Leader Attributes of High-Performing LTL Shipments

Ben Yin, Chris Rallis
Advised by Dr. Chris Caplice

Leader Attributes of High-Performing LTL Shipments

Agenda

1. LTL Market Dynamics

2. Description of Dataset and Methodologies

3. OTP Results and Implications

4. OTD Results and Implications

5. Leading Shipper Attributes

6. Carrier-Shipper Performance

7. Further recommendations & Conclusion

National wide, the on-time ratio for both pickup and delivery experienced a drop in 2017.
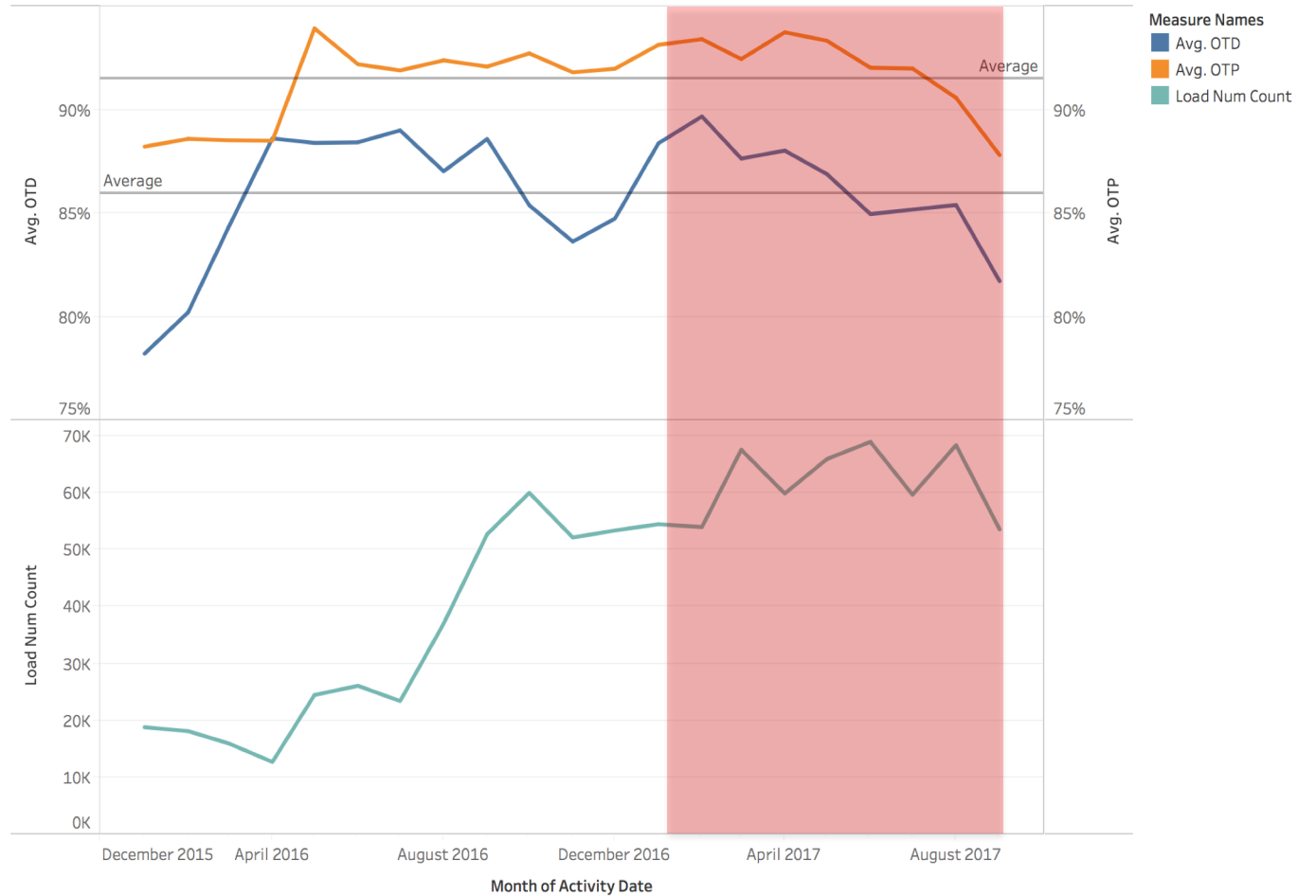

LTL 2017

Capacity Limitation on Expansion

Mark Up Shipping Cost

Performance Declining

On-Time Performance & Load Count

Measure Names
- Avg. OTD
- Avg. OTP
- Load Num Count

Avg. OTD

Avg. OTP

Load Num Count

Average

Average

Month of Activity Date

The trends of Avg. OTD, Avg. OTP and Load Num Count for Activity Date Month. Color shows details about Avg. OTD, Avg. OTP and Load Num Count.
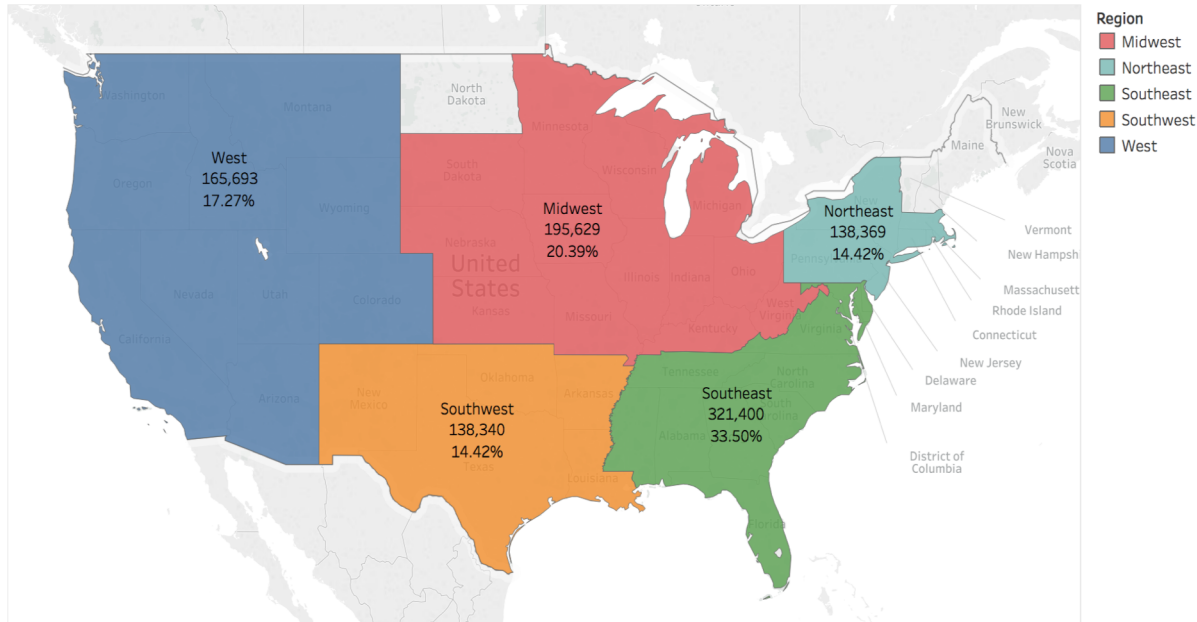
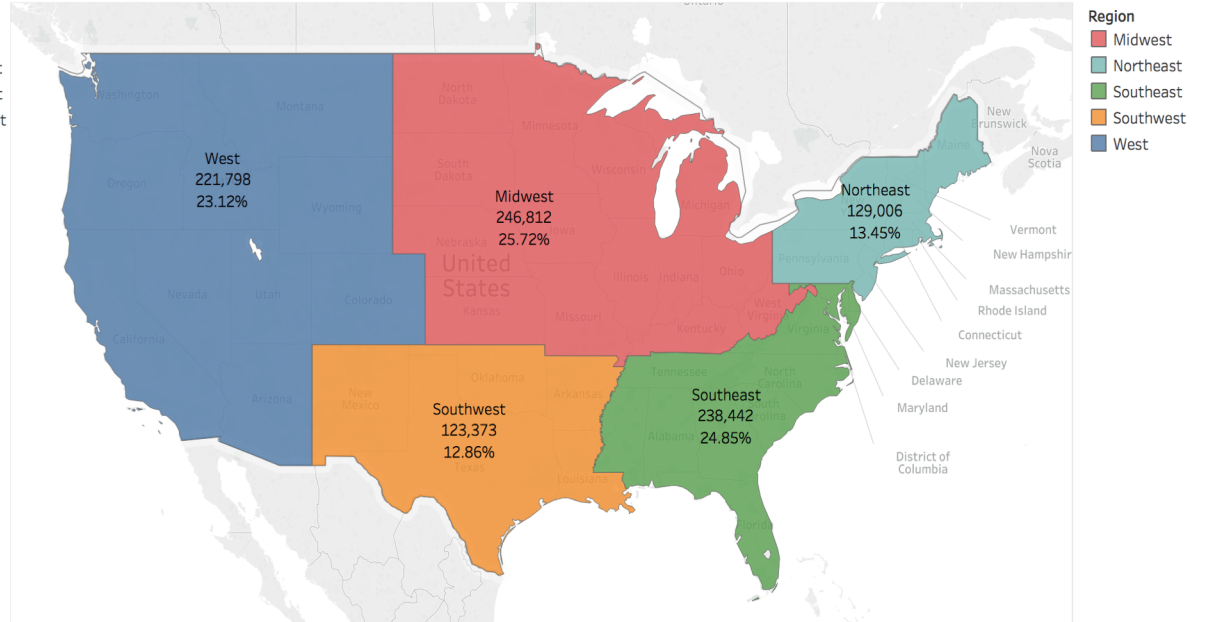C.H. ROBINSON — ACCELERATE YOUR ADVANTAGE®   TMC A DIVISION OF C.H. ROBINSON   MIT   Supply Chain MANAGEMENT

Description of dataset

Source	Timeframe	Type	Shipments	Performance
TMC — A DIVISION OF C.H. ROBINSON	**2 Yrs**	**Outbound**	**947 K**	**OTP 91%** **OTD 86%**

Regional Origin Shipment Count

West
165,693
17.27%

Midwest
195,629
20.39%

Northeast
138,369
14.42%

Southwest
138,340
14.42%

Southeast
321,400
33.50%

Region
Midwest
Northeast
Southeast
Southwest
West

Regional Destination Shipment Count

West
221,798
23.12%

Midwest
246,812
25.72%

Northeast
129,006
13.45%

Southwest
123,373
12.86%

Southeast
238,442
24.85%

Region
Midwest
Northeast
Southeast
Southwest
West

Binary logistic regression was used to conduct the analysis.

Y = 0 ➡️ Not On Time

Y = 1 ➡️ On Time

$$Ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k$$

where P is the probability of $Y=1$

X_k are the explanatory variables

| #	Variable Name	Definition
1	OTD	On Time Delivery; 0 -> Not on time; 1 -> On time.
2	OTP	On Time Pick Up; 0 -> Not on time; 1 -> On time.
3	Rate	Total amount paid on the load (Including LH, FSC, Accessorials)
4	SMC Transit Days	Carrier published transit days for the lane
5	Miles	Mileage of the shipment
6	Delivery Distance	Mileage between the delivery point and delivery terminal
7	Origin Distance	Mileage between the origin point and origin terminal
8	Weight	Actual weight of Shipment
9	Number of Pallets	Actual count of Pallets
10	Ord Pallet Positions	Planned version of the count of pallet
11	Volume	Cubic feet of the shipment
12	Fuel	Fuel surcharge
1	Broker Flag	1 -> With broker; 0 -> Without Broker
2	Hazmat Flag	1 -> Hazardous Material; 0 -> Not Hazardous Material
3	Detention Flag	1 -> With Detention; 0 -> Without Detention
4	Liftgate Flag	1 -> With Liftgate Accessorial; 0 -> Without Liftgate Accessorial

On-Time Pickup Findings

- Weight
- # of Pallets
- Distance from Origin Terminal

On-Time Pickup Findings

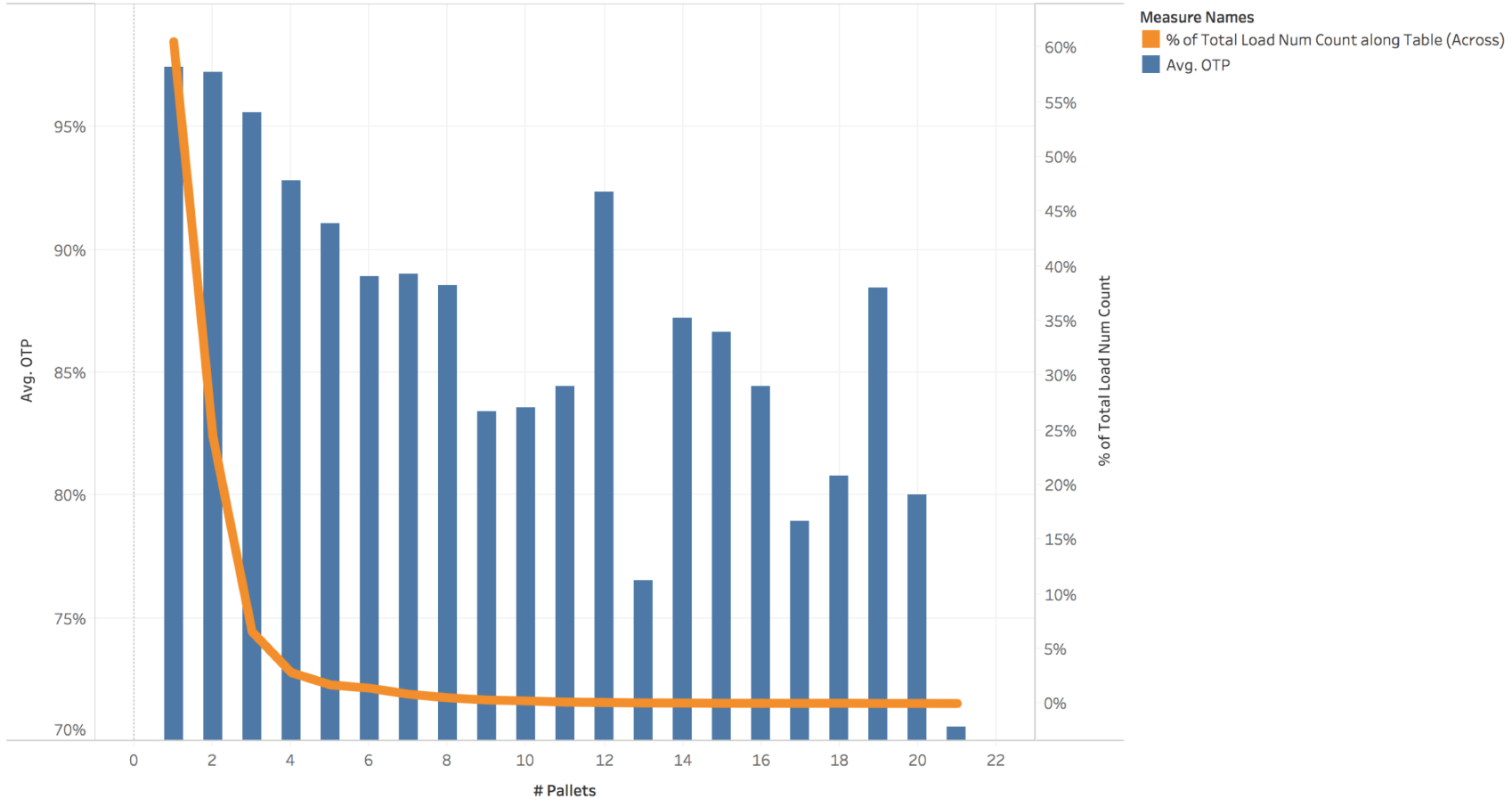■ Weight   ■ # of Pallets   ■ Distance from Origin Terminal

Weight & On-Time Pickup Performance
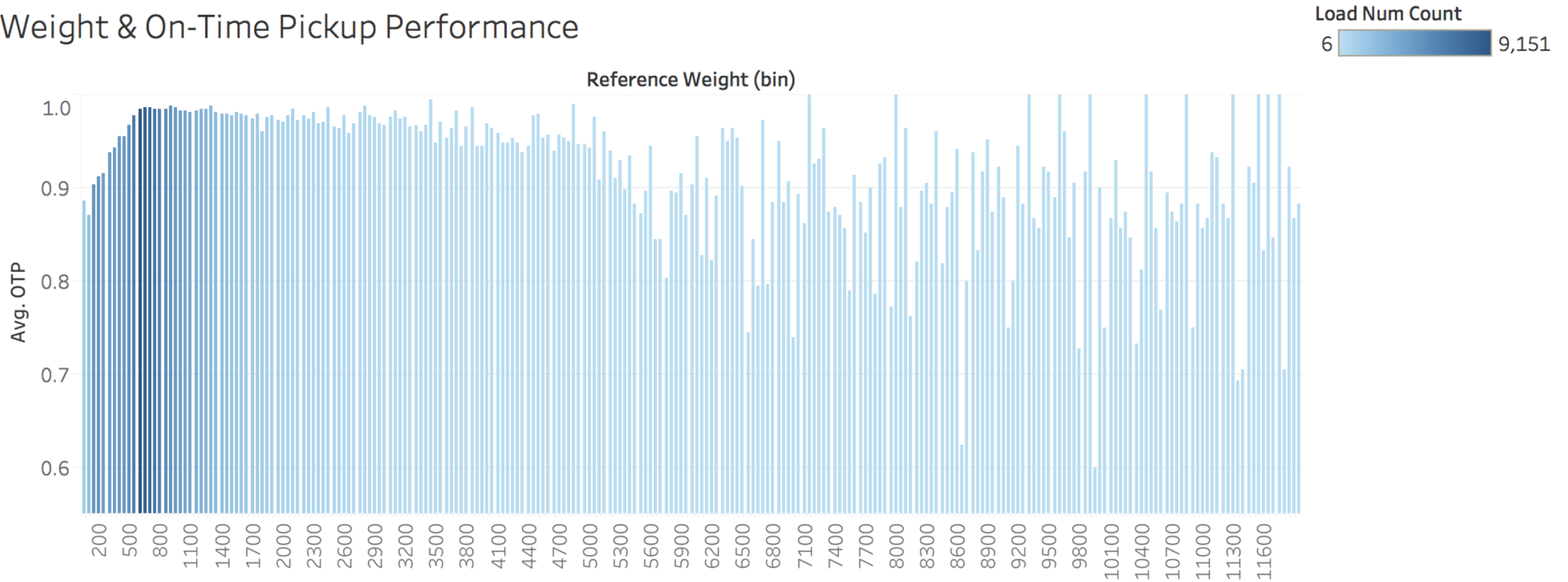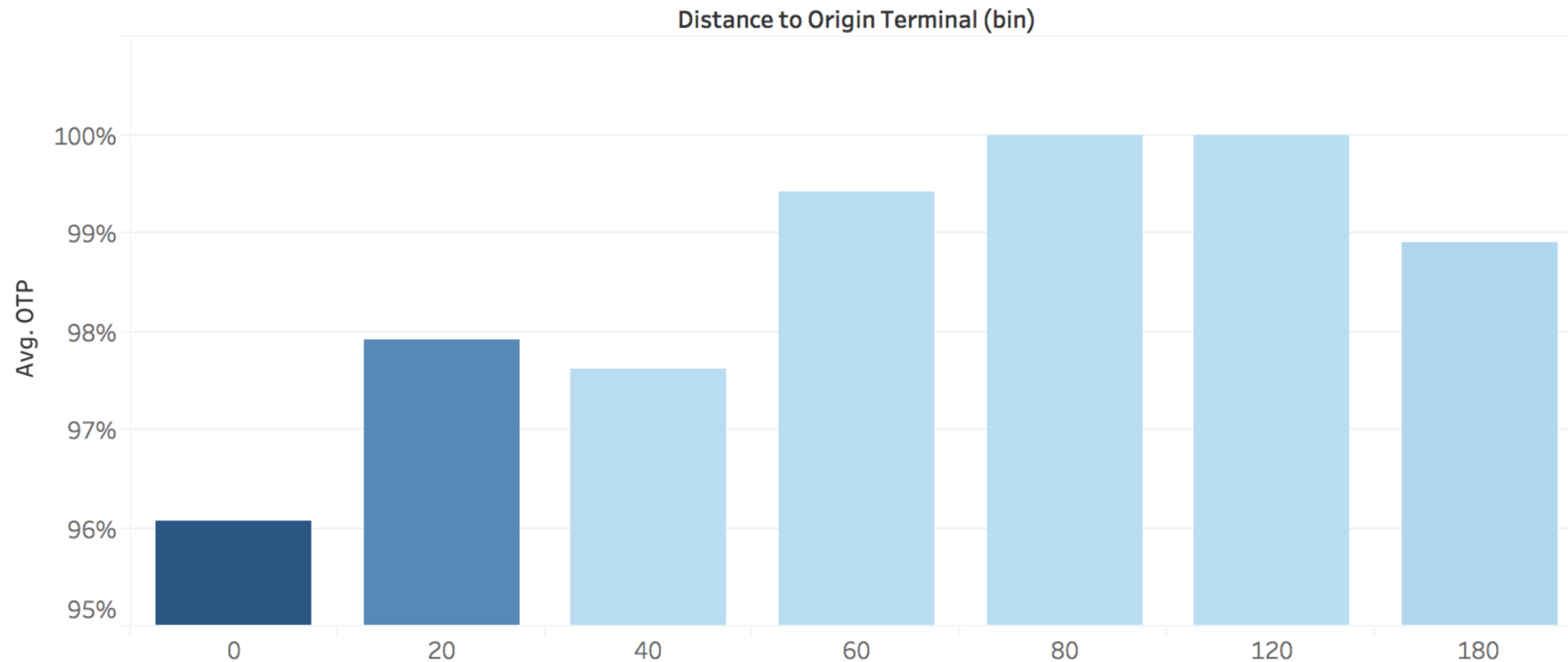
On-Time Pickup Findings

On-Time Pickup Findings

■ Weight   ■ # of Pallets   ■ Distance from Origin Terminal
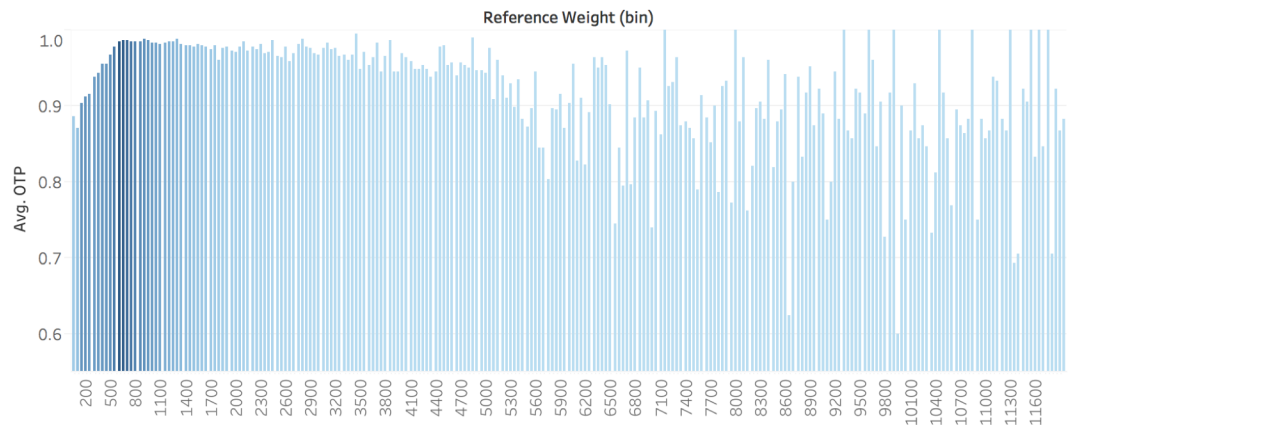

Distance to Origin Terminal & On-Time Performance

Load Num Count
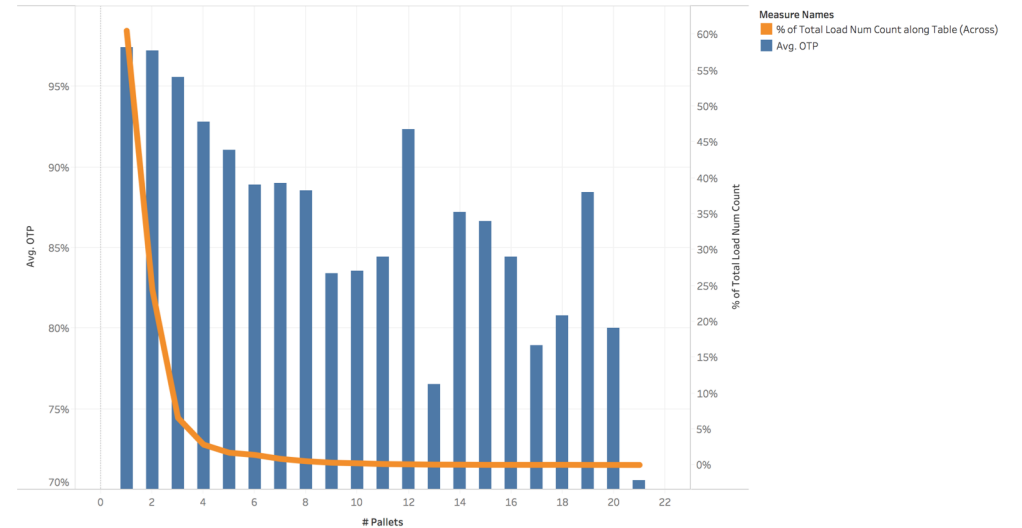9 — 99,116

Distance to Origin Terminal (bin)

Implications of OTP Findings

- Weight

- # of Pallets

- Distance from Origin Terminal

- Trailer capacity
  - Communication between shipper and carrier

- High weight/pallet variability
  - Dedicated pup or truckload

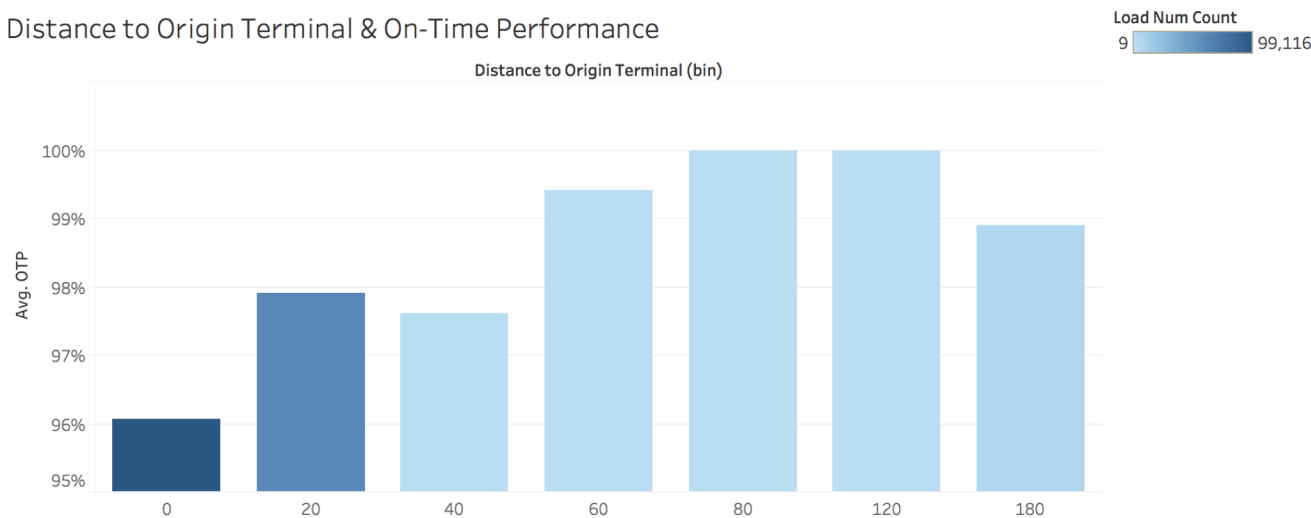Weight & On-Time Pickup Performance

Pallets & On-Time Pickup

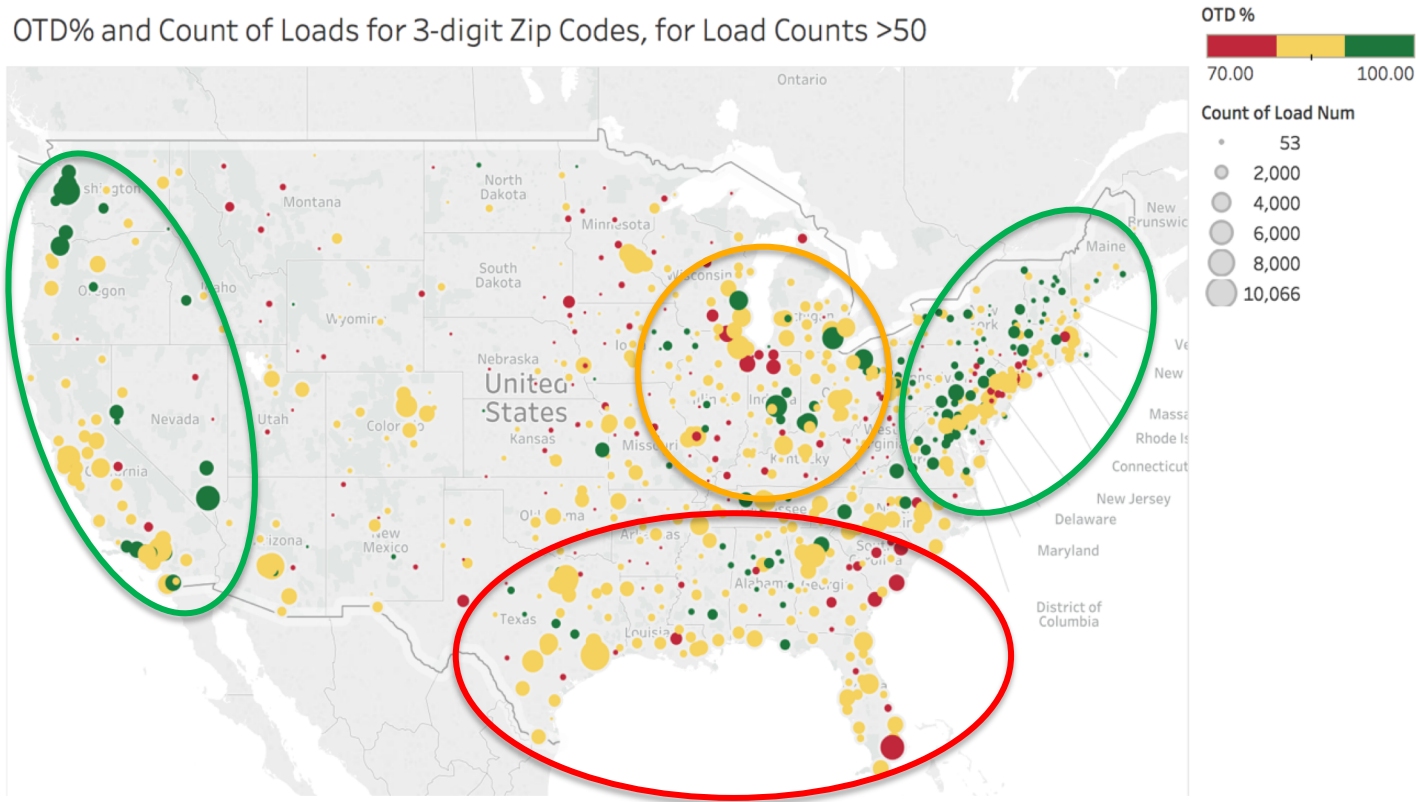# Implications of OTP Findings

- Weight

- # of Pallets

- Distance from Origin Terminal

- Pickup routes often begin with furthest stop
  - Capacity / Time constraints

Distance to Origin Terminal & On-Time Performance

Load Num Count
9 — 99,116

OTD Geographical Visualization and Model Result

OTD% and Count of Loads for 3-digit Zip Codes, for Load Counts >50

OTD %

70.00 ——— 100.00

Count of Load Num
- · 53
- ○ 2,000
- ○ 4,000
- ○ 6,000
- ○ 8,000
- ○ 10,066

Term	M3 R^2: 10.07%	
	Coefficient	P-Value
Intercept	1.71	<0.0001
Published Transit Days	-0.3534	<0.0001
High Weight	0.0001	<0.0001
Low Weight	0.00021	<0.0001
OTP [1]	1.3263	<0.0001
C-Code Zip Count	0.00027	<0.0001

Correlation between # of loads and OTD% is 0.21

- C-Code zip count: the business unit's count of loads in the destination 3-digit zip code area

- High weight ≥ 1000 lbs; Low < 1000 lbs.

OTD Geographical Visualization and Model Result

OTD Geographical Visualization and Model Result

OTP & OTD

Avg. OTD (y-axis) vs Avg. OTP (bin) (x-axis)

- 38,727
- 3,357
- 3,808
- 62,003
- 46,099
- 28,040
- 184,608
- 582,833
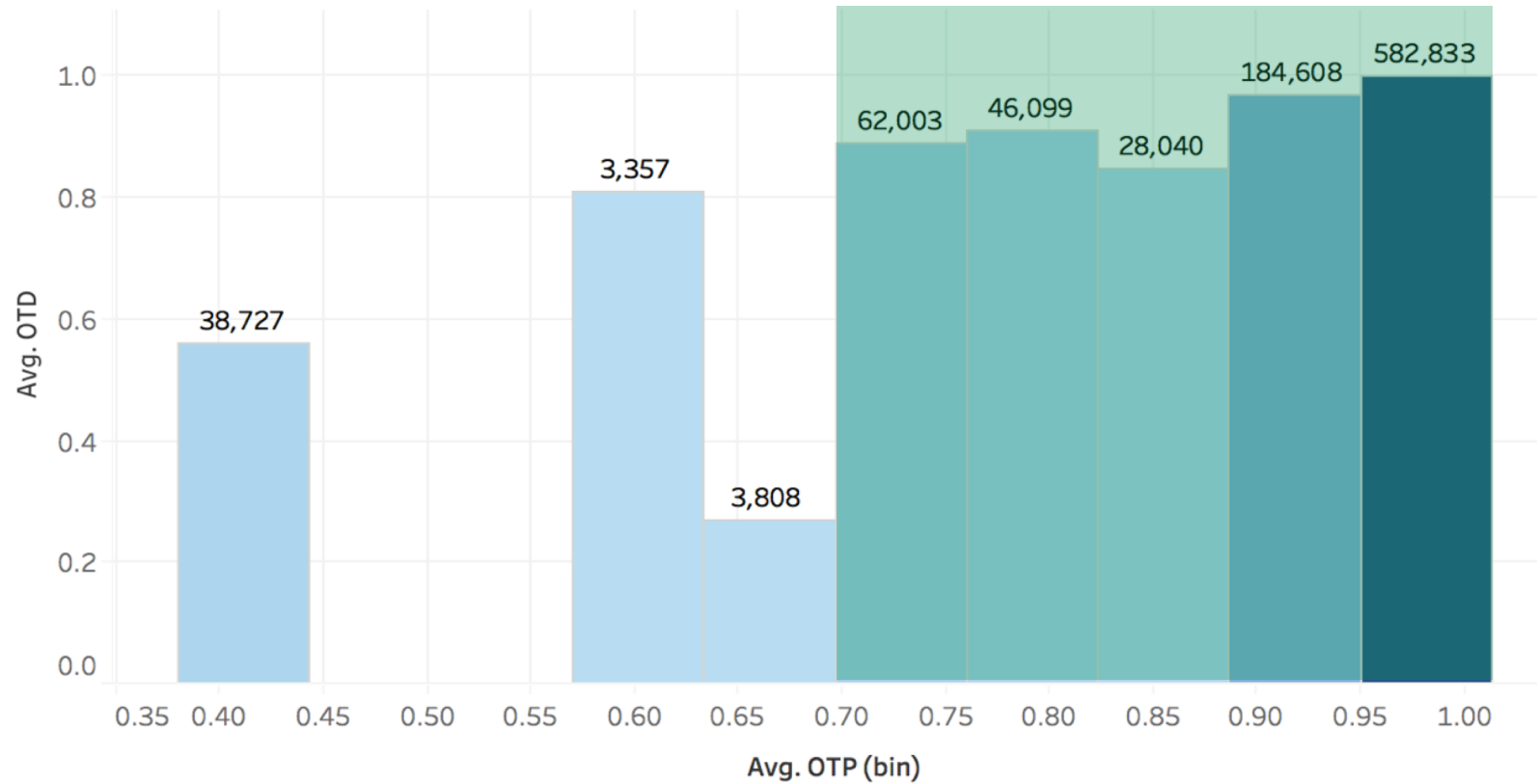
OTD Geographical Visualization and Model Result

Published Transit Days & On-Time Delivery Performance
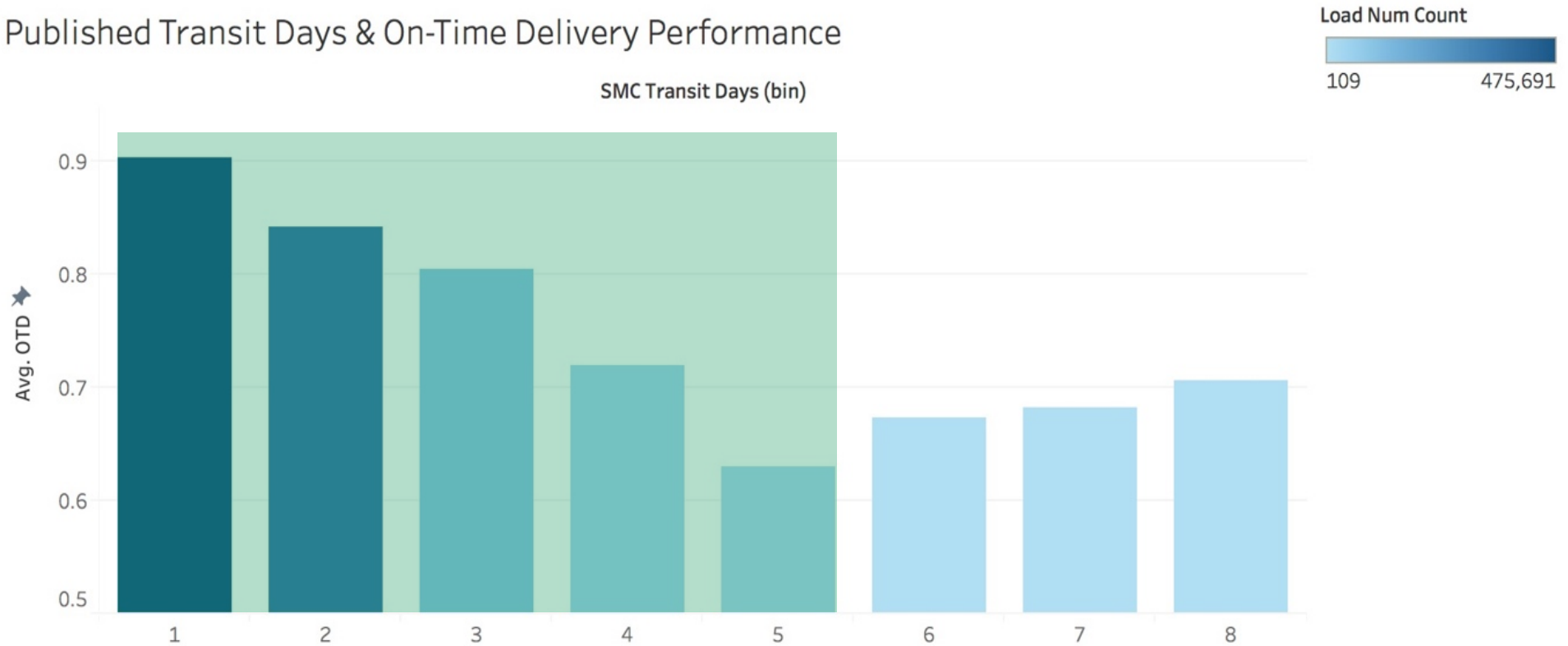
Implications of OTD results:

Significant Factors to OTD

1. OTP

2. C-Code Zip Count

3. Weight

| 1. Published Transit Days |

Recommendations:

Network Level:

- Locate closer to market

- Select suppliers with high OTP

Operations Level:

- Aggregate future shipments

- Control activities to gain higher OTP

Special Shipment Characteristics (Assessorial Charges)

- Hazmat often gets delayed in transit

- Liftgate shipments lag slightly on pickup, but significantly on delivery

- Detention numbers are very slow, but do not show a significant impact

Assessorial	Total Counts	OTP	OTD
Hazmat	7,299	95%	67%
Liftgate	5,685	83%	62%
Detention	57	88%	93%

Leaders & Laggards

- Separated shipper business units on OTD performance
    - Leader >90%   **41%**
    - Middle 80-90%   **36%**
    - Laggard <80%   **23%**

- Small and large shippers can achieve high performance

- Slight transit days variation, but similar weights

- Carrier performance is strongly dependent on destination

On-Time Delivery (%)						
	# Bus Unit	Mean	Min	Median	Max	Std Dev
Leader	31	95%	90%	94%	100%	3%
Middle	27	84%	80%	83%	89%	3%
Laggard	18	59%	27%	59%	78%	13%

On-Time Pickup (%)						
	# Bus Unit	Mean	Min	Median	Max	Std Dev
Leader	31	97%	81%	100%	100%	3.70%
Middle	27	90%	63%	95%	100%	10%
Laggard	18	85%	42%	92%	100%	16%

Published Transit Days						
	# Bus Unit	Mean	Min	Median	Max	Std Dev
Leader	31	1.71	1.03	1.75	2.4	0.37
Middle	27	1.93	1.4	1.79	3.37	0.44
Laggard	18	2.36	1.3	2.11	7.99	1.44

Number of Shipments						
	# Bus Unit	Mean	Min	Median	Max	Std Dev
Leader	31	17011	63	704	260957	51562
Middle	27	11083	67	3071	74094	17042
Laggard	18	6826	97	2719	38727	11051

Weight (pounds)						
	# Bus Unit	Mean	Min	Median	Max	Std Dev
Leader	31	2098	349	1552	6551	1625
Middle	27	2143	278	1718	5586	1665
Laggard	18	1839	185	1638	6720	1483

Further Discussion

- Defining on-time and performance to published transit days
  - Only **71%** of shipments met published transit days
  - At published days +1 → **91%**

- Tender codes
  - Shipments can be "removed" from performance statistics for a variety of reasons

- Integrating operational and shipping data
  - Damage and shortage
  - Invoicing accuracy

Industry Recommendations / Further Discussion / Conclusion

- Pickup and Delivery performance have different drivers
  - Managing attributes versus expectations

- Understanding the composition of shipments and network
  - Size of shipments
  - Number, distance, and volume of destinations
  - Integrated supply chain

Thank You!

Questions?