

Delay and Queue Calc. Spreadsheet for Bottleneck Work Zones - Quick Version

Note: Use this "Quick Version" when the capacity of the WZ does not vary from hour to hour, hourly volumes can be estimated from the AADT and TPG info., and the facility in question is not an existing bottleneck.

Project: I-80 Reconstruction (Phase II) - Int 306 to 307 EB Segment (High
Analyst: ECR
Date: 10/7/2015

One Way Work Zone Capacity (veh/hr) 1550 vph
One Way AADT (veh/day) 44092 vpd **Assumes 1 lane WZ Capacity
2025 Vol**

Percent of Peak Period (>1000 vph) Traffic Diverted (%) 0 %
Number of Lanes for Queued Vehicles(lanes) 2
Percent Trucks (Daily) 8 %
Traffic Pattern Group (Number 1 to 10) 1
Inbound = 1, Outbound = 2, Neutral = 3 3
Number of vehicles in Queue per Lane Mile (veh) 216 vpm

TPG Index

1=Urban Interstate
2=Rural Interstate
3=Urban Other Principal Arterials
4=Rural Other Principal Arterials
5=Urban Minor Arterials, Collectors, Local Roads
6=North Rural Minor Arterials
7=Central Rural Minor Arterials
8=North Rural Collectors and Local Roads
9=Central Rural Collectors and Local Roads
10=Special Recreational

20-Minute Delay Results

Number of Episodes of 20-Minute Delay 1
Longest Sustained Episode of 20-Minute Delay 17.13 hours
Total Hours per Day with Delays > 20-min 17.13 hours
Significant Project Based on 20-Minute Delay Threshold? Yes

Maximum Delay (min) 556 min

Total Daily Delay (vehicle-hours) 151,003 vehicle-hours

Time Beginning	Estimated Volume	Reduced Volume	Queue (Veh)	Queue (miles)	Delay for Last Arrival of Hour (min)	Restrict Work to Avoid 20 minute delay
0:00	524	524	0	0.0	0	
1:00	378	378	0	0.0	0	
2:00	342	342	0	0.0	0	
3:00	361	361	0	0.0	0	
4:00	489	489	0	0.0	0	
5:00	997	997	0	0.0	0	
6:00	2147	2147	597	1.4	23	X
7:00	2932	2932	1979	4.6	77	X
8:00	2604	2604	3033	7.0	117	X
9:00	2263	2263	3746	8.7	145	X
10:00	2232	2232	4427	10.2	171	X
11:00	2317	2317	5194	12.0	201	X
12:00	2388	2388	6032	13.9	234	X
13:00	2424	2424	6906	16.0	267	X
14:00	2661	2661	8017	18.5	310	X
15:00	3086	3086	9553	22.1	370	X
16:00	3325	3325	11328	26.2	439	X
17:00	3230	3230	13009	30.1	504	X
18:00	2465	2465	13923	32.2	539	X
19:00	1916	1916	14289	33.0	553	
20:00	1624	1624	14364	33.2	556	
21:00	1428	1428	14242	32.9	551	
22:00	1122	1122	13813	31.9	535	
23:00	838	838	13101	30.3	507	
44092		44092				

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Hourly Percentages from Table 350 of Traffic Data Report	
1.19%	0.00
0.86%	0.00
0.78%	0.00
0.82%	0.00
1.11%	0.00
2.26%	0.00
4.87%	0.13
6.65%	1.00
5.91%	1.00
5.13%	1.00
5.06%	1.00
5.25%	1.00
5.42%	1.00
5.50%	1.00
6.04%	1.00
7.00%	1.00
7.54%	1.00
7.33%	1.00
5.59%	1.00
4.34%	1.00
3.68%	1.00
3.24%	1.00
2.54%	1.00
1.90%	1.00

Portion of
Hour with
Delay>20 min

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Project: I-80 Reconstruction (Phase II) - Int 306 to 307 WB Segment (Hig
Analyst: ECR
Date: 10/7/2015

One Way Work Zone Capacity (veh/hr) 1550 vph Assumes 1 lane WZ Capacity
One Way AADT (veh/day) 45262 vpd 2025 Vol

Percent of Peak Period (>1000 vph) Traffic Diverted (%) 0 %
Number of Lanes for Queued Vehicles(lanes) 2
Percent Trucks (Daily) 8 %
Traffic Pattern Group (Number 1 to 10) 1
Inbound = 1, Outbound = 2, Neutral =3 3
Number of vehicles in Queue per Lane Mile (veh) 216 vpm

20-Minute Delay Results

Number of Episodes of 20-Minute Delay 1
Longest Sustained Episode of 20-Minute Delay 17.21 hours
Total Hours per Day with Delays > 20-min 17.21 hours
Significant Project Based on 20-Minute Delay Threshold? Yes

Maximum Delay (min) 595 min

Total Daily Delay (vehicle-hours) 161,673 vehicle-hours

TPG Index

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4=Rural Other Principal Arterials
5=Urban Minor Arterials, Collectors, Local Roads
6=North Rural Minor Arterials
7=Central Rural Minor Arterials
8=North Rural Collectors and Local Roads
9=Central Rural Collectors and Local Roads
10=Special Recreational

Portion of
Hour with
Delay>20 min

Time Beginning	Estimated Volume	Reduced Volume	Queue (Veh)	Queue (miles)	Delay for Last Arrival of Hour (min)	Restrict Work to Avoid 20 minute delay
0:00	538	538	0	0.0	0	
1:00	388	388	0	0.0	0	
2:00	351	351	0	0.0	0	
3:00	370	370	0	0.0	0	
4:00	502	502	0	0.0	0	
5:00	1023	1023	0	0.0	0	
6:00	2204	2204	654	1.5	25	X
7:00	3010	3010	2114	4.9	82	X
8:00	2673	2673	3237	7.5	125	X
9:00	2323	2323	4010	9.3	155	X
10:00	2291	2291	4751	11.0	184	X
11:00	2378	2378	5579	12.9	216	X
12:00	2451	2451	6480	15.0	251	X
13:00	2488	2488	7418	17.1	287	X
14:00	2732	2732	8600	19.9	333	X
15:00	3168	3168	10218	23.6	396	X
16:00	3413	3413	12081	27.9	468	X
17:00	3316	3316	13848	32.0	536	X
18:00	2530	2530	14827	34.3	574	X
19:00	1967	1967	15244	35.2	590	
20:00	1668	1668	15362	35.5	595	
21:00	1466	1466	15278	35.3	591	
22:00	1151	1151	14879	34.4	576	
23:00	860	860	14189	32.8	549	
45262 45262						

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Hourly Percentages from Table 350 of Traffic Data Report	
1.19%	0.00
0.86%	0.00
0.78%	0.00
0.82%	0.00
1.11%	0.00
2.26%	0.00
4.87%	0.21
6.65%	1.00
5.91%	1.00
5.13%	1.00
5.06%	1.00
5.25%	1.00
5.42%	1.00
5.50%	1.00
6.04%	1.00
7.00%	1.00
7.54%	1.00
7.33%	1.00
5.59%	1.00
4.34%	1.00
3.68%	1.00
3.24%	1.00
2.54%	1.00
1.90%	1.00

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Note: Use this "Quick Version" when the capacity of the WZ does not vary from hour to hour, hourly volumes can be estimated from the AADT and TPG info., and the facility in question is not an existing bottleneck.

Project: I-80 Reconstruction (Phase II) - Int 303 to 304 EB Segment (Highway)
 Analyst: JRE
 Date: 10/7/2015

One Way Work Zone Capacity (veh/hr) 1550 vph Assumes 1 lane WZ Capacity
 One Way AADT (veh/day) 29093 vpd 2025 Vol

Percent of Peak Period (>1000 vph) Traffic Diverted (%) 0 %
 Number of Lanes for Queued Vehicles (lanes) 2
 Percent Trucks (Daily) 8 %
 Traffic Pattern Group (Number 1 to 10) 1
 Inbound = 1, Outbound = 2, Neutral = 3 3
 Number of vehicles in Queue per Lane Mile (veh) 216 vpm

20-Minute Delay Results

Number of Episodes of 20-Minute Delay 2
 Longest Sustained Episode of 20-Minute Delay 8.50 hours
 Total Hours per Day with Delays > 20-min 9.35 hours
 Significant Project Based on 20-Minute Delay Threshold? Yes

Maximum Delay (min) 95 min

Total Daily Delay (vehicle-hours) 16,809 vehicle-hours

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9=Central Rural Collectors and Local Roads
10=Special Recreational

Time Beginning	Estimated Volume	Reduced Volume	Queue (Veh)	Queue (miles)	Delay for Last Arrival of Hour (min)	Restrict Work to Avoid 20 minute delay
0:00	346	346	0	0.0	0	
1:00	250	250	0	0.0	0	
2:00	226	226	0	0.0	0	
3:00	238	238	0	0.0	0	
4:00	323	323	0	0.0	0	
5:00	658	658	0	0.0	0	
6:00	1416	1416	0	0.0	0	
7:00	1935	1935	385	0.9	15	
8:00	1718	1718	553	1.3	21	
9:00	1493	1493	496	1.1	19	
10:00	1472	1472	418	1.0	16	
11:00	1529	1529	397	0.9	15	
12:00	1576	1576	423	1.0	16	
13:00	1599	1599	472	1.1	18	
14:00	1756	1756	678	1.6	26	
15:00	2036	2036	1164	2.7	45	
16:00	2194	2194	1808	4.2	70	X
17:00	2131	2131	2390	5.5	93	X
18:00	1626	1626	2466	5.7	95	
19:00	1264	1264	2180	5.0	84	
20:00	1072	1072	1702	3.9	66	
21:00	942	942	1094	2.5	42	
22:00	740	740	284	0.7	11	
23:00	553	553	0	0.0	0	
	29093	29093				

Hourly Percentages from Table 350 of Traffic Data Report
1.19%
0.86%
0.78%
0.82%
1.11%
2.26%
4.87%
6.65%
5.91%
5.13%
5.06%
5.25%
5.42%
5.50%
6.04%
7.00%
7.54%
7.33%
5.59%
4.34%
3.68%
3.24%
2.54%
1.90%

Portion of Hour with Delay > 20 min

0.00
0.00
0.00
0.00
0.00
0.00
0.00
0.00
0.22
0.64
0.00
0.00
0.00
0.00
0.00
0.78
1.00
1.00
1.00
1.00
1.00
1.00
0.71
0.00

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Project: I-80 Reconstruction (Phase II) - Int 303 to 304 WB Segment (Hig
Analyst: JRE
Date: 10/7/2015

One Way Work Zone Capacity (veh/hr) 1550 vph Assumes 1 lane WZ Capacity
One Way AADT (veh/day) 30950 vpd 2025 Vol

Percent of Peak Period (>1000 vph) Traffic Diverted (%) 0 %
Number of Lanes for Queued Vehicles (lanes) 2
Percent Trucks (Daily) 8 %
Traffic Pattern Group (Number 1 to 10) 1
Inbound = 1, Outbound = 2, Neutral = 3 3
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20-Minute Delay Results

Number of Episodes of 20-Minute Delay 1
Longest Sustained Episode of 20-Minute Delay 15.97 hours
Total Hours per Day with Delays > 20-min 15.97 hours
Significant Project Based on 20-Minute Delay Threshold? Yes

Maximum Delay (min) 148 min

Total Daily Delay (vehicle-hours) 31,907 vehicle-hours

Portion of
Hour with
Delay > 20 min

Time Beginning	Estimated Volume	Reduced Volume	Queue (Veh)	Queue (miles)	Delay for Last Arrival of Hour (min)	Restrict Work to Avoid 20 minute delay
0:00	368	368	0	0.0	0	
1:00	265	265	0	0.0	0	
2:00	240	240	0	0.0	0	
3:00	253	253	0	0.0	0	
4:00	343	343	0	0.0	0	
5:00	700	700	0	0.0	0	
6:00	1507	1507	0	0.0	0	
7:00	2058	2058	508	1.2	20	
8:00	1828	1828	786	1.8	30	
9:00	1589	1589	824	1.9	32	
10:00	1566	1566	841	1.9	33	
11:00	1626	1626	917	2.1	35	
12:00	1676	1676	1043	2.4	40	
13:00	1702	1702	1195	2.8	46	
14:00	1868	1868	1513	3.5	59	
15:00	2166	2166	2129	4.9	82	X
16:00	2334	2334	2913	6.7	113	X
17:00	2268	2268	3631	8.4	141	X
18:00	1730	1730	3811	8.8	148	
19:00	1345	1345	3605	8.3	140	
20:00	1140	1140	3196	7.4	124	
21:00	1002	1002	2648	6.1	103	
22:00	787	787	1885	4.4	73	
23:00	588	588	924	2.1	36	
	30950	30950				

Hourly Percentages from Table 350 of Traffic Data Report	13
1.19%	0.00
0.86%	0.00
0.78%	0.00
0.82%	0.00
1.11%	0.00
2.26%	0.00
4.87%	0.00
6.65%	0.00
5.91%	0.97
5.13%	1.00
5.06%	1.00
5.25%	1.00
5.42%	1.00
5.50%	1.00
6.04%	1.00
7.00%	1.00
7.54%	1.00
7.33%	1.00
5.59%	1.00
4.34%	1.00
3.68%	1.00
3.24%	1.00
2.54%	1.00
1.90%	1.00

I-80 RECONSTRUCTION

HIGHEST VOL SEGMENTS (USE AADT FOR WZ ANALYSIS)

			AADT (2013)		AADT (2025)	AADT (2045)
Eastbound I-80 (between Int 303 - Int 304)	EB	FS	22940	0.02	29093	43231
Westbound I-80 (between Int 303 - Int 304)	WB	FS	24404	0.02	30950	45990
Eastbound I-80 (between Int 306 - Int 307)	EB	FS	34766	0.02	44092	65518
Westbound I-80 (between Int 306 - Int 307)	WB	FS	35689	0.02	45262	67257