





WHAT STARTS HERE CHANGES THE WORLD

# Motivation

- Travel patterns vary over space (from city to city, region to region, & state to state) & over time (day to day & month to month) due to regionspecific events (e.g., local rainstorms), holidays, & various other factors.
- In order to optimally serve demand over time & space (e.g., transit, shared autonomous vehicle fleets, roadway supply), it is very valuable to understand these variations.
- NHTS 2009 data allow us to quantify these variations.

## Objectives

- Illuminate variations in a region's daily vehicle-miles traveled (VMT), average trip lengths, & vehicle occupancies (of light-duty vehicles [LDVs]) using the 2009 NHTS.
- Quantify day-to-day & spatial variations in travel patterns (each day of the 2009 year, holidays vs. non-holidays, by day of week & month of year, Dallas vs. Texas vs. U.S. averages).

### **Data Description**

- NHTS trip weights are used, resulting in important differences.
- While publicly available NHTS data do not carry survey dates, FHWA's Office of Policy provided the dates (upon special request).
- Survey data were analyzed from May 1, 2008 to April 30, 2009.
- Counts are high, but no vehicle trips exist for Dallas on 4/30/09.

### Sample Sizes in NHTS Data

Vehicle-trip Counts per Day	U.S.	Texas	Dallas
Average across 365 days	1,913	293	52
Std. dev. in daily counts across 365 days	536	91	25
Average count across top 18 days (5%)	3,071	489	108
Average count across bottom 18 days	723	126	13
Average across holidays (13 days)	1,483	251	50
Average across non-holidays	1,929	294	52

# VARIATIONS IN AMERICANS' DAY-TO-DAY TRAVEL PATTERNS Prateek Bansal, Daniel J. Fagnant, & Kara Kockelman

### Variations in Daily VMT

Daily VMT (per light-duty vehicle)	U.S.	U.S. (Wtd.)	Texas	Texas (Wtd.)	Dallas	Dallas (Wtd.)
Average across 365 days	37.3	39.0	40.0	40.0	41.5	41.5
Std. dev. across 365 days	3.5	10.8	7.9	11.9	21.6	28.0
Average of top 18 days	45.9	71.2	60.1	75.3	109.2	126.2
Average of bottom 18 days	31.1	26.8	26.9	24.2	15.9	14.6
Average of holidays (13 days)	38.1	45.2	36.1	38.5	39.2	36.8
Average of non-holidays	37.3	38.7	40.1	40.1	41.6	41.7

Percentage Higher/Lower than Avg. Daily VMT (U.S. [Weighted])

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	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monthly
January	2.77%	-5.17%	-10.8%	-23.5%	-7.44%	11.6%	-7.75%	-5.31%
February	22.3%	1.06%	-8.58%	2.23%	-4.41%	-11.5%	-0.52%	0.07%
March	-18.8%	-2.69%	-10.6%	-11.3%	2.63%	18.8%	-3.04%	-4.26%
April	-2.51%	-7.28%	-4.06%	-11.2%	2.36%	28.3%	-6.85%	-0.45%
May	-2.88%	-7.47%	-19.2%	0.10%	14.2%	6.80%	3.95%	0.23%
June	-21.6%	2.26%	-6.35%	-8.00%	67.8%	12.1%	-11.2%	4.01%
July	-10.4%	14.3%	-10.1%	49.0%	-1.58%	0.32%	17.6%	8.85%
August	-9.76%	-6.93%	0.08%	-7.59%	-6.59%	6.03%	13.1%	-1.20%
September	-4.12%	-9.05%	-7.34%	5.91%	-8.89%	-3.92%	-14.3%	-6.11%
October	10.1%	-2.01%	-5.61%	-6.20%	0.57%	16.6%	-2.66%	1.75%
November	-0.12%	-3.79%	-12.3%	12.1%	5.99%	-5.57%	5.76%	0.47%
December	2.35%	4.86%	-1.40%	-1.05%	2.10%	13.7%	-6.53%	1.90%
Weekly	-3.49%	-1.77%	-7.97%	0.63%	5.19%	7.98%	-0.67%	

Percentage Higher/Lower than Average Daily VMT (Texas [Weighted]

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monthly
January	-12.3%	-2.31%	-5.53%	-19.4%	52.1%	0.86%	-11.6%	1.30%
February	-21.2%	-18.5%	29.8%	1.30%	-3.30%	-6.68%	-29.2%	-6.82%
March	25.1%	-10.4%	21.5%	-6.01%	7.59%	33.3%	-13.9%	7.39%
April	-4.31%	-13.7%	-3.07%	14.1%	20.7%	-12.4%	6.89%	1.45%
May	12.4%	-10.4%	-8.90%	4.13%	-13.2%	-8.19%	2.54%	-3.35%
June	10.8%	2.77%	26.5%	-6.62%	10.1%	-3.47%	-2.81%	5.24%
July	2.50%	-11.5%	-1.90%	7.26%	6.19%	24.1%	-22.6%	0.32%
August	1.79%	-0.58%	-7.71%	-4.88%	0.78%	20.2%	-1.75%	1.64%
September	-18.1%	-0.70%	0.61%	-12.4%	-13.1%	-5.15%	-23.5%	-10.3%
October	14.6%	-19.6%	-2.46%	-6.31%	-0.84%	11.7%	-3.84%	-1.19%
November	18.9%	-7.21%	1.28%	-7.85%	0.31%	15.7%	1.35%	3.57%
December	-3.69%	20.4%	-20.3%	-12.2%	12.8%	-6.11%	10.6%	0.07%
Weekly	2.30%	-5.58%	1.77%	-3.71%	6.92%	5.46%	-7.08%	

### Percentage Higher/Lower than Average Daily VMT (Dallas [Weighted])

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	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monthly
January	-7.60%	-20.1%	-5.82%	-33.9%	7.48%	-31.5%	-10.6%	-15.1%
February	-38.8%	-25.6%	-17.8%	-42.4%	-13.1%	5.28%	-63.9%	- <mark>28.1</mark> %
March	136.5%	-28.1%	7.40%	23.2%	-33.4%	28.1%	-24.7%	16.8%
April	7.32%	-22.0%	-0.85%	32.9%	14.1%	-20.4%	-5.78%	0.70%
May	65.5%	-29.6%	12.7%	-27.8%	-20.2%	-11.9%	42.7%	2.16%
June	12.8%	45.1%	59.3%	-12.6%	28.7%	5.42%	-32.5%	13.5%
July	3.65%	3.30%	-18.4%	-10.5%	43.3%	9.65%	13.2%	4.88%
August	-3.55%	-18.4%	-26.3%	-2.39%	6.21%	18.1%	10.9%	-0.86%
September	-14.5%	-6.5%	-0.95%	-18.6%	-0.10%	-11.9%	-12.7%	-9.44%
October	48.1%	-19.8%	-16.7%	-26.5%	-15.7%	36.6%	-42.9%	-6.67%
November	19.6%	17.3%	6.40%	9.34%	-19.4%	-6.98%	47.7%	11.2%
December	19.9%	-12.6%	-12.2%	-24.2%	41.3%	12.4%	44.0%	8.72%
Weekly	22.1%	-9.86%	-1.93%	-12.1%	2.56%	1.91%	-2.65%	

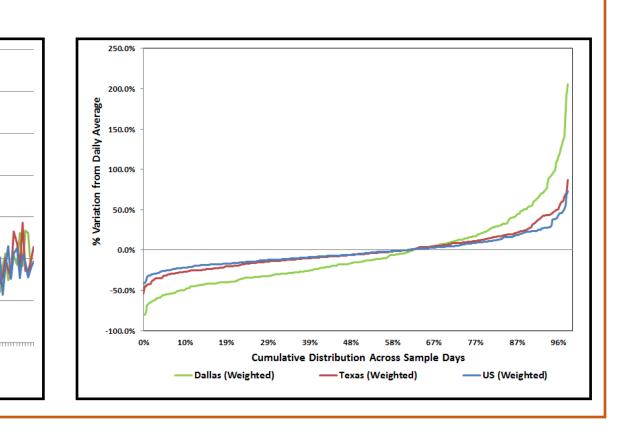
e Daily VMT (Weighted) Vs. Days of Year (starting from May 1,

Dallas (Weighted) — Texas (Weighted) — US (Weight

Daily VMT	Day or Month or	Percent higher or lower
(US)	Month-Day	than average
Highest Day of Week	Saturday	7.98%
Lowest Day of Week	Wednesday	-7.97%
Highest Month of Year	July	8.85%
Lowest Month of Year	September	-6.11%
Highest Month-Day	June-Friday	67.8%
Lowest Month-Day	January-Thursday	-23.5%

Daily VMT (Texas)	Day or Month or Month-Day	Percent higher or lower than average
Highest Day of Week	Friday	6.92%
Lowest Day of Week	Sunday	-7.08%
Highest Month of Year	March	7.39%
Lowest Month of Year	September	-10.3%
Highest Month-Day	January-Friday	52.1%
Lowest Month-Day	February-Sunday	-29.2%

Daily VMT (Dallas)	Day or Month or Month-Day	Percent higher or lower than average
Highest Day of Week	Monday	22.1%
Lowest Day of Week	Thursday	-12.1%
Highest Month of Year	March	16.8%
Lowest Month of Year	February	-28.1%
Highest Month-Day	March-Monday	136.5%
Lowest Month-Day	February-Sunday	-63.9%



• Greater variation emerges in smaller regions (e.g., Dallas daily averages [of VMT, trip lengths & occupancies] vary more over time than Texas & US values). This is not just due to smaller sample size, but also local weather, festival, vacations, & other events, which can have locally-pronounced impacts. Trip length & VMT are relatively more stable than vehicle occupancy, but they have greater variation in major vacation months (March, May, June, & December).

• If weights are incorporated in the analysis, daily VMT, trip lengths, and occupancies have higher standard deviation estimates, relative to those estimated without considering the weights.

# Variations in Vehicle Trip Lengths

Vehicle Trip Length(miles)	U.S.	U.S. (Wtd.)	Texas	Texas (Wtd.)	Dallas	Dallas(Wtd.)
Average across 365 days	9.1	9.5	9.6	9.8	10.1	10.4
Std. dev. across 365 days	1.1	2.7	2.0	3.0	5.9	8.5
Average of top 18 days	12.2	18.0	14.6	18.9	28.9	36.0
Average of bottom 18 days	7.5	6.6	6.5	6.1	3.8	3.5
Average of holidays (13 days)	10.5	11.6	9.7	9.7	11.1	11.4
Average of non-holidays	9.1	9.4	9.6	9.8	10.1	10.4

Percentage Higher/Lower than Avg. Trip Length (U.S. [Weighted])

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monthly
January	-8.25%	-10.2%	-18.5%	-2.78%	10.7%	-6.99%	13.3%	-2.91%
February	4.55%	-9.19%	6.90%	-10.7%	-17.2%	-10.0%	32.3%	-0.48%
March	-4.02%	-13.5%	-16.9%	-2.86%	5.89%	-3.44%	-8.40%	-6.43%
April	-2.85%	0.62%	-17.3%	-5.55%	20.3%	-6.66%	16.7%	-0.07%
May	-3.85%	-18.8%	-12.7%	9.01%	1.50%	-2.07%	8.55%	-2.10%
June	2.59%	-9.56%	-12.8%	62.3%	6.59%	-4.98%	-11.4%	4.08%
July	16.3%	-8.63%	53.5%	-0.15%	3.61%	19.6%	-3.91%	11.8%
August	-4.27%	3.16%	-4.84%	-7.61%	2.00%	14.9%	3.50%	1.55%
September	-6.78%	-11.3%	-0.03%	-9.21%	-8.04%	-16.8%	0.38%	-7.52%
October	-1.44%	-17.5%	-8.98%	0.96%	6.10%	-8.88%	22.3%	-1.02%
November	-7.82%	-20.5%	11.2%	19.2%	-12.6%	5.45%	13.8%	1.82%
December	4.15%	-4.71%	-8.74%	3.91%	8.47%	-11.9%	20.2%	1.17%
Weekly	-0.98%	-9.98%	-1.90%	<b>4.29%</b>	2.49%	-2.22%	8.21%	

Percentage Higher/Lower than Average Trip Length (Texas [Weighted

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monthly
January	-13.5%	-7.72%	-4.69%	-11.7%	58.7%	-9.52%	3.67%	3.18%
February	-19.3%	-14.9%	28.1%	0.44%	-15.8%	-7.09%	-22.0%	-7.23%
March	33.7%	-15.0%	12.0%	-11.4%	16.2%	17.4%	11.4%	9.29%
April	-3.59%	-12.7%	-7.40%	4.05%	9.45%	-11.8%	16.0%	-0.91%
May	3.19%	-8.77%	-9.27%	-4.70%	-7.13%	-12.7%	14.8%	-3.97%
June	14.6%	4.01%	18.9%	-10.9%	9.33%	-10.0%	-0.41%	3.87%
July	5.69%	-8.28%	1.53%	9.65%	11.2%	31.1%	-5.98%	5.89%
August	-3.25%	3.58%	-15.3%	-8.17%	-0.24%	18.9%	12.2%	1.98%
September	-12.8%	-2.45%	9.83%	-17.1%	-17.4%	-5.89%	-14.5%	-8.55%
October	6.47%	-29.8%	-11.2%	-4.26%	-13.7%	6.25%	7.51%	-5.94%
November	16.1%	-3.89%	-9.35%	-9.53%	-6.41%	16.0%	10.2%	2.62%
December	-11.4%	18.7%	-23.5%	-13.5%	13.7%	-8.82%	21.1%	-1.02%
Weekly	1.68%	-6.09%	-1.58%	-5.95%	5.19%	2.08%	4.78%	

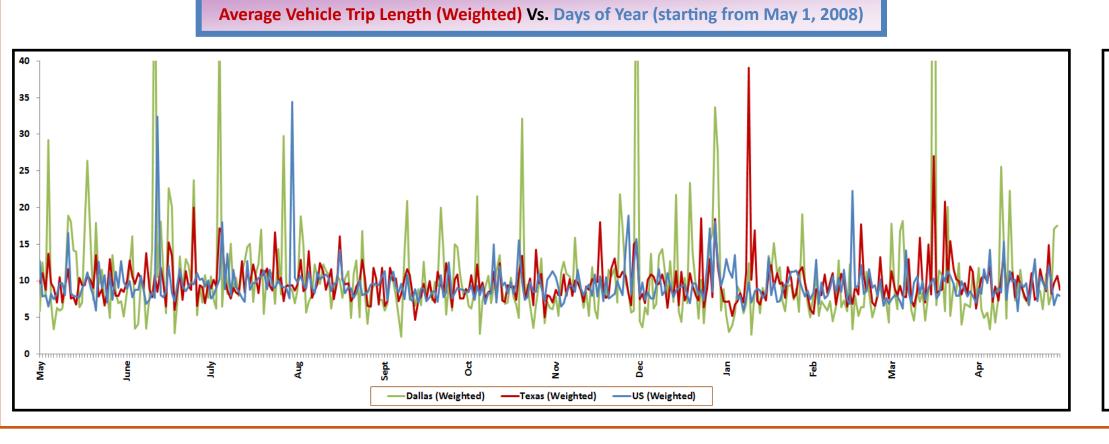
### Percentage Higher/Lower than Average Trip Length (Dallas [Weighted

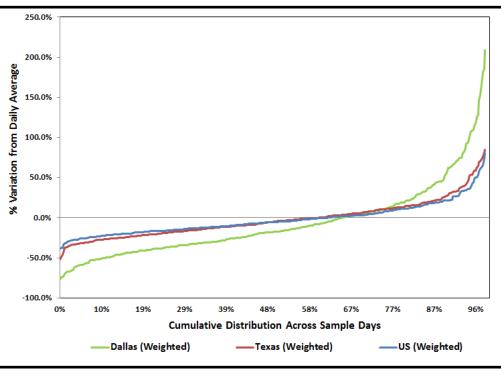
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monthly
January	-8.80%	-23.5%	-1.36%	-32.3%	-12.9%	-37.8%	-11.6%	-19.2%
February	-24.4%	-23.9%	-29.7%	-35.3%	-27.3%	-22.5%	-49.3%	-30.3%
March	185%	-27.5%	14.7%	-0.68%	-37.5%	10.4%	-11.9%	21.9%
April	-9.96%	-1.29%	4.91%	24.7%	-18.4%	-30.7%	-5.99%	-4.90%
May	8.37%	-7.07%	11.9%	-33.1%	-14.4%	-12.0%	99.7%	4.97%
June	19.4%	44.9%	118%	-35.1%	22.2%	-11.9%	-20.4%	18.3%
July	5.87%	16.7%	-17.4%	-20.3%	91.6%	3.34%	44.5%	15.4%
August	-14.1%	-19.5%	-32.8%	-0.78%	0.98%	-1.91%	13.6%	-6.64%
September	4.21%	-3.66%	-10.1%	-23.9%	-5.65%	-8.80%	-3.81%	-6.88%
October	46.5%	-33.0%	-21.2%	-29.8%	-32.2%	11.4%	-26.7%	-13.7%
November	25.3%	10.1%	-11.5%	-13.9%	-13.1%	-8.53%	77.6%	11.1%
December	8.39%	-26.0%	-20.6%	-26.6%	56.5%	5.14%	71.5%	7.58%
Weekly	23.1%	- <b>7.9</b> 9%	-0.65%	-19.7%	-0.38%	-9.15%	14.8%	

Trip Length (US)	Day or Month or Month-Day	Percent higher or lower than average
Highest Day of Week	Sunday	8.21%
Lowest Day of Week	Tuesday	-9.98%
Highest Month of Year	July	11.8%
Lowest Month of Year	September	-7.52%
Highest Month-Day	June-Thursday	62.3%
Lowest Month-Day	November-Tuesday	-20.5%

Trip Length (Texas)	Day or Month or Month-Day	Percent higher or lower than average
Highest Day of Week	Friday	5.19%
Lowest Day of Week	Tuesday	-6.09%
Highest Month of Year	March	9.29%
Lowest Month of Year	September	-8.55%
Highest Month-Day	January-Friday	58.7%
Lowest Month-Day	October-Tuesday	-29.8%

Trip Length (Dallas)	Day or Month or Month-Day	Percent higher or lower than average
Highest Day of Week	Monday	23.1%
Lowest Day of Week	Thursday	-19.7%
Highest Month of Year	March	21.9%
Lowest Month of Year	February	-30.3%
Highest Month-Day	March-Monday	185%
Lowest Month-Day	February-Sunday	-49.3%





### Conclusion

# THE UNIVERSITY of UTAH

## Vehicle Occupancy Variation

Vehicle Occupancy (persons per Vehicle)	U.S.	U.S. (Wtd.)	Texas	Texas (Wtd.)	Dallas	Dallas(Wtd.)
Average across 365 days	1.5	1.6	1.6	1.6	1.6	1.6
Std. dev. across 365 days	0.2	0.2	0.2	0.3	0.3	0.4
Average of top 18 days	1.9	2.2	2.0	2.4	2.3	2.8
Average of bottom 18 days	1.3	1.3	1.3	1.2	1.1	1.0
Average of holidays (13 days)	1.7	1.8	1.7	1.9	1.8	1.8
Average of non-holidays	1.5	1.6	1.5	1.6	1.6	1.6

Percentage Higher/Lower than Avg. Occupancy (U.S. [Weighted])

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monthly
January	-8.16%	-12.7%	-11.1%	-6.17%	-2.46%	10.6%	20.6%	-1.15%
February	-11.2%	-11.1%	-7.42%	-11.8%	-8.56%	7.35%	17.6%	- <b>3.6</b> 1%
March	-8.94%	-10.9%	-9.25%	-6.09%	-7.58%	10.0%	16.9%	-2.14%
April	-14.1%	-8.34%	-13.9%	-9.26%	-3.12%	8.88%	28.0%	-2.34%
May	-6.85%	-11.9%	-8.98%	-7.12%	2.99%	12.1%	23.1%	0.68%
June	-4.06%	-4.30%	-9.10%	-8.11%	-0.61%	7.22%	18.2%	0.36%
July	-2.55%	-5.44%	-7.05%	-5.62%	7.92%	22.0%	15.4%	2.61%
August	-0.60%	-5.09%	-4.42%	-1.95%	-1.34%	13.7%	27.1%	4.80%
September	-6.29%	-10.1%	-10.4%	-12.4%	-2.61%	9.65%	21.8%	-1.92%
October	-8.14%	-5.36%	-9.28%	-10.3%	-3.25%	17.9%	18.6%	-0.71%
November	-12.7%	-7.55%	-6.01%	-0.85%	-2.02%	12.0%	18.7%	1.24%
December	-7.44%	-7.49%	-5.57%	0.70%	-1.15%	14.4%	25.2%	1.74%
Weekly	-7.51%	-8.37%	-8.57%	-6.69%	-1.75%	12.2%	20.9%	

Percentage Higher/Lower than Average Occupancy (Texas [Weighte

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monthly
January	-4.35%	-11.4%	-10.8%	-9.52%	-7.95%	16.7%	22.8%	-0.61%
February	-19.0%	-15.2%	-11.9%	-14.4%	-10.2%	10.7%	19.0%	-5.86%
March	-0.47%	-12.2%	-11.0%	-11.6%	-15.0%	11.4%	16.1%	-2.81%
April	-11.2%	-17.9%	-17.0%	-8.16%	-4.57%	25.0%	21.8%	-2.46%
May	4.26%	-12.5%	-12.2%	-13.8%	-8.15%	9.03%	24.7%	-1.54%
June	-12.1%	-5.83%	-7.02%	-10.7%	-1.34%	41.1%	17.2%	2.99%
July	-9.75%	-5.07%	-6.74%	-9.67%	10.1%	11.5%	12.3%	-0.35%
August	4.02%	-6.41%	-9.82%	-1.02%	-1.79%	31.8%	24.5%	7.09%
September	-3.64%	-11.8%	-16.6%	-10.4%	-1.95%	4.08%	22.7%	-2.85%
October	-7.33%	-5.94%	-1.22%	-7.59%	-5.45%	36.9%	26.0%	4.10%
November	-9.26%	-6.47%	-10.9%	-2.33%	-7.33%	12.1%	15.8%	-0.20%
December	-8.98%	-12.4%	2.98%	6.50%	-1.65%	16.1%	16.3%	1.84%
Weekly	-6.48%	-10.3%	-9.05%	-7.91%	-4.70%	18.8%	19.8%	

### Percentage Higher/Lower than Average Occupancy (Dallas [Weighted

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monthly
January	-1.35%	-5.71%	-11.5%	-6.25%	-9.02%	-0.26%	35.9%	-0.27%
February	-24.8%	-9.95%	-19.5%	-15.9%	-12.1%	4.08%	18.8%	-8.50%
March	3.40%	-18.8%	-22.5%	11.9%	-23.4%	17.9%	13.4%	-2.40%
April	-5.12%	-19.1%	-17.5%	-10.8%	-10.1%	10.6%	0.72%	-7.67%
May	14.8%	-18.1%	-23.3%	-19.7%	0.04%	9.51%	-3.94%	-5.56%
June	-18.2%	25.1%	-9.48%	13.5%	-2.75%	22.4%	34.2%	9.16%
July	-19.1%	-12.2%	-7.87%	-5.65%	21.7%	22.7%	9.44%	0.32%
August	-12.8%	-10.6%	3.97%	11.4%	0.73%	39.1%	11.1%	7.18%
September	0.75%	-9.4%	-5.62%	-14.3%	-8.73%	15.1%	6.20%	-2.43%
October	-3.66%	18.8%	-14.1%	-4.18%	-2.95%	39.7%	3.29%	4.09%
November	-7.10%	-15.6%	1.44%	-7.42%	17.3%	6.27%	23.9%	3.51%
December	-12.9%	-24.6%	-6.42%	19.1%	-1.09%	6.35%	43.0%	1.59%
Weekly	-7.15%	-8.98%	-11.1%	-2.86%	-2.55%	15.9%	16.7%	

Occupancy (US)	Day or Month or Month-Day	Percent higher or lower than average
Highest Day of Week	Sunday	20.9%
Lowest Day of Week	Wednesday	-8.57%
Highest Month of Year	August	4.80%
Lowest Month of Year	February	-3.61%
Highest Month-Day	April-Sunday	28.0%
Lowest Month-Day	April-Monday	-14.1%

Occupancy (Texas)	Day or Month or Month-Day	Percent higher or lower than average
Highest Day of Week	Sunday	19.8%
Lowest Day of Week	Tuesday	-10.3%
Highest Month of Year	August	7.09%
Lowest Month of Year	February	-5.86%
Highest Month-Day	June-Saturday	41.1%
Lowest Month-Day	February-Monday	-19.0%

Occupancy (Dallas)	Day or Month or Month-Day	Percent higher or lower than average
Highest Day of Week	Sunday	16.7%
Lowest Day of Week	Wednesday	-11.1%
Highest Month of Year	June	9.16%
Lowest Month of Year	February	-8.50%
Highest Month-Day	December-Sunday	43.0%
Lowest Month-Day	February-Monday	-24.8%

