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August 4, 2021 Project #: 26306

Eric Liljequist and Chris Kerr
City of Woodburn
270 Montgomery Street
Woodburn, OR 97071

RE: Project Basie – Response to July 22, 2021 Transportation Impact Analysis Comments

Dear Eric and Chris,

This letter provides supplemental transportation-related information requested by City staff as part of the completeness review. The details addressed herein respond specifically to comments provided by Chuck Green of Otak, on behalf of the City, related to review of the July 15, 2021 *Project Basie Transportation Impact Analysis (Revised and expanded version from the original May 26, 2021 and subsequent July 6, 2021 report)*. Otak's comments were grouped into the following categories:

- Trip Generation
- Interchange Area Management Plan Overlay District Trip Budgets
- OR 211/214 and 99E Intersection Impact Analysis
- Transportation Demand Management
- Woodland Avenue Extension
- Other Items Not Affecting Technical Completeness

For ease of review, Otak's comments within these categories are shown below in italics followed by our response to each.

Trip Generation

The revised TIA, page 33 notes the following:

- *"In reviewing Table 9 (trip generation estimates using ITE trip rates for Land Use Code 155, High Cube Fulfillment Center with Sorting Facilities), it is important to note that these ITE rates are based on one or two study sites (depending on the analysis period) with a facility square footage that is significantly smaller than the proposed 3.849 million square foot Project Basie facility. In consultation with the Project Basie tenant, it was determined that the application of the Land Use 155 rates would significantly overestimate the daily and peak hour trip profile of the site.*
- *"Instead, the Project Basie tenant supplied a detailed employee and truck arrival/departure profile that was developed specifically for the proposed site, taking into consideration the*

> *size of the building, its geographic location and relation to other in-network distribution facilities, the finite processing capabilities of the facility, internal automation technology, anticipated employee levels, and site-specific work schedules. These variables are based on operational experience at other facilities with similar functions nationwide. A detailed summary of this profile is included in Appendix G."*

Appendix G of the TIA is "Project Basie Daily Trip Profile" which includes an hourly trip generation profile (ins and outs of the site), for cars and trucks, for something called "AR Sortable 640K FC - Non-Peak Season" There is no definition of what that means.

I have had lengthy conversations with Kittelson on the need and request for more specific information to support the modified trip generation for Project Basie Trip Generation. These included the following requests to provide more details regarding case studies used to develop the trip generation estimates, including quantitative research of similar type of fulfillment center site operations and truck and shift characteristics, and anything that would give us more comfort in the accuracy of the trip generation estimates since this site is so unique in its size and operational characteristics.

The response in the revised TIA that is of issue is this:

- *Current SDC rate table for high cube distribution center (2008 rate table, ITE Code 152) is 0.12 PM peak trips/KSF. ITE has subsequently split code 152 into four new codes, of which Code 155 is most applicable to Project Basie.*
- *ITE's Trip Generation Manual, 10th Edition query tool for Code 155, High Cube Fulfillment Center with sorting facility, yields 1.20 PM peak trips/KSF.*
- *Calculating a rate for Project Basie (PM peak trips for the site peak divided by square footage) yields 0.31 PM peak trips/KSF.*

In essence, the TIA takes exception to the ITE trip rates because they rely on "one or two study sites". To respond to this, they talk about site characteristics and experience with "other facilities with similar functions nationwide." I don't believe this is a complete explanation and definitely would not pass muster with ITE if the Applicant was submitting their trip generation information to be added to the case study files of ITE. There is not enough information to reduce the risk on the City's part as to the trip generation estimates being much higher.

Essentially, the following details providing the backup or "show your work" for the trip generation numbers in what would normally be needed in a research white paper are needed in order for us to review and determine if the TIA is technically complete:

- *How many sites did they use to develop their trip generation and profile?*
- *What was the range of square footage (KSF of operating space, like Project Basie is 3,849 KSF of operating space)?*

- *How were the trip counts and trip generation rates conducted? Were they daily, peak hour, etc.?*
- *How did these sites compare in the delivery distribution patterns, processing and sorting operations (manual vs. automated)?*

Trip Generation Response

We understand the City's desire for details on how the trip generation estimates are prepared. As discussed with City staff, this facility is unique in its size and operations for the designated tenant. Throughout the project, we have been working closely with the tenant's representatives to develop a reasonable estimate of what could be expected in terms of vehicular trips generated by the proposed facility. One of the unique aspects of the project relates to the proprietary details of anticipated operations. However, in response to City requests, we requested additional details on any available non-proprietary information that the tenant could provide. This additional research revealed the following:

- There are no other facilities currently in operation in the US that are the same size or have the exact operational characteristics of Project Basie.
- The trip generation used in the TIAs is based on the tenant's "AR Sortable 640K FC - Non-Peak Season" (the tenant code for the proposed sortable fulfillment center) data. This data is not reflective of traffic counts measured at similar facilities but instead is based on the tenant's detailed estimate of employee and truck arrivals and departures, the location of the facility related to other tenant facilities and the anticipated innovations in automation.
- Like other tenant owned fulfillment centers, Project Basie will operate 24 hours per day with two distinct employee shifts – a daytime shift and a night-time shift.
- The number of employees working at this facility will likely decrease over time as new technologies and efficiencies become available and allow for increased automated operations. Based on the tenant's experience, the increases in automation have allowed for more efficient use of existing buildings with no commensurate increase in employees. As a result, building size is expected to be a less reliable predictor of trip generation than a rate based on vehicular trips per employee.

Although there are no comparable facilities, the tenant supplied 24-hour profile counts previously measured at fulfillment centers located in Florida, Texas, and California. These counts were provided to help provide additional clarity on the reasonableness of the trip generation rates used in the TIA.

The tenant's representative (Langan Engineering) prepared a memo summarizing the data previously collected at these three facilities. This memo is included for your reference. Our review of the Langan memo revealed the following:

- The three sites varied in building size from approximately 1.8 million to 2.8 million square feet but each had approximately 2,600 employees in total, split between two distinct shifts. The employee shift times are consistent among the three facilities and also reflective of what is anticipated at Project Basie. In addition, like Project Basie, trucks are anticipated to enter and exit throughout the day and night.
- Given the operational characteristics, Langan calculated trip generation rates for the daily and different peak hours using employees as the appropriate variable. As shown in the attached memo, the measured trip rates reflect the following:
    - Weekday AM peak hour of the generator = 0.783 trips per employee
    - Weekday PM peak hour of the generator = 0.720 PM trips per employee.
- Applying these rates to the 937 employees anticipated at Project Basie would yield 734 trips during the weekday AM peak hour of the generator and 675 trips during the weekday PM peak hour of the generator. As shown in the TIA, the trip estimates used for Project Basie are 702 trips during the weekday AM peak hour of the generator (i.e., 0.75 trips per employee) and 1,176 trips during the weekday PM peak hour of the generator (i.e., 1.26 trips per employee). Given that the weekday AM generator trips are comparable and the weekday PM generator trips are much higher than would be predicted using the measured counts, we conclude that the rates used in the TIA are reasonable and appropriate.

Based on the additional information summarized herein, we conclude that the trip generation estimates applied in the Project Basie TIA are a reasonable basis for analyzing the traffic impacts. In addition, this data helps provide the City with "*more comfort in the accuracy of the trip generation estimates since this site is so unique in its size and operational characteristics."* As such, we believe this issue and the associated comments have been sufficiently addressed to allow the City to make its completeness findings related to trip generation.

Interchange Area Management Plan (IAMP) Overlay District Trip Budgets

Section 2.05.02 of the Woodburn Development Ordinance (WDO) applies a trip budget for subareas within the Interchange Management Area Overlay District. The TIA states "Ownership of Project Basie includes Subareas A and B in the SWIR as shown in Exhibit 2. Subarea A has 968 trips and Subarea B has 242 trips for a total of 1,210 trips. Per Table 10, Project Basie will generate approximately 1,176 trips during the weekday PM peak hour, which is within the combined Subarea A/B trip budget."

First, the 1,176 (PM peak) trips are based on the Applicant-supplied trip generation estimates that are of issue in the above discussion. Also, under the trip tracking against the budget for Subareas A and B, there would remain 34 PM peak hour trips available for remainder pieces of land in A and B.

There are inconsistencies between what is stated in the TIA and project documents and what has been supplied related to site plans. The TIA and some of the narrative supplied by Mackenzie indicates that Project Basie retains control over all of the land parcels included in Subareas A and B. However, a review of the site plan indicates a south property line that does not encompass the entirety of Subarea B, and only plan sheet C-100 "EROSION AND SEDIMENT CONTROL SITE OVERVIEW PLAN" shows the entirety of parcels contained in Subareas A and B; all other site plan graphics show a portion of these parcels. It is unclear what the Applicant intends to do with remainders of the parcels both at the south end of the site (Subarea B) but also remainders of the land used for the realignment of Butteville Road (Subarea A). There should be a statement about future use and trip generation from remainder parcels.

IAMP Overlay District Trip Budget Response

The Project Basie site incorporates Subareas A and B of the IAMP Overlay District but does not occupy the entirety of each area. At this time, there are no identified plans for developing the unused portions of either of the two subareas. If such plans materialize in the future, any subsequent development would be subject to the remaining 34 PM peak hour trips available for the two areas. In addition, any subsequent development would also need to comply with City standards related to the need for an additional transportation impact analysis.

Pending potential future development plans and as noted in *Section 2.05.02 of the Interchange Management Area Overlay District*, the City may allow additional development within Subareas A and B that exceeds a Subarea's nominal allocation, provided the development contributes substantially to the economic objectives found in the Comprehensive Plan.

Given that no additional development is anticipated at this time and the tenant acknowledges that the requirements of Section 2.05.02 of the Woodburn Development Ordinance will apply in the future, we conclude that this comment has been sufficiently addressed to enable the City to make its completeness findings related to the IAMP Overlay District Trip Budget.

OR 211/214 and 99E Intersection Impact Analysis

While the 7/15 TIA update includes a mobility/operational analysis of the OR 211/214 and 99E intersection as requested, a corresponding crash analysis for that intersection was not included. Julia Kuhn of Kittelson replied to my query that it appears Kittelson has not received the updated crash data from ODOT. Julia did supply the existing conditions memo that Kittelson had prepared on behalf of the City in 2019 for the Transportation System Plan update and which includes crash data. While it is not clear what years encompass "existing conditions" with regard to crashes, this

table does indicate that the intersection was operating at an elevated crash rate compared to ODOT's Critical Crash Rates for similar intersections statewide. The subsequent TIA submitted for the Woodburn Eastside Apartments (Enloe, 2020 and 2021) indicated the intersection was not operating at an elevated crash rate but referenced a higher Critical Crash Rate than what was used for the TSP for this intersection.

While it may not affect the proportionate share mitigation condition of Project Basie, it is my opinion that we require Kittelson to complete the crash analysis and compare to ODOT's approved Critical Crash Rate(s) for this intersection to determine if there is indeed an elevated crash rate and if so, any changes in the mitigation project basis with what to assess a proportionate share contribution.

OR 211/214 and 99E Intersection Impact Analysis Response

Subsequent to providing the City with previously analyzed crash data at the OR 214/OR 211/OR 99E intersection, we obtained updated crash records from ODOT based on the most recent period for which data is available (i.e., January 1, 2015 through December 31, 2019).

The updated crash data, by type, at this intersection is summarized in Table 1.

Table 1 - Reported Crash History (January 1, 2015 – December 31, 2019)

Study Intersection	Crash Type								Severity			Total
	Angle	Turn	Rear-End	Side Swipe	Fixed Object	Ped/ Bike	Head-On	Other	PDO[1]	Injury	Fatal	
OR 214/OR 211/OR 99E	3	7	27	0	1	1	0	2	17	24	0	41

[1]PDO = Property damage only

In addition to the crash types, intersection crash rates were calculated and compared to statewide crash rate performance thresholds based on the methodology provided in ODOT's Analysis Procedures Manual (APM). For this analysis, the observed crash rate was calculated and compared with the 90th percentile crash rates for signalized, 4-legged urban intersections. The result of this analysis are shown in Table 2.

Table 2 - Intersection Crash Rate Assessment

Intersection	Total Crashes	Observed Crash Rate	90th Percentile Crash Rate by Lane Type and Traffic Control	Observed Crash Rate > 90th Percentile Crash Rate?
OR 214/OR 211/OR 99E	41	0.74	0.64	Yes

As shown in Table 2, the updated crash rate at the OR 214/OR 211/OR 99E intersection also exceeds the 90th percentile crash rates for similar observed intersections across the state. This was also highlighted in the City's Transportation System Plan (TSP) and previously sent to Otak for review.

Similar to that summarized in the TSP, rear end crashes continue to be the predominant crash type at this intersection with the reported crashes nearly evenly distributed among the four intersection legs. A review of the crash time period (time of day and month) and conditions (wet vs. dry) revealed no discernable patterns. As many of the reported crashes appear to be congestion-related, it is recommended that ODOT continue to monitor the intersection for any new emerging or continued crash patterns. This recommendation is consistent with that summarized in the TSP.

Given that the updated crash data is similar to that contained in the TSP and the associated recommendation remains the same, we conclude that this comment has been sufficiently addressed to enable the City to make its completeness findings related to the OR 211/214 and 99E Intersection Impact Analysis.

Transportation Demand Management (TDM)

The updated TIA does include a revised discussion of Transportation Demand Management (TDM) including a preliminary list of TDM and Transportation Management Plan (TMP) strategies/practices in Appendix K of the TIA. The TIA states that "These strategies/practices are consistent with programs used at other sites owned by the tenant and will be refined in coordination with the City of Woodburn, Marion County, ODOT, and other local/regional transportation providers."

The TMP included in Appendix K is more of a boilerplate summary of what would be called an "Employer-based Commute Trip Reduction Program" in Washington state. However, it does not reference the City's 2010 Transit Plan Update nor the 2019 Transit Plan contained in the Transportation System Plan Update and transit improvement projects contained in those plans. The TMP does not reference any coordination discussions with Woodburn Transit regarding site design and transit considerations or service.

At a minimum, there should be commitments to on-site public transportation design and operational components (such as an ADA-accessible on-site bus stop) as well as to proportionate share contributions to relevant transit projects contained in Table 4 of the TSP update.

TDM Response

As previously discussed, the Project Basie tenant commits to working with the City of Woodburn, Marion County, ODOT, and all applicable regional travel providers on the formation of a site-specific Transportation Demand Management Plan as further details of the site's operations evolve. The TDM/ TDM/TMP strategies/practices included in *Appendix K of the July 15, 2021 TIA* were intended to provide a foundation from which this more detailed plan can be developed and also as a reflection of the tenant's commitments to further refinement.

Assuming the land use application is approved, the occupancy of the building is not anticipated until at least 2023. Given that many of the operational details and new innovative technologies will evolve in the next two years, a detailed TDM plan would be premature at this point. Instead, the Project Basie tenant is anticipating that the City issue a condition of approval to jointly develop, refine, and adopt a TDM Plan within 6 months of receiving occupancy permits. We also note that no transit service is provided to the site today so future transit service plans implemented by the City can also help to inform the future TDM Plan.

Finally, we note that the site plan has incorporated design elements that will support implementation of the TDM Plan, such as:

- 20 bicycle parking stalls are being proposed near the main entrances of the facility. This meets the City of Woodburn requirements for bicycle parking stalls.
- A percentage of the parking spaces in the lots nearest to Butteville Road would be reserved for carpool and vanpool parking.

Once more details on future transit service are developed in the future, the tenant commits to working with the City and transit provider to determine how best to connect employees from the future transit stops to the building entrances.

The tenant is committed to developing a detailed TDM Plan that reflects both (1) updated operational and technological innovations that may come on-line in the two years prior to the facility opening and (2) information on potential transit service that may be provided in the future. As such, we conclude that this comment has been sufficiently addressed to enable the City to make its completeness findings related to the Transportation Demand Management Plan.

Woodland Avenue Extension

Project Basie has applied for a variance to not be required to build the Woodland Avenue extension over to Butteville Road, a Local Access road currently shown in the City's TSP. The updated TIA includes a discussion about the system implications of not building this extension in context of the City's TSP. However, no "with and without" level-of-service table is provided for the Woodland Avenue/OR 219 intersection to support this discussion. Such a table, similar to other transportation impact analysis tables contained elsewhere in the TIA, should be included.

Woodland Avenue Extension Response

As noted on page 63 of our *July 15, 2021 TIA*, we performed a sensitivity analysis to understand the differences in intersection operations if Woodland Avenue is not extended. This analysis was conducted consistent with the travel demand model work provided by ODOT for the City's TSP. The TIA summarized the results of this sensitivity analysis but did not include a detailed summary table and analysis worksheets. To assist with the City's review, this information is shown in Table 3.

Table 3 – Woodburn TSP Model Results of OR 219/Woodland Avenue Intersection – Without and With Woodland Avenue Extension to Butteville Road

Intersection	Maximum Operating Standard/Target	Weekday PM Peak Hour			
		Critical Approach/Lane	LOS	Delay (sec)	V/C
2040 Future Conditions with No Extension of Woodland Avenue to Butteville Road					
OR 219/Woodland Avenue	V/C: 0.95	-	C	31.0	0.68
2040 Future Conditions with An Extension of Woodland Avenue to Butteville Road					
OR 219/Woodland Avenue	V/C: 0.95	-	C	30.6	0.65

As noted in the July 15, 2021 TIA:

- Given the operating characteristics coded into the travel demand model reflective of Woodland Avenue as an Access Street, the traffic volumes anticipated to use this roadway are not reflective of regional through traffic nor of a route that can offer a reasonable alternative to travel via the existing OR 219 and Butteville Road corridors.
- The forecast operations at the OR 219/Woodland Avenue intersection did not measurably change with or without the Woodland Avenue extension. As shown in Table 3, both scenarios result in LOS "C" and a volume-to-capacity ratio of less than 0.70 whereas the standard is 0.95.

These findings are consistent with the TSP's classification of the Woodland Avenue extension as a local access to potential future SWIR properties (in particular Tax Lot 400) and not as a regional capacity and circulation enhancing facility.

Based on this more detailed data, we conclude that this issue has been sufficiently addressed to enable the City to make its completeness findings related to the Woodland Avenue extension.

Other Items Not Affecting Technical Completeness

Other items were reviewed and are generally acceptable as far as analysis and conclusions:

- *A design concept of the closure of the existing south leg of Butteville Road at OR 219 should be reviewed by ODOT for their concurrence, but the concept appears reasonable.*
- *The analysis of the future LOS F condition with the site at the OR 219/Willow Avenue intersection is reasonable as far as how people would likely respond to peak hour delays trying to turn left onto OR 219 from Willow. A traffic signal is not warranted nor would one be acceptable to ODOT at this intersection, and neighborhood traffic would either use the roundabout for a u-turn to head east, or find their way to the Woodland Avenue/OR 219 intersection to turn left. Thus, there is no mitigation required of Project Basie.*

- *The TIA's finding of impacts to the I-5 Southbound off-ramp, OR 214 at Evergreen Road, OR 214 at Settlemier Avenue/Boones Ferry Road and OR 214/OR 211/OR 99E intersections and proportionate share contributions to improvement projects is acceptable and should be considered conditions of approval.*
- *The TIA assumes no site related trips will use LeBrun Road nor Stafney Road. While inconsequential to the analysis and conclusions, it is reasonable to assume that a few site trips would use either corridor.*

Other Items Response

Each of the four bullets above is responded to below.

- Following land use approvals, design plans for the OR 219/Butteville Road roundabout and Butteville Road realignment will be prepared and submitted to ODOT, Marion County and the City for review and approval. These plans will include detailed design, signing, and striping plans for the closure of the existing south leg of Butteville Road at OR 219 consistent with the preliminary design concept included in the July 15, 2021 TIA.
- We agree that a signal is not warranted at the OR 219/Willow Avenue intersection and that the future roundabout will provide an alternative for neighborhood residents to make a U-turn in lieu of a southbound left-turn to travel to the east.
- The tenant concurs and expects a condition of approval to make proportional share contributions at the OR 214 at Evergreen Road, OR 214 at Settlemier Avenue/Boones Ferry Road and OR 214/OR 211/OR 99E intersections.
- Stafney Lane is a local Marion County roadway that serves approximately ten rural single-family homes before dead-ending on the west side of the Pacific & Western rail line. LeBrun Road is also a local Marion County roadway that directly serves several large farms. While LeBrun Road connects to French Prairie Road, it is a narrow, gravel roadway. Given these characteristics, it is unlikely that either roadway will be used by any measurable amount of traffic generated by Project Basie. We further note that the assignment of one or two trips to either roadway would not change any of the findings or conclusions of the TIA nor would they reflect an impact to these facilities.

Given the above findings, we believe that the City's comments have been sufficiently addressed.

Conclusions

Based on the information presented herein, we conclude that all of the City's transportation-related comments provided via Otak have been sufficiently addressed to enable a completeness finding to be made. We appreciate the opportunity to continue to collaborate with you on this project.

Sincerely,
KITTELSON & ASSOCIATES, INC.

Matt Hughart, AICP	Zachary Bugg, Ph.D	Julia Kuhn, P.E.
Principal Planner	Senior Engineer	Senior Principal Engineer

Appendix 1 Supplemental Calculations

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	25	461	1	41	640	262	3	6	92	759	2	29
Future Volume (vph)	25	461	1	41	640	262	3	6	92	759	2	29
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.5	4.0	4.0	4.5	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.95	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1614	2866	975	1250	2866	1430	1662	1162		1490	1477	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1614	2866	975	1250	2866	1430	1662	1162		1490	1477	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	501	1	45	696	285	3	7	100	825	2	32
RTOR Reduction (vph)	0	0	1	0	0	59	0	93	0	0	2	0
Lane Group Flow (vph)	27	501	0	45	696	226	3	14	0	429	428	0
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	3%	16%	50%	33%	16%	4%	0%	50%	28%	6%	20%	11%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA		Split	NA	
Protected Phases	5	2	8	1	6	4	8	8		4	4	
Permitted Phases			2			6						
Actuated Green, G (s)	4.4	30.6	38.5	7.6	33.8	77.8	7.9	7.9		44.0	44.0	
Effective Green, g (s)	4.4	30.6	38.5	7.6	33.8	77.8	7.9	7.9		44.0	44.0	
Actuated g/C Ratio	0.04	0.29	0.36	0.07	0.32	0.73	0.07	0.07		0.41	0.41	
Clearance Time (s)	4.0	4.5	4.0	4.0	4.5	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.5	4.2	2.5	2.5	4.2	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	66	822	352	89	908	1043	123	86		615	609	
v/s Ratio Prot	0.02	0.17	0.00	c0.04	c0.24	0.09	0.00	c0.01		0.29	c0.29	
v/s Ratio Perm			0.00			0.07						
v/c Ratio	0.41	0.61	0.00	0.51	0.77	0.22	0.02	0.17		0.70	0.70	
Uniform Delay, d1	49.8	32.8	21.8	47.7	32.8	4.6	45.8	46.3		25.8	25.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.0	1.6	0.0	3.3	4.3	0.1	0.1	0.7		3.2	3.4	
Delay (s)	52.8	34.4	21.8	51.0	37.1	4.7	45.8	46.9		29.0	29.3	
Level of Service	D	C	C	D	D	A	D	D		C	C	
Approach Delay (s)		35.3			28.7			46.9			29.2	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	31.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	106.6	Sum of lost time (s)	16.5
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	589	1	34	565	262	3	5	85	753	2	25
Future Volume (vph)	32	589	1	34	565	262	3	5	85	753	2	25
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.5	4.0	4.0	4.5	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.95	0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (prot)	1614	2866	975	1250	2866	1430	1662	1162		1490	1479	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	0.96	
Satd. Flow (perm)	1614	2866	975	1250	2866	1430	1662	1162		1490	1479	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	640	1	37	614	285	3	5	92	818	2	27
RTOR Reduction (vph)	0	0	1	0	0	69	0	85	0	0	1	0
Lane Group Flow (vph)	35	640	0	37	614	216	3	12	0	425	421	0
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	3%	16%	50%	33%	16%	4%	0%	50%	28%	6%	20%	11%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Split	NA		Split	NA	
Protected Phases	5	2	8	1	6	4	8	8		4	4	
Permitted Phases			2			6						
Actuated Green, G (s)	4.7	30.6	38.4	5.4	31.3	74.3	7.8	7.8		43.0	43.0	
Effective Green, g (s)	4.7	30.6	38.4	5.4	31.3	74.3	7.8	7.8		43.0	43.0	
Actuated g/C Ratio	0.05	0.30	0.37	0.05	0.30	0.72	0.08	0.08		0.42	0.42	
Clearance Time (s)	4.0	4.5	4.0	4.0	4.5	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.5	4.2	2.5	2.5	4.2	2.5	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	73	848	362	65	868	1028	125	87		620	615	
v/s Ratio Prot	0.02	c0.22	0.00	c0.03	0.21	0.09	0.00	c0.01		c0.29	0.28	
v/s Ratio Perm			0.00			0.06						
v/c Ratio	0.48	0.75	0.00	0.57	0.71	0.21	0.02	0.14		0.69	0.68	
Uniform Delay, d1	48.1	32.9	20.4	47.8	31.9	4.8	44.2	44.6		24.6	24.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.6	4.2	0.0	9.0	2.9	0.1	0.1	0.5		2.9	2.9	
Delay (s)	51.7	37.1	20.4	56.8	34.9	4.9	44.3	45.1		27.5	27.5	
Level of Service	D	D	C	E	C	A	D	D		C	C	
Approach Delay (s)		37.9			26.6			45.1			27.5	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	30.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	103.3	Sum of lost time (s)	16.5
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

LANGAN

Memorandum

989 Lenox Drive, Suite 124 Lawrenceville, NJ 08648 T: 609.282.8000 F: 609.282.8001

TO: Matt Hughart

FROM: Daniel D. Disario, PE, PTOE

INFO: File

DATE: July 30, 2021

RE: **ARS Fulfillment Center Trip Rates**

Introduction

Langan Engineering and Environmental Services prepared this summary of traffic data collected at three fulfillment centers. The tenant designates this specific fulfillment center type as an ARS, which is indicative of using robotic sorting technology during the process of sorting small individual items of a customer's order into a single box.

Langan arranged traffic counts at each fulfillment center to record entering and exiting traffic by vehicle type (i.e., cars and trucks) for a 24-hour period on a typical weekday at all driveways for each site. From those traffic counts we identified the total entering and exiting traffic volume at each fulfillment center for the entire 24-hour period, for the morning and evening peak hours of generator and for the morning and evening peak hours of adjacent street traffic. The peak hours of generator were the hours of highest traffic generation between 12:00 AM to 12:00 PM and between 12:00 PM to 12:00 AM. The peak hours of adjacent street traffic were the hours of highest traffic generation between 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM.

Fulfillment Center Locations

The three ARS fulfillment centers that were counted are:

- Tracy, California (ARS)
- Fort Worth, Texas (ARS)
- Ruskin, Florida (ARS)

All three fulfillment centers were counted on Tuesday, December 13, 2016 from 12:00 AM to 12:00 AM (24-hours).

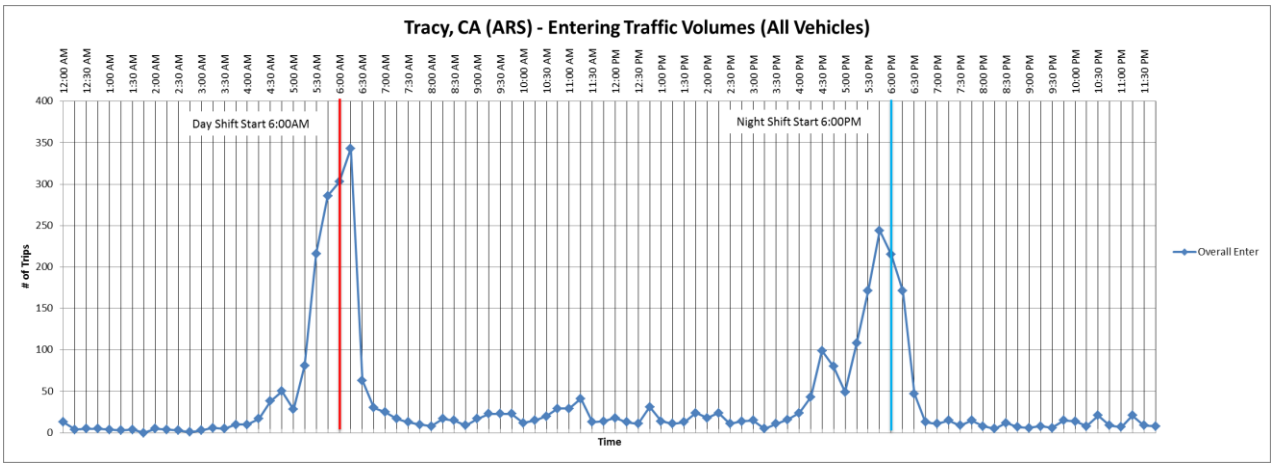
Location Descriptions

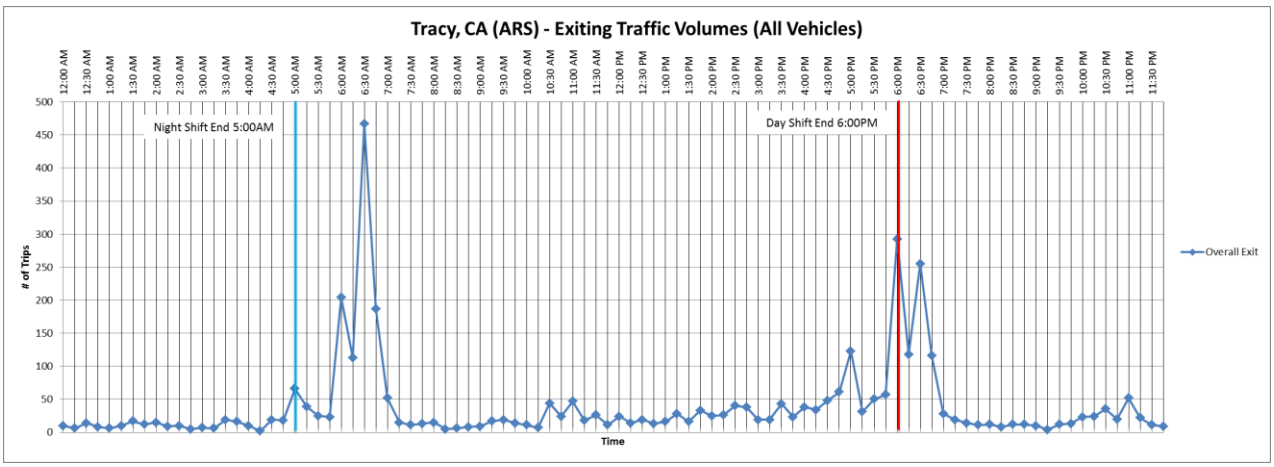
The descriptions below summarize the total building floor area (ground floor plus mezzanines), shift times and total employee headcount (both shifts) for each fulfillment center. Additionally, line graphs are provided that separately show the entering, exiting and overall (entering plus exiting) traffic volumes recorded during each 15-minute interval over the 24-hour count period for each fulfillment center.

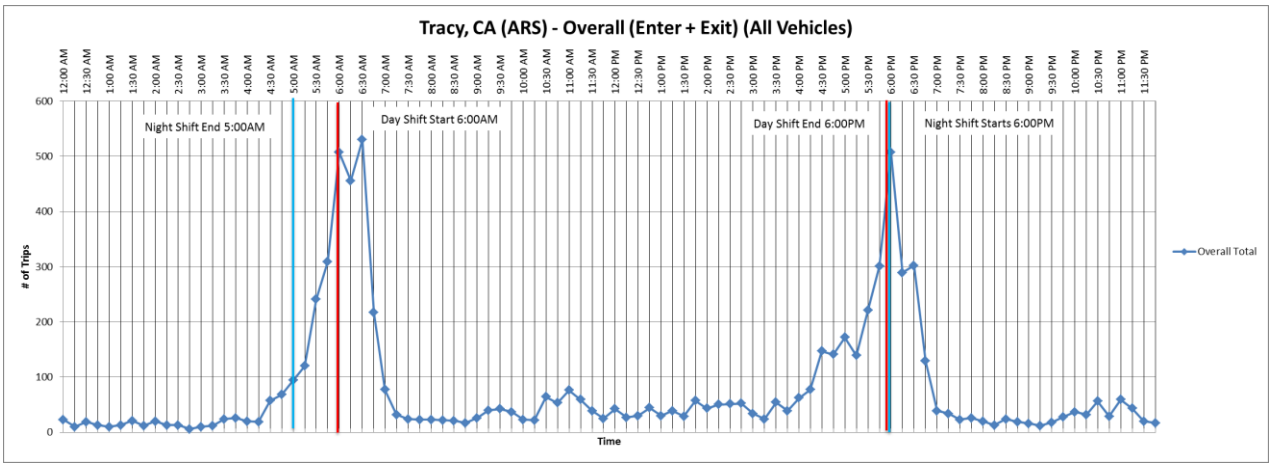
Tracy, California (ARS)

This fulfillment center has a total building floor area of approximately 1,830,972 square feet and operated with two shifts during the traffic counts. The day shift hours were reported as 6:00 AM to 6:00 PM with a headcount of 1,383 employees. The night shift hours were reported as 6:00 PM to 5:00 AM with a headcount of 1,219 employees. Accordingly, the total reported headcount for both shifts was 2,602 employees.

The graphs on the following page display the total vehicles entering, exiting and overall (entering plus exiting) for each 15-minute interval over the 24-hour count period. Note that all graphs depict the reported start and end time of both shifts with red lines for the day shift and blue lines for the night shift.


Tracy, CA (ARS) - Entering Traffic Volumes (All Vehicles)
Day Shift Start 6:00AM
Night Shift Start 6:00PM
# of Trips
Time
Overall Enter

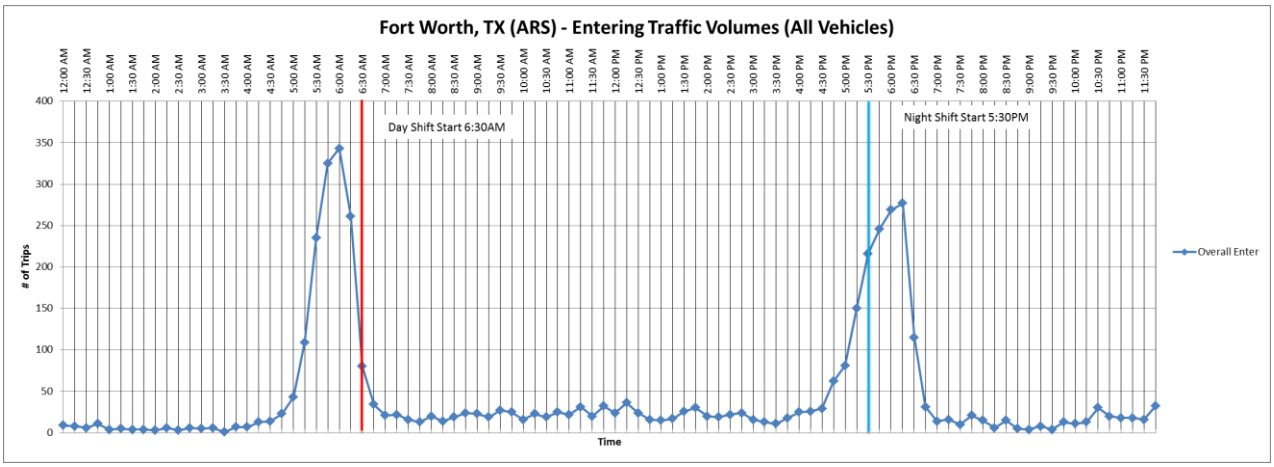

Tracy, CA (ARS) - Exiting Traffic Volumes (All Vehicles)
Night Shift End 5:00AM
Day Shift End 6:00PM
# of Trips
Time
Overall Exit

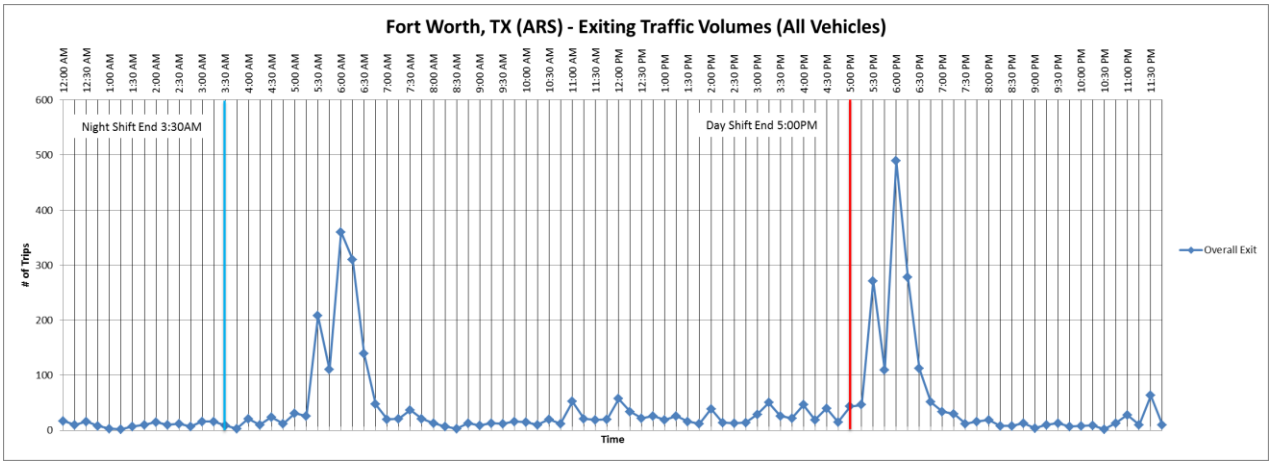

Tracy, CA (ARS) - Overall (Enter + Exit) (All Vehicles)
Night Shift End 5:00AM
Day Shift Start 6:00AM
Day Shift End 6:00PM
Night Shift Starts 6:00PM
# of Trips
Time
Overall Total

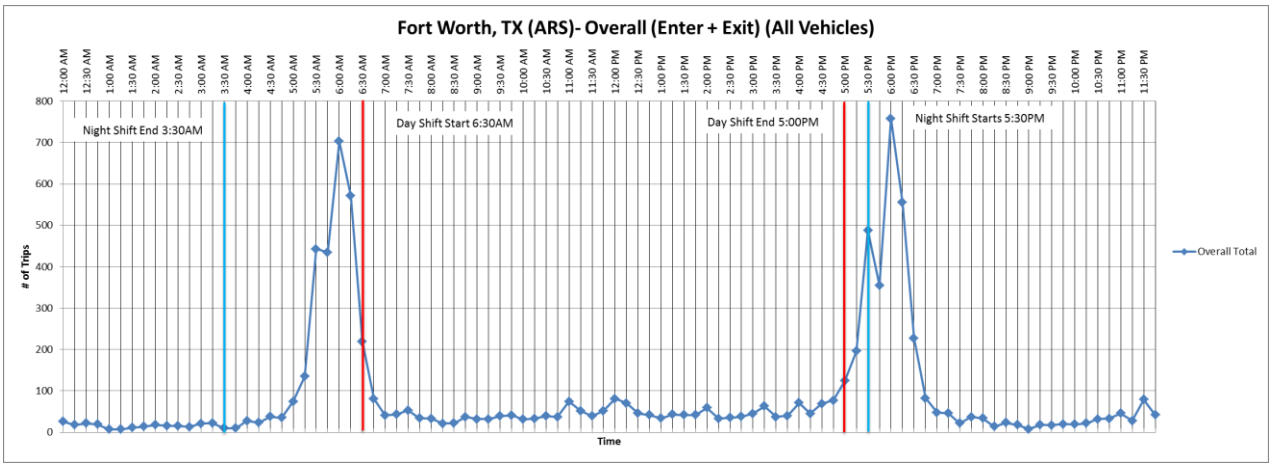
Fort Worth, Texas (ARS)

This fulfillment center has a total building floor area of approximately 2,783,913 square feet and operated with two shifts during the traffic counts. The day shift hours were reported as 6:30 AM to 5:00 PM with a headcount of 1,302 employees. The night shift hours were reported as 5:30 PM to 3:30 AM with a headcount of 1,294 employees. Accordingly, the total reported headcount for both shifts was 2,596 employees.

The graphs on the following page display the total vehicles entering, exiting and overall (entering plus exiting) for each 15-minute interval over the 24-hour count period. Note that all graphs depict the reported start and end time of both shifts with red lines for the day shift and blue lines for the night shift.


Fort Worth, TX (ARS) - Entering Traffic Volumes (All Vehicles)
Day Shift Start 6:30AM
Night Shift Start 5:30PM
# of Trips
Time
Overall Enter

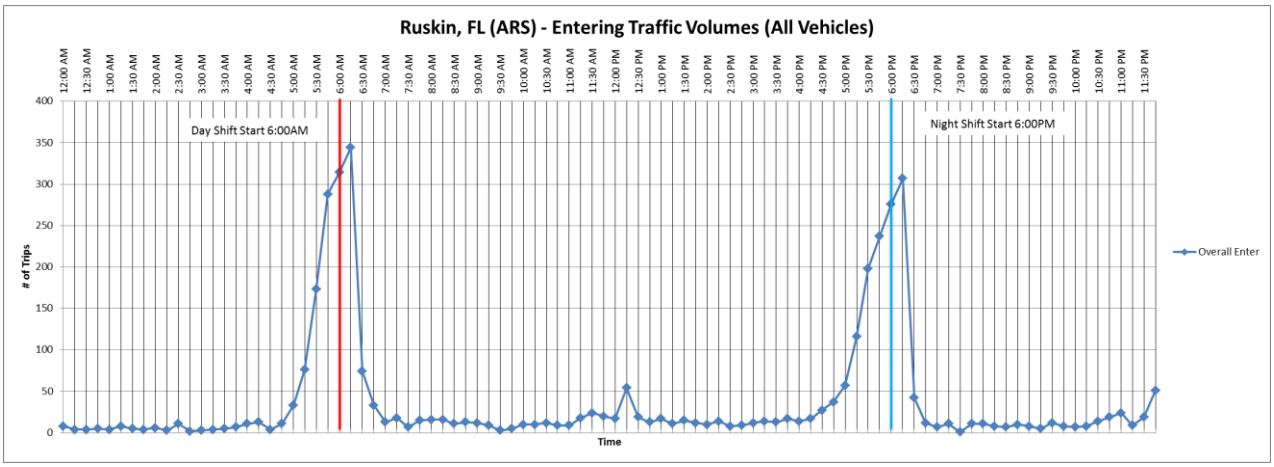

Fort Worth, TX (ARS) - Exiting Traffic Volumes (All Vehicles)
Night Shift End 3:30AM
Day Shift End 5:00PM
# of Trips
Time
Overall Exit

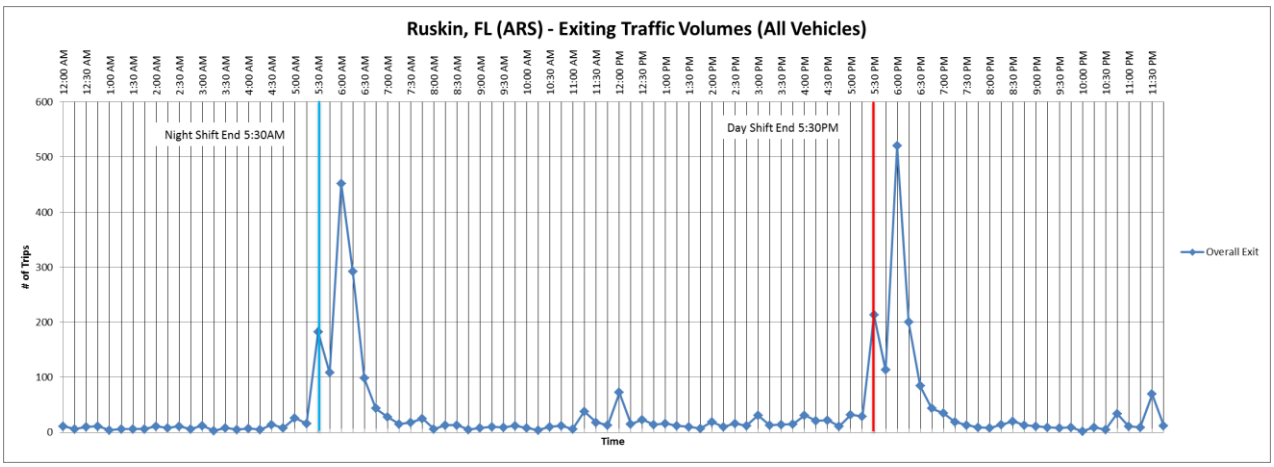

Fort Worth, TX (ARS)- Overall (Enter + Exit) (All Vehicles)
Night Shift End 3:30AM
Day Shift Start 6:30AM
Day Shift End 5:00PM
Night Shift Starts 5:30PM
# of Trips
Time
Overall Total

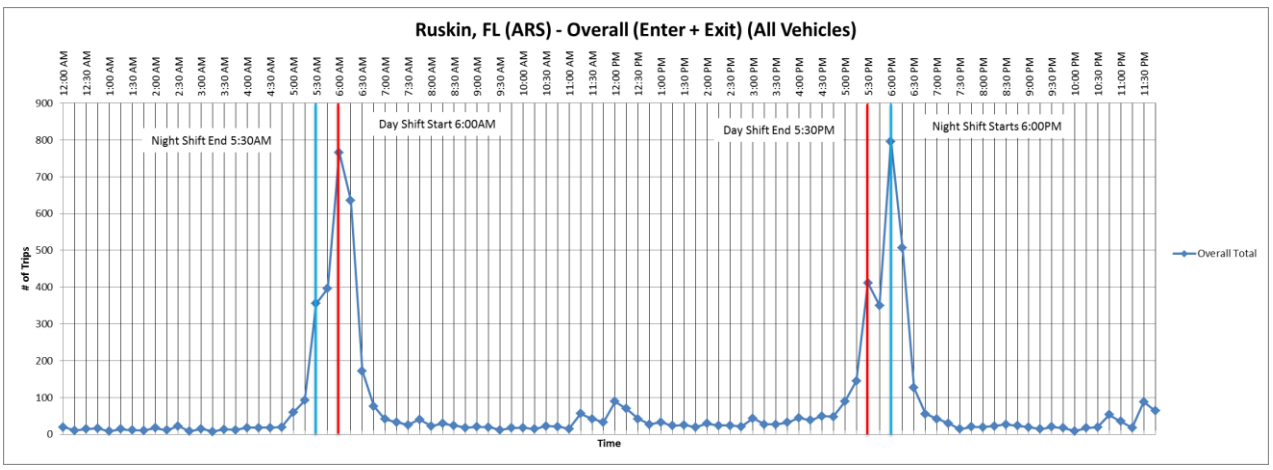
Ruskin, Florida (ARS)

This fulfillment center has a total building floor area of approximately 2,198,187 square feet and operated with two shifts during the traffic counts. The day shift hours were reported as 6:00 AM to 5:30 PM with a headcount of 1,338 employees. The night shift hours were reported as 6:00 PM to 5:30 AM with a headcount of 1,266 employees. Accordingly, the total reported headcount for both shifts was 2,604 employees.

The graphs on the following page display the total vehicles entering, exiting and overall (entering plus exiting) for each 15-minute interval over the 24-hour count period. Note that all graphs depict the reported start and end time of both shifts with red lines for the day shift and blue lines for the night shift.


Ruskin, FL (ARS) - Entering Traffic Volumes (All Vehicles)
Day Shift Start 6:00AM
Night Shift Start 6:00PM
# of Trips
Time
Overall Enter


Ruskin, FL (ARS) - Exiting Traffic Volumes (All Vehicles)
Night Shift End 5:30AM
Day Shift End 5:30PM
# of Trips
Time
Overall Exit


Ruskin, FL (ARS) - Overall (Enter + Exit) (All Vehicles)
Night Shift End 5:30AM
Day Shift Start 6:00AM
Day Shift End 5:30PM
Night Shift Starts 6:00PM
# of Trips
Time
Overall Total

Weighted Trip Rates

Consistent with the Trip Generation Manual published by the Institute of Transportation Engineers (ITE), we calculated weighted average trip rates for the entire 24-hour daily period, the morning and evening peak hours of generator and for the morning and evening peak hours of adjacent street traffic. The peak hours of generator were the hours of highest traffic generation between 12:00 AM to 12:00 PM and between 12:00 PM to 12:00 AM. The peak hours of adjacent street traffic were the hours of highest traffic generation between 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM.

Independent Variable – Total Employees

Tables 1-3 summarize the pertinent data collected at each fulfillment center and the weighted trip rates by total employees (i.e., total employees for both shifts over the 24-hour period).

Table 1 – Data Summary (24-Hour Daily)
Independent Variable – Total Employees

Description		Daily		
		Tracy, CA	Ft Worth, TX	Ruskin, FL
Traffic Count Volumes				
Peak Hour		Daily	Daily	Daily
Cars	Enter	3208	3649	3204
	Exit	3275	3553	3231
	Total	**6483**	**7202**	**6435**
Trucks	Enter	432	503	348
	Exit	410	512	352
	Total	**842**	**1015**	**700**
Overall*	Enter	3640	4153	3552
	Exit	3685	4068	3583
	Total	**7325**	**8221**	**7135**
Individual Calculations				
Percent Trucks		11.5%	12.3%	9.8%
Overall Distributions	Enter	50%	51%	50%
	Exit	50%	49%	50%
Trip Rate (Trips/Employee)		2.815	3.167	2.740
Weighted Average Rate				
Distribution	Enter	50%		
	Exit	50%		
Average Trip Rate (Trips/Employee)**		**2.9071**		

*Overall includes passenger cars and trucks.
**Average rate is calculated based on the total employees (day shift + night shift).

Table 2 – Data Summary (Peak Hour of Generator)
Independent Variable – Total Employees

Description		AM Peak Hour			PM Peak Hour		
		Tracy, CA	Ft Worth, TX	Ruskin, FL	Tracy, CA	Ft Worth, TX	Ruskin, FL
Traffic Count Volumes							
Peak Hour		5:45 – 6:45AM	5:30 – 6:30AM	5:30 – 6:30AM	5:45 – 6:45PM	5:30 – 6:30PM	5:30 – 6:30PM
Cars	Enter	979	1158	1111	671	987	1006
	Exit	803	979	1023	701	1119	1027
	Total	**1782**	**2137**	**2134**	**1372**	**2106**	**2033**
Trucks	Enter	16	6	8	6	21	12
	Exit	4	8	11	21	27	19
	Total	**20**	**14**	**19**	**27**	**48**	**31**
Overall*	Enter	995	1164	1119	677	1008	1018
	Exit	807	988	1034	722	1147	1046
	Total	**1802**	**2152**	**2153**	**1399**	**2155**	**2064**
Individual Calculations							
Percent Trucks		1.1%	0.7%	0.9%	1.9%	2.2%	1.5%
Overall Distributions	Enter	55%	54%	52%	48%	47%	49%
	Exit	45%	46%	48%	52%	53%	51%
Trip Rate (Trips/Employee)		0.693	0.829	0.827	0.538	0.830	0.793
Weighted Average Rate							
Distribution	Enter	54%			48%		
	Exit	46%			52%		
Average Trip Rate (Trips/Employee)**		**0.783**			**0.720**		

*Overall includes passenger cars and trucks.

**Average rate is calculated based on the total number of employees (day shift + night shift).

Table 3 – Data Summary (Peak Hour of Adjacent Street Traffic)
Independent Variable – Total Employees

Description		AM Peak Hour			PM Peak Hour		
		Tracy, CA	Ft Worth, TX	Ruskin, FL	Tracy, CA	Ft Worth, TX	Ruskin, FL
Traffic Count Volumes							
Peak Hour		7:00 – 8:00AM	7:00 – 8:00AM	7:00 – 8:00AM	5:00 – 6:00PM	5:00 – 6:00PM	5:00 – 6:00PM
Cars	Enter	50	61	44	550	671	595
	Exit	74	88	75	240	443	370
	Total	**124**	**149**	**119**	**790**	**1114**	**965**
Trucks	Enter	15	11	9	22	21	13
	Exit	17	11	11	21	26	17
	Total	**32**	**22**	**20**	**43**	**47**	**30**
Overall*	Enter	65	72	53	572	693	608
	Exit	91	99	86	261	469	387
	Total	**156**	**171**	**139**	**833**	**1162**	**995**
Individual Calculations							
Percent Trucks		20.5%	12.9%	14.4%	5.2%	4.0%	3.0%
Overall Distributions	Enter	42%	42%	38%	69%	60%	61%
	Exit	58%	58%	62%	31%	40%	39%
Trip Rate (Trips/Employee)		0.060	0.066	0.053	0.320	0.448	0.382
Weighted Average Rate							
Distribution	Enter	41%			63%		
	Exit	59%			37%		
Average Rate (Trips/Employee)**		**0.060**			**0.383**		

*Overall includes passenger cars and trucks.

**Average rate is calculated based on the total number of employees (day shift + night shift).

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