APPENDIX A: TRIP GENERATION DETAILS

TECHNICAL MEMORANDUM

Date: **January 11th, 2017**
To: **Paul Menaker, Ph.D.**
From: **Ray Kommidi, PE, TE**
Subject: **Project Trip Generation and Distribution – Norwalk Station**

This Memorandum is a summary of the steps involved to arrive from the daily ridership to the AM and PM peak hour in and out vehicle trips by mode split for the Norwalk Station.

Step 1 - Trip Aggregation By Gates

The auto access/origination and egress/destination passenger trips are provided at the Traffic Analysis Zone (TAZ) level. It is our assumption that the daily passenger trips provided in the Access column (ANA_Access_2029 and ANA_Access_2040) and Egress Column (ANA_Egress_2029 and ANA_Egress_2040) are the originating and destination passenger trips for the Anaheim Station, respectively for years 2029 and 2040.

The daily passenger trips are assigned to the respective gates based on the proximity of each TAZ to the nearest gate. The originating and destination auto daily passenger trips aggregated by gates are summarized in Table 1.

Table 1: Daily Passenger Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	I-5 N	83	21	203	34
2	NOT USED	0	0	0	0
3	Imperial W	0	0	0	0
4	Imperial E	5	0	0	0
5	Telegraph W	6	0	0	0
6	Telegraph E	6	0	0	0
7	Florence W	5	0	0	0
8	Mills Ave	0	0	0	0
9	Leffingwell Rd	2	0	0	0
10	Rosecrans W	12	12	21	8
11	Rosecrans E	5	0	0	0
12	I-605 N	83	21	203	33
13	I-605 S	50	15	86	34
14	Pioneer N	10	0	0	0
15	Pioneer S	0	0	0	0
16	Norwalk N	10	0	0	0
17	Shoemaker N	11	3	0	5
18	Shoemaker S	0	0	0	0
19	Carmenita N	11	3	0	5
20	Carmenita S	0	0	0	0
21	Bloomfield N	10	3	0	4
22	Bloomfield S	0	0	0	0
23	Studebaker S	0	0	0	0
24	I-5 S	146	75	260	103
25	Firestone W	5	0	2	0
26	I-105 W (Top Gate)	900	451	1871	641
27	Valley View	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0
29	Imperial E	0	0	0	0
30	Imperial W	0	0	0	0
Total		1360	604	2646	867

Step 2 - Conversion to Vehicle Trips

The passenger trips were converted to vehicle trips, based on the vehicle occupancy rates in Table 2. We assumed an occupancy rate of 1.40 for year 2029 and 2040 for originating and destination passenger trips. The daily vehicle trips by Originating and Destination are summarized in Table 3.

Table 2: Occupancy Rate Calculation

Norwalk Station

Year 2029 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	1,250	920	1.36
Transit	20	1	20.00
Total	1,270		

Year 2040 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	2,330	1,710	1.36
Transit	60	3	20.00
Total	2,390		

Year 2029 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	740	530	1.40
Transit	50	2	25.00
Total	790		

Year 2040 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	1,180	840	1.40
Transit	120	6	20.00
Total	1,300		

Table 3: Daily Vehicle Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	I-5 N	59	15	145	24
2	NOT USED	0	0	0	0
3	Imperial W	0	0	0	0
4	Imperial E	4	0	0	0
5	Telegraph W	4	0	0	0
6	Telegraph E	4	0	0	0
7	Florence W	4	0	0	0
8	Mills Ave	0	0	0	0
9	Leffingwell Rd	1	0	0	0
10	Rosecrans W	9	9	15	6
11	Rosecrans E	4	0	0	0
12	I-605 N	59	15	145	24
13	I-605 S	36	11	62	24
14	Pioneer N	7	0	0	0
15	Pioneer S	0	0	0	0
16	Norwalk N	7	0	0	0
17	Shoemaker N	8	2	0	4
18	Shoemaker S	0	0	0	0
19	Carmenita N	8	2	0	4
20	Carmenita S	0	0	0	0
21	Bloomfield N	7	2	0	3
22	Bloomfield S	0	0	0	0
23	Studebaker S	0	0	0	0
24	I-5 S	104	54	186	73
25	Firestone W	4	0	1	0
26	I-105 W (Top Gate)	643	322	1336	458
27	Valley View	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0
29	Imperial E	0	0	0	0
30	Imperial W	0	0	0	0
Total		972	432	1890	620

Step 3 - Split Between PNR Vs KNR Modes

The passenger trips by auto mode were split into park-and-ride (PNR) trips and kiss-and-ride (KNR) trips, based on the mode share percentages from the Authority. Table 4 shows the mode share numbers provided by the Authority for year 2029 and 2040. Table 5 and 6 show the mode split percentages used for calculating PNR and KNR passenger trips for year 2029 and 2040, respectively.

Table 4: Mode Share Numbers Provided by Authority

	Norwalk Station			
		Optimistic		
	Originating Passengers	Phase 1	Phase 1	
	Mode	2029	2040	
	Station access/egress trips	1,940	4,120	
Vehicle trips	Drop-Off/Pick-up	330	600	KNR
Vehicle trips	Parking Arrivals/Departures	570	1,070	PNR
Vehicle trips	Rental Car Arrivals/Departures	-	-	KNR
Vehicle trips	Taxi Arrivals/Departures	20	40	KNR
Vehicle trips	Local/Regional Transit Buses	1	3	BUS
	Unconstrained Parking Demand	350	640	
Passenger trips	Arriving/Departing by Drop-Off/Pick-up	470	860	
Passenger trips	Arriving/Departing by Parked Car	750	1,410	
Passenger trips	Arriving/Departing by Rental Car	-	-	
Passenger trips	Arriving/Departing by Taxi	30	60	
Passenger trips	Arriving/Departing by Transit	300	890	
Passenger trips	by dedicated HSR Bus	-	-	
Passenger trips	by Local/Regional Bus	20	60	
Passenger trips	by Local/Regional/Intercity Rail	290	830	
Passenger trips	Arriving/Departing by Bike/Walk	270	580	
		Optimistic		
	Destination Passengers	Phase 1	Phase 1	
	Mode	2029	2040	
	Station access/egress trips	1,860	3,860	
Vehicle trips	Drop-Off/Pick-up	240	370	KNR
Vehicle trips	Parking Arrivals/Departures	-	-	PNR
Vehicle trips	Rental Car Arrivals/Departures	210	330	KNR
Vehicle trips	Taxi Arrivals/Departures	80	140	KNR
Vehicle trips	Local/Regional Transit Buses	2	6	BUS
	Unconstrained Parking Demand	-	-	
Passenger trips	Arriving/Departing by Drop-Off/Pick-up	340	530	
Passenger trips	Arriving/Departing by Parked Car	-	-	
Passenger trips	Arriving/Departing by Rental Car	300	480	
Passenger trips	Arriving/Departing by Taxi	100	170	
Passenger trips	Arriving/Departing by Transit	980	2,420	
Passenger trips	by dedicated HSR Bus	-	-	
Passenger trips	by Local/Regional Bus	50	120	
Passenger trips	by Local/Regional/Intercity Rail	920	2,300	
Passenger trips	Arriving/Departing by Bike/Walk	270	580	

Table 5: Mode Split Percentage – Year 2029

Mode	Originating		Destination	
	Vehicle Trips	Percentage	Vehicle Trips	Percentage
PNR	603	62	0	0
KNR (PUDO, Taxi and Rental)	369	38	432	100

Table 6: Mode Split Percentage – Year 2040

Mode	Originating		Destination	
	Vehicle Trips	Percentage	Vehicle Trips	Percentage
PNR	1,172	62	0	0
KNR (PUDO, Taxi and Rental)	699	37	614	99

The KNR mode includes taxi, rental car and pickup/drop off. These percentages were used to calculate the daily vehicle passenger trips by mode summarized in Table 7. For destination passengers, PNR is not considered as a feasible option. Therefore, PNR trips are zero.

Table 7: Daily Vehicle Trips by Mode

Gate No.	Gate Name	Year 2029				Year 2040			
		Originating		Destination		Originating		Destination	
		PNR	KNR	PNR	KNR	PNR	KNR	PNR	KNR
1	I-5 N	37	23	0	15	90	54	0	24
2	NOT USED	0	0	0	0	0	0	0	0
3	Imperial W	0	0	0	0	0	0	0	0
4	Imperial E	2	1	0	0	0	0	0	0
5	Telegraph W	3	2	0	0	0	0	0	0
6	Telegraph E	3	2	0	0	0	0	0	0
7	Florence W	2	1	0	0	0	0	0	0
8	Mills Ave	0	0	0	0	0	0	0	0
9	Leffingwell Rd	1	1	0	0	0	0	0	0
10	Rosecrans W	5	3	0	9	9	6	0	6
11	Rosecrans E	2	1	0	0	0	0	0	0
12	I-605 N	37	23	0	15	90	54	0	23
13	I-605 S	22	14	0	11	38	23	0	24
14	Pioneer N	4	3	0	0	0	0	0	0
15	Pioneer S	0	0	0	0	0	0	0	0
16	Norwalk N	4	3	0	0	0	0	0	0
17	Shoemaker N	5	3	0	2	0	0	0	4
18	Shoemaker S	0	0	0	0	0	0	0	0
19	Carmenita N	5	3	0	2	0	0	0	4
20	Carmenita S	0	0	0	0	0	0	0	0
21	Bloomfield N	4	3	0	2	0	0	0	3
22	Bloomfield S	0	0	0	0	0	0	0	0
23	Studebaker S	0	0	0	0	0	0	0	0
24	I-5 S	66	39	0	54	115	68	0	73
25	Firestone W	2	1	0	0	1	1	0	0
26	I-105 W (Top Gate)	399	243	0	322	829	493	0	453
27	Valley View	0	0	0	0	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0	0	0	0	0
29	Imperial E	0	0	0	0	0	0	0	0
30	Imperial W	0	0	0	0	0	0	0	0
Total		603	369	0	432	1172	699	0	614

Step 4 - Conversion to Peak Hour Trips

Based on the CAHSR Model data provided through STV, 42% and 41% of the daily trips are incurred during the six hour peak period in Year 2029 and 2040, respectively at the Norwalk Station. It is assumed that the AM peak hour and PM peak hour would have approximately identical share of the peak period trips. Therefore, the peak hour trips are calculated by dividing the daily trips by six (6). In case of Norwalk Station, the peak hour trips will be 7.00% and 6.83% of the total daily trips in Year 2029 and 2040, respectively. The AM and PM peak hour vehicle trips by PNR and KNR are summarized in Table 8.

Table 8: AM/PM Peak Hour Vehicle Trips by Mode

Gate No.	Gate Name	Year 2029				Year 2040			
		Originating		Destination		Originating		Destination	
		PNR	KNR	PNR	KNR	PNR	KNR	PNR	KNR
1	I-5 N	3	2	0	1	6	4	0	2
2	NOT USED	0	0	0	0	0	0	0	0
3	Imperial W	0	0	0	0	0	0	0	0
4	Imperial E	0	0	0	0	0	0	0	0
5	Telegraph W	0	0	0	0	0	0	0	0
6	Telegraph E	0	0	0	0	0	0	0	0
7	Florence W	0	0	0	0	0	0	0	0
8	Mills Ave	0	0	0	0	0	0	0	0
9	Leffingwell Rd	0	0	0	0	0	0	0	0
10	Rosecrans W	0	0	0	1	1	0	0	0
11	Rosecrans E	0	0	0	0	0	0	0	0
12	I-605 N	3	2	0	1	6	4	0	2
13	I-605 S	2	1	0	1	3	2	0	2
14	Pioneer N	0	0	0	0	0	0	0	0
15	Pioneer S	0	0	0	0	0	0	0	0
16	Norwalk N	0	0	0	0	0	0	0	0
17	Shoemaker N	0	0	0	0	0	0	0	0
18	Shoemaker S	0	0	0	0	0	0	0	0
19	Carmenita N	0	0	0	0	0	0	0	0
20	Carmenita S	0	0	0	0	0	0	0	0
21	Bloomfield N	0	0	0	0	0	0	0	0
22	Bloomfield S	0	0	0	0	0	0	0	0
23	Studebaker S	0	0	0	0	0	0	0	0
24	I-5 S	5	3	0	4	8	5	0	5
25	Firestone W	0	0	0	0	0	0	0	0
26	I-105 W (Top Gate)	28	17	0	23	57	34	0	31
27	Valley View	0	0	0	0	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0	0	0	0	0
29	Imperial E	0	0	0	0	0	0	0	0
30	Imperial W	0	0	0	0	0	0	0	0
Total		41	25	0	31	81	49	0	42

Step 5 – In and Out Trips

The passenger trips and vehicle trips have been analyzed and calculated so far only represent the boarding trips, or inbound trips. It is assumed that the alighting trips, or outbound trips, will approximately follow a symmetric pattern. Table 9 and 10 show the inbound and outbound peak hour vehicle trips by PNR mode for the west and east parking lots and Table 11 and 12 show the inbound and outbound peak hour vehicle trips by KNR mode for the west and east parking lots.

Table 9: AM/PM Peak Hour Vehicle Trips by PNR Mode – East Parking Lot (40%)

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	I-5 N	1	1	2	2
2	NOT USED	0	0	0	0
3	Imperial W	0	0	0	0
4	Imperial E	0	0	0	0
5	Telegraph W	0	0	0	0
6	Telegraph E	0	0	0	0
7	Florence W	0	0	0	0
8	Mills Ave	0	0	0	0
9	Leffingwell Rd	0	0	0	0
10	Rosecrans W	0	0	0	0
11	Rosecrans E	0	0	0	0
12	I-605 N	1	1	2	2
13	I-605 S	1	1	1	1
14	Pioneer N	0	0	0	0
15	Pioneer S	0	0	0	0
16	Norwalk N	0	0	0	0
17	Shoemaker N	0	0	0	0
18	Shoemaker S	0	0	0	0
19	Carmenita N	0	0	0	0
20	Carmenita S	0	0	0	0
21	Bloomfield N	0	0	0	0
22	Bloomfield S	0	0	0	0
23	Studebaker S	0	0	0	0
24	I-5 S	2	2	3	3
25	Firestone W	0	0	0	0
26	I-105 W (Top Gate)	13	13	23	23
27	Valley View	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0
29	Imperial E	0	0	0	0
30	Imperial W	0	0	0	0
Total		18	18	31	31

Table 10: AM/PM Peak Hour Vehicle Trips by PNR Mode – West Parking Lot (60%)

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	I-5 N	2	2	4	4
2	NOT USED	0	0	0	0
3	Imperial W	0	0	0	0
4	Imperial E	0	0	0	0
5	Telegraph W	0	0	0	0
6	Telegraph E	0	0	0	0
7	Florence W	0	0	0	0
8	Mills Ave	0	0	0	0
9	Leffingwell Rd	0	0	0	0
10	Rosecrans W	0	0	1	1
11	Rosecrans E	0	0	0	0
12	I-605 N	2	2	4	4
13	I-605 S	1	1	2	2
14	Pioneer N	0	0	0	0
15	Pioneer S	0	0	0	0
16	Norwalk N	0	0	0	0
17	Shoemaker N	0	0	0	0
18	Shoemaker S	0	0	0	0
19	Carmenita N	0	0	0	0
20	Carmenita S	0	0	0	0
21	Bloomfield N	0	0	0	0
22	Bloomfield S	0	0	0	0
23	Studebaker S	0	0	0	0
24	I-5 S	3	3	5	5
25	Firestone W	0	0	0	0
26	I-105 W (Top Gate)	15	15	34	34
27	Valley View	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0
29	Imperial E	0	0	0	0
30	Imperial W	0	0	0	0
Total		23	23	50	50

Table 11: AM/PM Peak Hour Vehicle Trips by KNR Mode – East Parking Lot (40%)

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	I-5 N	1	1	2	2
2	NOT USED	0	0	0	0
3	Imperial W	0	0	0	0
4	Imperial E	0	0	0	0
5	Telegraph W	0	0	0	0
6	Telegraph E	0	0	0	0
7	Florence W	0	0	0	0
8	Mills Ave	0	0	0	0
9	Leffingwell Rd	0	0	0	0
10	Rosecrans W	0	0	0	0
11	Rosecrans E	0	0	0	0
12	I-605 N	1	1	2	2
13	I-605 S	1	1	2	2
14	Pioneer N	0	0	0	0
15	Pioneer S	0	0	0	0
16	Norwalk N	0	0	0	0
17	Shoemaker N	0	0	0	0
18	Shoemaker S	0	0	0	0
19	Carmenita N	0	0	0	0
20	Carmenita S	0	0	0	0
21	Bloomfield N	0	0	0	0
22	Bloomfield S	0	0	0	0
23	Studebaker S	0	0	0	0
24	I-5 S	3	3	4	4
25	Firestone W	0	0	0	0
26	I-105 W (Top Gate)	16	16	26	26
27	Valley View	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0
29	Imperial E	0	0	0	0
30	Imperial W	0	0	0	0
Total		22	22	36	36

Table 12: AM/PM Peak Hour Vehicle Trips by KNR Mode – West Parking Lot (60%)

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	I-5 N	2	2	4	4
2	NOT USED	0	0	0	0
3	Imperial W	0	0	0	0
4	Imperial E	0	0	0	0
5	Telegraph W	0	0	0	0
6	Telegraph E	0	0	0	0
7	Florence W	0	0	0	0
8	Mills Ave	0	0	0	0
9	Leffingwell Rd	0	0	0	0
10	Rosecrans W	1	1	0	0
11	Rosecrans E	0	0	0	0
12	I-605 N	2	2	4	4
13	I-605 S	1	1	2	2
14	Pioneer N	0	0	0	0
15	Pioneer S	0	0	0	0
16	Norwalk N	0	0	0	0
17	Shoemaker N	0	0	0	0
18	Shoemaker S	0	0	0	0
19	Carmenita N	0	0	0	0
20	Carmenita S	0	0	0	0
21	Bloomfield N	0	0	0	0
22	Bloomfield S	0	0	0	0
23	Studebaker S	0	0	0	0
24	I-5 S	4	4	6	6
25	Firestone W	0	0	0	0
26	I-105 W (Top Gate)	24	24	39	39
27	Valley View	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0
29	Imperial E	0	0	0	0
30	Imperial W	0	0	0	0
Total		34	34	55	55

Trip Distribution

Both PNR and KNR trips were distributed to the east and west side parking lots of the station.

Trip Assignment

The trip generation and distribution were coded into a Traffix network and the trips were assigned to the study intersections. The volumes at each study intersection were add to the volumes of interim year and build out year pre-project conditions and result in post-project volumes.

If you have any questions, please free to contact me directly.

Respectfully,



Ray Kommidi, PE, TE
Senior Project Manager

TECHNICAL MEMORANDUM

Date: **January 11th, 2017**
To: **Paul Menaker, Ph.D.**
From: **Ray Kommidi, PE, TE**
Subject: **Project Bus Trip Generation and Distribution – Norwalk Station**

This Memorandum is a summary of the steps involved to arrive from the daily bus ridership to the AM and PM peak hour in and out bus vehicle trips for the Norwalk Station.

Step 1 - Trip Aggregation By Gates

The bus access/origination and egress/destination passenger trips are provided at the Traffic Analysis Zone (TAZ) level. The daily passenger trips are assigned to the respective gates based on the proximity of each TAZ to the nearest gate. The originating and destination bus daily passenger trips aggregated by gates are summarized in Table 1.

Table 1: Daily Passenger Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	I-5 N	1	4	8	11
2	NOT USED	0	0	0	0
3	Imperial W	0	0	0	1
4	Imperial E	0	2	3	7
5	Telegraph W	0	0	0	1
6	Telegraph E	1	1	1	3
7	Florence W	0	0	0	1
8	Mills Ave	0	0	0	0
9	Leffingwell Rd	0	1	4	3
10	Rosecrans W	0	0	0	0
11	Rosecrans E	0	1	1	2
12	I-605 N	0	4	10	13
13	I-605 S	1	7	7	15
14	Pioneer N	0	0	0	0
15	Pioneer S	0	3	3	9
16	Norwalk N	0	0	0	1
17	Shoemaker N	0	2	0	5
18	Shoemaker S	0	1	1	3
19	Carmenita N	0	1	0	4
20	Carmenita S	0	1	2	3
21	Bloomfield N	0	3	0	6
22	Bloomfield S	0	0	0	2
23	Studebaker S	0	1	3	3
24	I-5 S	1	5	3	12
25	Firestone W	0	3	3	3
26	I-105 W (Top Gate)	0	0	4	3
27	Valley View	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0
29	Imperial E	0	0	0	0
30	Imperial W	0	0	0	0
Total		4	40	53	111

Step 2 - Conversion to Bus Trips

The passenger trips were converted to bus trips, based on the vehicle occupancy rates in Table 2. The daily bus trips by Originating and Destination are summarized in Table 3.

Table 2: Occupancy Rate Calculation

Norwalk Station

Year 2029 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	1,250	920	1.36
Transit	20	1	20.00
Total	1,270		

Year 2040 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	2,330	1,710	1.36
Transit	60	3	20.00
Total	2,390		

Year 2029 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	740	530	1.40
Transit	50	2	25.00
Total	790		

Year 2040 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	1,180	840	1.40
Transit	120	6	20.00
Total	1,300		

Table 3: Daily Bus Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	I-5 N	0	0	0	1
2	NOT USED	0	0	0	0
3	Imperial W	0	0	0	0
4	Imperial E	0	0	0	0
5	Telegraph W	0	0	0	0
6	Telegraph E	0	0	0	0
7	Florence W	0	0	0	0
8	Mills Ave	0	0	0	0
9	Leffingwell Rd	0	0	0	0
10	Rosecrans W	0	0	0	0
11	Rosecrans E	0	0	0	0
12	I-605 N	0	0	1	1
13	I-605 S	0	0	0	1
14	Pioneer N	0	0	0	0
15	Pioneer S	0	0	0	0
16	Norwalk N	0	0	0	0
17	Shoemaker N	0	0	0	0
18	Shoemaker S	0	0	0	0
19	Carmenita N	0	0	0	0
20	Carmenita S	0	0	0	0
21	Bloomfield N	0	0	0	0
22	Bloomfield S	0	0	0	0
23	Studebaker S	0	0	0	0
24	I-5 S	0	0	0	1
25	Firestone W	0	0	0	0
26	I-105 W (Top Gate)	0	0	0	0
27	Valley View	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0
29	Imperial E	0	0	0	0
30	Imperial W	0	0	0	0
Total		0	0	1	4

Step 3 - Conversion to Peak Hour Trips

Based on the CAHSR Model data provided through STV, 42% and 41% of the daily trips are incurred during the six hour peak period in Year 2029 and 2040, respectively at the Norwalk Station. It is assumed that the AM peak hour and PM peak hour would have approximately identical share of the peak period trips. Therefore, the peak hour trips are calculated by dividing the daily trips by six (6). In case of Norwalk Station, the peak hour trips will be 7.00% and 6.83% of the total daily trips in Year 2029 and 2040, respectively. The AM and PM peak hour bus trips are summarized in Table 4.

Table 4: AM/PM Peak Hour Bus Trips

Gate	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	I-5 N	0	0	0	0
2	NOT USED	0	0	0	0
3	Imperial W	0	0	0	0
4	Imperial E	0	0	0	0
5	Telegraph W	0	0	0	0
6	Telegraph E	0	0	0	0
7	Florence W	0	0	0	0
8	Mills Ave	0	0	0	0
9	Leffingwell Rd	0	0	0	0
10	Rosecrans W	0	0	0	0
11	Rosecrans E	0	0	0	0
12	I-605 N	0	0	0	0
13	I-605 S	0	0	0	0
14	Pioneer N	0	0	0	0
15	Pioneer S	0	0	0	0
16	Norwalk N	0	0	0	0
17	Shoemaker N	0	0	0	0
18	Shoemaker S	0	0	0	0
19	Carmenita N	0	0	0	0
20	Carmenita S	0	0	0	0
21	Bloomfield N	0	0	0	0
22	Bloomfield S	0	0	0	0
23	Studebaker S	0	0	0	0
24	I-5 S	0	0	0	0
25	Firestone W	0	0	0	0
26	I-105 W (Top Gate)	0	0	0	0
27	Valley View	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0
29	Imperial E	0	0	0	0
30	Imperial W	0	0	0	0
Total		0	0	0	0

Step 4 – In and Out Trips

The passenger trips and vehicle trips have been analyzed and calculated so far only represent the boarding trips, or inbound trips. It is assumed that the alighting trips, or outbound trips, will approximately follow a symmetric pattern. Table 5 shows the inbound and outbound peak hour bus trips.

Table 5: AM/PM Peak Hour Bus Trips

Gate	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	I-5 N	0.02	0.02	0.10	0.10
2	NOT USED	0.00	0.00	0.00	0.00
3	Imperial W	0.00	0.00	0.01	0.01
4	Imperial E	0.01	0.01	0.05	0.05
5	Telegraph W	0.00	0.00	0.01	0.01
6	Telegraph E	0.01	0.01	0.02	0.02
7	Florence W	0.00	0.00	0.01	0.01
8	Mills Ave	0.00	0.00	0.00	0.00
9	Leffingwell Rd	0.00	0.00	0.04	0.04
10	Rosecrans W	0.00	0.00	0.00	0.00
11	Rosecrans E	0.00	0.00	0.02	0.02
12	I-605 N	0.02	0.02	0.12	0.12
13	I-605 S	0.04	0.04	0.12	0.12
14	Pioneer N	0.00	0.00	0.00	0.00
15	Pioneer S	0.01	0.01	0.06	0.06
16	Norwalk N	0.00	0.00	0.01	0.01
17	Shoemaker N	0.01	0.01	0.03	0.03
18	Shoemaker S	0.00	0.00	0.02	0.02
19	Carmenita N	0.00	0.00	0.02	0.02
20	Carmenita S	0.00	0.00	0.03	0.03
21	Bloomfield N	0.01	0.01	0.03	0.03
22	Bloomfield S	0.00	0.00	0.01	0.01
23	Studebaker S	0.00	0.00	0.03	0.03
24	I-5 S	0.03	0.03	0.08	0.08
25	Firestone W	0.01	0.01	0.03	0.03
26	I-105 W (Top Gate)	0.00	0.00	0.04	0.04
27	Valley View	0.00	0.00	0.00	0.00
28	I-105 W (Bottom Gate)	0.00	0.00	0.00	0.00
29	Imperial E	0.00	0.00	0.00	0.00
30	Imperial W	0.00	0.00	0.00	0.00
Total		0.17	0.17	0.89	0.89

Step 5 – In and Out Trips Adjustment

The AM/PM vehicle bus trips calculated for each gate in Table 5 are very low and in order to get a correct estimate of the bus trips, we reviewed the existing bus routes and manually assigned the trips to the gates. Table 6 and 7 show the inbound and outbound peak hour bus trips for AM and PM peak hours, respectively.

Table 6: AM Peak Hour Bus Trips

Gate	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	I-5 N	0	0	0	0
2	NOT USED	0	0	0	0
3	Imperial W	0	0	0	0
4	Imperial E	0	0	0	0
5	Telegraph W	0	0	0	0
6	Telegraph E	0	0	0	0
7	Florence W	0	0	0	0
8	Mills Ave	0	0	0	0
9	Leffingwell Rd	0	0	0	0
10	Rosecrans W	0	0	0	0
11	Rosecrans E	0	0	0	0
12	I-605 N	0	0	0	1
13	I-605 S	0	0	1	0
14	Pioneer N	0	0	0	0
15	Pioneer S	0	0	0	0
16	Norwalk N	0	0	0	0
17	Shoemaker N	0	0	0	0
18	Shoemaker S	0	0	0	0
19	Carmenita N	0	0	0	0
20	Carmenita S	0	0	0	0
21	Bloomfield N	0	0	0	0
22	Bloomfield S	0	0	0	0
23	Studebaker S	0	0	0	0
24	I-5 S	0	0	0	0
25	Firestone W	0	0	0	0
26	I-105 W (Top Gate)	0	0	0	0
27	Valley View	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0
29	Imperial E	0	0	0	0
30	Imperial W	0	0	0	0
Total		0	0	1	1

Table 7: PM Peak Hour Bus Trips

Gate	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	I-5 N	0	0	0	0
2	NOT USED	0	0	0	0
3	Imperial W	0	0	0	0
4	Imperial E	0	0	0	0
5	Telegraph W	0	0	0	0
6	Telegraph E	0	0	0	0
7	Florence W	0	0	0	0
8	Mills Ave	0	0	0	0
9	Leffingwell Rd	0	0	0	0
10	Rosecrans W	0	0	0	0
11	Rosecrans E	0	0	0	0
12	I-605 N	0	0	0	1
13	I-605 S	0	0	1	0
14	Pioneer N	0	0	0	0
15	Pioneer S	0	0	0	0
16	Norwalk N	0	0	0	0
17	Shoemaker N	0	0	0	0
18	Shoemaker S	0	0	0	0
19	Carmenita N	0	0	0	0
20	Carmenita S	0	0	0	0
21	Bloomfield N	0	0	0	0
22	Bloomfield S	0	0	0	0
23	Studebaker S	0	0	0	0
24	I-5 S	0	0	0	0
25	Firestone W	0	0	0	0
26	I-105 W (Top Gate)	0	0	0	0
27	Valley View	0	0	0	0
28	I-105 W (Bottom Gate)	0	0	0	0
29	Imperial E	0	0	0	0
30	Imperial W	0	0	0	0
Total		0	0	1	1

Trip Distribution

The bus trips were distributed to the existing transit center off Imperial Highway and Shoemaker Avenue.

Trip Assignment

The trip generation and distribution were coded into a Traffix network and the trips were assigned to the study intersections. The volumes at each study intersection were add to the volumes of interim year and build out year pre-project conditions and result in post-project volumes.

If you have any questions, please free to contact me directly.

Respectfully,



Ray Kommidi, PE, TE
Senior Project Manager

TECHNICAL MEMORANDUM

Date: **January 11th, 2017**
To: **Paul Menaker, Ph.D.**
From: **Ray Kommidi, PE, TE**
Subject: **Project Trip Generation and Distribution – Fullerton Station**

This Memorandum is a summary of the steps involved to arrive from the daily ridership to the AM and PM peak hour in and out vehicle trips by mode split for the Fullerton Station.

Step 1 - Trip Aggregation By Gates

The auto access/origination and egress/destination passenger trips are provided at the Traffic Analysis Zone (TAZ) level. It is our assumption that the daily passenger trips provided in the Access column (FUL_Access_2029 and FUL_Access_2040) and Egress Column (FUL_Egress_2029 and FUL_Egress_2040) are the originating and destination passenger trips for the Fullerton Station, respectively for years 2029 and 2040.

The daily passenger trips are assigned to the respective gates based on the proximity of each TAZ to the nearest gate. The originating and destination auto daily passenger trips aggregated by gates are summarized in Table 1.

Table 1: Daily Passenger Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	Chapman W	5	0	7	0
2	Chapman E	13	0	30	0
3	Commonwealth W	4	0	7	0
4	NOT USED	0	0	0	0
5	Orangethorpe W	5	0	7	0
6	Orangethorpe E	13	0	30	0
7	SR-91 W	375	83	743	134
8	SR-91 E	1301	873	2451	1410
9	SR-57 N	898	374	1683	597
10	SR-57 S	363	368	586	563
11	State College N	0	0	35	0
12	State College S	0	0	0	0
13	Harbor N	0	0	34	0
14	Harbor S	0	0	0	0
15	Euclid N	10	0	34	0
16	Euclid S	0	0	0	0
17	Raymond Ave	0	0	0	0
18	East S	0	0	0	0
19	Brea N	0	0	36	0
20	Bastanchury W	10	0	7	0
21	Bastanchury E	13	0	30	0
22	Imperial W	11	0	43	0
23	Imperial E	15	0	30	0
24	Valencia W	4	0	7	0
25	Internal Gate	0	0	0	0
26	Yorba Linda E	15	0	30	0
27	Nutwood E	13	0	28	0
28	Anaheim S	0	0	0	0
29	La Palma W	0	0	0	0
30	La Palma E	0	0	0	0
Total		3068	1698	5858	2704

Step 2 - Conversion to Vehicle Trips

The passenger trips were converted to vehicle trips based on the vehicle occupancy rates in Table 2. We assumed an occupancy rate of 1.4 for year for year 2029 and 2040 for originating and destination passenger trips. The daily vehicle trips by Originating and Destination are summarized in Table 3.

Table 2: Occupancy Rate Calculation

Fullerton Station

Year 2029 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	2,940	2,160	1.36
Transit	30	1	30.00
Total	2,970		

Year 2040 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	5,150	3,730	1.38
Transit	90	5	18.00
Total	5,240		

Year 2029 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	1,720	1,230	1.40
Transit	90	5	18.00
Total	1,810		

Year 2040 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	3,370	2,400	1.40
Transit	210	10	21.00
Total	3,580		

Table 3: Daily Vehicle Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	Chapman W	4	0	5	0
2	Chapman E	9	0	22	0
3	Commonwealth W	3	0	5	0
4	NOT USED	0	0	0	0
5	Orangethorpe W	4	0	5	0
6	Orangethorpe E	9	0	22	0
7	SR-91 W	268	59	531	96
8	SR-91 E	930	624	1751	1007
9	SR-57 N	641	267	1202	427
10	SR-57 S	260	263	418	402
11	State College N	0	0	25	0
12	State College S	0	0	0	0
13	Harbor N	0	0	24	0
14	Harbor S	0	0	0	0
15	Euclid N	7	0	24	0
16	Euclid S	0	0	0	0
17	Raymond Ave	0	0	0	0
18	East S	0	0	0	0
19	Brea N	0	0	26	0
20	Bastanchury W	7	0	5	0
21	Bastanchury E	9	0	22	0
22	Imperial W	8	0	31	0
23	Imperial E	11	0	22	0
24	Valencia W	3	0	5	0
25	Internal Gate	0	0	0	0
26	Yorba Linda E	11	0	22	0
27	Nutwood E	9	0	20	0
28	Anaheim S	0	0	0	0
29	La Palma W	0	0	0	0
30	La Palma E	0	0	0	0
Total		2193	1213	4187	1932

Step 3 - Split Between PNR Vs KNR Modes

The passenger trips by auto mode were split into park-and-ride (PNR) trips and kiss-and-ride (KNR) trips, based on the mode share percentages from the Authority. Table 4 shows the mode share numbers provided by the Authority for year 2029 and 2040. Table 5 and 6 show the mode split percentages used for calculating PNR and KNR passenger trips for year 2029 and 2040, respectively.

Table 4: Mode Share Numbers Provided by Authority

	Fullerton Station			
		Optimistic		
	Originating Passengers	Phase 1	Phase 1	
	Mode	2029	2040	
	Station access/egress trips	3,990	8,340	
Vehicle trips	Drop-Off/Pick-up	780	2,060	KNR
Vehicle trips	Parking Arrivals/Departures	1,330	1,560	PNR
Vehicle trips	Rental Car Arrivals/Departures	-	-	KNR
Vehicle trips	Taxi Arrivals/Departures	50	110	KNR
Vehicle trips	Local/Regional Transit Buses	1	5	BUS
	Unconstrained Parking Demand	800	1,560	
Passenger trips	Arriving/Departing by Drop-Off/Pick-up	1,120	2,950	
Passenger trips	Arriving/Departing by Parked Car	1,750	2,050	
Passenger trips	Arriving/Departing by Rental Car	-	-	
Passenger trips	Arriving/Departing by Taxi	70	150	
Passenger trips	Arriving/Departing by Transit	520	1,500	
Passenger trips	by dedicated HSR Bus	-	-	
Passenger trips	by Local/Regional Bus	30	90	
Passenger trips	by Local/Regional/Intercity Rail	490	1,410	
Passenger trips	Arriving/Departing by Bike/Walk	470	1,040	
		Optimistic		
	Destination Passengers	Phase 1	Phase 1	
	Mode	2029	2040	
	Station access/egress trips	3,800	7,830	
Vehicle trips	Drop-Off/Pick-up	560	1,260	KNR
Vehicle trips	Parking Arrivals/Departures	-	-	PNR
Vehicle trips	Rental Car Arrivals/Departures	490	800	KNR
Vehicle trips	Taxi Arrivals/Departures	180	340	KNR
Vehicle trips	Local/Regional Transit Buses	5	10	BUS
	Unconstrained Parking Demand	-	-	
Passenger trips	Arriving/Departing by Drop-Off/Pick-up	790	1,790	
Passenger trips	Arriving/Departing by Parked Car	-	-	
Passenger trips	Arriving/Departing by Rental Car	710	1,150	
Passenger trips	Arriving/Departing by Taxi	220	430	
Passenger trips	Arriving/Departing by Transit	1,660	4,080	
Passenger trips	by dedicated HSR Bus	-	-	
Passenger trips	by Local/Regional Bus	90	210	
Passenger trips	by Local/Regional/Intercity Rail	1,570	3,870	
Passenger trips	Arriving/Departing by Bike/Walk	480	1,040	

Table 5: Mode Split Percentage – Year 2029

Mode	Originating		Destination	
	Vehicle Trips	Percentage	Vehicle Trips	Percentage
PNR	1,360	62	0	0
KNR (PUDO, Taxi and Rental)	833	38	1,213	100

Table 6: Mode Split Percentage – Year 2040

Mode	Originating		Destination	
	Vehicle Trips	Percentage	Vehicle Trips	Percentage
PNR	1,759	42	0	0
KNR (PUDO, Taxi and Rental)	2,428	58	1,932	100

The KNR mode includes taxi, rental car and pickup/drop off. These percentages were used to calculate the daily vehicle passenger trips by mode summarized in Table 7. For destination passengers, PNR is not considered as a feasible option. Therefore, PNR trips are zero.

Table 7: Daily Vehicle Trips by Mode

Gate No.	Gate Name	Year 2029				Year 2040			
		Originating		Destination		Originating		Destination	
		PNR	KNR	PNR	KNR	PNR	KNR	PNR	KNR
1	Chapman W	2	2	0	0	2	3	0	0
2	Chapman E	6	3	0	0	9	13	0	0
3	Commonwealth W	2	1	0	0	2	3	0	0
4	NOT USED	0	0	0	0	0	0	0	0
5	Orangethorpe W	2	1	0	0	2	3	0	0
6	Orangethorpe E	6	3	0	0	9	13	0	0
7	SR-91 W	166	102	0	59	223	308	0	96
8	SR-91 E	576	353	0	624	736	1015	0	1007
9	SR-57 N	398	244	0	267	505	697	0	427
10	SR-57 S	161	99	0	263	176	243	0	402
11	State College N	0	0	0	0	11	15	0	0
12	State College S	0	0	0	0	0	0	0	0
13	Harbor N	0	0	0	0	10	14	0	0
14	Harbor S	0	0	0	0	0	0	0	0
15	Euclid N	4	3	0	0	10	14	0	0
16	Euclid S	0	0	0	0	0	0	0	0
17	Raymond Ave	0	0	0	0	0	0	0	0
18	East S	0	0	0	0	0	0	0	0
19	Brea N	0	0	0	0	11	15	0	0
20	Bastanchury W	4	3	0	0	2	3	0	0
21	Bastanchury E	6	3	0	0	9	12	0	0
22	Imperial W	5	3	0	0	13	18	0	0
23	Imperial E	7	4	0	0	9	12	0	0
24	Valencia W	2	1	0	0	2	3	0	0
25	Internal Gate	0	0	0	0	0	0	0	0
26	Yorba Linda E	7	4	0	0	9	12	0	0
27	Nutwood E	6	4	0	0	9	12	0	0
28	Anaheim S	0	0	0	0	0	0	0	0
29	La Palma W	0	0	0	0	0	0	0	0
30	La Palma E	0	0	0	0	0	0	0	0
Total		1360	833	0	1213	1759	2428	0	1932

Step 4 - Conversion to Peak Hour Trips

Based on the CAHSR Model data provided through STV, 31% and 37% of the daily trips are incurred during the six hour peak period in Year 2029 and 2040, respectively at the Fullerton Station. It is assumed that the AM peak hour and PM peak hour would have approximately identical share of the peak period trips. Therefore, the peak hour trips are calculated by dividing the daily trips by six (6). In case of Fullerton Station, the peak hour trips will be 5.17% and 6.17% of the total daily trips in Year 2029 and 2040, respectively. The AM and PM peak hour vehicle trips by PNR and KNR are summarized in Table 8.

Table 8: AM/PM Peak Hour Vehicle Trips by Mode

Gate No.	Gate Name	Year 2029				Year 2040			
		Originating		Destination		Originating		Destination	
		PNR	KNR	PNR	KNR	PNR	KNR	PNR	KNR
1	Chapman W	0	0	0	0	0	0	0	0
2	Chapman E	0	0	0	0	1	1	0	0
3	Commonwealth W	0	0	0	0	0	0	0	0
4	NOT USED	0	0	0	0	0	0	0	0
5	Orangethorpe W	0	0	0	0	0	0	0	0
6	Orangethorpe E	0	0	0	0	1	1	0	0
7	SR-91 W	9	5	0	3	14	19	0	6
8	SR-91 E	30	18	0	32	45	63	0	62
9	SR-57 N	21	13	0	14	31	43	0	26
10	SR-57 S	8	5	0	14	11	15	0	25
11	State College N	0	0	0	0	1	1	0	0
12	State College S	0	0	0	0	0	0	0	0
13	Harbor N	0	0	0	0	1	1	0	0
14	Harbor S	0	0	0	0	0	0	0	0
15	Euclid N	0	0	0	0	1	1	0	0
16	Euclid S	0	0	0	0	0	0	0	0
17	Raymond Ave	0	0	0	0	0	0	0	0
18	East S	0	0	0	0	0	0	0	0
19	Brea N	0	0	0	0	1	1	0	0
20	Bastanchury W	0	0	0	0	0	0	0	0
21	Bastanchury E	0	0	0	0	1	1	0	0
22	Imperial W	0	0	0	0	1	1	0	0
23	Imperial E	0	0	0	0	1	1	0	0
24	Valencia W	0	0	0	0	0	0	0	0
25	Internal Gate	0	0	0	0	0	0	0	0
26	Yorba Linda E	0	0	0	0	1	1	0	0
27	Nutwood E	0	0	0	0	1	1	0	0
28	Anaheim S	0	0	0	0	0	0	0	0
29	La Palma W	0	0	0	0	0	0	0	0
30	La Palma E	0	0	0	0	0	0	0	0
Total		68	41	0	63	112	151	0	119

Step 5 – In and Out Trips

The passenger trips and vehicle trips have been analyzed and calculated so far only represent the boarding trips, or inbound trips. It is assumed that the alighting trips, or outbound trips, will approximately follow a symmetric pattern. Table 9 shows the inbound and outbound peak hour vehicle trips by PNR mode and Table 10, 11 and 12 show the inbound and outbound peak hour vehicle trips by KNR mode for SOCO West Parking Structure, Metrolink Depot and New Parking Structure locations.

Table 9: AM/PM Peak Hour Vehicle Trips by PNR Mode

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Chapman W	0	0	0	0
2	Chapman E	0	0	1	1
3	Commonwealth W	0	0	0	0
4	NOT USED	0	0	0	0
5	Orangethorpe W	0	0	0	0
6	Orangethorpe E	0	0	1	1
7	SR-91 W	9	9	14	14
8	SR-91 E	30	30	45	45
9	SR-57 N	21	21	31	31
10	SR-57 S	8	8	11	11
11	State College N	0	0	1	1
12	State College S	0	0	0	0
13	Harbor N	0	0	1	1
14	Harbor S	0	0	0	0
15	Euclid N	0	0	1	1
16	Euclid S	0	0	0	0
17	Raymond Ave	0	0	0	0
18	East S	0	0	0	0
19	Brea N	0	0	1	1
20	Bastanchury W	0	0	0	0
21	Bastanchury E	0	0	1	1
22	Imperial W	0	0	1	1
23	Imperial E	0	0	1	1
24	Valencia W	0	0	0	0
25	Internal Gate	0	0	0	0
26	Yorba Linda E	0	0	1	1
27	Nutwood E	0	0	1	1
28	Anaheim S	0	0	0	0
29	La Palma W	0	0	0	0
30	La Palma E	0	0	0	0
Total		68	68	112	112

Table 10: AM/PM Peak Hour Vehicle Trips by KNR Mode
SOCO West Parking Structure (40%)

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Chapman W	0	0	0	0
2	Chapman E	0	0	0	0
3	Commonwealth W	0	0	0	0
4	NOT USED	0	0	0	0
5	Orangethorpe W	0	0	0	0
6	Orangethorpe E	0	0	0	0
7	SR-91 W	3	3	10	10
8	SR-91 E	20	20	50	50
9	SR-57 N	12	12	28	28
10	SR-57 S	8	8	16	16
11	State College N	0	0	0	0
12	State College S	0	0	0	0
13	Harbor N	0	0	0	0
14	Harbor S	0	0	0	0
15	Euclid N	0	0	0	0
16	Euclid S	0	0	0	0
17	Raymond Ave	0	0	0	0
18	East S	0	0	0	0
19	Brea N	0	0	0	0
20	Bastanchury W	0	0	0	0
21	Bastanchury E	0	0	0	0
22	Imperial W	0	0	0	0
23	Imperial E	0	0	0	0
24	Valencia W	0	0	0	0
25	Internal Gate	0	0	0	0
26	Yorba Linda E	0	0	0	0
27	Nutwood E	0	0	0	0
28	Anaheim S	0	0	0	0
29	La Palma W	0	0	0	0
30	La Palma E	0	0	0	0
Total		43	43	104	104

Table 11: AM/PM Peak Hour Vehicle Trips by KNR Mode – Metrolink Depot (10%)

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Chapman W	0	0	0	0
2	Chapman E	0	0	0	0
3	Commonwealth W	0	0	0	0
4	NOT USED	0	0	0	0
5	Orangethorpe W	0	0	0	0
6	Orangethorpe E	0	0	0	0
7	SR-91 W	1	1	2	2
8	SR-91 E	5	5	12	12
9	SR-57 N	1	1	6	6
10	SR-57 S	1	1	4	4
11	State College N	0	0	0	0
12	State College S	0	0	0	0
13	Harbor N	0	0	0	0
14	Harbor S	0	0	0	0
15	Euclid N	0	0	0	0
16	Euclid S	0	0	0	0
17	Raymond Ave	0	0	0	0
18	East S	0	0	0	0
19	Brea N	0	0	0	0
20	Bastanchury W	0	0	0	0
21	Bastanchury E	0	0	0	0
22	Imperial W	0	0	0	0
23	Imperial E	0	0	0	0
24	Valencia W	0	0	0	0
25	Internal Gate	0	0	0	0
26	Yorba Linda E	0	0	0	0
27	Nutwood E	0	0	0	0
28	Anaheim S	0	0	0	0
29	La Palma W	0	0	0	0
30	La Palma E	0	0	0	0
Total		8	8	24	24

Table 12: AM/PM Peak Hour Vehicle Trips by KNR Mode – New Parking Structure (50%)

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Chapman W	0	0	0	0
2	Chapman E	0	0	1	1
3	Commonwealth W	0	0	0	0
4	NOT USED	0	0	0	0
5	Orangethorpe W	0	0	0	0
6	Orangethorpe E	0	0	1	1
7	SR-91 W	4	4	13	13
8	SR-91 E	25	25	63	63
9	SR-57 N	14	14	35	35
10	SR-57 S	10	10	20	20
11	State College N	0	0	1	1
12	State College S	0	0	0	0
13	Harbor N	0	0	1	1
14	Harbor S	0	0	0	0
15	Euclid N	0	0	1	1
16	Euclid S	0	0	0	0
17	Raymond Ave	0	0	0	0
18	East S	0	0	0	0
19	Brea N	0	0	1	1
20	Bastanchury W	0	0	0	0
21	Bastanchury E	0	0	1	1
22	Imperial W	0	0	1	1
23	Imperial E	0	0	1	1
24	Valencia W	0	0	0	0
25	Internal Gate	0	0	0	0
26	Yorba Linda E	0	0	1	1
27	Nutwood E	0	0	1	1
28	Anaheim S	0	0	0	0
29	La Palma W	0	0	0	0
30	La Palma E	0	0	0	0
Total		53	53	142	142

Trip Distribution

All the PNR trips were distributed to the New Parking Structured Parking off Santa Fe Avenue. The KNR trips were distributed to the SOCO West Parking Structure, Metrolink Depot and New Parking Structure locations.

Trip Assignment

The trip generation and distribution were coded into a Traffix network and the trips were assigned to the study intersections. The volumes at each study intersection were add to the volumes of interim year and build out year pre-project conditions and result in post-project volumes.

If you have any questions, please free to contact me directly.

Respectfully,



Ray Kommidi, PE, TE
Senior Project Manager

TECHNICAL MEMORANDUM

Date: **January 11th, 2017**
To: **Paul Menaker, Ph.D.**
From: **Ray Kommidi, PE, TE**
Subject: **Project Bus Trip Generation and Distribution – Fullerton Station**

This Memorandum is a summary of the steps involved to arrive from the daily bus ridership to the AM and PM peak hour in and out bus vehicle trips for the Fullerton Station.

Step 1 - Trip Aggregation By Gates

The bus access/origination and egress/destination passenger trips are provided at the Traffic Analysis Zone (TAZ) level. The daily passenger trips are assigned to the respective gates based on the proximity of each TAZ to the nearest gate. The originating and destination bus daily passenger trips aggregated by gates are summarized in Table 1.

Table 1: Daily Passenger Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	Chapman W	3	3	5	8
2	Chapman E	1	2	4	6
3	Commonwealth W	1	2	3	4
4	NOT USED	0	0	0	0
5	Orangethorpe W	2	2	3	5
6	Orangethorpe E	0	0	0	2
7	SR-91 W	2	6	9	13
8	SR-91 E	4	13	15	36
9	SR-57 N	0	18	2	0
10	SR-57 S	1	0	5	44
11	State College N	0	1	1	3
12	State College S	0	1	3	5
13	Harbor N	0	1	1	3
14	Harbor S	0	1	1	2
15	Euclid N	0	2	1	4
16	Euclid S	0	1	1	2
17	Raymond Ave	0	0	0	0
18	East S	0	2	3	6
19	Brea N	3	7	7	16
20	Bastanchury W	0	2	2	4
21	Bastanchury E	0	1	2	4
22	Imperial W	1	1	3	2
23	Imperial E	1	2	2	4
24	Valencia W	0	1	2	3
25	Internal Gate	0	0	0	0
26	Yorba Linda E	0	0	1	1
27	Nutwood E	0	5	4	15
28	Anaheim S	0	2	2	3
29	La Palma W	1	4	3	10
30	La Palma E	0	0	0	0
Total		20	80	85	205

Step 2 - Conversion to Bus Trips

The passenger trips were converted to bus trips, based on the vehicle occupancy rates in Table 2. The daily bus trips by Originating and Destination are summarized in Table 3.

Table 2: Occupancy Rate Calculation

Fullerton Station

Year 2029 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	2,940	2,160	1.36
Transit	30	1	30.00
Total	2,970		

Year 2040 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	5,150	3,730	1.38
Transit	90	5	18.00
Total	5,240		

Year 2029 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	1,720	1,230	1.40
Transit	90	5	18.00
Total	1,810		

Year 2040 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	3,370	2,400	1.40
Transit	210	10	21.00
Total	3,580		

Table 3: Daily Bus Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	Chapman W	0	0	0	0
2	Chapman E	0	0	0	0
3	Commonwealth W	0	0	0	0
4	NOT USED	0	0	0	0
5	Orangethorpe W	0	0	0	0
6	Orangethorpe E	0	0	0	0
7	SR-91 W	0	0	1	1
8	SR-91 E	0	1	1	2
9	SR-57 N	0	1	0	0
10	SR-57 S	0	0	0	2
11	State College N	0	0	0	0
12	State College S	0	0	0	0
13	Harbor N	0	0	0	0
14	Harbor S	0	0	0	0
15	Euclid N	0	0	0	0
16	Euclid S	0	0	0	0
17	Raymond Ave	0	0	0	0
18	East S	0	0	0	0
19	Brea N	0	0	0	1
20	Bastanchury W	0	0	0	0
21	Bastanchury E	0	0	0	0
22	Imperial W	0	0	0	0
23	Imperial E	0	0	0	0
24	Valencia W	0	0	0	0
25	Internal Gate	0	0	0	0
26	Yorba Linda E	0	0	0	0
27	Nutwood E	0	0	0	1
28	Anaheim S	0	0	0	0
29	La Palma W	0	0	0	0
30	La Palma E	0	0	0	0
Total		0	2	2	7

Step 3 - Conversion to Peak Hour Trips

Based on the CAHSR Model data provided through STV, 31% and 37% of the daily trips are incurred during the six hour peak period in Year 2029 and 2040, respectively at the Fullerton Station. It is assumed that the AM peak hour and PM peak hour would have approximately identical share of the peak period trips. Therefore, the peak hour trips are calculated by dividing the daily trips by six (6). In case of Fullerton Station, the peak hour trips will be 5.17% and 6.17% of the total daily trips in Year 2029 and 2040, respectively. The AM and PM peak hour bus trips are summarized in Table 4.

Table 4: AM/PM Peak Hour Bus Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	Chapman W	0	0	0	0
2	Chapman E	0	0	0	0
3	Commonwealth W	0	0	0	0
4	NOT USED	0	0	0	0
5	Orangethorpe W	0	0	0	0
6	Orangethorpe E	0	0	0	0
7	SR-91 W	0	0	0	0
8	SR-91 E	0	0	0	0
9	SR-57 N	0	0	0	0
10	SR-57 S	0	0	0	0
11	State College N	0	0	0	0
12	State College S	0	0	0	0
13	Harbor N	0	0	0	0
14	Harbor S	0	0	0	0
15	Euclid N	0	0	0	0
16	Euclid S	0	0	0	0
17	Raymond Ave	0	0	0	0
18	East S	0	0	0	0
19	Brea N	0	0	0	0
20	Bastanchury W	0	0	0	0
21	Bastanchury E	0	0	0	0
22	Imperial W	0	0	0	0
23	Imperial E	0	0	0	0
24	Valencia W	0	0	0	0
25	Internal Gate	0	0	0	0
26	Yorba Linda E	0	0	0	0
27	Nutwood E	0	0	0	0
28	Anaheim S	0	0	0	0
29	La Palma W	0	0	0	0
30	La Palma E	0	0	0	0
Total		0	0	0	0

Step 4 – In and Out Trips

The passenger trips and vehicle trips have been analyzed and calculated so far only represent the boarding trips, or inbound trips. It is assumed that the alighting trips, or outbound trips, will approximately follow a symmetric pattern. Table 5 shows the inbound and outbound peak hour bus trips.

Table 5: AM/PM Peak Hour Bus Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Chapman W	0.01	0.01	0.04	0.04
2	Chapman E	0.01	0.01	0.03	0.03
3	Commonwealth W	0.01	0.01	0.02	0.02
4	NOT USED	0.00	0.00	0.00	0.00
5	Orangethorpe W	0.01	0.01	0.02	0.02
6	Orangethorpe E	0.00	0.00	0.01	0.01
7	SR-91 W	0.02	0.02	0.07	0.07
8	SR-91 E	0.04	0.04	0.16	0.16
9	SR-57 N	0.05	0.05	0.01	0.01
10	SR-57 S	0.00	0.00	0.15	0.15
11	State College N	0.00	0.00	0.01	0.01
12	State College S	0.00	0.00	0.02	0.02
13	Harbor N	0.00	0.00	0.01	0.01
14	Harbor S	0.00	0.00	0.01	0.01
15	Euclid N	0.01	0.01	0.02	0.02
16	Euclid S	0.00	0.00	0.01	0.01
17	Raymond Ave	0.00	0.00	0.00	0.00
18	East S	0.01	0.01	0.03	0.03
19	Brea N	0.03	0.03	0.07	0.07
20	Bastanchury W	0.01	0.01	0.02	0.02
21	Bastanchury E	0.00	0.00	0.02	0.02
22	Imperial W	0.00	0.00	0.02	0.02
23	Imperial E	0.01	0.01	0.02	0.02
24	Valencia W	0.00	0.00	0.02	0.02
25	Internal Gate	0.00	0.00	0.00	0.00
26	Yorba Linda E	0.00	0.00	0.01	0.01
27	Nutwood E	0.01	0.01	0.06	0.06
28	Anaheim S	0.01	0.01	0.02	0.02
29	La Palma W	0.01	0.01	0.04	0.04
30	La Palma E	0.00	0.00	0.00	0.00
Total		0.25	0.25	0.92	0.92

Step 5 – In and Out Trips Adjustment

The AM/PM vehicle bus trips calculated for each gate in Table 5 are very low and in order to get a correct estimate of the bus trips, we reviewed the existing bus routes and manually assigned the trips to the gates. Table 6 and 7 show the inbound and outbound peak hour bus trips for AM and PM peak hours, respectively.

Table 6: AM Peak Hour Bus Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Chapman W	0	0	0	0
2	Chapman E	0	0	0	0
3	Commonwealth W	0	0	0	0
4	NOT USED	0	0	0	0
5	Orangethorpe W	0	0	0	0
6	Orangethorpe E	0	0	0	0
7	SR-91 W	0	0	0	0
8	SR-91 E	0	0	1	1
9	SR-57 N	0	0	0	0
10	SR-57 S	0	0	0	0
11	State College N	0	0	0	0
12	State College S	0	0	0	0
13	Harbor N	0	0	0	0
14	Harbor S	0	0	0	0
15	Euclid N	0	0	0	0
16	Euclid S	0	0	0	0
17	Raymond Ave	0	0	0	0
18	East S	0	0	0	0
19	Brea N	0	0	0	0
20	Bastanchury W	0	0	0	0
21	Bastanchury E	0	0	0	0
22	Imperial W	0	0	0	0
23	Imperial E	0	0	0	0
24	Valencia W	0	0	0	0
25	Internal Gate	0	0	0	0
26	Yorba Linda E	0	0	0	0
27	Nutwood E	0	0	0	0
28	Anaheim S	0	0	0	0
29	La Palma W	0	0	0	0
30	La Palma E	0	0	0	0
Total		0	0	1	1

Table 7: PM Peak Hour Bus Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Chapman W	0	0	0	0
2	Chapman E	0	0	0	0
3	Commonwealth W	0	0	0	0
4	NOT USED	0	0	0	0
5	Orangethorpe W	0	0	0	0
6	Orangethorpe E	0	0	0	0
7	SR-91 W	0	0	0	0
8	SR-91 E	0	0	1	1
9	SR-57 N	0	0	0	0
10	SR-57 S	0	0	0	0
11	State College N	0	0	0	0
12	State College S	0	0	0	0
13	Harbor N	0	0	0	0
14	Harbor S	0	0	0	0
15	Euclid N	0	0	0	0
16	Euclid S	0	0	0	0
17	Raymond Ave	0	0	0	0
18	East S	0	0	0	0
19	Brea N	0	0	0	0
20	Bastanchury W	0	0	0	0
21	Bastanchury E	0	0	0	0
22	Imperial W	0	0	0	0
23	Imperial E	0	0	0	0
24	Valencia W	0	0	0	0
25	Internal Gate	0	0	0	0
26	Yorba Linda E	0	0	0	0
27	Nutwood E	0	0	0	0
28	Anaheim S	0	0	0	0
29	La Palma W	0	0	0	0
30	La Palma E	0	0	0	0
Total		0	0	1	1

Trip Distribution

The bus trips were distributed to the existing transit center off Pomona Avenue and Santa Fe Avenue.

Trip Assignment

The trip generation and distribution were coded into a Traffix network and the trips were assigned to the study intersections. The volumes at each study intersection were add to the volumes of interim year and build out year pre-project conditions and result in post-project volumes.

If you have any questions, please free to contact me directly.

Respectfully,



Ray Kommidi, PE, TE
Senior Project Manager

TECHNICAL MEMORANDUM

Date: **January 11th, 2017**
To: **Paul Menaker, Ph.D.**
From: **Ray Kommidi, PE, TE**
Subject: **Project Trip Generation and Distribution – Anaheim Station**

This Memorandum is a summary of the steps involved to arrive from the daily ridership to the AM and PM peak hour in and out vehicle trips by mode split for the Anaheim Station.

Step 1 - Trip Aggregation By Gates

The auto access/origination and egress/destination passenger trips are provided at the Traffic Analysis Zone (TAZ) level. It is our assumption that the daily passenger trips provided in the Access column (ANA_Access_2029 and ANA_Access_2040) and Egress Column (ANA_Egress_2029 and ANA_Egress_2040) are the originating and destination passenger trips for the Anaheim Station, respectively for years 2029 and 2040.

The daily passenger trips are assigned to the respective gates based on the proximity of each TAZ to the nearest gate. The originating and destination auto daily passenger trips aggregated by gates are summarized in Table 1.

Table 1: Daily Passenger Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	Ball W	3	0	5	0
2	Taft E	0	1	0	2
3	Katella W	4	0	6	1
4	Katella E	0	2	0	3
5	Orangewood W	3	0	5	0
6	Walnut E	0	1	0	2
7	Chapman W	3	0	5	0
8	Chapman E	0	1	0	3
9	I-5 N	0	0	0	0
10	I-5 S	3711	3439	6928	6118
11	Harbor N	0	0	0	0
12	Harbor S	0	0	0	0
13	Anaheim N	0	0	0	0
14	Anaheim S	0	0	0	0
15	State College N	0	0	0	0
16	Lewis N	0	0	0	0
17	State College S	0	0	0	0
18	SR-57 N	349	378	895	655
19	SR-57 S	186	0	162	52
20	Main N	0	0	0	0
21	Main S	0	0	0	0
22	Lewis S	0	0	0	0
23	I-5 HOV	0	0	0	0
24	SR-22 W	288	106	514	116
Total		4547	3928	8520	6952

Step 2 - Conversion to Vehicle Trips

The passenger trips were converted to vehicle trips, based on the vehicle occupancy rates in Table 2. We assumed an occupancy rate of 1.40 for year 2029 and 2040 for originating and destination passenger trips. The daily vehicle trips by Originating and Destination are summarized in Table 3.

Table 2: Occupancy Rate Calculation

Anaheim Station

Year 2029 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	4,490	3,300	1.36
Transit	130	6	21.67
Total	4,620		

Year 2040 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	7,440	5,390	1.38
Transit	290	14	20.71
Total	7,730		

Year 2029 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	3,900	2,770	1.41
Transit	180	9	20.00
Total	4,080		

Year 2040 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	7,930	5,660	1.40
Transit	390	20	19.50
Total	8,320		

Table 3: Daily Vehicle Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	Ball W	2	0	4	0
2	Taft E	0	1	0	1
3	Katella W	3	0	4	1
4	Katella E	0	1	0	2
5	Orangewood W	2	0	4	0
6	Walnut E	0	1	0	1
7	Chapman W	2	0	4	0
8	Chapman E	0	1	0	2
9	I-5 N	0	0	0	0
10	I-5 S	2650	2457	4948	4370
11	Harbor N	0	0	0	0
12	Harbor S	0	0	0	0
13	Anaheim N	0	0	0	0
14	Anaheim S	0	0	0	0
15	State College N	0	0	0	0
16	Lewis N	0	0	0	0
17	State College S	0	0	0	0
18	SR-57 N	250	270	640	468
19	SR-57 S	133	0	116	37
20	Main N	0	0	0	0
21	Main S	0	0	0	0
22	Lewis S	0	0	0	0
23	I-5 HOV	0	0	0	0
24	SR-22 W	205	75	367	83
Total		3247	2806	6087	4965

Step 3 - Split Between PNR Vs KNR Modes

The passenger trips by auto mode were split into park-and-ride (PNR) trips and kiss-and-ride (KNR) trips, based on the mode share percentages from the Authority. Table 4 shows the mode share numbers provided by the Authority for year 2029 and 2040. Table 5 and 6 show the mode split percentages used for calculating PNR and KNR passenger trips for year 2029 and 2040, respectively.

Table 4: Mode Share Numbers Provided by Authority

	Anaheim Station			
		Optimistic		
	Originating Passengers	Phase 1	Phase 1	
	Mode	2029	2040	
	Station access/egress trips	5,860	11,830	
Vehicle trips	Drop-Off/Pick-up	1,230	3,000	KNR
Vehicle trips	Parking Arrivals/Departures	1,990	2,240	PNR
Vehicle trips	Rental Car Arrivals/Departures	-	-	KNR
Vehicle trips	Taxi Arrivals/Departures	80	150	KNR
Vehicle trips	Local/Regional Transit Buses	6	14	BUS
	Unconstrained Parking Demand	1,210	2,280	
Passenger trips	Arriving/Departing by Drop-Off/Pick-up	1,760	4,290	
Passenger trips	Arriving/Departing by Parked Car	2,620	2,940	
Passenger trips	Arriving/Departing by Rental Car	-	-	
Passenger trips	Arriving/Departing by Taxi	110	210	
Passenger trips	Arriving/Departing by Transit	790	2,030	
Passenger trips	by dedicated HSR Bus	-	-	
Passenger trips	by Local/Regional Bus	130	290	
Passenger trips	by Local/Regional/Intercity Rail	660	1,740	
Passenger trips	Arriving/Departing by Bike/Walk	560	1,320	
		Optimistic		
	Destination Passengers	Phase 1	Phase 1	
	Mode	2029	2040	
	Station access/egress trips	8,760	18,630	
Vehicle trips	Drop-Off/Pick-up	1,230	2,880	KNR
Vehicle trips	Parking Arrivals/Departures	-	-	PNR
Vehicle trips	Rental Car Arrivals/Departures	1,100	1,950	KNR
Vehicle trips	Taxi Arrivals/Departures	440	830	KNR
Vehicle trips	Local/Regional Transit Buses	9	20	BUS
	Unconstrained Parking Demand	-	-	
Passenger trips	Arriving/Departing by Drop-Off/Pick-up	1,760	4,090	
Passenger trips	Arriving/Departing by Parked Car	-	-	
Passenger trips	Arriving/Departing by Rental Car	1,590	2,800	
Passenger trips	Arriving/Departing by Taxi	550	1,040	
Passenger trips	Arriving/Departing by Transit	4,310	10,470	
Passenger trips	by dedicated HSR Bus	-	-	
Passenger trips	by Local/Regional Bus	180	390	
Passenger trips	by Local/Regional/Intercity Rail	4,130	10,080	
Passenger trips	Arriving/Departing by Bike/Walk	580	1,280	

Table 5: Mode Split Percentage – Year 2029

Mode	Originating		Destination	
	Vehicle Trips	Percentage	Vehicle Trips	Percentage
PNR	1,948	60	0	0
KNR (PUDO, Taxi and Rental)	1,299	40	2,806	100

Table 6: Mode Split Percentage – Year 2040

Mode	Originating		Destination	
	Vehicle Trips	Percentage	Vehicle Trips	Percentage
PNR	2,557	42	0	0
KNR (PUDO, Taxi and Rental)	3,530	58	4,965	100

The KNR mode includes taxi, rental car and pickup/drop off. These percentages were used to calculate the daily vehicle passenger trips by mode summarized in Table 7. For destination passengers, PNR is not considered as a feasible option. Therefore, PNR trips are zero.

Table 7: Daily Vehicle Trips by Mode

Gate No.	Gate Name	Year 2029				Year 2040			
		Originating		Destination		Originating		Destination	
		PNR	KNR	PNR	KNR	PNR	KNR	PNR	KNR
1	Ball W	1	1	0	0	1	2	0	0
2	Taft E	0	0	0	1	0	0	0	1
3	Katella W	2	1	0	0	2	3	0	1
4	Katella E	0	0	0	1	0	0	0	2
5	Orangewood W	1	1	0	0	2	2	0	0
6	Walnut E	0	0	0	1	0	0	0	1
7	Chapman W	1	1	0	0	2	2	0	0
8	Chapman E	0	0	0	1	0	0	0	2
9	I-5 N	0	0	0	0	0	0	0	0
10	I-5 S	1590	1060	0	2457	2078	2870	0	4370
11	Harbor N	0	0	0	0	0	0	0	0
12	Harbor S	0	0	0	0	0	0	0	0
13	Anaheim N	0	0	0	0	0	0	0	0
14	Anaheim S	0	0	0	0	0	0	0	0
15	State College N	0	0	0	0	0	0	0	0
16	Lewis N	0	0	0	0	0	0	0	0
17	State College S	0	0	0	0	0	0	0	0
18	SR-57 N	150	100	0	270	269	371	0	468
19	SR-57 S	80	53	0	0	49	67	0	37
20	Main N	0	0	0	0	0	0	0	0
21	Main S	0	0	0	0	0	0	0	0
22	Lewis S	0	0	0	0	0	0	0	0
23	I-5 HOV	0	0	0	0	0	0	0	0
24	SR-22 W	123	82	0	75	154	213	0	83
Total		1948	1299	0	2806	2557	3530	0	4965

Step 4 - Conversion to Peak Hour Trips

Based on the CAHSR Model data provided through STV, 33% and 35% of the daily trips are incurred during the six hour peak period in Year 2029 and 2040, respectively at the Anaheim Station. It is assumed that the AM peak hour and PM peak hour would have approximately identical share of the peak period trips. Therefore, the peak hour trips are calculated by dividing the daily trips by six (6). In case of Anaheim Station, the peak hour trips will be 5.5% and 5.8% of the total daily trips in Year 2029 and 2040, respectively. The AM and PM peak hour vehicle trips by PNR and KNR are summarized in Table 8.

Table 8: AM/PM Peak Hour Vehicle Trips by Mode

Gate No.	Gate Name	Year 2029				Year 2040			
		Originating		Destination		Originating		Destination	
		PNR	KNR	PNR	KNR	PNR	KNR	PNR	KNR
1	Ball W	0	0	0	0	0	0	0	0
2	Taft E	0	0	0	0	0	0	0	0
3	Katella W	0	0	0	0	0	0	0	0
4	Katella E	0	0	0	0	0	0	0	0
5	Orangewood W	0	0	0	0	0	0	0	0
6	Walnut E	0	0	0	0	0	0	0	0
7	Chapman W	0	0	0	0	0	0	0	0
8	Chapman E	0	0	0	0	0	0	0	0
9	I-5 N	0	0	0	0	0	0	0	0
10	I-5 S	87	58	0	135	121	167	0	255
11	Harbor N	0	0	0	0	0	0	0	0
12	Harbor S	0	0	0	0	0	0	0	0
13	Anaheim N	0	0	0	0	0	0	0	0
14	Anaheim S	0	0	0	0	0	0	0	0
15	State College N	0	0	0	0	0	0	0	0
16	Lewis N	0	0	0	0	0	0	0	0
17	State College S	0	0	0	0	0	0	0	0
18	SR-57 N	8	5	0	15	16	22	0	27
19	SR-57 S	4	3	0	0	3	4	0	2
20	Main N	0	0	0	0	0	0	0	0
21	Main S	0	0	0	0	0	0	0	0
22	Lewis S	0	0	0	0	0	0	0	0
23	I-5 HOV	0	0	0	0	0	0	0	0
24	SR-22 W	7	5	0	4	9	12	0	5
Total		106	71	0	154	149	205	0	289

Step 5 – In and Out Trips

The passenger trips and vehicle trips have been analyzed and calculated so far only represent the boarding trips, or inbound trips. It is assumed that the alighting trips, or outbound trips, will approximately follow a symmetric pattern. Table 9 shows the inbound and outbound peak hour vehicle trips by PNR mode and Table 10 and 11 show the inbound and outbound peak hour vehicle trips by KNR mode for west side and east side KNR locations.

Table 9: AM/PM Peak Hour Vehicle Trips by PNR Mode

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Ball W	0	0	0	0
2	Taft E	0	0	0	0
3	Katella W	0	0	0	0
4	Katella E	0	0	0	0
5	Orangewood W	0	0	0	0
6	Walnut E	0	0	0	0
7	Chapman W	0	0	0	0
8	Chapman E	0	0	0	0
9	I-5 N	0	0	0	0
10	I-5 S	87	87	121	121
11	Harbor N	0	0	0	0
12	Harbor S	0	0	0	0
13	Anaheim N	0	0	0	0
14	Anaheim S	0	0	0	0
15	State College N	0	0	0	0
16	Lewis N	0	0	0	0
17	State College S	0	0	0	0
18	SR-57 N	8	8	16	16
19	SR-57 S	4	4	3	3
20	Main N	0	0	0	0
21	Main S	0	0	0	0
22	Lewis S	0	0	0	0
23	I-5 HOV	0	0	0	0
24	SR-22 W	7	7	9	9
Total		106	106	149	149

Table 10: AM/PM Peak Hour Vehicle Trips by KNR Mode – West Side (50%)

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Ball W	0	0	0	0
2	Taft E	0	0	0	0
3	Katella W	0	0	0	0
4	Katella E	0	0	0	0
5	Orangewood W	0	0	0	0
6	Walnut E	0	0	0	0
7	Chapman W	0	0	0	0
8	Chapman E	0	0	0	0
9	I-5 N	0	0	0	0
10	I-5 S	97	97	211	211
11	Harbor N	0	0	0	0
12	Harbor S	0	0	0	0
13	Anaheim N	0	0	0	0
14	Anaheim S	0	0	0	0
15	State College N	0	0	0	0
16	Lewis N	0	0	0	0
17	State College S	0	0	0	0
18	SR-57 N	9	9	24	24
19	SR-57 S	2	2	3	3
20	Main N	0	0	0	0
21	Main S	0	0	0	0
22	Lewis S	0	0	0	0
23	I-5 HOV	0	0	0	0
24	SR-22 W	5	5	9	9
Total		113	113	247	247

Table 11: AM/PM Peak Hour Vehicle Trips by KNR Mode – East Side (50%)

Gate No.	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Ball W	0	0	0	0
2	Taft E	0	0	0	0
3	Katella W	0	0	0	0
4	Katella E	0	0	0	0
5	Orangewood W	0	0	0	0
6	Walnut E	0	0	0	0
7	Chapman W	0	0	0	0
8	Chapman E	0	0	0	0
9	I-5 N	0	0	0	0
10	I-5 S	96	96	211	211
11	Harbor N	0	0	0	0
12	Harbor S	0	0	0	0
13	Anaheim N	0	0	0	0
14	Anaheim S	0	0	0	0
15	State College N	0	0	0	0
16	Lewis N	0	0	0	0
17	State College S	0	0	0	0
18	SR-57 N	11	11	25	25
19	SR-57 S	1	1	3	3
20	Main N	0	0	0	0
21	Main S	0	0	0	0
22	Lewis S	0	0	0	0
23	I-5 HOV	0	0	0	0
24	SR-22 W	4	4	8	8
Total		112	112	247	247

Trip Distribution

All the PNR trips were distributed to the HSR Structured Parking off Douglas Road. The KNR trips were equally distributed to the west side and east side KNR.

Trip Assignment

The trip generation and distribution were coded into a Traffix network and the trips were assigned to the study intersections. The volumes at each study intersection were add to the volumes of interim year and build out year pre-project conditions and result in post-project volumes.

If you have any questions, please free to contact me directly.

Respectfully,



Ray Kommidi, PE, TE
Senior Project Manager

TECHNICAL MEMORANDUM

Date: **January 11th, 2017**
To: **Paul Menaker, Ph.D.**
From: **Ray Kommidi, PE, TE**
Subject: **Project Bus Trip Generation and Distribution – Anaheim Station**

This Memorandum is a summary of the steps involved to arrive from the daily bus ridership to the AM and PM peak hour in and out bus vehicle trips for the Anaheim Station.

Step 1 - Trip Aggregation By Gates

The bus access/origination and egress/destination passenger trips are provided at the Traffic Analysis Zone (TAZ) level. The daily passenger trips are assigned to the respective gates based on the proximity of each TAZ to the nearest gate. The originating and destination bus daily passenger trips aggregated by gates are summarized in Table 1.

Table 1: Daily Passenger Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	Ball W	0	0	0	3
2	Taft E	2	2	5	3
3	Katella W	1	13	3	24
4	Katella E	5	4	9	7
5	Orangewood W	1	12	2	24
6	Walnut E	9	4	27	10
7	Chapman W	0	0	0	0
8	Chapman E	9	8	27	22
9	I-5 N	0	25	0	63
10	I-5 S	57	84	112	169
11	Harbor N	0	0	0	0
12	Harbor S	2	3	4	5
13	Anaheim N	0	0	0	0
14	Anaheim S	2	1	4	3
15	State College N	12	7	32	18
16	Lewis N	0	0	0	0
17	State College S	1	2	3	4
18	SR-57 N	0	0	2	0
19	SR-57 S	10	4	17	13
20	Main N	1	0	4	0
21	Main S	3	4	6	12
22	Lewis S	2	1	3	3
23	I-5 HOV	0	0	0	0
24	SR-22 W	8	0	19	6
Total		125	174	279	389

Step 2 - Conversion to Bus Trips

The passenger trips were converted to bus trips, based on the vehicle occupancy rates in Table 2. The daily bus trips by Originating and Destination are summarized in Table 3.

Table 2: Occupancy Rate Calculation

Anaheim Station

Year 2029 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	4,490	3,300	1.36
Transit	130	6	21.67
Total	4,620		

Year 2040 Originating/Access Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	7,440	5,390	1.38
Transit	290	14	20.71
Total	7,730		

Year 2029 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	3,900	2,770	1.41
Transit	180	9	20.00
Total	4,080		

Year 2040 Destination/Egress Passengers

	Passenger Trips	Vehicle Trips	Occupancy Rate
Auto	7,930	5,660	1.40
Transit	390	20	19.50
Total	8,320		

Table 3: Daily Bus Trips

Gate No.	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	Ball W	0	0	0	0
2	Taft E	0	0	0	0
3	Katella W	0	1	0	1
4	Katella E	0	0	0	0
5	Orangewood W	0	1	0	1
6	Walnut E	0	0	1	1
7	Chapman W	0	0	0	0
8	Chapman E	0	0	1	1
9	I-5 N	0	1	0	3
10	I-5 S	3	4	5	9
11	Harbor N	0	0	0	0
12	Harbor S	0	0	0	0
13	Anaheim N	0	0	0	0
14	Anaheim S	0	0	0	0
15	State College N	1	0	2	1
16	Lewis N	0	0	0	0
17	State College S	0	0	0	0
18	SR-57 N	0	0	0	0
19	SR-57 S	0	0	1	1
20	Main N	0	0	0	0
21	Main S	0	0	0	1
22	Lewis S	0	0	0	0
23	I-5 HOV	0	0	0	0
24	SR-22 W	0	0	1	0
Total		4	7	11	19

Step 3 - Conversion to Peak Hour Trips

Based on the CAHSR Model data provided through STV, 33% and 35% of the daily trips are incurred during the six hour peak period in Year 2029 and 2040, respectively at the Anaheim Station. It is assumed that the AM peak hour and PM peak hour would have approximately identical share of the peak period trips. Therefore, the peak hour trips are calculated by dividing the daily trips by six (6). In case of Anaheim Station, the peak hour trips will be 5.5% and 5.8% of the total daily trips in Year 2029 and 2040, respectively. The AM and PM peak hour bus trips are summarized in Table 4.

Table 4: AM/PM Peak Hour Bus Trips

Gate	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	Ball W	0	0	0	0
2	Taft E	0	0	0	0
3	Katella W	0	0	0	0
4	Katella E	0	0	0	0
5	Orangewood W	0	0	0	0
6	Walnut E	0	0	0	0
7	Chapman W	0	0	0	0
8	Chapman E	0	0	0	0
9	I-5 N	0	0	0	0
10	I-5 S	0	0	0	1
11	Harbor N	0	0	0	0
12	Harbor S	0	0	0	0
13	Anaheim N	0	0	0	0
14	Anaheim S	0	0	0	0
15	State College N	0	0	0	0
16	Lewis N	0	0	0	0
17	State College S	0	0	0	0
18	SR-57 N	0	0	0	0
19	SR-57 S	0	0	0	0
20	Main N	0	0	0	0
21	Main S	0	0	0	0
22	Lewis S	0	0	0	0
23	I-5 HOV	0	0	0	0
24	SR-22 W	0	0	0	0
Total		0	0	0	1

Step 4 – In and Out Trips

The passenger trips and vehicle trips have been analyzed and calculated so far only represent the boarding trips, or inbound trips. It is assumed that the alighting trips, or outbound trips, will approximately follow a symmetric pattern. Table 5 shows the inbound and outbound peak hour bus trips.

Table 5: AM/PM Peak Hour Bus Trips

Gate	Gate Name	Year 2029		Year 2040	
		Originating	Destination	Originating	Destination
1	Ball W	0.00	0.00	0.01	0.01
2	Taft E	0.01	0.01	0.02	0.02
3	Katella W	0.04	0.04	0.08	0.08
4	Katella E	0.02	0.02	0.05	0.05
5	Orangewood W	0.04	0.04	0.08	0.08
6	Walnut E	0.03	0.03	0.11	0.11
7	Chapman W	0.00	0.00	0.00	0.00
8	Chapman E	0.04	0.04	0.14	0.14
9	I-5 N	0.07	0.07	0.19	0.19
10	I-5 S	0.38	0.38	0.82	0.82
11	Harbor N	0.00	0.00	0.00	0.00
12	Harbor S	0.01	0.01	0.03	0.03
13	Anaheim N	0.00	0.00	0.00	0.00
14	Anaheim S	0.01	0.01	0.02	0.02
15	State College N	0.05	0.05	0.14	0.14
16	Lewis N	0.00	0.00	0.00	0.00
17	State College S	0.01	0.01	0.02	0.02
18	SR-57 N	0.00	0.00	0.01	0.01
19	SR-57 S	0.04	0.04	0.09	0.09
20	Main N	0.00	0.00	0.01	0.01
21	Main S	0.02	0.02	0.05	0.05
22	Lewis S	0.01	0.01	0.02	0.02
23	I-5 HOV	0.00	0.00	0.00	0.00
24	SR-22 W	0.02	0.02	0.07	0.07
Total		0.8	0.8	1.96	1.96

Step 5 – In and Out Trips Adjustment

The AM/PM vehicle bus trips calculated for each gate in Table 5 are very low and in order to get a correct estimate of the bus trips, we reviewed the existing bus routes and manually assigned the trips to the gates. Table 6 and 7 show the inbound and outbound peak hour bus trips for AM and PM peak hours, respectively.

Table 6: AM Peak Hour Bus Trips

Gate	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Ball W	0	0	0	0
2	Taft E	0	0	0	0
3	Katella W	0	0	1	1
4	Katella E	0	0	0	0
5	Orangewood W	0	0	0	0
6	Walnut E	0	0	0	0
7	Chapman W	0	0	0	0
8	Chapman E	0	0	0	0
9	I-5 N	0	0	0	0
10	I-5 S	0	0	0	0
11	Harbor N	0	0	0	0
12	Harbor S	0	0	0	0
13	Anaheim N	0	0	0	0
14	Anaheim S	0	0	0	0
15	State College N	0	0	0	0
16	Lewis N	0	0	0	0
17	State College S	0	0	0	0
18	SR-57 N	0	1	1	0
19	SR-57 S	1	0	0	1
20	Main N	0	0	0	0
21	Main S	0	0	0	0
22	Lewis S	0	0	0	0
23	I-5 HOV	0	0	0	0
24	SR-22 W	0	0	0	0
Total		1	1	2	2

Table 7: PM Peak Hour Bus Trips

Gate	Gate Name	Year 2029		Year 2040	
		In	Out	In	Out
1	Ball W	0	0	0	0
2	Taft E	0	0	0	0
3	Katella W	0	0	1	1
4	Katella E	0	0	0	0
5	Orangewood W	0	0	0	0
6	Walnut E	0	0	0	0
7	Chapman W	0	0	0	0
8	Chapman E	0	0	0	0
9	I-5 N	0	0	0	0
10	I-5 S	0	0	0	0
11	Harbor N	0	0	0	0
12	Harbor S	0	0	0	0
13	Anaheim N	0	0	0	0
14	Anaheim S	0	0	0	0
15	State College N	0	0	0	0
16	Lewis N	0	0	0	0
17	State College S	0	0	0	0
18	SR-57 N	0	1	1	0
19	SR-57 S	1	0	0	1
20	Main N	0	0	0	0
21	Main S	0	0	0	0
22	Lewis S	0	0	0	0
23	I-5 HOV	0	0	0	0
24	SR-22 W	0	0	0	0
Total		1	1	2	2

Trip Distribution

The bus trips were distributed to the Transit Center off Douglas Road.

Trip Assignment

The trip generation and distribution were coded into a Traffix network and the trips were assigned to the study intersections. The volumes at each study intersection were add to the volumes of interim year and build out year pre-project conditions and result in post-project volumes.

If you have any questions, please free to contact me directly.

Respectfully,



Ray Kommidi, PE, TE
Senior Project Manager