

APPENDIX E

TRAFFIC FORECAST REPORT

Northern Kentucky Outer Loop Traffic Forecast Report

To help determine the need for potential transportation improvement options for the Northern Kentucky Outer Loop Study, it is necessary to estimate future conditions. This Traffic Forecast Report summarizes the anticipated future conditions within the study area as well as the methodology used to develop the traffic forecasts.

1.0 LEVEL 1 ANALYSIS

The Kentucky Statewide Travel Demand Model version 17 (KYSTMv17), which is maintained by the KYTC Division of Planning and run in TransCAD 6.0 Build 9250, was used to develop average daily traffic (ADT) forecasts for this study. At the time of the analysis, the KYSTM had been updated to reflect a 2017 base year and a 2040 forecast horizon year. Revisions included updated population, household, and employment data. The model structure, script, and estimation parameters were not changed.

1.1 SOCIOECONOMIC DATA

Traffic Analysis Zones (TAZs) form the geographical basis for delineating and organizing the socioeconomic data used by the model to generate the vehicular trips that are assigned to the roadway network. Household and population data, as well as employment and school enrollment, are stored in each of the model's internal zones. These socioeconomic data are used to generate the vehicular trips that are distributed and assigned to the road network.

To prepare the model for this analysis, Stantec began with updating the boundaries of eleven TAZs in the study. These zones were split typically along existing roadways, to better reflect the probable redistribution of traffic with the introduction of potential alignments. **Figure 1** presents the location of the eleven split zones. There were no additional changes to the socioeconomic data for the Level 1 Analysis.

After splitting the 12 zones, for a total of 5,964 zones, the root-mean-square error (RMSE) for the 919 study area links with counts was 66.84 and the RMSE for the 461 links with counts above 5,000 VPD was 46.19. **Table 1** presents a summary of the proportions allocated to each TAZ after the split.

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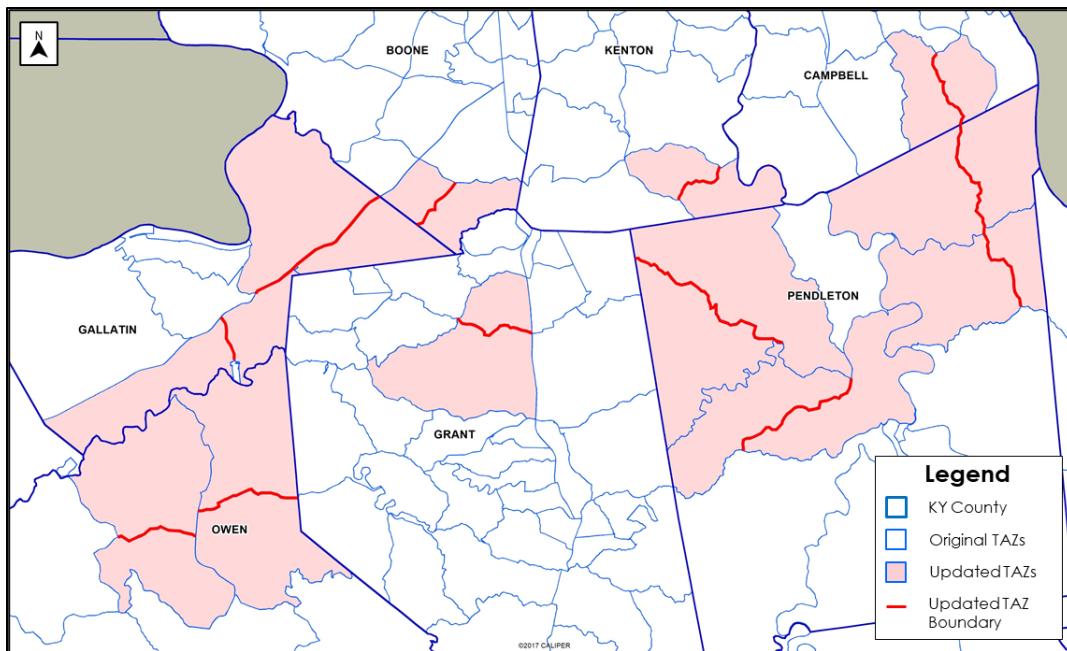


Figure 1: Revised Traffic Analysis Zones

Table 1: Summary of TAZ Splits

Original TAZ	New TAZs	Proportion
3039021	3039062	73%
	3039065	27%
3008011	3008382	39%
	3008383	61%
3041051	3041383	22%
	3041382	78%
3039031	3039064	33%
	3039063	67%
3094021	3094113	62%
	3094114	38%
3094111	3094112	52%
	3094115	48%
3059371	3059524	47%
	3059523	53%
4096041	4096115	58%
	4096116	42%
4096051	4096114	47%
	4096117	53%
4019421	4019582	58%
	4019583	42%
4096011	4096112	61%
	4096119	39%
4096031	4096113	74%
	4096118	26%

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1.2 LEVEL 1 ALTERNATIVES

Seven Level 1 Alternates were identified and analyzed. These alternates begin at various locations along I-71, but all end at KY 9 (AA Highway) near Flagg Spring in Campbell County.

Alternative A

- Starts at I-71, approximately two miles south of the existing Walton KY14 interchange (exit 72), crosses I-75 two miles north of the Crittenden KY 491 interchange (exit 166) and parallels KY 14 before ending at KY 9 (AA Highway) near milepoint 2.6.
- Alternative length is approximately 25 miles.
- Two system interchanges would be required, at I-71 and I-75, with approximately five service interchanges.

Alternative B1

- Starts at the Owenton US 127 interchange (exit 62), crosses I-75 3.2 miles north of Dry Ridge KY 22 interchange (exit 159), and ends at the AA highway (KY 9) between California and Mentor near milepoint 2.1.
- Alternative length is approximately 36 miles.
- Two system interchanges would be required, at I-71 and I-75, with approximately seven service interchanges.

Alternative B2

- Starts at the Owenton US 127 interchange (exit 62), crosses I-75 3.2 miles north of Dry Ridge KY 22 interchange (exit 159) and ends at the AA highway (KY 9) near milepoint 0.6 at the Pendleton/Bracken county line. The western half of Alternative B2 matches Alternative B1.
- Alternative length is approximately 36 miles.
- Two system interchanges would be required, at I-71 and I-75, with approximately six service interchanges.

Alternative C1

- Starts at I-71, at the existing KY 1039 interchange (exit 55), parallels KY 467 to I-75, 3.2 miles north of Dry Ridge KY 22 interchange (exit 159) and ends at the AA highway (KY 9) between California and Mentor near milepoint 2.1.
- Alternative length is approximately 43 miles.
- Two system interchanges would be required, at I-71 and I-75, with approximately eight service interchanges.

Alternative C2

- Starts at I-71, at the existing KY 1039 interchange (exit 55), parallels KY 467 to I-75, 3.2 miles north of Dry Ridge KY 22 interchange (exit 159) and ends at the AA highway (KY 9) near milepoint 0.6 at the Pendleton/Bracken county line. The western half of Alternative C2 matches Alternative C1.
- Alternative length is approximately 43 miles.

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- Two system interchanges would be required, at I-71 and I-75, with approximately seven service interchanges.

Alternative D1

- Starts at I-71, at the existing KY 1039 interchange (exit 55), runs southeast to I-75 about two miles south of the Williamstown KY 36 interchange (exit 154) and ends at KY 9 (AA highway) near milepoint 0.6 at the Pendleton/Bracken county line.
- Alternative length is approximately 48 miles.
- Two system interchanges would be required, at I-71 and I-75, with approximately six service interchanges.

Alternative D2

- Starts at I-71, at the existing KY 1039 interchange (exit 55) and runs southeast to I-75 about two miles south of the Williamstown KY 36 interchange (exit 154). It then runs concurrent with existing I-75 through Williamstown and Dry Ridge then continues east on new alignment to the AA Highway between California and Mentor near milepoint 2.1. The western half of Alternative D2 matches D1 and the eastern half matches Alternative B1.
- Alternative length is approximately 44 miles, excluding the nine-mile section that follows existing I-75.
- Three system interchanges would be required, one at I-71 and two at I-75, with approximately seven service interchanges.

The seven Level 1 alternatives were then coded into the KYSTM network individually to determine the traffic impact each corridor would have on the region. All seven alternatives were run with and without an Ohio River connection to the Cincinnati Eastern Bypass, as shown in **Table 2**. It should be noted that no additional Existing plus Committed (E+C) projects were added to the 2040 network.

Table 2: 2040 Level 1 Traffic Summary

Alternative		2040 Average Daily Traffic (VPD)						
No Ohio River Connection	I-71 to I-75	13,600	5,600	5,700	4,900	5,000	8,600	8,300
	I-75 to US 27	19,300	12,300	6,600	11,900	6,800	7,800	11,700
	US 27 to AA	2,800	6,000	4,000	5,700	4,000	5,300	5,500
With Ohio River Connection	I-71 to I-75	19,400	10,200	9,500	9,400	8,600	10,000	9,600
	I-75 to US 27	35,900	30,700	22,500	30,200	22,600	24,000	28,800
	US 27 to AA	27,100	29,600	24,700	29,400	24,600	26,300	27,900

2.0 LEVEL 2 ANALYSIS

Four alternatives, A, B1, D1, and D2, advanced beyond the level one screening for a more detailed analysis.

2.1 2040 SOCIOECONOMIC UPDATES

The current socioeconomic conditions in the study area counties and the potential for growth with and without new highway alignments were then compared. Baseline population growth anywhere outside of the northern “suburban” counties of Boone and Kenton is expected to be minimal or negative through 2040. Specifically, Campbell County is expected to lose population between 2010 and 2040 while Pendleton, Carroll and Owen counties are all expected to see population grow annually by less than 0.5 percent over the same period. Boone County, however, is expected to experience an annual population growth of 2.1 percent per year.

An analysis was conducted to estimate the remaining “developable land” within each county. Developable land is shovel-ready land and excludes any already developed land, bodies of water, wetlands, right of ways and steep slopes. Developable land is an important indicator for the future development opportunities within a county as shovel-ready land is more attractive to developers than land that requires extensive conditioning – it is essentially the path of least resistance to future development.

All counties within the market area have at least 47 percent of their gross area as developable, with Grant and Boone counties having the highest percentage of gross land as developable at 56 percent, as shown in **Figure 2**. Approximately 21 percent of Kenton County is currently developed leaving 47 percent as developable. A clear distinction can be seen between the northern-most counties (Boone, Kenton and Campbell) and the more rural counties to the south.

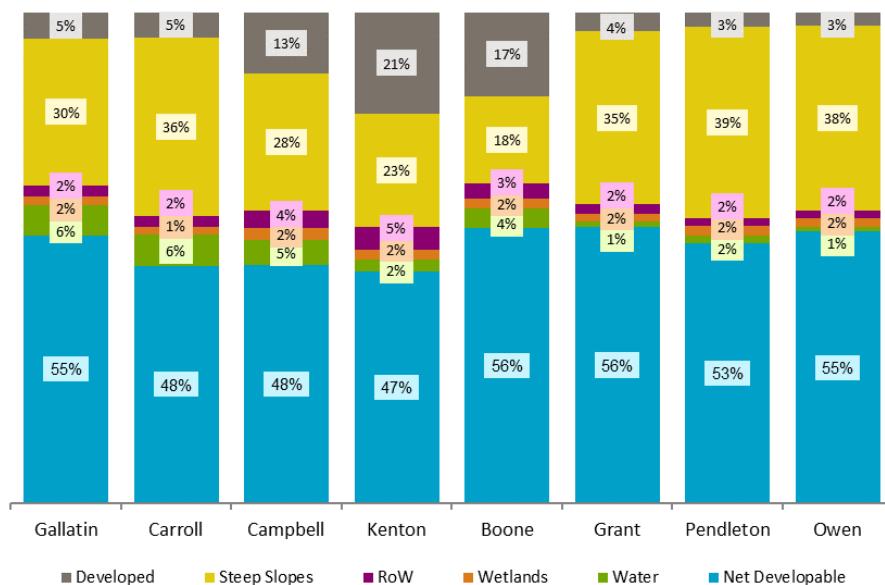


Figure 2: Net Developable Land by County

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An analysis was then performed to determine the socioeconomic impact of each of the four alternatives. Results from the analysis show that rural counties tend to see larger percentage gains over the short-term from development of a new interstate. Based on these results and an assumed opening year of 2030 for the purposes of developing traffic forecasts, Stantec revised the KYSTM's 2040 projections of population, households, and employment projections within each TAZ affected by each potential alignment scenario.

Table 3 presents the baseline “no build” and revised 2040 population, household, and employment growth for each alternative with and without the construction of an interstate bridge at the eastern end of each corridor to connect to Ohio across the Ohio River. A full summary of the TAZ changes can be found attached at the end of this memorandum.

Table 3: KYSTM Base and Revised 2040 Socioeconomic Summary

	Baseline	With Interstate	With Interstate & Bridge	Projected Growth with Interstate	Projected Growth with Interstate & Bridge
POPULATION					
Alternative A	46,852	47,868	49,396	1,016	2,544
Alternative B1	35,083	35,682	36,375	599	1,292
Alternative D1	30,985	31,548	32,207	563	1,222
Alternative D2	45,087	45,984	47,028	897	1,941
HOUSEHOLDS					
Alternative A	18,440	19,707	20,115	409	1,025
Alternative B1	13,463	13,693	13,823	229	493
Alternative D1	12,251	12,446	12,549	222	482
Alternative D2	17,385	17,730	17,917	345	748
EMPLOYMENT					
Alternative A	9,229	9,479	10,012	250	783
Alternative B1	11,816	13,201	13,553	1,385	1,737
Alternative D1	9,338	10,723	11,006	1,385	1,668
Alternative D2	14,758	16,697	17,163	1,939	2,405

2.2 2040 TRAFFIC FORECASTS

Using the updated KYSTM, 2040 daily traffic volumes were developed for each Level Two Alternative for scenarios with (With CEB) and without (No CEB) a bridge to Ohio across the Ohio River. It is evident that an Ohio River crossing would drastically increase the amount of traffic utilizing a new east-west interstate route.

Without an Ohio River bridge, the eastern portion of Alternative A would not be heavily utilized, with only 2,800 (vehicles per day) VPD in 2040. With a bridge, however, that same segment would carry over 27,000 VPD. The portions of Alternative A near the interstate would also be utilized more with an Ohio River crossing, as shown in **Figure 3**. Similarly, Alternative B1 (shown in **Figure 4**) and Alternatives D1 and D2 (shown in **Figure 5**) would also see a significant increase in traffic with a bridge to Ohio.

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Table 4: 2040 Level 2 Traffic Summary

Alternative		2040 Average Daily Traffic (VPD)			
		A	B1	D1	D2
No Ohio River Connection	I-71 to I-75	13,600	5,700	8,700	8,400
	I-75 to US 27	19,300	12,400	7,800	11,800
	US 27 to AA	2,800	6,000	5,300	5,500
With Ohio River Connection	I-71 to I-75	19,800	10,300	10,100	9,600
	I-75 to US 27	36,200	30,900	24,000	28,900
	US 27 to AA	27,100	29,700	26,300	27,900

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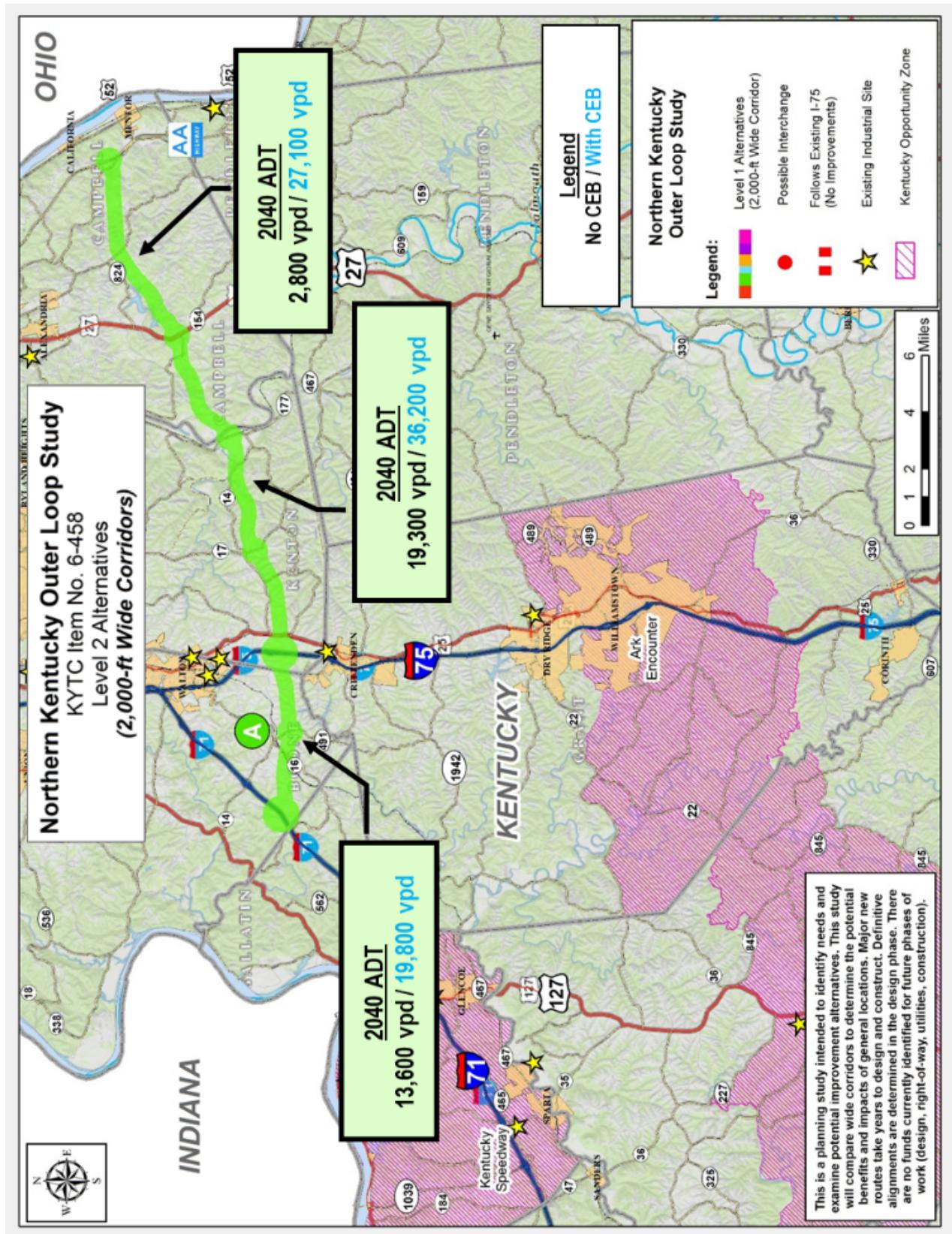


Figure 3: Alternative A – 2040 Daily Traffic Forecasts

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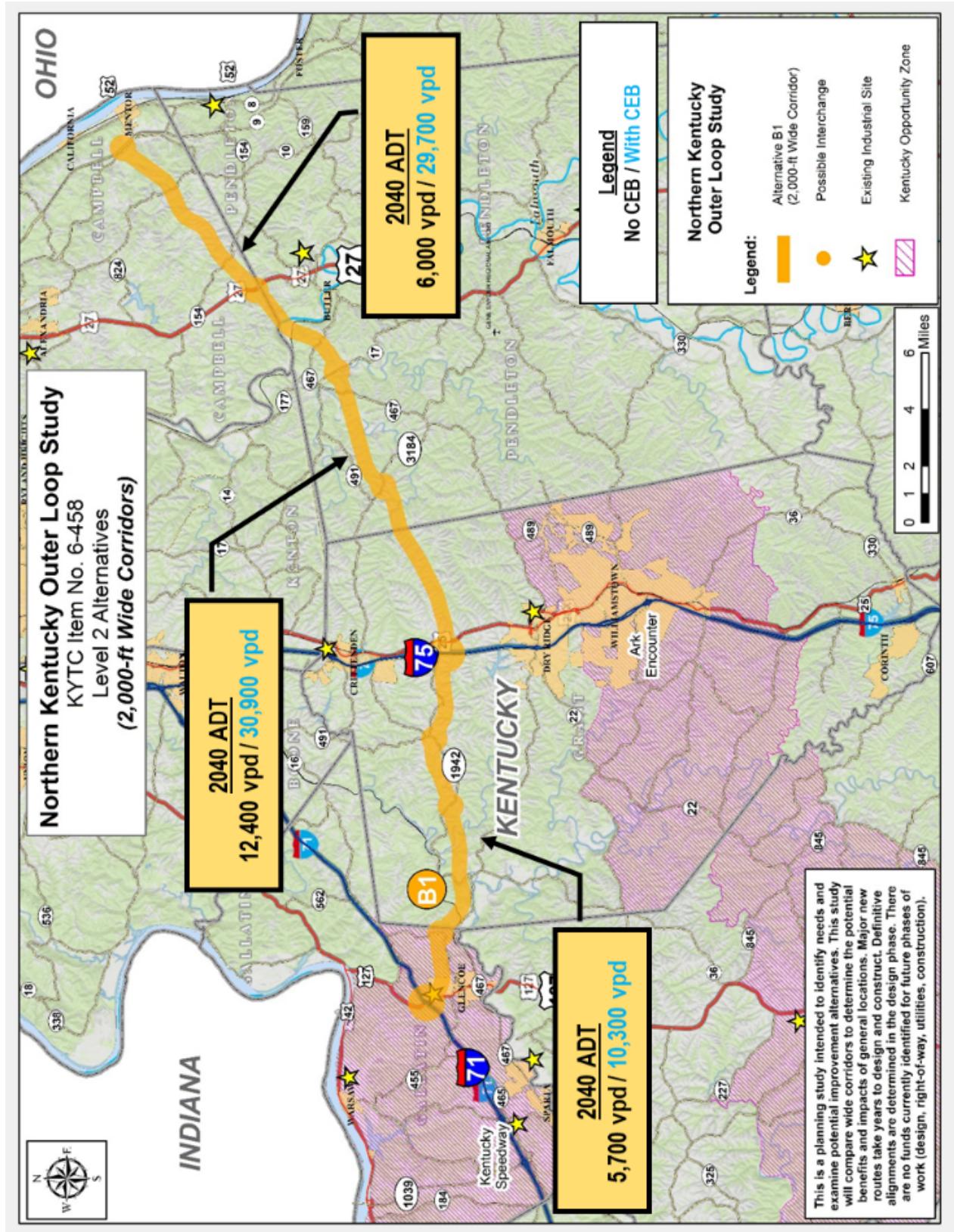


Figure 4: Alternative B1 – 2040 Daily Traffic Forecasts

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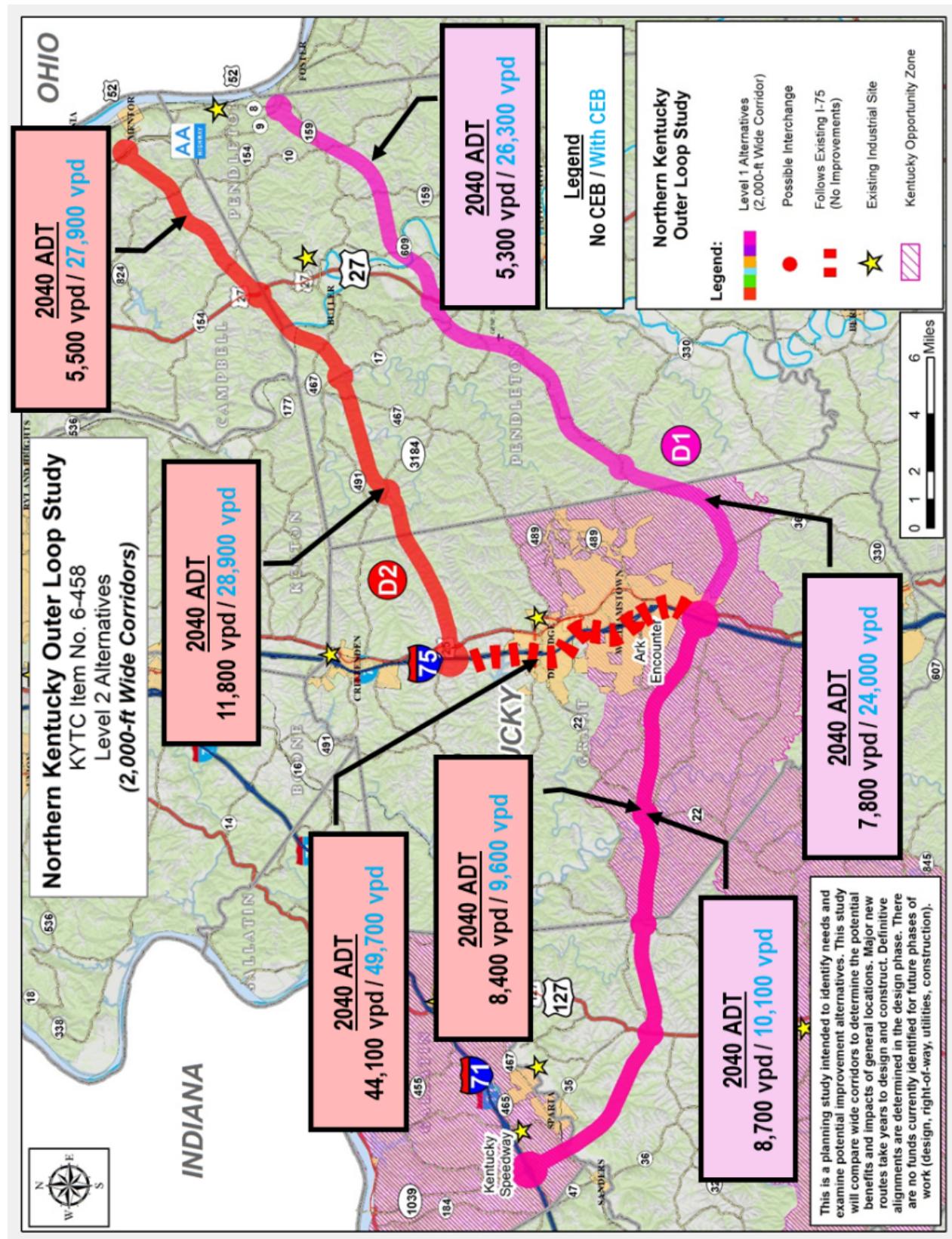


Figure 5: Alternatives D1 & D2 – 2040 Daily Traffic

TAZ	Base						Alt A					
	F_pop	F_HHs	F_Service	F_Retail	F_NonRetail	F_TotalEmp	F_pop	F_HHs	F_Service	F_Retail	F_NonRetail	F_TotalEmp
3008041	5397	2267	55	2	167	224	5687	2389	55	2	167	224
3008383	3552	1398	323	16	131	471	3709	1460	324	16	131	472
3008382	2245	884	205	10	83	297	2344	923	205	10	83	298
3008291	4299	1558	149	105	132	386	4385	1589	149	105	132	387
3008091	2029	799	207	75	572	854	2070	815	207	75	572	854
3039062	2014	778	14	4	4	22	2055	794	16	5	5	25
3008271	2008	981	671	88	251	1010	2048	1001	672	88	251	1011
3041021	1234	442	11	1	10	22	1269	455	12	1	11	25
3041011	1185	461	63	17	161	241	1219	474	70	19	178	267
3041371	1052	418	652	134	122	908	1082	430	762	157	143	1061
3008221	1184	527	26	0	30	56	1208	538	26	0	30	56
3041221	811	316	63	26	50	139	834	325	71	29	57	158
3041041	550	216	49	1	29	79	566	222	56	1	33	91
3041381	573	237	11	24	17	52	589	244	12	27	19	58
3008281	753	326	399	144	58	601	768	333	400	144	58	603
3039065	754	291	5	2	1	8	769	297	6	2	1	9
3041351	425	172	33	4	2	39	437	177	39	5	2	46
3008231	429	178	0	2	40	42	438	182	0	2	40	42
3059361	1720	664	23	18	300	341	1726	666	23	18	301	342
3059011	1345	511	25	10	34	69	1350	513	25	10	34	69
3059111	1172	445	4	13	24	41	1176	447	4	13	24	41
3059121	1017	394	84	37	138	259	1021	395	84	37	139	260
3059151	615	227	50	5	32	87	617	228	50	5	32	87
3059523	488	179	50	0	9	59	490	180	50	0	9	59
3059524	430	157	44	0	8	52	432	158	44	0	8	52
4019031	1515	572	197	245	272	714	1516	572	197	245	272	715
4019071	876	320	185	89	104	378	877	320	186	89	104	379
4019101	1760	658	196	704	295	1195	1761	659	197	707	296	1201
4019391	813	303	0	0	0	0	814	303	0	0	0	1
4019411	614	223	2	0	13	15	615	223	2	0	13	15
4019461	841	323	24	17	7	48	842	323	24	17	7	48
4019471	1219	476	32	29	35	96	1220	476	32	29	35	97

TAZ	Base						Alt B1					
	F_pop	F_HHs	F_Service	F_Retail	F_NonRetail	F_TotalEmp	F_pop	F_HHs	F_Service	F_Retail	F_NonRetail	F_TotalEmp
3041211	3845	1417	455	399	772	1626	4082	1504	518	454	878	1849
3041382	3111	1113	221	749	88	1058	3302	1181	253	856	101	1209
3039051	2455	1028	1658	405	880	2943	2561	1072	1929	471	1024	3423
3039062	2014	778	14	4	4	22	2101	812	16	5	5	26
3041371	1052	418	652	134	122	908	1117	444	784	161	147	1092
3039063	1332	507	30	85	75	190	1390	529	34	96	85	214
3041361	899	307	167	77	76	320	954	326	196	91	89	376
3041383	866	310	61	209	25	295	919	329	70	239	29	337
3041221	811	316	63	26	50	139	861	335	73	30	58	161
3041381	573	237	11	24	17	52	608	252	12	27	19	59
3041041	550	216	49	1	29	79	584	229	58	1	34	93
3039065	754	291	5	2	1	8	787	304	6	2	1	9
3041031	542	209	14	4	29	47	575	222	16	5	33	53
3039064	667	254	15	42	38	95	696	265	17	48	43	108
3094112	603	239	13	2	38	53	632	251	17	3	50	70
3039041	657	273	335	19	112	466	685	285	394	22	132	548
3041351	425	172	33	4	2	39	451	183	40	5	2	48
3041151	418	168	112	6	22	140	444	178	136	7	27	170
3041161	348	144	14	0	47	61	369	153	16	0	53	69
3041181	254	89	0	0	0	0	270	94	0	0	0	0
3059011	1345	511	25	10	34	69	1358	516	27	11	36	74
3041191	206	77	22	16	17	55	219	82	25	18	20	63
3039061	218	98	33	3	22	58	227	102	38	3	26	68
4096021	1572	648	585	4	84	673	1580	651	702	5	101	807
4096112	1411	550	63	40	553	657	1418	553	69	44	610	724
4096115	1217	465	23	12	87	122	1223	467	26	13	98	137
3059523	488	179	50	0	9	59	493	181	56	0	10	66
4096119	903	352	41	26	354	420	908	354	45	29	390	463
4096116	865	331	16	9	61	86	869	333	18	10	68	96
4019031	1515	572	197	245	272	714	1518	573	202	251	279	733
4019461	841	323	24	17	7	48	843	324	26	18	8	52
4019391	813	303	0	0	0	0	814	304	0	0	2	2
4019401	516	205	52	21	0	73	517	205	54	22	0	75
4019582	523	187	1	2	0	3	524	187	1	2	0	3
4019583	379	136	1	1	0	2	380	136	1	1	0	2

TAZ	Base						Alt D1					
	F_pop	F_HHs	F_Service	F_Retail	F_NonRetail	F_TotalEmp	F_pop	F_HHs	F_Service	F_Retail	F_NonRetail	F_TotalEmp
3041251	3029	1022	1440	254	494	2188	3215	1085	1717	303	589	2609
3041231	2818	1191	1111	208	241	1560	2991	1264	1335	250	290	1875
3039011	1766	728	4	9	107	120	1842	759	4	10	119	133
3039063	1332	507	30	85	75	190	1390	529	34	96	85	214
3094011	1143	499	0	0	14	14	1199	523	0	0	18	18
3041131	841	329	30	32	12	74	893	349	35	37	14	86
3041061	676	283	140	69	22	231	718	300	166	82	26	275
3041111	556	205	30	0	55	85	590	218	34	0	63	97
3041071	542	212	38	7	13	58	575	225	45	8	15	69
3021011	808	304	27	10	220	257	839	316	31	11	250	292
3041261	512	196	11	1	9	21	543	208	13	1	10	24
3041291	498	193	22	4	27	53	529	205	25	5	31	61
3041171	466	177	763	0	24	787	495	188	946	0	30	976
3094112	603	239	13	2	38	53	632	251	17	3	50	70
3094113	561	230	7	4	32	43	589	241	9	5	42	56
3094115	560	222	13	1	36	50	588	233	17	1	48	67
3041151	418	168	112	6	22	140	444	178	136	7	27	170
3041141	399	169	11	0	3	14	424	179	13	0	4	17
3041081	355	136	3	0	12	15	377	144	3	0	14	17
3041161	348	144	14	0	47	61	369	153	16	0	53	69
3041341	348	169	30	4	3	37	369	179	36	5	4	45
3041271	327	132	14	2	23	39	347	140	16	2	26	44
3041201	272	121	19	22	81	122	289	128	21	24	90	136
3094114	346	142	4	3	19	26	363	149	5	4	24	33
3041241	221	80	11	94	21	126	235	85	12	106	24	142
3041091	218	87	44	60	48	152	231	92	50	69	55	174
3041101	193	73	14	24	5	43	205	78	16	28	6	50
3041321	177	76	93	0	50	143	188	81	110	0	59	170
3021141	269	88	57	5	15	77	279	91	67	6	18	91
3041311	166	60	0	0	7	7	176	64	0	0	8	8
3041301	142	56	0	0	28	28	151	60	0	0	30	30
4096021	1572	648	585	4	84	673	1580	651	702	5	101	807
4096071	1397	560	58	4	60	122	1404	563	66	5	69	140
4096112	1411	550	63	40	553	657	1418	553	69	44	610	724
3041281	105	51	115	37	59	211	111	54	135	43	69	248
4096115	1217	465	23	12	87	122	1223	467	26	13	98	137
4096119	903	352	41	26	354	420	908	354	45	29	390	463
4096113	859	348	11	19	4	34	863	350	13	23	5	41
4096114	683	276	9	5	11	25	687	277	10	6	13	29
4096116	865	331	16	9	61	86	869	333	18	10	68	96
4096117	758	307	10	5	13	28	762	309	11	6	15	32
4096118	298	121	4	6	2	12	300	122	5	7	2	14

TAZ	Base						Alt D2					
	F_pop	F_HHs	F_Service	F_Retail	F_NonRetail	F_TotalEmp	F_pop	F_HHs	F_Service	F_Retail	F_NonRetail	F_TotalEmp
3041211	3845	1417	455	399	772	1626	4082	1504	518	454	878	1849
3041382	3111	1113	221	749	88	1058	3302	1181	253	856	101	1209
3041251	3029	1022	1440	254	494	2188	3215	1085	1717	303	589	2609
3041231	2818	1191	1111	208	241	1560	2991	1264	1335	250	290	1875
3039011	1766	728	4	9	107	120	1842	759	4	10	119	133
3041371	1052	418	652	134	122	908	1117	444	784	161	147	1092
3039063	1332	507	30	85	75	190	1390	529	34	96	85	214
3094011	1143	499	0	0	14	14	1199	523	0	0	18	18
3041361	899	307	167	77	76	320	954	326	196	91	89	376
3041383	866	310	61	209	25	295	919	329	70	239	29	337
3041131	841	329	30	32	12	74	893	349	35	37	14	86
3041221	811	316	63	26	50	139	861	335	73	30	58	161
3041061	676	283	140	69	22	231	718	300	166	82	26	275
3041381	573	237	11	24	17	52	608	252	12	27	19	59
3041111	556	205	30	0	55	85	590	218	34	0	63	97
3041071	542	212	38	7	13	58	575	225	45	8	15	69
3021011	808	304	27	10	220	257	839	316	31	11	250	292
3041261	512	196	11	1	9	21	543	208	13	1	10	24
3041291	498	193	22	4	27	53	529	205	25	5	31	61
3041171	466	177	763	0	24	787	495	188	946	0	30	976
3094112	603	239	13	2	38	53	632	251	17	3	50	70
3094113	561	230	7	4	32	43	589	241	9	5	42	56
3094115	560	222	13	1	36	50	588	233	17	1	48	67
3041351	425	172	33	4	2	39	451	183	40	5	2	48
3041151	418	168	112	6	22	140	444	178	136	7	27	170
3041141	399	169	11	0	3	14	424	179	13	0	4	17
3041081	355	136	3	0	12	15	377	144	3	0	14	17
3041161	348	144	14	0	47	61	369	153	16	0	53	69
3041341	348	169	30	4	3	37	369	179	36	5	4	45
3041271	327	132	14	2	23	39	347	140	16	2	26	44
3041201	272	121	19	22	81	122	289	128	21	24	90	136
3094114	346	142	4	3	19	26	363	149	5	4	24	33
3041241	221	80	11	94	21	126	235	85	12	106	24	142
3059011	1345	511	25	10	34	69	1358	516	27	11	36	74
3041091	218	87	44	60	48	152	231	92	50	69	55	174
3041101	193	73	14	24	5	43	205	78	16	28	6	50
3041321	177	76	93	0	50	143	188	81	110	0	59	170
3021141	269	88	57	5	15	77	279	91	67	6	18	91
3041311	166	60	0	0	7	7	176	64	0	0	8	8
3041301	142	56	0	0	28	28	151	60	0	0	30	30
4096021	1572	648	585	4	84	673	1580	651	702	5	101	807
4096112	1411	550	63	40	553	657	1418	553	69	44	610	724
3041281	105	51	115	37	59	211	111	54	135	43	69	248
4096115	1217	465	23	12	87	122	1223	467	26	13	98	137
3059523	488	179	50	0	9	59	493	181	56	0	10	66
4096119	903	352	41	26	354	420	908	354	45	29	390	463
4096116	865	331	16	9	61	86	869	333	18	10	68	96
4019031	1515	572	197	245	272	714	1518	573	202	251	279	733
4019461	841	323	24	17	7	48	843	324	26	18	8	52
4019391	813	303	0	0	0	0	814	304	0	0	0	2
4019401	516	205	52	21	0	73	517	205	54	22	0	75
4019582	523	187	1	2	0	3	524	187	1	2	0	3
4019583	379	136	1	1	0	2	380	136	1	1	0	2