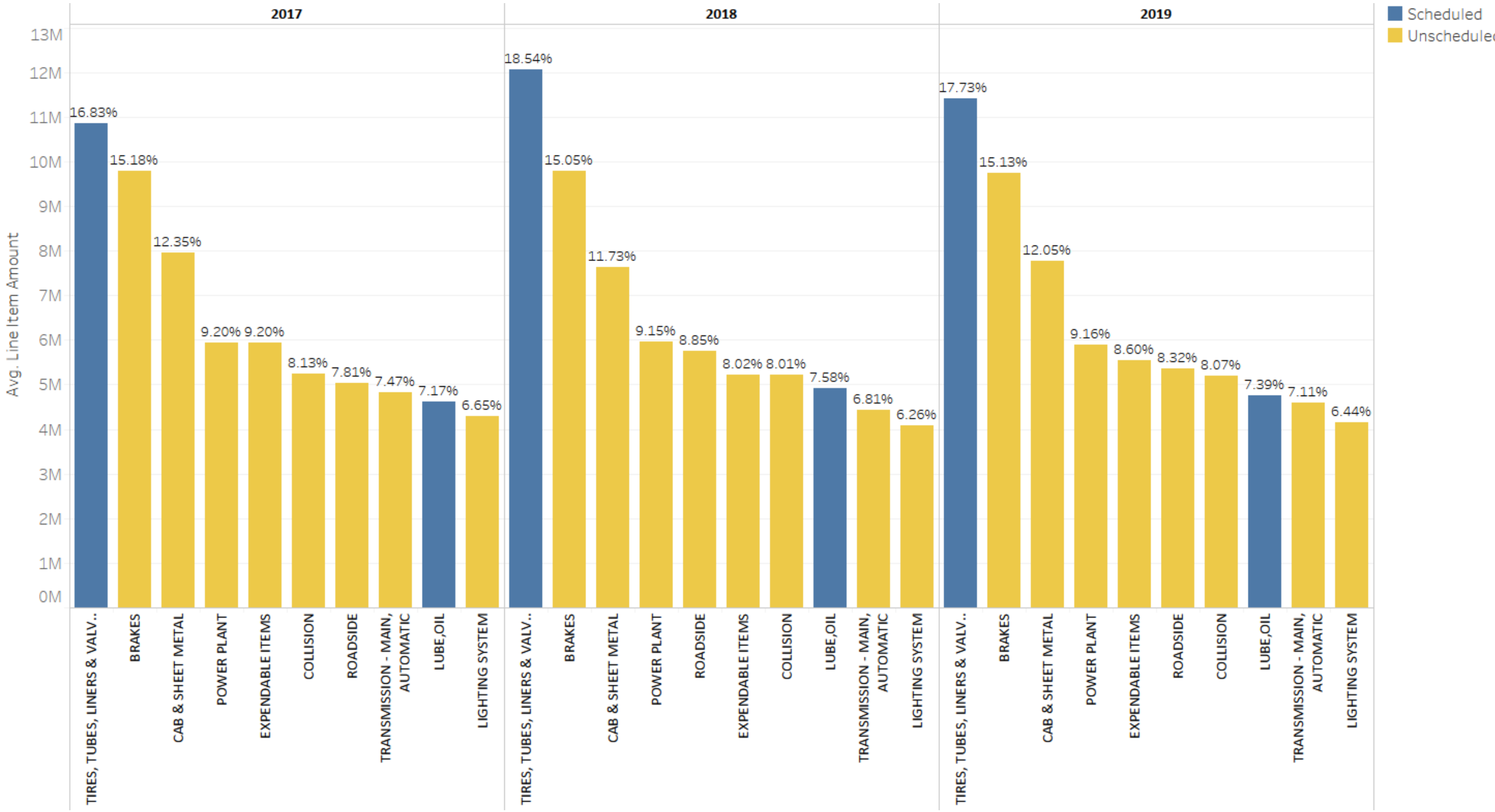
Idle Time Takeaways

- Idle time:
  - 80 minutes on average
  - 69 minutes as a middle point
  - 16.8% of the vehicles met the goal
- Division and temperature are significant factors in determining idle time:
  - Northeast has higher idle times than Central and West.
  - Warmer days exhibit higher idle times.
- Vans have more idle time outliers than other types of vehicles.
- Two groups of special cases merit further study.

Fuel Consumption and Maintenance Data Summary

- Maintenance data: 39,057 vehicles from 2017 to 2019
- 4251 records removed because of unmatched date
- Fuel data: 30,902 vehicles from November 2016 to April 2019

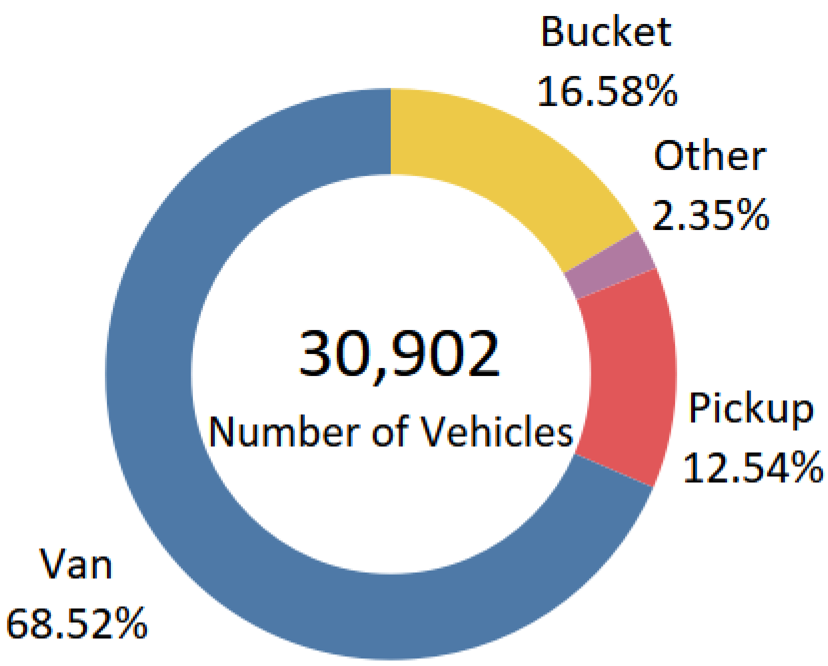
Maintenance

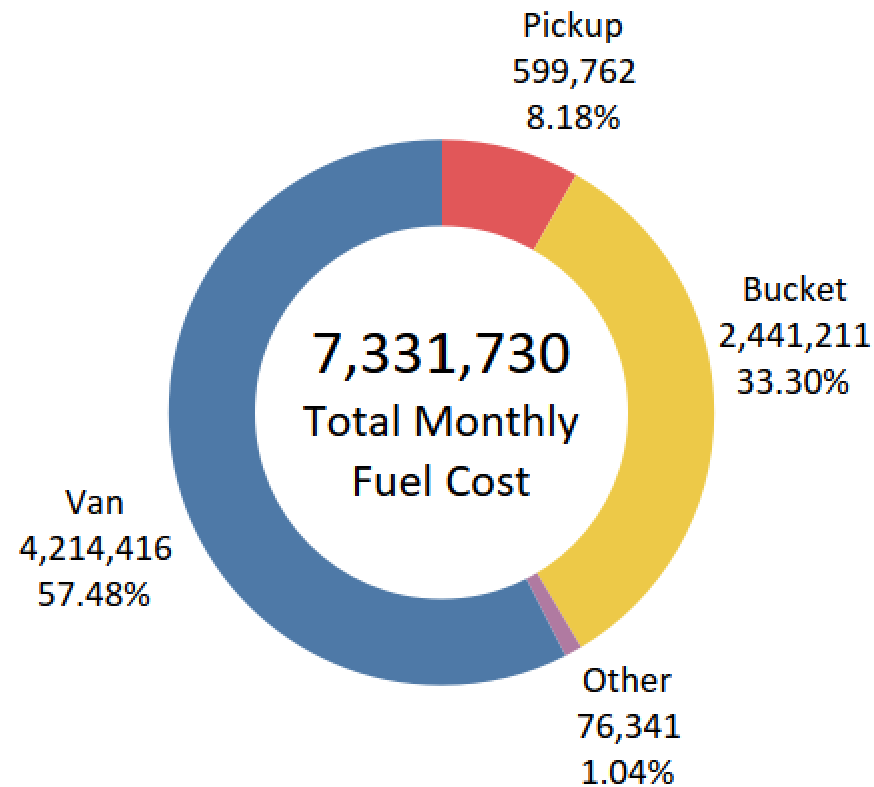


DREXEL UNIVERSITY
LeBow
College of Business

COMCAST

Fuel Expenditure

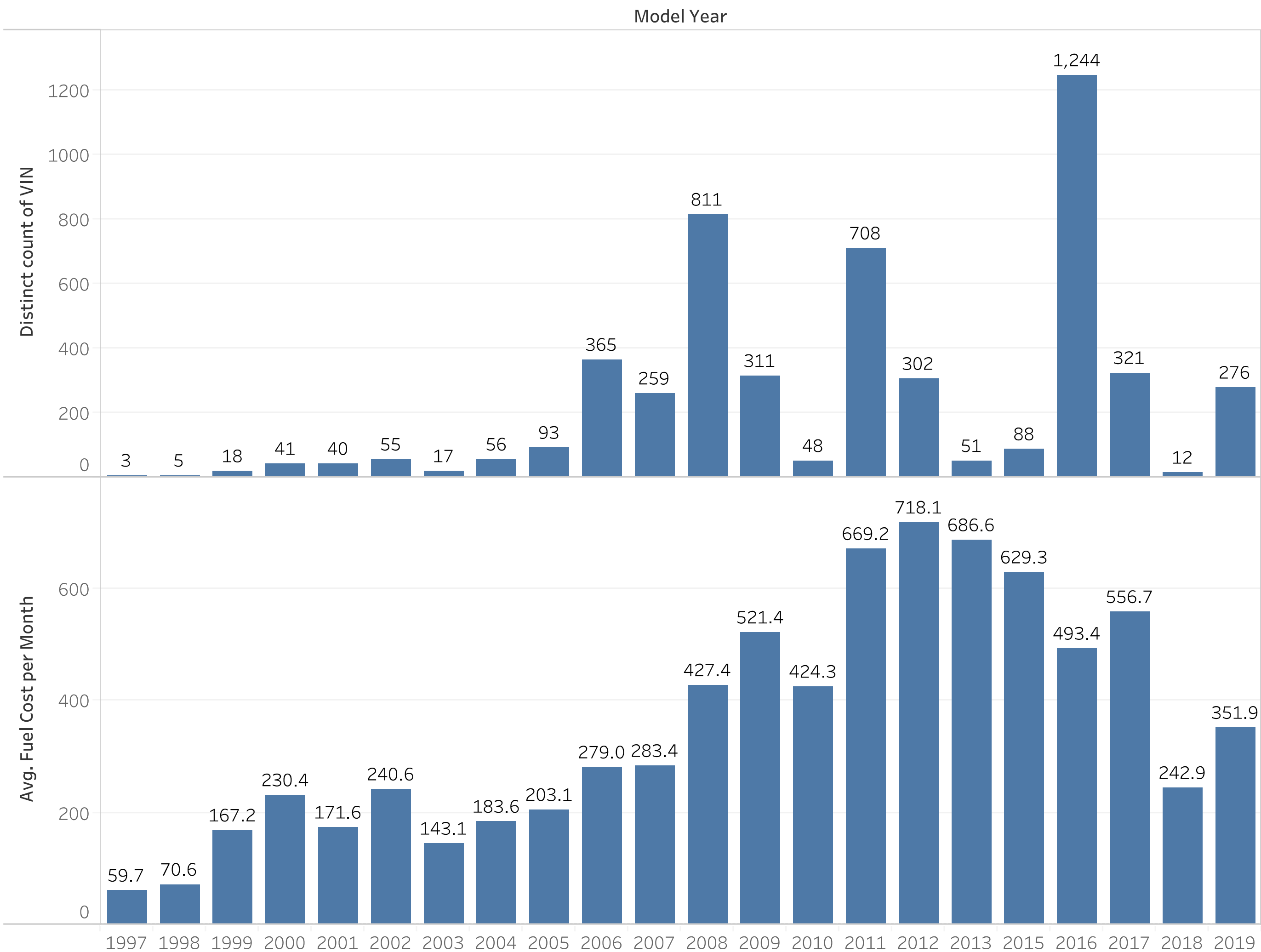




Drexel University LeBow College of Business

COMCAST

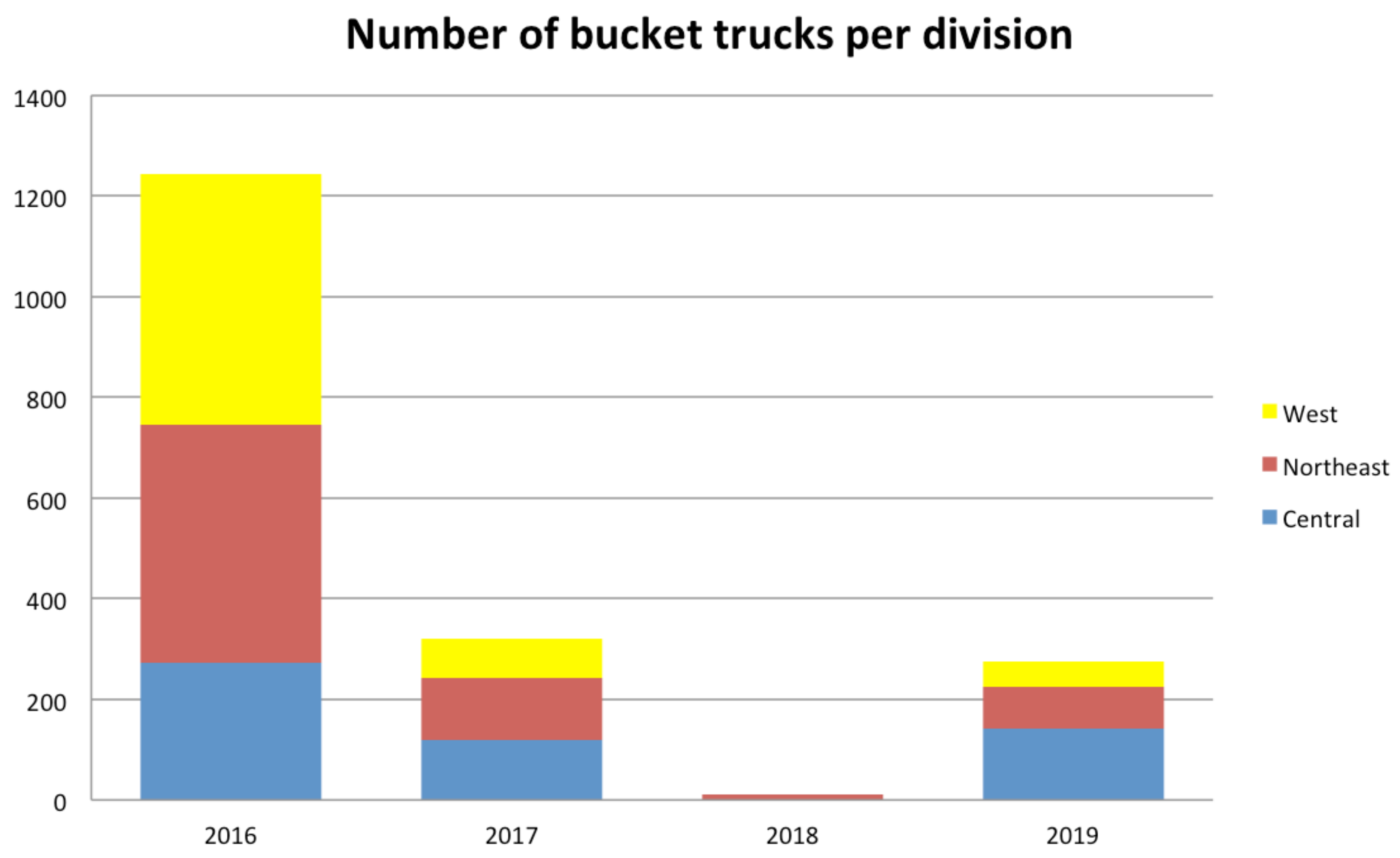
Fuel Expenditure by Model Year: Bucket Truck



DREXEL UNIVERSITY
LeBow
College of Business

COMCAST

Fuel Expenditure by Model Year: Bucket Truck



DREXEL UNIVERSITY LeBow College of Business

COMCAST

Idle Time and Fuel Consumption

- Argonne National Labs reports idle time fuel consumption data:

	Gallons / Idle Hour		
Miles Driven / Year	Multi-stop vans	Service – utility trucks	Pick-up and other
< 40,000	0.540	0.603	0.339
40-60,000	0.483	0.566	0.371
60-80,000	0.546	0.411	0.595
> 80,000	0.459	0.450	0.714

- The annual fuel cost savings per vehicle if the idle time goal is reached was calculated as follows:

$$\begin{pmatrix}\text{Daily Idle Hours}\\ \text{Reduction}\\ \text{to Reach Goal}\end{pmatrix} \times \begin{pmatrix}\text{Fuel Gallons}\\ \text{per Idle Hour}\end{pmatrix} \times \begin{pmatrix}\text{Fuel Price}\\ \text{per Gallon}\end{pmatrix} \times \begin{pmatrix}\text{Number of Days}\\ \text{Worked per Month}\end{pmatrix} \times 12$$

Idle Time and Fuel Consumption

- Idle time and fuel consumption data was provided for 10,485 vehicles.
- The current annual fuel cost for these vehicles is $30,170,455.
- The current estimated fuel cost savings due to idle time reduction is $1,748,334. This represents a reduction of 5.8%.
- The current annual fuel cost for the fleet is $87,980,756. A 5.8% cost reduction would save $5,098,357.

Fuel Consumption and Maintenance Takeaways

- Use of telematics has the potential for cost savings:
  - 83% of the maintenance costs are unscheduled.
  - Vans constitute the majority of vehicles and fuel costs.
  - Bucket trucks have disproportionately high fuel costs, but their costs have decreased significantly with change in use of power take-off.
  - Reducing daily idle time to below 30 minutes/day is expected to reduce fuel costs by 5.8%, or approximately $5 million annually for the fleet.

DREXEL UNIVERSITY
LeBow
College of Business

Thank You