2019 Project Traffic Forecasting Handbook Training

Webinar

Welcome

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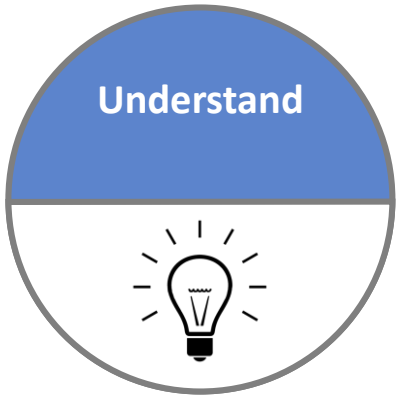
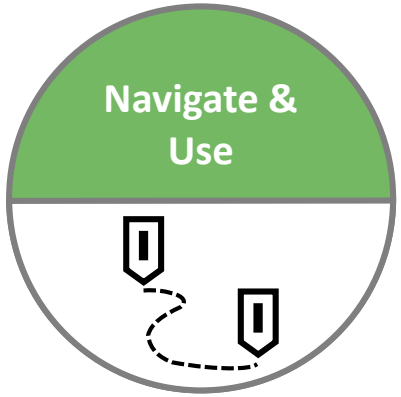
Training Objectives

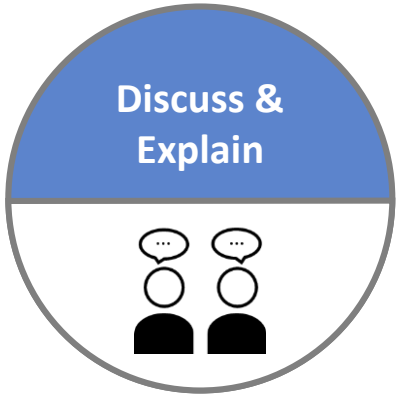
- At the conclusion of this training, you will be able to…



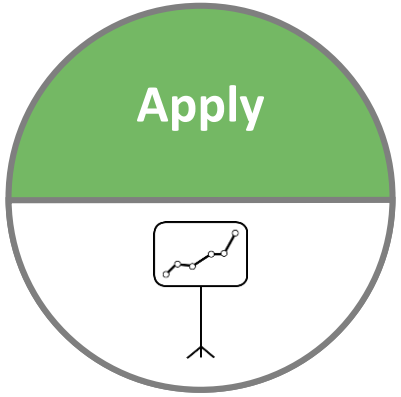
Understand the purpose of the Florida Department of Transportation (FDOT) Traffic Forecasting Handbook



Navigate and use the FDOT Project Traffic Forecasting Handbook

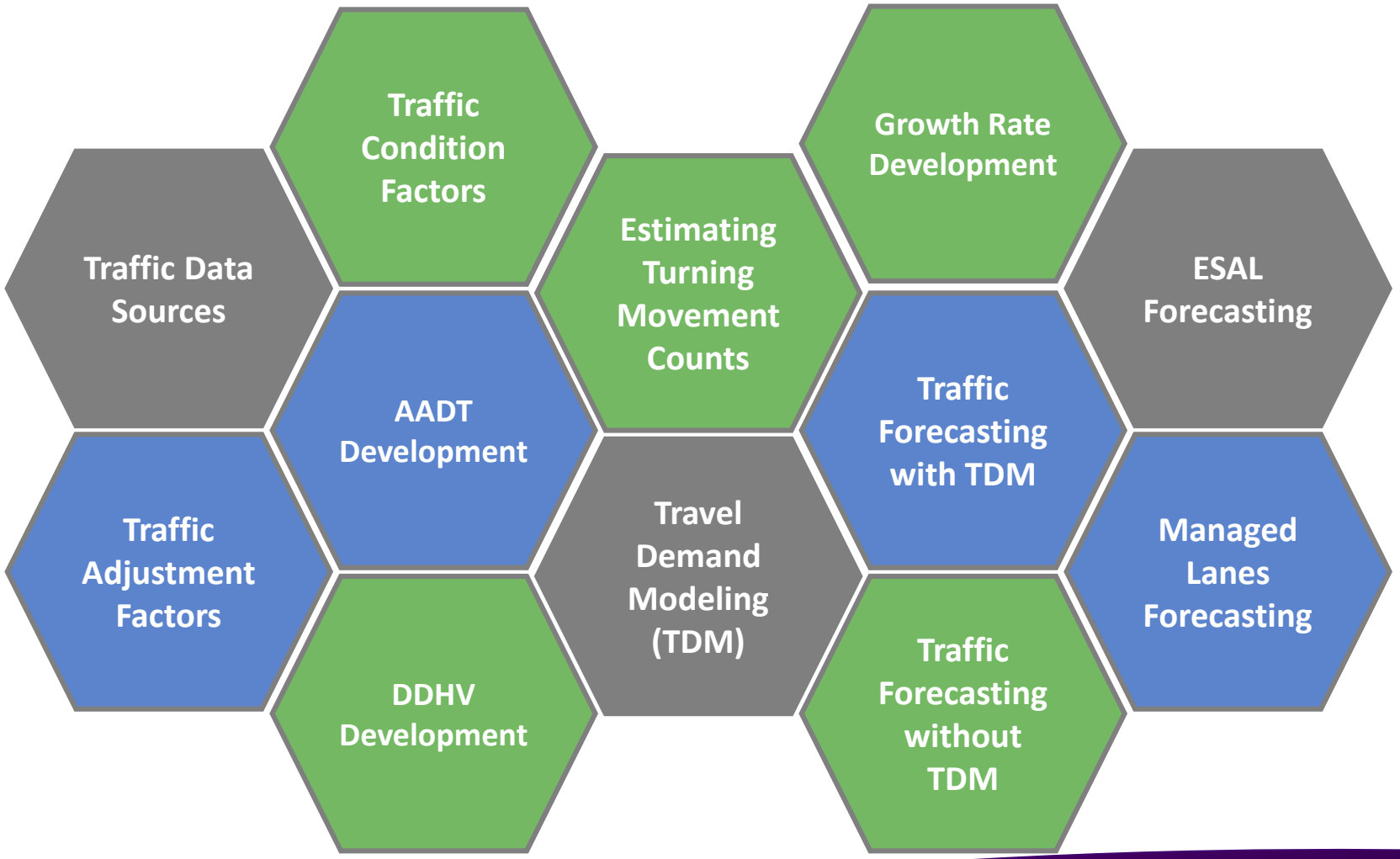


Discuss and explain FDOT guidelines on principles and techniques for various stages of traffic development



Apply the traffic development processes for varying project types

General Concepts being Covered



Agenda

- This webinar will cover Project Traffic Forecasting Handbook Overview & Application

- ❑ Introduction
- ❑ Traffic Data Sources and Factors
- ❑ Forecasting with Travel Demand Model
- ❑ Forecasting without Travel Demand Model
- ❑ Directional Design Hour Volumes
- ❑ Estimating Intersection Turning Movements
- ❑ ESAL Forecasting
- ❑ Tolled Managed Lanes Forecasting
- ❑ Practice Problems/Project Examples
- ❑ Quizzes

Introduction

- Background
- Purpose of the Handbook
- Who Uses the Handbook?
- Purpose of Project Traffic Forecasting
- Traffic Forecasting Process
- Quiz

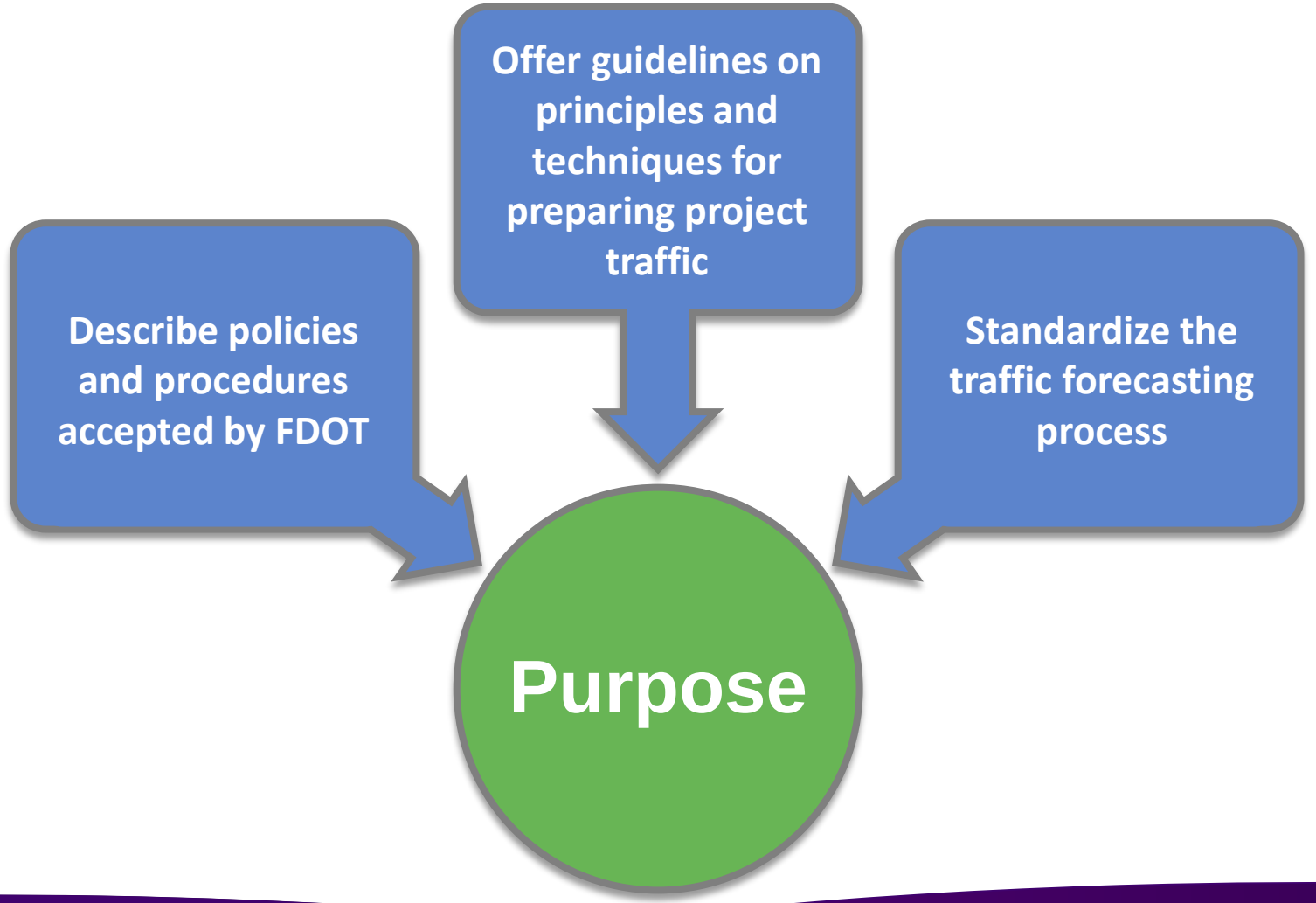
Background

- It is the policy of the Florida Department of Transportation (FDOT)
  - To provide instructions for using design traffic criteria to forecast
    - Corridor Traffic
    - Project Traffic
    - 18-KIP Equivalent Single Axle Load (ESAL)

- This Handbook supplements the Project Traffic Forecasting Procedure Topic No.525-030-120

- 2019 Project Traffic Forecasting Handbook

Purpose of the Handbook



Who Uses the Handbook?

- FDOT
- Local Governments
- MPOs, TPOs, TPAs
- Consultant engineers and planners

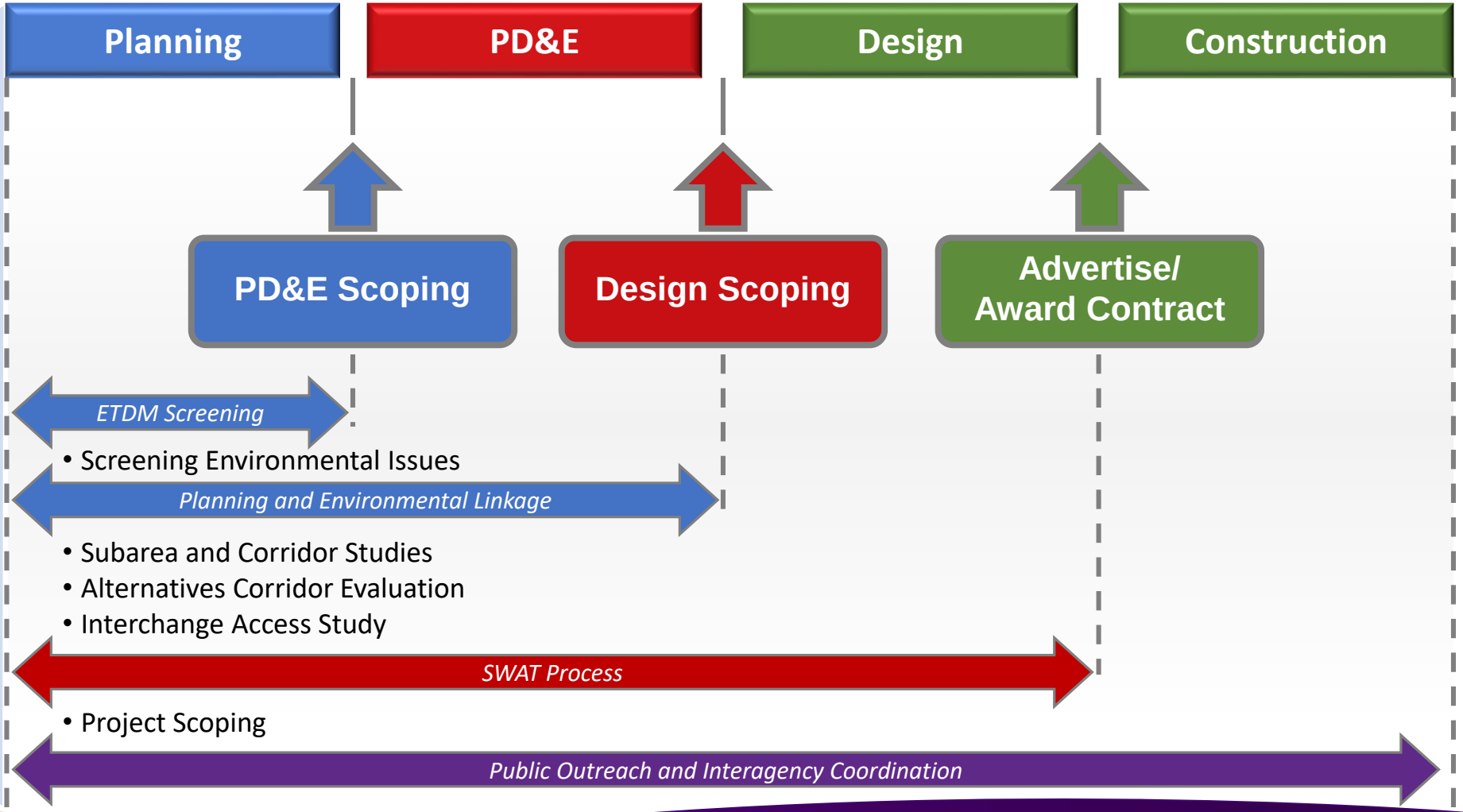
This Handbook is used to develop, review, accept or approve project traffic developed for infrastructure projects

Purpose of Project Traffic Forecasting

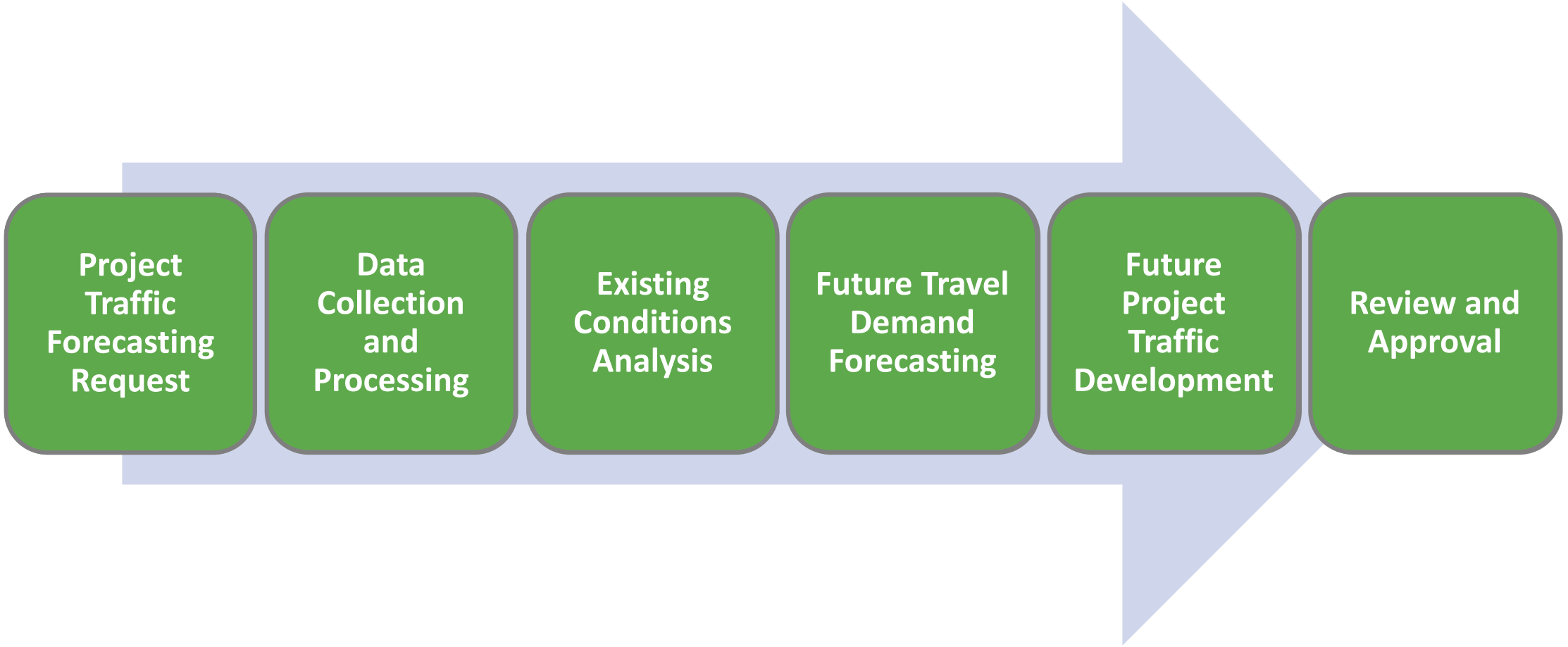
- Support the FDOT Mission and Vision
- Maintain Existing Facilities
- Plan for Future Transportation Needs

Purpose of Project Traffic Forecasting

Project Traffic Forecasting is needed throughout project development



Traffic Forecasting Process



Introduction

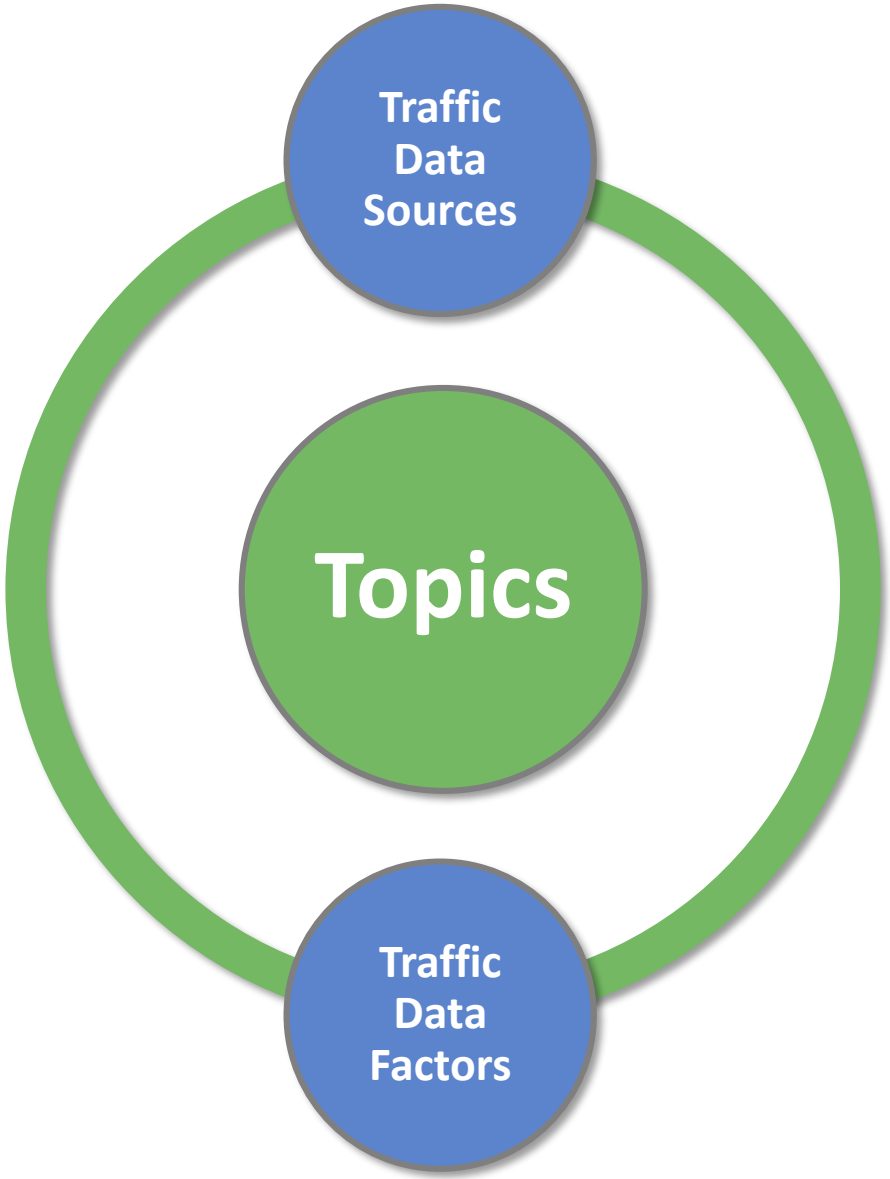
QUIZ

Traffic Data Sources and Factors

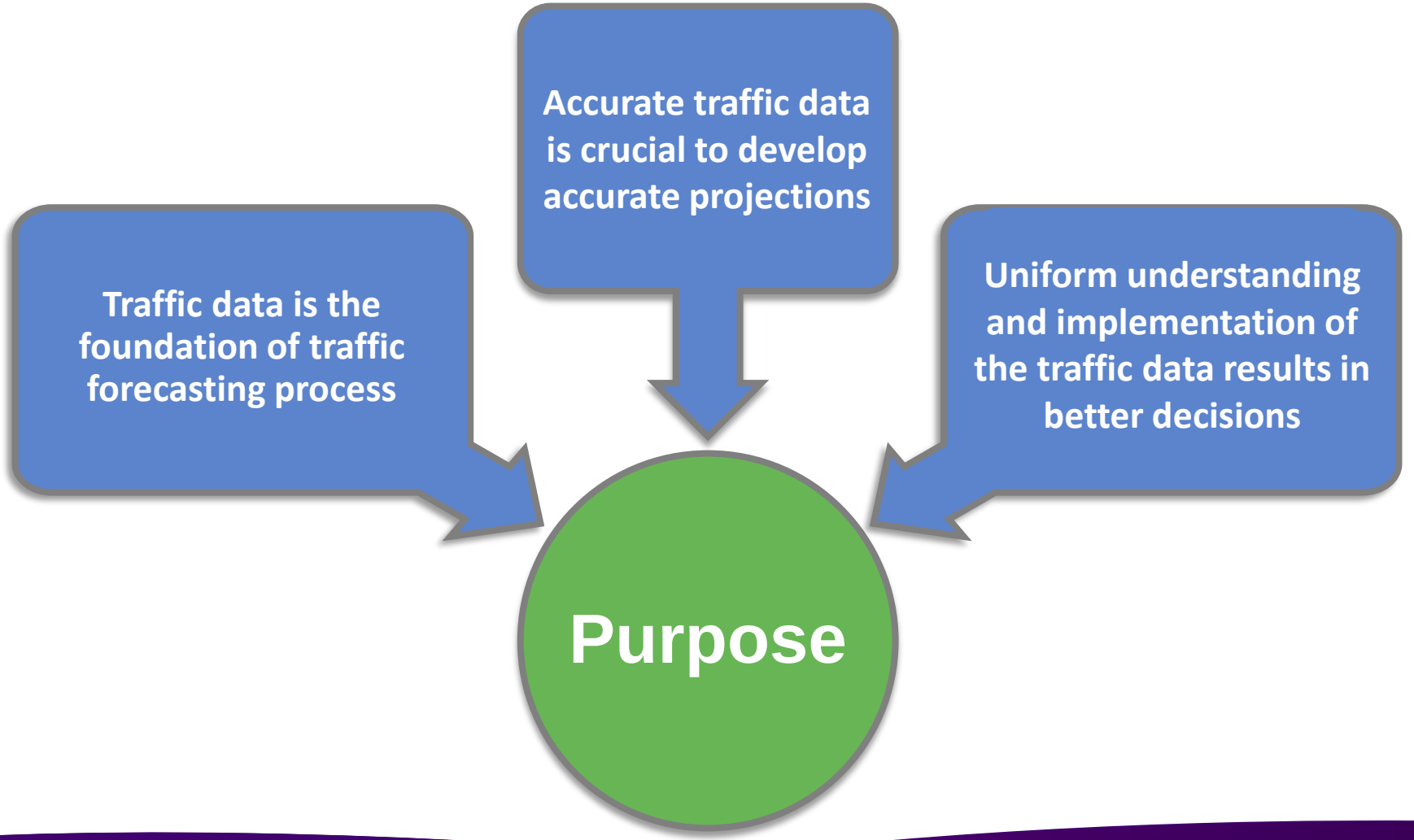
- Introduction
- Purpose
- Traffic Data Sources
- Traffic Data Factors
- Quiz

Introduction

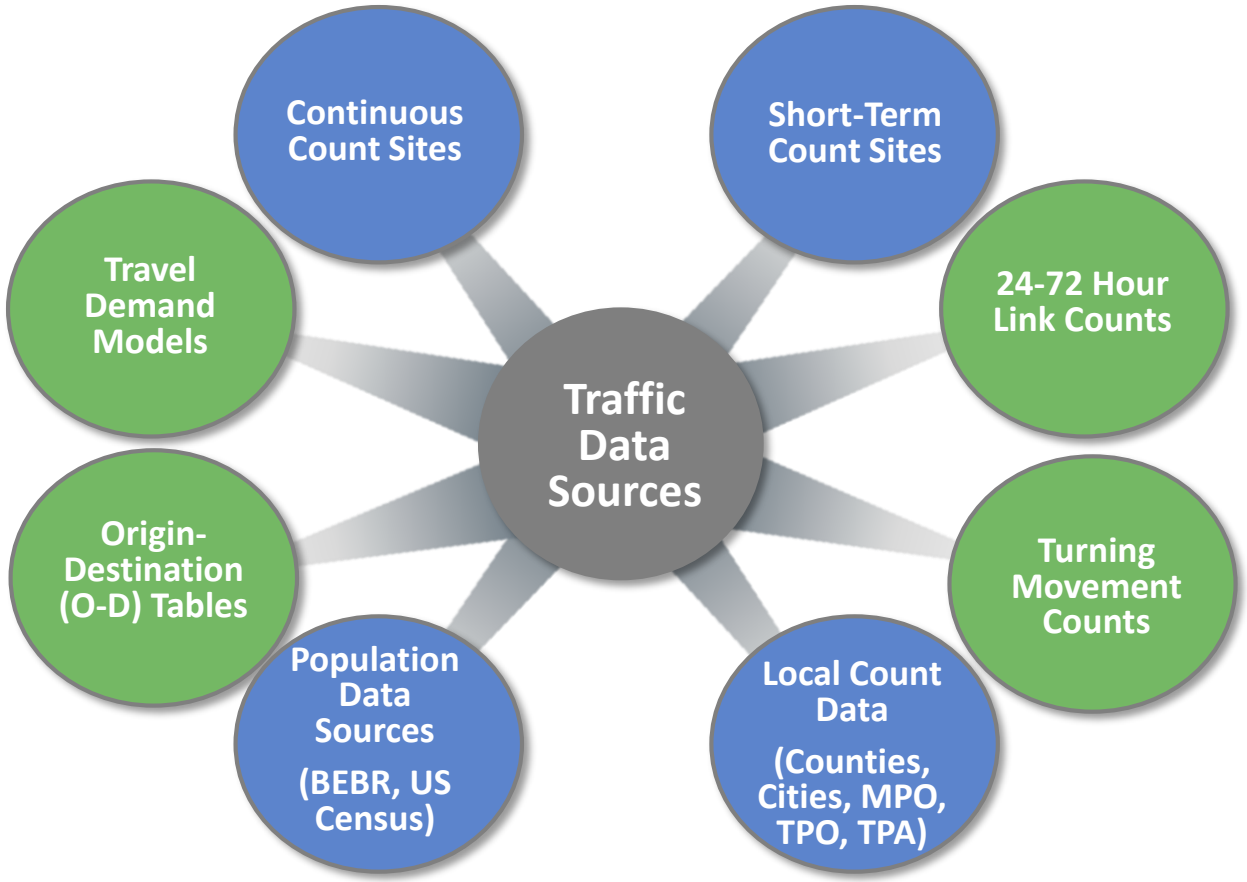
- FDOT collects and stores a broad range of traffic data



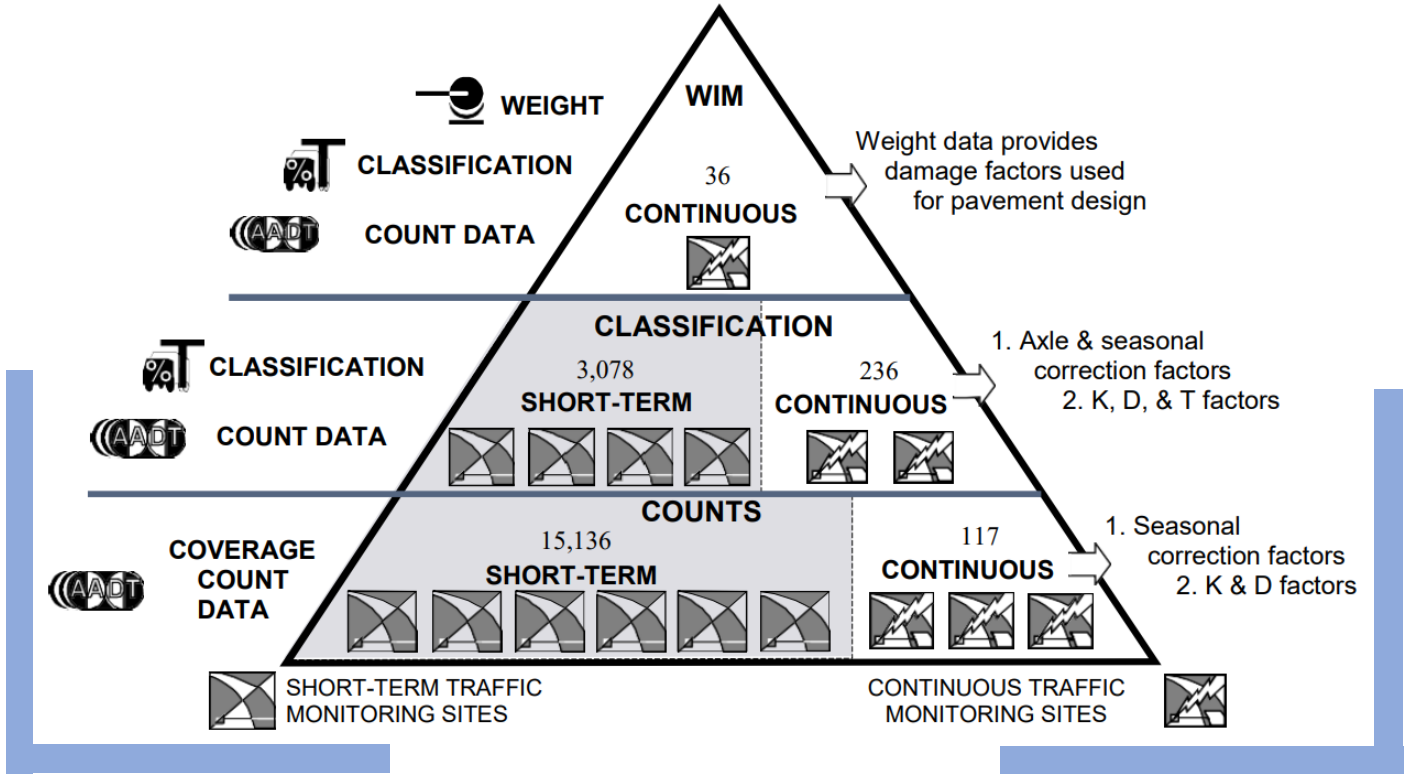
Purpose of Data Sources and Factors



Traffic Data Sources



Traffic Data Sources



Source: 2019 FDOT Project Traffic Forecasting Handbook; Page 6; Figure 2-1

- Count Sites
  - 2 types of FDOT Traffic Monitoring Sites
    - Continuous Count Sites
    - Short-Term Count Sites
- FDOT Traffic Monitoring Site Count Information Available on Florida Traffic Online (FTO)

Traffic Data Sources

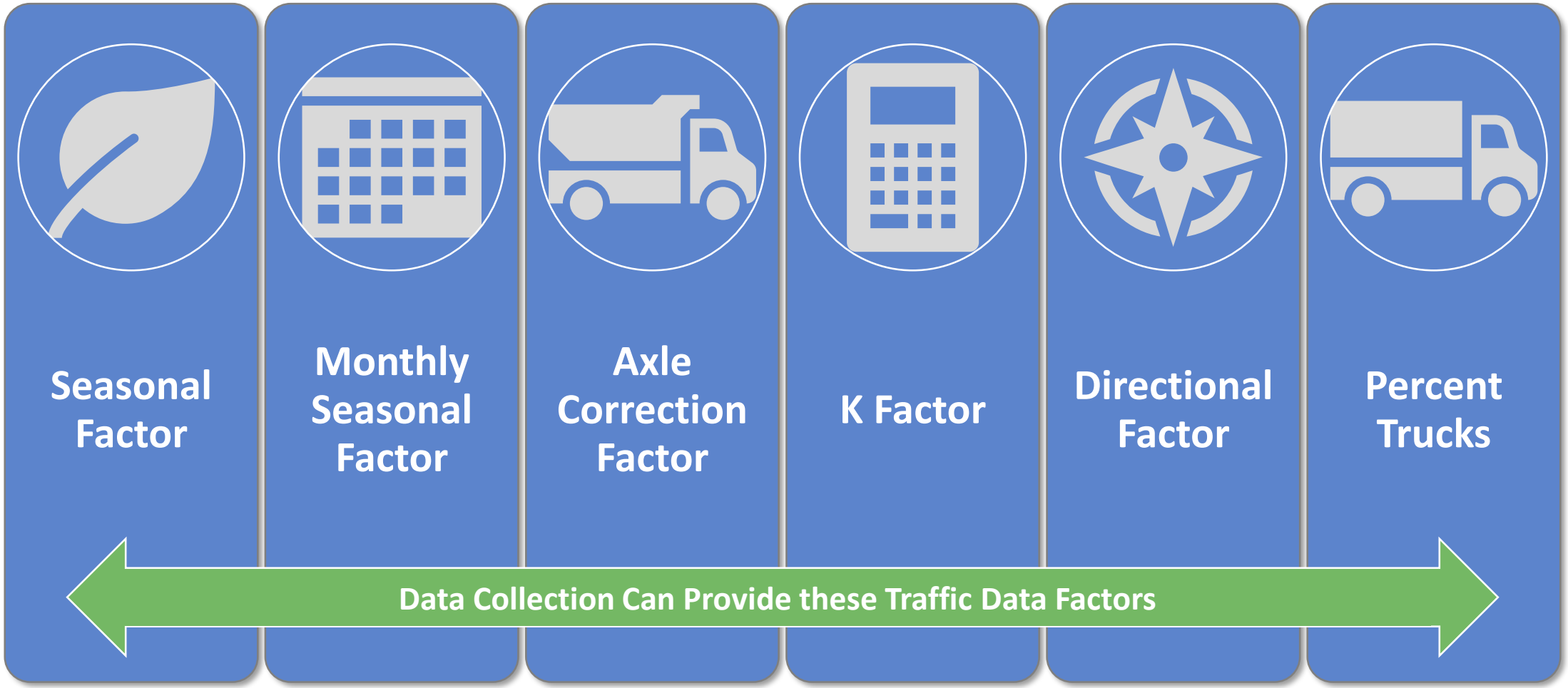
- FDOT Traffic Monitoring Sites
  - Continuous Count Sites
    - Permanently Installed
    - Records the distribution and variation of traffic flow for every hour of the year
    - Produces AADT, K and D factors
    - Performs classification counts

Site 729905: I-95 S of Old St. Augustine Road, Duval County

Traffic Data Sources

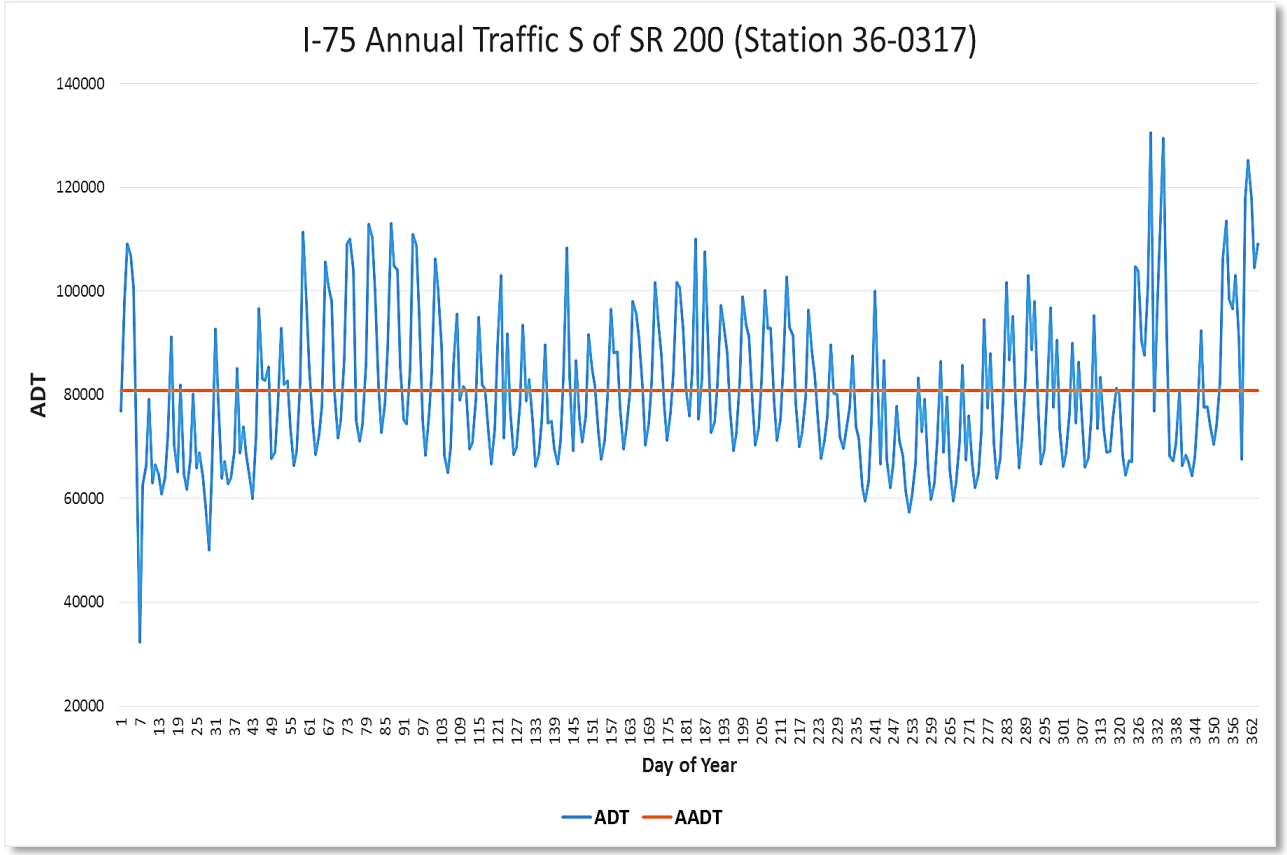
- FDOT Traffic Monitoring Sites
  - Short-Term Count Sites
    - Temporarily Placed
    - Records the distribution and variation of traffic flow
    - Seasonal Classification Counts develop
      - Axle Correction Factors (ACF)
      - Truck Percentages

Traffic Data Factors



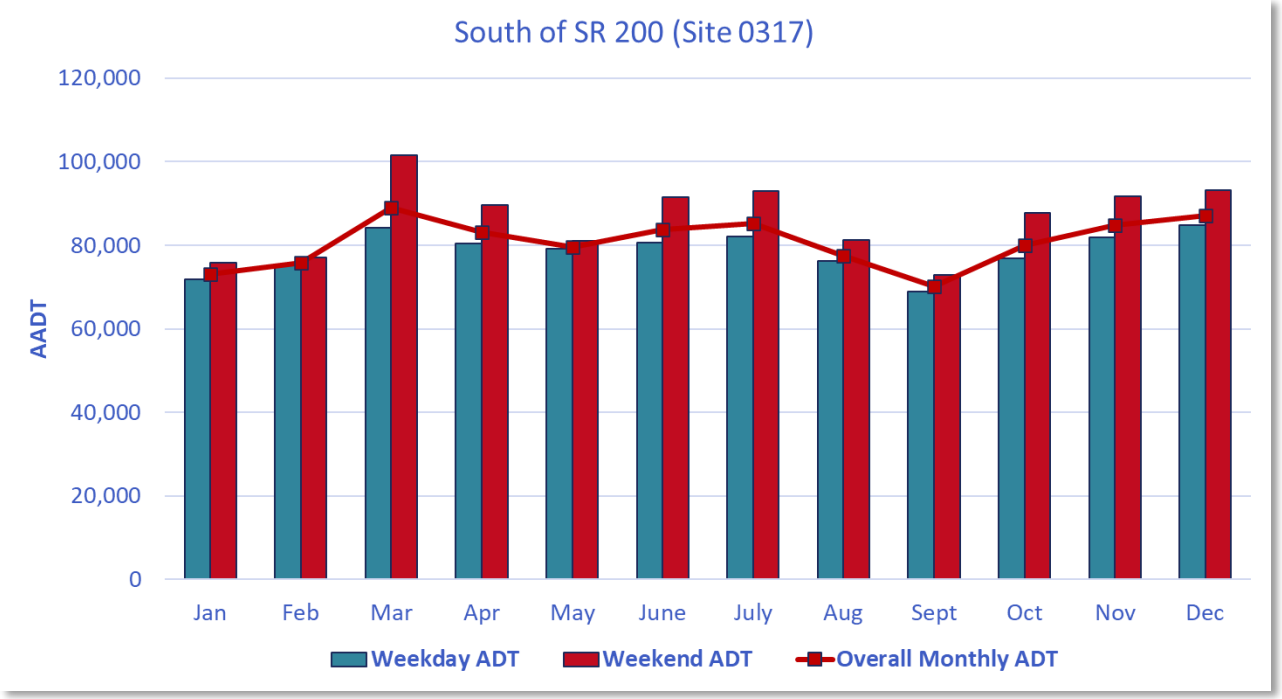
Traffic Data Factors

- **Annual Average Daily Traffic (AADT)**
  - AADT is the estimate of typical daily traffic on a road segment for all seven days of the week over the period of one year
    - AADT is the best measure of the total use of the road
  - Average Daily Traffic (ADT) is obtained by short-term traffic counts
    - Typically, a 72-hour traffic count



Traffic Data Factors

- **Annual Average Daily Traffic (AADT)**
  - Monthly Average Daily Traffic (MADT)
    - Average traffic of one month
  - Peak Season Weekday Average Daily Traffic (PSWADT)
    - Average weekday traffic during the peak season
    - Typical volume produced in Travel Demand Models



Traffic Data Factors

- **Annual Average Daily Traffic (AADT)**
  - AADT calculation equations
    - For Continuous Traffic Counts

$$AADT = \frac{Total\ Number\ of\ Vehicles\ in\ One\ Year}{Total\ Number\ of\ Days\ in\ One\ Year}$$

    - For Short-Term Traffic Counts

$$AADT = ADT \times SF \times ACF$$

SF – Weekly Seasonal Factor
ACF – Axle Correction Factor
ACF only applied to short-term counts obtained from portable axle counters

Traffic Data Factors

- **Seasonal Factor**
  - Adjusts for variations in traffic throughout the year
  - Determined using traffic data from continuous count locations
  - Two types of seasonal factors
    - Monthly Seasonal Factor (MSF)
    - Weekly Seasonal Factor (SF)
  - SFs are in Peak Season Factor Reports
    - Available on FTO Website

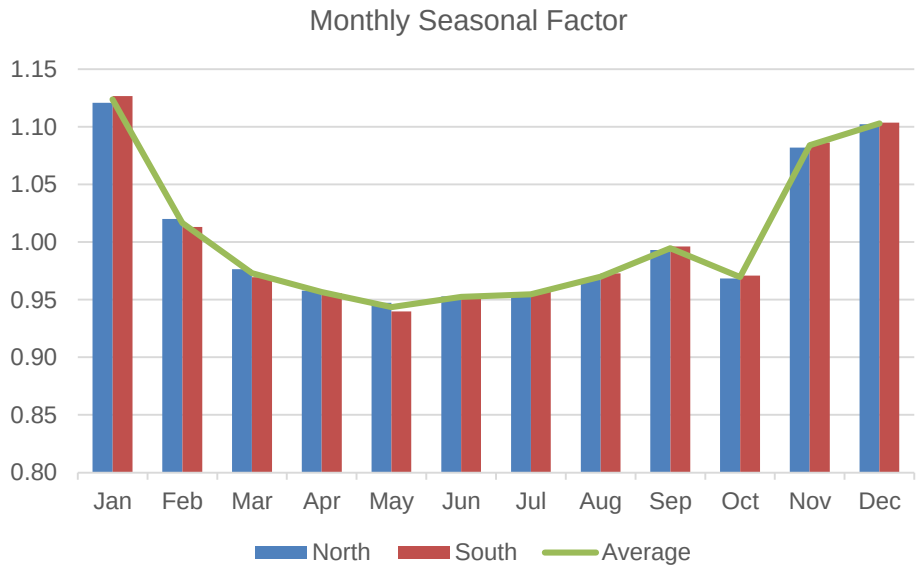
Traffic Data Factors

- **Monthly Seasonal Factor**
  - MSF for each direction is calculated separately

$$MSF_{Direction} = \frac{AADT}{MADT}$$

  - MSF for the station is the average of the two directional monthly factors

$$MSF_{Station} = \frac{MSF_{D1} + MSF_{D2}}{2}$$



Traffic Data Factors

- Monthly Seasonal Factor Example – I-75 Northbound in January
  - $MSF_{NB} = \frac{AADT}{MADT}$
  - $AADT = 26{,}419$
  - $MADT = 23{,}243$
  - $MSF_{NB} = \frac{26{,}419}{23{,}243} = 1.14$

2018 DIRECTIONAL VOLUME REPORT - REPORT TYPE: ALL

DISTRICT: 2 COUNTY: 29 - COLUMBIA SITE: 0320

DIRECTION: NORTH

	SUN	MON	TUE	WED	THR	FRI	SAT	MADT 23243	AWDT	AWET
JAN	22819	25250	23233	19915	22066	26543	22877		23401	22848
FEB	24957	23972	20640	21485	22346	27382	23220	23429	23165	24089
MAR	34501	26592	23331	25599	29258	36793	35702	30254	28315	35102
APR	32118	26369	23612	24775	28057	34704	33450	29012	27503	32784
MAY	26059	25205	23548	24187	28053	33083	26986	26732	26815	26523
JUN	31416	25769	23136	25085	29068	35268	34458	29171	27665	32937
JUL	33880	26567	23958	23102	28636	35012	35032	29455	27455	34456
AUG	24636	21234	19900	21997	24825	30396	25285	24039	23670	24961
SEP	22931	23298	19640	19844	22303	27831	22060	22558	22583	22496
OCT	26769	22286	19640	20660	26484	33133	24462	24776	24441	25616
NOV	33204	26428	24546	26445	23448	31450	31644	28166	26463	32424
DEC	27142	21514	20154	27572	27368	30457	29102	26187	25413	28122
ANNUAL AVG	28369	24540	22112	23389	25993	31838	28690	AADT 26419	AAWD 25574	AAWE 28530

Traffic Data Factors

- Monthly Seasonal Factor Example – I-75 Southbound in January
  - $MSF_{SB} = \frac{AADT}{MADT}$
  - $AADT = 26{,}835$
  - $MADT = 24{,}040$
  - $MSF_{SB} = \frac{26{,}835}{24{,}040} = 1.12$

2018 DIRECTIONAL VOLUME REPORT - REPORT TYPE: ALL

DISTRICT: 2 COUNTY: 29 - COLUMBIA SITE: 0320

DIRECTION: SOUTH

	SUN	MON	TUE	WED	THR	FRI	SAT	MADT 24040	AWDT	AWET
JAN	25524	23996	22754	20802	24484	28294	22426		24066	23975
FEB	26073	21907	19441	21600	25877	30227	23974	24157	23810	25024
MAR	33083	24498	20837	23127	28622	37777	37541	29355	26972	35312
APR	29277	22959	19464	20759	23906	27603	21500	23638	22938	25389
MAY	29813	24826	20473	21587	26083	31925	26449	25879	24979	28131
JUN	34131	25606	21896	23493	26885	33317	33715	28435	26239	33923
JUL	37214	27792	23710	23912	27897	32964	32717	29458	27255	34966
AUG	28624	21780	19432	21318	24314	29328	24071	24124	23234	26348
SEP	27204	24341	20558	20030	22679	26538	23859	23601	22829	25532
OCT	38240	28323	22946	24030	27618	30609	26002	28253	26705	32121
NOV	39956	28224	25957	28347	26088	30883	33754	30458	27900	36855
DEC	34849	23645	21070	30885	33605	34252	36058	30623	28691	35454
ANNUAL AVG	31999	24825	21545	23324	26505	31143	28506	AADT 26835	AAWD 25468	AAWE 30253

Traffic Data Factors

- Monthly Seasonal Factor Example – I-75 Station in January
  - $MSF_{Station} = \frac{MSF_{NB}+MSF_{SB}}{2}$
  - $MSF_{Station} = \frac{1.14+1.12}{2} = 1.13$

2018 VOLUME FACTOR CATEGORY SUMMARY REPORT - REPORT TYPE: ALL

CATEGORY: 2675 - ALACHUA I75

COSITE	DIR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUN	MON	TUE	WED	THU	FRI	SAT	STD "K"	MEDIAN "D"	AADT
290320	N	1.14	1.13	0.87	0.91	0.99	0.91	0.90	1.10	1.17	1.07	0.94	1.01	0.93	1.08	1.19	1.13	1.02	0.83	0.92			
290320	S	1.12	1.11	0.91	1.14	1.04	0.94	0.91	1.11	1.14	0.95	0.88	0.88	0.84	1.08	1.25	1.15	1.01	0.86	0.94			
290320	B	1.13	1.12	0.89	1.03	1.02	0.93	0.91	1.11	1.16	1.01	0.91	0.95	0.89	1.08	1.22	1.14	1.02	0.85	0.93	9.0	54.0	53254

Practice Problem 1

What is the station MSF in the month of July?

A. 0.87

B. 0.88

C. 1.87

D. 0.85

2018 DIRECTIONAL VOLUME REPORT - REPORT TYPE: ALL

DISTRICT: 2 COUNTY: 32 - HAMILTON SITE: 0112

DIRECTION: NORTH

	SUN	MON	TUE	WED	THR	FRI	SAT	MADT	AWDT	AWET
JAN	17374	20333	18824	16614	18227	21156	18317	18692	19031	17846
FEB	20152	19256	16834	17386	18092	21845	19373	18991	18683	19763
MAR	26957	21060	19119	20860	24226	30838	30947	24858	23221	28952
APR	28135	21681	19503	20870	23274	29444	30390	24757	22954	29263
MAY	21672	20680	19109	19645	22507	26317	22949	21840	21652	22311
JUN	27156	21330	19769	21080	24236	30148	31183	24986	23313	29170
JUL	30674	22758	20372	20001	24664	30089	32630	25884	23577	31652
AUG	20983	17442	16587	18011	20224	24644	21322	19888	19382	21153
SEP	19206	20127	17237	17466	19048	23259	19536	19411	19427	19371
OCT	23607	19604	16780	17554	21122	26127	21990	20969	20237	22799
NOV	26264	20427	20296	22273	19522	24412	25881	22725	21386	26073
DEC	22982	18072	16924	22453	23053	27575	24994	22293	21615	23988

ANNUAL								AADT	AAWD	AAWE
AVG	23764	20231	18446	19518	21516	26321	24959	22108	21206	24362

261 RECORDS FLAGGED NORMAL
14 RECORDS FLAGGED BAD
89 RECORDS FLAGGED ATYPICAL
0 RECORDS FLAGGED NULL
0 RECORDS FLAGGED OTHER

DIRECTION: SOUTH

	SUN	MON	TUE	WED	THR	FRI	SAT	MADT	AWDT	AWET
JAN	20512	20027	19002	17699	20037	22541	18759	19797	19861	19636
FEB	20811	17975	16228	17741	20932	24403	20075	19738	19456	20443
MAR	27639	19711	17152	19256	23237	31663	33580	24605	22204	30610
APR	23844	19772	16312	18213	20194	22685	18415	19919	19435	21130
MAY	23008	20600	16843	17758	21297	25492	22220	21031	20398	22614
JUN	28422	21601	18532	19405	22687	28350	31018	24288	22115	29720
JUL	31579	23212	20045	20816	23725	28501	29961	25406	23260	30770
AUG	23717	18218	16223	17783	19977	24332	20329	20083	19307	22023
SEP	22706	20443	16507	16999	18986	21697	21098	19777	18926	21902
OCT	28783	21563	19103	20124	23481	26731	23165	23279	22200	25974
NOV	32269	22808	20490	23020	21053	23978	27293	24416	22270	29781
DEC	29103	19733	17685	25015	28018	29941	30153	25664	24078	29628

ANNUAL								AADT	AAWD	AAWE
AVG	26033	20472	17844	19486	21969	25860	24672	22334	21126	25353

261 RECORDS FLAGGED NORMAL
13 RECORDS FLAGGED BAD
90 RECORDS FLAGGED ATYPICAL
0 RECORDS FLAGGED NULL
0 RECORDS FLAGGED OTHER

Practice Problem 1

- Explanation – I-75 Northbound in July
  - $MSF_{NB} = \frac{AADT}{MADT}$
  - $AADT = 22{,}108$
  - $MADT = 25{,}884$
  - $MSF_{NB} = \frac{22{,}108}{25{,}884} = 0.85$

2018 DIRECTIONAL VOLUME REPORT - REPORT TYPE: ALL

DISTRICT: 2 COUNTY: 32 - HAMILTON SITE: 0112

DIRECTION: NORTH

	SUN	MON	TUE	WED	THR	FRI	SAT	MADT	AWDT	AWET
JAN	17374	20333	18824	16614	18227	21156	18317	18692	19031	17846
FEB	20152	19256	16834	17386	18092	21845	19373	18991	18683	19763
MAR	26957	21060	19119	20860	24226	30838	30947	24858	23221	28952
APR	28135	21681	19503	20870	23274	29444	30390	24757	22954	29263
MAY	21672	20680	19109	19645	22507	26317	22949	21840	21652	22311
JUN	27156	21330	19769	21080	24236	30148	31183		23313	29170
JUL	30674	22758	20372	20001	24664	30089	32630	25884	23577	31652
AUG	20983	17442	16587	18011	20224	24644	21322		19382	21153
SEP	19206	20127	17237	17466	19048	23259	19536	19411	19427	19371
OCT	23607	19604	16780	17554	21122	26127	21990	20969	20237	22799
NOV	26264	20427	20296	22273	19522	24412	25881	22725	21386	26073
DEC	22982	18072	16924	22453	23053	27575	24994	22293	21615	23988
ANNUAL AVG	23764	20231	18446	19518	21516	26321	24959	AADT 22108	AAWD 21206	AAWE 24362

Practice Problem 1

- Explanation – I-75 Southbound in July
  - $MSF_{SB} = \frac{AADT}{MADT}$
  - $AADT = 22{,}334$
  - $MADT = 25{,}406$
  - $MSF_{SB} = \frac{22{,}334}{25{,}406} = 0.88$

2018 DIRECTIONAL VOLUME REPORT - REPORT TYPE: ALL

DISTRICT: 2 COUNTY: 32 - HAMILTON SITE: 0112

DIRECTION: SOUTH

	SUN	MON	TUE	WED	THR	FRI	SAT	MADT	AWDT	AWET
JAN	20512	20027	19002	17699	20037	22541	18759	19797	19861	19636
FEB	20811	17975	16228	17741	20932	24403	20075	19738	19456	20443
MAR	27639	19711	17152	19256	23237	31663	33580	24605	22204	30610
APR	23844	19772	16312	18213	20194	22685	18415	19919	19435	21130
MAY	23008	20600	16843	17758	21297	25492	22220	21031	20398	22614
JUN	28422	21601	18532	19405	22687	28350	31018	[illegible]	22115	29720
JUL	31579	23212	20045	20816	23725	28501	29961	25406	23260	30770
AUG	23717	18218	16223	17783	19977	24332	20329	[illegible]	19307	22023
SEP	22706	20443	16507	16999	18986	21697	21098	19777	18926	21902
OCT	28783	21563	19103	20124	23481	26731	23165	23279	22200	25974
NOV	32269	22808	20490	23020	21053	23978	27293	24416	22270	29781
DEC	29103	19733	17685	25015	28018	29941	30153	25664	24078	29628
ANNUAL AVG	26033	20472	17844	19486	21969	25860	24672	AADT 22334	AAWD 21126	AAWE 25353

Practice Problem 1

- Explanation – I-75 in July
  - $MSF_{Station} = \frac{MSF_{NB} + MSF_{SB}}{2}$
  - $MSF_{Station} = \frac{0.85 + 0.88}{2} = 0.87$

2018 VOLUME FACTOR CATEGORY SUMMARY REPORT - REPORT TYPE: ALL

CATEGORY: 2675 - ALACHUA I75

COSITE	DIR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUN	MON	TUE	WED	THU	FRI	SAT	STD "K"	MEDIAN "D"	AADT
320112	N	1.18	1.16	0.89	0.89	1.01	0.88	0.85	1.11	1.14	1.05	0.97	0.99	0.93	1.09	1.20	1.13	1.03	0.84	0.89			
320112	S	1.13	1.13	0.91	1.12	1.06	0.92	0.88	1.11	1.13	0.96	0.91	0.87	0.86	1.09	1.25	1.15	1.02	0.86	0.91			
320112	B	1.16	1.15	0.90	1.01	1.04	0.90	0.87	1.11	1.14	1.01	0.94	0.93	0.90	1.09	1.23	1.14	1.03	0.85	0.90	9.5	53.6	44442

Traffic Data Factors

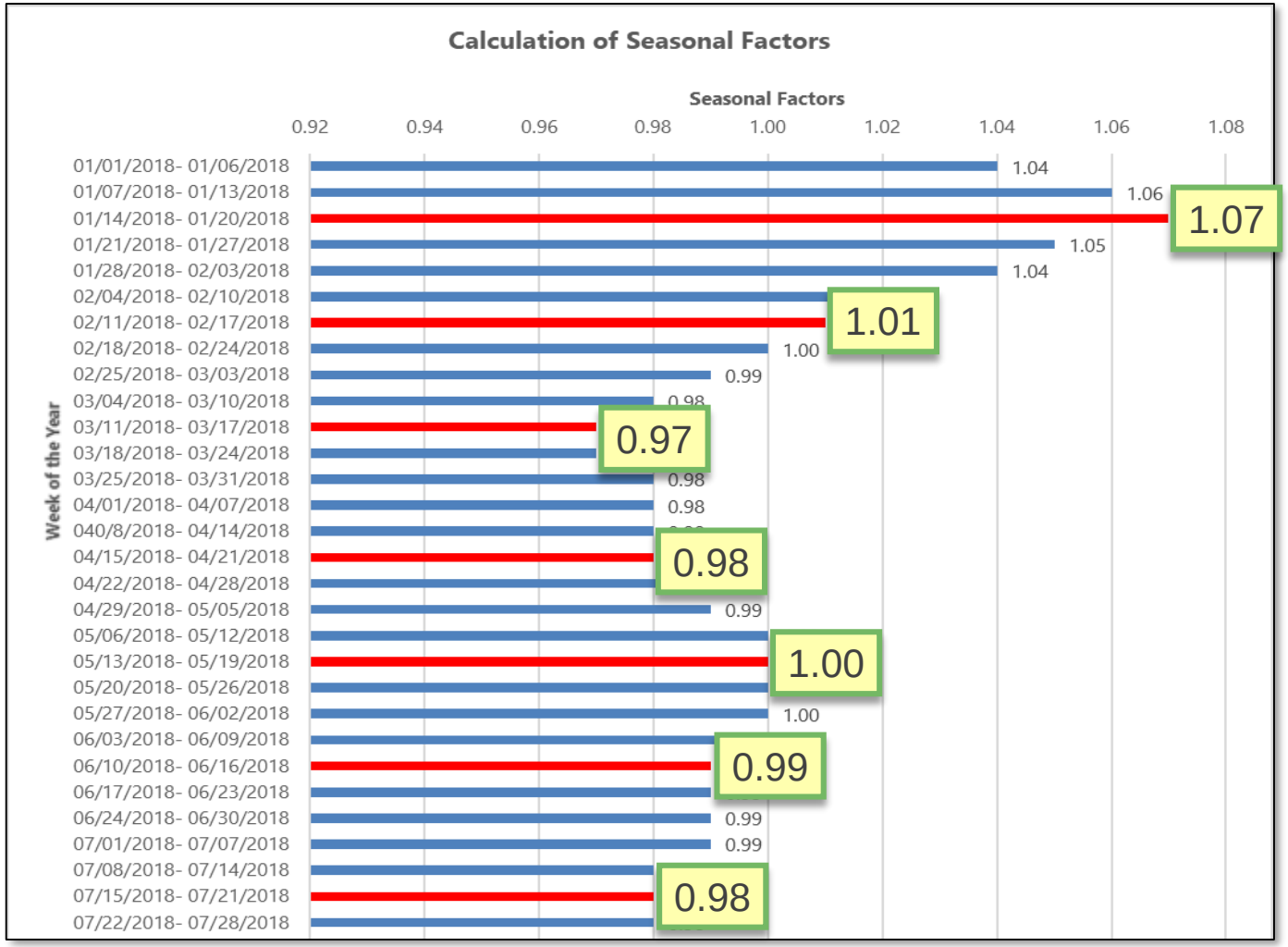
- **Weekly Seasonal Factor**
  - The SFs are calculated for each week of the year
    - Each continuous count station is categorized, and the SFs for each count station in the category are averaged
    - For example, SFs at all continuous stations along I-75 in Alachua County are averaged
  - SFs are in Peak Season Factor Reports
    - Available on FTO Website

2018 PEAK SEASON FACTOR CATEGORY REPORT - REPORT TYPE: ALL
CATEGORY: 2675 ALACHUA I75 MOCF: 0.95

WEEK	DATES	SF	PSCF
1	01/01/2018 - 01/06/2018	0.94	0.99
2	01/07/2018 - 01/13/2018	1.04	1.09
3	01/14/2018 - 01/20/2018	1.15	1.21
4	01/21/2018 - 01/27/2018	1.14	1.20
5	01/28/2018 - 02/03/2018	1.14	1.20
6	02/04/2018 - 02/10/2018	1.14	1.20
7	02/11/2018 - 02/17/2018	1.14	1.20
8	02/18/2018 - 02/24/2018	1.14	1.14
9	02/25/2018 - 03/03/2018	1.08	1.07
10	03/04/2018 - 03/10/2018	1.02	1.01
11	03/11/2018 - 03/17/2018	0.96	0.95
12	03/18/2018 - 03/24/2018	0.90	0.97
13	03/25/2018 - 03/31/2018	0.92	1.00
14	04/01/2018 - 04/07/2018	0.95	1.02
15	04/08/2018 - 04/14/2018	0.97	1.05
16	04/15/2018 - 04/21/2018	1.00	1.07
17	04/22/2018 - 04/28/2018	1.02	1.07
18	04/29/2018 - 05/05/2018	1.02	1.08
		1.03	

Traffic Data Factors

- Weekly Seasonal Factor
  - The MSFs are assigned to the week of the midpoint of the month
  - Weeks without factors are estimated by interpolating from the mid-week of one month to the mid-week of the next month



Traffic Data Factors

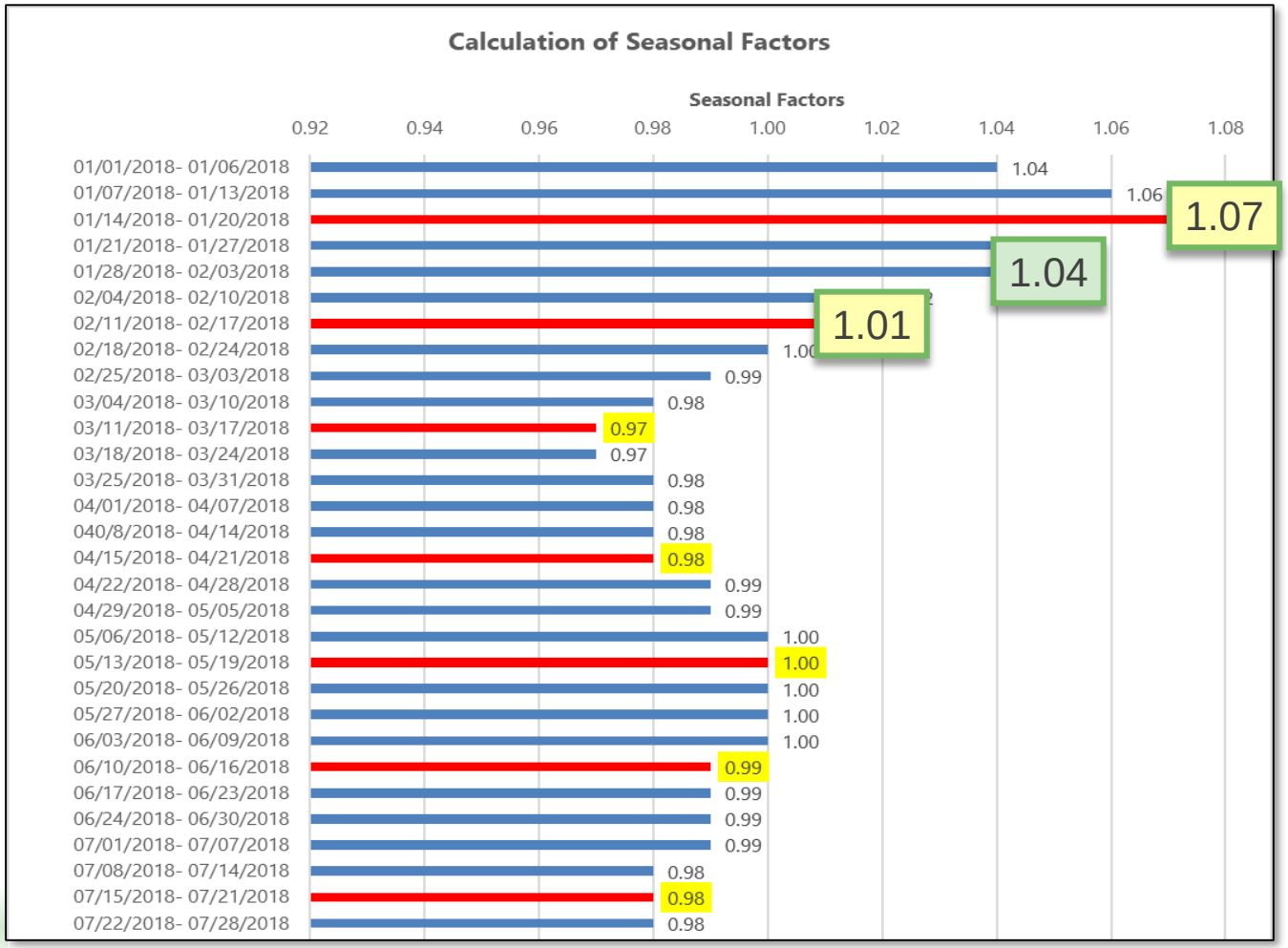
- Weekly Seasonal Factor Equation

$$SF = MSF_i + \frac{MSF_{i+1} - MSF_i}{N} \times n$$

  - MSF_i = MSF for a particular month i. The MSFs are assigned to the week of the year that contains the midpoint of the month
  - MSF_{i+1} = MSF for the following month i+1
  - N = Number of weeks between the midpoint of month i and the midpoint of the following month i+1, usually 4
  - n = Number of weeks between the midpoint of the month i and the week for SF, usually between 1 and 4

Traffic Data Factors

- Weekly Seasonal Factor Example – 1/28/2018-2/03/2018
  - $SF = MSF_i + (\frac{MSF_{i+1} - MSF_i}{N} \times n)$
  - $MSF_i = 1.07$
  - $MSF_{i+1} = 1.01$
  - $N = 4$
  - $n = 2$
  - $SF = 1.07 + (\frac{1.01 - 1.07}{4} \times 2) = 1.04$



Practice Problem 2

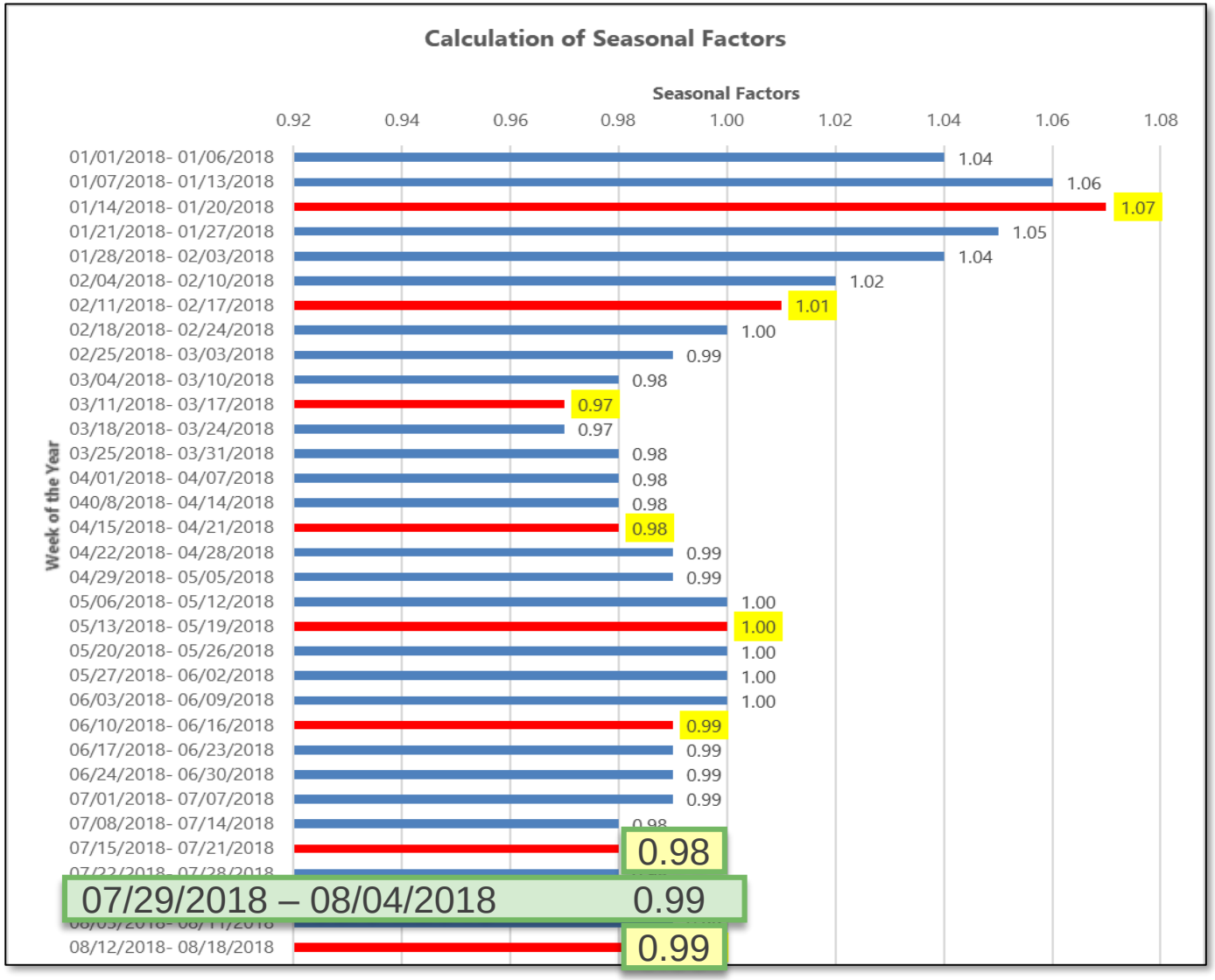
What is the station SF for the week of 7/29/2018-8/4/2018?

A 1.00

B 0.97

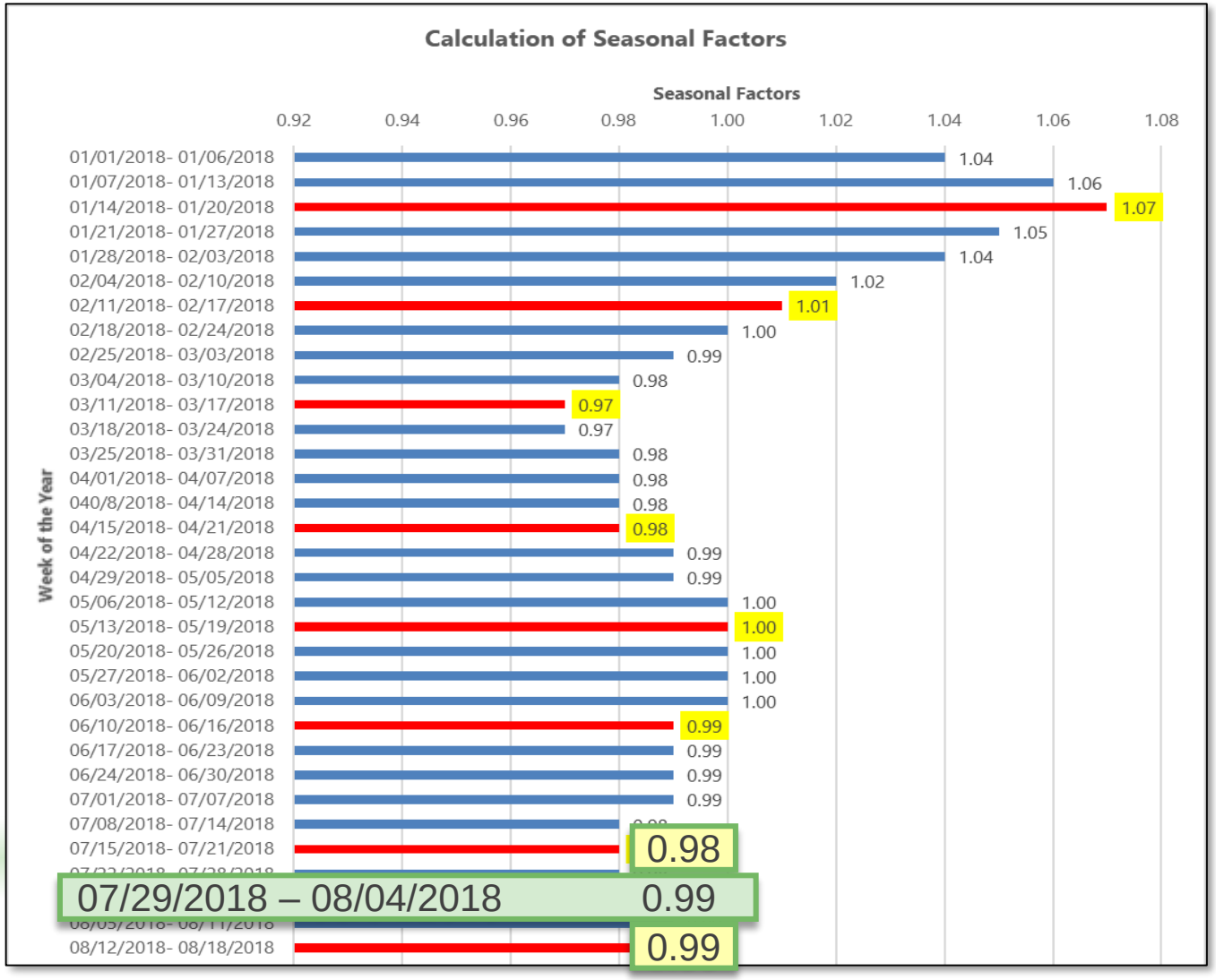
C 0.99

D 0.94

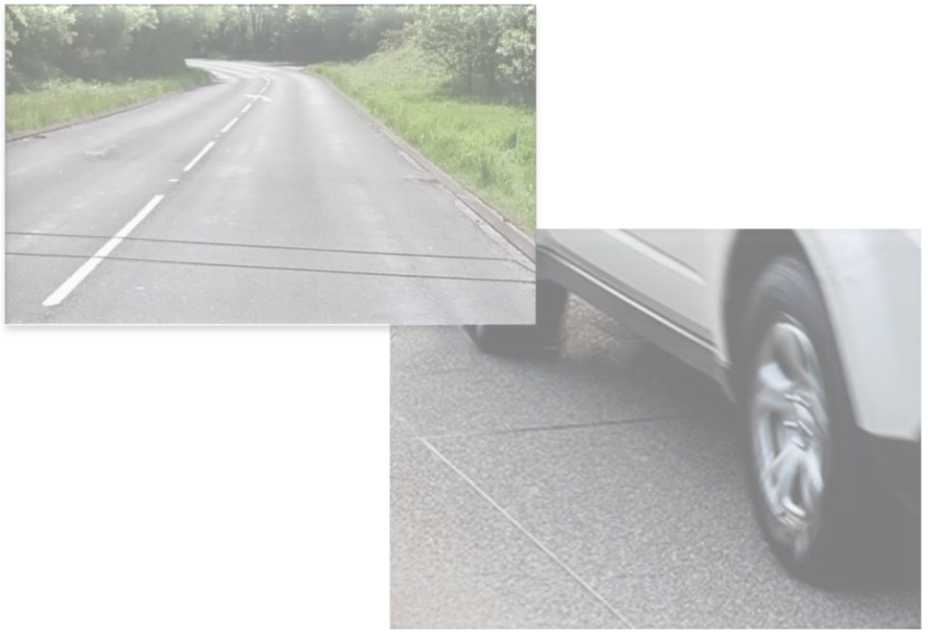


Practice Problem 2

- Explanation – 7/29/2018-8/4/2018
  - $SF = MSF_i + (\frac{MSF_{i+1} - MSF_i}{N} \times n)$
  - $MSF_i = 0.98$
  - $MSF_{i+1} = 0.99$
  - $N = 4$
  - $n = 2$
  - $SF = 0.98 + (\frac{0.99 - 0.98}{4} \times 2) = 0.99$



Traffic Data Factors

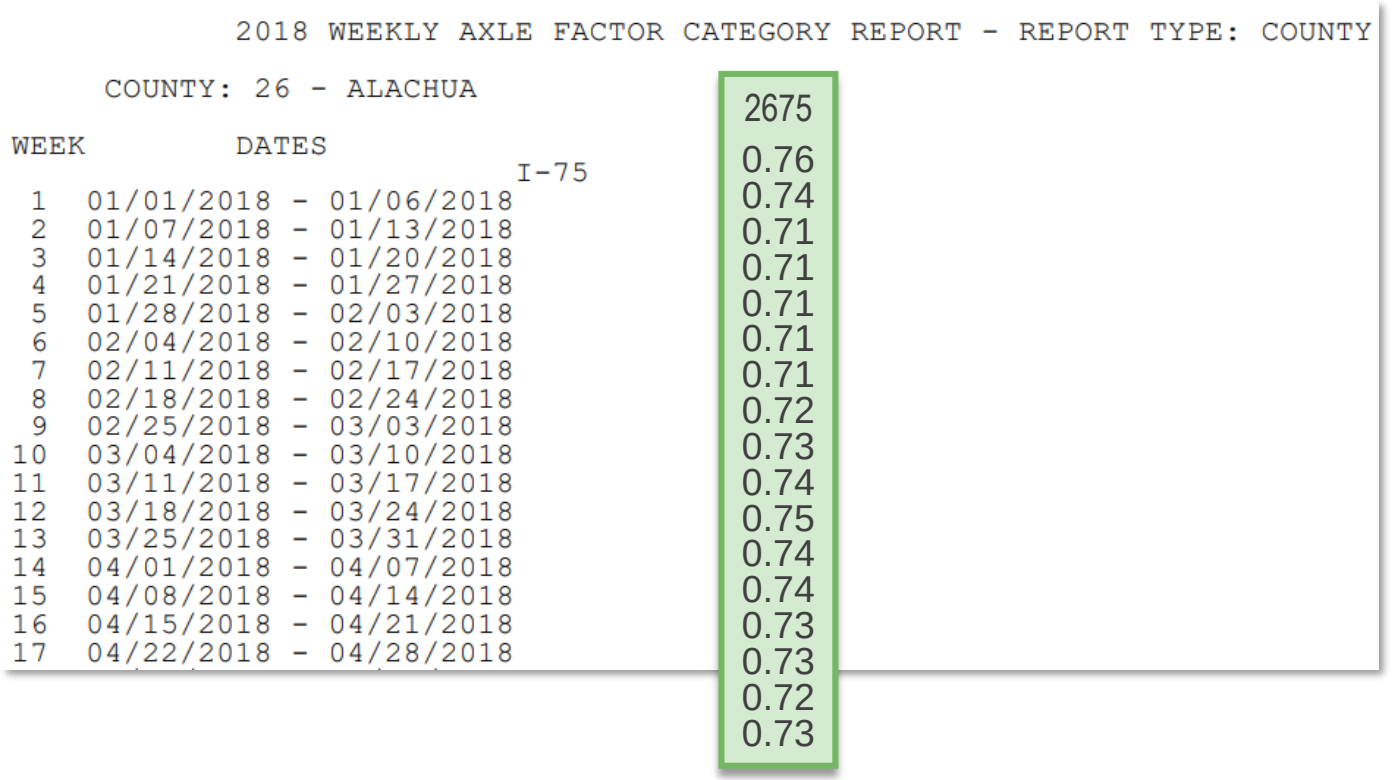


- Axle Correction Factor (ACF)
  - Developed to adjust axle counts into vehicle counts
  - Determined using
    - Continuous Classification Counts
    - Short-Term Classification Counts

$$ACF = \frac{Total\ Number\ of\ Vehicles}{Total\ Number\ of\ Axles\ on\ the\ Vehicles}$$

Traffic Data Factors

- Axle Correction Factor (ACF)
  - Developed for each
    - Roadway Section
    - Week of the Year
  - Always less ≤ 1.00
  - ACFs are in a Weekly Axle Factor Category Report
    - Available on FTO Website



2018 WEEKLY AXLE FACTOR CATEGORY REPORT - REPORT TYPE: COUNTY

COUNTY: 26 - ALACHUA

WEEK	DATES	I-75
		2675
1	01/01/2018 - 01/06/2018	0.76
2	01/07/2018 - 01/13/2018	0.74
3	01/14/2018 - 01/20/2018	0.71
4	01/21/2018 - 01/27/2018	0.71
5	01/28/2018 - 02/03/2018	0.71
6	02/04/2018 - 02/10/2018	0.71
7	02/11/2018 - 02/17/2018	0.71
8	02/18/2018 - 02/24/2018	0.72
9	02/25/2018 - 03/03/2018	0.73
10	03/04/2018 - 03/10/2018	0.74
11	03/11/2018 - 03/17/2018	0.75
12	03/18/2018 - 03/24/2018	0.74
13	03/25/2018 - 03/31/2018	0.74
14	04/01/2018 - 04/07/2018	0.73
15	04/08/2018 - 04/14/2018	0.73
16	04/15/2018 - 04/21/2018	0.72
17	04/22/2018 - 04/28/2018	0.73

Traffic Data Factors

- Precision of Data
  - Round the volumes to reflect the uncertainty of estimates and forecasts

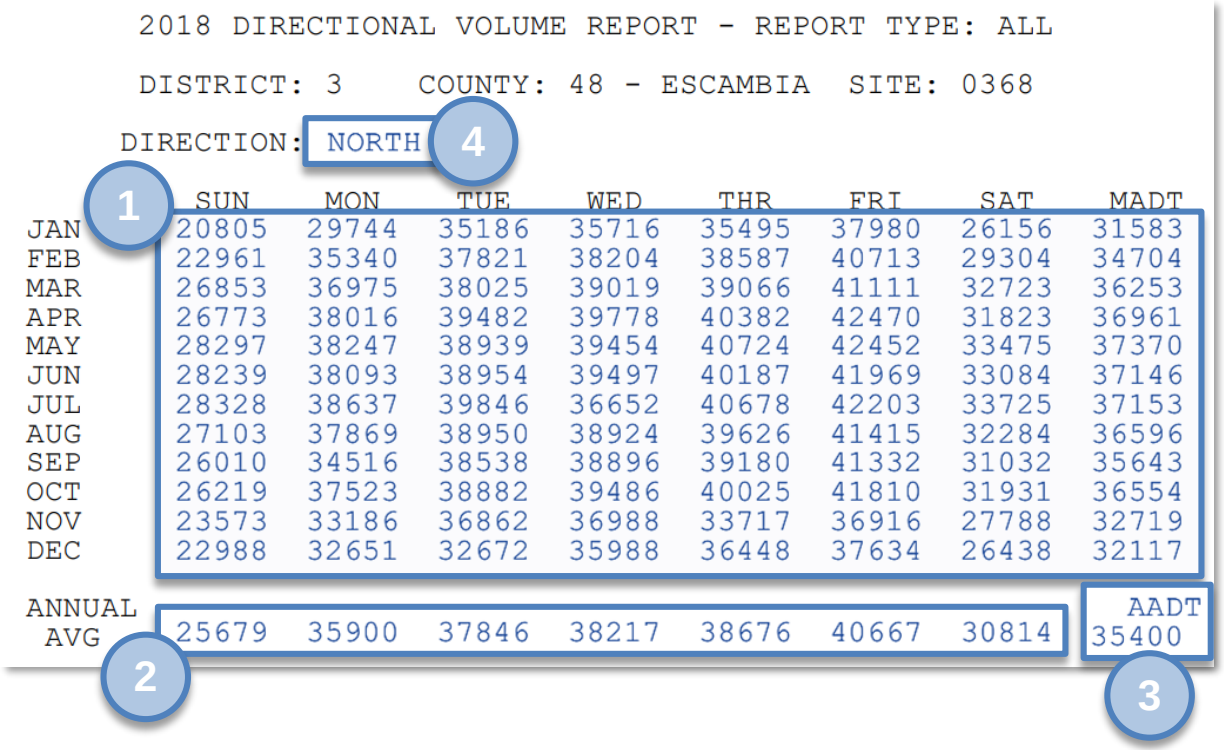
Rounding Convention

Forecast Volume	Round to Nearest
<100	10
100 to 999	50
1,000 to 9,999	100
10,000 to 99,999	500
>99,999	1,000

The rounding convention was adapted from *AASHTO Guidelines for Traffic Data Programs* published in 2009. The convention was revised to be more stringent to address situations where growth is low and future volumes after rounding appear to be the same.

Traffic Data Factors

- Annual Average Daily Traffic (AADT)
  - AADT Calculation Example – Continuous Count Site
    1. Calculate average volumes for each day-of-week for each month
    2. Calculate average volumes for each day-of-week for the whole year
    3. Calculate directional AADT by averaging seven daily volumes for the year
    4. Sum the directional AADT volumes to generate the AADT volume for the traffic monitoring site.



2018 DIRECTIONAL VOLUME REPORT - REPORT TYPE: ALL

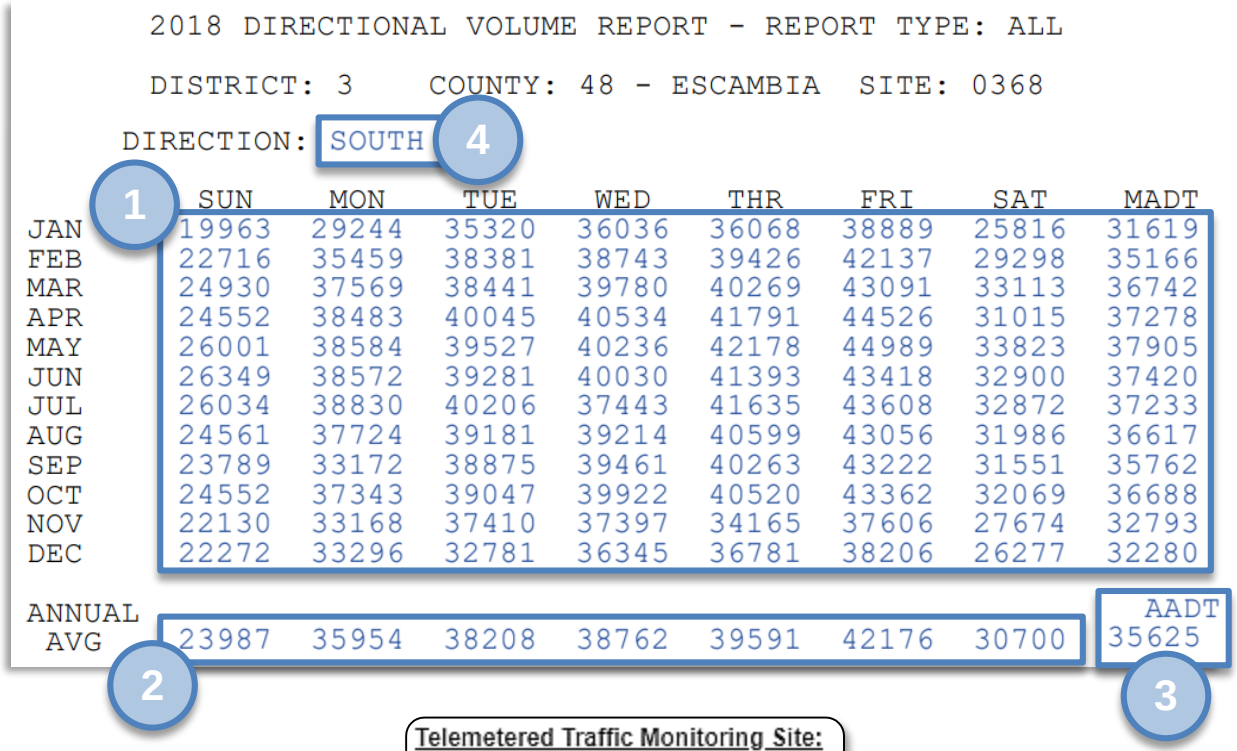
DISTRICT: 3 COUNTY: 48 - ESCAMBIA SITE: 0368

DIRECTION: NORTH (4)

	SUN (1)	MON	TUE	WED	THR	FRI	SAT	MADT
JAN	20805	29744	35186	35716	35495	37980	26156	31583
FEB	22961	35340	37821	38204	38587	40713	29304	34704
MAR	26853	36975	38025	39019	39066	41111	32723	36253
APR	26773	38016	39482	39778	40382	42470	31823	36961
MAY	28297	38247	38939	39454	40724	42452	33475	37370
JUN	28239	38093	38954	39497	40187	41969	33084	37146
JUL	28328	38637	39846	36652	40678	42203	33725	37153
AUG	27103	37869	38950	38924	39626	41415	32284	36596
SEP	26010	34516	38538	38896	39180	41332	31032	35643
OCT	26219	37523	38882	39486	40025	41810	31931	36554
NOV	23573	33186	36862	36988	33717	36916	27788	32719
DEC	22988	32651	32672	35988	36448	37634	26438	32117
ANNUAL AVG (2)	25679	35900	37846	38217	38676	40667	30814	AADT (3) 35400

Traffic Data Factors

- Annual Average Daily Traffic (AADT)
  - AADT Calculation Example - Continuous Count Site
    - What is the NB AADT?
      - 35,400
    - What is the SB AADT?
      - 35,625
    - What is the I-110 AADT?
      - $AADT = AADT_{NB} + AADT_{SB}$
      - $AADT = 35{,}400 + 35{,}625$
      - $AADT = 71{,}025$



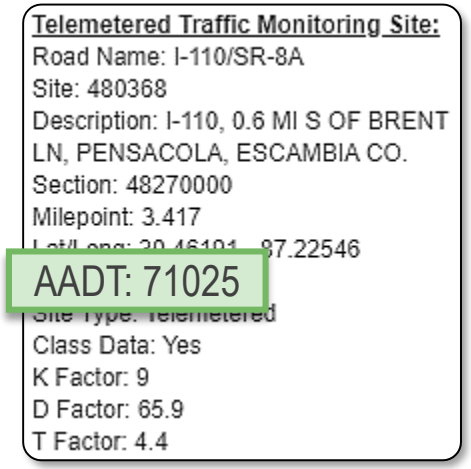
2018 DIRECTIONAL VOLUME REPORT - REPORT TYPE: ALL

DISTRICT: 3 COUNTY: 48 - ESCAMBIA SITE: 0368

DIRECTION: SOUTH

	SUN	MON	TUE	WED	THR	FRI	SAT	MADT
JAN	19963	29244	35320	36036	36068	38889	25816	31619
FEB	22716	35459	38381	38743	39426	42137	29298	35166
MAR	24930	37569	38441	39780	40269	43091	33113	36742
APR	24552	38483	40045	40534	41791	44526	31015	37278
MAY	26001	38584	39527	40236	42178	44989	33823	37905
JUN	26349	38572	39281	40030	41393	43418	32900	37420
JUL	26034	38830	40206	37443	41635	43608	32872	37233
AUG	24561	37724	39181	39214	40599	43056	31986	36617
SEP	23789	33172	38875	39461	40263	43222	31551	35762
OCT	24552	37343	39047	39922	40520	43362	32069	36688
NOV	22130	33168	37410	37397	34165	37606	27674	32793
DEC	22272	33296	32781	36345	36781	38206	26277	32280
ANNUAL AVG	23987	35954	38208	38762	39591	42176	30700	AADT 35625

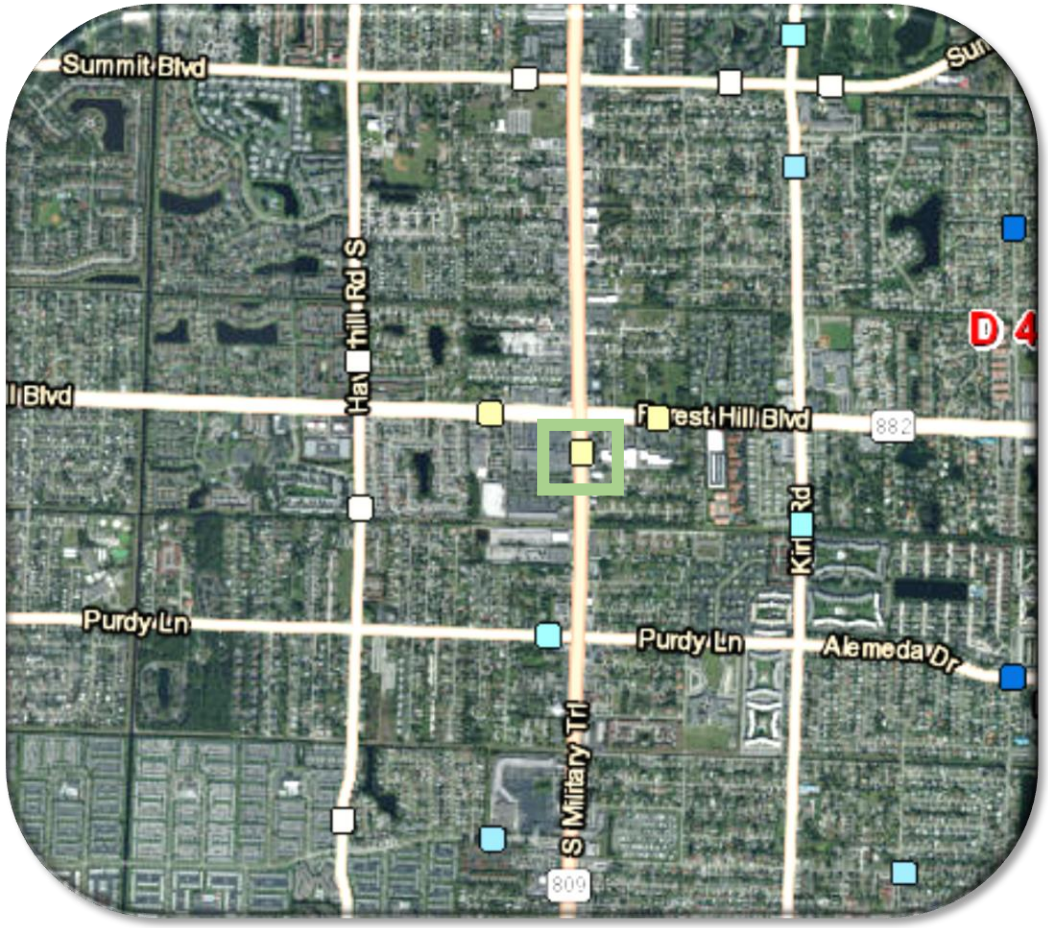
1 2 3 4



Telemetered Traffic Monitoring Site:
Road Name: I-110/SR-8A
Site: 480368
Description: I-110, 0.6 MI S OF BRENT LN, PENSACOLA, ESCAMBIA CO.
Section: 48270000
Milepoint: 3.417
Lat/Long: 30.46191, -87.22546
AADT: 71025
Site Type: Telemetered
Class Data: Yes
K Factor: 9
D Factor: 65.9
T Factor: 4.4

Traffic Data Factors

- Annual Average Daily Traffic (AADT)
  - AADT Calculation Example – Short-Term Count Site
    - Count Location:
      - SR 809 S of Forest Hill Boulevard
    - Date of Count
      - 3/14/2018
    - Determine
      - SAF
      - ACF
      - AADT



Traffic Data Factors

- Annual Average Daily Traffic (AADT)
  - AADT Calculation Example – Short-Term Count Site
    - Steps to calculate SAF
      1. Determine appropriate category
      2. Locate week of count
      3. Note the SAF
    - $SAF = 0.95$

2018 PEAK SEASON FACTOR CATEGORY REPORT - REPORT TYPE: ALL

CATEGORY: 9301 CEN.-W OF US1 TO SR7 (1)

MOCF: 0.95

WEEK	DATES	SF	PSCF
1	01/01/2018 - 01/06/2018	1.00	1.05
2	01/07/2018 - 01/13/2018	1.00	1.05
3	01/14/2018 - 01/20/2018	0.99	1.04
* 4	01/21/2018 - 01/27/2018	0.98	1.03
* 5	01/28/2018 - 02/03/2018	0.96	1.01
* 6	02/04/2018 - 02/10/2018	0.95	1.00
* 7	02/11/2018 - 02/17/2018	0.94	0.99
* 8	02/18/2018 - 02/24/2018	0.94	0.99
* 9	02/25/2018 - 03/03/2018	0.94	0.99
*10	03/04/2018 - 03/10/2018	0.94	0.99
*11	03/11/2018 - 03/17/2018	0.95 (3)	1.00
*12	03/18/2018 - 03/24/2018	0.95	1.00
*13	03/25/2018 - 03/31/2018	0.96	1.01
*14	04/01/2018 - 04/07/2018	0.96	1.01
*15	04/08/2018 - 04/14/2018	0.97	1.02
*16	04/15/2018 - 04/21/2018	0.97	1.02
17	04/22/2018 - 04/28/2018	0.99	1.04
18	04/29/2018 - 05/05/2018	1.01	1.06
19	05/06/2018 - 05/12/2018	1.02	1.07
20	05/13/2018 - 05/19/2018	1.04	1.09
21	05/20/2018 - 05/26/2018	1.04	1.09
22	05/27/2018 - 06/02/2018	1.04	1.09
23	06/03/2018 - 06/09/2018	1.04	1.09
24	06/10/2018 - 06/16/2018	1.04	1.09
25	06/17/2018 - 06/23/2018	1.05	1.11
26	06/24/2018 - 06/30/2018	1.06	1.12

(2)

Traffic Data Factors

- Annual Average Daily Traffic (AADT)
  - AADT Calculation Example – Short-Term Count Site

    - Steps to calculate ACF
      1. Determine appropriate roadway
      2. Locate week of count
      3. Note the ACF

    - $ACF = 0.99$

2018 WEEKLY AXLE FACTOR CATEGORY REPORT - REPORT TYPE: DISTRICT

COUNTY: 93 - PALM BEACH

WEEK	DATES	9330 SR 15,AV E-HOOKER HW	9331 SR700,CR880-SR 15	9332 SR809, SR802 - PGA
1	01/01/2018 - 01/06/2018	0.93	0.83	0.99
2	01/07/2018 - 01/13/2018	0.93	0.83	0.99
3	01/14/2018 - 01/20/2018	0.93	0.83	0.99
4	01/21/2018 - 01/27/2018	0.93	0.83	0.99
5	01/28/2018 - 02/03/2018	0.92	0.83	0.99
6	02/04/2018 - 02/10/2018	0.92	0.83	0.99
7	02/11/2018 - 02/17/2018	0.92	0.83	0.99
8	02/18/2018 - 02/24/2018	0.91	0.83	0.99
9	02/25/2018 - 03/03/2018	0.91	0.83	0.99
10	03/04/2018 - 03/10/2018	0.91	0.83	0.99
11	03/11/2018 - 03/17/2018	0.91	0.83	0.99
12	03/18/2018 - 03/24/2018	0.90	0.83	0.99
13	03/25/2018 - 03/31/2018	0.90	0.83	0.99
14	04/01/2018 - 04/07/2018	0.90	0.83	0.99
15	04/08/2018 - 04/14/2018	0.89	0.83	0.99
16	04/15/2018 - 04/21/2018	0.89	0.83	0.99
17	04/22/2018 - 04/28/2018	0.89	0.83	0.99
18	04/29/2018 - 05/05/2018	0.89	0.83	0.99
19	05/06/2018 - 05/12/2018	0.89	0.83	0.99
20	05/13/2018 - 05/19/2018	0.89	0.83	0.99
21	05/20/2018 - 05/26/2018	0.90	0.83	0.99
22	05/27/2018 - 06/02/2018	0.90	0.83	0.99
23	06/03/2018 - 06/09/2018	0.90	0.83	0.99
24	06/10/2018 - 06/16/2018	0.90	0.83	0.99
25	06/17/2018 - 06/23/2018	0.90	0.83	0.99
26	06/24/2018 - 06/30/2018	0.90	0.83	0.99

Traffic Data Factors

- Annual Average Daily Traffic (AADT)
  - AADT Calculation Example – Short-Term Count Site

    - Steps to calculate AADT
      1. Determine the ADT
      2. Calculate AADT

    - $AADT = ADT \times SF \times ACF$

    - $AADT = 49{,}615 \times 0.95 \times 0.99$

    - $AADT = 47{,}000\ vehicles$

COUNTY: 93
STATION: 0722
DESCRIPTION: SR 809 S OF FOREST HILL BLVD (COUNTY LINK: 3642)
START DATE: 03/14/2018
START TIME: 0000

TIME	DIRECTION: N 1ST	2ND	3RD	4TH	TOTAL	DIRECTION: S 1ST	2ND	3RD	4TH	TOTAL	COMBINED TOTAL
0000	92	49	30	45	216	82	53	40	40	215	431
0100	27	26	38	37	128	23	13	33	31	100	228
0200	47	19	32	18	116	27	21	11	15	74	190
0300	21	16	20	25	82	14	15	21	36	86	168
0400	36	46	42	52	176	44	35	12	31	122	298
0500	55	69	63	93	280	27	58	82	61	228	508
0600	94	168	189	246	697	112	140	223	258	733	1430
0700	270	379	440	427	1516	339	373	452	454	1618	3134
0800	288	294	386	441	1409	384	349	348	308	1389	2798
0900	409	317	305	382	1413	294	285	296	279	1154	2567
1000	313	302	293	311	1219	283	294	346	299	1222	2441
1100	371	380	363	431	1545	290	310	350	359	1309	2854
1200	413	398	407	370	1588	361	352	379	408	1500	3088
1300	401	358	390	352	1501	442	453	430	432	1757	3258
1400	405	437	422	421	1685	399	385	437	249	1470	3155
1500	380	384	365	359	1488	414	424	438	452	1728	3216
1600	408	404	425	441	1678	446	391	445	458	1740	3418
1700	406	460	432	467	1765	463	458	485	426	1832	3597
1800	455	434	412	452	1753	406	436	410	403	1655	3408
1900	410	367	319	268	1364	443	427	376	294	1540	2904
2000	281	258	262	295	1096	289	263	255	258	1065	2161
2100	275	223	199	195	892	280	246	180	213	919	1811
2200	188	166	172	447	973	239	220	144	140	743	1716
2300	153	111	88	72	424	140	107	90	75	412	836
24-HOUR TOTALS:					25004						49615

1

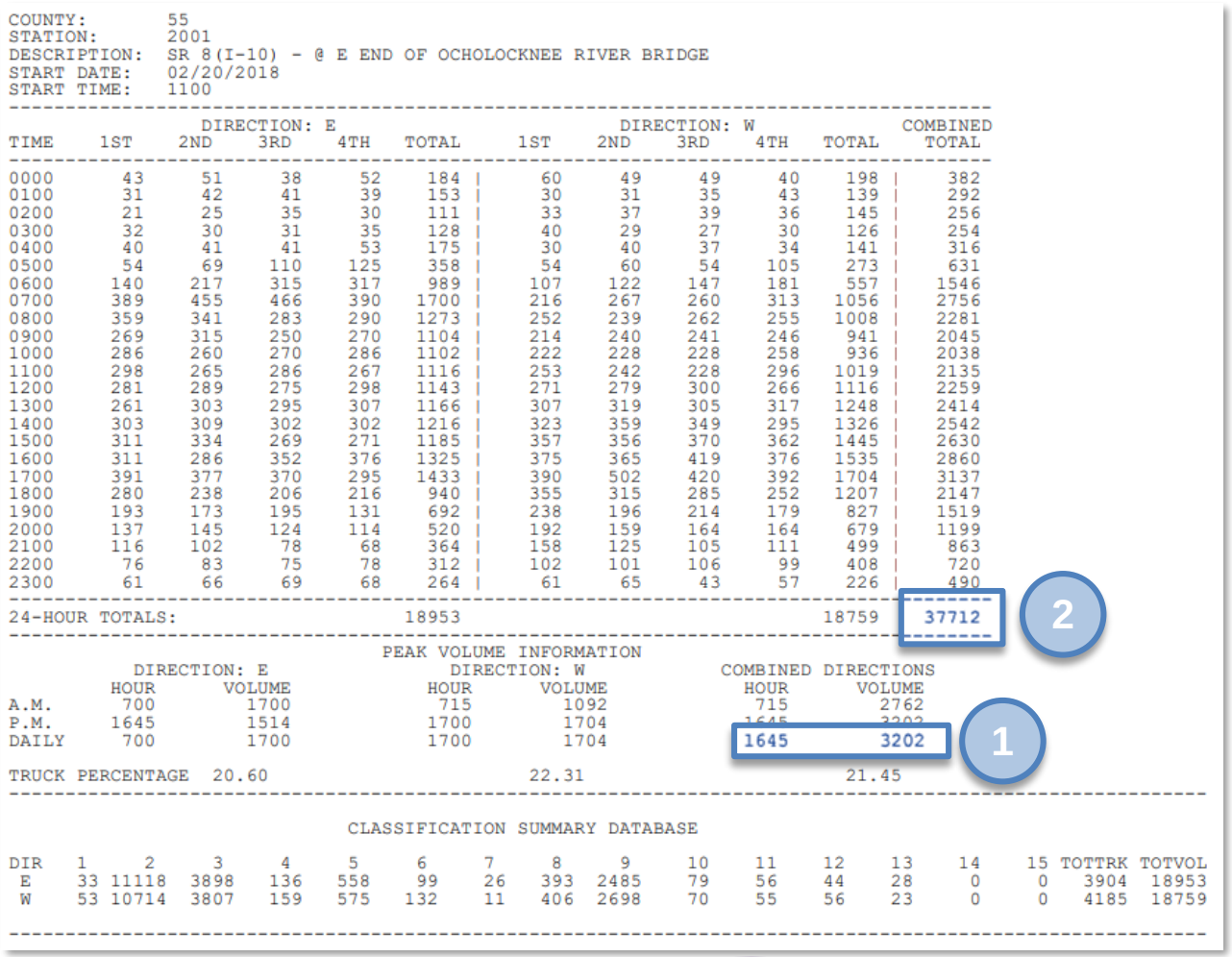
Traffic Data Factors

- K Factor
  - K Factor
    - Defined as the proportion of AADT occurring in the peak hour
    - Most Critical Period of Operations
    - $K\ Factor = \frac{Total\ Peak\ Hour\ Volume}{Daily\ Volume}$

Traffic Data Factors

- K Factor
  - Determine the K Factor from the count data
    - Steps to calculate K Factor
      1. Determine the Daily Peak Hour Volume
      2. Determine the Daily Volume
      3. Calculate the K Factor

- $K\ Factor = \frac{Total\ Peak\ Hour\ Volume}{Daily\ Volume}$
- $K\ Factor = \frac{3{,}202}{37{,}712} = 8.5\%$



COUNTY: 55
STATION: 2001
DESCRIPTION: SR 8(I-10) - @ E END OF OCHOLOCKNEE RIVER BRIDGE
START DATE: 02/20/2018
START TIME: 1100

TIME	DIRECTION: E 1ST	2ND	3RD	4TH	TOTAL	DIRECTION: W 1ST	2ND	3RD	4TH	TOTAL	COMBINED TOTAL
0000	43	51	38	52	184	60	49	49	40	198	382
0100	31	42	41	39	153	30	31	35	43	139	292
0200	21	25	35	30	111	33	37	39	36	145	256
0300	32	30	31	35	128	40	29	27	30	126	254
0400	40	41	41	53	175	30	40	37	34	141	316
0500	54	69	110	125	358	54	60	54	105	273	631
0600	140	217	315	317	989	107	122	147	181	557	1546
0700	389	455	466	390	1700	216	267	260	313	1056	2756
0800	359	341	283	290	1273	252	239	262	255	1008	2281
0900	269	315	250	270	1104	214	240	241	246	941	2045
1000	286	260	270	286	1102	222	228	228	258	936	2038
1100	298	265	286	267	1116	253	242	228	296	1019	2135
1200	281	289	275	298	1143	271	279	300	266	1116	2259
1300	261	303	295	307	1166	307	319	305	317	1248	2414
1400	303	309	302	302	1216	323	359	349	295	1326	2542
1500	311	334	269	271	1185	357	356	370	362	1445	2630
1600	311	286	352	376	1325	375	365	419	376	1535	2860
1700	391	377	370	295	1433	390	502	420	392	1704	3137
1800	280	238	206	216	940	355	315	285	252	1207	2147
1900	193	173	195	131	692	238	196	214	179	827	1519
2000	137	145	124	114	520	192	159	164	164	679	1199
2100	116	102	78	68	364	158	125	105	111	499	863
2200	76	83	75	78	312	102	101	106	99	408	720
2300	61	66	69	68	264	61	65	43	57	226	490
24-HOUR TOTALS:					18953					18759	37712

PEAK VOLUME INFORMATION

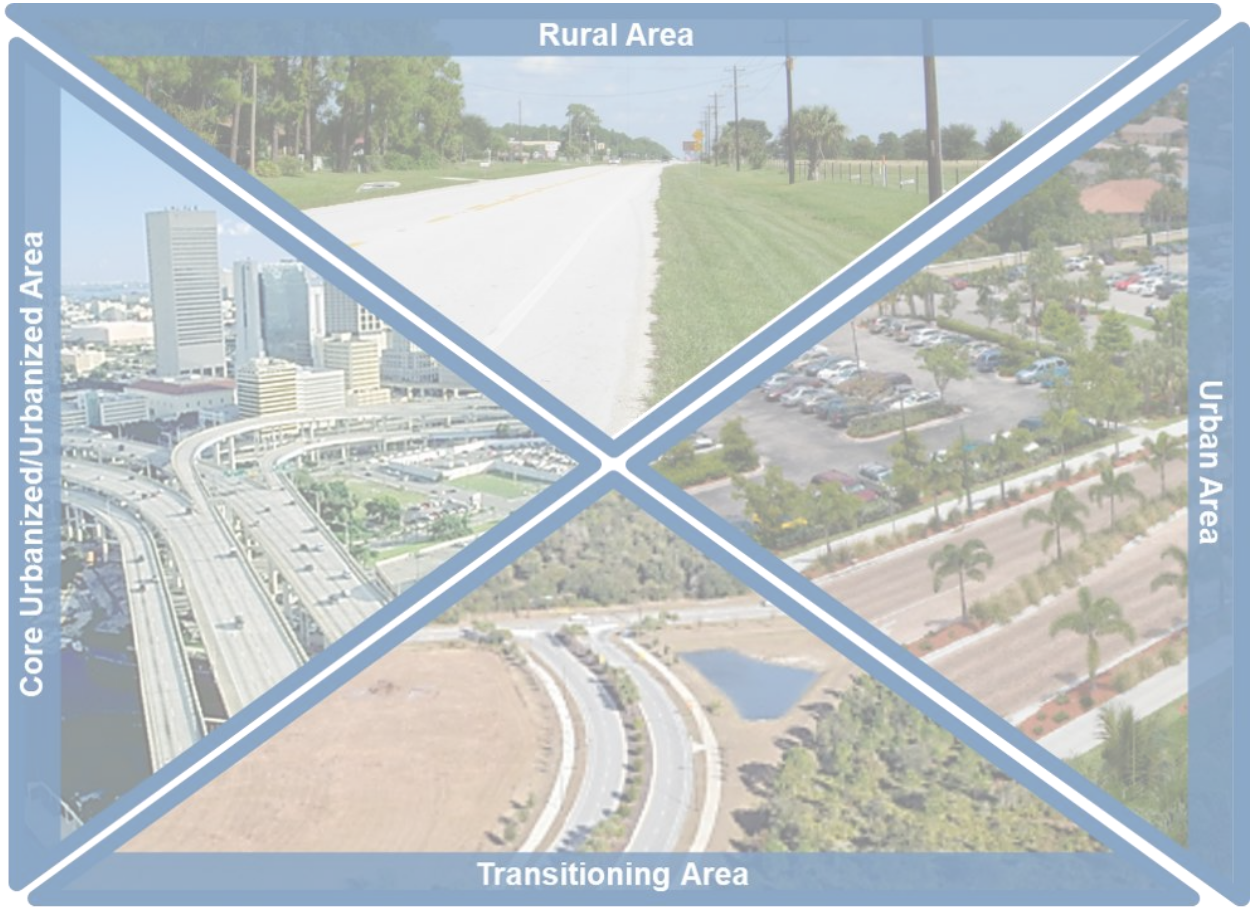
	DIRECTION: E HOUR	VOLUME	DIRECTION: W HOUR	VOLUME	COMBINED DIRECTIONS HOUR	VOLUME
A.M.	700	1700	715	1092	715	2762
P.M.	1645	1514	1700	1704	1645	3202
DAILY	700	1700	1700	1704	1645	3202
TRUCK PERCENTAGE	20.60		22.31		21.45	

CLASSIFICATION SUMMARY DATABASE

DIR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTTRK	TOTVOL
E	33	11118	3898	136	558	99	26	393	2485	79	56	44	28	0	0	3904	18953
W	53	10714	3807	159	575	132	11	406	2698	70	55	56	23	0	0	4185	18759

Traffic Data Factors

- Standard K Factor
  - FDOT prescribes a Standard K Factor
    - For Traffic Forecasting Projects
    - Cost-Effective Measure
  - A Standard K is recommended for a project based on its geographic context
    - Large/Core Urbanized Area
    - Other Urbanized Area
    - Transitioning to Urbanized Area
    - Urban Area
    - Rural Area



FDOT Standard K Factors

Area (Population)	Facility Type	Standard K Factor (% AADT)*	Representative Time Period
Large Urbanized Areas with Core Freeways (1,000,000+)	Freeways	8.0 - 9.0 ***	Typical weekday peak period or hour
	Arterials & Highways	9.0 **	Typical weekday peak hour
Other Urbanized Areas (50,000+)	Freeways	9.0 **	Typical weekday peak hour
	Arterials & Highways		
Transitioning to Urbanized Areas (Uncertain)	Freeways	9.0	Typical weekday peak hour
	Arterials & Highways		
Urban (5,000-50,000)	Freeways	10.5	100th highest hour of the year
	Arterials & Highways	9.0**	Typical weekday peak hour
Rural (<5,000)	Freeways	10.5	100th highest hour of the year
	Arterials	9.5**	
	Highways	9.5	

* Some smoothing of values at area boundaries/edges would be desirable.

** Value is 7.5% in approved Multimodal Transportation Districts where automobile movements are deemphasized. This lower value represents an extensive multi-hour peak period rather than a peak hour.

*** Value is 8.0% for FDOT-designated urbanized core freeways and may either be 8.5% or 9.0% for non-core freeways. Values less than 9% essentially represent a multi-hour peak period rather than a peak hour.

Traffic Data Factors

- **Directional Factor (D Factor)**
  - Directional Distribution is the percentage of the total, two-way hourly traffic traveling in the peak direction
  - Always ≥ 50%
  - Determination of D Factor
    - Continuous count sites
      - Median D for the highest 200 hours
    - Short-term count sites
      - $D\ Factor = \frac{\max(Volume_{Peak1}, Volume_{Peak2})}{Combined\ Peak\ Hour\ Volume}$

Traffic Data Factors

- **Directional Factor (D Factor) Example**
  - Determine the D Factor from the count data
    - Steps to calculate D Factor
      1. Determine the Daily Peak Hour
      2. Calculate D Factor

- $D\ Factor = \frac{\max(Volume_{Peak1}, Volume_{Peak2})}{Combined\ Peak\ Hour\ Volume}$
- $D\ Factor = \frac{\max(1{,}700, 1{,}704)}{3{,}202} = 53.2\%$

COUNTY: 55
STATION: 2001
DESCRIPTION: SR 8(I-10) - @ E END OF OCHOLOCKNEE RIVER BRIDGE
START DATE: 02/20/2018
START TIME: 1100

	DIRECTION: E					DIRECTION: W					COMBINED
TIME	1ST	2ND	3RD	4TH	TOTAL	1ST	2ND	3RD	4TH	TOTAL	TOTAL
0000	43	51	38	52	184	60	49	49	40	198	382
0100	31	42	41	39	153	30	31	35	43	139	292
0200	21	25	35	30	111	33	37	39	36	145	256
0300	32	30	31	35	128	40	29	27	30	126	254
0400	40	41	41	53	175	30	40	37	34	141	316
0500	54	69	110	125	358	54	60	54	105	273	631
0600	140	217	315	317	989	107	122	147	181	557	1546
0700	389	455	466	390	1700	216	267	260	313	1056	2756
0800	359	341	283	290	1273	252	239	262	255	1008	2281
0900	269	315	250	270	1104	214	240	241	246	941	2045
1000	286	260	270	286	1102	222	228	228	258	936	2038
1100	298	265	286	267	1116	253	242	228	296	1019	2135
1200	281	289	275	298	1143	271	279	300	266	1116	2259
1300	261	303	295	307	1166	307	319	305	317	1248	2414
1400	303	309	302	302	1216	323	359	349	295	1326	2542
1500	311	334	269	271	1185	357	356	370	362	1445	2630
1600	311	286	352	376	1325	375	365	419	376	1535	2860
1700	391	377	370	295	1433	390	502	420	392	1704	3137
1800	280	238	206	216	940	355	315	285	252	1207	2147
1900	193	173	195	131	692	238	196	214	179	827	1519
2000	137	145	124	114	520	192	159	164	164	679	1199
2100	116	102	78	68	364	158	125	105	111	499	863
2200	76	83	75	78	312	102	101	106	99	408	720
2300	61	66	69	68	264	61	65	43	57	226	490
24-HOUR TOTALS:					18953					18759	37712

PEAK VOLUME INFORMATION

	DIRECTION: E		DIRECTION: W		COMBINED DIRECTIONS	
	HOUR	VOLUME	HOUR	VOLUME	HOUR	VOLUME
A.M.	700	1700	715	1092	715	2762
P.M.	1645	1514	1700	1704	1645	3202
DAILY	700	1700	1700	1704	1645	3202

TRUCK PERCENTAGE 20.60 22.31 21.45

1

CLASSIFICATION SUMMARY DATABASE

DIR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTTRK	TOTVOL
E	33	11118	3898	136	558	99	26	393	2485	79	56	44	28	0	0	3904	18953
W	53	10714	3807	159	575	132	11	406	2698	70	55	56	23	0	0	4185	18759

Traffic Data Factors

- **Directional Factor (D Factor)**
  - D-Factor sources
    - FTO website
  - If FTO traffic counts for the project site are not available,
    - Obtain short-term traffic counts (Field)
    - Determine hourly traffic volume distribution
  - Calculated D-Factors should be checked to assure they are within the allowable range

Recommended D-Factors for Project Traffic Forecasting

Road Type	Low	D	High	Standard Deviation
Rural Freeway	52.3	54.8	57.3	1.73
Rural Arterial	51.1	58.1	79.6	6.29
Urban Freeway	50.4	55.8	61.2	4.11
Urban Arterial	50.8	57.9	67.1	4.60

Traffic Data Factors

- **Percent Trucks**
  - Daily Truck Percentage (T or T_{24})
    - The percentage of truck traffic during the day
    - $Daily\ Truck\ Volume\ (DTV) = AADT \times T$
  - Peak Hour T Percentage (DHT or T_f)
    - The percentage of truck traffic during the peak hour
    - $DHT = \frac{T}{2}$
  - Common Uses for T Factors
    - Capacity Analysis
    - Pavement Design

Traffic Data Factors

- **Percent Trucks Capacity Analysis Example**
  - Determine the DHT Factor from the count data
    - Steps to calculate T Factor

1. Determine the T Factor

$$T = 21.45\%$$

2. Calculate the DHT

$$DHT = \frac{T}{2}$$

$$DHT = \frac{21.45}{2} = 10.73\%$$

COUNTY: 55
STATION: 2001
DESCRIPTION: SR 8(I-10) - @ E END OF OCHOLOCKNEE RIVER BRIDGE
START DATE: 02/20/2018
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TIME	DIRECTION: E 1ST	2ND	3RD	4TH	TOTAL	DIRECTION: W 1ST	2ND	3RD	4TH	TOTAL	COMBINED TOTAL
0000	43	51	38	52	184	60	49	49	40	198	382
0100	31	42	41	39	153	30	31	35	43	139	292
0200	21	25	35	30	111	33	37	39	36	145	256
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0500	54	69	110	125	358	54	60	54	105	273	631
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TRUCK PERCENTAGE 20.60 22.31 21.45

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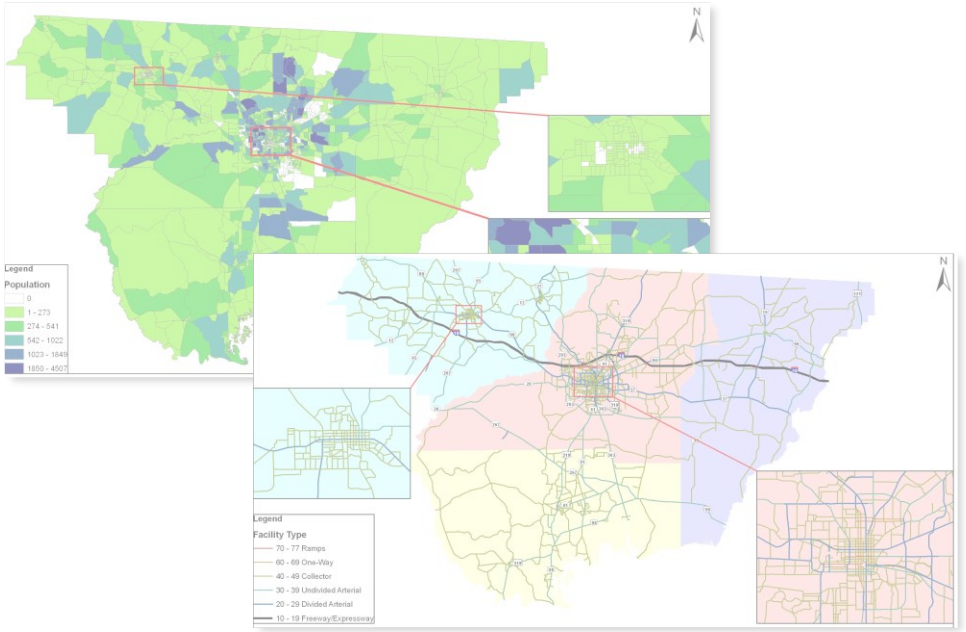
Traffic Data Sources and Factors

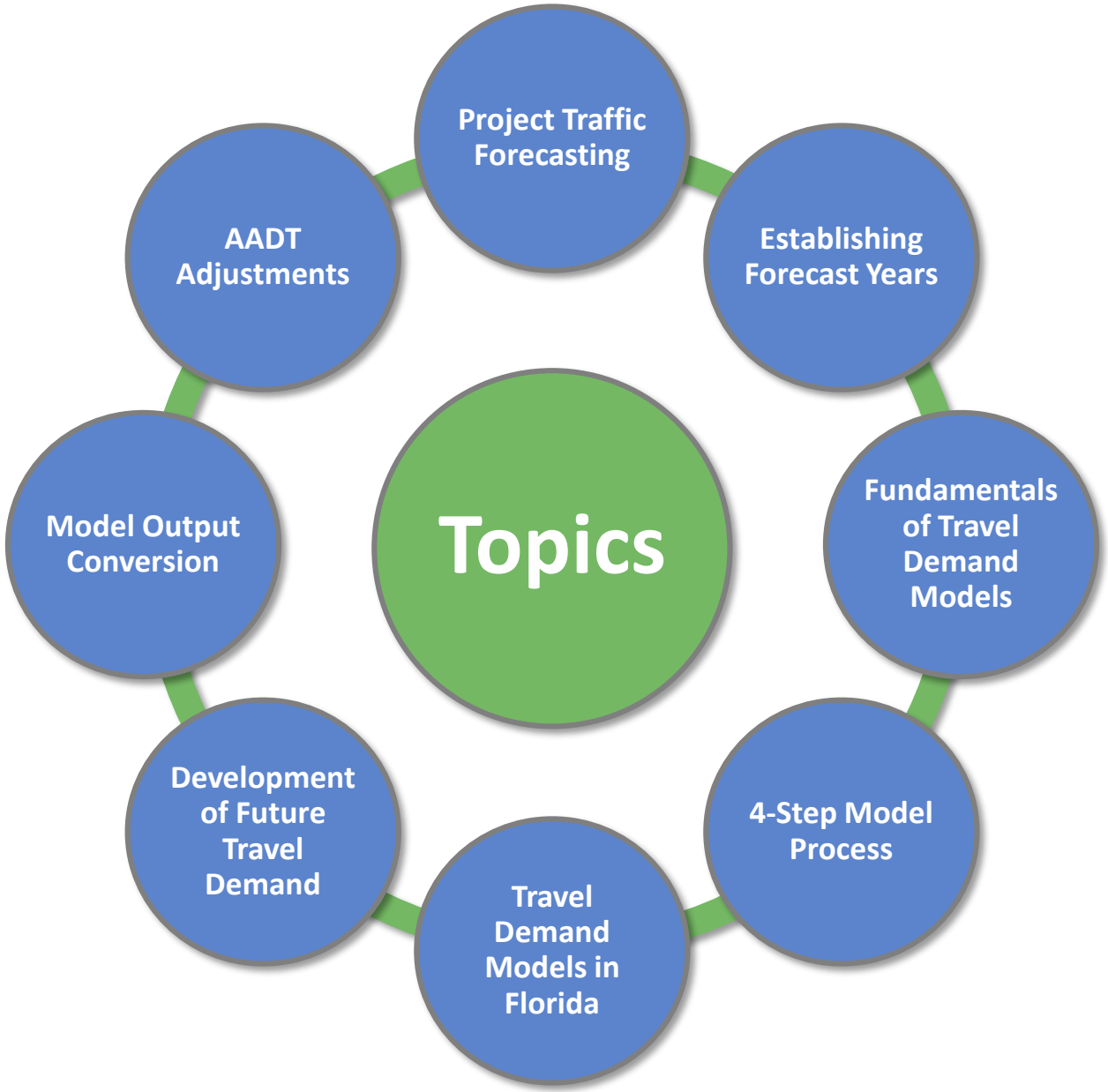
QUIZ

Forecasting with a Travel Demand Model

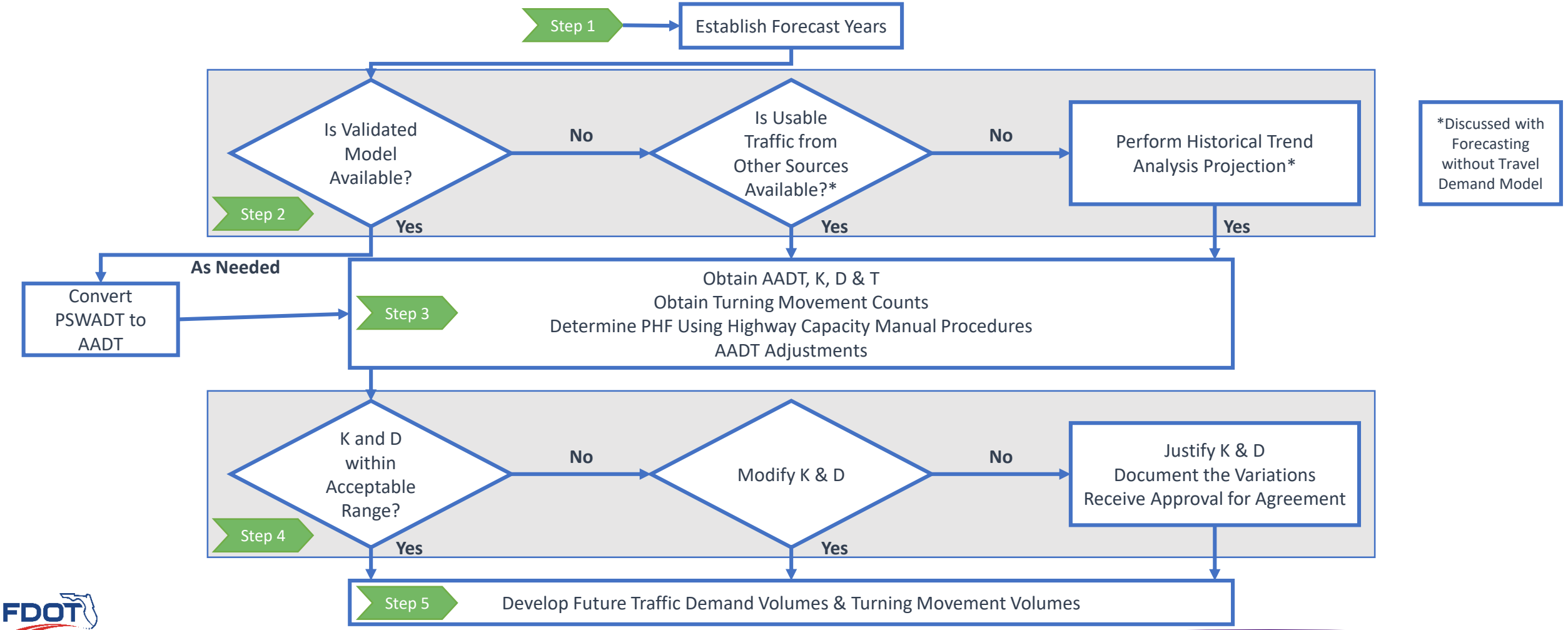
- Introduction
- Project Traffic Forecasting
- Establishing Forecast Years
- Fundamentals of TDMs
- 4-Step Model Process
- TDMs in Florida
- Development of Future Travel Demand
- Model Output Conversion
- AADT Adjustments
- Quiz

Introduction





Project Traffic Forecasting



Establishing Forecast Years

Model Forecasting Years

- Base Year: Year traffic conditions in model is adjusted to replicate
- Horizon Year: Future model year that corresponds to LRTP Horizon year

Analysis Forecasting Years

- Existing Year: Most recent year traffic counts
- Opening Year: One year after project is scheduled to be open
- Interim Year: Halfway between Opening Year and Design Year
- Design Year: Year the roadway is designed, usually 20 years after Opening Year

Fundamentals of Travel Demand Models

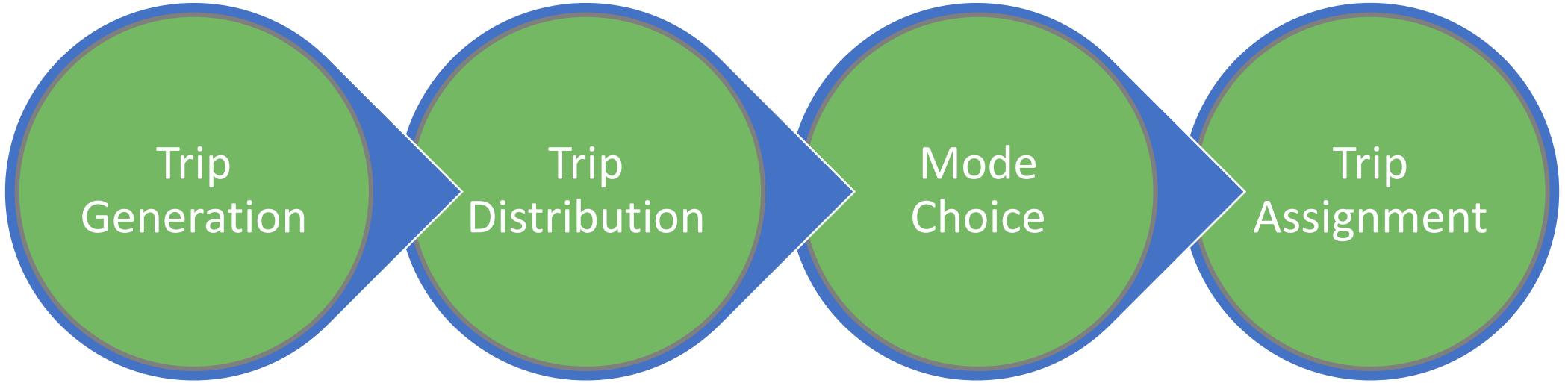
- Travel Demand Models
  - Developed based on mathematical equations representing
  - Used to forecast travel demand on future transportation facilities
- Additional information on the modeling process can be found on the http://www.fsutmsonline.net/index.php

Land Use and Economic Development

Household and Individual Behavior

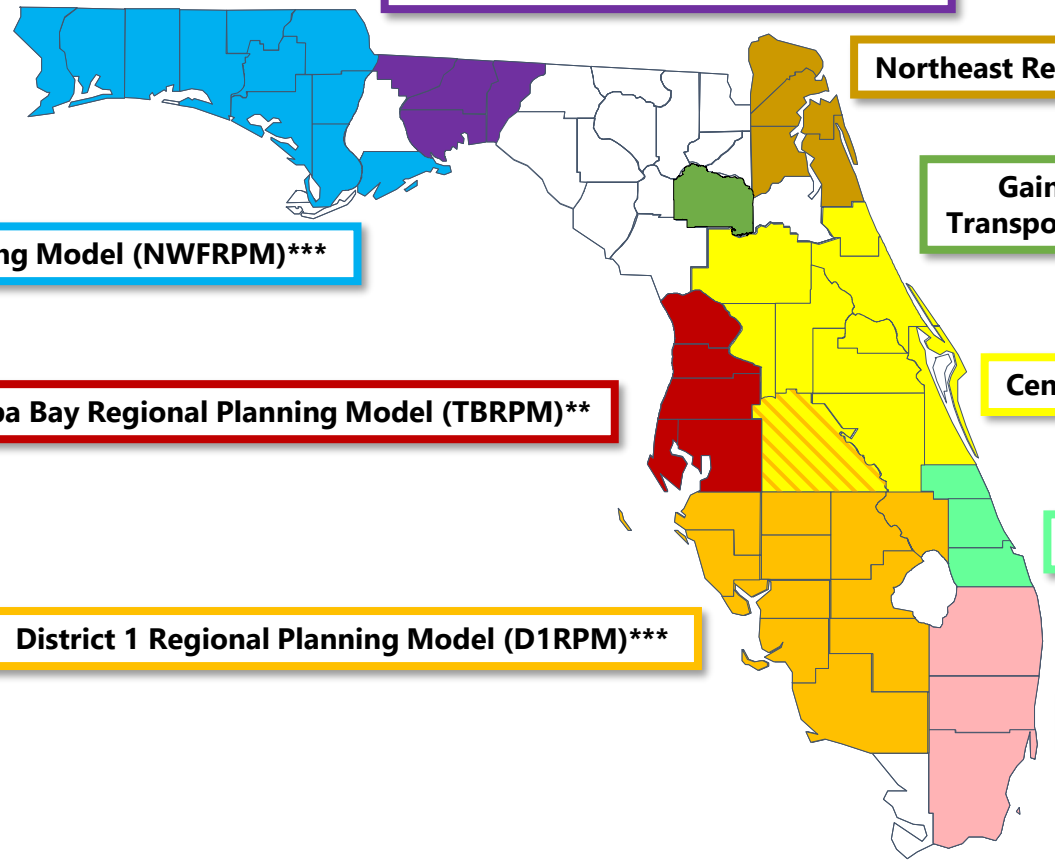
Transportation System Performance

4-Step Model Process



- Most TDMs used in Florida are 4-Step Models
- Additional Types of Models:
  - Time of Day Model
  - Activity-Based Model

Travel Demand Models in Florida



Capital Region TPA (CRTPA) Model***

Northeast Regional Planning Model - Activity Based (NERPM-AB)*

Gainesville Urbanized Area*** Transportation Study (GUATS) Model

Northwest Florida Regional Planning Model (NWFRPM)***

Tampa Bay Regional Planning Model (TBRPM)**

Central Florida Regional Planning Model (CFRPM)**

Treasure Coast Regional Planning Model (TCRPM)*

District 1 Regional Planning Model (D1RPM)***

Southeast Florida Regional Planning Model (SERPM)*

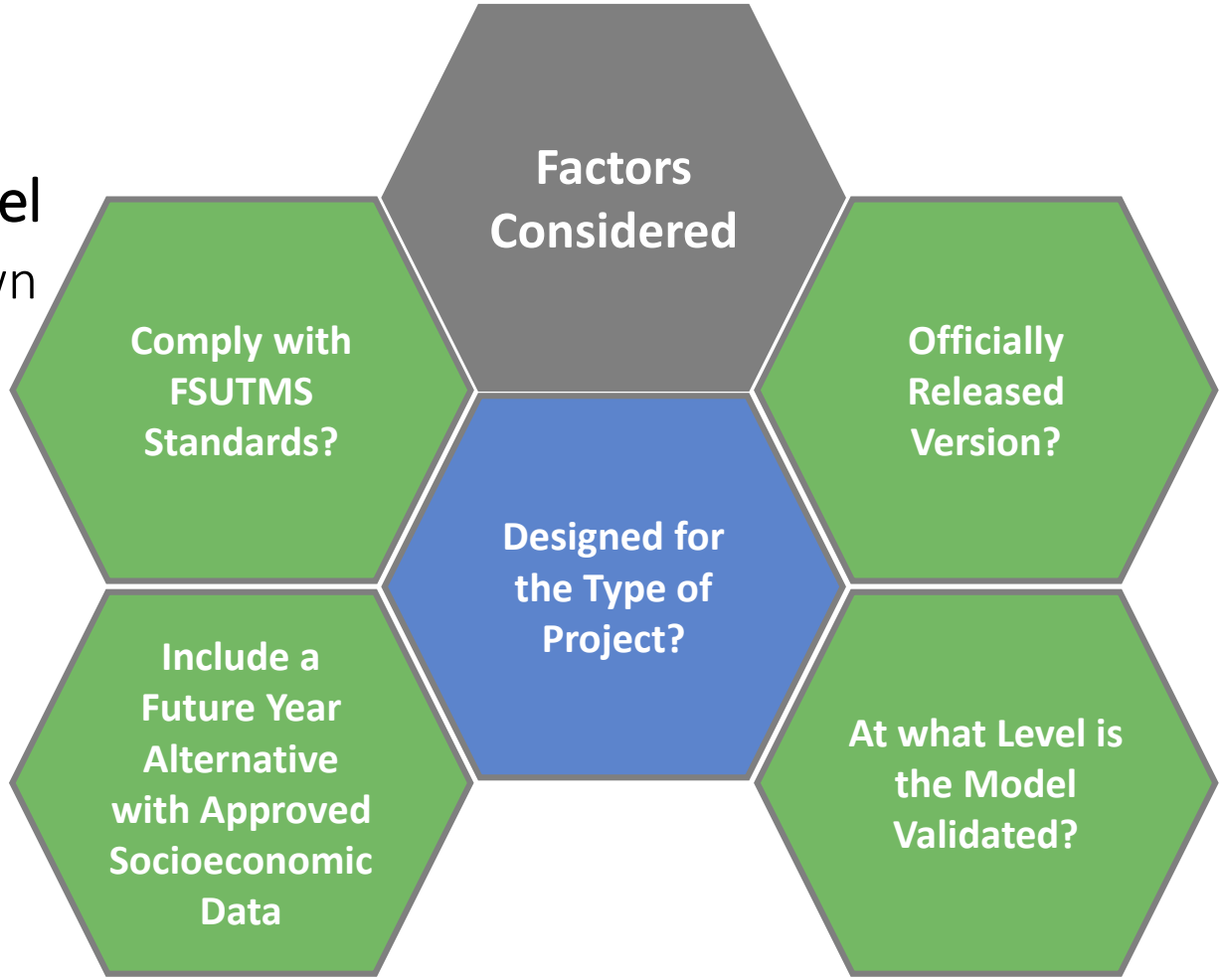
* Activity-based Model
** Time of Day Model
*** Traditional Four Step Model

Florida Statewide Model (FLSWM) (Passenger & Freight)

Florida Turnpike Models

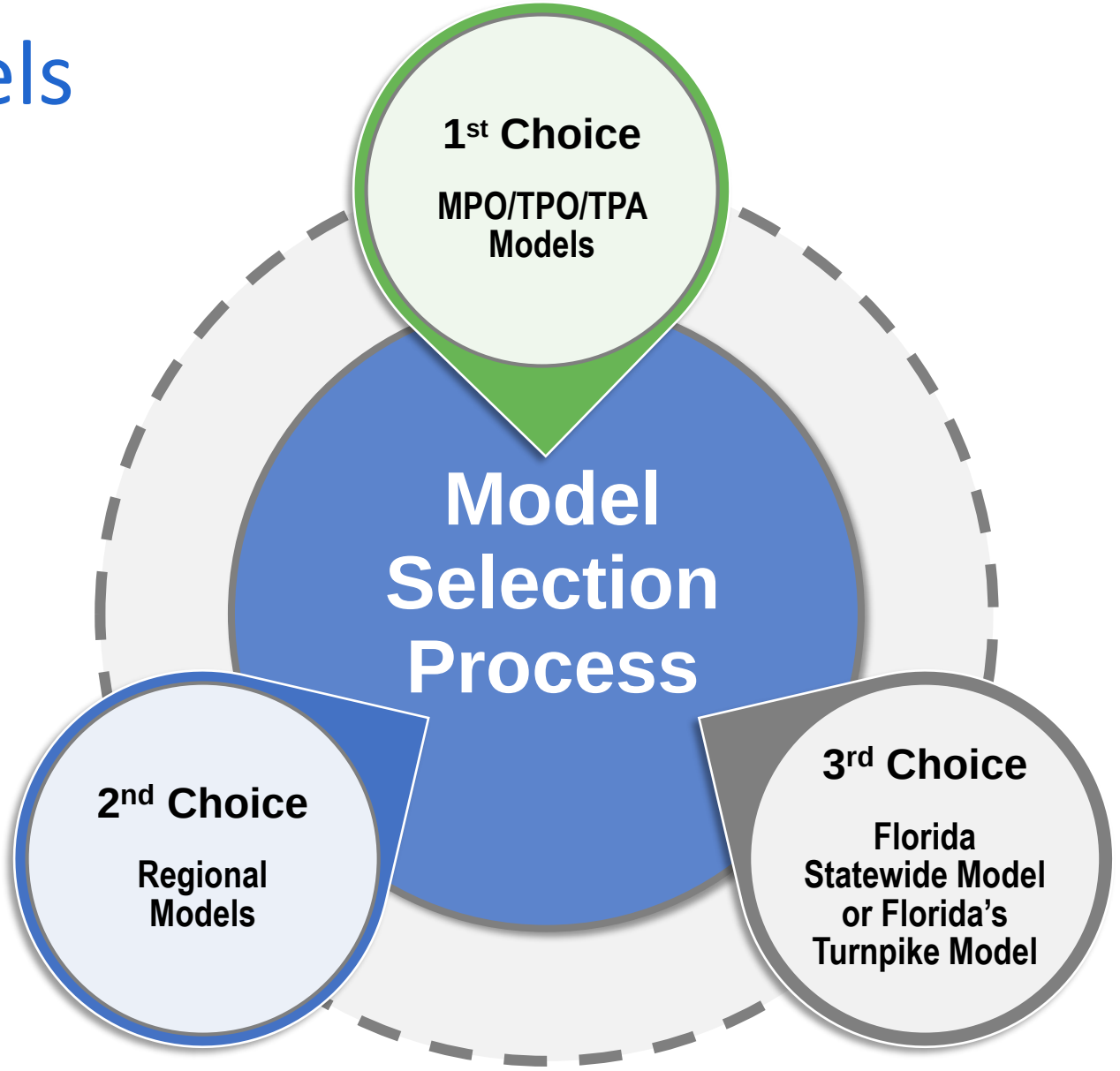
Travel Demand Models in Florida

- Factors Considered when Selecting a Model
  - When adopted FSUTMS models are shown to be inadequate
    - Document the deficiencies
    - Recommend Alternatives
      - A non-FSUTMS model
      - A combination of other approaches
  - Obtain approval from the District



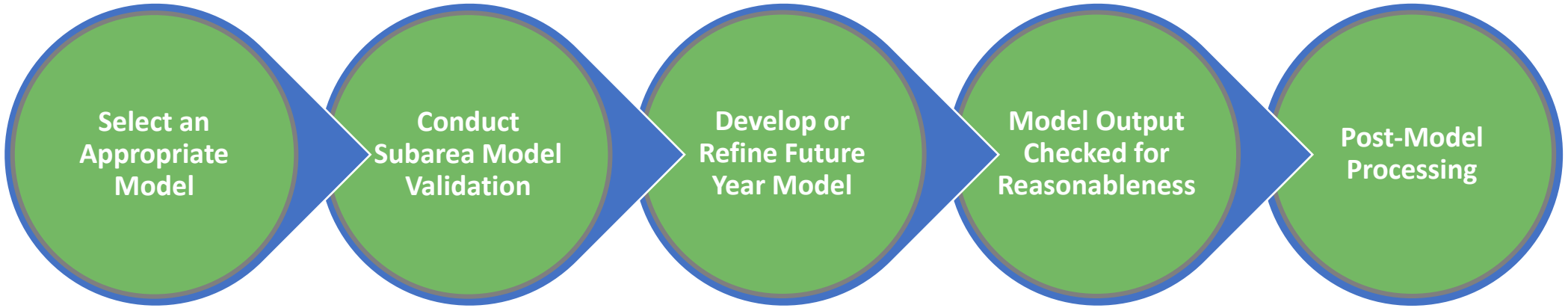
Travel Demand Models in Florida

- Florida's modeling web portal provides all available models
  - http://www.fsutmsonline.net/index.php



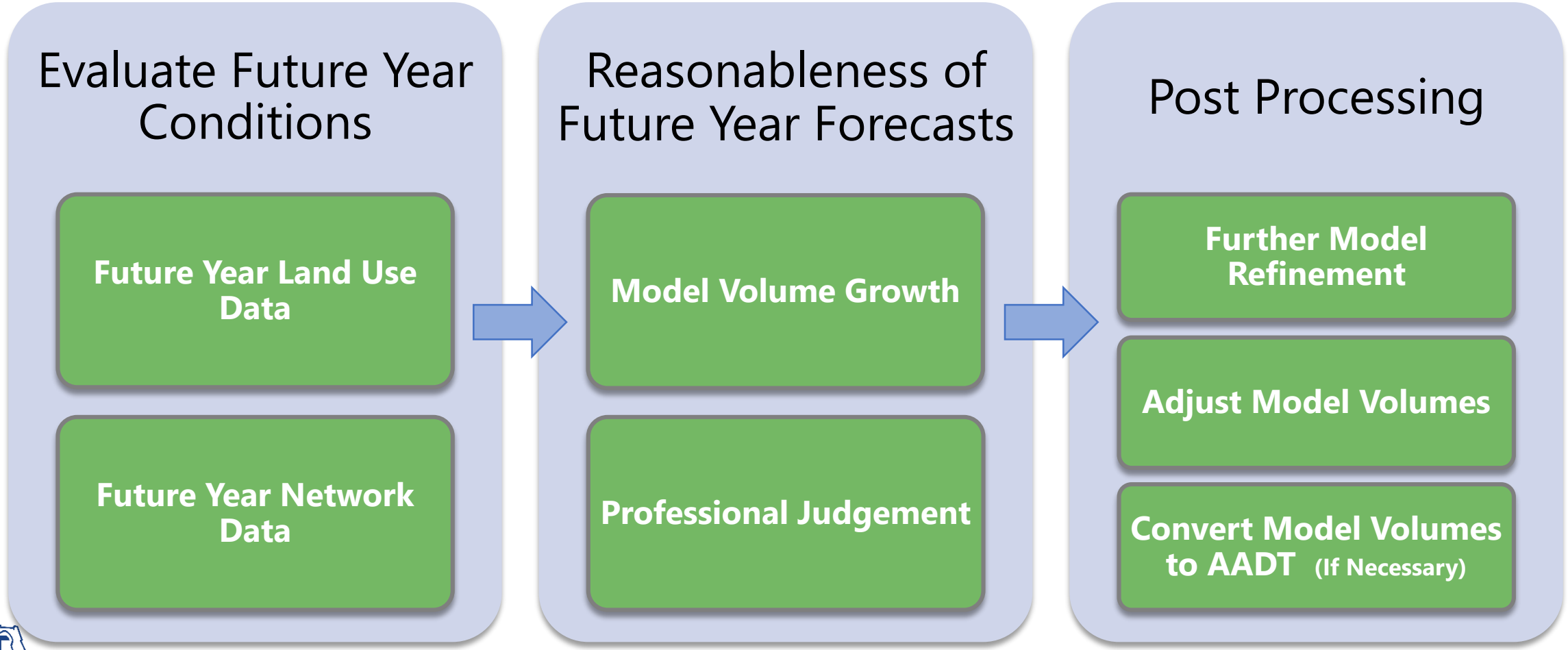
Development of Future Travel Demand

- Demand Forecasting with Model Process



- Model chosen typically
  - Adopts the Long-Range Transportation Plan (LRTP) Cost Feasible Network
  - Includes approved employment and population data

Development of Future Travel Demand



Model Output Conversion

Peak Season Weekday Average Daily Traffic (PSWADT)

- Most Florida models are validated to peak season travel conditions
- Peak Season is the 13 consecutive weeks of the year with the highest traffic volumes
- Some models in Florida are validated to AADT volumes
  - SERPM
  - TCRPM
  - FLSWM

PSWADT Volumes Need to be Converted to AADT Volumes

Model Output Conversion

- **Model Output Conversion Factor (MOCF)**
  - Used to convert PSWADT to AADT
    - $AADT = PSWADT \times MOCF$
  - Reported in the Peak Season Factor Category Report
    - Report available on FTO Website
  - Average of 13 SFs during the peak season
  - Example:
    - $MOCF = \frac{12.36}{13}$
    - $MOCF = 0.95$

2018 PEAK SEASON FACTOR CATEGORY REPORT - REPORT TYPE: DISTRICT
CATEGORY: 1600 POLK COUNTYWIDE

MOCF: 0.95

WEEK	DATES	SF	PSCF
1	01/01/2018 - 01/06/2018	0.98	1.03
2	01/07/2018 - 01/13/2018	1.01	1.06
3	01/14/2018 - 01/20/2018	1.03	1.08
4	01/21/2018 - 01/27/2018	1.01	1.06
* 5	01/28/2018 - 02/03/2018	0.99	1.04
* 6	02/04/2018 - 02/10/2018	0.97	1.02
* 7	02/11/2018 - 02/17/2018	0.95	1.00
* 8	02/18/2018 - 02/24/2018	0.94	0.99
* 9	02/25/2018 - 03/03/2018	0.94	0.99
*10	03/04/2018 - 03/10/2018	0.93	0.98
*11	03/11/2018 - 03/17/2018	0.92	0.97
*12	03/18/2018 - 03/24/2018	0.93	0.98
*13	03/25/2018 - 03/31/2018	0.94	0.99
*14	04/01/2018 - 04/07/2018	0.95	1.00
*15	04/08/2018 - 04/14/2018	0.96	1.01
*16	04/15/2018 - 04/21/2018	0.96	1.01
*17	04/22/2018 - 04/28/2018	0.98	1.03
18	04/29/2018 - 05/05/2018	1.00	1.05
19	05/06/2018 - 05/12/2018	1.01	1.06
20	05/13/2018 - 05/19/2018	1.03	1.08
21	05/20/2018 - 05/26/2018	1.03	1.08
22	05/27/2018 - 06/02/2018	1.03	1.08
23	06/03/2018 - 06/09/2018	1.04	1.09

Model Output Conversion

- **Peak Season Conversion Factors (PSCF)**
  - Used to convert ADT to PSWADT
    - $PSWADT = ADT \times PSCF$
  - Reported in the Peak Season Factor Category Report
    - Report available on FTO Website

2018 PEAK SEASON FACTOR CATEGORY REPORT - REPORT TYPE: DISTRICT
CATEGORY: 1600 POLK COUNTYWIDE

WEEK	DATES	SF	MOCF: 0.95 PSCF
1	01/01/2018 - 01/06/2018	0.98	1.03
2	01/07/2018 - 01/13/2018	1.01	1.06
3	01/14/2018 - 01/20/2018	1.03	1.08
4	01/21/2018 - 01/27/2018	1.01	1.06
* 5	01/28/2018 - 02/03/2018	0.99	1.04
* 6	02/04/2018 - 02/10/2018	0.97	1.02
* 7	02/11/2018 - 02/17/2018	0.95	1.00
* 8	02/18/2018 - 02/24/2018	0.94	0.99
* 9	02/25/2018 - 03/03/2018	0.94	0.99
*10	03/04/2018 - 03/10/2018	0.93	0.98
*11	03/11/2018 - 03/17/2018	0.92	0.97
*12	03/18/2018 - 03/24/2018	0.93	0.98
*13	03/25/2018 - 03/31/2018	0.94	0.99
*14	04/01/2018 - 04/07/2018	0.95	1.00
*15	04/08/2018 - 04/14/2018	0.96	1.01
*16	04/15/2018 - 04/21/2018	0.96	1.01
*17	04/22/2018 - 04/28/2018	0.98	1.03
18	04/29/2018 - 05/05/2018	1.00	1.05
19	05/06/2018 - 05/12/2018	1.01	1.06
20	05/13/2018 - 05/19/2018	1.03	1.08
21	05/20/2018 - 05/26/2018	1.03	1.08
22	05/27/2018 - 06/02/2018	1.03	1.08
23	06/03/2018 - 06/09/2018	1.04	1.09

Model Output Conversion

- **Peak Season Conversion Factors (PSCF)**
  - Obtained by dividing SFs by MOCF for the same week.
    - $PSCF = \frac{SF}{MOCF}$
  - Needed to convert short-term traffic counts to PSWADT for model validation
  - PSCF Example for 03/04/2018 – 03/10/2018:
    - $PSCF = \frac{0.93}{0.95}$
    - $PSCF = 0.98$

2018 PEAK SEASON FACTOR CATEGORY REPORT - REPORT TYPE: DISTRICT
CATEGORY: 1600 POLK COUNTYWIDE

MOCF: 0.95

WEEK	DATES	SF	PSCF
1	01/01/2018 - 01/06/2018	0.98	1.03
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3	01/14/2018 - 01/20/2018	1.03	1.08
4	01/21/2018 - 01/27/2018	1.01	1.06
* 5	01/28/2018 - 02/03/2018	0.99	1.04
* 6	02/04/2018 - 02/10/2018	0.97	1.02
* 7	02/11/2018 - 02/17/2018	0.95	1.00
* 8	02/18/2018 - 02/24/2018	0.94	0.99
* 9	02/25/2018 - 03/03/2018	0.94	0.99
*10	03/04/2018 - 03/10/2018	0.93	0.98
*11	03/11/2018 - 03/17/2018	0.92	0.96
*12	03/18/2018 - 03/24/2018	0.93	0.98
*13	03/25/2018 - 03/31/2018	0.94	0.99
*14	04/01/2018 - 04/07/2018	0.95	1.00
*15	04/08/2018 - 04/14/2018	0.96	1.01
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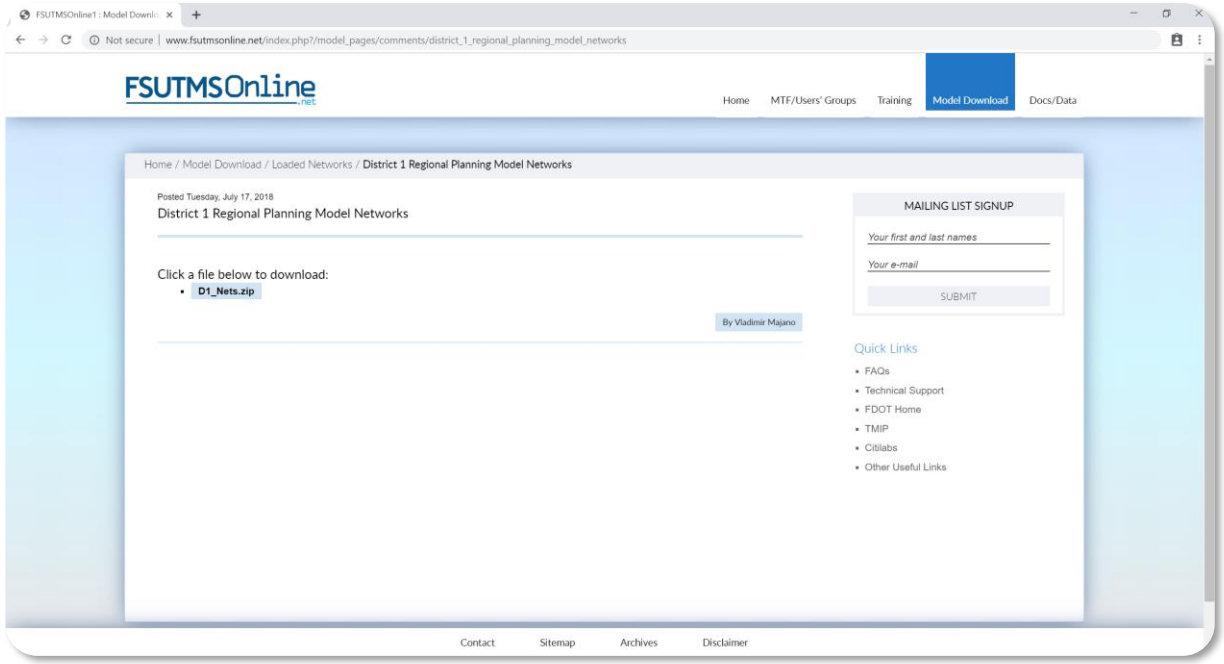
18	04/29/2018 - 05/05/2018	1.00	1.05
19	05/06/2018 - 05/12/2018	1.01	1.06
20	05/13/2018 - 05/19/2018	1.03	1.08
21	05/20/2018 - 05/26/2018	1.03	1.08
22	05/27/2018 - 06/02/2018	1.03	1.08
23	06/03/2018 - 06/09/2018	1.04	1.09

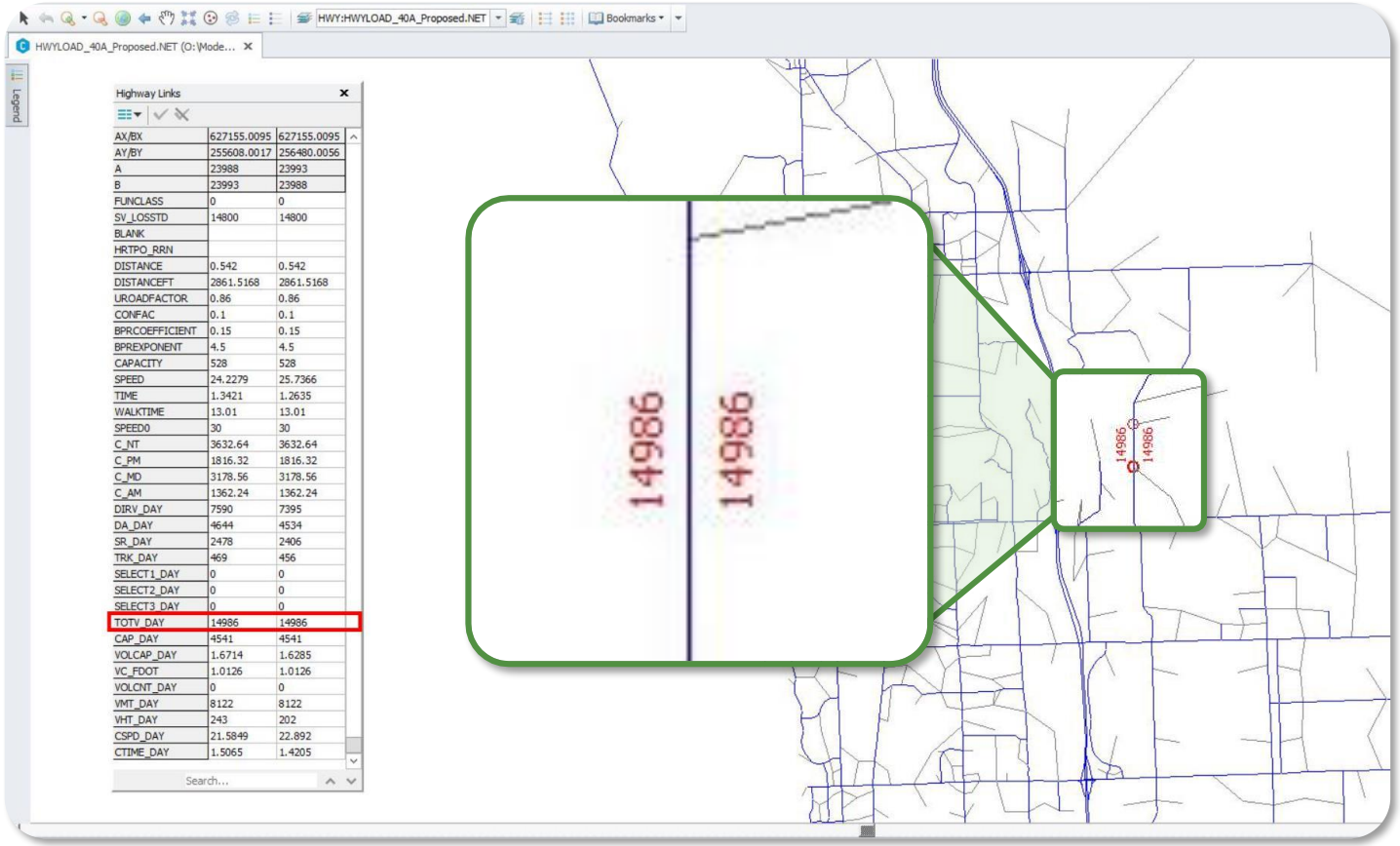
Practice Problem

- Determine the AADT from the District 1 Regional Planning Model Output
  - Model has been validated and approved for use
  - Request or download loaded highway network from FSUTMSOnline.net



Practice Problem

- AADT from Model Output Example
  - Use Cube Voyager to open the loaded network for 2040, or have the network converted to GIS shapefile
  - Locate the link in the network and make sure to select the correct attribute



AX/BX	627155.0095	627155.0095
AY/BY	255608.0017	256480.0056
A	23988	23993
B	23993	23988
FUNCLASS	0	0
SV_LOSSTD	14800	14800
BLANK		
HRTPO_RRN		
DISTANCE	0.542	0.542
DISTANCEFT	2861.5168	2861.5168
UROADFACTOR	0.86	0.86
CONFAC	0.1	0.1
BPRCOEFFICIENT	0.15	0.15
BPREXPONENT	4.5	4.5
CAPACITY	528	528
SPEED	24.2279	25.7366
TIME	1.3421	1.2635
WALKTIME	13.01	13.01
SPEED0	30	30
C_NT	3632.64	3632.64
C_PM	1816.32	1816.32
C_MD	3178.56	3178.56
C_AM	1362.24	1362.24
DIRV_DAY	7590	7395
DA_DAY	4644	4534
SR_DAY	2478	2406
TRK_DAY	469	456
SELECT1_DAY	0	0
SELECT2_DAY	0	0
SELECT3_DAY	0	0
TOTV_DAY	14986	14986
CAP_DAY	4541	4541
VOLCAP_DAY	1.6714	1.6285
VC_FDOT	1.0126	1.0126
VOLCNT_DAY	0	0
VMT_DAY	8122	8122
VHT_DAY	243	202
CSPD_DAY	21.5849	22.892
CTIME_DAY	1.5065	1.4205

Practice Problem

- AADT from Model Output Example
  - Note PSWADT
    - $PSWADT = 14{,}986$
  - Note MOCF
    - $MOCF = 0.89$
  - Determine AADT
    - $AADT = PSWADT \times MOCF$
    - $AADT = 14{,}986 \times 0.89 = 13{,}338$
    - $AADT = 13{,}500\ (rounded\ to\ nearest\ 500)$

2018 PEAK SEASON FACTOR CATEGORY REPORT - REPORT TYPE: DISTRICT
CATEGORY: 0300 COLLIER COUNTYWIDE

MOCF: 0.89
PSCF

WEEK	DATES	SF	PSCF
1	01/01/2018 - 01/06/2018	0.94	1.06
2	01/07/2018 - 01/13/2018	0.94	1.06
3	01/14/2018 - 01/20/2018	0.94	1.06
* 4	01/21/2018 - 01/27/2018	0.92	1.03
* 5	01/28/2018 - 02/03/2018	0.90	1.01
* 6	02/04/2018 - 02/10/2018	0.89	1.00
* 7	02/11/2018 - 02/17/2018	0.87	0.98
* 8	02/18/2018 - 02/24/2018	0.86	0.97
* 9	02/25/2018 - 03/03/2018	0.86	0.97
*10	03/04/2018 - 03/10/2018	0.86	0.97
*11	03/11/2018 - 03/17/2018	0.86	0.97
*12	03/18/2018 - 03/24/2018	0.87	0.98
*13	03/25/2018 - 03/31/2018	0.88	0.99
*14	04/01/2018 - 04/07/2018	0.90	1.01
*15	04/08/2018 - 04/14/2018	0.91	1.02
*16	04/15/2018 - 04/21/2018	0.93	1.04
17	04/22/2018 - 04/28/2018	0.95	1.07
18	04/29/2018 - 05/05/2018	0.98	1.10
19	05/06/2018 - 05/12/2018	1.01	1.13
20	05/13/2018 - 05/19/2018	1.04	1.17
21	05/20/2018 - 05/26/2018	1.05	1.18
22	05/27/2018 - 06/02/2018	1.06	1.19
23	06/03/2018 - 06/09/2018	1.08	1.21
24	06/10/2018 - 06/16/2018	1.09	1.22

AADT Adjustments

- **Model Forecasting Years May Be Different than the Project Analysis Years**
  - Base Year of the Model ≠ Project Existing Year
  - Horizon Year of the Model ≠ Project Design Year

- **Reasonableness checks are required for model volumes for base year and forecast year**
  - Inherent discrepancies between base year model volumes and existing year traffic counts
  - Errors associated with base year assignment could continue in any future year forecast

Analysis Years

A. *Traffic Forecasting*
   - Base year – 2010
   - Horizon year – 2040

B. *Traffic Operational Analysis*
   - Existing year – 2019
   - Opening year – 2025
   - Design year – 2045

AADT Adjustments

- Model Horizon Year Traffic Volume is Adjusted Using Two Methods
  - Ratio adjustment, V_{r_adj}

$$V_{r\_adj} = \frac{Count}{V_b} \times V_f$$

  - Difference adjustment, V_{d_adj}

$$V_{d\_adj} = (Count - V_b) + V_f$$

- Final Adjustment is Made by Averaging the Two Methods
  - Final adjusted forecast, V_{adj}

$$V_{adj} = \frac{\left(V_{r_{adj}} + V_{d_{adj}}\right)}{2}$$

$V_{r\_adj} - adjusted\ future\ year\ model\ volume\ by\ ratio\ method$
$V_{r\_adj} - adjusted\ future\ year\ model\ volume\ by\ difference\ method$
$Count - existing\ year\ traffic\ count$
$V_b - base\ year\ model\ volume$
$V_f - future\ year\ model\ volume$

Forecasting with Travel Demand Model

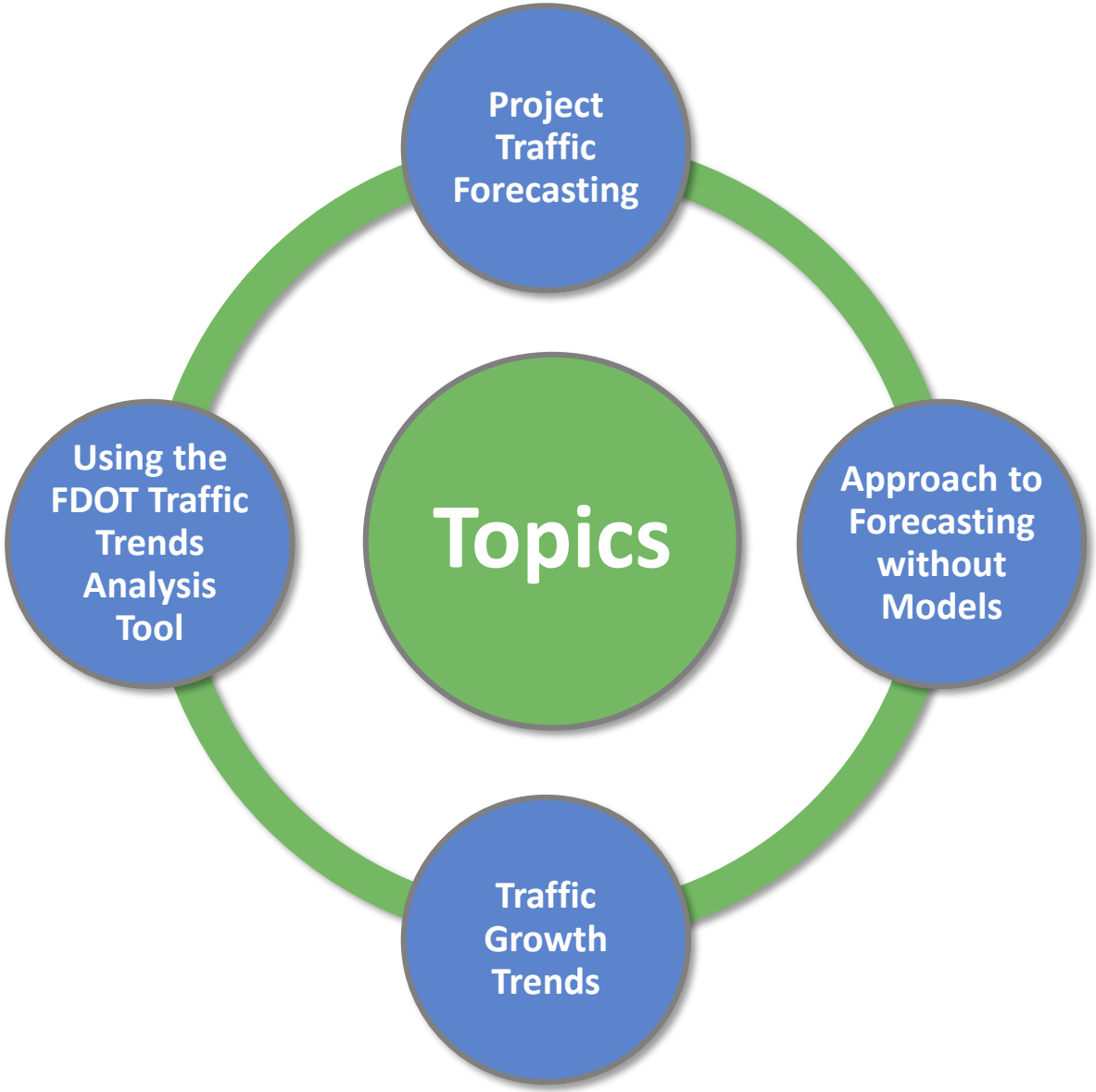
QUIZ

Forecasting without a Travel Demand Model

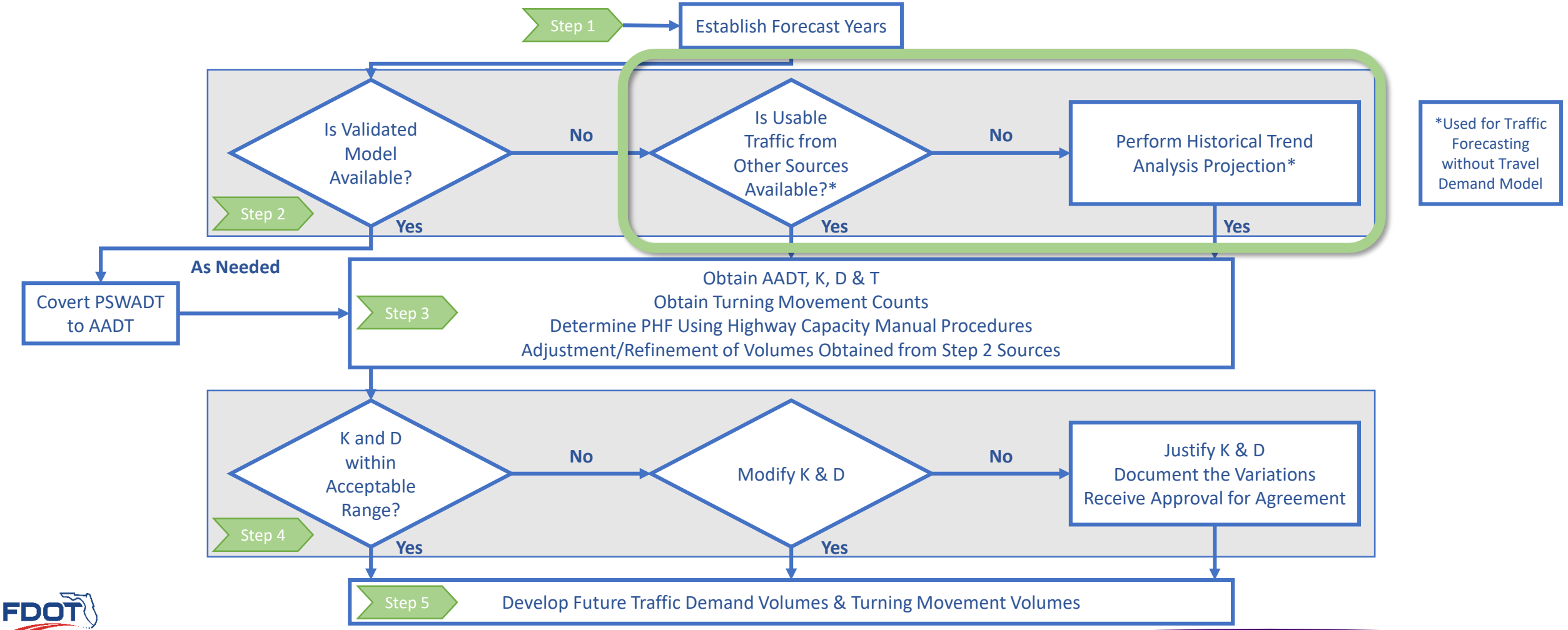
- Introduction
- Project Traffic Forecasting
- Approach to Forecasting without Models
- Traffic Growth Trends
- Using the FDOT Traffic Trends Analysis Tool
- Quiz

Introduction

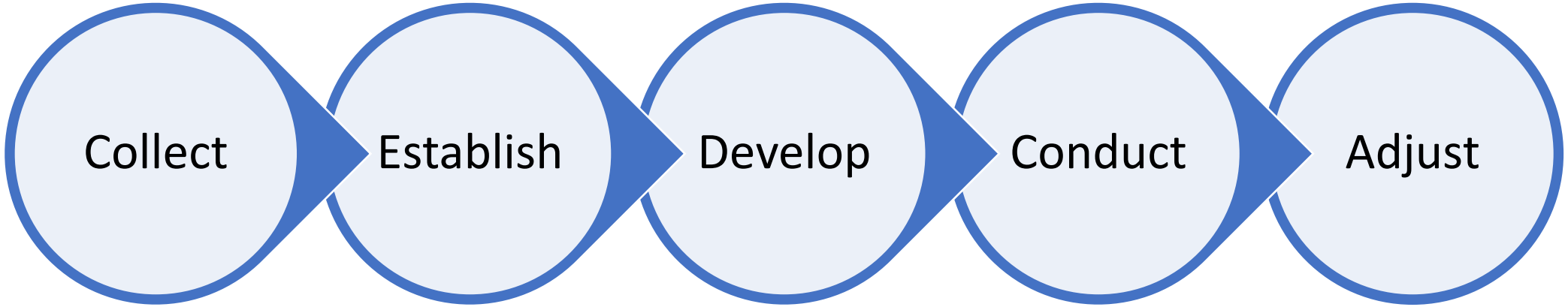
- This Module covers
  - Appropriate methods and practice problems for forecasting future traffic in areas without a model



Project Traffic Forecasting

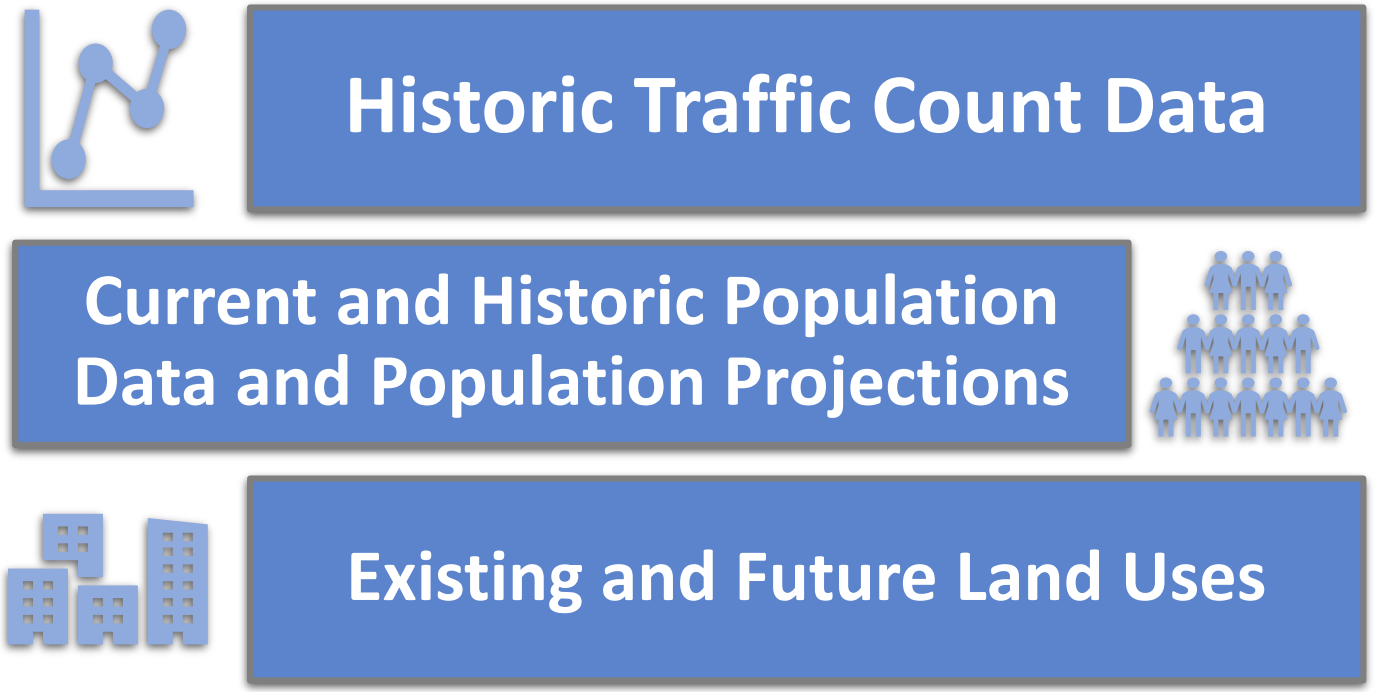


Approach to Forecasting without Models



Traffic Growth Trends

- To establish traffic growth trends, the following data is needed



Traffic Growth Trends

- **Historic Traffic Count Data**
  - Used to perform regression analysis
  - 5 to 10 years of historical data is recommended
  - Source: FTO Website

FLORIDA DEPARTMENT OF TRANSPORTATION
TRANSPORTATION STATISTICS OFFICE
2018 HISTORICAL AADT REPORT

COUNTY: 75 - ORANGE

SITE: 0535 - ON I-4, 0.880 MI. E OF SR-535

YEAR	AADT	DIRECTION 1	DIRECTION 2	*K FACTOR	D FACTOR	T FACTOR
2018	235000 C	E 111000	W 124000	9.00	54.60	6.50
2017	210000 F	E 104000	W 106000	9.00	52.60	7.00
2016	208000 C	E 103000	W 105000	8.50	52.10	7.00
2015	207000 S	E 103000	W 104000	8.50	51.20	11.30
2014	203000 F	E 101000	W 102000	8.50	51.40	4.70
2013	198500 C	E 98500	W 100000	8.50	51.30	5.80
2012	184000 C	E 92000	W 92000	8.50	51.20	4.60
2011	180500 C	E 89000	W 91500	8.50	51.30	4.60
2010	189500 C	E 95500	W 94000	7.45	52.11	4.90
2009	183500 C	E 91500	W 92000	9.89	55.14	4.90
2006	165000 S	E 85000	W 80000	9.69	53.38	7.30
2005	156000 F	E 80500	W 75500	7.30	50.70	6.40
2004	147500 C	E 76000	W 71500	7.90	51.40	5.60
2003	119000 C	E 61500	W 57500	7.90	52.30	7.70

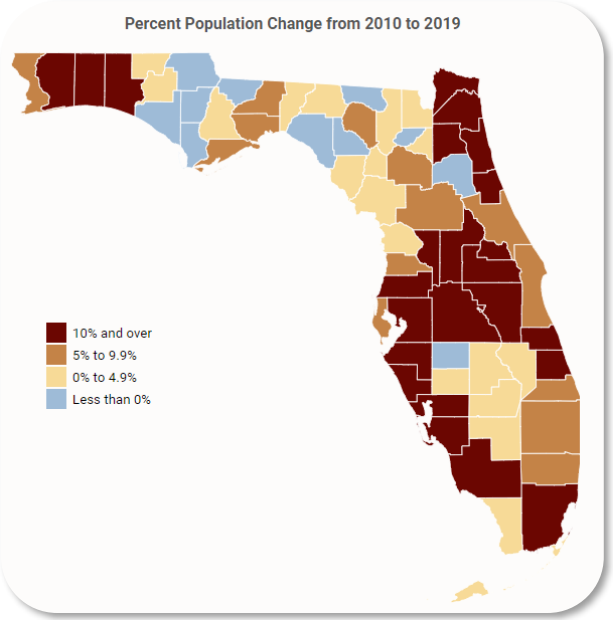
Traffic Growth Trends

- **Population Data**
  - Used to assure traffic trends are consistent with projected population growth
  - Sources:
    - Bureau of Economic and Business Research (BEBR)
    - US Census

Historic Traffic Count Data

Current and Historic Population Data and Population Projections

Existing and Future Land Uses



County Estimates & Projections

Choose a county:

Broward

2010 Census Count: 1,748,066
2019 Estimate: 1,919,644
2020 Projection: 1,942,700
2030 Projection: 2,120,300
2040 Projection: 2,238,300

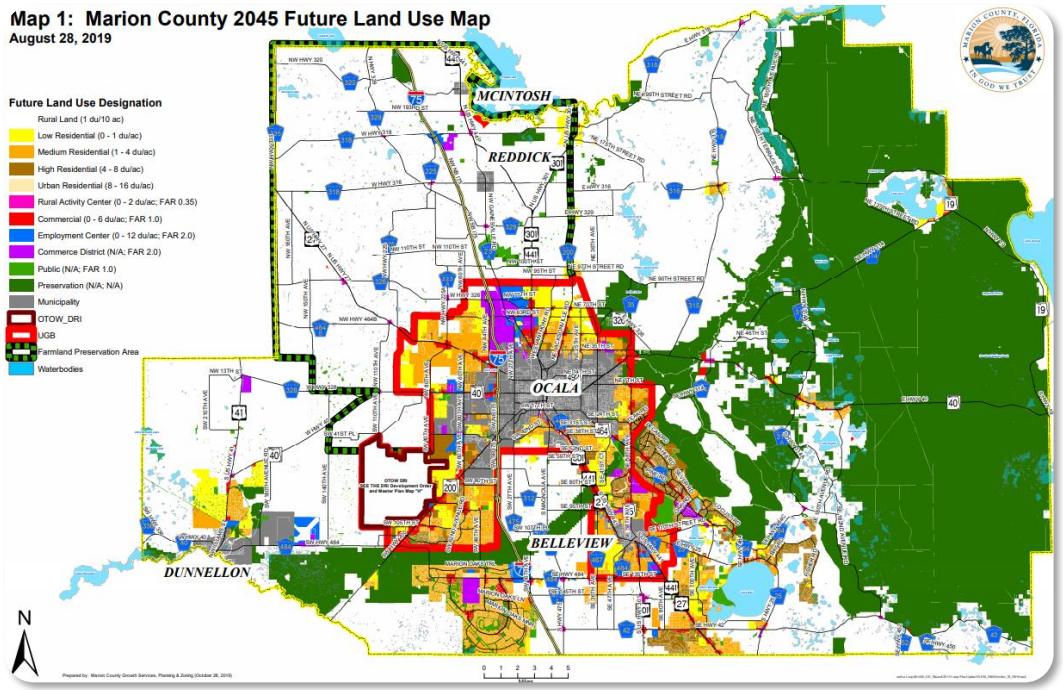
Traffic Growth Trends

- **Land Use Data**
  - Used to assure traffic trends are consistent with projected development and land use
  - ITE Trip Generation Rates can be used to establish daily trips for the new land uses
  - Source: MPO/TPO/TPAs and Local Government Authorities

Historic Traffic Count Data

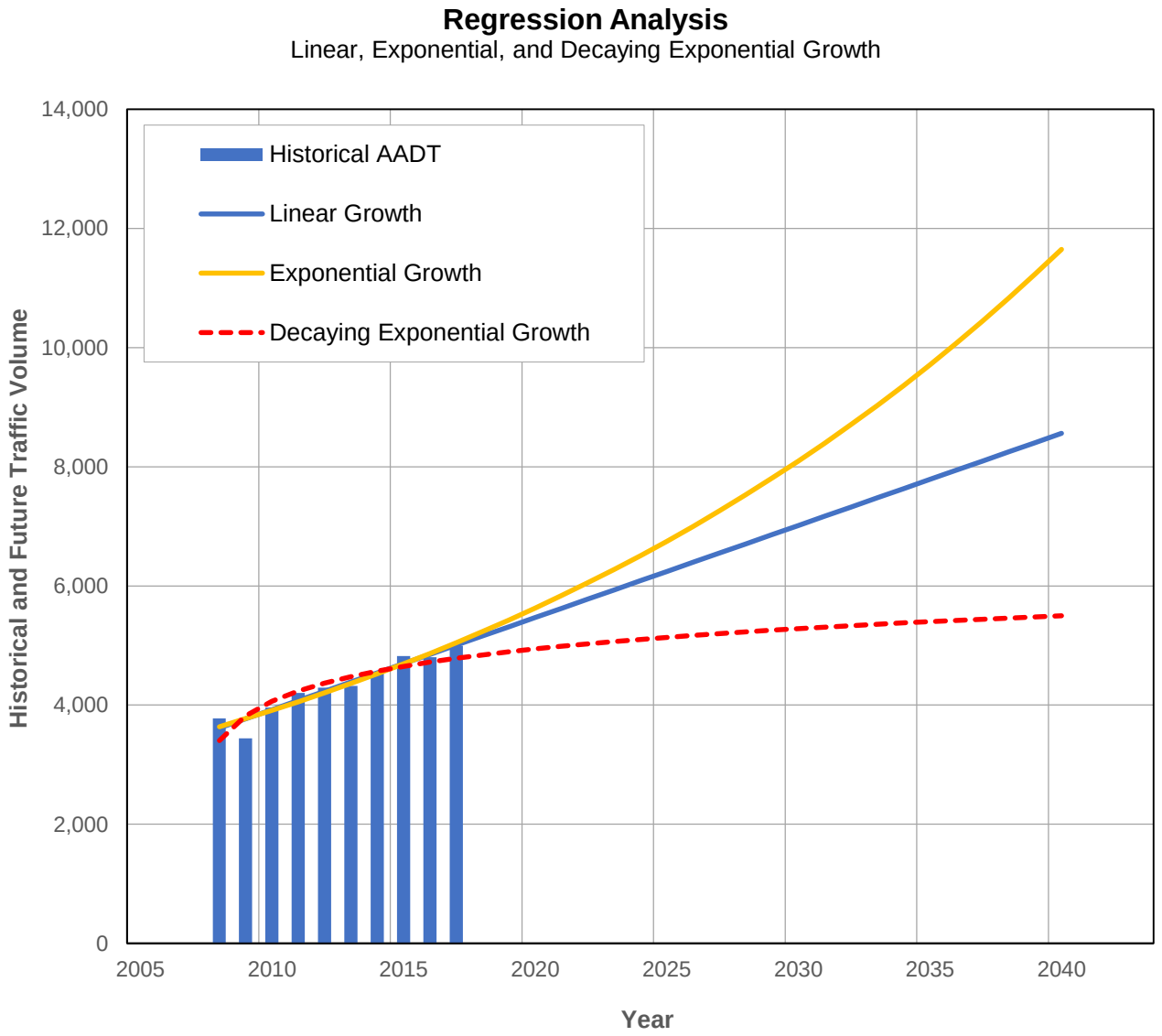
Current and Historic Population Data and Population Projections

Existing and Future Land Uses



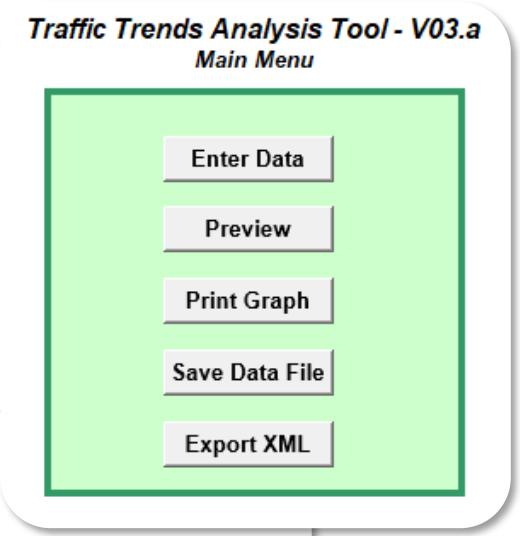
Traffic Growth Trends

- Regression Analysis
  - Use historical data to perform regression analysis
    - Establishes growth trends to estimate future traffic
  - Three common types of regression
    - Linear: uniform growth over the years
    - Exponential: increasing growth rate in the future
    - Decaying exponential: decreasing growth in the future



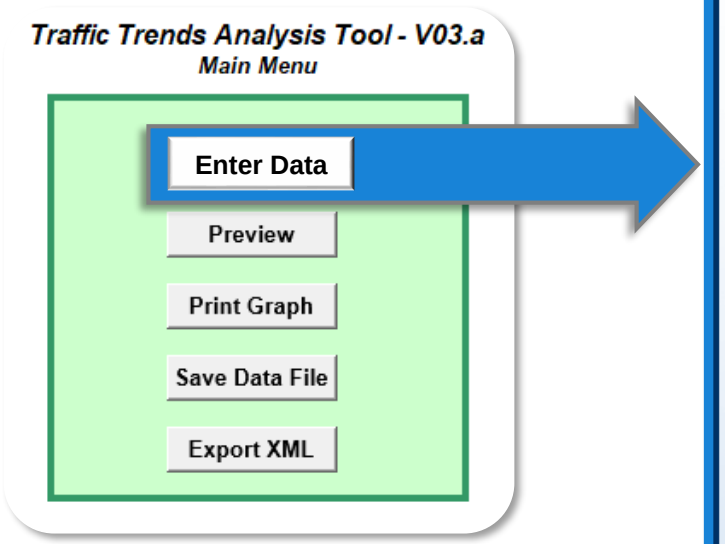
Traffic Growth Trends

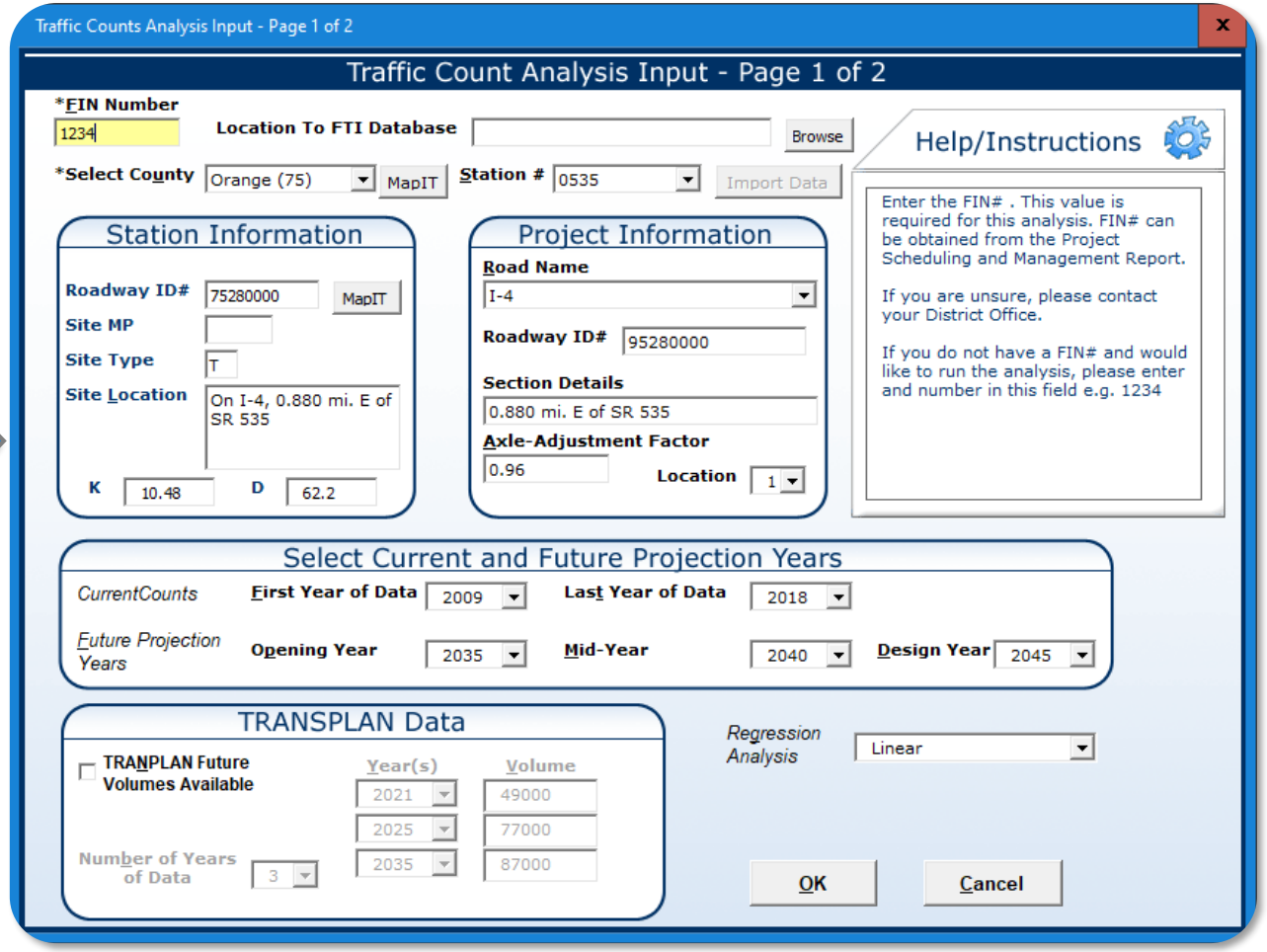
- **Regression Analysis**
  - Regression analysis can be performed using the
    - FDOT Traffic Trends Analysis Tool
  - Current Version
    - trend_v03a.xls



Using the FDOT Traffic Trends Analysis Tool

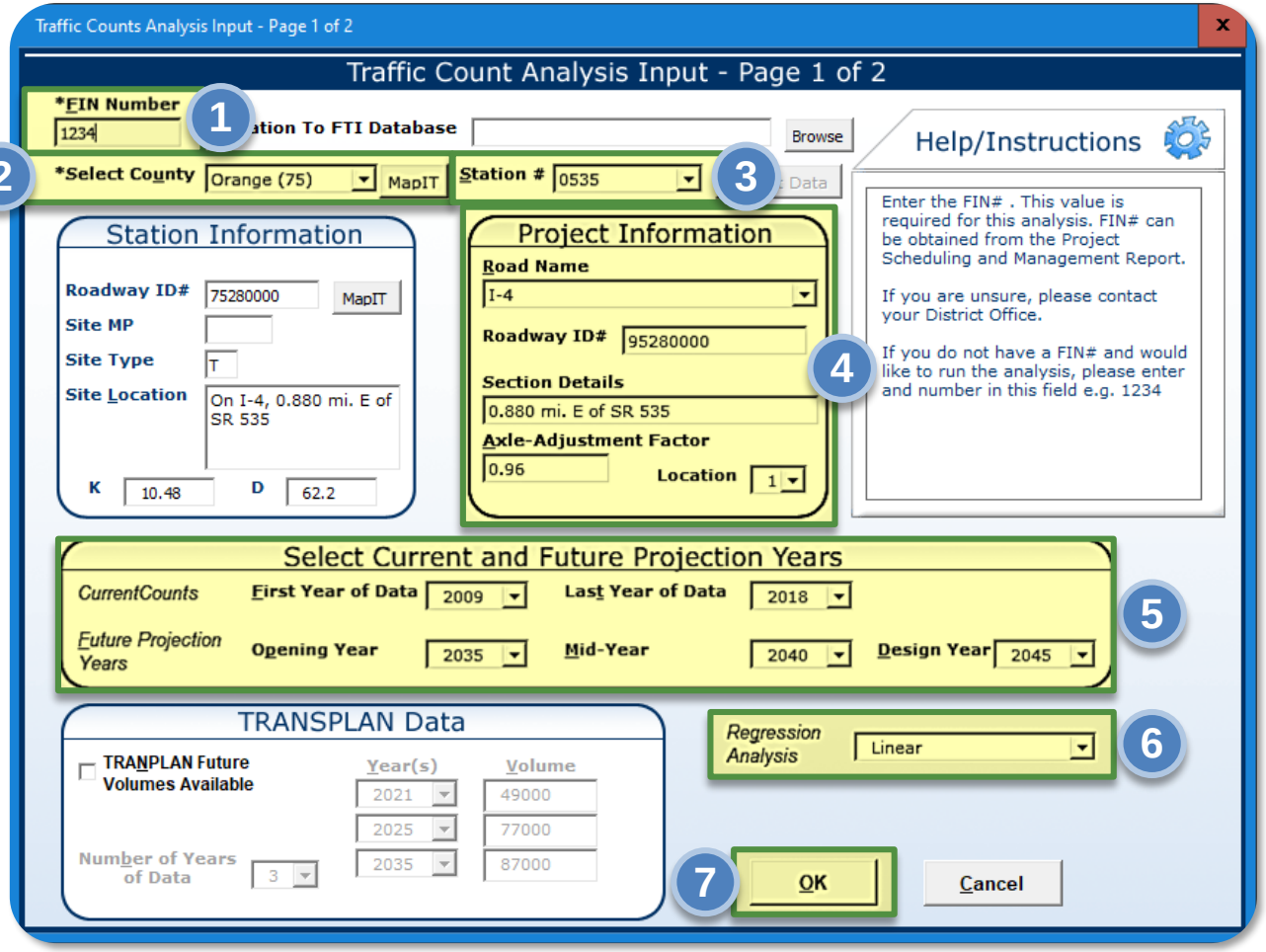
- Open Excel Spreadsheet (Trend-v03a.xls)





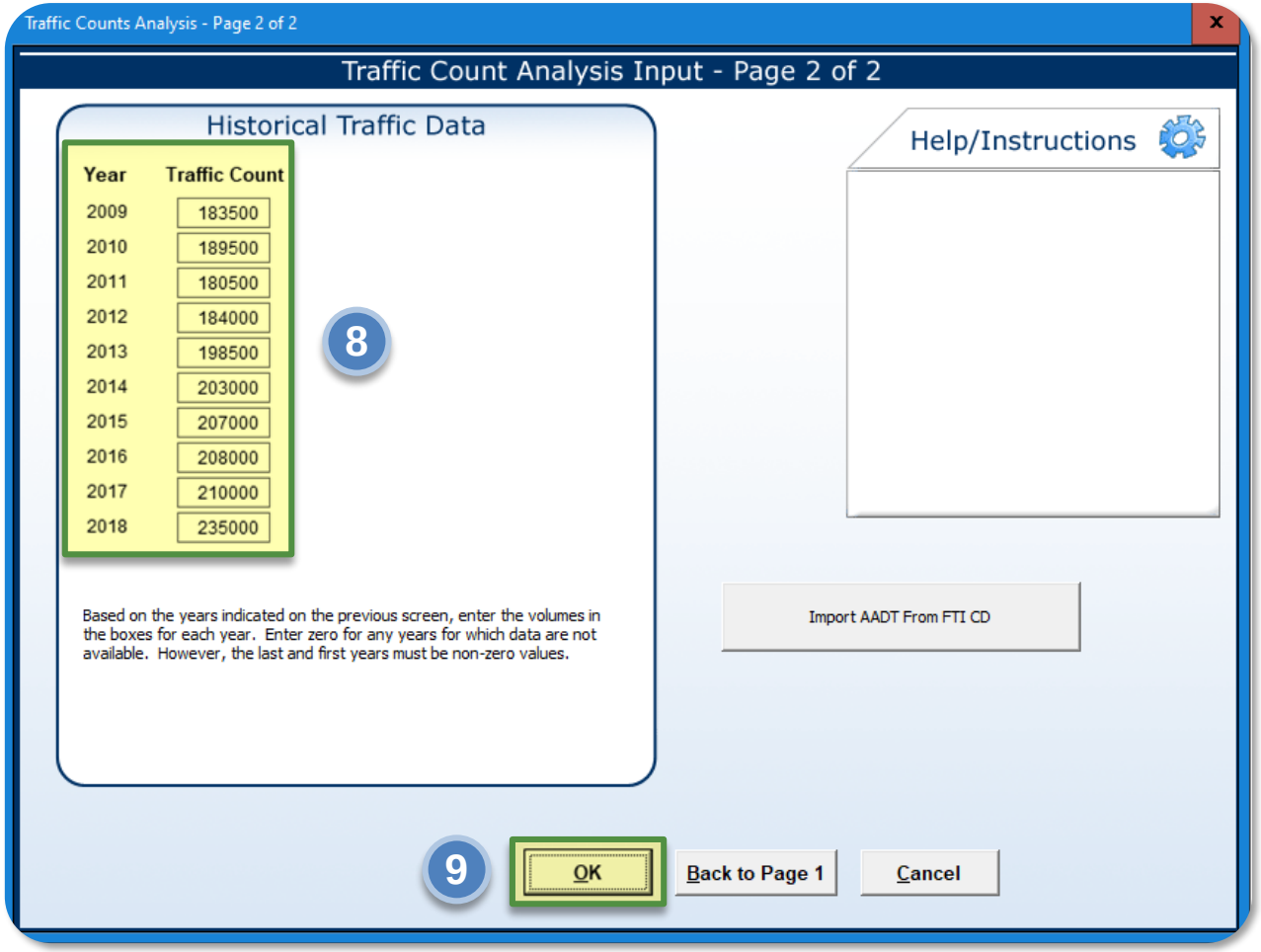
Using the FDOT Traffic Trends Analysis Tool

- **Fill Out Data Entry Screen**
  1. Enter FIN Number
  2. Select County from drop down
  3. Enter Station ID
  4. Enter “Project Information”
  5. Enter “Current and Future Projection Years”
  6. Select “Regression Analysis” type
  7. Click “OK” button



Using the FDOT Traffic Trends Analysis Tool

- Fill Out Data Entry Screen
  - 8 Input Historical AADT
    - 5 to 10 years of historical AADT
  - 9 Click “OK” button



Using the FDOT Traffic Trends Analysis Tool

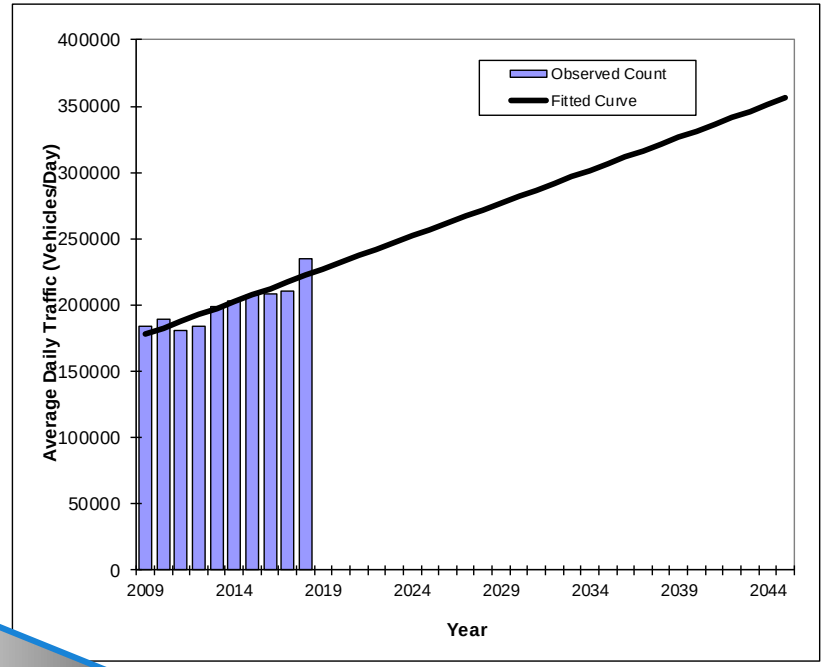
- Output Screen
  - 10 Check the R^2 to assure good fit
    - $R^2 \geq 75\%$
  - 11 Note the Historical Growth Trend
  - 12 Always check for reasonableness
    - Population Projections
    - Land Use Data

Traffic Trends - V03.a

I-4 -- 0.880 mi. E of SR 535

FIN#	1234
Location	1

County:	Orange (75)
Station #:	0535
Highway:	I-4



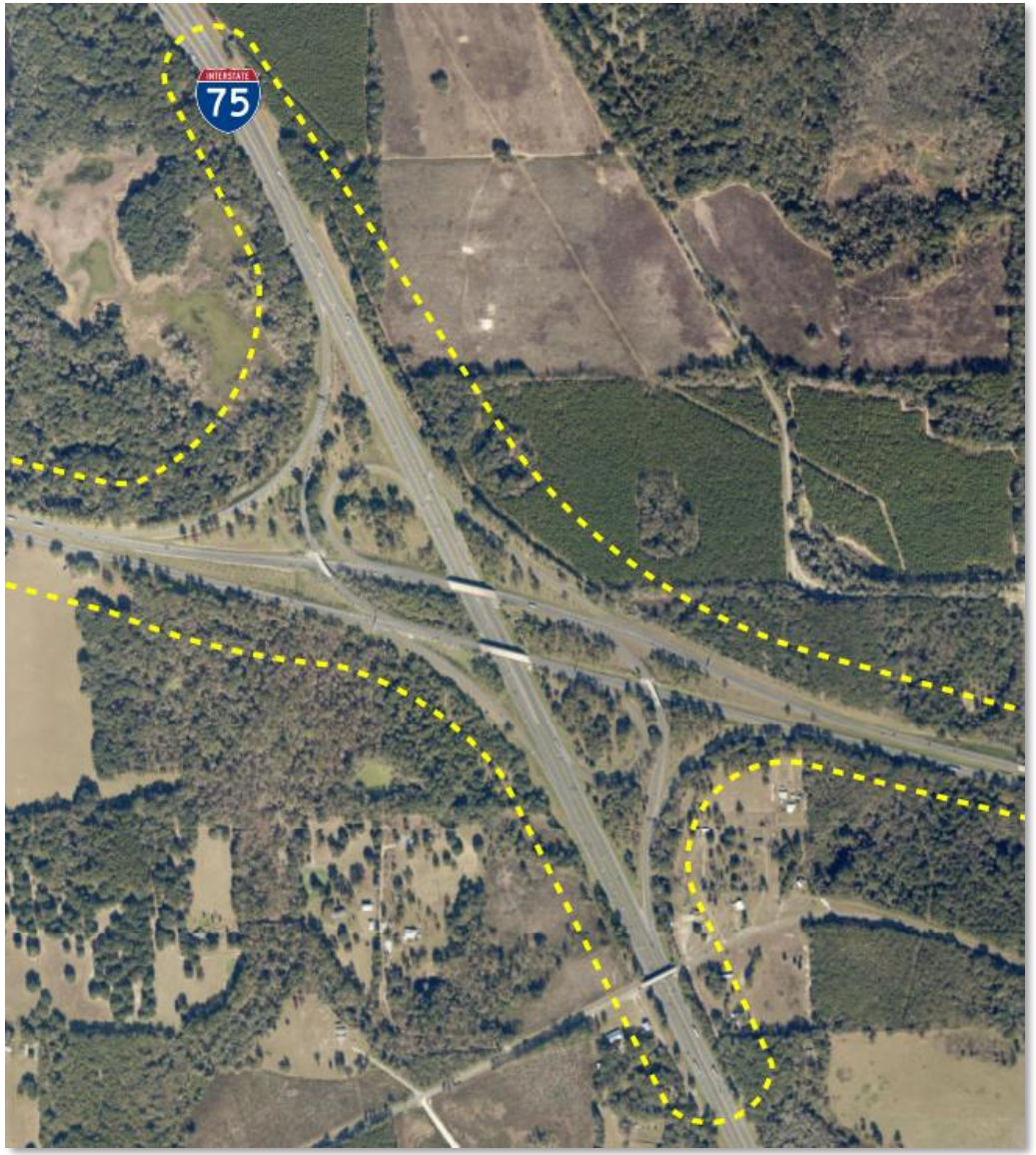
Year	Traffic (ADT/AADT) Count*	Trend**
2009	183500	177600
2010	189500	182500
2011	180500	187500
2012	184000	192500
2013	198500	197400
2014	203000	202400
2015	207000	207300
2016	208000	212300
2017	210000	217300
2018	235000	222200
2035 Opening Year Trend		
2035	N/A	306500
2040 Mid-Year Trend		
2040	N/A	331300
2045 Design Year Trend		
2045	N/A	356100
TRANPLAN Forecasts/Trends		

*Axle-Adjusted

** Annual Trend Increase: 4,958
Trend R-squared: 82.16%
Trend Annual Historic Growth Rate: 2.79%
Trend Growth Rate (2018 to Design Year): 2.23%
Printed: 14-Feb-20
Straight Line Growth Option

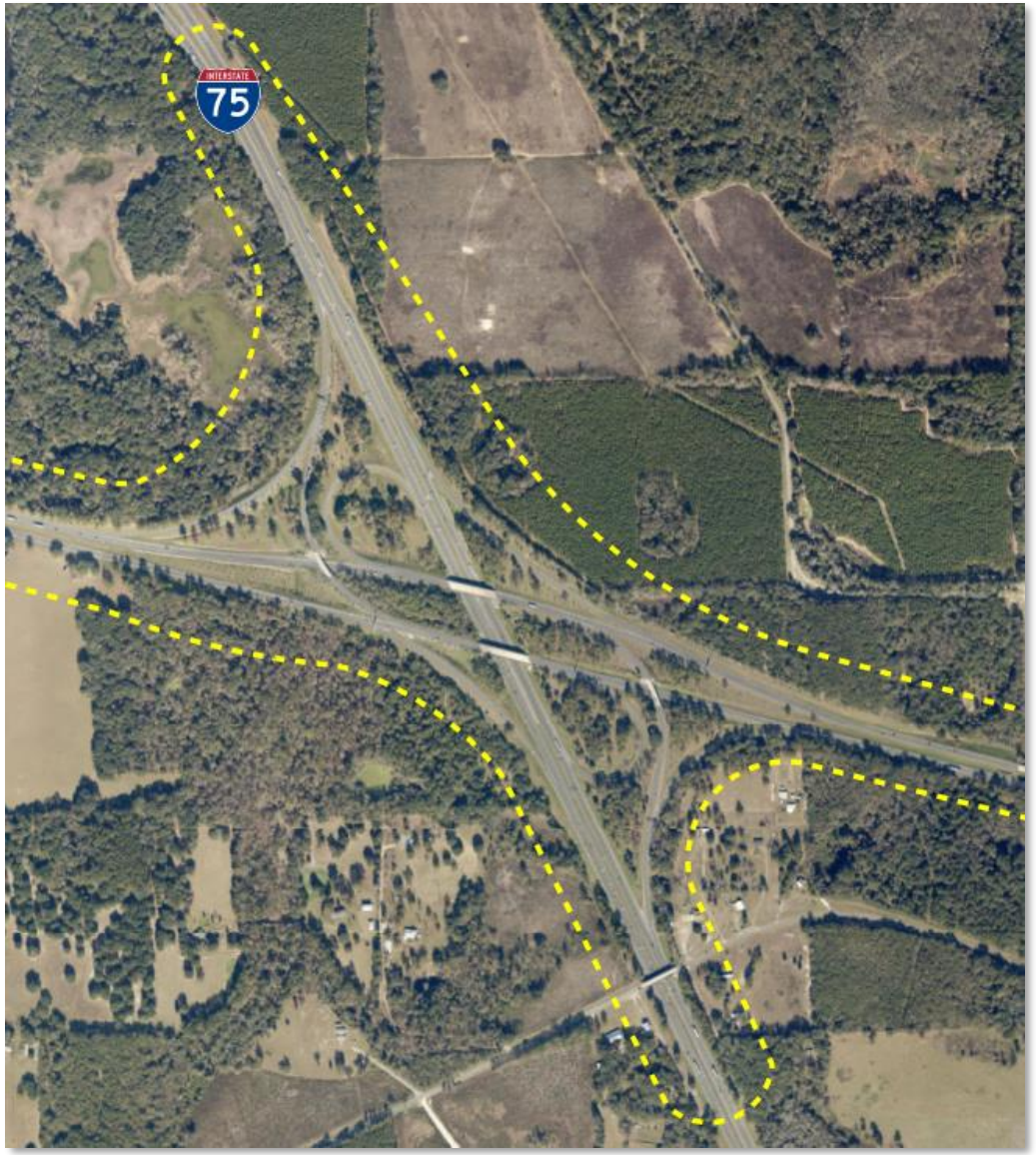
Practice Problem

- Perform Steps 1-2 of the Project Traffic Forecasting without a Travel Demand Model. Also, develop 2043 AADT with the estimated growth rate.
  - Project Location:
    - I-75 at I-10 System to System Interchange
    - Columbia County



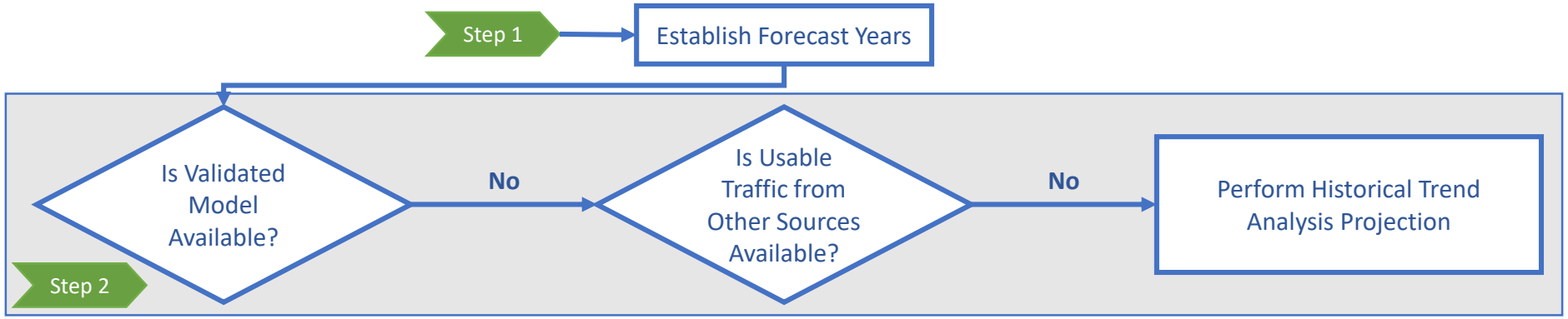
Practice Problem

- Project Characteristics
  - Area type
    - Rural Area
  - Validated Model Not Available
  - No classification counts available
  - Historical AADT Data Available from 2008 to 2016
  - Recent BEBR Population Data Available



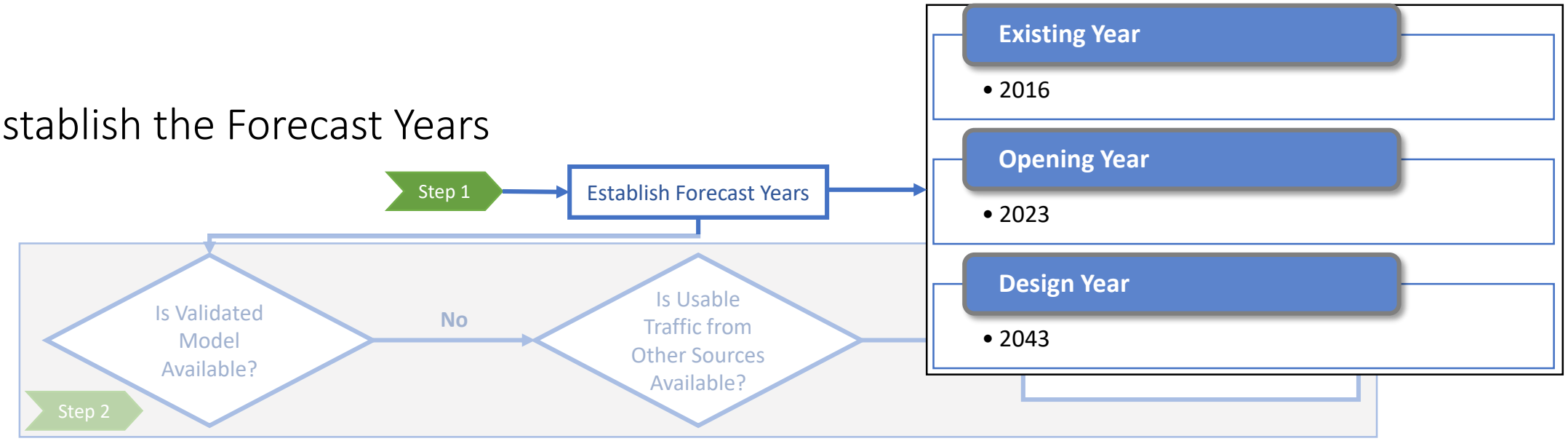
Practice Problem

- Steps 1-2



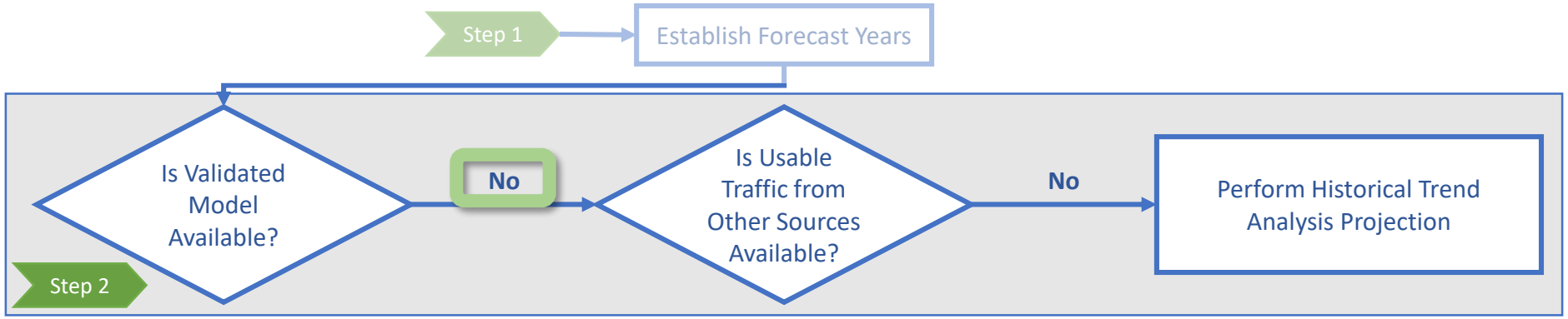
Practice Problem

Step 1 Establish the Forecast Years



Practice Problem

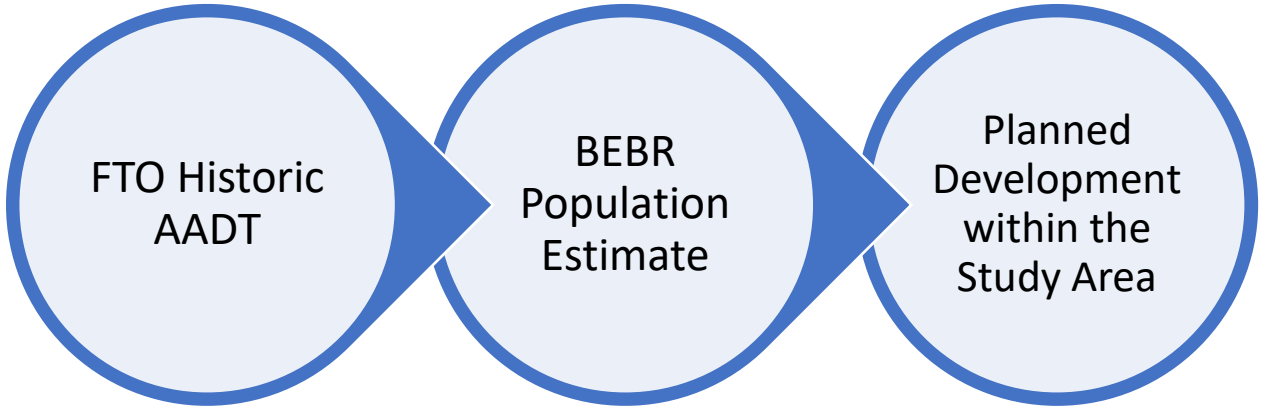
Step 2 Is Validated Model Available?



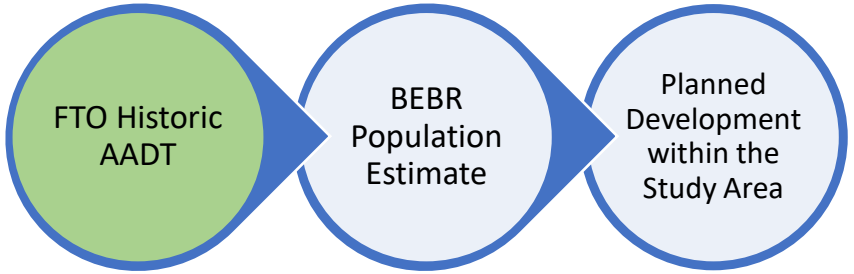
Practice Problem

Step 2 Perform Historic Trend Analysis Projection

- Assemble Available Data



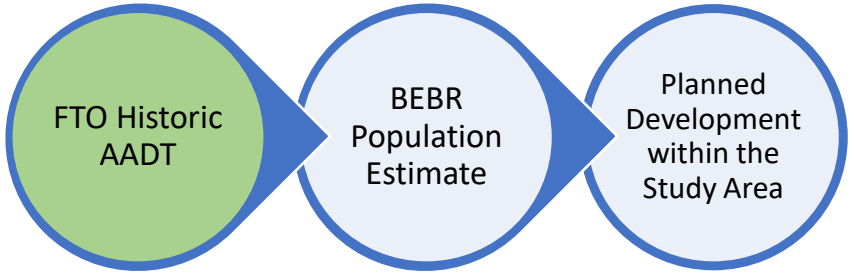
Practice Problem



Step 2 Perform Historic Trend Analysis Projection

1. Gather Historic AADT from FTO
   - 9 years data (2008-2016)
   - Historical growth rate estimated based on regression analysis from 8 FDOT count stations
   - Regression Analysis
     - 1a Linear Regression Performed using FDOT's Trends Analysis Tool
     - 1b Compound Annual Growth Rate (CAGR) Method also performed

Practice Problem



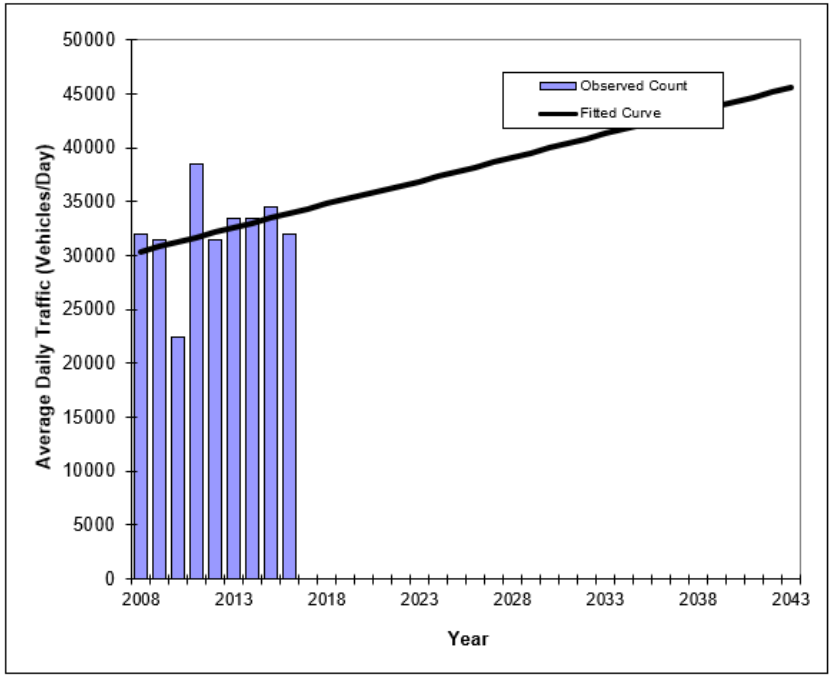
Step 2 Perform Historic Trend Analysis Projection

1 Gather Historic AADT from FTO

1a Linear Regression

	Description	FTO Station	Annual Historical Growth Rate	R Square*	Average
Mainline	I-75 South of I-10	290320	0.49%	38.01%	1.01%
	I-75 North of I-10	290324	1.44%	7.85%	
	I-10 West of I-75	370144	1.45%	19.67%	
	I-10 East of I-75	290247	0.64%	1.38%	
Ramps	I-75 NB to I-10 WB	290280	5.17%	62.09%	4.27%
	I-75 SB to I-10 EB	290281	2.84%	19.50%	
	I-10 EB to I-75 SB	290291	4.32%	72.74%	
	I-10 WB to I-75 NB	290293	4.73%	68.51%	

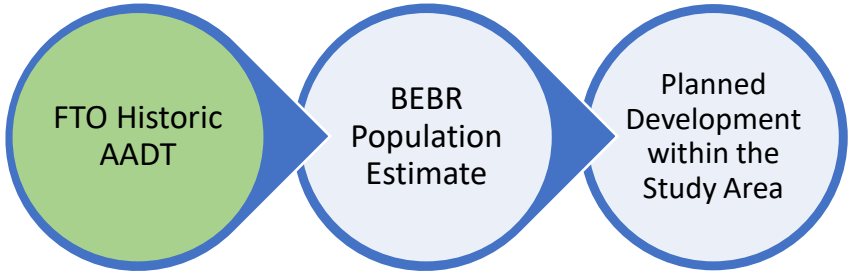
*No stations have a R Square value of 75% and greater



Year	Traffic (ADT/AADT) Count*	Trend**
2008	32000	30400
2009	31500	30900
2010	22500	31300
2011	38500	31700
2012	31500	32200
2013	33500	32600
2014	33500	33000
2015	34500	33500
2016	32000	33900
2023 Opening Year Trend		
2023	N/A	36900
2032 Mid-Year Trend		
2032	N/A	40800
2043 Design Year Trend		
2043	N/A	45600
TRANPLAN Forecasts/Trends		

** Annual Trend Increase:	433
Trend R-squared:	7.85%
Trend Annual Historic Growth Rate:	1.44%
Trend Growth Rate (2016 to Design Year):	1.28%

Practice Problem



Step 2 Perform Historic Trend Analysis Projection

1 Gather Historic AADT from FTO

1b CAGR Method

$$Compound\ Growth\ Rate = \left(\frac{V_n}{V_o}\right)^{\left(\frac{1}{n}\right)} - 1$$

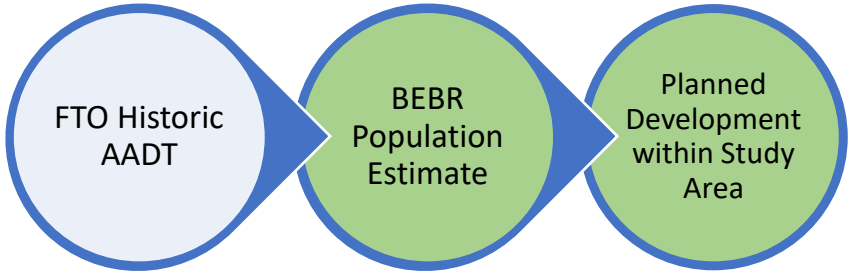
$V_n = Ending\ Value$

$V_o = Starting\ Value$

$n = Number\ of\ Years$

	Description	FTO Station	2016	2015	2014	2013	2012	2011	2010	2009	2008	CAGR	Average
Mainline	I-75 South of I-10	290320	46,000	44,266	45,411	44,727	43,123	43,371	44,697	44,436	43,271	0.77%	1.12%
	I-75 North of I-10	290324	32,000	34,500	33,500	33,500	31,500	38,500	22,500	31,500	32,000		
	I-10 West of I-75	370144	25,500	25,500	22,000	22,500	21,000	20,500	23,500	21,000	24,000	0.76%	
	I-10 East of I-75	290247	21,500	19,000	18,000	14,200	14,100	18,500	18,600	19,000	18,600	1.83%	
Ramps	I-75 NB to I-10 WB	290280	8,200	9,100	7,200	6,700	6,000	6,900	7,000	6,000	6,000	3.98%	2.84%
	I-75 SB to I-10 EB	290281	5,700	5,600	5,500	5,000	4,200	4,400	4,100	4,000	5,900	-0.43%	
	I-10 EB to I-75 SB	290291	7,700	7,300	6,700	6,400	6,000	6,900	6,200	5,300	5,800	3.61%	
	I-10 WB to I-75 NB	290293	5,000	5,000	4,300	5,200	4,600	4,300	4,400	3,600	3,600	4.19%	

Practice Problem



Step 2 Perform Historic Trend Analysis Projection

2 Gather BEBR Population Estimates (Medium)

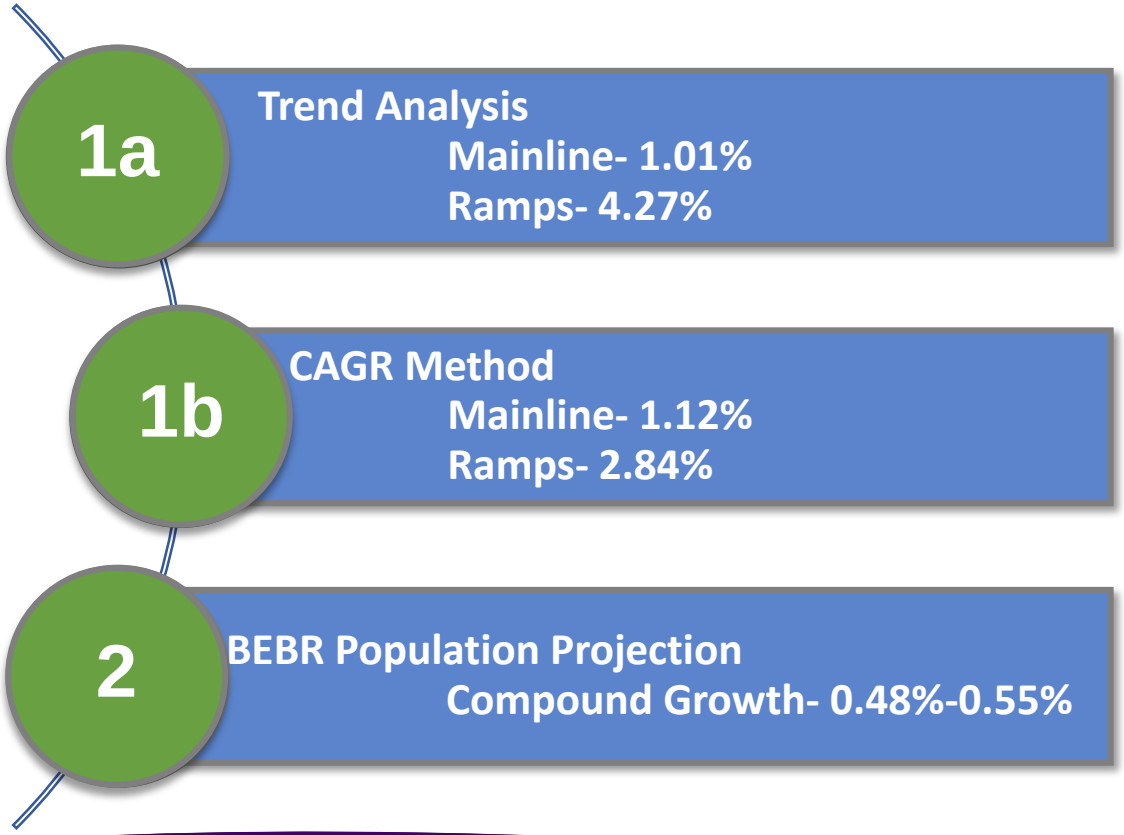
Year	Columbia County
Population	
2010	67,531
2019	70,492
2045	81,200
Compound Growth Rate	
2010-2019	0.48%
2019-2045	0.55%

3 Planned Development within the Study Area

- No Planned Developments within the Study Area

Practice Problem

Step 2 Perform Historic Trend Analysis Projection



Growth Rate Determination

- 1.0% growth rate was estimated for study area
- Reasonable based on the County population and traffic growth

Practice Problem

- Develop 2043 AADT

	Description	FTO Station	2016 AADT	2043 AADT with 1% CAGR
Mainline	I-75 South of I-10	290320	46,000	60,000
	I-75 North of I-10	290324	32,000	42,000
	I-10 West of I-75	370144	25,500	33,500
	I-10 East of I-75	290247	21,500	28,000
Ramps	I-75 NB to I-10 WB	290280	8,200	10,500
	I-75 SB to I-10 EB	290281	5,700	7,500
	I-10 EB to I-75 SB	290291	7,700	10,000
	I-10 WB to I-75 NB	290293	5,000	6,500

Design Year 2043 Final AADT

- Apply 1.0% CAGR to Existing Year 2016 AADT

$$Future\ AADT = Final\ AADT(1 + Growth\ Rate)^{\Delta Time}$$

$$2043\ AADT = 32{,}000(1 + 0.01)^{2043-2016}$$

$$2043\ AADT = 42{,}000\ (rounded\ to\ nearest\ 500)$$

Forecasting Without a Travel Demand Model

QUIZ

Directional Design Hour Volumes

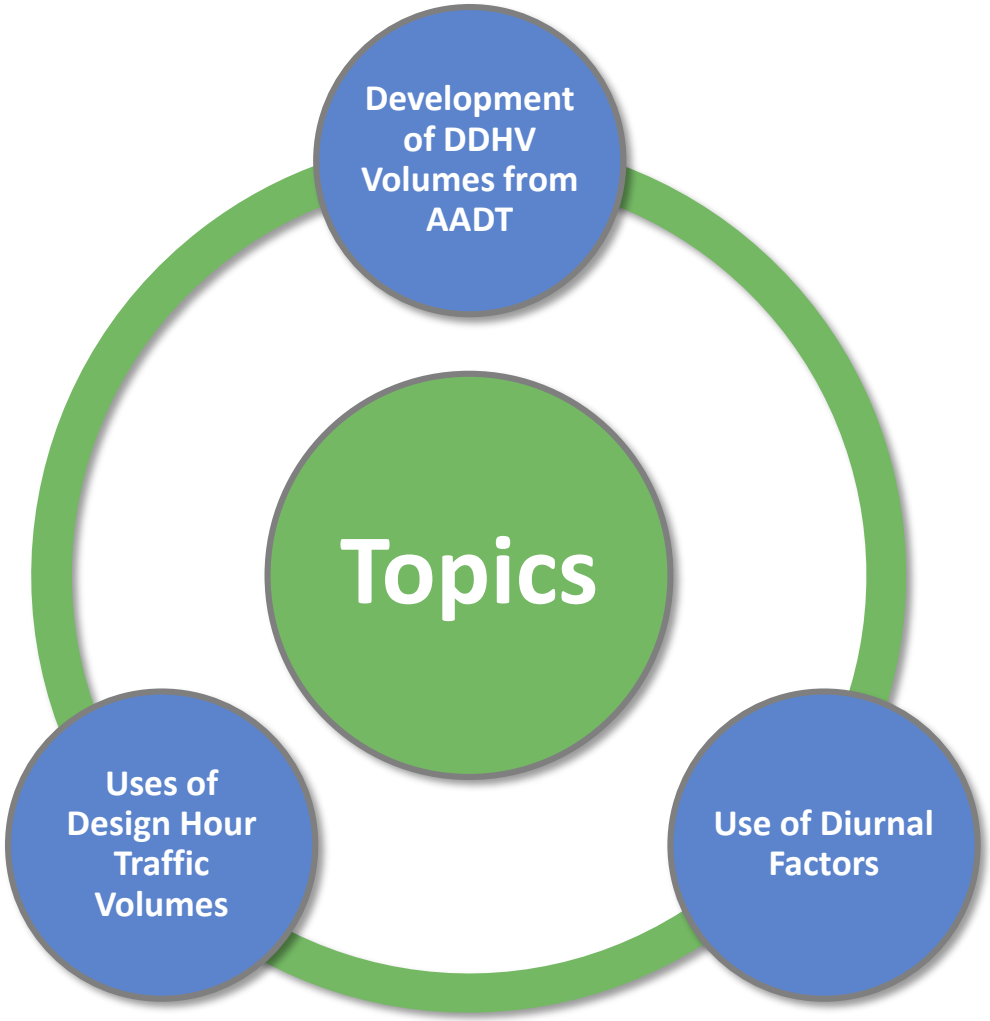
- Introduction
- Development of DDHV from AADT
- Use of Diurnal Factors
- Uses of Design Hour Traffic Volumes
- Quiz

Introduction

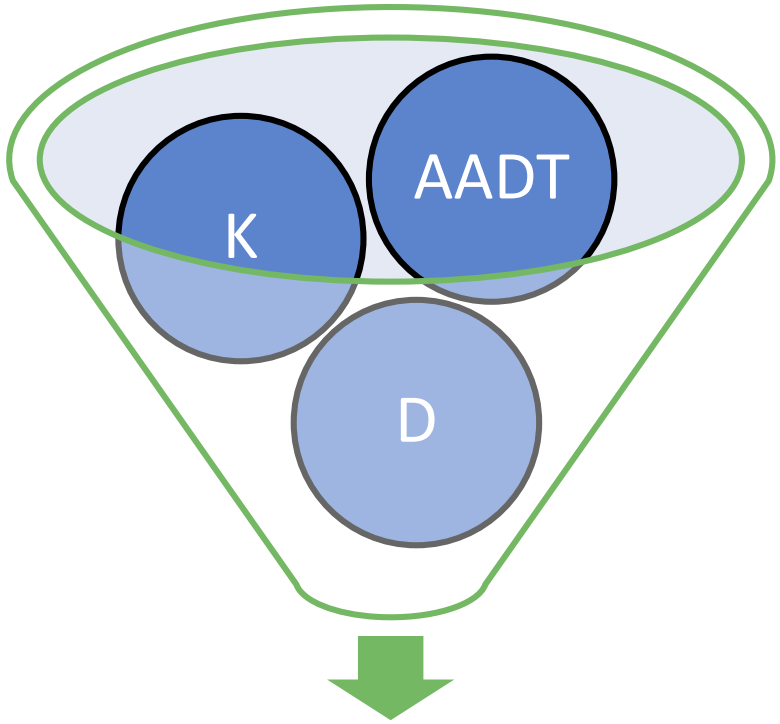
- Design and operational analysis requires hourly volumes in a peak hour in peak direction

- Volume corresponding to the peak hour is the Design Hour Volume (DHV)
  - $DHV = AADT \times K$

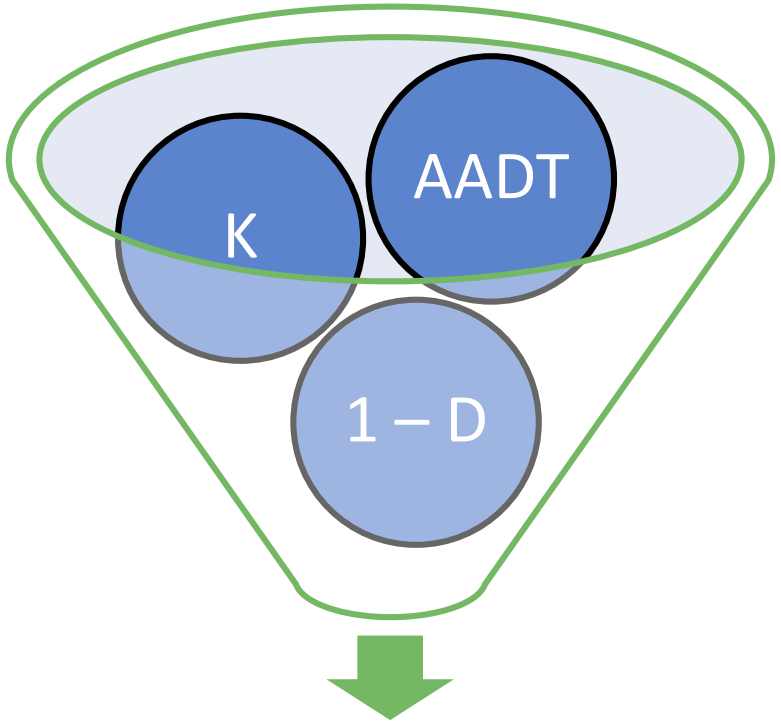
- Volume corresponding to the peak hour in the peak direction is the Directional Design Hour Volume (DDHV)



Development of DDHV Volumes from AADT



$$DDHV_{Peak} = AADT \times K \times D$$

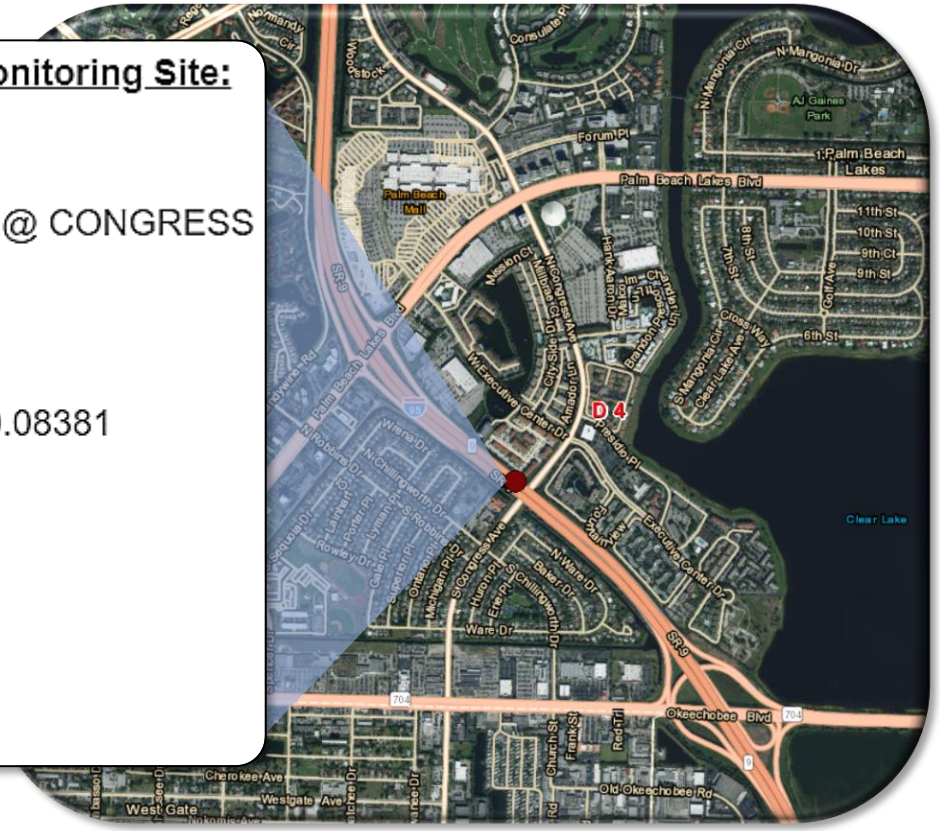


$$DDHV_{Off\ Peak} = AADT \times K \times (1 - D)$$

Development of DDHV Volumes from AADT

- Develop DDHV from AADT Example
  - Count Location
    - I-95 at Congress Avenue
  - Determine
    - Peak Direction DDHV
    - Off-Peak Direction DDHV

Telemetered Traffic Monitoring Site:
Road Name: I-95
Site: 930174
Description: SR 9 / I-95 @ CONGRESS AVE O/P,WPB,PBC
Section: 93220000
Milepoint: 27.962
Lat/Long: 26.71428, -80.08381
AADT: 214308
Site Type: Telemetered
Class Data: Yes
K Factor: 9
D Factor: 51.3
T Factor: 6.4



Development of DDHV Volumes from AADT

- Develop DDHV from AADT Example
  - Steps to calculate DDHVs

1. Determine AADT

$$AADT = 214{,}308$$

2. Determine K Factor

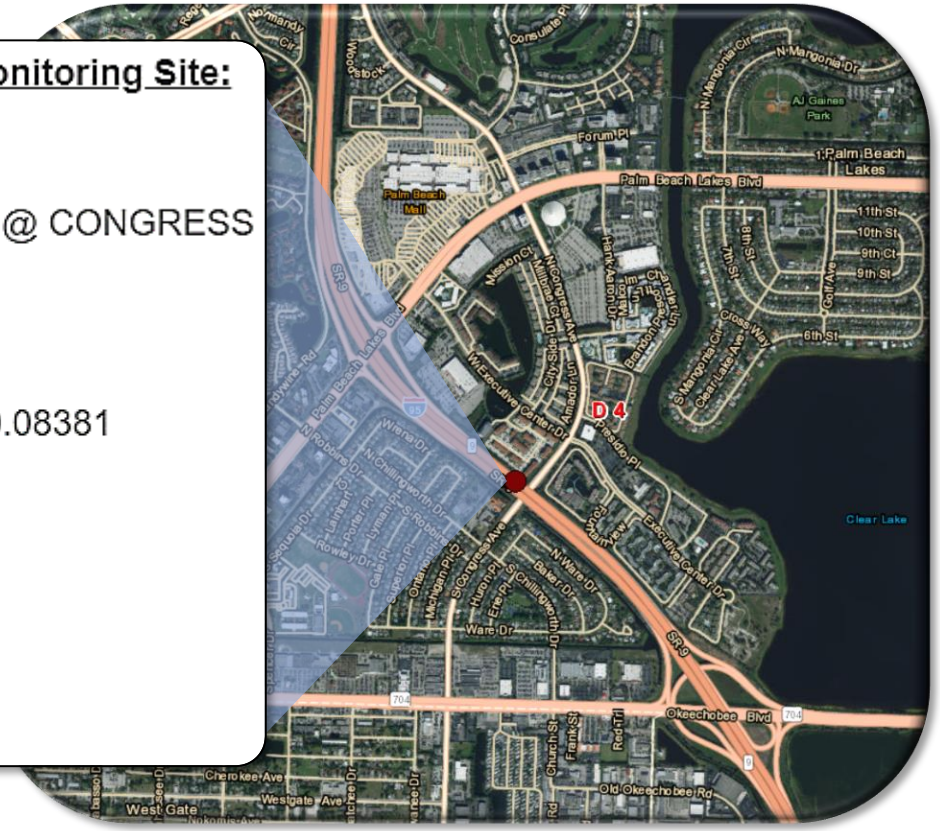
$$K\ Factor = 9.0\%$$

3. Determine D Factor

$$D\ Factor = 51.3\%$$

Telemetered Traffic Monitoring Site:
Road Name: I-95
Site: 930174
Description: SR 9 / I-95 @ CONGRESS AVE O/P,WPB,PBC
Section: 93220000
Milepoint: 27.962
Lat/Long: 26.71428, -80.08381

1. AADT: 214308
Site Type: Telemetered
Class Data: Yes
2. K Factor: 9
3. D Factor: 51.3
T Factor: 6.4



Development of DDHV Volumes from AADT

- Develop DDHV from AADT Example
  - Steps to calculate DDHVs
    4. Calculate Peak Direction DDHV

$$DDHV_{Peak} = AADT \times K \times D$$

$$DDHV_{Peak} = 214{,}308 \times 9.0\% \times 51.3\%$$

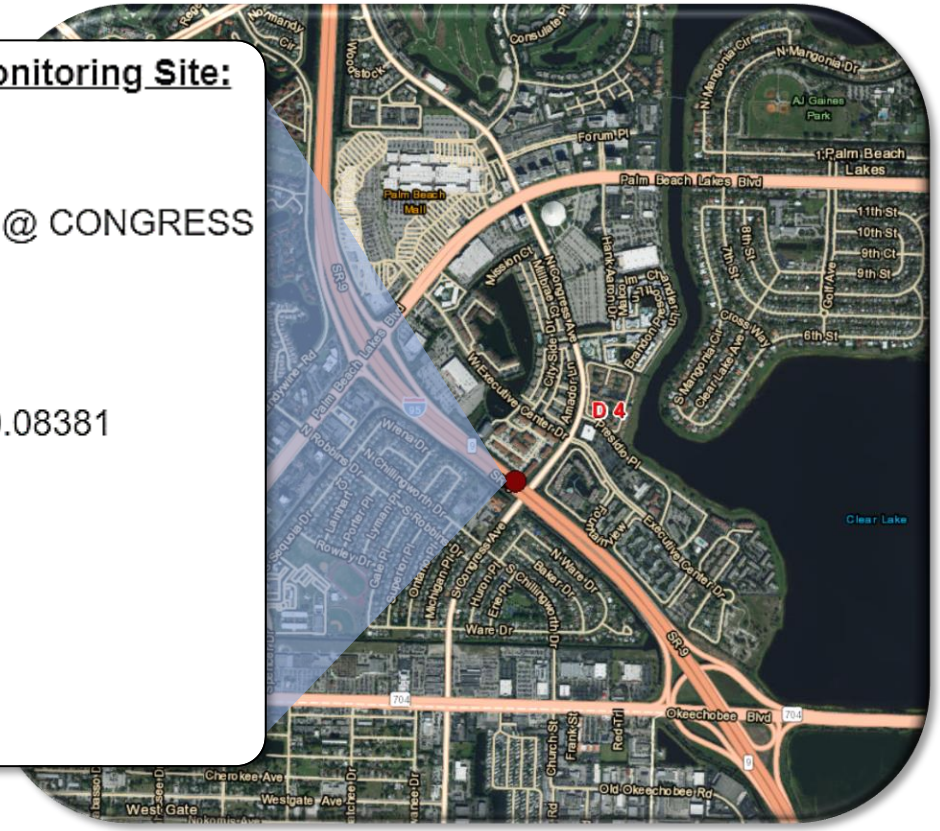
$$DDHV_{Peak} = 9{,}895$$

$$DDHV_{Peak} = 9{,}900\ (round\ to\ nearest\ 100)$$

Telemetered Traffic Monitoring Site:

Road Name: I-95
Site: 930174
Description: SR 9 / I-95 @ CONGRESS AVE O/P,WPB,PBC
Section: 93220000
Milepoint: 27.962
Lat/Long: 26.71428, -80.08381

1. AADT: 214308
   Site Type: Telemetered
   Class Data: Yes
2. K Factor: 9
3. D Factor: 51.3
   T Factor: 6.4



Development of DDHV Volumes from AADT

- Develop DDHV from AADT Example
  - Steps to calculate DDHVs
    - 5 Calculate Off Peak Direction DDHV

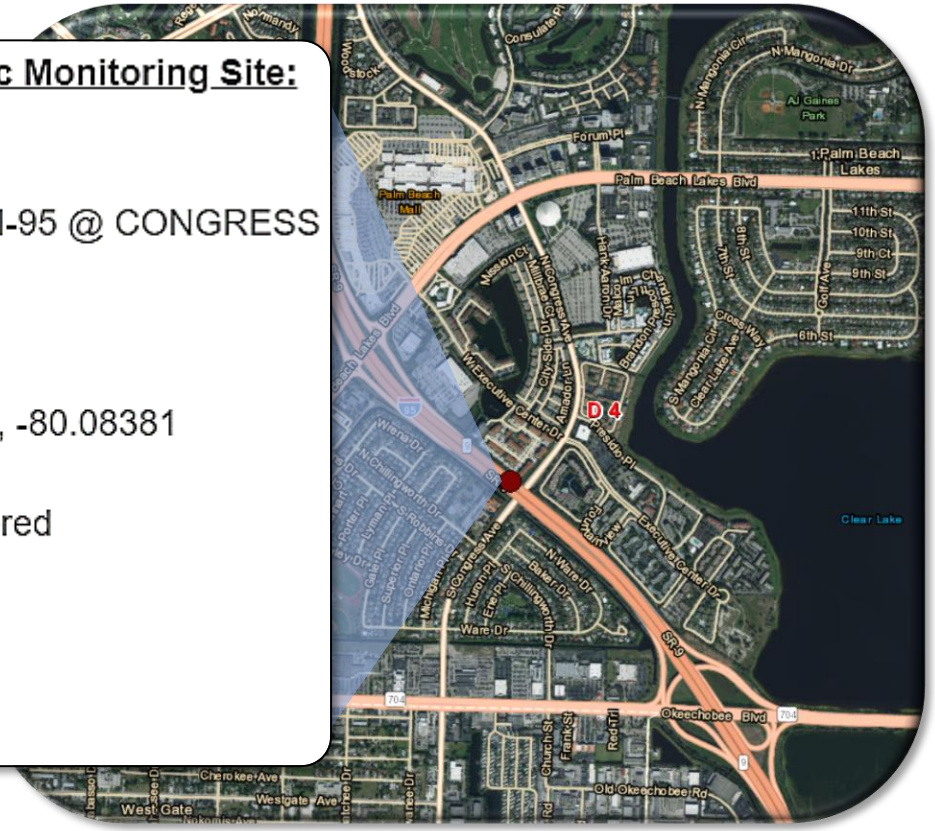
$$DDHV_{Off\ Peak} = AADT \times K \times (1 - D)$$

$$DDHV_{Off\ Peak} = 214{,}308 \times 9.0\% \times (1 - 51.3\%)$$ 1

$$DDHV_{Off\ Peak} = 9{,}393$$ 2

$$DDHV_{Off\ Peak} = 9{,}400\ (round\ to\ nearest\ 100)$$ 3

Telemetered Traffic Monitoring Site:
Road Name: I-95
Site: 930174
Description: SR 9 / I-95 @ CONGRESS AVE O/P,WPB,PBC
Section: 93220000
Milepoint: 27.962
Lat/Long: 26.71428, -80.08381
AADT: 214308
Site Type: Telemetered
Class Data: Yes
K Factor: 9
D Factor: 51.3
T Factor: 6.4



Development of DDHV Volumes from AADT

- **Develop DDHV from PSWADT Example**
  - Model
    - CFRPM
      - Base Year 2015
      - Horizon Year 2040
  - Location
    - Urban Arterial in Orlando (Orange County)
  - Horizon Year 2040 PSWADT
    - 78,500
  - Determine
    - Peak Direction DDHV
    - Off-Peak Direction DDHV

Development of DDHV Volumes from AADT

- Develop DDHV from PSWADT Example
  - Steps to calculate DDHVs
    1. Determine AADT

$$AADT = PSWADT \times MOCF$$

$$PSWADT = 78{,}500$$

$$MOCF = 0.98$$

$$AADT = 78{,}500 \times 0.98$$

$$AADT = 76{,}930$$

$$AADT = 77{,}000\ (round\ to\ nearest\ 500)$$

2018 PEAK SEASON FACTOR CATEGORY REPORT - REPORT TYPE: ALL
CATEGORY: 7500 ORANGE COUNTYWIDE

MOCF: 0.98
PSCF

WEEK	DATES	SF	
1	01/01/2018 - 01/06/2018	1.02	1.04
2	01/07/2018 - 01/13/2018	1.04	1.06
3	01/14/2018 - 01/20/2018	1.05	1.07
4	01/21/2018 - 01/27/2018	1.03	1.05
5	01/28/2018 - 02/03/2018	1.02	1.04
6	02/04/2018 - 02/10/2018	1.00	1.02
* 7	02/11/2018 - 02/17/2018	0.99	1.01
* 8	02/18/2018 - 02/24/2018	0.98	1.00
* 9	02/25/2018 - 03/03/2018	0.98	1.00
*10	03/04/2018 - 03/10/2018	0.98	1.00
*11	03/11/2018 - 03/17/2018	0.98	1.00
*12	03/18/2018 - 03/24/2018	0.98	1.00
*13	03/25/2018 - 03/31/2018	0.98	1.00
*14	04/01/2018 - 04/07/2018	0.98	1.00
*15	04/08/2018 - 04/14/2018	0.98	1.00
*16	04/15/2018 - 04/21/2018	0.98	1.00
*17	04/22/2018 - 04/28/2018	0.99	1.01
*18	04/29/2018 - 05/05/2018	1.00	1.02
*19	05/06/2018 - 05/12/2018	1.00	1.02
20	05/13/2018 - 05/19/2018	1.01	1.03
21	05/20/2018 - 05/26/2018	1.01	1.03
22	05/27/2018 - 06/02/2018	1.01	1.03
23	06/03/2018 - 06/09/2018	1.01	1.03
24	06/10/2018 - 06/16/2018	1.01	1.03

Development of DDHV Volumes from AADT

- Develop DDHV from PSWADT Example
  - Steps to calculate DDHVs
    2. Determine K Factor

$$K\ Factor = 9.0\%$$

Area (Population)	Facility Type	Standard K Factor (% AADT)*	Representative Time Period
Large Urbanized Areas with Core Freeways (1,000,000+)	Freeways	8.0 - 9.0 ***	Typical weekday peak period or hour
	Arterials & Highways	**9.0 *** **	Typical weekday peak hour
Other Urbanized Areas (50,000+)	Freeways	**9.0 *** **	Typical weekday peak hour
	Arterials & Highways		
Transitioning to Urbanized Areas (Uncertain)	Freeways	9.0	Typical weekday peak hour
	Arterials & Highways		
Urban (5,000-50,000)	Freeways	10.5	100th highest hour of the year
	Arterials & Highways	9.0**	Typical weekday peak hour
Rural (<5,000)	Freeways	10.5	100th highest hour of the year
	Arterials	9.5**	
	Highways	9.5	

Development of DDHV Volumes from AADT

- Develop DDHV from PSWADT Example
  - Steps to calculate DDHVs
    3. Determine D Factor

$$D\ Factor = 53.2\%$$

2018 VOLUME FACTOR CATEGORY SUMMARY REPORT - REPORT TYPE: ALL

CATEGORY: 7500 - ORANGE COUNTYWIDE

COSITE	DIR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	SUN	MON	TUE	WED	THU	FRI	SAT	STD "K"	MEDIAN "D"	AADT
750104	E	1.08	0.97	0.97	0.97	1.02	1.01	1.01	0.98	1.00	0.99	0.98	1.01	1.11	1.04	1.02	1.00	0.99	0.90	0.98			
750104	W	1.06	0.98	0.97	0.97	1.01	1.01	1.01	0.98	1.00	0.99	0.99	1.04	1.07	1.02	1.02	1.00	1.00	0.92	0.99			
750104	B	1.07	0.98	0.97	0.97	1.02	1.01	1.01	0.98	1.00	0.99	0.99	1.03	1.09	1.03	1.02	1.00	1.00	0.91	0.99	9.5	52.4	28877
750154	N	1.04	1.00	0.99	1.00	0.99	0.99	1.00	0.99	1.01	1.00	0.99	1.00	1.19	0.98	0.98	0.97	0.95	0.90	1.09			
750154	S	1.03	1.00	0.98	0.99	1.00	0.99	1.00	0.99	1.02	1.01	0.99	1.00	1.24	0.98	0.97	0.96	0.95	0.89	1.08			
750154	B	1.04	1.00	0.99	1.00	1.00	0.99	1.00	0.99	1.02	1.01	0.99	1.00	1.22	0.98	0.98	0.97	0.95	0.90	1.09	9.0	53.7	60922
750175	N	1.01	0.96	0.99	0.98	1.01	0.99	1.02	1.00	1.00	0.99	1.01	1.03	1.47	0.96	0.91	0.91	0.90	0.88	1.19			
750175	S	1.10	1.03	1.03	1.00	1.02	1.00	1.01	0.97	0.97	0.94	0.96	0.98	1.47	0.96	0.91	0.90	0.90	0.88	1.22			
750175	B	1.06	1.00	1.01	0.99	1.02	1.00	1.02	0.99	0.99	0.97	0.99	1.01	1.47	0.96	0.91	0.91	0.90	0.88	1.21	9.0	53.9	37064
770102	N	1.03	0.96	0.95	0.96	1.00	1.01	1.04	1.00	1.01	0.99	1.03	1.04	1.31	0.99	0.97	0.96	0.95	0.87	1.05			
770102	S	1.03	0.95	0.95	0.96	1.00	1.02	1.05	0.99	1.01	0.99	1.03	1.04	1.33	0.99	0.96	0.95	0.94	0.87	1.07			
770102	B	1.03	0.96	0.95	0.96	1.00	1.02	1.05	1.00	1.01	0.99	1.03	1.04	1.32	0.99	0.97	0.96	0.95	0.87	1.06	9.0	52.7	36951
CATEGORY:		1.05	0.99	0.98	0.98	1.01	1.01	1.02	0.99	1.01	0.99	1.00	1.02	1.28	0.99	0.97	0.96	0.95	0.89	1.09	9.1	**53.2**	

3

Development of DDHV Volumes from AADT

- Develop DDHV from PSWADT Example
  - Steps to calculate DDHVs
    4. Calculate Peak Direction DDHV

$$DDHV_{Peak} = AADT \times K \times D$$

$$DDHV_{Peak} = 77{,}000 \times 9.0\% \times 53.2\%$$

$$DDHV_{Peak} = 3{,}687$$

$$DDHV_{Peak} = 3{,}700\ (round\ to\ nearest\ 100)$$

Development of DDHV Volumes from AADT

- Develop DDHV from PSWADT Example
  - Steps to calculate DDHVs
    5. Calculate Off Peak Direction DDHV

$$DDHV_{Off\ Peak} = AADT \times K \times (1 - D)$$

$$DDHV_{Off\ Peak} = 77{,}000 \times 9.0\% \times (1 - 53.2\%)$$

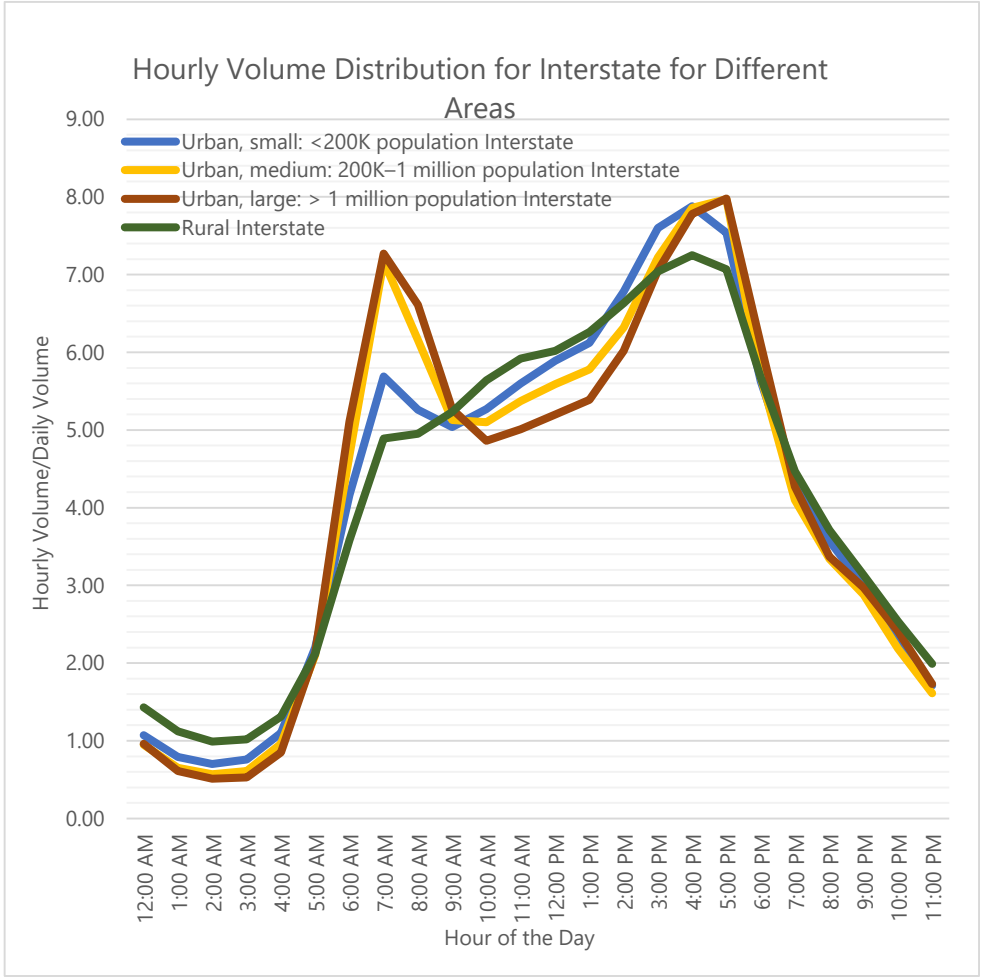
$$DDHV_{Off\ Peak} = 3{,}243$$

$$DDHV_{Off\ Peak} = 3{,}200\ (round\ to\ nearest\ 100)$$

Use of Diurnal Factors

- Diurnal Factors are hourly volume distribution factors for an average weekday defined by area type, facility type and area size
  - Diurnal Factors are used when traffic volumes for multiple peak hours for analysis are needed

- Diurnal distribution factors available from NCHRP Report 765



Source: NCHRP Report 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design, Ch.8.

Use of Diurnal Factors

- Example: Develop the 7:00 AM Peak Hour Volumes with Factors from NCHRP Report 765
  - Location
    - I-75 through Sarasota
  - AADT
    - 142,000

Hour Begin	Urban, small: Pop <200K			Urban, medium: Pop 200K–1 million				Urban, large: Pop > 1 million				Rural Area		
	Interstate	Arterial	Collector	Interstate	Arterial CBD	Arterial Others	Collector	Interstate	Arterial CBD	Arterial Others	Collector	Interstate	Arterial	Collector
12:00 AM	1.07	0.59	0.47	0.95	0.81	0.71	0.61	0.96	1.22	0.78	0.59	1.43	0.72	0.57
1:00 AM	0.79	0.39	0.29	0.65	0.47	0.46	0.36	0.61	0.75	0.48	0.38	1.12	0.49	0.36
2:00 AM	0.70	0.30	0.23	0.57	0.41	0.40	0.31	0.51	0.58	0.37	0.30	0.99	0.43	0.31
3:00 AM	0.76	0.33	0.26	0.61	0.31	0.46	0.34	0.53	0.57	0.37	0.33	1.02	0.51	0.38
4:00 AM	1.10	0.58	0.30	0.96	0.43	0.77	0.60	0.85	0.79	0.61	0.59	1.31	0.93	0.84
5:00 AM	2.20	1.44	1.16	2.10	0.98	1.80	1.32	2.13	1.74	1.70	1.16	2.12	2.28	2.19
6:00 AM	4.16	3.21	2.93	4.67	2.67	4.05	3.63	5.11	4.23	4.17	2.72	3.58	4.54	4.36
7:00 AM	5.69	6.09	6.27	7.17	5.90	6.40	6.70	7.27	6.31	6.58	5.92	4.89	6.63	6.55
8:00 AM	5.26	5.53	5.75	6.16	5.79	5.75	6.60	6.61	6.24	6.08	6.05	4.95	5.55	5.58
9:00 AM	5.04	5.12	4.95	5.13	4.96	5.18	5.60	5.27	5.43	5.04	5.82	5.23	5.24	5.25
10:00 AM	5.27	5.55	5.24	5.10	5.19	5.36	5.49	4.86	5.18	4.96	5.78	5.64	5.41	5.44
11:00 AM	5.60	6.31	6.01	5.37	6.22	5.76	5.92	5.01	5.40	5.39	6.55	5.92	5.67	5.71
12:00 PM	5.89	6.74	6.66	5.59	7.10	6.11	6.33	5.20	5.72	5.81	7.08	6.02	5.91	6.05
1:00 PM	6.12	6.72	6.72	5.78	6.95	6.25	6.40	5.39	5.77	5.93	6.95	6.26	6.13	6.24
2:00 PM	6.78	7.07	7.63	6.32	6.75	6.70	6.74	6.02	6.07	6.31	7.20	6.63	6.68	6.78
3:00 PM	7.60	8.29	8.65	7.22	7.18	7.46	7.44	7.05	6.66	7.05	7.97	7.04	7.53	7.63
4:00 PM	7.88	8.30	9.22	7.86	7.91	8.05	7.82	7.78	7.07	7.85	7.94	7.25	8.02	8.15
5:00 PM	7.54	7.91	8.45	7.97	8.27	8.14	8.18	7.98	7.45	8.33	7.60	7.07	7.98	8.16
6:00 PM	5.63	5.96	5.96	5.69	6.06	6.10	6.05	6.11	6.12	6.52	5.66	5.68	5.95	6.17
7:00 PM	4.32	4.49	4.49	4.10	4.72	4.42	4.33	4.27	4.72	4.80	4.20	4.47	4.21	4.37
8:00 PM	3.57	3.50	3.38	3.34	3.89	3.48	3.42	3.37	3.77	3.88	3.29	3.71	3.30	3.41
9:00 PM	2.99	2.63	2.46	2.88	3.18	2.82	2.71	2.97	3.30	3.17	2.66	3.13	2.62	2.59
10:00 PM	2.31	1.77	1.54	2.19	2.27	2.00	1.89	2.41	2.77	2.28	1.97	2.54	1.94	1.77
11:00 PM	1.71	1.16	0.98	1.61	1.57	1.36	1.24	1.73	2.14	1.53	1.28	1.99	1.34	1.14

Source: NCHRP Report 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design, Chapter 8.

Use of Diurnal Factors

- Example: Develop the 7:00 AM Peak Hour Volume with Factors from NCHRP Report 765

1 Determine Diurnal Factor

$$Diurnal\ Factor = 7.27\%$$

2 Calculate Peak Volume

$$Volume_{7:00AM} = AADT \times Diurnal\ Factor$$

$$Volume_{7:00AM} = 142{,}000 \times 7.27\%$$

$$Volume_{7:00AM} = 10{,}500$$

Hour Begin	Urban, small: Pop <200K			Urban, medium: Pop 200K–1 million				Urban, large: Pop > 1 million				Rural Area		
	Interstate	Arterial	Collector	Interstate	Arterial CBD	Arterial Others	Collector	Interstate	Arterial CBD	Arterial Others	Collector	Interstate	Arterial	Collector
12:00 AM	1.07	0.59	0.47	0.95	0.81	0.71	0.61	0.96	1.22	0.78	0.59	1.43	0.72	0.57
1:00 AM	0.79	0.39	0.29	0.65	0.47	0.46	0.36	0.61	0.75	0.48	0.38	1.12	0.49	0.36
2:00 AM	0.70	0.30	0.23	0.57	0.41	0.40	0.31	0.51	0.58	0.37	0.30	0.99	0.43	0.31
3:00 AM	0.76	0.33	0.26	0.61	0.31	0.46	0.34	0.53	0.57	0.37	0.33	1.02	0.51	0.38
4:00 AM	1.10	0.58	0.30	0.96	0.43	0.77	0.60	0.85	0.79	0.61	0.59	1.31	0.93	0.84
5:00 AM	2.20	1.44	1.16	2.10	0.98	1.80	1.32	2.13	1.74	1.70	1.16	2.12	2.28	2.19
6:00 AM	4.16	3.21	2.93	4.67	2.67	4.05	3.[illegible]	[illegible]	[illegible]	4.17	2.72	3.58	4.54	4.36
7:00 AM	5.69	6.09	6.27	7.17	5.90	6.40	6.[illegible]	7.27	1	6.58	5.92	4.89	6.63	6.55
8:00 AM	5.26	5.53	5.75	6.16	5.79	5.75	6.[illegible]	[illegible]	[illegible]	6.08	6.05	4.95	5.55	5.58
9:00 AM	5.04	5.12	4.95	5.13	4.96	5.18	5.60	5.27	5.43	5.04	5.82	5.23	5.24	5.25
10:00 AM	5.27	5.55	5.24	5.10	5.19	5.36	5.49	4.86	5.18	4.96	5.78	5.64	5.41	5.44
11:00 AM	5.60	6.31	6.01	5.37	6.22	5.76	5.92	5.01	5.40	5.39	6.55	5.92	5.67	5.71
12:00 PM	5.89	6.74	6.66	5.59	7.10	6.11	6.33	5.20	5.72	5.81	7.08	6.02	5.91	6.05
1:00 PM	6.12	6.72	6.72	5.78	6.95	6.25	6.40	5.39	5.77	5.93	6.95	6.26	6.13	6.24
2:00 PM	6.78	7.07	7.63	6.32	6.75	6.70	6.74	6.02	6.07	6.31	7.20	6.63	6.68	6.78
3:00 PM	7.60	8.29	8.65	7.22	7.18	7.46	7.44	7.05	6.66	7.05	7.97	7.04	7.53	7.63
4:00 PM	7.88	8.30	9.22	7.86	7.91	8.05	7.82	7.78	7.07	7.85	7.94	7.25	8.02	8.15
5:00 PM	7.54	7.91	8.45	7.97	8.27	8.14	8.18	7.98	7.45	8.33	7.60	7.07	7.98	8.16
6:00 PM	5.63	5.96	5.96	5.69	6.06	6.10	6.05	6.11	6.12	6.52	5.66	5.68	5.95	6.17
7:00 PM	4.32	4.49	4.49	4.10	4.72	4.42	4.33	4.27	4.72	4.80	4.20	4.47	4.21	4.37
8:00 PM	3.57	3.50	3.38	3.34	3.89	3.48	3.42	3.37	3.77	3.88	3.29	3.71	3.30	3.41
9:00 PM	2.99	2.63	2.46	2.88	3.18	2.82	2.71	2.97	3.30	3.17	2.66	3.13	2.62	2.59
10:00 PM	2.31	1.77	1.54	2.19	2.27	2.00	1.89	2.41	2.77	2.28	1.97	2.54	1.94	1.77
11:00 PM	1.71	1.16	0.98	1.61	1.57	1.36	1.24	1.73	2.14	1.53	1.28	1.99	1.34	1.14

Source: NCHRP Report 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design, Chapter 8.

Uses of Design Hour Traffic Volumes

- **Determine Lane Requirements**
- **Conduct Capacity Analysis**
- **Conduct Level of Service Analysis**
- **Basis for Developing Turning Movement Projections**

Directional Design Hour Volumes

QUIZ

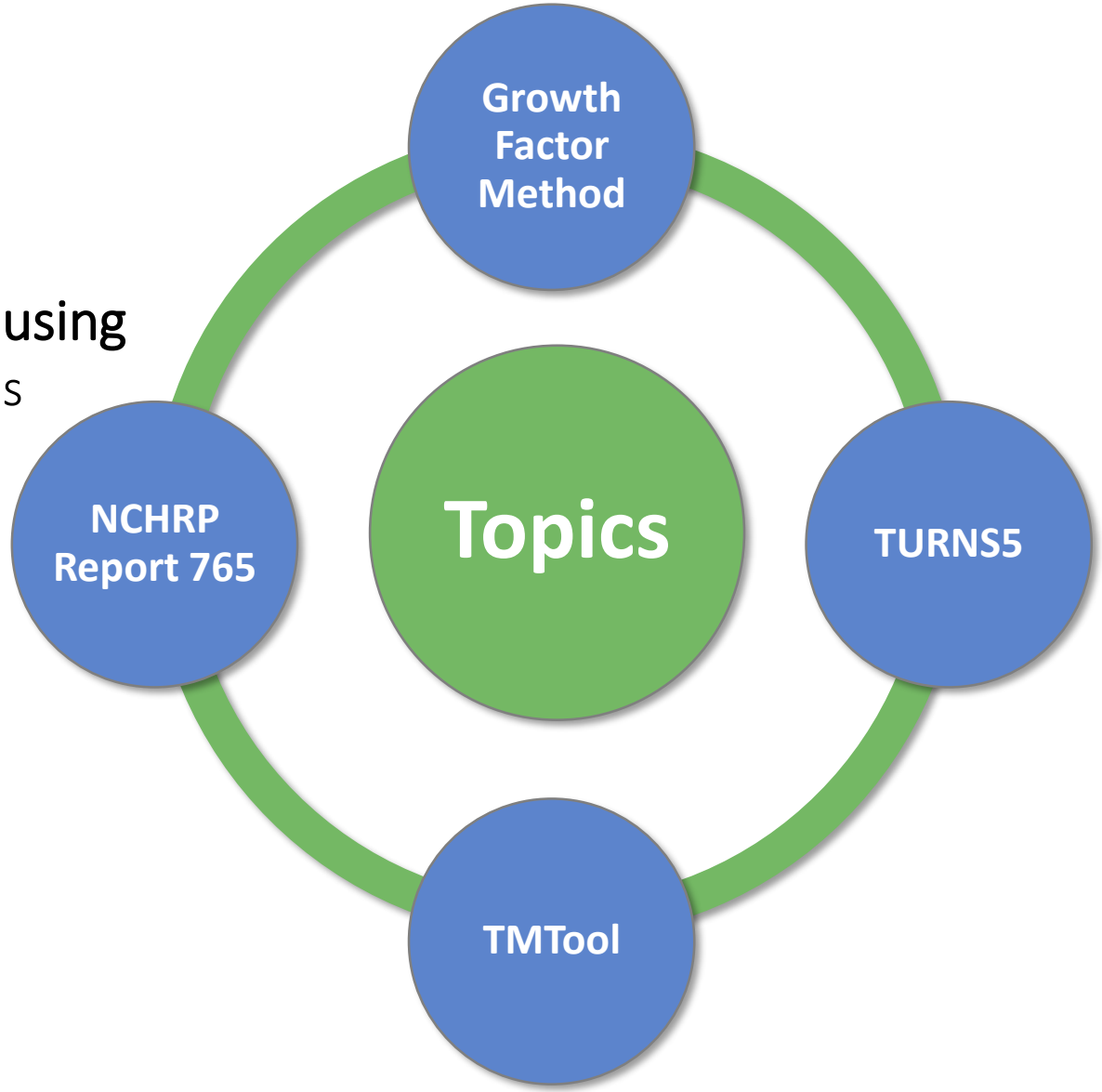
Estimating Intersection Turning Movements

- Introduction
- Growth Factor Method
- TURNS5
- TMTool
- NCHRP Report 765
- Quiz

Introduction

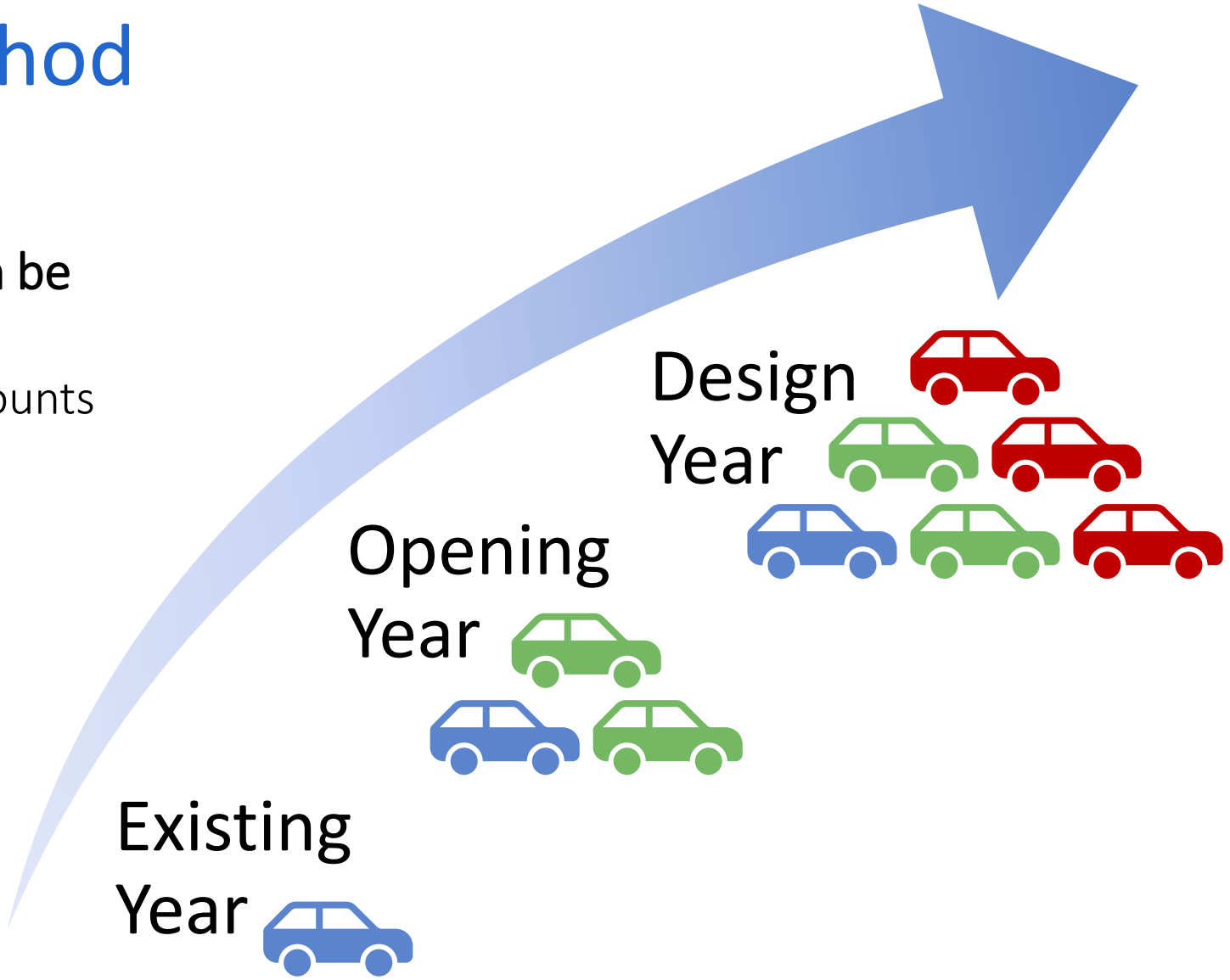
- **Turning Movement Volumes are developed using**
  - FSUTMS Travel Demand Forecasting Models
  - Other Common Methods
    - Growth Factor Method
    - TURNS5
    - TMTool
    - NCHRP Report 765

- **Turning Movement Volumes required for**
  - Intersection Design
  - Traffic Operational Analyses
  - Site Impact Evaluations



Growth Factor Method

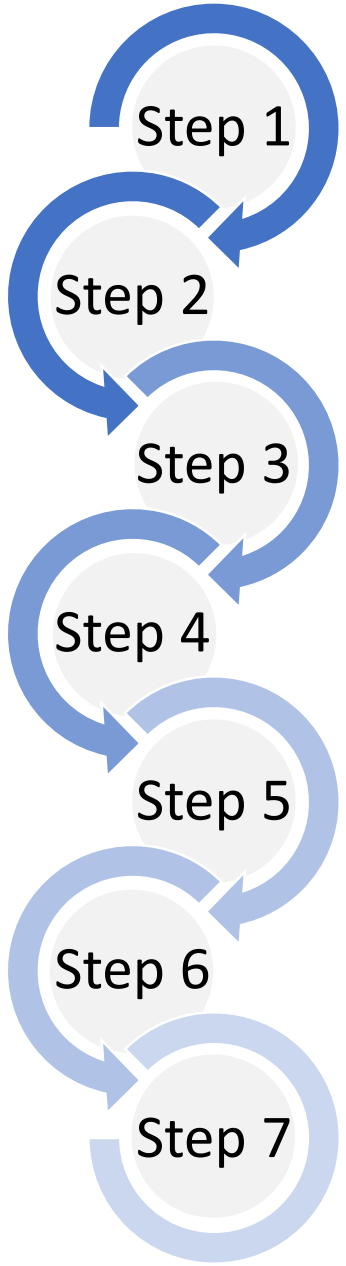
- The Growth Factor Method can be used when
  - Existing turning movement counts are available
  - No major changes in land use patterns are expected
- Most commonly used method



Growth Factor Method

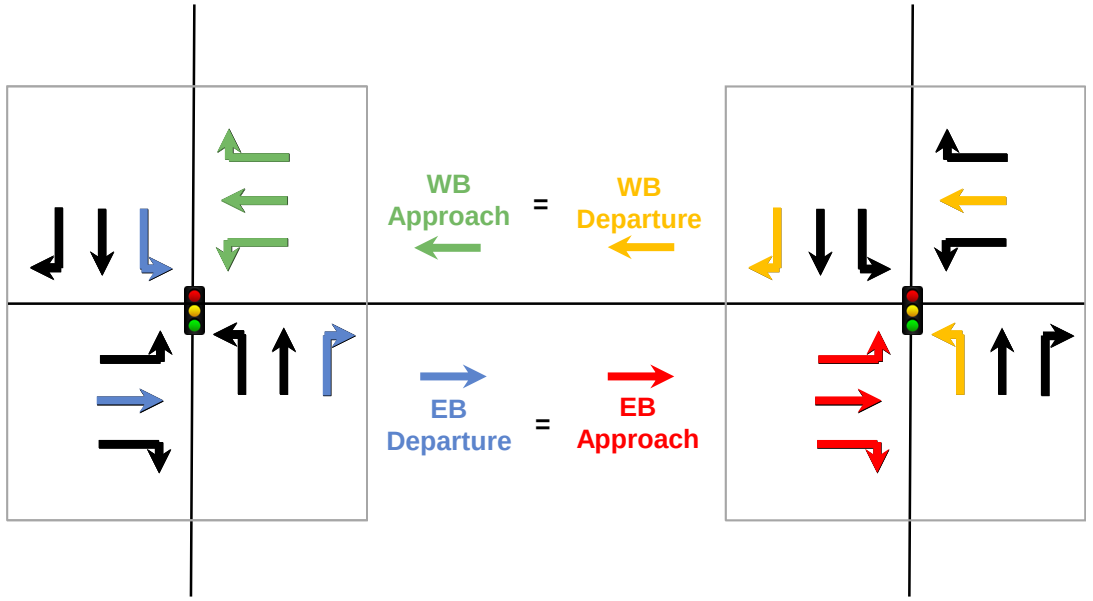
- **The Growth Factor Method Steps**

1. Balance Existing Year Turning Movement Volumes
2. Calculate Existing Year Turning Movement Percentages
3. Hold Ramp Volumes from DDHV Development Constant
4. Distribute Ramp Volumes based on the Existing Year Turning Movement Percentages
5. Apply Growth Rate to the Arterial Approach Volumes
6. Calculate Arterial Through and Turning Volumes
7. Refine and Balance Arterial Volumes



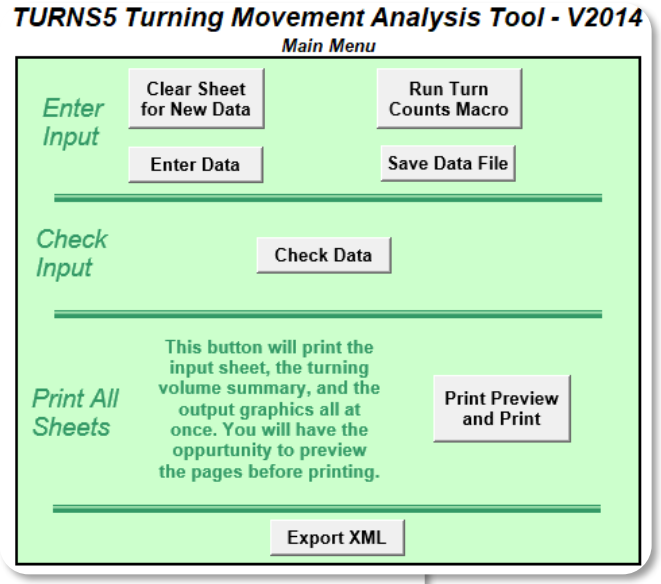
Growth Factor Method

- Corridor Balancing
  - Link volumes between two adjacent intersections along a corridor should balance
  - The degree of accuracy that can be obtained from “intersection balancing” methods depends on
    - Change in land use
    - Travel pattern expected to occur between the existing and future design years



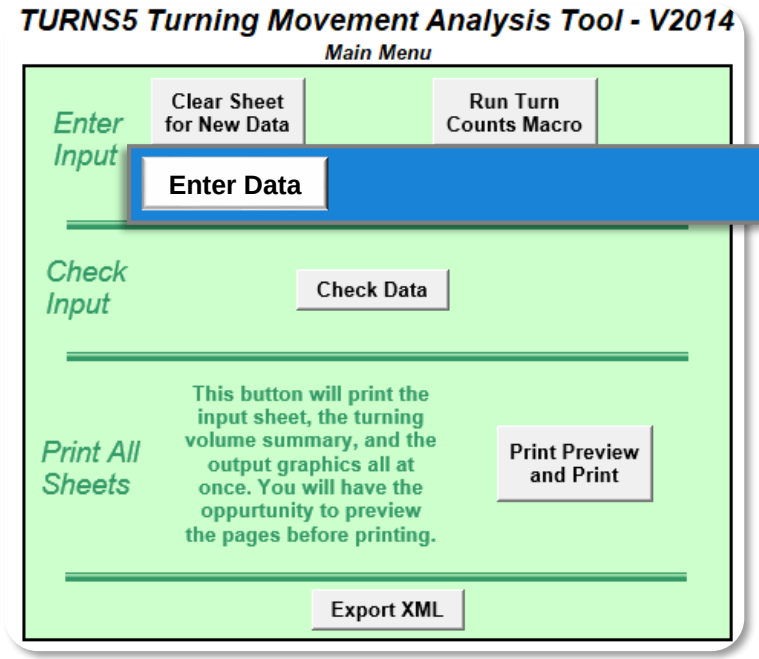
TURNS5

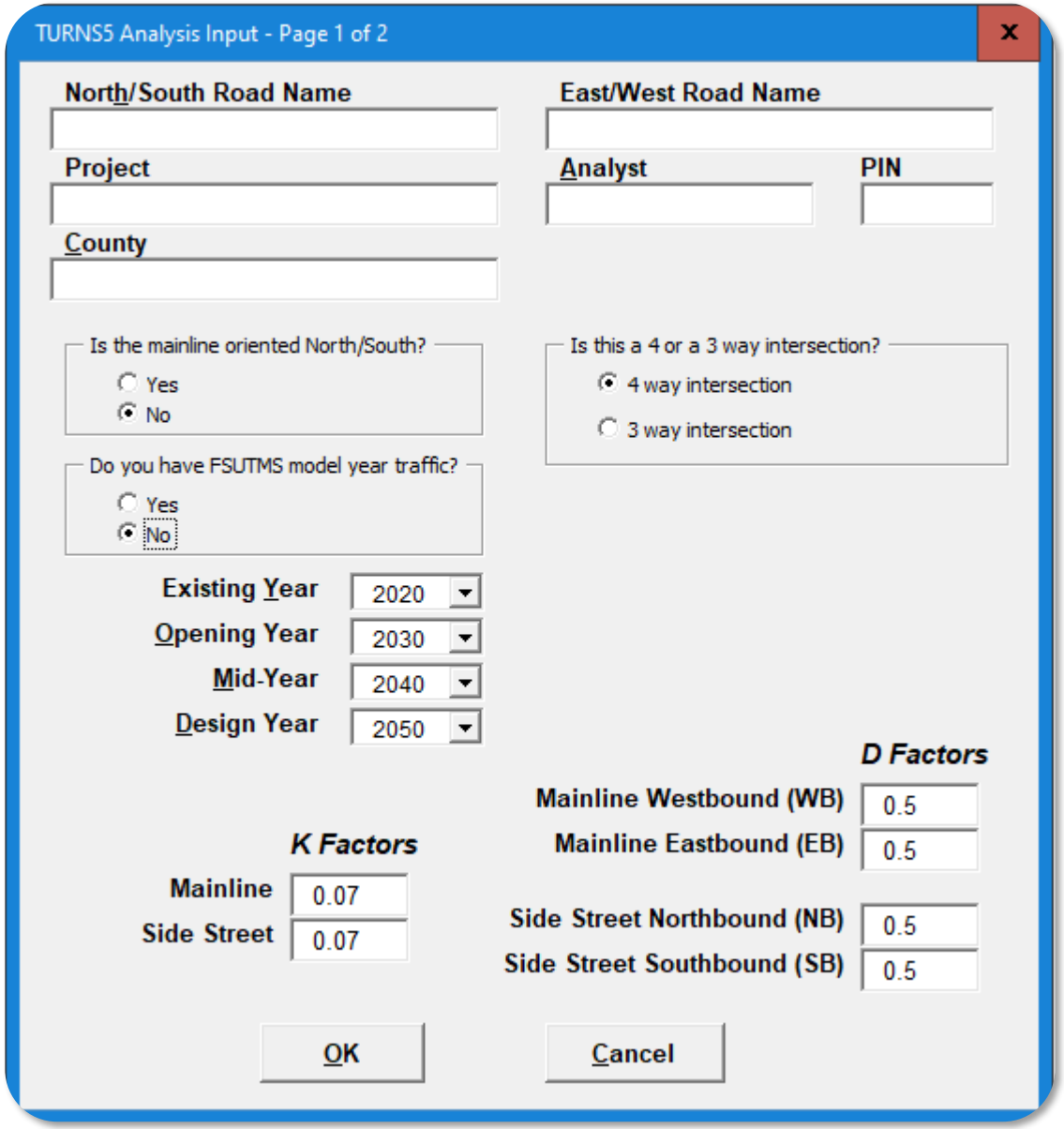
- Current Version
  - turns5---v2014-final.xlsm
- TURNS5 develops turning movements with two methods
  - Interpolation
  - Growth Rate Application
- Limitations
  - One peak period per application
  - Allows input only by direction not by approach
  - Does not allow direct input of AADT developed by methodologies other than growth factors



TURNS5

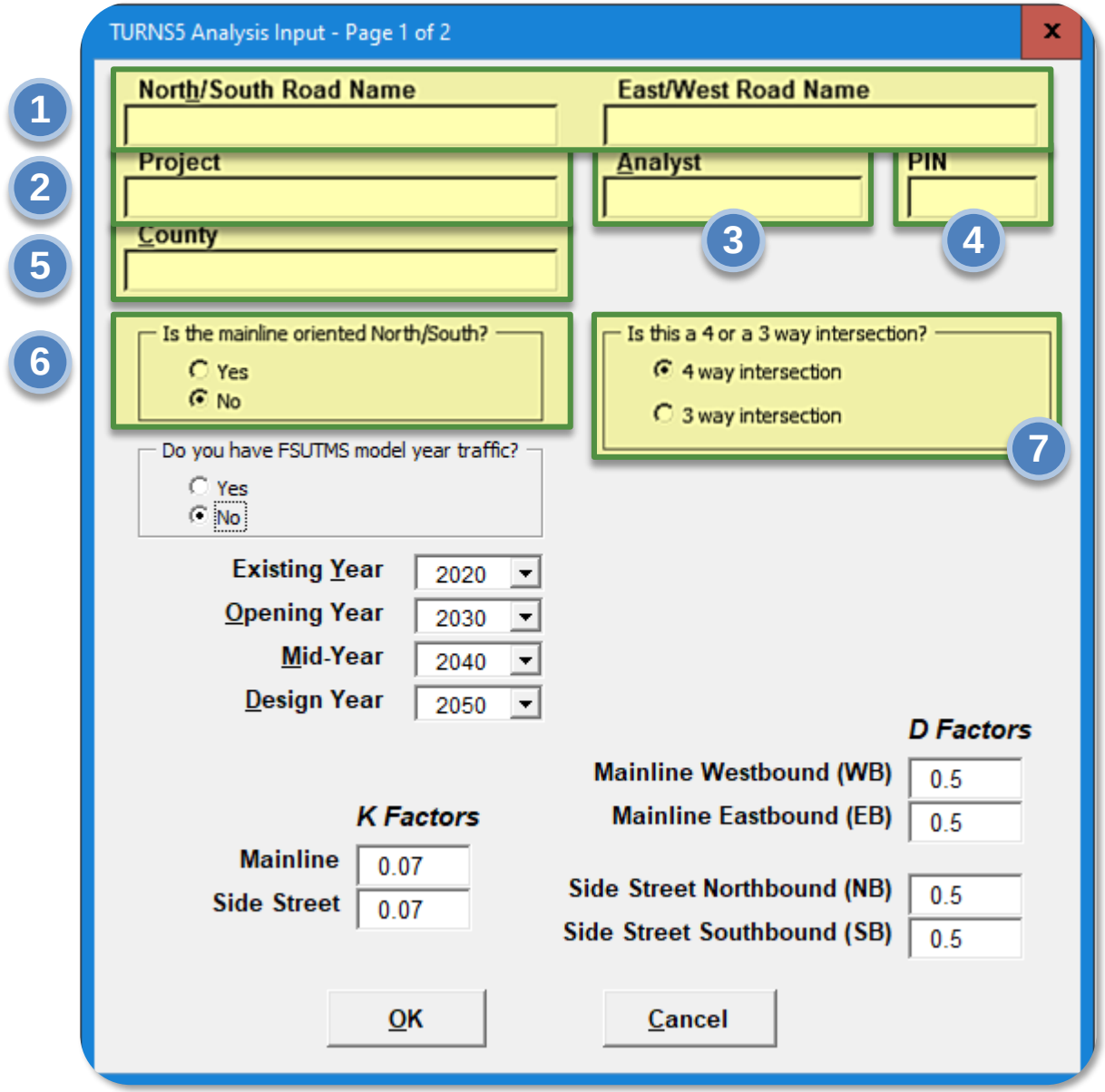
- Open Excel Spreadsheet (turns5---v2014-final.xlsm)





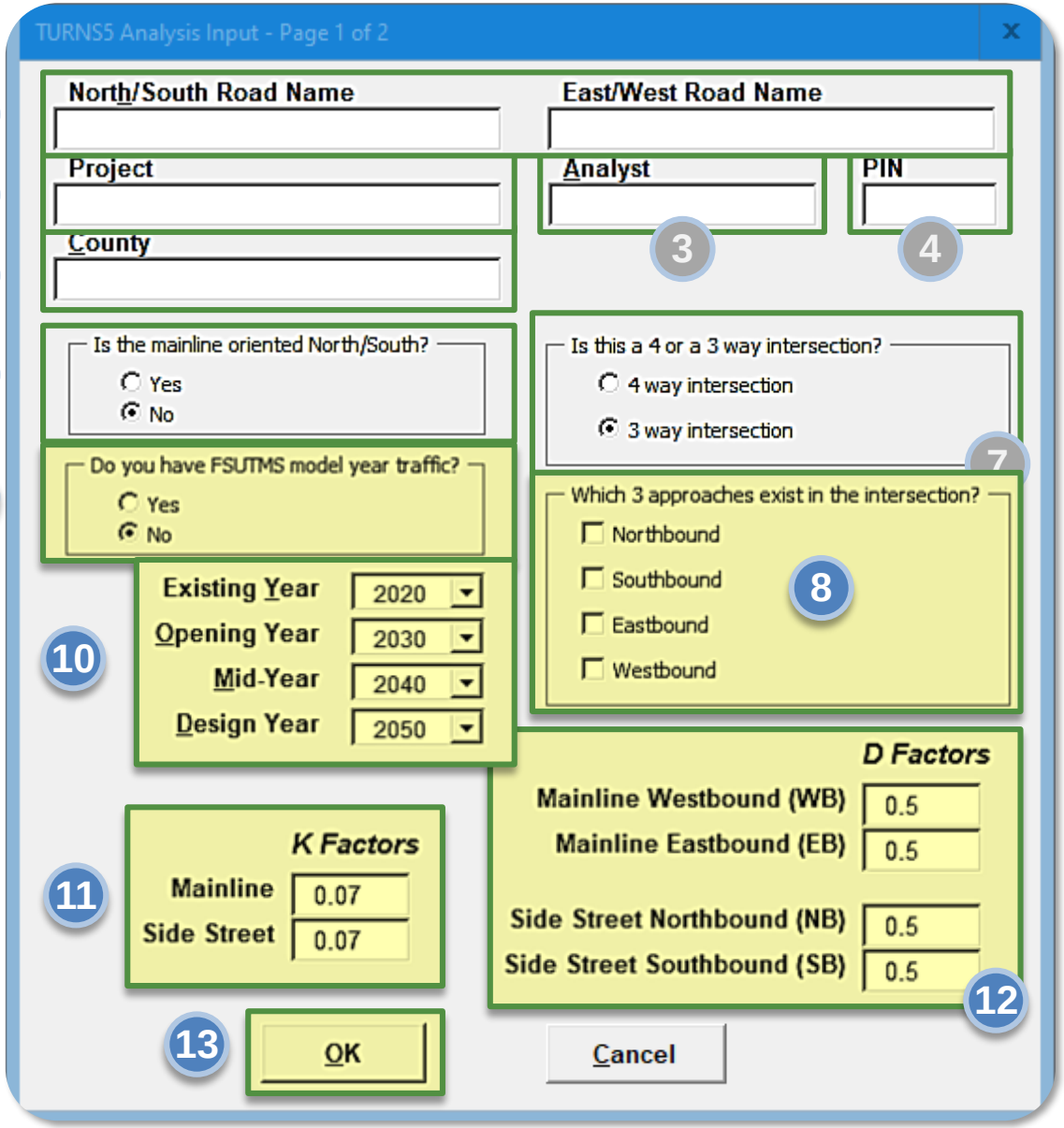
TURNS5

- Fill Out Data Entry Screen
  1. Enter Roadway Names
  2. Enter Project Name/Description
  3. Enter Name of Analyst
  4. Enter PIN Number
  5. Enter County Name
  6. Select N/S Orientation on Mainline
  7. Select Type of Intersection



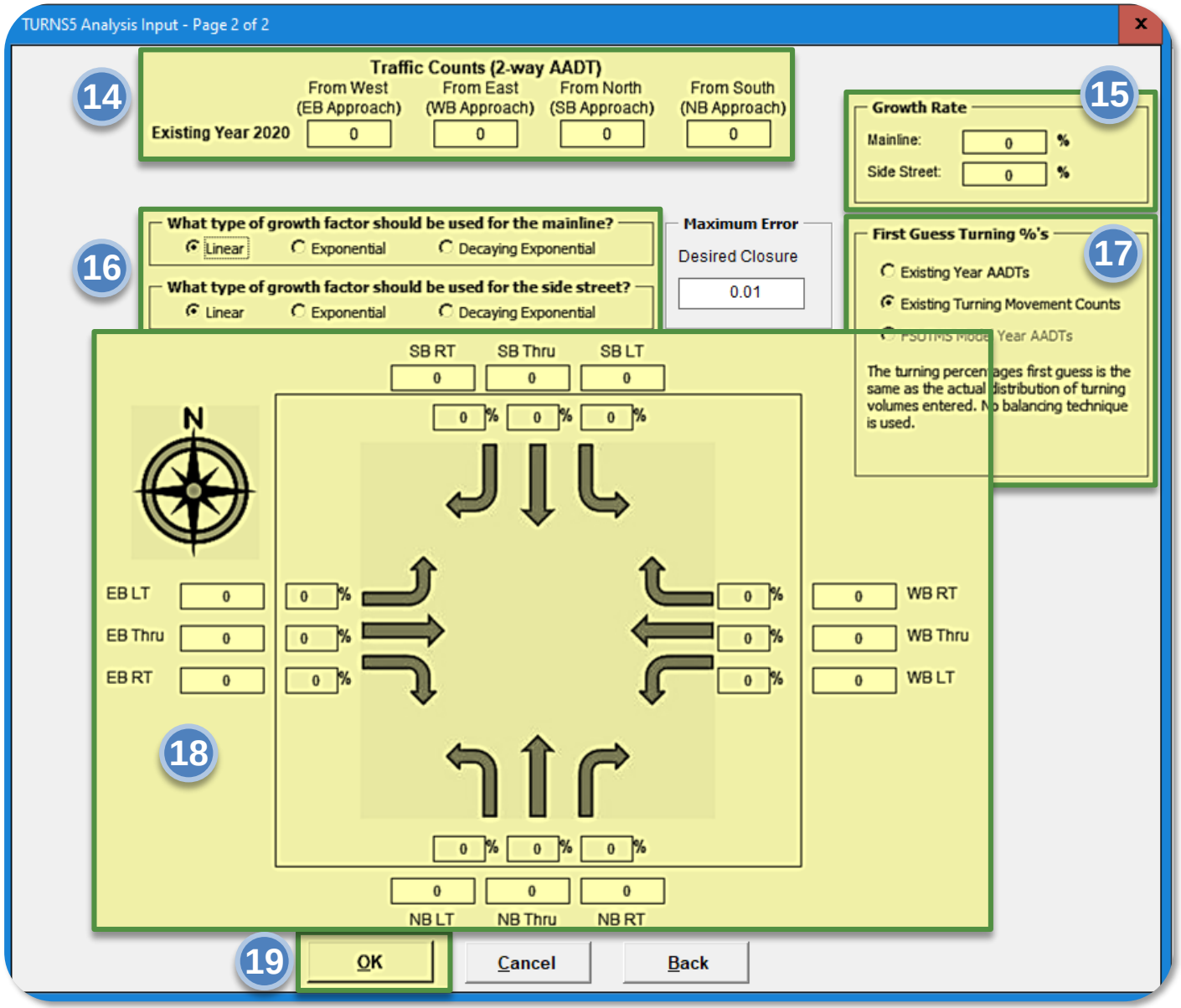
TURNS5

- Fill Out Data Entry Screen
  - 8 If 3-Way Intersection, Select the 3 Approaches at the Intersection
  - 9 Select if FSUTMS Model Traffic is Available
  - 10 Enter Years of Analysis
  - 11 Enter K Factor Values
  - 12 Enter D Factor Values
  - 13 Click “OK”



TURNS5

- Fill Out Data Entry Screen
  - 14 Enter Existing Year AADTs by Approach
  - 15 Enter Annual Growth Rate as a Percentage
  - 16 Select Growth Rate Factor Type
  - 17 Select First Guess Turning % Based On
    - It is recommended Existing Turning Movement Counts be Used
  - 18 Enter Existing Turning Movement Counts
  - 19 Click “OK”



TURNS5

- Output Screens
  - Initial Turning Volume Summary

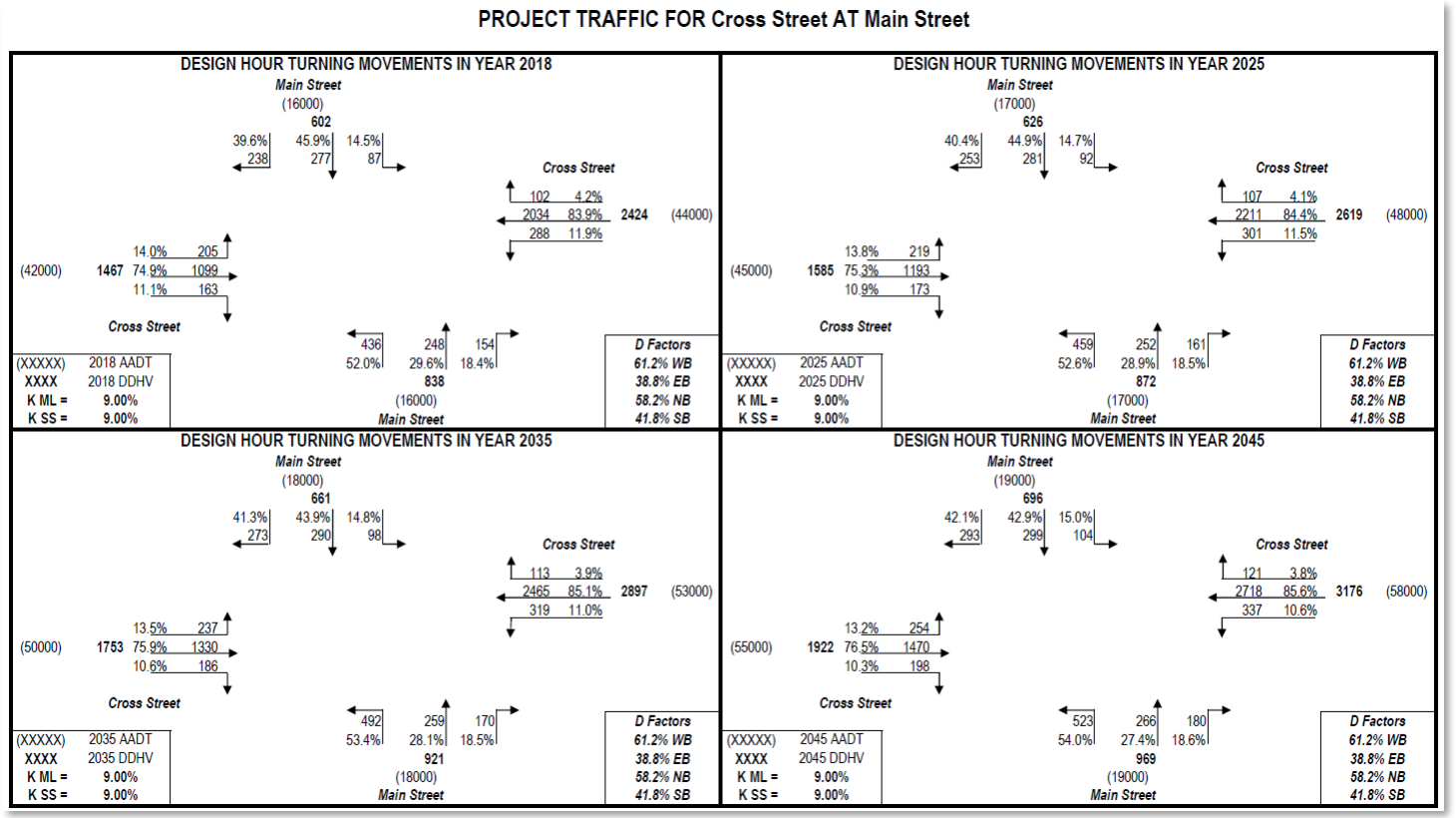
TURNS5 INITIAL TURNING VOLUME SUMMARY

Highway:	Cross Street	**County:**	Polk
Intersection:	Main Street		
Project:	Project	**Analyst:**	John Doe
		Date:	25-Feb-20

Approach-To-Approach	2018 Initial Estimate	2018 Final Estimate	2018 Calculated Volume	2025 Final Estimate	2025 Calculated Volume	2035 Final Estimate	2035 Calculated Volume	2045 Final Estimate	2045 Calculated Volume
West-To-North (LT)	0.120	0.140	205	0.138	219	0.135	237	0.132	254
West-To-East (Thru)	0.825	0.749	1099	0.753	1193	0.759	1330	0.765	1470
West-To-South (RT)	0.055	0.111	163	0.109	173	0.106	186	0.103	198
Total Flow From West:			**1467**		**1585**		**1753**		**1922**
East-To-South (LT)	0.235	0.119	288	0.115	301	0.110	319	0.106	337
East-To-West (Thru)	0.621	0.839	2034	0.844	2211	0.851	2465	0.856	2718
East-To-North (RT)	0.144	0.042	102	0.041	107	0.039	113	0.038	121
Total Flow From East:			**2424**		**2619**		**2897**		**3176**
North-To-East (LT)	0.348	0.145	87	0.147	92	0.148	98	0.150	104
North-To-South (Thru)	0.493	0.459	277	0.449	281	0.439	290	0.429	299
North-To-West (RT)	0.159	0.396	238	0.404	253	0.413	273	0.421	293
Total Flow From North:			**602**		**626**		**661**		**696**
South-To-West (LT)	0.174	0.520	436	0.526	459	0.534	492	0.540	523
South-To-North (Thru)	0.458	0.296	248	0.289	252	0.281	259	0.274	266
South-To-East (RT)	0.368	0.184	154	0.185	161	0.185	170	0.186	180
Total Flow From South:			**838**		**872**		**921**		**969**

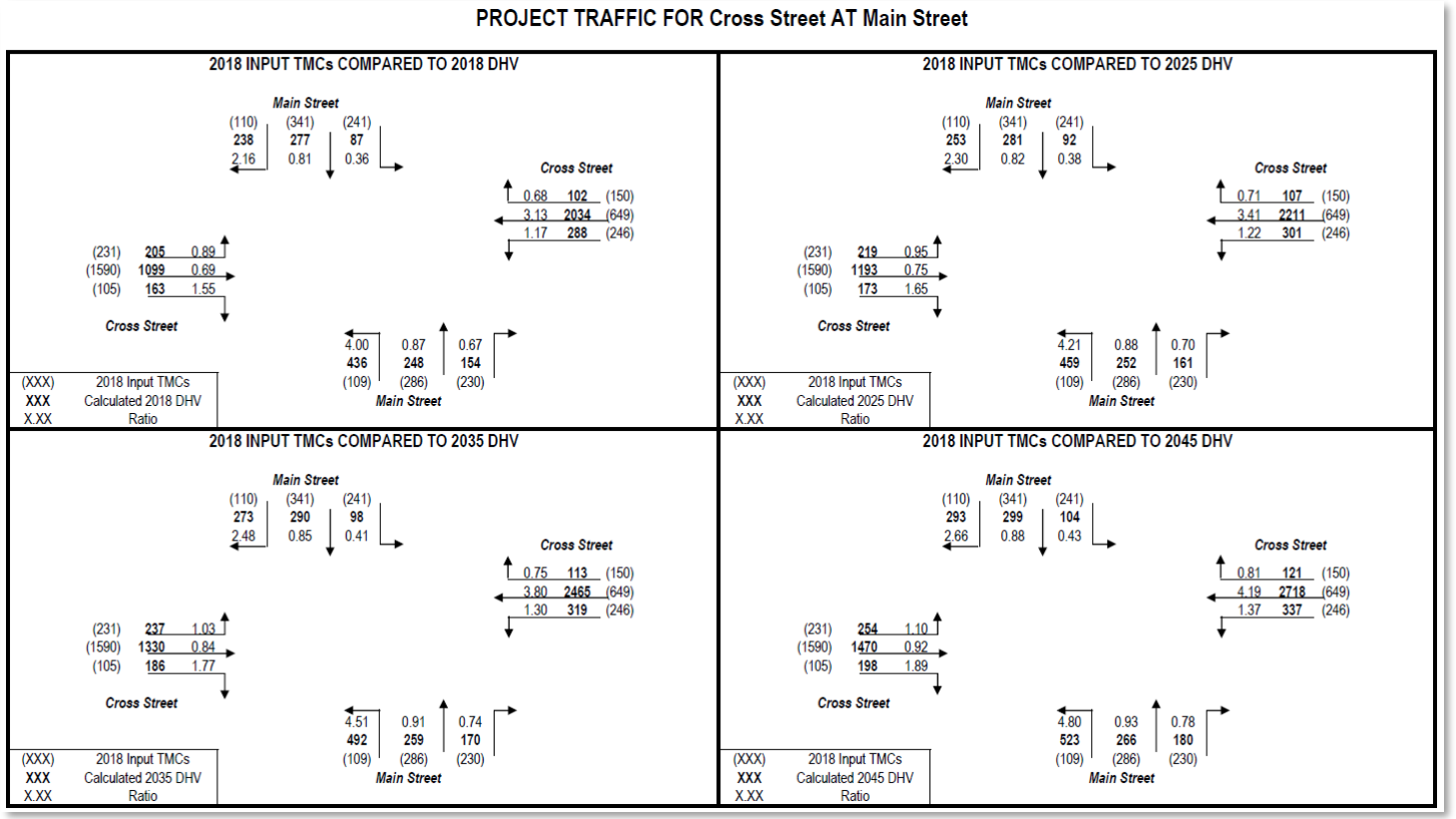
TURNS5

- Output Screens
  - Turning Movement Counts for All Analysis Years



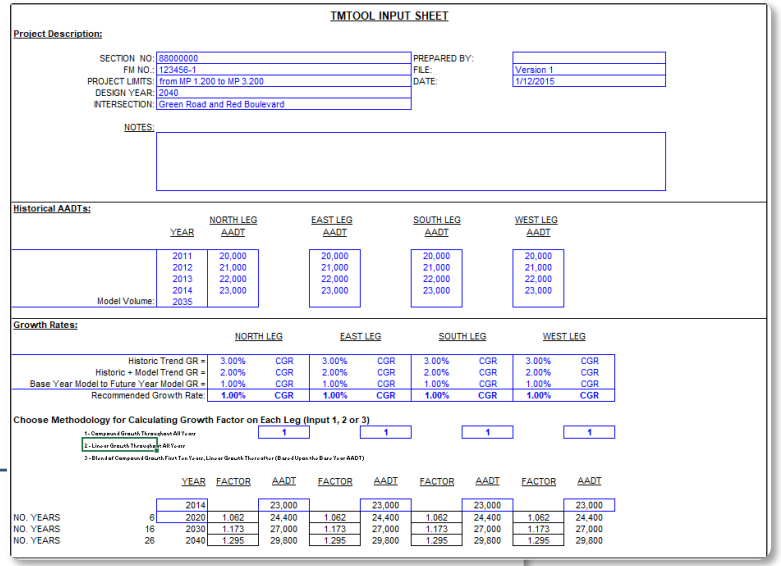
TURNS5

- Output Screens
  - Comparison Between existing and Future Year Turning Movement Counts



TMTool

- Current Version
  - district-4-tmtool-v2.xlsm
- TMTool developed by District 4
- Required Data
  - Existing AADTs
  - Future AADTs or Growth Rate
  - Existing Turning Movement Counts
- Estimates future turning movement volumes for multiple periods at the same time
- Used to develop turning movements for
  - Existing Intersections
  - Planned Intersections



TMTOOL INPUT SHEET

Project Description:

SECTION NO: 88000000
FM NO.: 123456-1
PROJECT LIMITS: from MP 1.200 to MP 3.200
DESIGN YEAR: 2040
INTERSECTION: Green Road and Red Boulevard
PREPARED BY:
FILE: Version 1
DATE: 1/12/2015
NOTES:

Historical AADTs:

	YEAR	NORTH LEG AADT	EAST LEG AADT	SOUTH LEG AADT	WEST LEG AADT
	2011	20,000	20,000	20,000	20,000
	2012	21,000	21,000	21,000	21,000
	2013	22,000	22,000	22,000	22,000
	2014	23,000	23,000	23,000	23,000
Model Volume:	2035				

Growth Rates:

	NORTH LEG		EAST LEG		SOUTH LEG		WEST LEG	
Historic Trend GR =	3.00%	CGR	3.00%	CGR	3.00%	CGR	3.00%	CGR
Historic + Model Trend GR =	2.00%	CGR	2.00%	CGR	2.00%	CGR	2.00%	CGR
Base Year Model to Future Year Model GR =	1.00%	CGR	1.00%	CGR	1.00%	CGR	1.00%	CGR
Recommended Growth Rate:	**1.00%**	CGR	**1.00%**	CGR	**1.00%**	CGR	**1.00%**	CGR

Choose Methodology for Calculating Growth Factor on Each Leg (Input 1, 2 or 3)

1-Compound Growth Throughout All Years: 1 | 1 | 1 | 1
2-Linear Growth Throughout All Years
3-Blend of Compound Growth First Two Years, Linear Growth Thereafter (Based Upon the Base Year AADT)

		YEAR	FACTOR	AADT	FACTOR	AADT	FACTOR	AADT	FACTOR	AADT
		2014		23,000		23,000		23,000		23,000
NO. YEARS	6	2020	1.062	24,400	1.062	24,400	1.062	24,400	1.062	24,400
NO. YEARS	16	2030	1.173	27,000	1.173	27,000	1.173	27,000	1.173	27,000
NO. YEARS	26	2040	1.295	29,800	1.295	29,800	1.295	29,800	1.295	29,800

Resources

Project Traffic Forecasting Guidance

- Project Traffic Forecasting Handbook 2019
- Project Traffic Forecasting Procedure (525-030-120-h)
- TURNS5 Turning Movement Analysis Tool Documentation (2014)
- Florida Specific Traffic Data Inputs to the Mechanistic-Empirical Pavement Design Guide (MEPDG)

Project Traffic Forecasting Tools

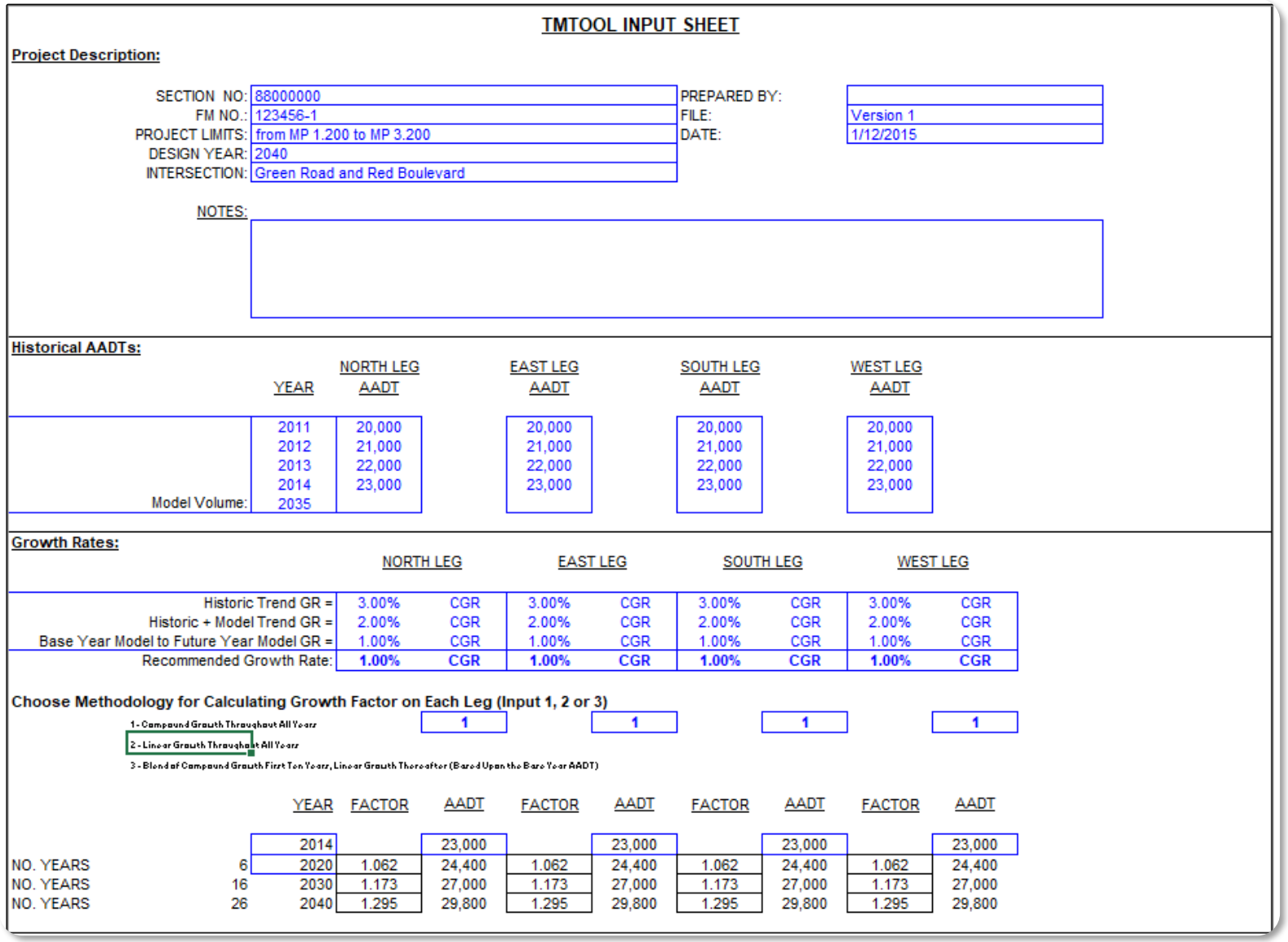
- Turns5 Turning Movement Analysis Tool (2014)
- Equivalent Single Axle Load Analysis Tool (*Version 2*)
- Traffic Trends Analysis Tool
- District 4's Turning Movement Tool (TM Tool)

Project Traffic Forecasting Training

- Project Traffic Forecasting Training

TMTool

- Open Excel Spreadsheet (district-4-tmtool-v2.xlsm)
  - Blue Text = Manual Input
  - Black Text = Calculation



TMTOOL INPUT SHEET

Project Description:

SECTION NO:	88000000	PREPARED BY:	
FM NO.:	123456-1	FILE:	Version 1
PROJECT LIMITS:	from MP 1.200 to MP 3.200	DATE:	1/12/2015
DESIGN YEAR:	2040		
INTERSECTION:	Green Road and Red Boulevard		

NOTES:

Historical AADTs:

	YEAR	NORTH LEG AADT	EAST LEG AADT	SOUTH LEG AADT	WEST LEG AADT
	2011	20,000	20,000	20,000	20,000
	2012	21,000	21,000	21,000	21,000
	2013	22,000	22,000	22,000	22,000
	2014	23,000	23,000	23,000	23,000
Model Volume:	2035				

Growth Rates:

	NORTH LEG		EAST LEG		SOUTH LEG		WEST LEG	
Historic Trend GR =	3.00%	CGR	3.00%	CGR	3.00%	CGR	3.00%	CGR
Historic + Model Trend GR =	2.00%	CGR	2.00%	CGR	2.00%	CGR	2.00%	CGR
Base Year Model to Future Year Model GR =	1.00%	CGR	1.00%	CGR	1.00%	CGR	1.00%	CGR
Recommended Growth Rate:	**1.00%**	**CGR**	**1.00%**	**CGR**	**1.00%**	**CGR**	**1.00%**	**CGR**

Choose Methodology for Calculating Growth Factor on Each Leg (Input 1, 2 or 3)

	NORTH LEG	EAST LEG	SOUTH LEG	WEST LEG
1 - Compound Growth Throughout All Years	1	1	1	1
2 - Linear Growth Throughout All Years				
3 - Blend of Compound Growth First Ten Years, Linear Growth Thereafter (Based Upon the Base Year AADT)				

		YEAR	NORTH LEG FACTOR	NORTH LEG AADT	EAST LEG FACTOR	EAST LEG AADT	SOUTH LEG FACTOR	SOUTH LEG AADT	WEST LEG FACTOR	WEST LEG AADT
		2014		23,000		23,000		23,000		23,000
NO. YEARS	6	2020	1.062	24,400	1.062	24,400	1.062	24,400	1.062	24,400
NO. YEARS	16	2030	1.173	27,000	1.173	27,000	1.173	27,000	1.173	27,000
NO. YEARS	26	2040	1.295	29,800	1.295	29,800	1.295	29,800	1.295	29,800

TMTool

- Fill Out Data Entry Screen
  1. Enter Project Description

TMTOOL INPUT SHEET

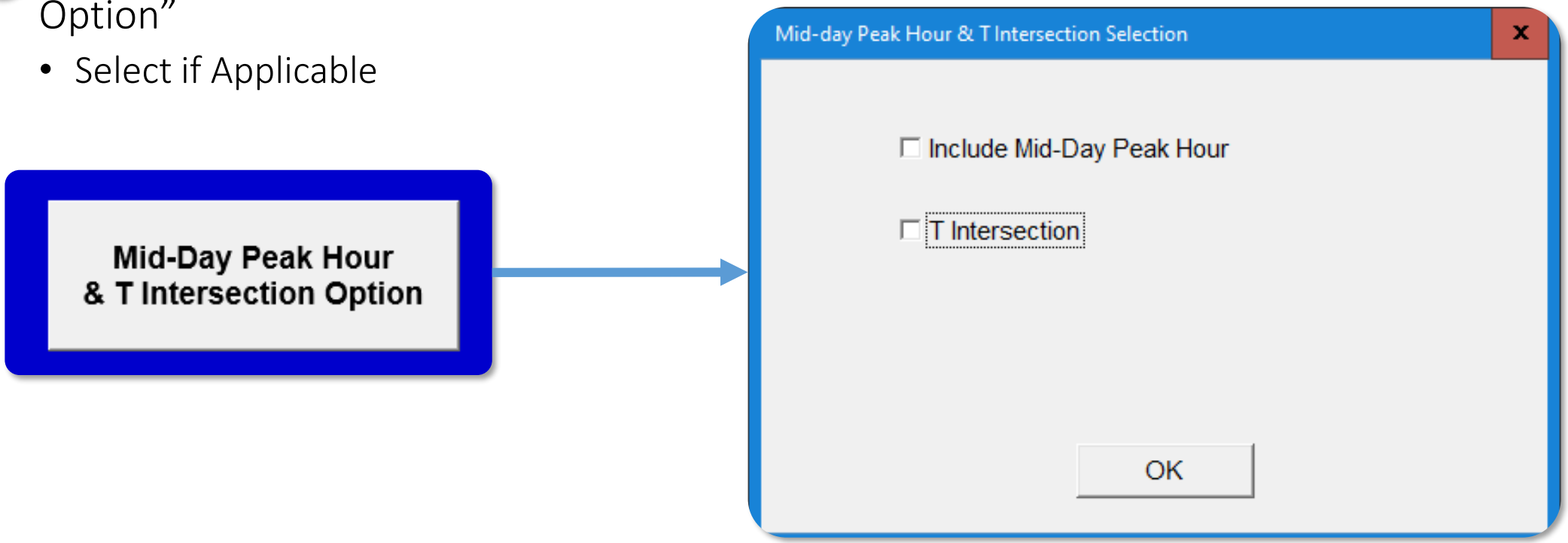
Project Description:

SECTION NO:	88000000	PREPARED BY:	
FM NO.:	123456-1	FILE:	Version 1
PROJECT LIMITS:	from MP 1.200 to MP 3.200	DATE:	1/12/2015
DESIGN YEAR:	2040		
INTERSECTION:	Green Road and Red Boulevard		

NOTES:

TMTool

- **Fill Out Data Entry Screen**
  2. Click “Mid-Day Peak Hour & T Intersection Option”
     - Select if Applicable



TMTool

- Fill Out Data Entry Screen
  3. Enter AADTs

Historical AADTs:

	YEAR	NORTH LEG AADT	EAST LEG AADT	SOUTH LEG AADT	WEST LEG AADT
	2011	20,000	20,000	20,000	20,000
	2012	21,000	21,000	21,000	21,000
	2013	22,000	22,000	22,000	22,000
	2014	23,000	23,000	23,000	23,000
Model Volume:	2035				

TMTool

- Fill Out Data Entry Screen
  4. Input Growth Rates

Growth Rates:	NORTH LEG		EAST LEG		SOUTH LEG		WEST LEG	
Historic Trend GR =	3.00%	CGR	3.00%	CGR	3.00%	CGR	3.00%	CGR
Historic + Model Trend GR =	2.00%	CGR	2.00%	CGR	2.00%	CGR	2.00%	CGR
Base Year Model to Future Year Model GR =	1.00%	CGR	1.00%	CGR	1.00%	CGR	1.00%	CGR
Recommended Growth Rate:	**1.00%**	**CGR**	**1.00%**	**CGR**	**1.00%**	**CGR**	**1.00%**	**CGR**

TMTool

- **Fill Out Data Entry Screen**
  5. Select Methodology for Calculating Growth Rate
     - 1 = Compound Annual Growth Rate
     - 2 = Linear Growth Rate
     - 3 = Blend of Compound and Linear

Choose Methodology for Calculating Growth Factor on Each Leg (Input 1, 2 or 3)

1 = Compound Growth Throughout All Years — 1 | 1 | 1 | 1

2 = Linear Growth Throughout All Years

3 = Blend of Compound Growth First Ten Years, Linear Growth Thereafter (Based Upon the Base Year AADT)

		YEAR	FACTOR	AADT	FACTOR	AADT	FACTOR	AADT	FACTOR	AADT
		2014		23,000		23,000		23,000		23,000
NO. YEARS	6	2020	1.062	24,400	1.062	24,400	1.062	24,400	1.062	24,400
NO. YEARS	16	2030	1.173	27,000	1.173	27,000	1.173	27,000	1.173	27,000
NO. YEARS	26	2040	1.295	29,800	1.295	29,800	1.295	29,800	1.295	29,800

TMTool

- Fill Out Data Entry Screen

6 Input Turning Movement Count Data & Estimate Future Turn Percentages

Percent Turns Calculated From Base Year TMCs:

TURN STUDY		FROM NORTH LEG (Southbound)			FROM EAST LEG (Westbound)			FROM SOUTH LEG (Northbound)			FROM WEST LEG (Eastbound)			
	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	TOTAL
A.M.	2-Way Pk Hr Vol:	1,280			1,280			1,280			1,280		
7/20/2019	20	600	20	20	600	20	20	600	20	20	600	20	2,560
% TURNS:	3%	94%	3%	3%	94%	3%	3%	94%	3%	3%	94%	3%	
P.M.	2-Way Pk Hr Vol:	1,720			1,720			1,720			1,720		
7/20/2019	30	800	30	30	800	30	30	800	30	30	800	30	3,440
% TURNS:	3%	93%	3%	3%	93%	3%	3%	93%	3%	3%	93%	3%	

TMTool

- **Fill Out Data Entry Screen**

6 Input Turning Movement Count Data

TURN STUDY		FROM NORTH LEG (Southbound)			FROM EAST LEG (Westbound)			FROM SOUTH LEG (Northbound)			FROM WEST LEG (Eastbound)			
		RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	TOTAL
A.M.	2-Way Pk Hr Vol:		18,147			5,430			18,635			5,640		
7/20/2014		701	7,583	780	245	1,283	461	883	8,334	569	805	1,778	504	23,926
% TURNS:		8%	84%	9%	12%	65%	23%	9%	85%	6%	26%	58%	16%	
P.M.	2-Way Pk Hr Vol:		13,930			4,686			14,673			5,141		
7/20/2014		612	6,018	431	326	1,352	737	494	6,068	552	804	1,346	475	19,215
% TURNS:		9%	85%	6%	13%	56%	31%	7%	85%	8%	31%	51%	18%	

Future turning percentages calculated from future year AADT and existing turning movement counts

Est. % Turns Calculated From Base Year AADTs & TMCs:

SUGGESTED STARTING POINTS

	NORTH LEG			EAST LEG			SOUTH LEG			WEST LEG		
	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT
A.M.												
2020	6%	88%	6%	6%	88%	6%	6%	88%	6%	6%	88%	6%
2030	7%	86%	7%	7%	86%	7%	7%	86%	7%	7%	86%	7%
2040	8%	84%	8%	8%	84%	8%	8%	84%	8%	8%	84%	8%
P.M.												
2020	6%	87%	6%	6%	87%	6%	6%	87%	6%	6%	87%	6%
2030	7%	86%	7%	7%	86%	7%	7%	86%	7%	7%	86%	7%
2040	8%	83%	8%	8%	83%	8%	8%	83%	8%	8%	83%	8%

TMTool

- Fill Out Data Entry Screen
  7. K Factors and D Factors are Calculated

Est. % Turns Calculated From Base Year AADTs & TMCs:

SUGGESTED STARTING POINTS

	NORTH LEG			EAST LEG			SOUTH LEG			WEST LEG		
	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT
A.M.												
2014	3%	94%	3%	3%	94%	3%	3%	94%	3%	3%	94%	3%
2020	6%	88%	6%	6%	88%	6%	6%	88%	6%	6%	88%	6%
2030	7%	86%	7%	7%	86%	7%	7%	86%	7%	7%	86%	7%
2040	8%	84%	8%	8%	84%	8%	8%	84%	8%	8%	84%	8%
P.M.												
2014	3%	93%	3%	3%	93%	3%	3%	93%	3%	3%	93%	3%
2020	6%	87%	6%	6%	87%	6%	6%	87%	6%	6%	87%	6%
2030	7%	86%	7%	7%	86%	7%	7%	86%	7%	7%	86%	7%
2040	8%	83%	8%	8%	83%	8%	8%	83%	8%	8%	83%	8%

K & D FACTORS:

	NORTH LEG		EAST LEG		SOUTH LEG		WEST LEG	
	AM	PM	AM	PM	AM	PM	AM	PM
K FACTOR								
2014	5.6%	7.5%	5.6%	7.5%	5.6%	7.5%	5.6%	7.5%
2020	5.6%	7.5%	5.6%	7.5%	5.6%	7.5%	5.6%	7.5%
2030	5.6%	7.5%	5.6%	7.5%	5.6%	7.5%	5.6%	7.5%
2040	5.6%	7.5%	5.6%	7.5%	5.6%	7.5%	5.6%	7.5%
D FACTOR								
2014	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
2020	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
2030	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
2040	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%

TMTool

- Output Screens
  - Future AADT Estimates

TMTOOL "TURNS" REPORT

DESIGN HOUR TURNS CALCULATIONS

SECTION NO: 88000000
FM NO.: 123456-1
PROJECT LIMITS: from MP 1.200 to MP 3.200
DESIGN YEAR: 2040
INTERSECTION: Green Road and Red Boulevard
PREPARED BY:
FILE: Version 1

DATE: 1/12/2015
NOTES:

ESTIMATED TWO-WAY 24 HOUR AADT FOR EACH LEG OF THE INTERSECTION:

	YEAR	NORTH LEG	EAST LEG	SOUTH LEG	WEST LEG
24 HR EST. AADT	2014	23,000	23,000	23,000	23,000
24 HR EST. AADT	2020	24,400	24,400	24,400	24,400
24 HR EST. AADT	2030	27,000	27,000	27,000	27,000
24 HR EST. AADT	2040	29,800	29,800	29,800	29,800

Percent Turns Calculated From Base Year AADTs:

JKTURNS		FROM NORTH LEG			FROM EAST LEG			FROM SOUTH LEG			FROM WEST LEG		
2014	2-WAY ADT		23,000			23,000			23,000			23,000	
		RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT
		23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000
		33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%
2020	2-WAY ADT		24,400			24,400			24,400			24,400	
		RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT
		24,400	24,400	24,400	24,400	24,400	24,400	24,400	24,400	24,400	24,400	24,400	24,400
		33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%
2030	2-WAY ADT		27,000			27,000			27,000			27,000	
		RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT
		27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000
		33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%
2040	2-WAY ADT		29,800			29,800			29,800			29,800	
		RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT
		29,800	29,800	29,800	29,800	29,800	29,800	29,800	29,800	29,800	29,800	29,800	29,800
		33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%

TMTool

- Output Screens
  - Estimated Turning Movement Volumes

		NORTH LEG			EAST LEG			SOUTH LEG			WEST LEG		
		RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT	RIGHT	THRU	LEFT
A.M. DESIGN HR. TURNS													
2014	EST. TURNS	20	600	20	20	600	20	20	600	20	20	600	20
2020	EST. TURNS	42	597	42	42	597	42	42	597	42	42	597	42
2030	EST. TURNS	52	646	52	52	646	52	52	646	52	52	646	52
2040	EST. TURNS	68	695	68	68	695	68	68	695	68	68	695	68
P.M. DESIGN HR. TURNS													
2014	EST. TURNS	30	800	30	30	800	30	30	800	30	30	800	30
2020	EST. TURNS	59	794	59	59	790	59	59	790	59	59	790	59
2030	EST. TURNS	73	864	73	73	864	73	73	864	73	73	864	73
2040	EST. TURNS	94	927	94	94	927	94	94	927	94	94	927	94

TMTool

- Output Screens
  - Link Volume Check

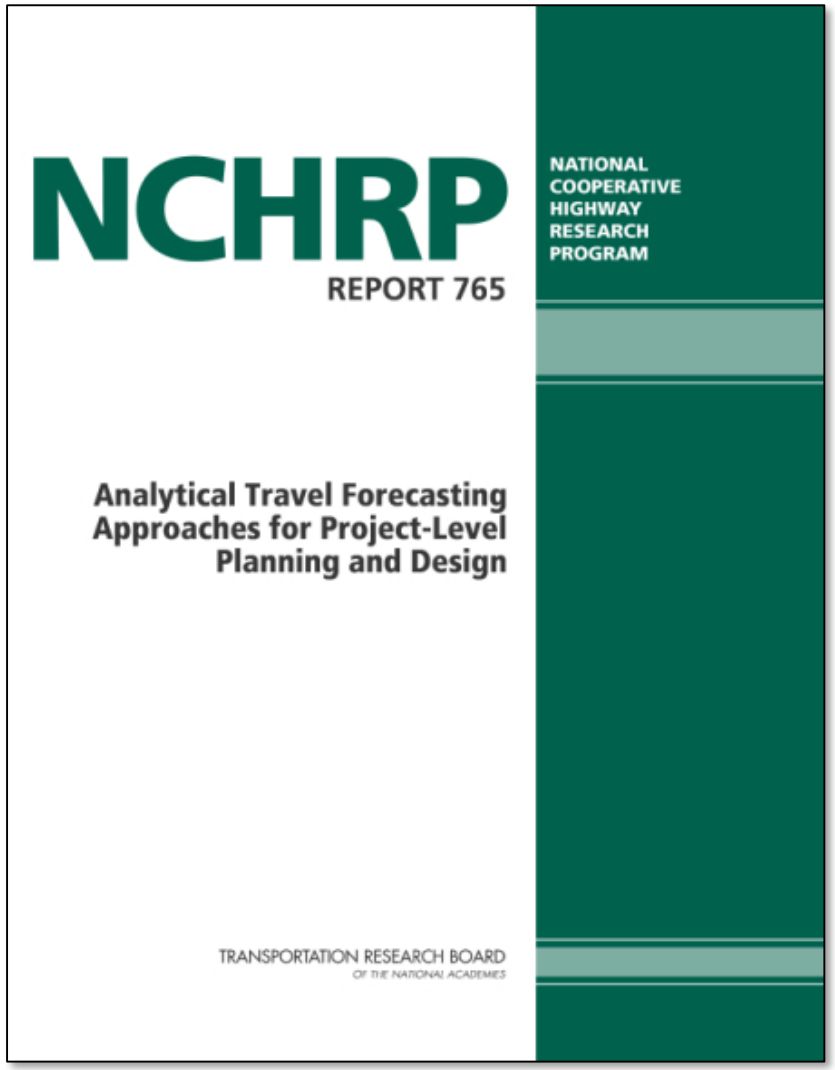
LINK VOLUME CHECK	NORTH LEG			EAST LEG			SOUTH LEG			WEST LEG		
DESIGN HOUR A.M.:	FROM	TO	LINK	FROM	TO	LINK	FROM	TO	LINK	FROM	TO	LINK
CONTROL LINK VOLUMES	640	640	1,280	640	640	1,280	640	640	1,280	640	640	1,280
2014 TURN SUMMARY	640	640	1,280	640	640	1,280	640	640	1,280	640	640	1,280
CONTROL LINK VOLUMES	679	681	1,360	679	681	1,360	679	681	1,360	679	681	1,360
2020 TURN SUMMARY	681	681	1,362	681	681	1,362	681	681	1,362	681	681	1,362
CONTROL LINK VOLUMES	751	749	1,500	751	749	1,500	751	749	1,500	751	749	1,500
2030 TURN SUMMARY	749	749	1,498	749	749	1,498	749	749	1,498	749	749	1,498
CONTROL LINK VOLUMES	829	831	1,660	829	831	1,660	829	831	1,660	829	831	1,660
2040 TURN SUMMARY	831	831	1,662	831	831	1,662	831	831	1,662	831	831	1,662
DESIGN HOUR P.M.:	FROM	TO	LINK	FROM	TO	LINK	FROM	TO	LINK	FROM	TO	LINK
CONTROL LINK VOLUMES	860	860	1,720	860	860	1,720	860	860	1,720	860	860	1,720
2014 TURN SUMMARY	860	860	1,720	860	860	1,720	860	860	1,720	860	860	1,720
CONTROL LINK VOLUMES	912	908	1,820	912	908	1,820	912	908	1,820	912	908	1,820
2020 TURN SUMMARY	911	908	1,819	908	908	1,816	908	911	1,819	908	908	1,816
CONTROL LINK VOLUMES	1,010	1,010	2,020	1,010	1,010	2,020	1,010	1,010	2,020	1,010	1,010	2,020
2030 TURN SUMMARY	1,010	1,010	2,020	1,010	1,010	2,020	1,010	1,010	2,020	1,010	1,010	2,020
CONTROL LINK VOLUMES	1,114	1,116	2,230	1,114	1,116	2,230	1,114	1,116	2,230	1,114	1,116	2,230
2040 TURN SUMMARY	1,116	1,116	2,232	1,116	1,116	2,232	1,116	1,116	2,232	1,116	1,116	2,232

Note: Boxed number indicates manual adjustment.

NCHRP Report 765

- NCHRP Report 765 provides alternative ways to develop turning movement forecasts from traffic volumes from a TDM

- 3 Categories of Procedures to Develop Turning Movements from TDM Output
  - Factoring Procedures
  - Iterative Procedures
    - Directional Volume Method
    - Non-Directional Volume Method
  - “T” Intersection Procedures



NCHRP Report 765

- Users are advised to consult Chapter 6 of the NCHRP Report 765 for detailed discussions on the procedures

Input Elements	Procedure			
	Factoring (Ratio or Difference Method)	Iterative – Directional Volume Method	Iterative – Non-Directional Volume Method	"T" Intersection
Turning Movements Forecasting	• Base Year Count • Base Year Assignment • Future Year Assignment	• Base Year Count or • Estimated Turning Percentages	• Estimated Turning Percentages	• Future Year Directional (one turning movement known or estimated)
Link Volumes Forecasting		• Base Year Directional Volume • Future Year Directional Assignment	• Base Year Bi-Directional Assignment • Future Year Bi-Directional Assignment	• Base or Future Year Bi-Directional • Base or Future Year Directional

Source: NCHRP Report 765, Analytical Travel Forecasting Approaches for Project Level Planning and Design, 2014

Estimating Intersection Turning Movements

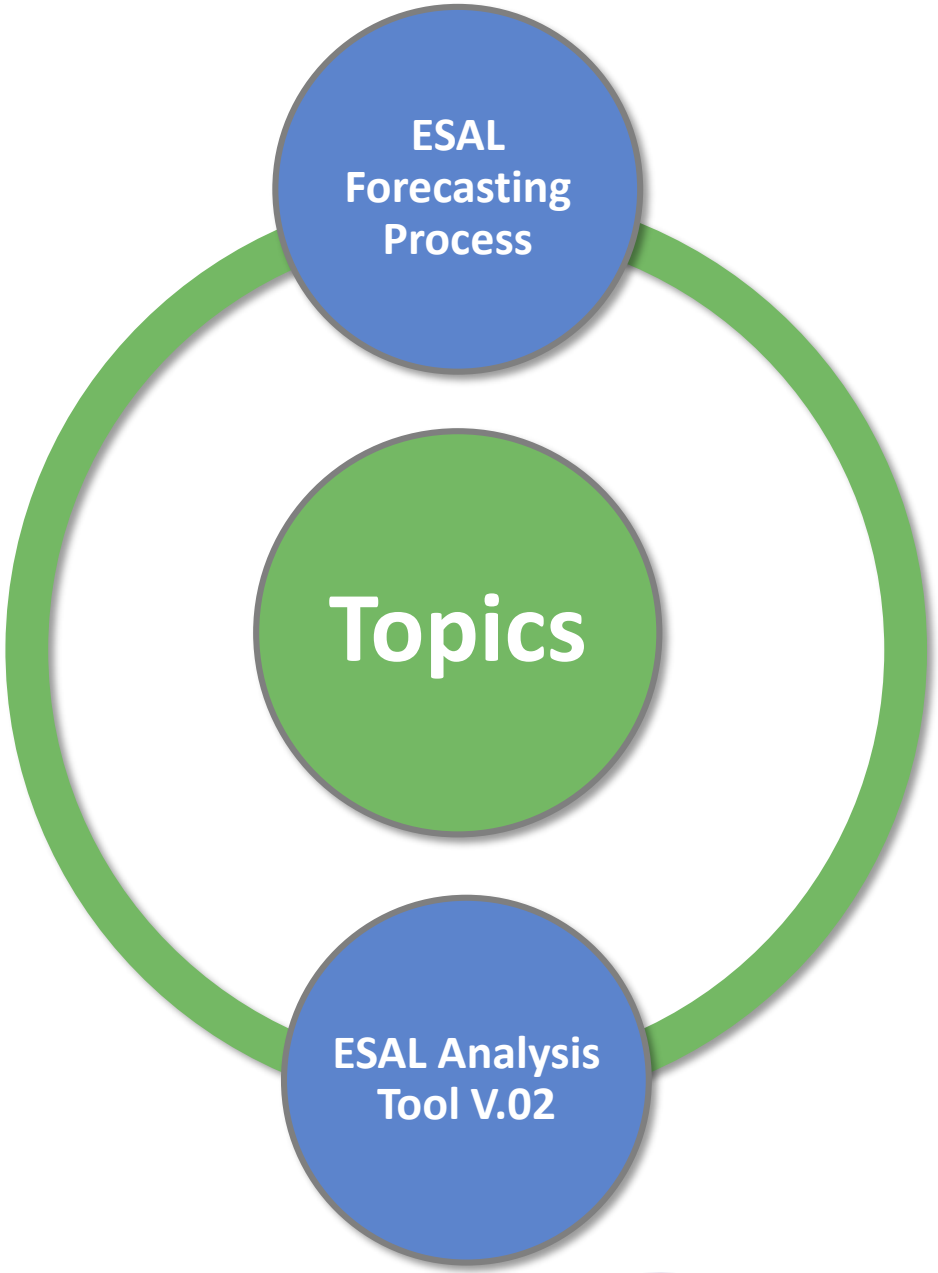
QUIZ

ESAL Forecasting

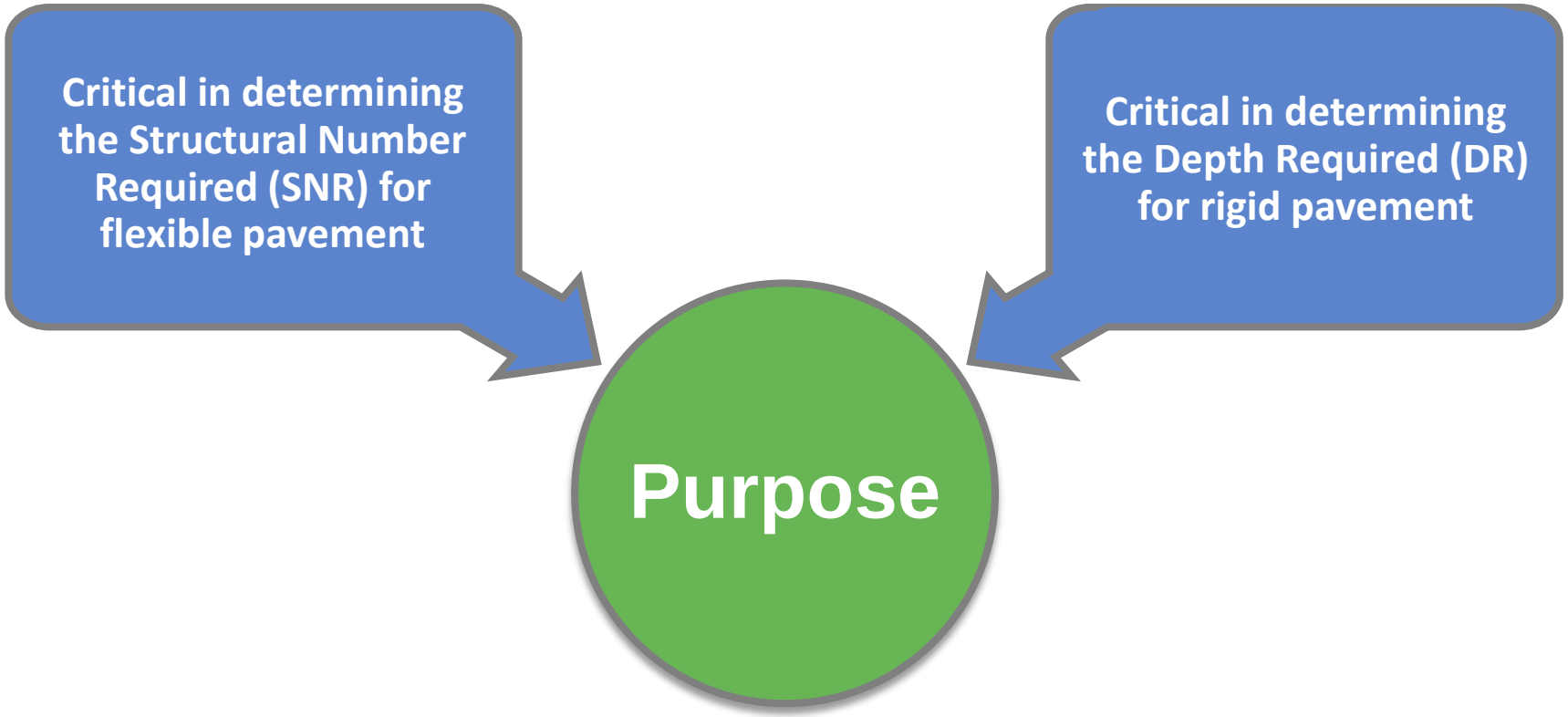
- Introduction
- Purpose
- ESAL Forecasting Process
- ESAL Analysis Tool V.02
- Quiz

Introduction

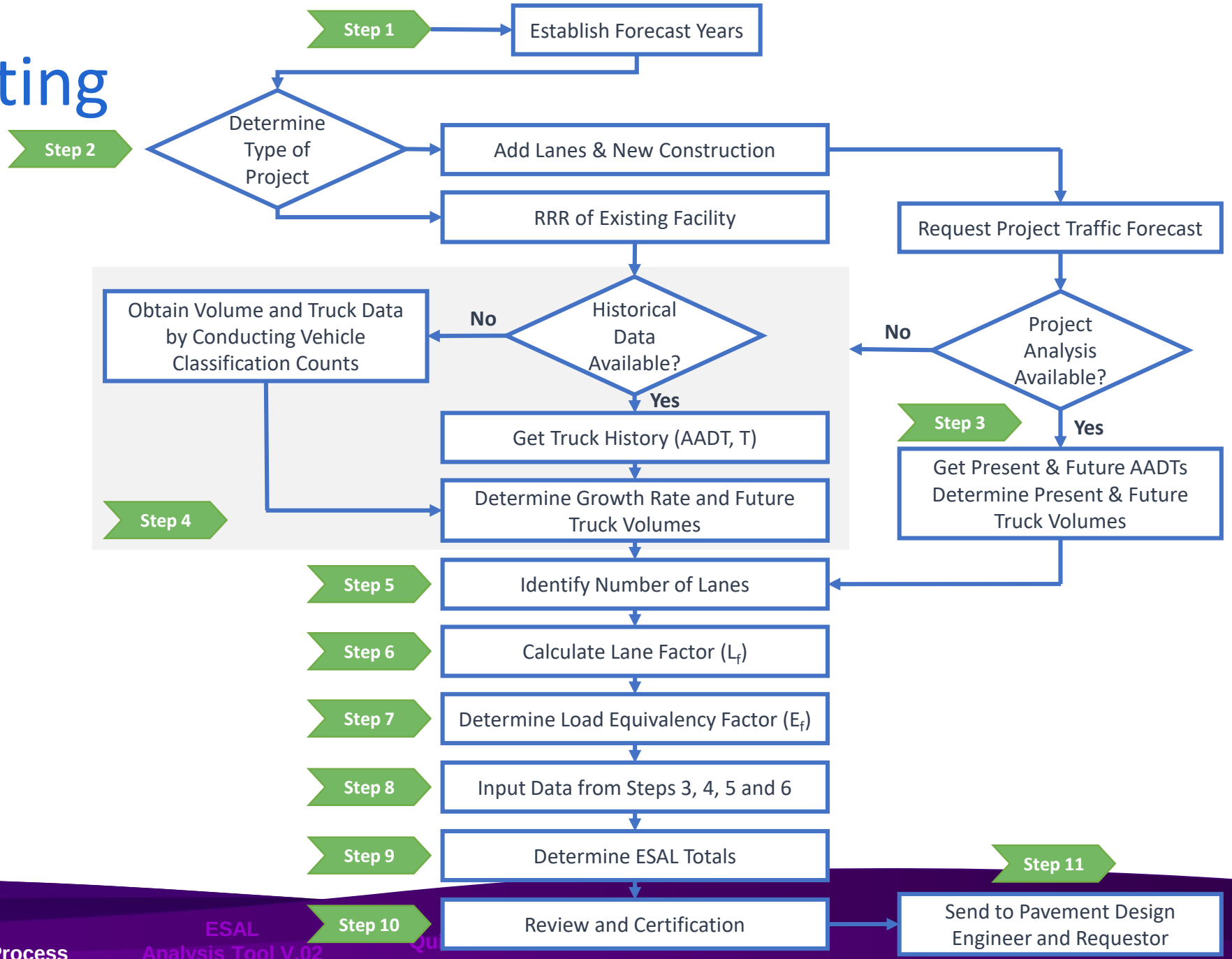
- Equivalent Single Axle Loads (ESALs)
  - The number of axle loadings accumulated for the entire design life
- Necessary for pavement design
  - New Construction
  - Resurfacing, Reconstruction or Rehabilitation (RRR)



Purpose of ESAL Forecasting



ESAL Forecasting Process



ESAL Forecasting Process

- $ESAL_D$ Equation

$$ESAL_D = \sum_{i=1}^{n} AADT_i \times L_F \times T_{24} \times D_F \times E_F \times 365$$

  - $ESAL_D = The\ number\ of\ accumulated\ 18 - KIP\ ESALs$
  - $i = The\ year\ for\ which\ the\ calculation\ is\ made$
  - $n = The\ numbe\ rof\ years\ the\ design\ is\ expected\ to\ last$
  - $AADT_i = AADT\ for\ the\ year\ i$
  - $L_F = Lane\ Factor\ converts\ directional\ trucks\ to\ the\ design\ lane\ trucks$
  - $T_{24} = Percent\ heavy\ trucks\ during\ a\ 24\ hour\ period$
  - $D_F = Directional\ Distribution\ Factor$
  - $E_f = Equivalency\ Factor\ is\ the\ damage\ caused\ by\ one\ average\ heavy\ truck\ measured\ in\ 18 - KIP\ ESALs$

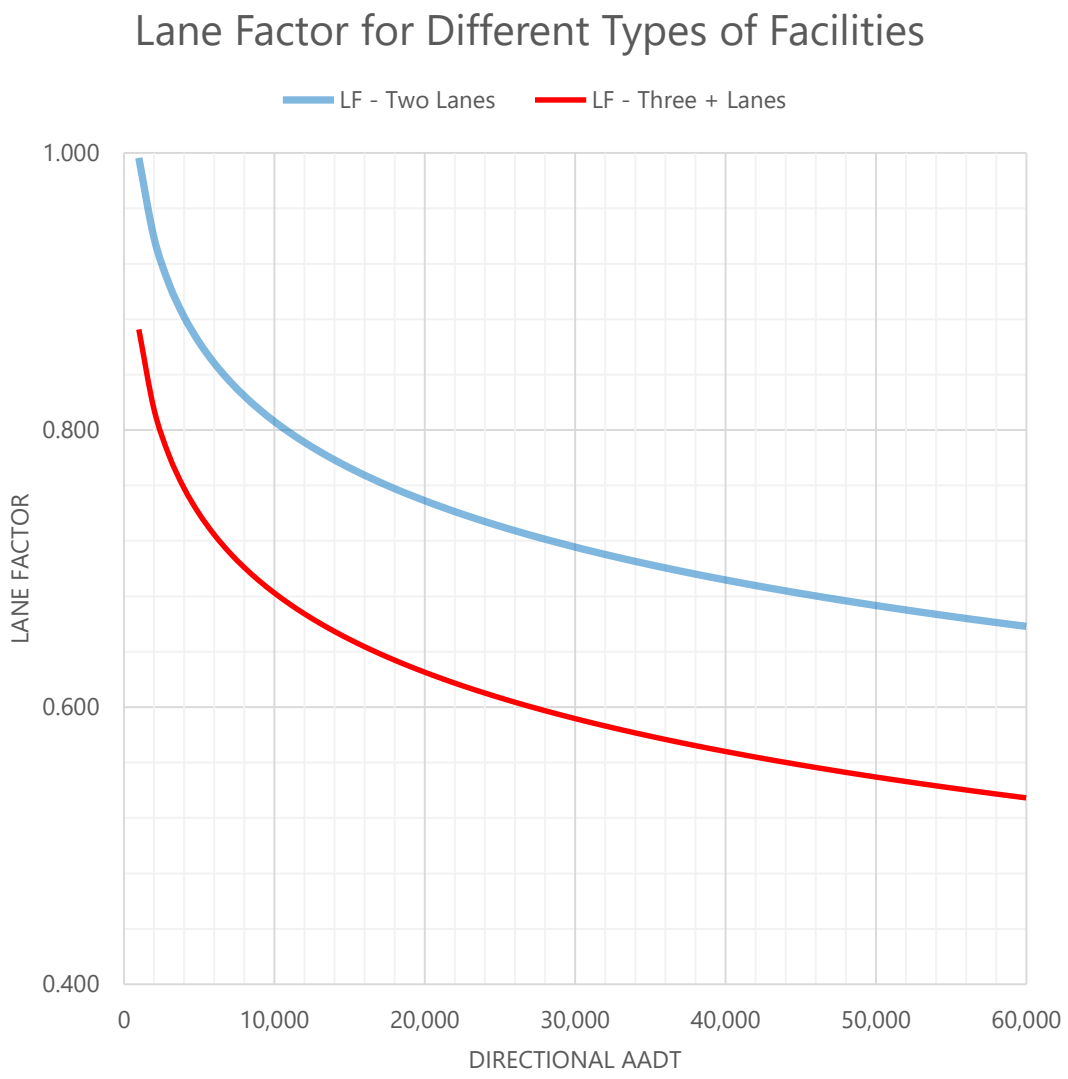
ESAL Forecasting Process

- Lane Factor (L_F) Equation

$$L_F = 1.567 - 0.0826 \times \ln(AADT) - 0.12368 \times LV$$

  - $AADT = One - Way\ AADT$
  - $LV = 0\ if\ two\ lanes\ in\ one\ direction$
    $1\ if\ three\ or\ more\ lanes\ in\ one\ direction$

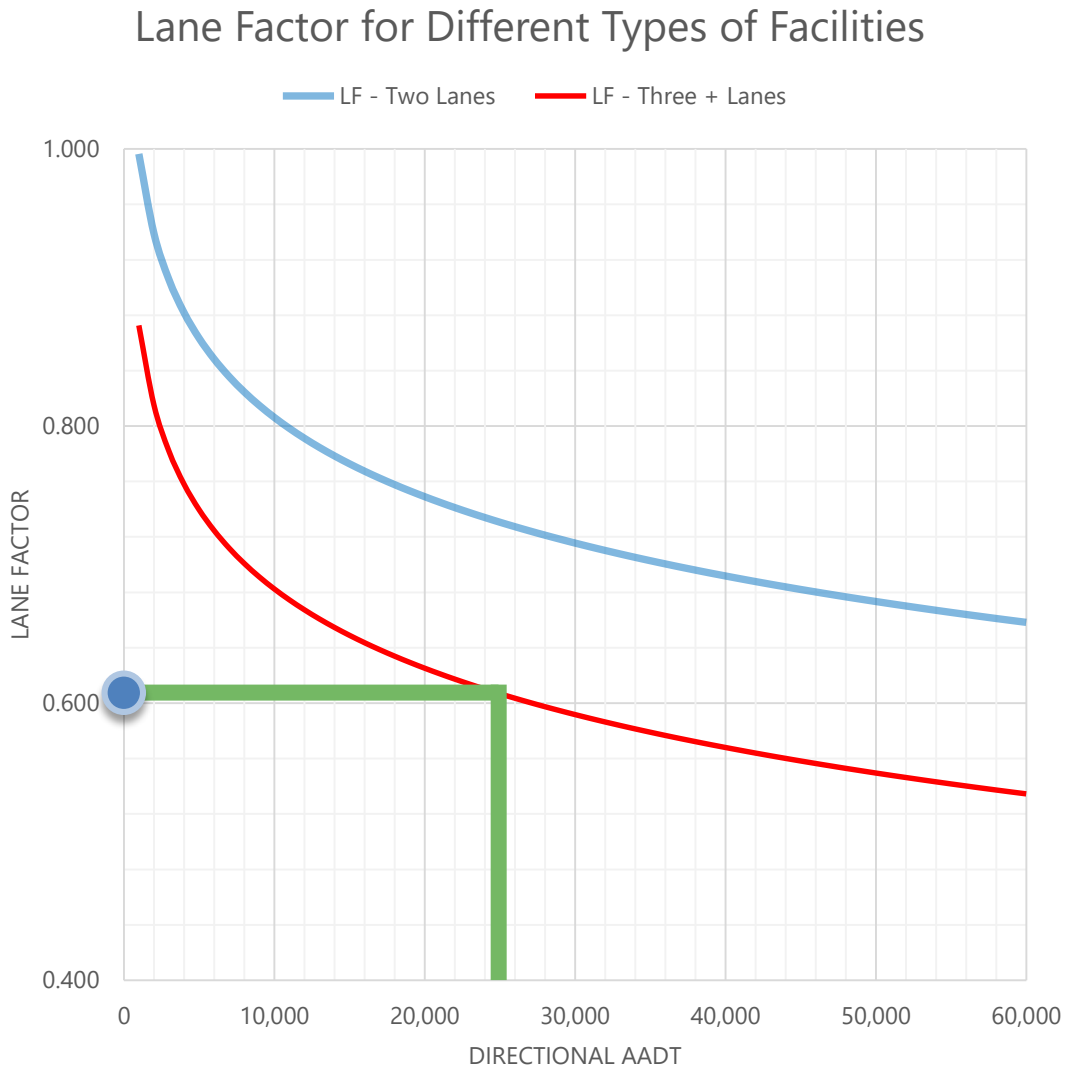
- L_F can be considered as the proportion of directional traffic in the design lane
  - Always less than 1.0
  - Decreases as volume increases



ESAL Forecasting Process

- Lane Factor (L_F) Example
  - Assume
    - One-Way AADT = 25,000
    - One-Way Lanes = 3
    - Determine L_F

  - $L_F = 1.567 - 0.0826 \times \ln(AADT) - 0.12368 \times LV$
  - $AADT = 25{,}000$
  - $LV = 1$
  - $L_F = 1.567 - 0.0826 \times \ln(25{,}000) - 0.12368 \times 1$
  - $L_F = 0.607$



ESAL Forecasting Process

- E_F is determined using
  - FDOT Topic #625-010-006 Rigid Pavement Design Manual
  - FDOT Topic #625-010-002 Flexible Pavement Design Manual

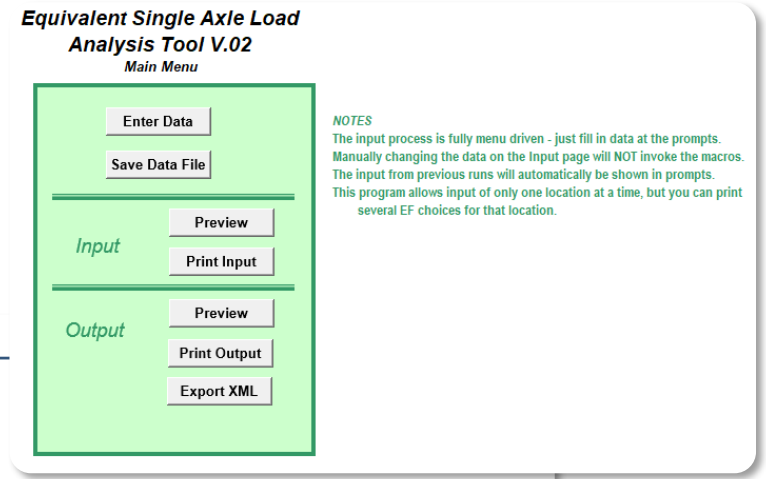
Equivalency Factors for Different Type of Facilities

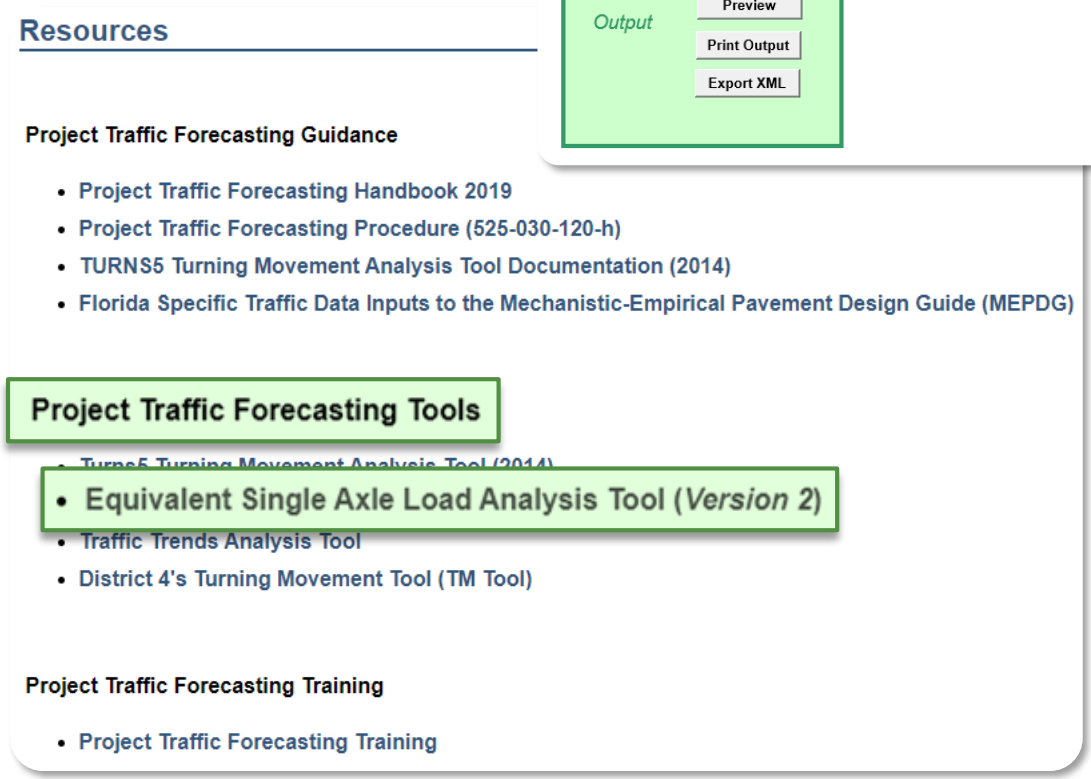
	Flexible Pavement	Rigid Pavement
Freeways		
Rural	1.05	1.60
Urban	0.90	1.27
Arterials and Collectors		
Rural	0.96	1.35
Urban	0.89	1.22

ESAL Forecasting Process

- ESAL Forecasting Process can be performed using
  - Equivalent Single Axle Load (ESAL) Analysis Tool V.02

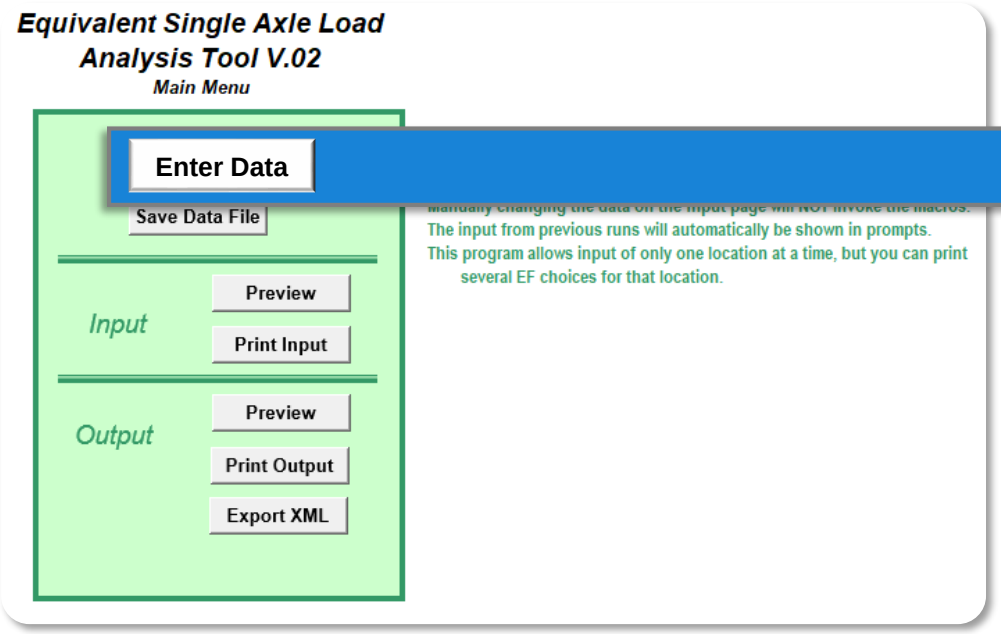
- Automates the ESAL Process
  - L_f calculations built in
  - E_f hard coded

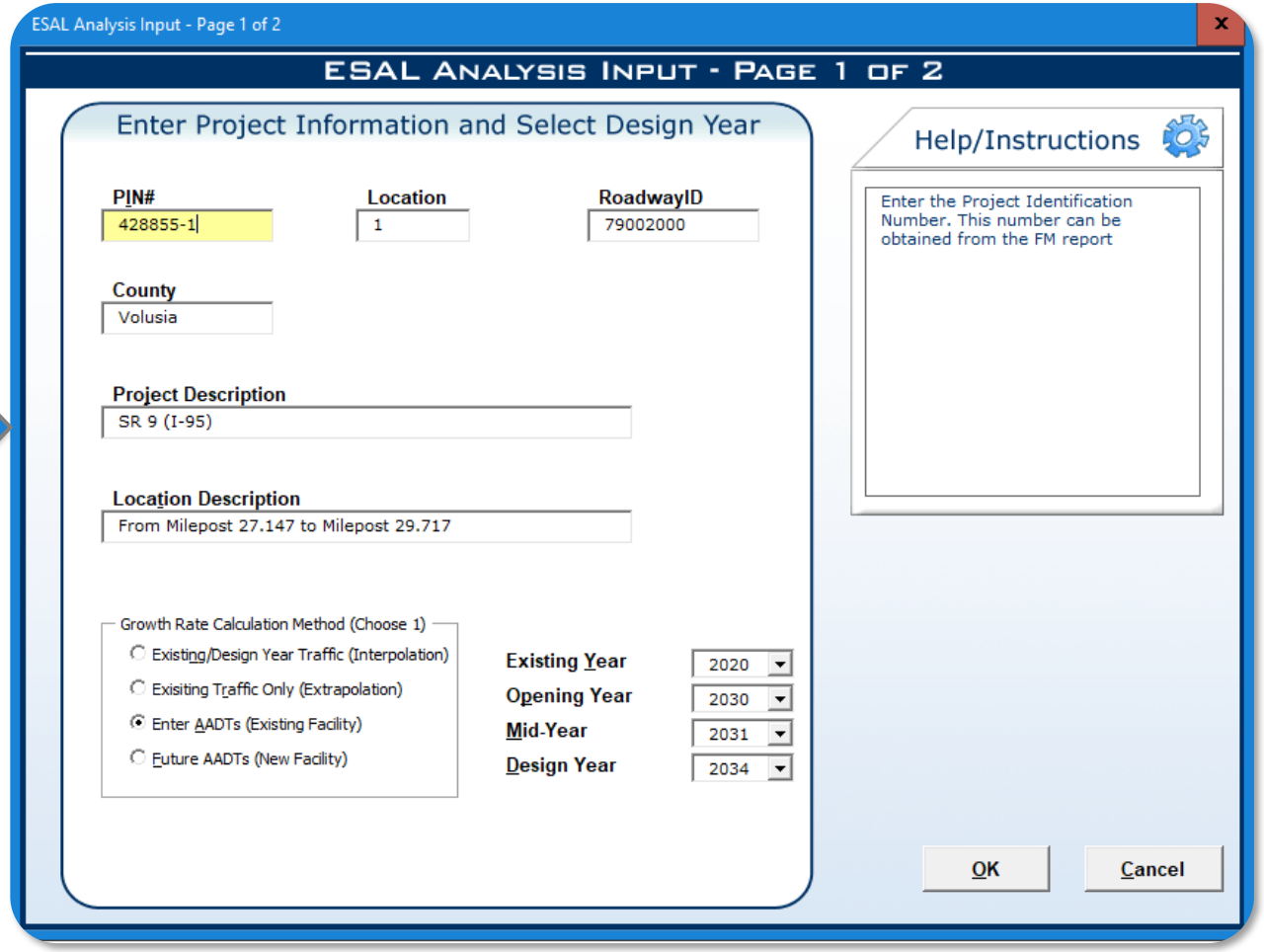




ESAL Analysis Tool V.02

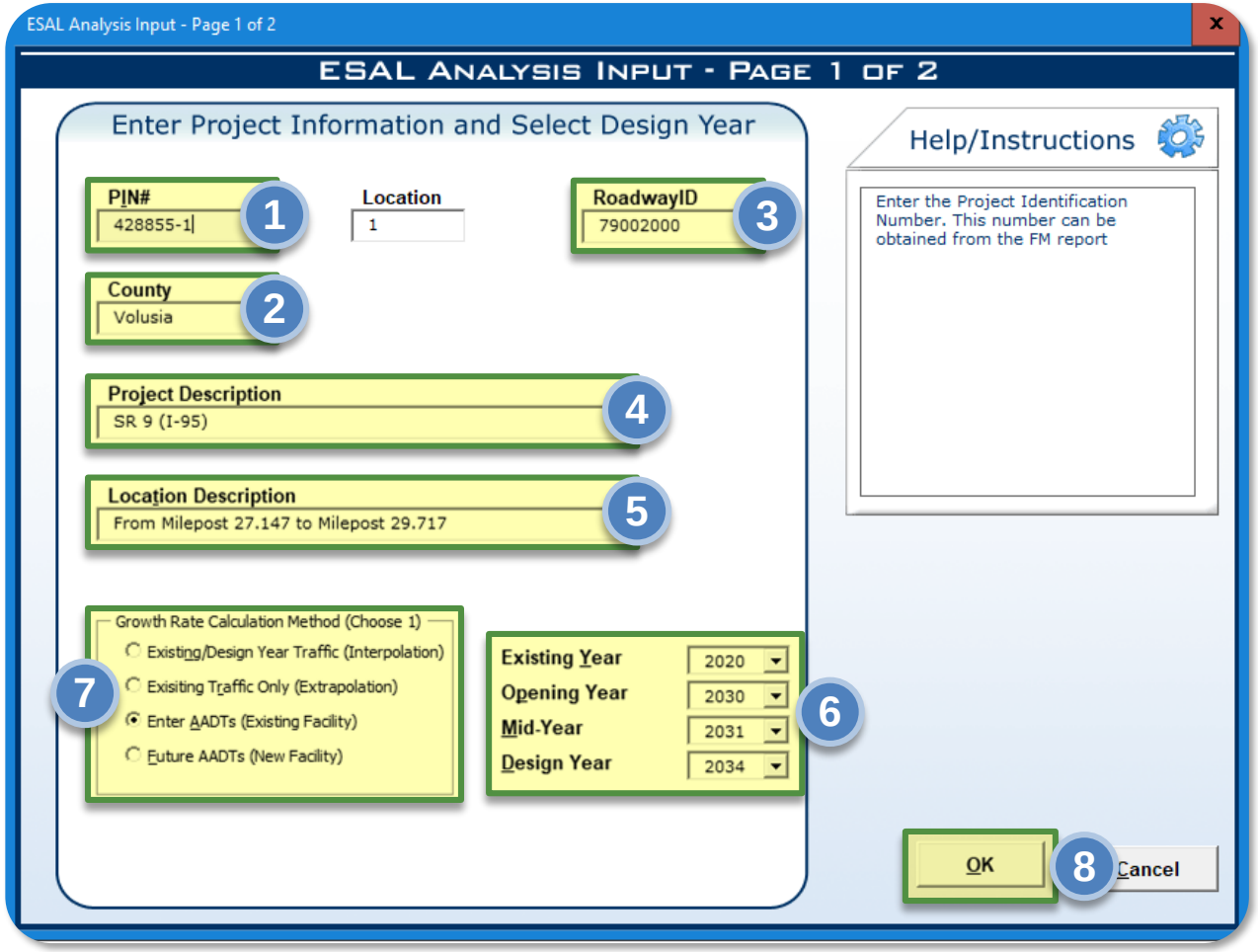
- Open Excel Spreadsheet (ESAL_V02_XML.XLS)





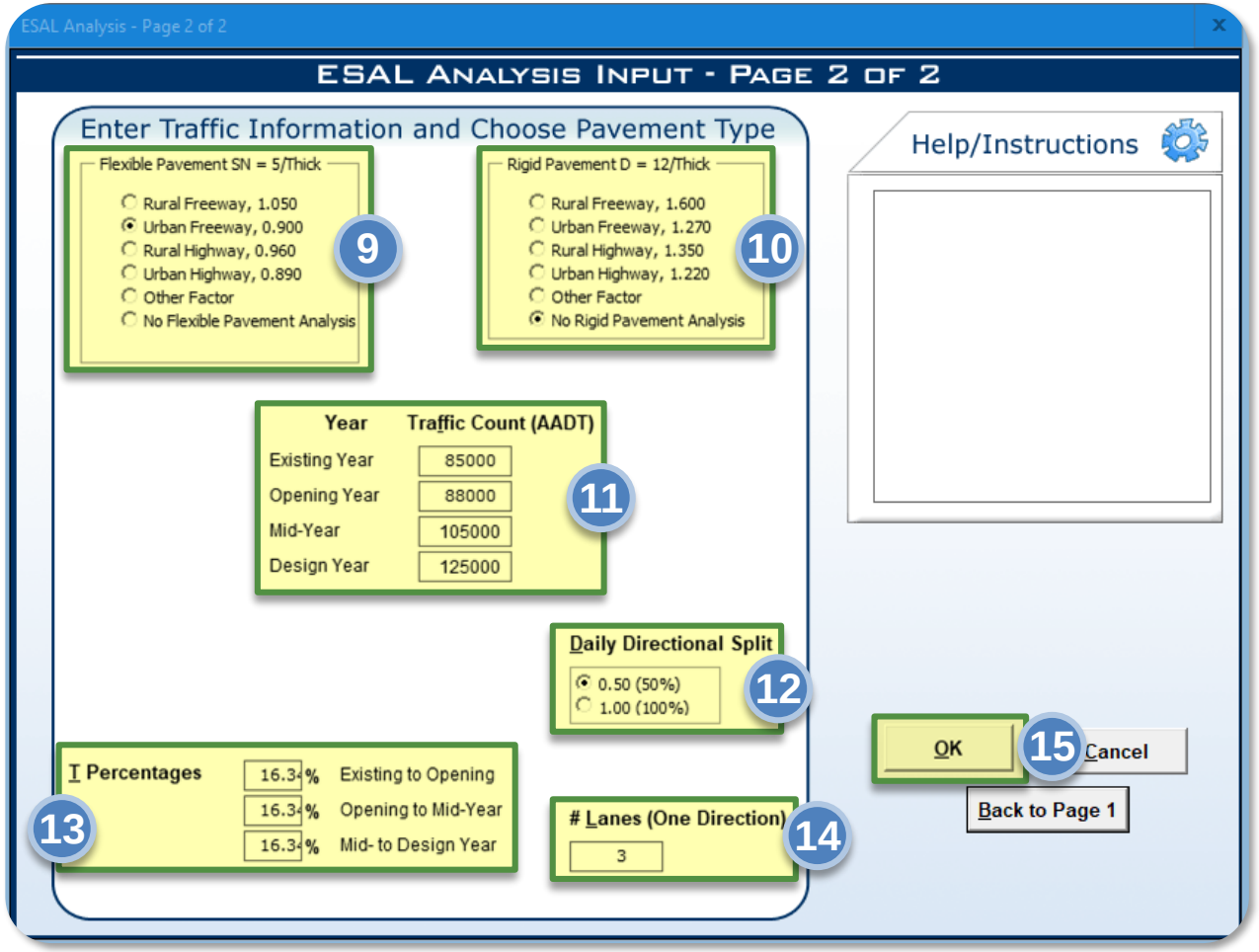
ESAL Analysis Tool V.02

- Fill Out Data Entry Screen
  1. Enter PIN Number
  2. Enter County
  3. Enter Roadway ID
  4. Enter “Project Description”
  5. Enter “Location Description”
  6. Enter “Current and Future Projection Years”
  7. Select “Growth Rate Calculation Method”
  8. Click “OK” button



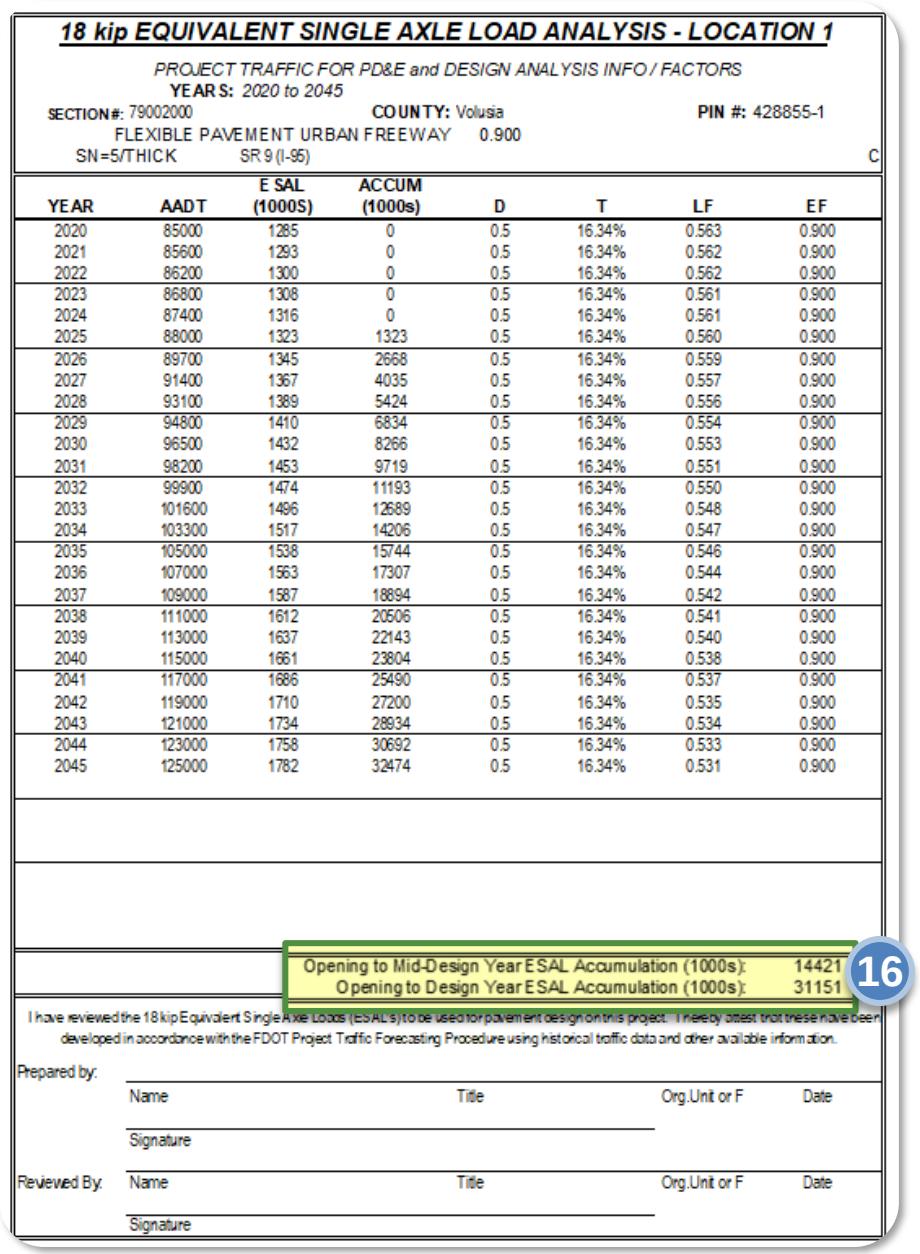
ESAL Analysis Tool V.02

- Fill Out Data Entry Screen
  - 9 Select “Flexible Pavement” type
  - 10 Select “Rigid Pavement” type
  - 11 Enter “Traffic Count” data
  - 12 Select “Daily Directional Split”
  - 13 Enter “Truck Percentages”
  - 14 Enter “Number of Lanes (One Direction)”
  - 15 Click “OK” button



ESAL Analysis Tool V.02

- Produce Output Report
  - 16 Note the ESAL Accumulation for Pavement Design



18 kip EQUIVALENT SINGLE AXLE LOAD ANALYSIS - LOCATION 1

PROJECT TRAFFIC FOR PD&E and DESIGN ANALYSIS INFO / FACTORS

YEARS: *2020 to 2045*

SECTION#: 79002000 **COUNTY:** Volusia **PIN #:** 428855-1

FLEXIBLE PAVEMENT URBAN FREEWAY 0.900

SN=5/THICK SR 9 (I-95) C

YEAR	AADT	E SAL (1000S)	ACCUM (1000s)	D	T	LF	EF
2020	85000	1285	0	0.5	16.34%	0.563	0.900
2021	85600	1293	0	0.5	16.34%	0.562	0.900
2022	86200	1300	0	0.5	16.34%	0.562	0.900
2023	86800	1308	0	0.5	16.34%	0.561	0.900
2024	87400	1316	0	0.5	16.34%	0.561	0.900
2025	88000	1323	1323	0.5	16.34%	0.560	0.900
2026	89700	1345	2668	0.5	16.34%	0.559	0.900
2027	91400	1367	4035	0.5	16.34%	0.557	0.900
2028	93100	1389	5424	0.5	16.34%	0.556	0.900
2029	94800	1410	6834	0.5	16.34%	0.554	0.900
2030	96500	1432	8266	0.5	16.34%	0.553	0.900
2031	98200	1453	9719	0.5	16.34%	0.551	0.900
2032	99900	1474	11193	0.5	16.34%	0.550	0.900
2033	101600	1496	12689	0.5	16.34%	0.548	0.900
2034	103300	1517	14206	0.5	16.34%	0.547	0.900
2035	105000	1538	15744	0.5	16.34%	0.546	0.900
2036	107000	1563	17307	0.5	16.34%	0.544	0.900
2037	109000	1587	18894	0.5	16.34%	0.542	0.900
2038	111000	1612	20506	0.5	16.34%	0.541	0.900
2039	113000	1637	22143	0.5	16.34%	0.540	0.900
2040	115000	1661	23804	0.5	16.34%	0.538	0.900
2041	117000	1686	25490	0.5	16.34%	0.537	0.900
2042	119000	1710	27200	0.5	16.34%	0.535	0.900
2043	121000	1734	28934	0.5	16.34%	0.534	0.900
2044	123000	1758	30692	0.5	16.34%	0.533	0.900
2045	125000	1782	32474	0.5	16.34%	0.531	0.900

Opening to Mid-Design Year ESAL Accumulation (1000s): 14421

Opening to Design Year ESAL Accumulation (1000s): 31151

16

I have reviewed the 18 kip Equivalent Single Axle Loads (ESALs) to be used for pavement design on this project. I hereby attest that these have been developed in accordance with the FDOT Project Traffic Forecasting Procedure using historical traffic data and other available information.

Prepared by: Name Title Org.Unit or F Date

Signature

Reviewed By: Name Title Org.Unit or F Date

Signature

ESAL Forecasting

QUIZ

Tolled Managed Lanes Forecasting

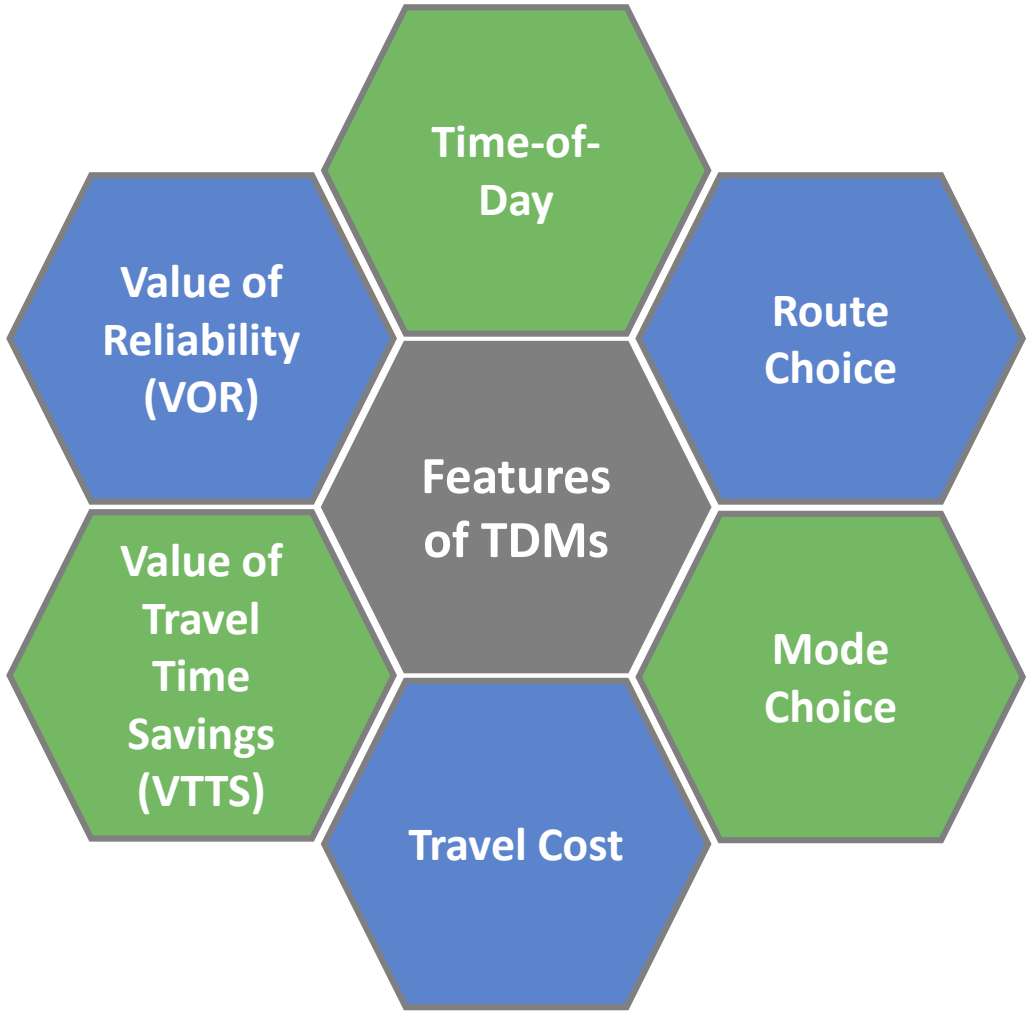
- Introduction
- Travel Demand Forecasting for Express Lanes
- Express Lanes Project Traffic Methods
- ELToD Method
- Express Lanes Project Traffic Forecasting Methodology
- Quiz

Introduction

- Managed Lanes
  - TSM&O solution where highway facilities or sets of lanes within a highway facility use management strategies to provide congestion relief
- Express Lanes
  - Managed Lanes
  - Pricing through Electronic Tolling
- This Training Covers Project Traffic Development for Express Lanes
  - Revenue Traffic Development will Not be Discussed

Travel Demand Forecasting for Express Lanes

- Desirable Features for Travel Demand Models
- Many advanced Florida TDMs already include some of these features
- Managed Lanes limit access points, which affects trip eligibility and potential demand for the facility

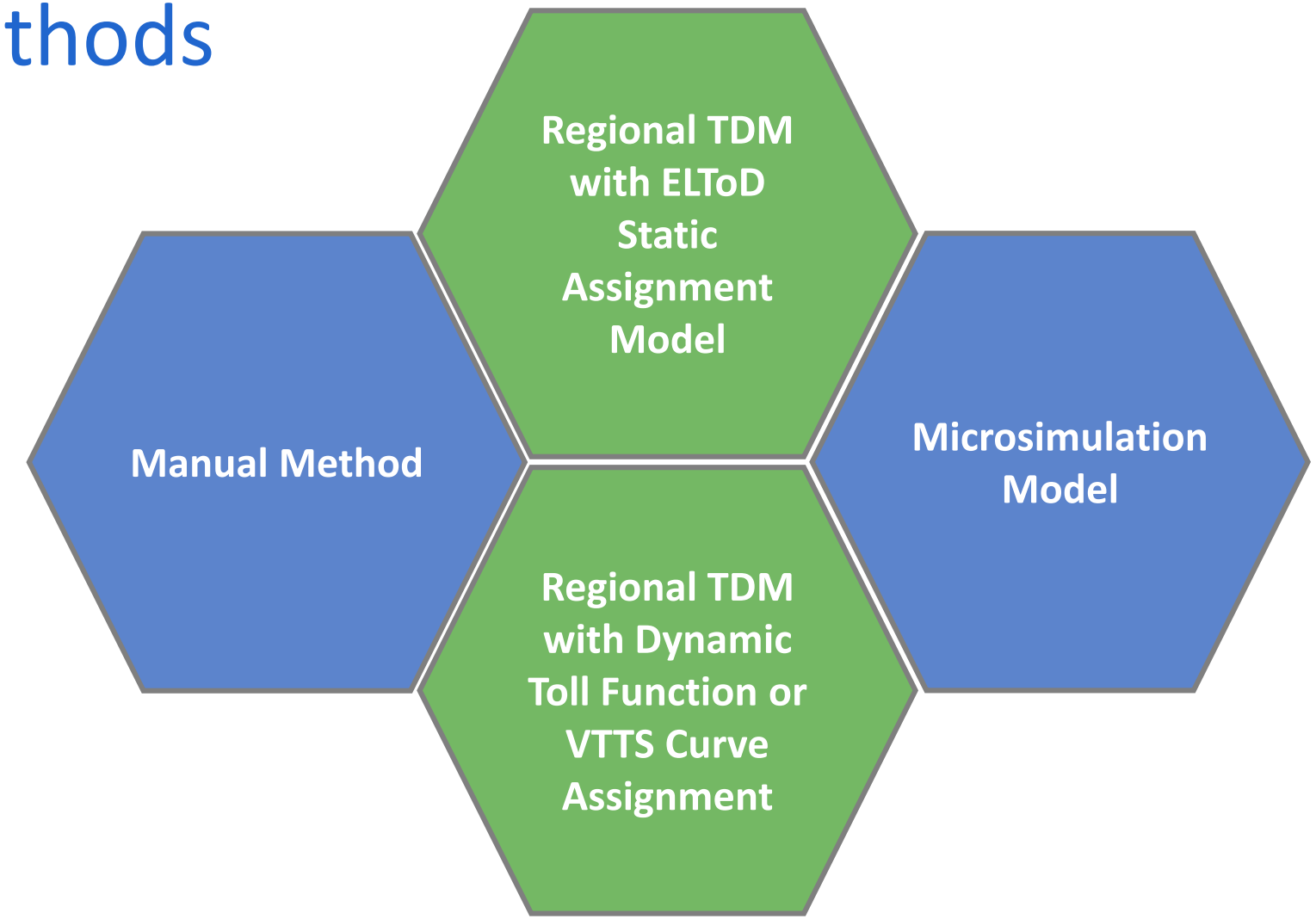


Travel Demand Forecasting for Express Lanes

- **Value of Travel Time Savings (VTTS)**
  - VTTS is critical in determining Express Lane demand
  - Represents the monetary equivalent of travel-time savings by using the Express Lanes facility

Express Lanes Project Traffic Forecasting Methods

- 4 Methods



Express Lanes Project Traffic Forecasting Methods

- Manual Method

Pros

- ✓ Quick estimation
- ✓ Provides expected volume range for EL Ramps

Cons

- ⊘ Supply/demand equilibrium not considered
- ⊘ Aggregate effect of multiple O-Ds not considered

Express Lanes Project Traffic Forecasting Methods

- Regional TDM with Dynamic Toll Function or VTTS Curve Assignment

Pros

- ✓ Estimates Daily or period demand directly from TDM without needing to use another model
- ✓ Provides a systemwide EL evaluation

Cons

- ⊘ Typically uses generalized cost or predefined share
- ⊘ Dynamic toll calculation typically at period level and not at 15-min or hourly levels
- ⊘ Toll amount not reported or used
- ⊘ VOR not considered
- ⊘ Long model run times for alternative testing
- ⊘ Post processing needed

Express Lanes Project Traffic Forecasting Methods

- Microsimulation Model

Pros

- ✓ Pricing model customized to match the Statewide Express Lanes Software tolling algorithm
- ✓ Accounts for complex weaving and geometry
- ✓ Accounts for queue build-up, spillback and dissipation
- ✓ Can be integrated with other multiresolution tools

Cons

- ⊘ Extensive time and effort for model development and validation
- ⊘ Default model does not account for VOR and requires customized scripting
- ⊘ EL choice selection at first entry only

Express Lanes Project Traffic Forecasting Methods

- Regional TDM with ELToD Static Assignment Model

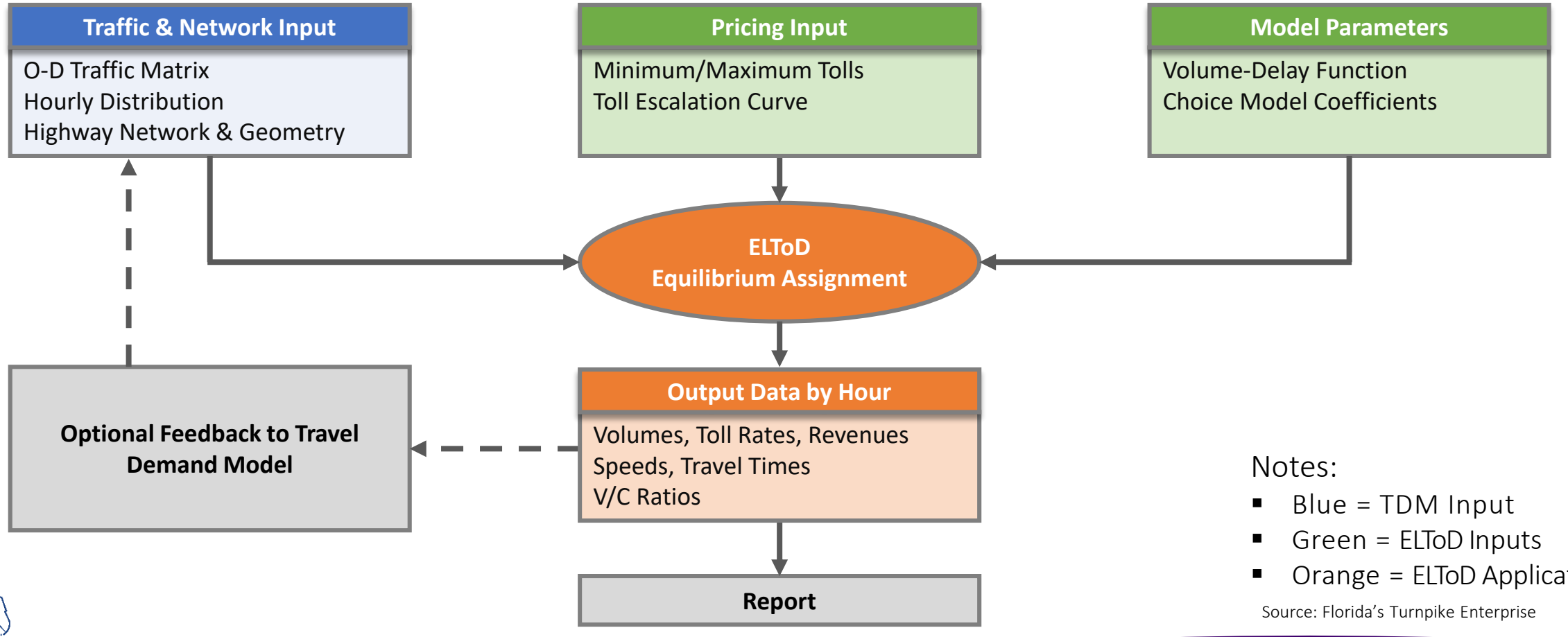
Pros

- ✓ Proven to be efficient
- ✓ Quick turnaround time for alternatives testing
- ✓ Consistent results in controlled environment
- ✓ Incorporates value of reliability
- ✓ Calculates tolls, congested speeds, and volumes by hour

Cons

- ⊘ Does not account for queue spillback
- ⊘ EL choice selection at first entry only

ELToD Method



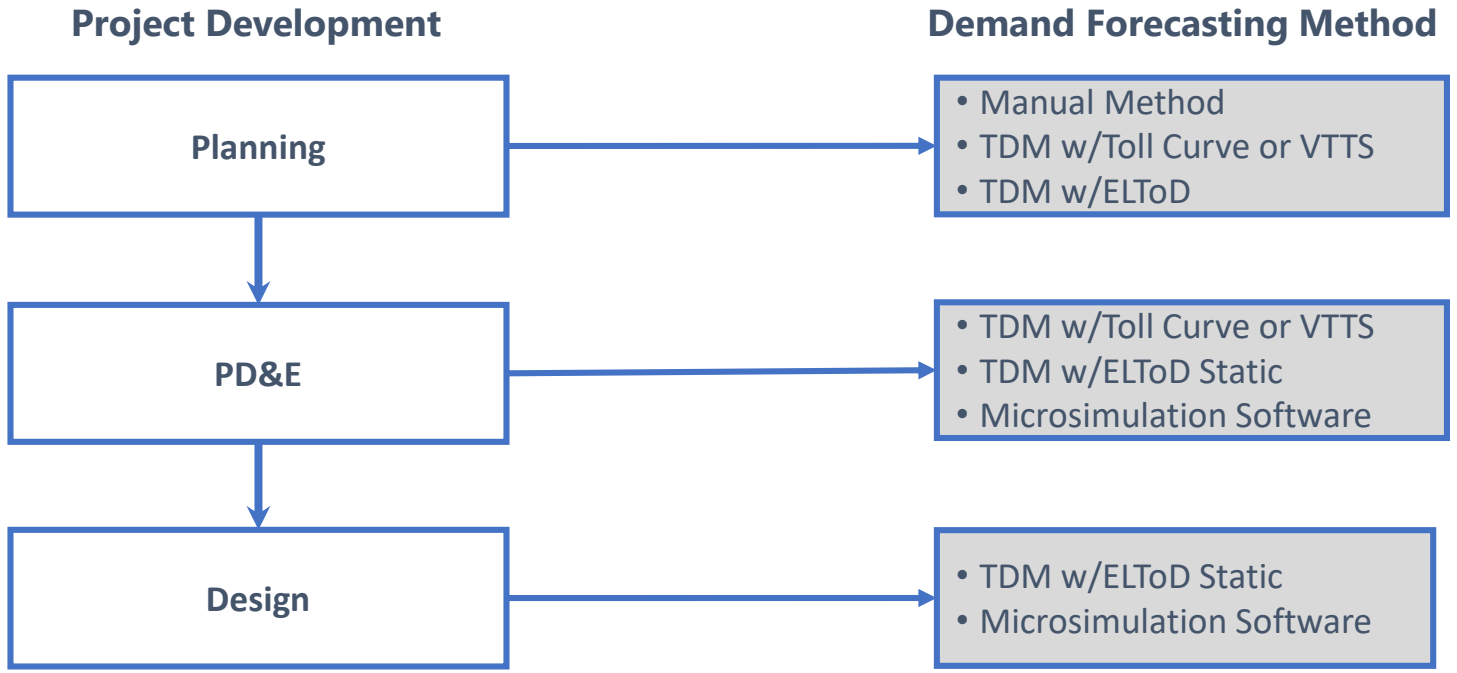
Notes:

- Blue = TDM Input
- Green = ELToD Inputs
- Orange = ELToD Applications

Source: Florida's Turnpike Enterprise

Express Lanes Project Traffic Forecasting Methodology

- General Guidance on Tools and Methodologies Recommended for Each Project Phase



Tolled and Managed Lanes Forecasting

QUIZ

Thank You!

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