

Salem Pedestrian/Bicycle Corridor Demand Analysis

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September 4, 2009

There has been extensive academic and practical work done throughout the United States focused on methodologies to estimate pedestrian and bicycle usage on new or expanded ped/bike corridors. The challenge for all of the published methodologies is that there are many potential variables to be examined. When these variables are cross tabulated with the very small percentages of actual walking and bicycling users, the projected results have been found to have excessive variation and low reliability. After conducting an extensive literature review we have concluded that one report developed a pragmatic demand estimation methodology that is well suited to the Salem Ped/Bike Corridor project. This report presents a similar methodology for bicycle trips and pedestrian trips.

The report entitled *Guidelines for Analysis of Investments in Bicycle Facilities*¹ was completed in 2006 and sponsored by the National Cooperative Highway Research Board. The methodology proposed in this report is based on the U.S. Census journey to work information and the National Household Transportation Survey² combined with detailed land use information from the Salem Assessor's office. The bicycle demand methodology is as follows:

Estimating Bicycle Utilization Potential

1. Estimate the number of residents within a ½, 1.0, and 1½ mile radius (800, 1600 and 2400 meters) of the proposed ped/bike corridor (the catchment area).
2. Multiply the number of residents in each buffer section by 0.4 based on the assumption that nationally 80% of residents are adults and 50% of the adults are commuters. The resulting number is the estimated number of commuters in each buffer segment.

¹ Kevin J. Krizek et al., *Guidelines for Analysis of Investments in Bicycle Facilities* National Cooperative Highway Research Program, Report 552 (Washington, D.C.: Transportation Research Board, 2006).

² Bureau of Transportation Statistics. National Household Transportation Survey (Washington, D.C.: U.S. Department of Transportation, 2001).

3. Multiply these numbers by the region's bicycle commute share, which is 0.182% for Salem. Based on additional research undertaken for the NHCRP Report 552, they determined that a low, medium and high range of potential ridership was feasible.
4. Because commuting adult bicyclists only represent a portion of the total bikers in the community, the above figures need to be extrapolated to estimate the total number of users, not just commuters. The low, moderate and high estimates are then multiplied by 0.8 to arrive at the total number of existing adult bicyclists.
5. The number of children in the buffer area is obtained by multiplying the total number of residents by 0.2 and then by 0.05 to approximate the number of children who ride on a daily basis.
6. Finally, the total estimated adult commuters, other adults, and children are added together and multiplied by their likelihood of bicycling based on the distance from the ped/bike corridor to arrive at estimated daily bicycling potential for those who live within ½ , 1.0 and 1½ mile radii of the trail.

The authors of the NHHRP Report 552 developed a convenient web site to simplify most of the math calculations. The calculator can be found at <http://www.bicyclinginfo.org/bikecost/>.

Estimating Pedestrian Utilization Potential

Because walking is a much more accessible transportation mode, there is a considerably higher incidence of walking in Salem, even without extensive trail and sidewalk infrastructure to support it. After researching pedestrian demand methodologies in the national transportation literature, it was concluded that a consistent methodology as was used to estimate bicycle demand was both consistent and appropriate. We have developed a series of utilization estimates that take into account distance from the proposed ped/bike corridor and land use. Because pedestrians do not walk as far as bicyclists ride, the catchment area for pedestrians has been limited to between ½ mile and 1.0 mile (800 and 1600 meters) radius of the proposed corridor.

Demand Analysis

Land Use Data Base: In order to evaluate the potential use of the Pedestrian/Bicycle

corridor we need to examine the nature of land uses, density and number of people that live and work within the catchment area of the corridor. Because the catchment area for bicycling is three miles wide, it encompasses nearly the entire geographic area of Salem. Using the town assessor’s database we organized the more than 11,000 parcels of land in town into 62 bicycle/pedestrian analysis zones (BPAZ)(see figure 1). We determined the percentages of each zone that were within the specified distances from the existing rail corridor to evaluate land use and population intensity.

The ped/bike corridor was then divided into four analysis segments based on the predominant land uses along the corridor:

- Segment 1: Mass. State line to Kelly Road;
- Segment 2: Kelly Road to the northerly edge of the Rockingham Mall property and the Rockingham racetrack, and directly opposite the driveway entrance to the US Post Office;
- Segment 3: Post Office Driveway to Old Rockingham Road;
- Segment 4: Old Rockingham Road to the Windham town line.

Figure 1: Basic Data for Bike-Ped Analysis Zones

BPAZ #	Land Area in Acres	#units	Bldg SF	Res Calc	Comm Calc	Total Persons
1	324.2529	413	840,390	1,006	2,986	3,991
2	2425.724	2095	3,699,835	5,440	989	6,429
3	253.4209	214	321,524	555	193	747
4	65.51451	185	360,117	121	2,262	2,383
5	147.3792	395	571,723	1,085	78	1,164
6	33.0888	52	88,148	144	24	168
7	67.30216	9	20,265	25		25
8	242.1305	201	832,959	551	715	1,267
9	271.5898	147	1,529,571	28	3,084	3,112
10	7.569995	22	28,754	62		62
11	623.2302	538	889,801	1,404	24	1,427
12	137.31	89	246,089	87	447	534
13	153.568	464	1,087,750	14	4,177	4,191
14	5.530028	3	5,968	6	19	25
15	629.0663	468	919,361	1,269	100	1,369
16	35.95999	4	235,428		323	323
17	43.30129	28	118,209	14	207	221
18	117.2368	245	303,028	472	386	858
19	64.73	3	1,208,785		11,894	11,894
20	93.9829	240	454,262	574	602	1,175
21	179.0486	71	269,685	99	2,198	2,297
22	370.5535	587	700,684	1,309	185	1,495
23	14.42831	20	135,555	6	1,298	1,303
24	183.6358	250	564,709	620	1,922	2,542
25	78.57009	13	425,334	14	1,063	1,076
26	473.725	845	1,348,538	2,363	125	2,487
27	143.1118	323	527,868	834	1,227	2,061
28	22.06288	23	54,971	62	18	80
29	55.35445	51	85,674	131	93	224
30	50.14001	14	377,287	3	3,558	3,561
31	52.18914	61	585,248	14	5,707	5,721
32	402.5003	586	1,093,508	1,615	590	2,205
33	759.1868	633	1,270,784	1,618	605	2,224
34	471.0991	799	1,203,632	2,220	85	2,304
35	53.03914	81	122,596	191	122	313
36	239.6811	465	657,453	1,154	759	1,913
37	48.88003	169	234,255	471	9	480
38	111.4323	77	177,115	215	91	306
39	42.84855	89	152,646	238	150	388
40	10.43003	59	35,055	12	198	210
41	4.3	7	8,549	19		19
42	15.69013	29	42,214	71	34	105
43	28.96706	71	98,422	199		199
44	40.08999	12	259,940		2,558	2,558
45	30.51951	358	319,774	933	130	1,063
46	78.71203	199	262,126	442	366	808
47	41.98326	33	158,975	63	310	373
48	99.4464	47	573,430	25	1,735	1,760
49	33.50002	32	45,634	83	42	125
50	18.44522	61	85,167	3	824	827
51	25.19998	49	211,887	12	1,134	1,146
52	10.55	121	77,382	177	18	195
53	9.711938	6	18,960	17		17
54	1.843733	6	15,643	3	148	151
55	65.3188	655	593,801	1,552	5	1,556
56	64.57998	32	44,402	87		87
57	34.08448	111	165,885	311	5	315
58	15.66003	23	143,006	3	1,378	1,380
59	44.61189	241	313,521	491	202	693
60	15.57	6	13,688	12	12	24
61	13.28127	22	83,865	3	555	558
62	36.08696	77	252,844	48	2,246	2,294
totals	10231.96	13229	27,573,679	30,598	60,214	90,811

From the 2000 U.S. Census we know the existing pedestrian and bicycle utilization figures for that year. According to the 2000 Census there were 27 workers who commuted to work by bicycle and 146 who walked to work in Salem. These figures translate into a bicycle commute share of 0.182% and walking commute share of 0.983%. This snapshot of commuting demand helps us to understand the base level of demand for both bicyclists and pedestrians – but only for the commuting population.

Using both the BPAZ analysis and the four corridor segment delineations, both pedestrian and bicycle demand were then calculated to predict how many new users would be likely to use the ped/bike corridor when it is built.

Figure 2: Bicycle & Pedestrian Demand Estimation

Results of demand estimation from www.bicyclinginfo.org/bikecost/						
	Bicycle Estimate			Pedestrian Estimate		
Segment 1	Low est	Med est	High est	Low	Med	High
Residents	51810	51810	51810	14131	14131	14131
Existing Commuters	37	37	37	55	55	55
New Commuters	9	9	9	25	25	25
Total Existing	555	8852	13064	197	2469	3699
Total new	139	2083	3070	116	1161	1727
Segment 2	Low est	Med est	High est	Low	Med	High
Residents	6990	6990	6990	4048	4048	4048
Existing Commuters	5	5	5	16	16	16
New Commuters	2	2	2	7	7	7
Total Existing	75	1194	1763	56	707	1060
Total new	27	402	593	34	340	506
Segment 3	Low est	Med est	High est	Low	Med	High
Residents	5070	5070	5070	3105	3105	3105
Existing Commuters	4	4	4	12	12	12
New Commuters	1	1	1	6	6	6
Total Existing	54	866	1278	43	542	813
Total new	20	304	448	26	264	392
Segment 4	Low est	Med est	High est	Low	Med	High
Residents	13356	13356	13356	5680	5680	5680
Existing Commuters	10	10	10	22	22	22
New Commuters	3	3	3	10	10	10
Total Existing	143	2282	3368	79	992	1487
Total new	44	656	966	48	477	709
Total -All Segments	Low est	Med est	High est	Low	Med	High
Residents	77227	77227	77227	30698	30698	30698
Existing Commuters	56	56	56	120	120	120
New Commuters	15	15	15	57	57	57
Total Existing	828	13195	19474	427	5363	8036
Total new	245	3674	5414	257	2578	3834

Daily Bicycle Demand

The bicycle demand estimate projected that 56 commuters currently bicycle to work. That figure is double the 2000 Census figure and can be accounted for by considering that only about 30,000 people live in Salem and the remainder that make up the total of 77,227 people live within three miles of the bike corridor in the surrounding communities of Windham, Pelham, Atkinson, Haverhill, Lawrence, Andover, Methuen and Dracut. Factoring in that additional population from these communities makes the estimated existing commuting bike figure proportionately consistent. Knowing the density characteristics of Salem and the surrounding communities, the Low and Medium estimates appear to be the most appropriate figures to use for this corridor evaluation.

The predicted new cyclists from the development of the ped/bike corridor therefore ranges from a low of 245 cyclists per day to a high of 3,674. This is a very large range of predicted bicycle utilization but is indicative of the nature of bicycle demand estimation due to the current very low utilization rates.

Daily Pedestrian Demand

Because the catchment area for pedestrian use of the ped/bike corridor is much smaller (no more than one mile from the trail), the number of people who live and work in that smaller geographic area is also less. National and local pedestrian and bicycle utilization figures indicate that pedestrian activity is normally many times higher than bicycle use. For this reason we believe that it is appropriate to utilize both the medium and high demand estimates summarized in figure 2. The medium to high range is from 2,578 to 3,834 for the entire 5.6 mile corridor length.

Total Daily Demand

Combining the demand projections for bicycles and pedestrians yields a potential total new demand that ranges between 2,823 and 7,508 for the entire corridor. Demand for each of the segments is also included in figure 2.

Annual Corridor Utilization

For comparison purposes with other transportation modes, it is also beneficial to project the annual corridor utilization. Applying the same annualized estimating methodology as the 2003 report of "Salem – Concord Bikeway Demand Estimate"³ will provide a basis of comparison. Figure 3 takes the daily demand data included in figure 2 and separates them into average weekday and weekend trips by season. The Salem-Concord report concluded that weekend trips were three times more prevalent than weekday trips and winter pedestrian/bicycle trial activity was only 25% of the average levels during the other three seasons.

Annualized bicycle and pedestrian demand totals produce overall utilization rates of 2.6 trips per day per 100 population within the catchment area at the low end estimate and 7.15 trips per day per 100 people at the high end. Put another way, the demand projections suggest a low end utilization of one pedestrian or bicycle trip per day for every 38 residents in the catchment area. The high end estimate suggests that there would be one trip per day for every 14 residents.

³ Alta Planning +Design and Rizzo Associates, Salem-Concord Bikeway Demand Estimate (Concord, NH: NH Department of Transportation, 2003).

Figure 3: Annual Ped & Bike Demand

Annualized Bike Demand		Avg Weekday	Avg Weekday	Avg Weekend	Avg Weekend	No. Weekdays	No. Weekend	Annual Wkdays	Annual Wkdays	Annual Wkend	Annual Wkend	Total Annual	Total Annual
Segment	Season	Low	Med	Day Low	Day Med	Days	Days	Low	Med	Low	Med	Low	Med
1	Spring,Summer,Fall	88	1,326	265	3,977	195	79	17,249	258,481	20,964	314,154	41,375	620,024
	Winter	22	331	66	994	65	26	1,437	21,540	1,725	25,848		
2	Spring,Summer,Fall	17	256	52	767	195	79	3,350	49,885	4,072	60,629	8,037	119,659
	Winter	4	64	13	192	65	26	279	4,157	335	4,988		
3	Spring,Summer,Fall	13	193	38	580	195	79	2,482	37,724	3,016	45,849	5,953	90,488
	Winter	3	48	10	145	65	26	207	3,144	248	3,772		
4	Spring,Summer,Fall	28	417	84	1,252	195	79	5,460	81,404	6,636	98,937	13,097	195,264
	Winter	7	104	21	313	65	26	455	6,784	546	8,140		
Total	Spring,Summer,Fall	146	2,192	439	6,577	195	79	28,541	427,493	34,688	519,569	68,462	1,025,436
	Winter	37	548	110	1,644	65	26	2,378	35,624	2,854	42,749		

Annualized Ped Demand		Med	High	Med	High	Wkdays	Wkends	Med	High	Med	High	Med	High
1	Spring,Summer,Fall	739	1,099	2,216	3,297	195	79	144,070	214,305	175,100	260,463	345,582	514,057
	Winter	185	275	554	824	65	26	12,006	17,859	14,407	21,431		
2	Spring,Summer,Fall	216	322	649	966	195	79	42,191	62,790	51,278	76,314	101,204	150,616
	Winter	54	81	162	242	65	26	3,516	5,233	4,219	6,279		
3	Spring,Summer,Fall	168	249	504	748	195	79	32,760	48,644	39,816	59,121	78,582	116,682
	Winter	42	62	126	187	65	26	2,730	4,054	3,276	4,864		
4	Spring,Summer,Fall	304	451	911	1,354	195	79	59,191	87,980	71,940	106,930	141,983	211,040
	Winter	76	113	228	338	65	26	4,933	7,332	5,919	8,798		
Total	Spring,Summer,Fall	1,427	2,122	4,280	6,365	195	79	278,212	413,719	338,134	502,828	667,352	992,395
	Winter	357	530	1,070	1,591	65	26	23,184	34,477	27,821	41,372		

Annualized Ped & Bike Demand		Avg Wkday	Avg Wkday	Avg Wkend	Avg Wkend	No. Weekday	No. Weekend	Annual Wkdays	Annual Wkdays	Annual Wkend	Annual Wkend	Total Annual	Total Annual
Segment	Season	Low	High	Low	High	Days	Days	Low	High	Low	High	Low	High
1	Spring,Summer,Fall	827	2,425	2,482	7,274	390	158	161,318	472,786	196,064	574,617	386,957	1,134,081
	Winter	207	606	620	1,818	130	52	13,443	39,399	16,132	47,279		
2	Spring,Summer,Fall	234	578	701	1,733	390	158	45,541	112,675	55,350	136,943	109,241	270,274
	Winter	58	144	175	433	130	52	3,795	9,390	4,554	11,267		
3	Spring,Summer,Fall	181	443	542	1,329	390	158	35,242	86,367	42,832	104,969	84,535	207,171
	Winter	45	111	136	332	130	52	2,937	7,197	3,524	8,637		
4	Spring,Summer,Fall	332	869	995	2,606	390	158	64,651	169,384	78,576	205,867	155,080	406,305
	Winter	83	217	249	651	130	52	5,388	14,115	6,465	16,938		
Total	Spring,Summer,Fall	1,573	4,314	4,719	12,942	390	158	306,753	841,212	372,823	1,022,396	735,813	2,017,831
	Winter	393	1,078	1,180	3,235	130	52	25,563	70,101	30,675	84,121		

Conclusions

Based on the analysis conducted for this project it is reasonable to conclude that the annual utilization of a completed pedestrian/bicycle corridor adjacent to Route 28 in Salem will be in the range of 736,000 to 2,018 million trips per year for both bicycle and pedestrian travel modes. This results in a low end estimate for average daily use of about one trip for every 34 residents within the catchment area which is very consistent with the utilization developed in the 2006 Salem-Concord Bikeway Demand Estimate.⁴ With longer term acceptance and use of the corridor it is conceivable that corridor use could increase to levels approaching the high end estimate developed in this study of one trip for every 18 residents.

⁴ ibid, p.17.