Traffic Impact Analysis
Sandpines Fairway Estates
Residential Planned Development
North Rhododendron Drive
Florence, Oregon

Prepared for:
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SUMMARY REPORT
TRAFFIC IMPACT ANALYSIS
Fairway Estates at Sandpines, Florence, OR
### August 19, 2015

BACKGROUND

Fairway Estates at Sandpines is owned by Pacific Golf Communities, LLC represented by Michael Pearson. Fairway Estates is proposed as a residential planned development consisting of 77 platted lots for single family detached homes. The project site is located immediately west of the Fairway No. 6 on the Sandpines Golf Links in Florence, Oregon. Development of these lots will occur in two phases of 40 and 37 lots. Lots will be offered for sale to builders or owners. Full build-out likely will take 15-20 years.

Pacific Golf Communities has authorized the preparation of a traffic analysis for its proposed new development. Traffic impact assessment will include vehicular trip generation for proposed, staged development scenarios within the existing prescribed zoning for the vacant parcels. These vacant parcels have progressed through prior land use reviews, but the housing projects were abandoned by the previous developers following the financial crash of 2008. When abandoned, the parcel comprised two phases. Phase I had received construction permits for public infrastructure. Much of the underground improvements had been completed when the project was abandoned. Phase II was still progressing through permitting processes when abandoned. All permits, approvals and entitlements have long expired.

Recognizing the prospect of a housing market recovery in Florence, the current owners intend to develop building lots on this site for single family detached housing. Additionally, the owners wish to develop a design for the gated entry driveway for the future development. This Traffic Impact Analysis will provide important traffic data needed for the driveway design.

VICINITY MAPS

FLORENCE OREGON

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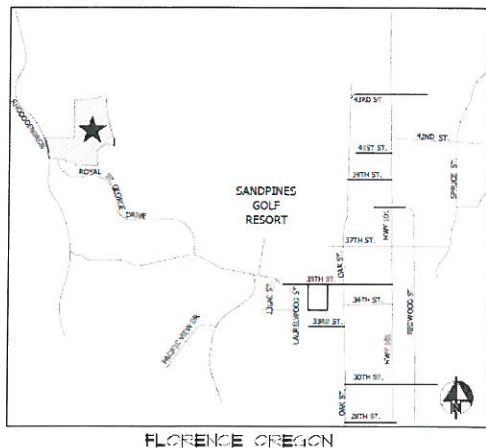
VICINITY MAPS

The following excerpt from City of Florence GIS mapping shows relevant street names in the vicinity of our proposed project.

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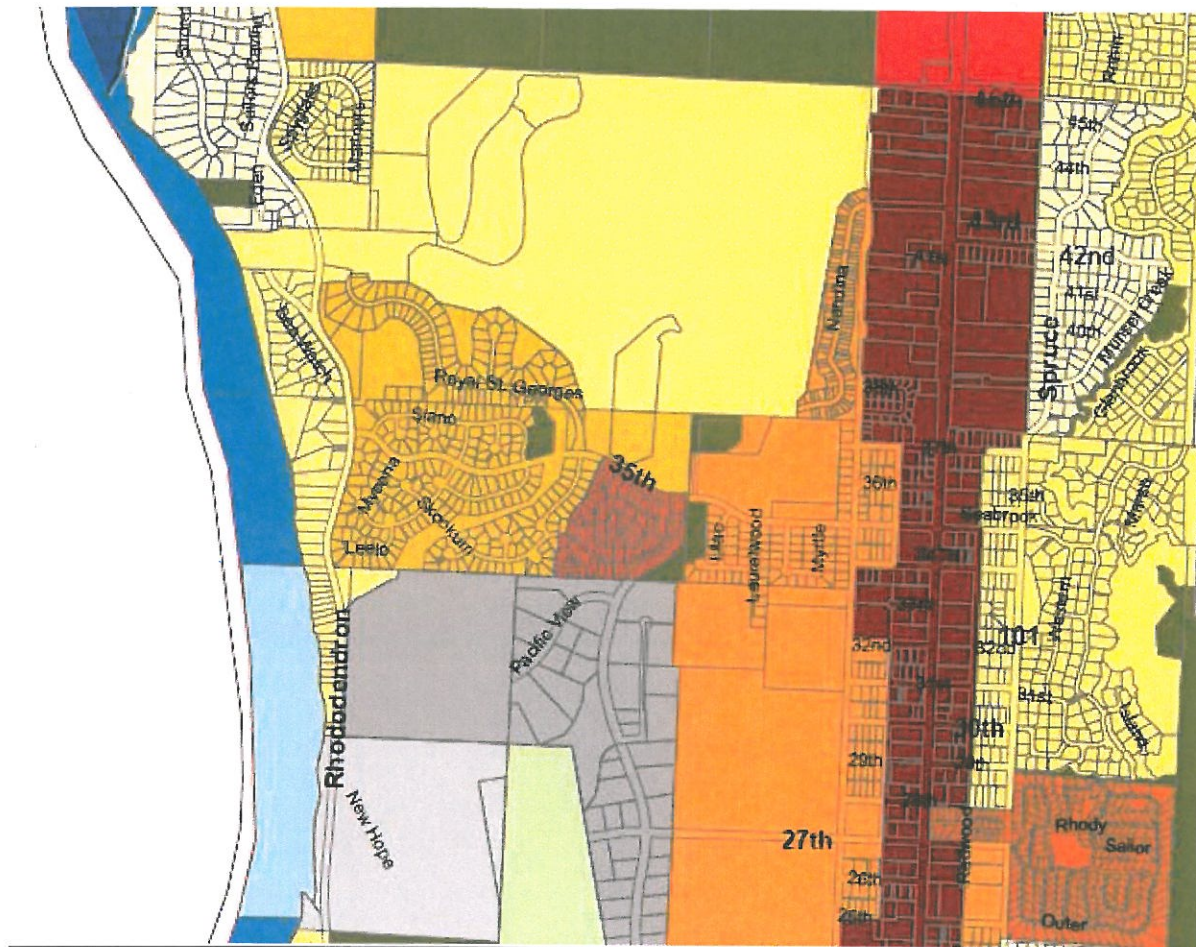
EXISTING SITE

The following Google Earth aerial photo excerpt of Florence, Oregon shows the general location of the proposed development. The Sandpines Links Golf Course is located immediately east of the project site. A portion of the property abuts Fairway No. 6.

EXISTING AUTOMOBILE TRAFFIC

The subject site is vacant currently. A construction access has been fenced for security. Currently, there is no vehicular traffic generated by the development site. Fairway No. 6 can be accessed only by golf carts or pedestrian golfers parked at the Sandpines Links Clubhouse. Access to the proposed development site is available only from North Rhododendron Drive. This northerly section of North Rhododendron Drive provides access to a series of gated, private single-access residential communities. Vehicular traffic from the proposed development all will be routed to North Rhododendron Drive via a new gated entry.

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PLANNED AUTOMOBILE TRAFFIC

A single driveway is proposed, located approximately mid-way between 35th and 46th Streets on North Rhododendron Drive. Rhododendron is classified as a Minor Arterial from Ninth Street to Heceta Beach Road on Figure 4-3 of the Florence Transportation System Plan (TSP). The Sandpines neighborhood label has been added to the map. The Minor Arterial street classification is appropriate for the volume and character of traffic expected from existing and proposed development.

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STREET IMPROVEMENT STANDARDS

Streets within Fairway Estates will be owned and maintained as private facilities by a homeowner's association. Street widths will conform to City of Florence standards as required for fire and emergency vehicle access and circulation. While no offsite street improvements are proposed with this development plan, the new entry drive will be designed to meet City's planned cross sections for Rhododendron Drive.

PHASE I DEVELOPMENT PLAN

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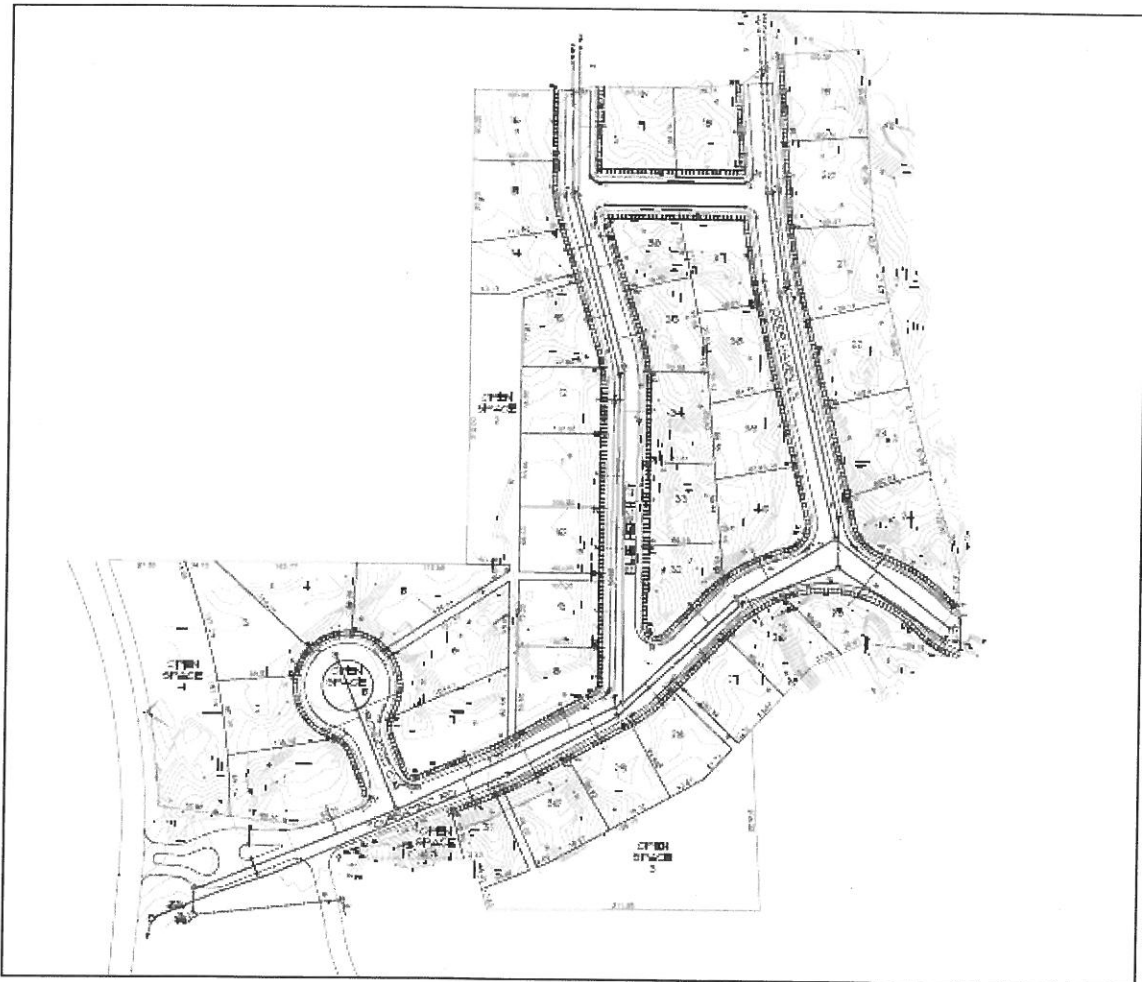
VEHICULAR TRIP GENERATION

Trip generation analysis will be based on the estimated number of single family detached dwelling units (DU) proposed for each of two planned phases:

Phase 1: 40 DU
Phase 2: 37 DU

Vehicular access to vacant property located on the east side of the Fairway No. 6 can be secured only through the currently proposed development. The significant presence of jurisdictional wetlands make development the easterly vacant site problematic, nonetheless an estimated allocation of 40 DU for potential future housing will be included in the trip generation analysis.

The data presented in ITE's *Trip Generation* provides a database of the primary land uses for which the evaluation of these distinct categories of trips is critical to volume analysis. Among ITE's land use categories is owner-occupied *Single Family Detached Housing (Land Use 210)*. This category provides most appropriate traffic data for the proposed development plan. Using ITE's database and prescribed methodology, we have estimated trip generation and directional distribution for three weekday time periods.

Average daily traffic is the total number of trip ends to the site on an average 24-hour weekday. Although measured in vehicles per day, the commonly used dimension is ADT (Average Daily Traffic). A *trip* or *trip end* is a single or one-directional vehicle movement with either the origin or destination (*exiting or entering*) inside the study site. For trip generation calculations, the total trip ends for a land use over a given period of time are the total of all trips entering plus all trips exiting a site during a designated time period.

AM Peak Hour Roadway Traffic (7-9) is the single peak hour of adjacent street traffic, usually occurring between 7 AM and 9 AM, when the combination of the trips generated by a site land use and the volume of traffic on adjacent streets is the highest. Likewise *PM Peak Hour Roadway Traffic (4-6)* is the single peak hour afternoon volume. Generally, it is these volumes that are most relevant to the design of traffic facilities on streets adjacent to or near the generator, consequently of greatest interest to the local municipality, and to other neighborhood residents.

We followed ITE's recommended decision tree for estimating trip generation, which is shown as *Figure 3.1 Recommended Procedure for Selecting between Trip Generation Average Rates and Equations*, to calculate traffic volumes for the three weekday time periods for staged development of the proposed SFD land use, and applied these rates to the various stages under consideration.

We made no attempt to collect local traffic data, but relied solely on the ITE national database, as is widely practiced by traffic engineering consultants and widely accepted by traffic engineers of local jurisdictions, including City of Florence.

Recognizing that Florence includes a significant population segment of retired persons, the ITE trip generation rates may overestimate actual trip rates for peak hour traffic. Much of the peak hour traffic contribution comes from workday commuters. However,

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no adjustment has been included in the analysis for resident status, and the peak hour rates should be considered conservative.

The trip generation calculations, including directional distributions (Enter and Exit) are summarized in the table captioned *TABLE A – TOTAL TRIP-ENDS*. The proposed development increases traffic on the adjacent roadway, namely North Rhododendron Drive.

TRIP ASSIGNMENT AND DISTRIBUTION

Directional distribution at North Rhododendron Drive is shown in Table A in the columns labeled "Enter" and "Exit." Distribution analysis has not been carried further into neighborhood street systems, although it is estimated that approximately 90% or more of exit traffic will be southbound, toward the City center. Likewise, the same proportion of inbound traffic will originate from the City center or Highway 101 via 35th Street.

Trip estimates are not directly proportional to number of dwelling units. The ITE database algorithm is applied to the aggregate of lots serviced by the driveway on Rhododendron Drive. It must be remembered that the total build-out represented in the chart will likely occur over a 20-year plus time period.

TABLE A - TOTAL TRIP-ENDS

DEVELOPMENT SCENARIO	AVERAGE DAILY TRAFFIC			AM PEAK HOUR ROADWAY (7-9 AM)			PM PEAK HOUR ROADWAY (4-6 PM)		
	WEEKDAY (ADT)			WEEKDAY (VPH)			WEEKDAY (VPH)		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Phase I 40 Dwelling Units (Proposed)	226	226	452	9	28	37	29	17	46
	50%	50%	100%	24%	76%	100%	63%	37%	100%
Phases I & II 40 + 37 = 77 DU's (Proposed)	413	413	826	16	48	64	52	31	83
	50%	50%	100%	25%	75%	100%	63%	37%	100%
Phases I, II & Vacant 40 + 37 + 40 = 117 DU's (Estimated)	607	607	1214	23	69	92	76	45	121
	50%	50%	100%	25%	75%	100%	63%	37%	100%

SUMMARY

Based on historical background, City's volume analysis (Florence Transportation System Plan, December 2012) and current observations of the existing traffic circulation we know that the estimated increased traffic generated by the proposed development easily can be assimilated within the existing neighborhood traffic infrastructure over the estimated time period for build-out. Likewise, we conclude that increased traffic demand on the surrounding public transportation infrastructure does not warrant

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additional investigation of mitigation measures. The two major offsite intersections with Rhododendron Drive, 9th Street and 35th Street both exhibit Level of Service (LOS) "A" currently (Florence Transportation System Plan, December 2012), offering significant additional capacity for the traffic volumes expected from Fairway Estates Phases I & II.

While not part of any current land use proposal, the Rhododendron access driveway for the planned development will be designed to accommodate traffic generated by an additional 40 lots on the vacant property located east of Fairway No. 6.

Respectfully submitted by:

Fred Wright

Fred Wright, P.E., P.L.S., F. ASCE
Professional Civil and Traffic Engineer

Engineer's Seal

FAIRWAY ESTATES PHASE I
VEHICULAR TRAFFIC ESTIMATES
FLORENCE, OREGON

Special Units & Dimensions Used in this Analysis

$$SF := ft^2 \quad KSF := 1000SF \quad DU := 2500SF \quad VPH := hr^{-1} \quad ADT := day^{-1}$$

Procedure: Follow the decision tree shown in Figure 3.1 Recommended Procedure for Selecting Between Trip Generation Average Rates and Equations, ITE Trip Generation Handbook, 2012.
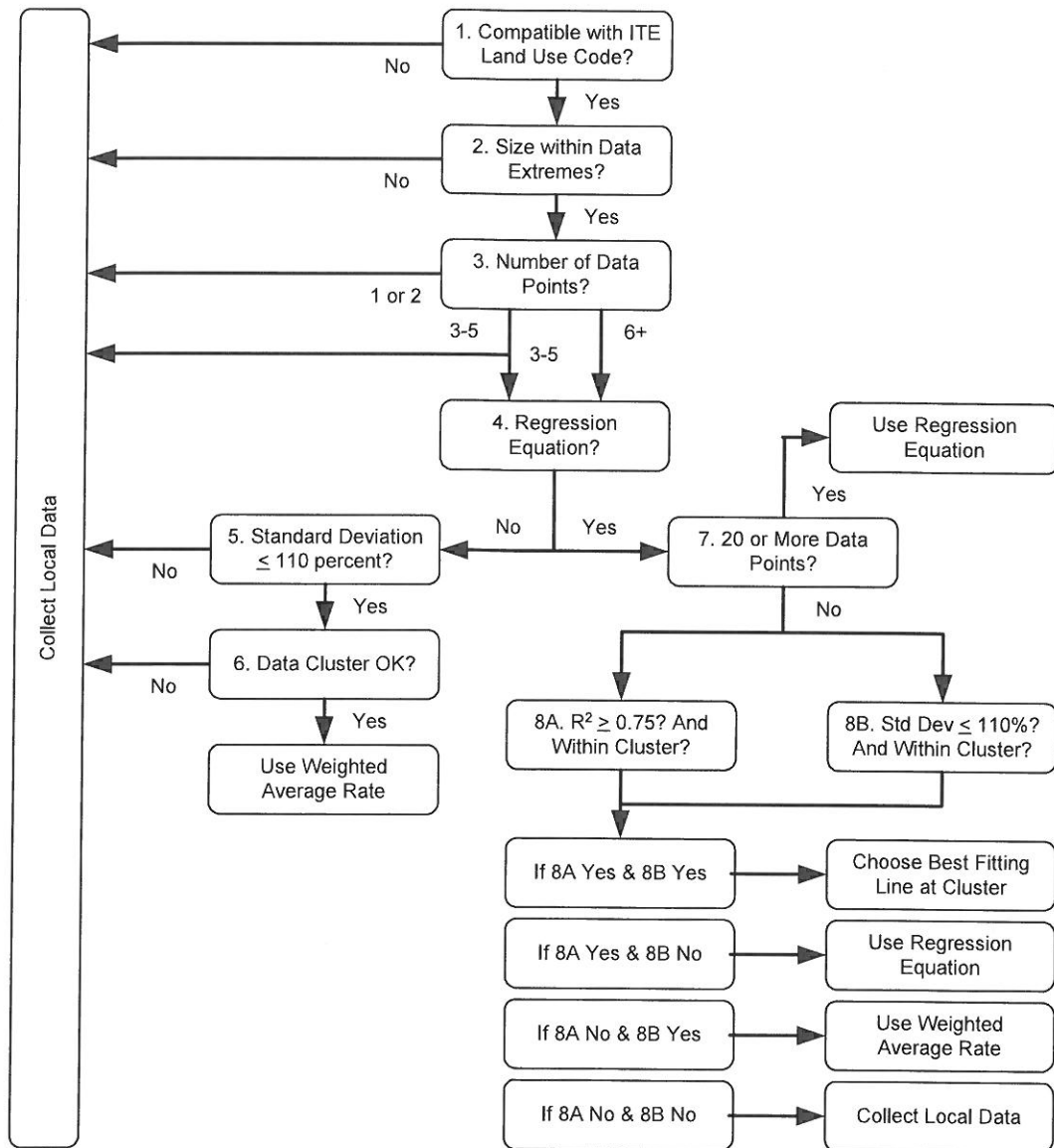
Land Uses, ITE Land Use Codes

Code & Land Use

Independent Variable

210 Single-Family Detached Housing

$X_{sfd} := 40DU$

Single Family Detached Housing Land Use - Average Weekday Traffic

STEP 1: Is the development under analysis consistent with the description of the land use code in *Trip Generation* and with the described or presumed characteristics of development site for which the data points are provided?

$Step_1 := $ "Yes"

$Next\_Step := \left| \begin{array}{l} \text{"Step 2"} \quad \text{if} \quad Step_1 = \text{"Yes"} \\ \text{"Collect local traffic data and establish a local trip rate"} \quad \text{otherwise} \end{array} \right.$

$Next\_Step = \text{"Step 2"}$

STEP 2: Is the size of the development under analysis (in terms of the unit of measurement of the independent variable) within the range of the data shown in the data plot?

$Data\_Low := 10DU \quad Data\_High := 2900DU \quad$ (ITE *Trip Generation,* 9th Edition)

$Next\_Step := \left| \begin{array}{l} \text{"Step 3"} \quad \text{if} \quad Data\_Low \le min(X_{sfd}) \wedge max(X_{sfd}) \le Data\_High \\ \text{"Collect local traffic data and establish a local trip rate"} \quad \text{otherwise} \end{array} \right.$

$Next\_Step = \text{"Step 3"}$

STEP 3: How many data points comprise the sample reported in *Trip Generation?*

$Data\_Points := 355 \quad$ (ITE *Trip Generation,* 9th Edition)

$Next\_Step := \left| \begin{array}{l} \text{"Step 4"} \quad \text{if} \quad Data\_Points \ge 6 \\ \text{"Step 4 but collect local data to support ITE rate"} \quad \text{if} \quad 3 \le Data\_Points \le 5 \\ \text{"Collect local traffic data and establish a local trip rate"} \quad \text{otherwise} \end{array} \right.$

$Next\_Step = \text{"Step 4"}$

STEP 4: Is a regression equation provided in *Trip Generation?*

$Step_4 := \text{"Yes"} \quad$ (ITE *Trip Generation,* 9th Edition)

$Next\_Step := \left| \begin{array}{l} \text{"Step 7"} \quad \text{if} \quad Step_4 = \text{"Yes"} \\ \text{"Step 5"} \quad \text{if} \quad Step_4 = \text{"No"} \\ \text{"Requires a Yes or No response!"} \quad \text{otherwise} \end{array} \right.$

$Next\_Step = \text{"Step 7"}$

STEP 7A: Are at least 20 data points distributed over the range of the values typically found for the independent variable?

$Step_{7A} :=$ "Yes"   (ITE *Trip Generation,* 9th Edition)

STEP 7B: Are there few erratic data points (i.e. outliers)?

$Step_{7B} :=$ "Yes"   (ITE *Trip Generation,* 9th Edition)

STEP 7C: Is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{7C} :=$ "Yes"   (ITE *Trip Generation,* 9th Edition)

$Next\_Step :=$ "Use the regression equation."   if $Step_{7A} =$ "Yes" $\wedge$ $Step_{7B} =$ "Yes" $\wedge$ $Step_{7C} =$ "Yes"

"Step 8A1"   otherwise

$Next\_Step =$ "Use the regression equation."

STEP 8A1: Is the R^2 for the regression equation greater than or equal to 0.75?

$R\_squared := 0.95$ (ITE *Trip Generation,* 9th Edition)

$Step_{8A1} :=$ "Yes"   if $R\_squared \geq 0.75$

"No"   otherwise

$Step_{8A1} =$ "Yes"

STEP 8A2: And, is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{8A2} :=$ "Yes"   (ITE *Trip Generation,* 9th Edition)

$Step_{8A} :=$ "Yes"   if $Step_{8A1} =$ "Yes" $\wedge$ $Step_{8A2} =$ "Yes"

"No"   otherwise

$Step_{8A} =$ "Yes"

STEP 8B1: Is the standard deviation for the weighted average rate less than or equal to 110 percent of the weighted average rate?

$Std\_Dev := 3.70 \dfrac{ADT}{DU}$ (ITE *Trip Generation,* 9th Edition)

$Avg\_Rate := 9.52 \dfrac{ADT}{DU}$ (ITE *Trip Generation,* 9th Edition)

$Ratio := \dfrac{Std\_Dev}{Avg\_Rate}$ $Ratio = 38.9 \cdot \%$

$Step_{8B1} :=$ "Yes"   if $Ratio \leq 110\%$

"No"   otherwise

$Step_{8B1} =$ "Yes"

STEP 8B2: And, is the line that corresponds to the weighted average rate within the cluster of data points near the size of the development site?

$\text{Step}_{8B2} := \text{"Yes"}$ (ITE *Trip Generation*, 9th Edition)

$\text{Step}_{8B} := \begin{cases} \text{"Yes"} & \text{if } \text{Step}_{8B1} = \text{"Yes"} \wedge \text{Step}_{8B2} = \text{"Yes"} \\ \text{"No"} & \text{otherwise} \end{cases}$

$\text{Step}_{8B} = \text{"Yes"}$

$\text{Choose} := \begin{cases} \text{"whichever line best fits the data point for the site"} & \text{if } \text{Step}_{8A} = \text{"Yes"} \wedge \text{Step}_{8B} = \text{"Yes"} \\ \text{"Use the regression equation"} & \text{if } \text{Step}_{8A} = \text{"Yes"} \wedge \text{Step}_{8B} = \text{"No"} \\ \text{"use the weighted average rate"} & \text{if } \text{Step}_{8A} = \text{"No"} \wedge \text{Step}_{8B} = \text{"Yes"} \\ \text{"collect traffic data and establish a local trip rate"} & \text{otherwise} \end{cases}$

$\text{Choose} = \text{"whichever line best fits the data point for the site"}$

$\text{Exception} := \begin{cases} \text{"use regression"} & \text{if } \text{Step}_{8A} = \text{"No"} \wedge \text{Step}_{8B} = \text{"No"} \wedge \text{Step}_{8A2} = \text{"No"} \wedge \text{Step}_{8B2} = \text{"Yes"} \\ \text{"use wtd avg"} & \text{if } \text{Step}_{8A} = \text{"No"} \wedge \text{Step}_{8B} = \text{"No"} \wedge \text{Step}_{8A2} = \text{"Yes"} \wedge \text{Step}_{8B2} = \text{"No"} \\ \text{Choose} & \text{otherwise} \end{cases}$

$\text{Exception} = \text{"whichever line best fits the data point for the site"}$

Estimated Total Average Daily Vehicle Trip Ends, Weekday

Regression curve: $T_{sfd\_ADT} := \exp\left(0.92 \cdot \ln\left(\dfrac{X_{sfd}}{DU}\right) + 2.72\right) \cdot ADT$ $T_{sfd\_ADT} = 452 \cdot ADT$

ADT ADJUSTMENTS

Internal Capture Rate for Multi-Use Development

$P_0 := 0\%$ (ITE *Trip Generation Handbook*, Tables 7.1 and 7.2)

Modal Distribution

$P_1 := 0\%$ (Estimated Pedestrian Mode)

$P_2 := 0\%$ (Estimated Bicycle Mode)

$P_3 := 0\%$ (Estimated Transit Mode)

Estimated Average Roadway Daily Vehicle Trip Ends, Weekday

$T_{sfd\_ADT\_veh} := T_{sfd\_ADT} \cdot \left(100\% - \sum P\right)$ $T_{sfd\_ADT\_veh} = 452 \cdot ADT$

Entering/Exiting Distribution

Entering Distribution:

$Enter\_ADT := 50\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_ADT\_Enter} := Enter\_ADT \cdot T_{sfd\_ADT\_veh}$ $T_{sfd\_ADT\_Enter} = 226 \cdot ADT$

Exiting Distribution:

$Exit\_ADT := 50\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_ADT\_Exit} := Exit\_ADT \cdot T_{sfd\_ADT\_veh}$ $T_{sfd\_ADT\_Exit} = 226 \cdot ADT$

Confirm that all traffic is counted:

$Check := if\left(T_{sfd\_ADT\_Enter} + T_{sfd\_ADT\_Exit} = T_{sfd\_ADT\_veh}, "OK", "Missing Traffic"\right)$

$Check = "OK"$

Single Family Detached Housing - AM PEAK HOUR of Adjacent Street Traffic

STEP 1: Is the development under analysis consistent with the description of the land use code in (ITE *Trip Generation* and with the described or presumed characteristics of development site for which the data points are provided?

$Step_1 :=$ "Yes"

$Next\_Step :=$ | "Step 2"   if $Step_1$ = "Yes"
| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step$ = "Step 2"

STEP 2: Is the size of the development under analysis (in terms of the unit of measurement of the independent variable) within the range of the data shown in the data plot?

$Data\_Low :=$ 20DU $Data\_High :=$ 2900DU   (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Step 3"   if $Data\_Low \le min(X_{sfd}) \wedge max(X_{sfd}) \le Data\_High$
| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step$ = "Step 3"

STEP 3: How many data points comprise the sample reported in *Trip Generation?*

$Data\_Points :=$ 292   (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Step 4"   if $Data\_Points \ge 6$
| "Step 4 but collect local data to support ITE rate"   if $3 \le Data\_Points \le 5$
| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step$ = "Step 4"

STEP 4: Is a regression equation provided in *Trip Generation?*

$Step_4 :=$ "Yes"

$Next\_Step :=$ | "Step 7"   if $Step_4$ = "Yes"
| "Step 5"   if $Step_4$ = "No"
| "Requires a Yes or No response!"   otherwise

$Next\_Step$ = "Step 7"

STEP 7A: Are at least 20 data points distributed over the range of the values typically found for the independent variable?

$Step_{7A} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

STEP 7B: Are there few erratic data points (i.e. outliers)?

$Step_{7B} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

STEP 7B: Is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{7C} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Use the regression equation."   if $Step_{7A}$ = "Yes" $\land$ $Step_{7B}$ = "Yes" $\land$ $Step_{7C}$ = "Yes"
| "Step 8A1"   otherwise

$Next\_Step$ = "Use the regression equation."

STEP 8A1: Is the R^2 for the regression equation greater than or equal to 0.75?

$R\_squared :=$ 0.89   (ITE *Trip Generation*, 9th Edition)

$Step_{8A1} :=$ | "Yes"   if $R\_squared \geq 0.75$
| "No"   otherwise

$Step_{8A1}$ = "Yes"

STEP 8A2: And, is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{8A2} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

$Step_{8A} :=$ | "Yes"   if $Step_{8A1}$ = "Yes" $\land$ $Step_{8A2}$ = "Yes"
| "No"   otherwise

$Step_{8A}$ = "Yes"

STEP 8B1: Is the standard deviation for the weighted average rate less than or equal to 110 percent of the weighted average rate?

$Std\_Dev := 0.90 \dfrac{VPH}{DU}$ (ITE *Trip Generation*, 9th Edition)

$Avg\_Rate := 0.75 \dfrac{VPH}{DU}$ (ITE *Trip Generation*, 9th Edition)

$Ratio := \dfrac{Std\_Dev}{Avg\_Rate}$ $Ratio$ = 120.0·%

$Step_{8B1} :=$ | "Yes"   if $Ratio \leq 110\%$
| "No"   otherwise

$Step_{8B1}$ = "No"

STEP 8B2: And, is the line that corresponds to the weighted average rate within the cluster of data points near the size of the development site?

$Step_{8B2} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

$Step_{8B} :=$ | "Yes" if $Step_{8B1}$ = "Yes" $\wedge$ $Step_{8B2}$ = "Yes"
| "No" otherwise

$Step_{8B}$ = "No"

$Choose :=$ | "whichever line best fits the data point for the site" if $Step_{8A}$ = "Yes" $\wedge$ $Step_{8B}$ = "Yes"
| "Use the regression equation" if $Step_{8A}$ = "Yes" $\wedge$ $Step_{8B}$ = "No"
| "use the weighted average rate" if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "Yes"
| "collect traffic data and establish a local trip rate" otherwise

$Choose$ = "Use the regression equation"

$Exception :=$ | "use regression" if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "No" $\wedge$ $Step_{8A2}$ = "Yes" $\wedge$ $Step_{8B2}$ = "No"
| "use wtd avg" if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "No" $\wedge$ $Step_{8A2}$ = "No" $\wedge$ $Step_{8B2}$ = "Yes"
| $Choose$ otherwise

$Exception$ = "Use the regression equation"

Estimated Average Vehicle Trip Ends, Weekday Roadway AM Peak

Regression curve: $T_{sfd\_AM} := \left[0.70 \cdot \left(\dfrac{X_{sfd}}{DU} \right) + 9.74 \right] \cdot VPH$ $T_{sfd\_AM} = 38 \cdot VPH$

AM PEAK HOUR ADJUSTMENTS

Internal Capture Rate for Multi-Use Development

$P_0 := 0\%$ (ITE *Trip Generation Handbook*, Tables 7.1 and 7.2)

Modal Distribution

$P_1 = 0.00 \cdot \%$ (Estimated Pedestrian Mode)

$P_2 = 0.00 \cdot \%$ (Estimated Bicycle Mode)

$P_3 = 0.00 \cdot \%$ (Estimated Transit Mode)

Adjusted Average Roadway Daily Vehicle Trip Ends, Roadway AM Peak Hour

$T_{sfd\_AM\_veh} := T_{sfd\_AM} \cdot \left(100\% - \sum P \right)$ $T_{sfd\_AM\_veh} = 38 \cdot VPH$

Entering/Exiting Distribution

Entering Distribution:

$\text{Enter\_AM} := 25\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_AM\_Enter} := \text{Enter\_AM} \cdot T_{sfd\_AM\_veh}$ $T_{sfd\_AM\_Enter} = 9 \cdot VPH$

Exiting Distribution:

$\text{Exit\_AM} := 75\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_AM\_Exit} := \text{Exit\_AM} \cdot T_{sfd\_AM\_veh}$ $T_{sfd\_AM\_Exit} = 28 \cdot VPH$

Confirm that all traffic is counted:

$\text{Check} := \text{if}\left(T_{sfd\_AM\_Enter} + T_{sfd\_AM\_Exit} = T_{sfd\_AM\_veh}, \text{"OK"}, \text{"Missing Traffic"}\right)$

$\text{Check} = \text{"OK"}$

Single Family Detached Housing Land Use - PM PEAK HOUR of Adjacent Street Traffic

STEP 1: Is the development under analysis consistent with the description of the land use code in *Trip Generation* and with the described or presumed characteristics of development site for which the data points are provided?

$Step_1$:= "Yes"

$Next\_Step$:= | "Step 2"   if $Step_1$ = "Yes"

| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step$ = "Step 2"

STEP 2: Is the size of the development under analysis (in terms of the unit of measurement of the independent variable) within the range of the data shown in the data plot?

$Data\_Low$:= 20DU $Data\_High$:= 2900DU   (ITE *Trip Generation*, 9th Edition)

$Next\_Step$:= | "Step 3"   if $Data\_Low \leq min(X_{sfd}) \wedge max(X_{sfd}) \leq Data\_High$

| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step$ = "Step 3"

STEP 3: How many data points comprise the sample reported in *Trip Generation*?

$Data\_Points$:= 321   (ITE *Trip Generation*, 9th Edition)

$Next\_Step$:= | "Step 4"   if $Data\_Points \geq 6$

| "Step 4 but collect local data to support ITE rate"   if $3 \leq Data\_Points \leq 5$

| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step$ = "Step 4"

STEP 4: Is a regression equation provided in in *Trip Generation*?

$Step_4$:= "Yes"

$Next\_Step$:= | "Step 7"   if $Step_4$ = "Yes"

| "Step 5"   if $Step_4$ = "No"

| "Requires a Yes or No response!"   otherwise

$Next\_Step$ = "Step 7"

STEP 7A: Are at least 20 data points distributed over the range of the values typically found for the independent variable?

$Step_{7A}$:= "Yes" (ITE *Trip Generation*, 9th Edition)

STEP 7B: Are there few erratic data points (i.e. outliers)?

$Step_{7B}$:= "Yes"   (ITE *Trip Generation*, 9th Edition)

STEP 7C: Is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{7C}$:= "Yes"   (ITE *Trip Generation*, 9th Edition)

$Next\_Step$:= | "Use the regression equation."   if $Step_{7A}$ = "Yes" $\wedge$ $Step_{7B}$ = "Yes" $\wedge$ $Step_{7C}$ = "Yes"
| "Step 8A1"   otherwise

$Next\_Step$ = "Use the regression equation."

STEP 8A1: Is the R^2 for the regression equation greater than or equal to 0.75?

$R\_squared$:= 0.91   (ITE *Trip Generation*, 9th Edition)

$Step_{8A1}$:= | "Yes"   if $R\_squared \geq 0.75$
| "No"   otherwise

$Step_{8A1}$ = "Yes"

STEP 8A2: And, is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{8A2}$:= "Yes"   (ITE *Trip Generation*, 9th Edition)

$Step_{8A}$:= | "Yes"   if $Step_{8A1}$ = "Yes" $\wedge$ $Step_{8A2}$ = "Yes"
| "No"   otherwise

$Step_{8A}$ = "Yes"

STEP 8B1: Is the standard deviation for the weighted average rate less than or equal to 110 percent of the weighted average rate?

Std_Dev := $1.05 \dfrac{VPH}{DU}$ (ITE *Trip Generation*, 9th Edition)

Avg_Rate := $1.00 \dfrac{VPH}{DU}$ (ITE *Trip Generation*, 9th Edition)

$Ratio$:= $\dfrac{Std\_Dev}{Avg\_Rate}$ $Ratio = 105.0 \cdot \%$

$Step_{8B1}$:= | "Yes"   if $Ratio \leq 110\%$
| "No"   otherwise

$Step_{8B1}$ = "Yes"

STEP 8B2: And, is the line that corresponds to the weighted average rate within the cluster of data points near the size of the development site?

$Step_{8B2} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

$Step_{8B} :=$ | "Yes"   if $Step_{8B1} =$ "Yes" $\wedge$ $Step_{8B2} =$ "Yes"
| "No"   otherwise

$Step_{8B} =$ "Yes"

$Choose :=$ | "whichever line best fits the data point for the site"   if $Step_{8A} =$ "Yes" $\wedge$ $Step_{8B} =$ "Yes"
| "Use the regression equation"   if $Step_{8A} =$ "Yes" $\wedge$ $Step_{8B} =$ "No"
| "use the weighted average rate"   if $Step_{8A} =$ "No" $\wedge$ $Step_{8B} =$ "Yes"
| "collect traffic data and establish a local trip rate"   otherwise

$Choose =$ "whichever line best fits the data point for the site"

$Exception :=$ | "use regression"   if $Step_{8A} =$ "No" $\wedge$ $Step_{8B} =$ "No" $\wedge$ $Step_{8A2} =$ "Yes" $\wedge$ $Step_{8B2} =$ "No"
| "use wtd avg"   if $Step_{8A} =$ "No" $\wedge$ $Step_{8B} =$ "No" $\wedge$ $Step_{8A2} =$ "No" $\wedge$ $Step_{8B2} =$ "Yes"
| Choose   otherwise

$Exception =$ "whichever line best fits the data point for the site"

Estimated Average Vehicle Trip Ends, Weekday Roadway PM Peak Hour

Regression curve: $T_{sfd\_PM} := exp\left(0.90 \cdot ln\left(\dfrac{X_{sfd}}{DU} \right) + 0.51 \right) \cdot VPH$ $T_{sfd\_PM} = 46 \cdot VPH$

PM PEAK HOUR ADJUSTMENTS

Internal Capture Rate for Multi-Use Development

$P_0 := 0\%$ (ITE *Trip Generation Handbook*, Tables 7.1 and 7.2)

Modal Distribution

$P_1 = 0.00 \cdot \%$ (Estimated Pedestrian Mode)

$P_2 = 0.00 \cdot \%$ (Estimated Bicycle Mode)

$P_3 = 0.00 \cdot \%$ (Estimated Transit Mode)

Adjusted Average Roadway Daily Vehicle Trip Ends, Roadway PM Peak Hour

$T_{sfd\_PM\_veh} := T_{sfd\_PM} \cdot \left(100\% - \sum P \right)$ $T_{sfd\_PM\_veh} = 46 \cdot VPH$

Entering/Exiting Distribution

Entering Distribution:

$Enter\_PM := 63\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_PM\_Enter} := Enter\_PM \cdot T_{sfd\_PM\_veh}$ $\qquad\qquad T_{sfd\_PM\_Enter} = 29 \cdot VPH$

Exiting Distribution:

$Exit\_PM := 37\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_PM\_Exit} := Exit\_PM \cdot T_{sfd\_PM\_veh}$ $\qquad\qquad T_{sfd\_PM\_Exit} = 17 \cdot VPH$

Confirm all traffic is represented

$Check := if(T_{sfd\_PM\_Enter} + T_{sfd\_PM\_Exit} = T_{sfd\_PM\_veh}, "OK", "Missing Traffic")$

$Check = "OK"$

SUMMARY OF ANALYSES

Traffic Parameter	Total Traffic	Entering Traffic	Exiting Traffic
Average Daily Traffic	$T_{sfd\_ADT\_veh} = 452 \cdot ADT$	$T_{sfd\_ADT\_Enter} = 226 \cdot ADT$	$T_{sfd\_ADT\_Exit} = 226 \cdot ADT$
AM Peak Hour Traffic	$T_{sfd\_AM\_veh} = 38 \cdot VPH$	$T_{sfd\_AM\_Enter} = 9 \cdot VPH$	$T_{sfd\_AM\_Exit} = 28 \cdot VPH$
PM Peak Hour Traffic	$T_{sfd\_PM\_veh} = 46 \cdot VPH$	$T_{sfd\_PM\_Enter} = 29 \cdot VPH$	$T_{sfd\_PM\_Exit} = 17 \cdot VPH$

FAIRWAY ESTATES PHASES I & II
VEHICULAR TRAFFIC ESTIMATES
FLORENCE, OREGON

Special Units & Dimensions Used in this Analysis

$SF := ft^2$ $KSF := 1000SF$ $DU := 2500SF$ $VPH := hr^{-1}$ $ADT := day^{-1}$

Procedure: Follow the decision tree shown in Figure 3.1 Recommended Procedure for Selecting Between Trip Generation Average Rates and Equations, ITE Trip Generation Handbook, 2012.
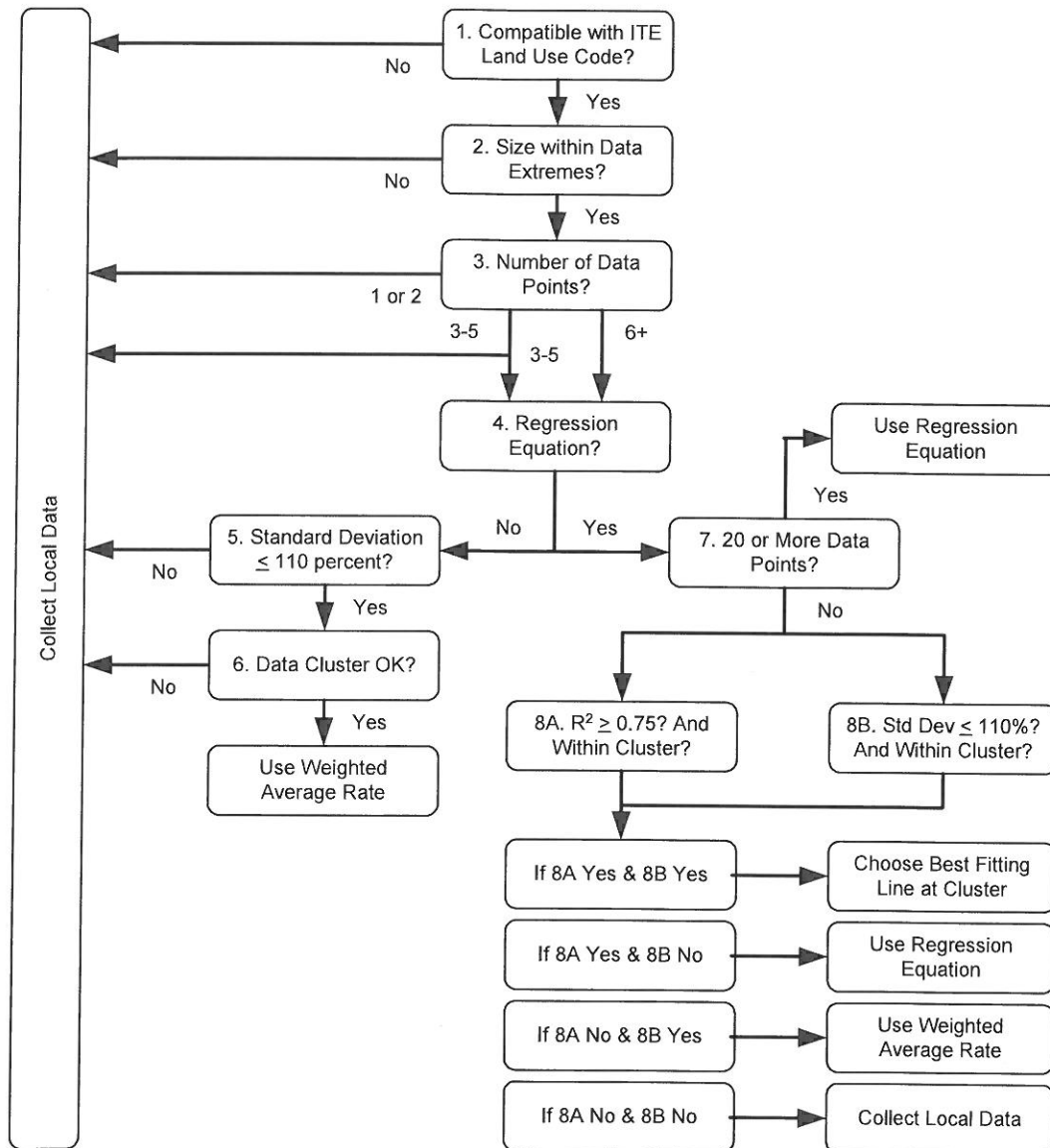
Land Uses, ITE Land Use Codes

Code & Land Use

Independent Variable

210 Single-Family Detached Housing

$X_{sfd} := 77DU$

Single Family Detached Housing Land Use - Average Weekday Traffic

STEP 1: Is the development under analysis consistent with the description of the land use code in *Trip Generation* and with the described or presumed characteristics of development site for which the data points are provided?

$Step_1 :=$ "Yes"

$Next\_Step :=$ | "Step 2" if $Step_1$ = "Yes"

"Collect local traffic data and establish a local trip rate" otherwise

$Next\_Step$ = "Step 2"

STEP 2: Is the size of the development under analysis (in terms of the unit of measurement of the independent variable) within the range of the data shown in the data plot?

$Data\_Low := 10DU$ $Data\_High := 2900DU$ (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Step 3" if $Data\_Low \le min(X_{sfd}) \wedge max(X_{sfd}) \le Data\_High$

"Collect local traffic data and establish a local trip rate" otherwise

$Next\_Step$ = "Step 3"

STEP 3: How many data points comprise the sample reported in *Trip Generation?*

$Data\_Points := 355$ (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Step 4" if $Data\_Points \ge 6$

"Step 4 but collect local data to support ITE rate" if $3 \le Data\_Points \le 5$

"Collect local traffic data and establish a local trip rate" otherwise

$Next\_Step$ = "Step 4"

STEP 4: Is a regression equation provided in *Trip Generation?*

$Step_4 :=$ "Yes" (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Step 7" if $Step_4$ = "Yes"

"Step 5" if $Step_4$ = "No"

"Requires a Yes or No response!" otherwise

$Next\_Step$ = "Step 7"

STEP 7A: Are at least 20 data points distributed over the range of the values typically found for the independent variable?

$Step_{7A} := $ "Yes"　　(ITE *Trip Generation*, 9th Edition)

STEP 7B: Are there few erratic data points (i.e. outliers)?

$Step_{7B} := $ "Yes"　　(ITE *Trip Generation*, 9th Edition)

STEP 7C: Is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{7C} := $ "Yes"　　(ITE *Trip Generation*, 9th Edition)

$Next\_Step := \begin{cases} \text{"Use the regression equation."} & \text{if } Step_{7A} = \text{"Yes"} \wedge Step_{7B} = \text{"Yes"} \wedge Step_{7C} = \text{"Yes"} \\ \text{"Step 8A1"} & \text{otherwise} \end{cases}$

$Next_Step = $ "Use the regression equation."

STEP 8A1: Is the R^2 for the regression equation greater than or equal to 0.75?

$R\_squared := 0.95$　(ITE *Trip Generation*, 9th Edition)

$Step_{8A1} := \begin{cases} \text{"Yes"} & \text{if } R\_squared \geq 0.75 \\ \text{"No"} & \text{otherwise} \end{cases}$

$Step_{8A1} = $ "Yes"

STEP 8A2: And, is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{8A2} := $ "Yes"　　(ITE *Trip Generation*, 9th Edition)

$Step_{8A} := \begin{cases} \text{"Yes"} & \text{if } Step_{8A1} = \text{"Yes"} \wedge Step_{8A2} = \text{"Yes"} \\ \text{"No"} & \text{otherwise} \end{cases}$

$Step_{8A} = $ "Yes"

STEP 8B1: Is the standard deviation for the weighted average rate less than or equal to 110 percent of the weighted average rate?

$Std\_Dev := 3.70 \dfrac{ADT}{DU}$　　(ITE *Trip Generation*, 9th Edition)

$Avg\_Rate := 9.52 \dfrac{ADT}{DU}$　　(ITE *Trip Generation*, 9th Edition)

$Ratio := \dfrac{Std\_Dev}{Avg\_Rate}$　　　$Ratio = 38.9 \cdot \%$

$Step_{8B1} := \begin{cases} \text{"Yes"} & \text{if } Ratio \leq 110\% \\ \text{"No"} & \text{otherwise} \end{cases}$

$Step_{8B1} = $ "Yes"

STEP 8B2: And, is the line that corresponds to the weighted average rate within the cluster of data points near the size of the development site?

$Step_{8B2} :=$ "Yes"   (ITE *Trip Generation,* 9th Edition)

$Step_{8B} :=$ | "Yes"   if $Step_{8B1}$ = "Yes" $\wedge$ $Step_{8B2}$ = "Yes"
| "No"   otherwise

$Step_{8B}$ = "Yes"

Choose := | "whichever line best fits the data point for the site"   if $Step_{8A}$ = "Yes" $\wedge$ $Step_{8B}$ = "Yes"
| "Use the regression equation"   if $Step_{8A}$ = "Yes" $\wedge$ $Step_{8B}$ = "No"
| "use the weighted average rate"   if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "Yes"
| "collect traffic data and establish a local trip rate"   otherwise

Choose = "whichever line best fits the data point for the site"

Exception := | "use regression"   if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "No" $\wedge$ $Step_{8A2}$ = "No" $\wedge$ $Step_{8B2}$ = "Yes"
| "use wtd avg"   if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "No" $\wedge$ $Step_{8A2}$ = "Yes" $\wedge$ $Step_{8B2}$ = "No"
| Choose   otherwise

Exception = "whichever line best fits the data point for the site"

Estimated Total Average Daily Vehicle Trip Ends, Weekday

Regression curve: $T_{sfd\_ADT} := \exp\left(0.92 \cdot \ln\left(\dfrac{X_{sfd}}{DU} \right) + 2.72 \right) \cdot ADT$ $T_{sfd\_ADT} = 826 \cdot ADT$

ADT ADJUSTMENTS

Internal Capture Rate for Multi-Use Development

$P_0 := 0\%$ (ITE *Trip Generation Handbook,* Tables 7.1 and 7.2)

Modal Distribution

$P_1 := 0\%$ (Estimated Pedestrian Mode)

$P_2 := 0\%$ (Estimated Bicycle Mode)

$P_3 := 0\%$ (Estimated Transit Mode)

Estimated Average Roadway Daily Vehicle Trip Ends, Weekday

$T_{sfd\_ADT\_veh} := T_{sfd\_ADT} \cdot \left(100\% - \sum P \right)$ $T_{sfd\_ADT\_veh} = 826 \cdot ADT$

Entering/Exiting Distribution

Entering Distribution:

$Enter\_ADT := 50\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_ADT\_Enter} := Enter\_ADT \cdot T_{sfd\_ADT\_veh}$ $T_{sfd\_ADT\_Enter} = 413 \cdot ADT$

Exiting Distribution:

$Exit\_ADT := 50\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_ADT\_Exit} := Exit\_ADT \cdot T_{sfd\_ADT\_veh}$ $T_{sfd\_ADT\_Exit} = 413 \cdot ADT$

Confirm that all traffic is counted:

$Check := if(T_{sfd\_ADT\_Enter} + T_{sfd\_ADT\_Exit} = T_{sfd\_ADT\_veh}, \text{"OK"}, \text{"Missing Traffic"})$

$Check = \text{"OK"}$

<u>Single Family Detached Housing - AM PEAK HOUR of Adjacent Street Traffic</u>

STEP 1: Is the development under analysis consistent with the description of the land use code in (ITE *Trip Generation* and with the described or presumed characteristics of development site for which the data points are provided?

$Step_1 :=$ "Yes"

$Next\_Step :=$ | "Step 2"   if $Step_1 =$ "Yes"
| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step =$ "Step 2"

STEP 2: Is the size of the development under analysis (in terms of the unit of measurement of the independent variable) within the range of the data shown in the data plot?

$Data\_Low :=$ 20DU $Data\_High :=$ 2900DU   (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Step 3"   if $Data\_Low \leq min(X_{sfd}) \wedge max(X_{sfd}) \leq Data\_High$
| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step =$ "Step 3"

STEP 3: How many data points comprise the sample reported in *Trip Generation?*

$Data\_Points :=$ 292   (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Step 4"   if $Data\_Points \geq 6$
| "Step 4 but collect local data to support ITE rate"   if $3 \leq Data\_Points \leq 5$
| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step =$ "Step 4"

STEP 4: Is a regression equation provided in *Trip Generation?*

$Step_4 :=$ "Yes"

$Next\_Step :=$ | "Step 7"   if $Step_4 =$ "Yes"
| "Step 5"   if $Step_4 =$ "No"
| "Requires a Yes or No response!"   otherwise

$Next\_Step =$ "Step 7"

STEP 7A: Are at least 20 data points distributed over the range of the values typically found for the independent variable?

$Step_{7A} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

STEP 7B: Are there few erratic data points (i.e. outliers)?

$Step_{7B} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

STEP 7B: Is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$\text{Step}_{7C} := \text{"Yes"}$ (ITE *Trip Generation*, 9th Edition)

$\text{Next\_Step} := \begin{cases} \text{"Use the regression equation."} & \text{if} \quad \text{Step}_{7A} = \text{"Yes"} \wedge \text{Step}_{7B} = \text{"Yes"} \wedge \text{Step}_{7C} = \text{"Yes"} \\ \text{"Step 8A1"} & \text{otherwise} \end{cases}$

$\text{Next\_Step} = \text{"Use the regression equation."}$

STEP 8A1: Is the R^2 for the regression equation greater than or equal to 0.75?

$\text{R\_squared} := 0.89$ (ITE *Trip Generation*, 9th Edition)

$\text{Step}_{8A1} := \begin{cases} \text{"Yes"} & \text{if} \quad \text{R\_squared} \geq 0.75 \\ \text{"No"} & \text{otherwise} \end{cases}$

$\text{Step}_{8A1} = \text{"Yes"}$

STEP 8A2: And, is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$\text{Step}_{8A2} := \text{"Yes"}$ (ITE *Trip Generation*, 9th Edition)

$\text{Step}_{8A} := \begin{cases} \text{"Yes"} & \text{if} \quad \text{Step}_{8A1} = \text{"Yes"} \wedge \text{Step}_{8A2} = \text{"Yes"} \\ \text{"No"} & \text{otherwise} \end{cases}$

$\text{Step}_{8A} = \text{"Yes"}$

STEP 8B1: Is the standard deviation for the weighted average rate less than or equal to 110 percent of the weighted average rate?

$\text{Std\_Dev} := 0.90 \dfrac{\text{VPH}}{\text{DU}}$ (ITE *Trip Generation*, 9th Edition)

$\text{Avg\_Rate} := 0.75 \dfrac{\text{VPH}}{\text{DU}}$ (ITE *Trip Generation*, 9th Edition)

$\text{Ratio} := \dfrac{\text{Std\_Dev}}{\text{Avg\_Rate}}$ $\text{Ratio} = 120.0 \cdot \%$

$\text{Step}_{8B1} := \begin{cases} \text{"Yes"} & \text{if} \quad \text{Ratio} \leq 110\% \\ \text{"No"} & \text{otherwise} \end{cases}$

$\text{Step}_{8B1} = \text{"No"}$

STEP 8B2: And, is the line that corresponds to the weighted average rate within the cluster of data points near the size of the development site?

$\text{Step}_{8B2} := \text{"Yes"}$ (ITE *Trip Generation*, 9th Edition)

$\text{Step}_{8B} := \begin{cases} \text{"Yes"} & \text{if } \text{Step}_{8B1} = \text{"Yes"} \land \text{Step}_{8B2} = \text{"Yes"} \\ \text{"No"} & \text{otherwise} \end{cases}$

$\text{Step}_{8B} = \text{"No"}$

$\text{Choose} := \begin{cases} \text{"whichever line best fits the data point for the site"} & \text{if } \text{Step}_{8A} = \text{"Yes"} \land \text{Step}_{8B} = \text{"Yes"} \\ \text{"Use the regression equation"} & \text{if } \text{Step}_{8A} = \text{"Yes"} \land \text{Step}_{8B} = \text{"No"} \\ \text{"use the weighted average rate"} & \text{if } \text{Step}_{8A} = \text{"No"} \land \text{Step}_{8B} = \text{"Yes"} \\ \text{"collect traffic data and establish a local trip rate"} & \text{otherwise} \end{cases}$

$\text{Choose} = \text{"Use the regression equation"}$

$\text{Exception} := \begin{cases} \text{"use regression"} & \text{if } \text{Step}_{8A} = \text{"No"} \land \text{Step}_{8B} = \text{"No"} \land \text{Step}_{8A2} = \text{"Yes"} \land \text{Step}_{8B2} = \text{"No"} \\ \text{"use wtd avg"} & \text{if } \text{Step}_{8A} = \text{"No"} \land \text{Step}_{8B} = \text{"No"} \land \text{Step}_{8A2} = \text{"No"} \land \text{Step}_{8B2} = \text{"Yes"} \\ \text{Choose} & \text{otherwise} \end{cases}$

$\text{Exception} = \text{"Use the regression equation"}$

Estimated Average Vehicle Trip Ends, Weekday Roadway AM Peak

Regression curve: $T_{sfd\_AM} := \left[0.70 \cdot \left(\dfrac{X_{sfd}}{DU} \right) + 9.74 \right] \cdot VPH$ $T_{sfd\_AM} = 64 \cdot VPH$

AM PEAK HOUR ADJUSTMENTS

Internal Capture Rate for Multi-Use Development

$P_0 := 0\%$ (ITE *Trip Generation Handbook*, Tables 7.1 and 7.2)

Modal Distribution

$P_1 = 0.00 \cdot \%$ (Estimated Pedestrian Mode)

$P_2 = 0.00 \cdot \%$ (Estimated Bicycle Mode)

$P_3 = 0.00 \cdot \%$ (Estimated Transit Mode)

Adjusted Average Roadway Daily Vehicle Trip Ends, Roadway AM Peak Hour

$T_{sfd\_AM\_veh} := T_{sfd\_AM} \cdot \left(100\% - \sum P \right)$ $T_{sfd\_AM\_veh} = 64 \cdot VPH$

Entering/Exiting Distribution

Entering Distribution:

$\text{Enter\_AM} := 25\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_AM\_Enter} := \text{Enter\_AM} \cdot T_{sfd\_AM\_veh}$ $T_{sfd\_AM\_Enter} = 16 \cdot \text{VPH}$

Exiting Distribution:

$\text{Exit\_AM} := 75\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_AM\_Exit} := \text{Exit\_AM} \cdot T_{sfd\_AM\_veh}$ $T_{sfd\_AM\_Exit} = 48 \cdot \text{VPH}$

Confirm that all traffic is counted:

$\text{Check} := \text{if}\left(T_{sfd\_AM\_Enter} + T_{sfd\_AM\_Exit} = T_{sfd\_AM\_veh}, \text{"OK"}, \text{"Missing Traffic"}\right)$

$\text{Check} = \text{"OK"}$

Single Family Detached Housing Land Use - PM PEAK HOUR of Adjacent Street Traffic

STEP 1: Is the development under analysis consistent with the description of the land use code in *Trip Generation* and with the described or presumed characteristics of development site for which the data points are provided?

$Step_1 :=$ "Yes"

$Next\_Step :=$ | "Step 2"   if $Step_1 =$ "Yes"

| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step =$ "Step 2"

STEP 2: Is the size of the development under analysis (in terms of the unit of measurement of the independent variable) within the range of the data shown in the data plot?

$Data\_Low :=$ 20DU $Data\_High :=$ 2900DU   (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Step 3"   if $Data\_Low \leq min(X_{sfd}) \wedge max(X_{sfd}) \leq Data\_High$

| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step =$ "Step 3"

STEP 3: How many data points comprise the sample reported in *Trip Generation*?

$Data\_Points :=$ 321   (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Step 4"   if $Data\_Points \geq 6$

| "Step 4 but collect local data to support ITE rate"   if $3 \leq Data\_Points \leq 5$

| "Collect local traffic data and establish a local trip rate"   otherwise

$Next\_Step =$ "Step 4"

STEP 4: Is a regression equation provided in in *Trip Generation*?

$Step_4 :=$ "Yes"

$Next\_Step :=$ | "Step 7"   if $Step_4 =$ "Yes"

| "Step 5"   if $Step_4 =$ "No"

| "Requires a Yes or No response!"   otherwise

$Next\_Step =$ "Step 7"

STEP 7A: Are at least 20 data points distributed over the range of the values typically found for the independent variable?

$Step_{7A} :=$ "Yes" (ITE *Trip Generation*, 9th Edition)

STEP 7B: Are there few erratic data points (i.e. outliers)?

$Step_{7B} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

STEP 7C: Is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$\text{Step}_{7C} := \text{"Yes"}$ (ITE *Trip Generation*, 9th Edition)

$\text{Next\_Step} := \begin{vmatrix} \text{"Use the regression equation."} & \text{if} & \text{Step}_{7A} = \text{"Yes"} \wedge \text{Step}_{7B} = \text{"Yes"} \wedge \text{Step}_{7C} = \text{"Yes"} \\ \text{"Step 8A1"} & \text{otherwise} \end{vmatrix}$

$\text{Next\_Step} = \text{"Use the regression equation."}$

STEP 8A1: Is the R^2 for the regression equation greater than or equal to 0.75?

$\text{R\_squared} := 0.91$ (ITE *Trip Generation*, 9th Edition)

$\text{Step}_{8A1} := \begin{vmatrix} \text{"Yes"} & \text{if} & \text{R\_squared} \geq 0.75 \\ \text{"No"} & \text{otherwise} \end{vmatrix}$

$\text{Step}_{8A1} = \text{"Yes"}$

STEP 8A2: And, is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$\text{Step}_{8A2} := \text{"Yes"}$ (ITE *Trip Generation*, 9th Edition)

$\text{Step}_{8A} := \begin{vmatrix} \text{"Yes"} & \text{if} & \text{Step}_{8A1} = \text{"Yes"} \wedge \text{Step}_{8A2} = \text{"Yes"} \\ \text{"No"} & \text{otherwise} \end{vmatrix}$

$\text{Step}_{8A} = \text{"Yes"}$

STEP 8B1: Is the standard deviation for the weighted average rate less than or equal to 110 percent of the weighted average rate?

$\text{Std\_Dev} := 1.05 \dfrac{\text{VPH}}{\text{DU}}$ (ITE *Trip Generation*, 9th Edition)

$\text{Avg\_Rate} := 1.00 \dfrac{\text{VPH}}{\text{DU}}$ (ITE *Trip Generation*, 9th Edition)

$\text{Ratio} := \dfrac{\text{Std\_Dev}}{\text{Avg\_Rate}}$ $\text{Ratio} = 105.0 \cdot \%$

$\text{Step}_{8B1} := \begin{vmatrix} \text{"Yes"} & \text{if} & \text{Ratio} \leq 110\% \\ \text{"No"} & \text{otherwise} \end{vmatrix}$

$\text{Step}_{8B1} = \text{"Yes"}$

STEP 8B2: And, is the line that corresponds to the weighted average rate within the cluster of data points near the size of the development site?

$Step_{8B2}$:= "Yes"   (ITE *Trip Generation*, 9th Edition)

$Step_{8B}$:= | "Yes" if $Step_{8B1}$ = "Yes" $\land$ $Step_{8B2}$ = "Yes"
| "No" otherwise

$Step_{8B}$ = "Yes"

Choose := | "whichever line best fits the data point for the site" if $Step_{8A}$ = "Yes" $\land$ $Step_{8B}$ = "Yes"
| "Use the regression equation" if $Step_{8A}$ = "Yes" $\land$ $Step_{8B}$ = "No"
| "use the weighted average rate" if $Step_{8A}$ = "No" $\land$ $Step_{8B}$ = "Yes"
| "collect traffic data and establish a local trip rate" otherwise

Choose = "whichever line best fits the data point for the site"

Exception := | "use regression" if $Step_{8A}$ = "No" $\land$ $Step_{8B}$ = "No" $\land$ $Step_{8A2}$ = "Yes" $\land$ $Step_{8B2}$ = "No"
| "use wtd avg" if $Step_{8A}$ = "No" $\land$ $Step_{8B}$ = "No" $\land$ $Step_{8A2}$ = "No" $\land$ $Step_{8B2}$ = "Yes"
| Choose otherwise

Exception = "whichever line best fits the data point for the site"

Estimated Average Vehicle Trip Ends, Weekday Roadway PM Peak Hour

Regression curve: $T_{sfd\_PM} := \exp\left(0.90 \cdot \ln\left(\dfrac{X_{sfd}}{DU} \right) + 0.51 \right) \cdot VPH$ $T_{sfd\_PM} = 83 \cdot VPH$

PM PEAK HOUR ADJUSTMENTS

Internal Capture Rate for Multi-Use Development

P_0 := 0%   (ITE *Trip Generation Handbook*, Tables 7.1 and 7.2)

Modal Distribution

P_1 = 0.00·%   (Estimated Pedestrian Mode)

P_2 = 0.00·%   (Estimated Bicycle Mode)

P_3 = 0.00·%   (Estimated Transit Mode)

Adjusted Average Roadway Daily Vehicle Trip Ends, Roadway PM Peak Hour

$T_{sfd\_PM\_veh} := T_{sfd\_PM} \cdot \left(100\% - \sum P \right)$ $T_{sfd\_PM\_veh} = 83 \cdot VPH$

Entering/Exiting Distribution

Entering Distribution:

$\text{Enter\_PM} := 63\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_PM\_Enter} := \text{Enter\_PM} \cdot T_{sfd\_PM\_veh}$ $\qquad\qquad\qquad T_{sfd\_PM\_Enter} = 52 \cdot \text{VPH}$

Exiting Distribution:

$\text{Exit\_PM} := 37\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_PM\_Exit} := \text{Exit\_PM} \cdot T_{sfd\_PM\_veh}$ $\qquad\qquad\qquad T_{sfd\_PM\_Exit} = 31 \cdot \text{VPH}$

Confirm all traffic is represented

$\text{Check} := \text{if}\left(T_{sfd\_PM\_Enter} + T_{sfd\_PM\_Exit} = T_{sfd\_PM\_veh}, \text{"OK"}, \text{"Missing Traffic"}\right)$

$\text{Check} = \text{"OK"}$

SUMMARY OF ANALYSES

Traffic Parameter	Total Traffic	Entering Traffic	Exiting Traffic
Average Daily Traffic	$T_{sfd\_ADT\_veh} = 826 \cdot \text{ADT}$	$T_{sfd\_ADT\_Enter} = 413 \cdot \text{ADT}$	$T_{sfd\_ADT\_Exit} = 413 \cdot \text{ADT}$
AM Peak Hour Traffic	$T_{sfd\_AM\_veh} = 64 \cdot \text{VPH}$	$T_{sfd\_AM\_Enter} = 16 \cdot \text{VPH}$	$T_{sfd\_AM\_Exit} = 48 \cdot \text{VPH}$
PM Peak Hour Traffic	$T_{sfd\_PM\_veh} = 83 \cdot \text{VPH}$	$T_{sfd\_PM\_Enter} = 52 \cdot \text{VPH}$	$T_{sfd\_PM\_Exit} = 31 \cdot \text{VPH}$

FAIRWAY ESTATES PHASES I & II + VACANT
VEHICULAR TRAFFIC ESTIMATES
FLORENCE, OREGON

Special Units & Dimensions Used in this Analysis

$SF := ft^2$ $KSF := 1000SF$ $DU := 2500SF$ $VPH := hr^{-1}$ $ADT := day^{-1}$

Procedure: Follow the decision tree shown in Figure 3.1 Recommended Procedure for Selecting Between Trip Generation Average Rates and Equations, ITE Trip Generation Handbook, 2012.
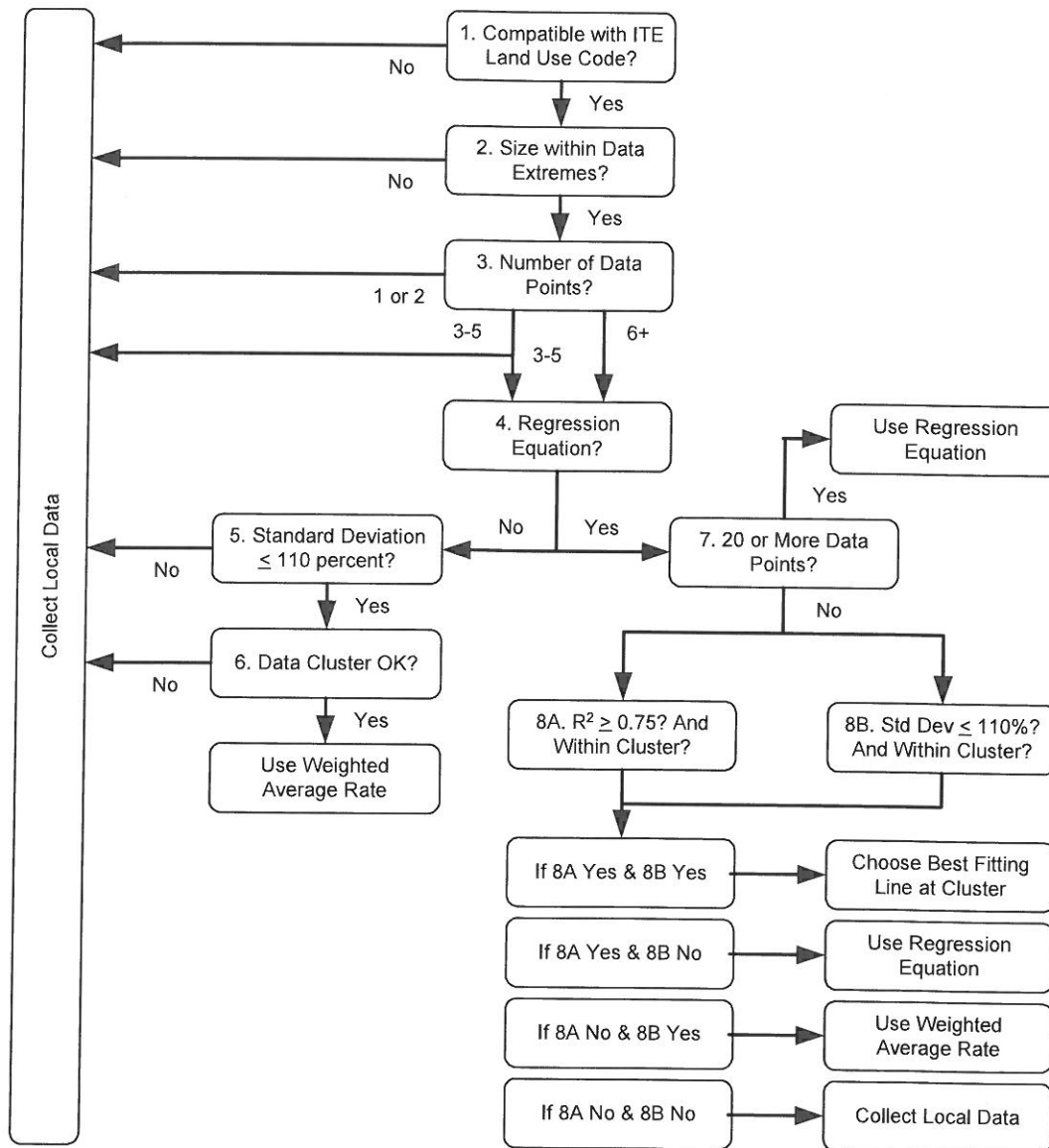
Land Uses, ITE Land Use Codes

Code & Land Use

Independent Variable

210 Single-Family Detached Housing

$X_{sfd} := 117DU$

Single Family Detached Housing Land Use - Average Weekday Traffic

STEP 1: Is the development under analysis consistent with the description of the land use code in *Trip Generation* and with the described or presumed characteristics of development site for which the data points are provided?

$Step_1 := "Yes"$

$Next\_Step := \begin{vmatrix} "Step\ 2" & if & Step_1 = "Yes" \\ "Collect\ local\ traffic\ data\ and\ establish\ a\ local\ trip\ rate" & otherwise \end{vmatrix}$

$Next\_Step = "Step\ 2"$

STEP 2: Is the size of the development under analysis (in terms of the unit of measurement of the independent variable) within the range of the data shown in the data plot?

$Data\_Low := 10DU$ $Data\_High := 2900DU$ (ITE *Trip Generation,* 9th Edition)

$Next\_Step := \begin{vmatrix} "Step\ 3" & if & Data\_Low \le min(X_{sfd}) \wedge max(X_{sfd}) \le Data\_High \\ "Collect\ local\ traffic\ data\ and\ establish\ a\ local\ trip\ rate" & otherwise \end{vmatrix}$

$Next\_Step = "Step\ 3"$

STEP 3: How many data points comprise the sample reported in *Trip Generation?*

$Data\_Points := 355$ (ITE *Trip Generation,* 9th Edition)

$Next\_Step := \begin{vmatrix} "Step\ 4" & if & Data\_Points \ge 6 \\ "Step\ 4\ but\ collect\ local\ data\ to\ support\ ITE\ rate" & if & 3 \le Data\_Points \le 5 \\ "Collect\ local\ traffic\ data\ and\ establish\ a\ local\ trip\ rate" & otherwise \end{vmatrix}$

$Next\_Step = "Step\ 4"$

STEP 4: Is a regression equation provided in *Trip Generation?*

$Step_4 := "Yes"$ (ITE *Trip Generation,* 9th Edition)

$Next\_Step := \begin{vmatrix} "Step\ 7" & if & Step_4 = "Yes" \\ "Step\ 5" & if & Step_4 = "No" \\ "Requires\ a\ Yes\ or\ No\ response!" & otherwise \end{vmatrix}$

$Next\_Step = "Step\ 7"$

STEP 7A: Are at least 20 data points distributed over the range of the values typically found for the independent variable?

$Step_{7A} := \text{"Yes"}$ (ITE *Trip Generation,* 9th Edition)

STEP 7B: Are there few erratic data points (i.e. outliers)?

$Step_{7B} := \text{"Yes"}$ (ITE *Trip Generation,* 9th Edition)

STEP 7C: Is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{7C} := \text{"Yes"}$ (ITE *Trip Generation,* 9th Edition)

$$Next\_Step := \begin{vmatrix} \text{"Use the regression equation."} & \text{if} & Step_{7A} = \text{"Yes"} \wedge Step_{7B} = \text{"Yes"} \wedge Step_{7C} = \text{"Yes"} \\ \text{"Step 8A1"} & \text{otherwise} \end{vmatrix}$$

$Next\_Step = \text{"Use the regression equation."}$

STEP 8A1: Is the R^2 for the regression equation greater than or equal to 0.75?

$R\_squared := 0.95$ (ITE *Trip Generation,* 9th Edition)

$$Step_{8A1} := \begin{vmatrix} \text{"Yes"} & \text{if} & R\_squared \geq 0.75 \\ \text{"No"} & \text{otherwise} \end{vmatrix}$$

$Step_{8A1} = \text{"Yes"}$

STEP 8A2: And, is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{8A2} := \text{"Yes"}$ (ITE *Trip Generation,* 9th Edition)

$$Step_{8A} := \begin{vmatrix} \text{"Yes"} & \text{if} & Step_{8A1} = \text{"Yes"} \wedge Step_{8A2} = \text{"Yes"} \\ \text{"No"} & \text{otherwise} \end{vmatrix}$$

$Step_{8A} = \text{"Yes"}$

STEP 8B1: Is the standard deviation for the weighted average rate less than or equal to 110 percent of the weighted average rate?

$Std\_Dev := 3.70 \dfrac{ADT}{DU}$ (ITE *Trip Generation,* 9th Edition)

$Avg\_Rate := 9.52 \dfrac{ADT}{DU}$ (ITE *Trip Generation,* 9th Edition)

$Ratio := \dfrac{Std\_Dev}{Avg\_Rate}$ $Ratio = 38.9 \cdot \%$

$$Step_{8B1} := \begin{vmatrix} \text{"Yes"} & \text{if} & Ratio \leq 110\% \\ \text{"No"} & \text{otherwise} \end{vmatrix}$$

$Step_{8B1} = \text{"Yes"}$

STEP 8B2: And, is the line that corresponds to the weighted average rate within the cluster of data points near the size of the development site?

$Step_{8B2} :=$ "Yes"   (ITE *Trip Generation,* 9th Edition)

$Step_{8B} :=$ | "Yes"   if $Step_{8B1}$ = "Yes" $\wedge$ $Step_{8B2}$ = "Yes"
| "No"   otherwise

$Step_{8B}$ = "Yes"

$Choose :=$ | "whichever line best fits the data point for the site"   if $Step_{8A}$ = "Yes" $\wedge$ $Step_{8B}$ = "Yes"
| "Use the regression equation"   if $Step_{8A}$ = "Yes" $\wedge$ $Step_{8B}$ = "No"
| "use the weighted average rate"   if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "Yes"
| "collect traffic data and establish a local trip rate"   otherwise

Choose = "whichever line best fits the data point for the site"

$Exception :=$ | "use regression"   if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "No" $\wedge$ $Step_{8A2}$ = "No" $\wedge$ $Step_{8B2}$ = "Yes"
| "use wtd avg"   if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "No" $\wedge$ $Step_{8A2}$ = "Yes" $\wedge$ $Step_{8B2}$ = "No"
| Choose   otherwise

Exception = "whichever line best fits the data point for the site"

Estimated Total Average Daily Vehicle Trip Ends, Weekday

Regression curve: $T_{sfd\_ADT} := \exp\left(0.92 \cdot \ln\left(\dfrac{X_{sfd}}{DU}\right) + 2.72\right) \cdot ADT$ $T_{sfd\_ADT} = 1213 \cdot ADT$

ADT ADJUSTMENTS

Internal Capture Rate for Multi-Use Development

$P_0 := 0\%$ (ITE *Trip Generation Handbook,* Tables 7.1 and 7.2)

Modal Distribution

$P_1 := 0\%$ (Estimated Pedestrian Mode)

$P_2 := 0\%$ (Estimated Bicycle Mode)

$P_3 := 0\%$ (Estimated Transit Mode)

Estimated Average Roadway Daily Vehicle Trip Ends, Weekday

$T_{sfd\_ADT\_veh} := T_{sfd\_ADT} \cdot \left(100\% - \sum P\right)$ $T_{sfd\_ADT\_veh} = 1213 \cdot ADT$

Entering/Exiting Distribution

Entering Distribution:

$Enter\_ADT := 50\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_ADT\_Enter} := Enter\_ADT \cdot T_{sfd\_ADT\_veh}$ $T_{sfd\_ADT\_Enter} = 607 \cdot ADT$

Exiting Distribution:

$Exit\_ADT := 50\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_ADT\_Exit} := Exit\_ADT \cdot T_{sfd\_ADT\_veh}$ $T_{sfd\_ADT\_Exit} = 607 \cdot ADT$

Confirm that all traffic is counted:

$Check := if(T_{sfd\_ADT\_Enter} + T_{sfd\_ADT\_Exit} = T_{sfd\_ADT\_veh}, "OK", "Missing Traffic")$

$Check = "OK"$

Single Family Detached Housing - AM PEAK HOUR of Adjacent Street Traffic

STEP 1: Is the development under analysis consistent with the description of the land use code in(ITE *Trip Generation* and with the described or presumed characteristics of development site for which the data points are provided?

$Step_1 :=$ "Yes"

$Next\_Step :=$ | "Step 2"   if $Step_1$ = "Yes"

| "Collect local traffic data and establish a local trip rate"   otherwise

Next_Step = "Step 2"

STEP 2: Is the size of the development under analysis (in terms of the unit of measurement of the independent variable) within the range of the data shown in the data plot?

$Data\_Low :=$ 20DU $Data\_High :=$ 2900DU   (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Step 3"   if $Data\_Low \leq min(X_{sfd}) \wedge max(X_{sfd}) \leq Data\_High$

| "Collect local traffic data and establish a local trip rate"   otherwise

Next_Step = "Step 3"

STEP 3: How many data points comprise the sample reported in *Trip Generation*?

$Data\_Points :=$ 292   (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ | "Step 4"   if $Data\_Points \geq 6$

| "Step 4 but collect local data to support ITE rate"   if $3 \leq Data\_Points \leq 5$

| "Collect local traffic data and establish a local trip rate"   otherwise

Next_Step = "Step 4"

STEP 4: Is a regression equation provided in *Trip Generation?*

$Step_4 :=$ "Yes"

$Next\_Step :=$ | "Step 7"   if $Step_4$ = "Yes"

| "Step 5"   if $Step_4$ = "No"

| "Requires a Yes or No response!"   otherwise

Next_Step = "Step 7"

STEP 7A: Are at least 20 data points distributed over the range of the values typically found for the independent variable?

$Step_{7A} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

STEP 7B: Are there few erratic data points (i.e. outliers)?

$Step_{7B} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

STEP 7B: Is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{7C} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ $\begin{cases} \text{"Use the regression equation."} & \text{if} \quad Step_{7A} = \text{"Yes"} \land Step_{7B} = \text{"Yes"} \land Step_{7C} = \text{"Yes"} \\ \text{"Step 8A1"} & \text{otherwise} \end{cases}$

$Next\_Step =$ "Use the regression equation."

STEP 8A1: Is the R^2 for the regression equation greater than or equal to 0.75?

$R\_squared :=$ 0.89 (ITE *Trip Generation*, 9th Edition)

$Step_{8A1} :=$ $\begin{cases} \text{"Yes"} & \text{if} \quad R\_squared \geq 0.75 \\ \text{"No"} & \text{otherwise} \end{cases}$

$Step_{8A1} =$ "Yes"

STEP 8A2: And, is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{8A2} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

$Step_{8A} :=$ $\begin{cases} \text{"Yes"} & \text{if} \quad Step_{8A1} = \text{"Yes"} \land Step_{8A2} = \text{"Yes"} \\ \text{"No"} & \text{otherwise} \end{cases}$

$Step_{8A} =$ "Yes"

STEP 8B1: Is the standard deviation for the weighted average rate less than or equal to 110 percent of the weighted average rate?

$Std\_Dev := 0.90 \dfrac{VPH}{DU}$ (ITE *Trip Generation*, 9th Edition)

$Avg\_Rate := 0.75 \dfrac{VPH}{DU}$ (ITE *Trip Generation*, 9th Edition)

$Ratio := \dfrac{Std\_Dev}{Avg\_Rate}$ $Ratio = 120.0 \cdot \%$

$Step_{8B1} :=$ $\begin{cases} \text{"Yes"} & \text{if} \quad Ratio \leq 110\% \\ \text{"No"} & \text{otherwise} \end{cases}$

$Step_{8B1} =$ "No"

STEP 8B2: And, is the line that corresponds to the weighted average rate within the cluster of data points near the size of the development site?

$Step_{8B2} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

$Step_{8B} :=$ | "Yes" if $Step_{8B1}$ = "Yes" $\wedge$ $Step_{8B2}$ = "Yes"
| "No" otherwise

$Step_{8B}$ = "No"

$Choose :=$ | "whichever line best fits the data point for the site" if $Step_{8A}$ = "Yes" $\wedge$ $Step_{8B}$ = "Yes"
| "Use the regression equation" if $Step_{8A}$ = "Yes" $\wedge$ $Step_{8B}$ = "No"
| "use the weighted average rate" if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "Yes"
| "collect traffic data and establish a local trip rate" otherwise

Choose = "Use the regression equation"

$Exception :=$ | "use regression" if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "No" $\wedge$ $Step_{8A2}$ = "Yes" $\wedge$ $Step_{8B2}$ = "No"
| "use wtd avg" if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "No" $\wedge$ $Step_{8A2}$ = "No" $\wedge$ $Step_{8B2}$ = "Yes"
| Choose otherwise

Exception = "Use the regression equation"

<u>Estimated Average Vehicle Trip Ends, Weekday Roadway AM Peak</u>

Regression curve: $T_{sfd\_AM} := \left[0.70 \cdot \left(\dfrac{X_{sfd}}{DU} \right) + 9.74 \right] \cdot VPH$ $T_{sfd\_AM} = 92 \cdot VPH$

<u>AM PEAK HOUR ADJUSTMENTS</u>

<u>Internal Capture Rate for Multi-Use Development</u>

$P_0 := 0\%$ (ITE *Trip Generation Handbook*, Tables 7.1 and 7.2)

<u>Modal Distribution</u>

$P_1 = 0.00 \cdot \%$ (Estimated Pedestrian Mode)

$P_2 = 0.00 \cdot \%$ (Estimated Bicycle Mode)

$P_3 = 0.00 \cdot \%$ (Estimated Transit Mode)

<u>Adjusted Average Roadway Daily Vehicle Trip Ends, Roadway AM Peak Hour</u>

$T_{sfd\_AM\_veh} := T_{sfd\_AM} \cdot \left(100\% - \sum P \right)$ $T_{sfd\_AM\_veh} = 92 \cdot VPH$

Entering/Exiting Distribution

Entering Distribution:

$Enter\_AM := 25\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_AM\_Enter} := Enter\_AM \cdot T_{sfd\_AM\_veh}$ $T_{sfd\_AM\_Enter} = 23 \cdot VPH$

Exiting Distribution:

$Exit\_AM := 75\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_AM\_Exit} := Exit\_AM \cdot T_{sfd\_AM\_veh}$ $T_{sfd\_AM\_Exit} = 69 \cdot VPH$

Confirm that all traffic is counted:

$Check := if\left(T_{sfd\_AM\_Enter} + T_{sfd\_AM\_Exit} = T_{sfd\_AM\_veh}, "OK", "Missing Traffic"\right)$

$Check = "OK"$

Single Family Detached Housing Land Use - PM PEAK HOUR of Adjacent Street Traffic

STEP 1: Is the development under analysis consistent with the description of the land use code in *Trip Generation* and with the described or presumed characteristics of development site for which the data points are provided?

$Step_1 :=$ "Yes"

$Next\_Step :=$ $\begin{vmatrix} \text{"Step 2"} & \text{if} & Step_1 = \text{"Yes"} \\ \\ \text{"Collect local traffic data and establish a local trip rate"} & \text{otherwise} \end{vmatrix}$

Next_Step = "Step 2"

STEP 2: Is the size of the development under analysis (in terms of the unit of measurement of the independent variable) within the range of the data shown in the data plot?

$Data\_Low := 20DU$ $\qquad Data\_High := 2900DU$ (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ $\begin{vmatrix} \text{"Step 3"} & \text{if} & Data\_Low \leq \min(X_{sfd}) \wedge \max(X_{sfd}) \leq Data\_High \\ \\ \text{"Collect local traffic data and establish a local trip rate"} & \text{otherwise} \end{vmatrix}$

Next_Step = "Step 3"

STEP 3: How many data points comprise the sample reported in *Trip Generation*?

$Data\_Points := 321$ (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$ $\begin{vmatrix} \text{"Step 4"} & \text{if} & Data\_Points \geq 6 \\ \\ \text{"Step 4 but collect local data to support ITE rate"} & \text{if} & 3 \leq Data\_Points \leq 5 \\ \\ \text{"Collect local traffic data and establish a local trip rate"} & \text{otherwise} \end{vmatrix}$

Next_Step = "Step 4"

STEP 4: Is a regression equation provided in in *Trip Generation*?

$Step_4 :=$ "Yes"

$Next\_Step :=$ $\begin{vmatrix} \text{"Step 7"} & \text{if} & Step_4 = \text{"Yes"} \\ \\ \text{"Step 5"} & \text{if} & Step_4 = \text{"No"} \\ \\ \text{"Requires a Yes or No response!"} & \text{otherwise} \end{vmatrix}$

Next_Step = "Step 7"

STEP 7A: Are at least 20 data points distributed over the range of the values typically found for the independent variable?

$Step_{7A} :=$ "Yes" (ITE *Trip Generation*, 9th Edition)

STEP 7B: Are there few erratic data points (i.e. outliers)?

$Step_{7B} :=$ "Yes" (ITE *Trip Generation*, 9th Edition)

STEP 7C: Is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{7C} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

$Next\_Step :=$
| "Use the regression equation."   if $Step_{7A} =$ "Yes" $\wedge$ $Step_{7B} =$ "Yes" $\wedge$ $Step_{7C} =$ "Yes"
| "Step 8A1"   otherwise

$Next\_Step =$ "Use the regression equation."

STEP 8A1: Is the R^2 for the regression equation greater than or equal to 0.75?

$R\_squared :=$ 0.91   (ITE *Trip Generation*, 9th Edition)

$Step_{8A1} :=$
| "Yes"   if $R\_squared \geq 0.75$
| "No"   otherwise

$Step_{8A1} =$ "Yes"

STEP 8A2: And, is the line corresponding to the regression equation within the cluster of data points at the size of the development in question?

$Step_{8A2} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

$Step_{8A} :=$
| "Yes"   if $Step_{8A1} =$ "Yes" $\wedge$ $Step_{8A2} =$ "Yes"
| "No"   otherwise

$Step_{8A} =$ "Yes"

STEP 8B1: Is the standard deviation for the weighted average rate less than or equal to 110 percent of the weighted average rate?

$Std\_Dev := 1.05 \dfrac{VPH}{DU}$ (ITE *Trip Generation*, 9th Edition)

$Avg\_Rate := 1.00 \dfrac{VPH}{DU}$ (ITE *Trip Generation*, 9th Edition)

$Ratio := \dfrac{Std\_Dev}{Avg\_Rate}$ $Ratio = 105.0 \cdot \%$

$Step_{8B1} :=$
| "Yes"   if $Ratio \leq 110\%$
| "No"   otherwise

$Step_{8B1} =$ "Yes"

STEP 8B2: And, is the line that corresponds to the weighted average rate within the cluster of data points near the size of the development site?

$Step_{8B2} :=$ "Yes"   (ITE *Trip Generation*, 9th Edition)

$Step_{8B} :=$ | "Yes"   if $Step_{8B1}$ = "Yes" $\wedge$ $Step_{8B2}$ = "Yes"
         | "No"   otherwise

$Step_{8B}$ = "Yes"

$Choose :=$ | "whichever line best fits the data point for the site"   if $Step_{8A}$ = "Yes" $\wedge$ $Step_{8B}$ = "Yes"
       | "Use the regression equation"   if $Step_{8A}$ = "Yes" $\wedge$ $Step_{8B}$ = "No"
       | "use the weighted average rate"   if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "Yes"
       | "collect traffic data and establish a local trip rate"   otherwise

Choose = "whichever line best fits the data point for the site"

$Exception :=$ | "use regression"   if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "No" $\wedge$ $Step_{8A2}$ = "Yes" $\wedge$ $Step_{8B2}$ = "No"
            | "use wtd avg"   if $Step_{8A}$ = "No" $\wedge$ $Step_{8B}$ = "No" $\wedge$ $Step_{8A2}$ = "No" $\wedge$ $Step_{8B2}$ = "Yes"
            | Choose   otherwise

Exception = "whichever line best fits the data point for the site"

Estimated Average Vehicle Trip Ends, Weekday Roadway PM Peak Hour

Regression curve: $T_{sfd\_PM} := exp\left(0.90 \cdot ln\left(\dfrac{X_{sfd}}{DU}\right) + 0.51\right) \cdot VPH$ $T_{sfd\_PM} = 121 \cdot VPH$

PM PEAK HOUR ADJUSTMENTS

Internal Capture Rate for Multi-Use Development

$P_0 := 0\%$ (ITE *Trip Generation Handbook*, Tables 7.1 and 7.2)

Modal Distribution

$P_1 = 0.00 \cdot \%$ (Estimated Pedestrian Mode)

$P_2 = 0.00 \cdot \%$ (Estimated Bicycle Mode)

$P_3 = 0.00 \cdot \%$ (Estimated Transit Mode)

Adjusted Average Roadway Daily Vehicle Trip Ends, Roadway PM Peak Hour

$T_{sfd\_PM\_veh} := T_{sfd\_PM} \cdot \left(100\% - \sum P\right)$ $T_{sfd\_PM\_veh} = 121 \cdot VPH$

Entering/Exiting Distribution

Entering Distribution:

$Enter\_PM := 63\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_PM\_Enter} := Enter\_PM \cdot T_{sfd\_PM\_veh}$ $T_{sfd\_PM\_Enter} = 76 \cdot VPH$

Exiting Distribution:

$Exit\_PM := 37\%$ (ITE *Trip Generation*, 9th Edition)

$T_{sfd\_PM\_Exit} := Exit\_PM \cdot T_{sfd\_PM\_veh}$ $T_{sfd\_PM\_Exit} = 45 \cdot VPH$

Confirm all traffic is represented

$Check := if(T_{sfd\_PM\_Enter} + T_{sfd\_PM\_Exit} = T_{sfd\_PM\_veh}, "OK", "Missing Traffic")$

$Check = "OK"$

SUMMARY OF ANALYSES

Traffic Parameter	Total Traffic	Entering Traffic	Exiting Traffic
Average Daily Traffic	$T_{sfd\_ADT\_veh} = 1213 \cdot ADT$	$T_{sfd\_ADT\_Enter} = 607 \cdot ADT$	$T_{sfd\_ADT\_Exit} = 607 \cdot ADT$
AM Peak Hour Traffic	$T_{sfd\_AM\_veh} = 92 \cdot VPH$	$T_{sfd\_AM\_Enter} = 23 \cdot VPH$	$T_{sfd\_AM\_Exit} = 69 \cdot VPH$
PM Peak Hour Traffic	$T_{sfd\_PM\_veh} = 121 \cdot VPH$	$T_{sfd\_PM\_Enter} = 76 \cdot VPH$	$T_{sfd\_PM\_Exit} = 45 \cdot VPH$