

MEMORANDUM

Date: August 28, 2013
To: Rob Ball and KernCOG Modeling Staff
CC: Jessica Kirchner, Impact Sciences
From: Mike Wallace and Richard Lee
Subject: Revised KernCOG Model Dynamic Validation

WC12-2993

This memo documents the updated dynamic validation and sensitivity testing results based on the revised KernCOG Model. Changes to the model and static validation results are documented in the *Cumulative summary of revisions to the KernCOG MIP travel demand Model*, DKS July 2013. The dynamic validation results are based on the model provided by KernCOG staff as presented in the document above, with the addition of the High Speed Rail (HSR) post-processor. The HSR post-processor does not influence the results of this testing.

Tests originally performed in early 2012 were repeated with the revised model for both the base condition and the dynamic test condition. As expected, the model responds equal to or better than the February 2012 version due to the updated inputs and processes that occurred since the original tests were conducted. Overall, the model responds to the types of changes anticipated to be analyzed as part of the Regional Transportation Plan (RTP) and Sustainable Community Strategy (SCS). Details and results of each test are below.

TRANSPORTATION SYSTEM TESTS

The tests below were designed to test the impact of changes to the highway network in terms of routing and overall VMT and different scales keeping the land use inputs constant, and consist of the following tests:

- Widen an existing roadway
- Add or remove an existing roadway connection
- Change the speed on an existing roadway
- Add a toll to a state route



- Test for suppressed/induced demand

Widen an existing roadway

Select a street across a constraint (railroad track, river, or freeway). Add lanes to selected link.

Expectation

Model should show increased volume on subject links. Parallel facility should show similar magnitude decrease in volume. Screenline should show slight increase. Changes should be concentrated near the subject link.

Model Response

Model showed an increase in volume on the subject link in the peak direction. Parallel facilities showed a decrease in volume nearly identical in magnitude to the subject link. The model responded appropriately.

**TABLE 1:
 SUMMARY OF MODEL PERFORMANCE – WIDEN EXISTING ROADWAY**

Screenline Roadways	Peak Hour Volume		Volume Change	
	NB/EB	SB/WB	NB/EB	SB/WB
<i>Street Across Screenline - Calloway Drive from Brimhall Road to Stockdale Highway</i>				
Stockdale Highway - Jewetta Avenue to Buena Vista Road	3,318	3,458	-5	-6
Calloway Drive - Brimhall Road to Stockdale Highway	4,490	3,294	418	9
Coffee Road - Brimhall Road to Truxtun Avenue	5,143	4,940	-383	5
SR 99 - Rosedale Highway to Truxtun Avenue	16,723	18,526	-37	19
Total	29,674	30,218	-7	28

Source: Fehr & Peers, 2013

Add/Remove a Roadway Connection

Select a street across a constraint (railroad track, river, or freeway). Add/remove facilities to increase or decrease connectivity.



Expectation

For the add facility test, expect increased volume on subject link. The parallel facility should show similar magnitude decrease in volume. Screenline should show slight increase. For remove facility test, expect decreased volume on subject link. Parallel facility should show similar magnitude increase in volume. Screenline should show slight decrease.

Model Response

For the add facility test, the parallel facilities showed a similar magnitude decrease in volume and the screenline showed a slight increase. For the remove facility test, the parallel facilities showed a similar magnitude increase in volume and the screenline showed a slight decrease. The model responded appropriately.

**TABLE 2:
 SUMMARY OF MODEL PERFORMANCE – ADD/REMOVE CONNECTION**

Screenline Roadways	Peak Hour Volume		Volume Change	
	NB/EB	SB/WB	NB/EB	SB/WB
<i>Added Link Across Screenline - Connecting Mohawk Street across Kern River</i>				
Stockdale Highway - Jewetta Avenue to Buena Vista Road	3,276	3,477	-47	14
Calloway Drive - Brimhall Road to Stockdale Highway	3,746	3,091	-326	-194
Coffee Road - Brimhall Road to Truxtun Avenue	5,301	4,466	-225	-468
Added Link	1,769	1,607	1,769	1,607
SR 99 - Rosedale Highway to Truxtun Avenue	15,968	17,911	-792	-596
Total	30,060	30,552	379	363
<i>Deleted Street Across Screenline - Calloway Drive from Brimhall Road to Stockdale Highway</i>				
Stockdale Highway - Jewetta Avenue to Buena Vista Road	5,088	4,664	1,765	1,200
Calloway Drive - Brimhall Road to Stockdale Highway	0	0	-4,072	-3,285
Coffee Road - Brimhall Road to Truxtun Avenue	7,139	6,358	1,613	1,423
SR 99 - Rosedale Highway to Truxtun Avenue	17,463	19,184	703	677
Total	29,689	30,206	9	16

Source: Fehr & Peers, 2013



Change Link Speed

Select one street across a constraint (railroad track, river, or freeway) that has a defined screenline developed with subject link and adjacent roadways. Increase and decrease posted speeds by +/- 10 mph on subject facility.

Expectation

As posted speed is increased, volume on selected link should increase and volume on adjacent screenline links should decrease. As posted speed is decreased, volume on selected link should decrease and volume on adjacent screenline links should increase. The influence area should be concentrated near the subject link.

Model Response

For the increased speed test, the parallel facilities showed a similar magnitude decrease and increase in volume, but the decrease was minor on more distant routes. For the decreased speed test, the parallel facilities showed both increases and decreases in volume, but the increases were minor on further distance routes. The model responded appropriately for the increased and decreased speed tests.



**TABLE 3:
 SUMMARY OF MODEL PERFORMANCE – SPEED CHANGE**

Screenline Roadways	Speed		Peak Hour Volume		Volume Change	
	Posted	Adjusted	NB/EB	SB/WB	NB/EB	SB/WB
<i>Increased Speed on Street Across Screenline - Coffee Road from Brimhall Road to Truxtun Avenue</i>						
Stockdale Highway - Jewetta Avenue to Buena Vista Road	35	35	3,319	3,456	-4	-7
Calloway Drive - Brimhall Road to Stockdale Highway	45	45	3,999	3,231	-73	-54
Coffee Road - Brimhall Road to Truxtun Avenue	45	55	5,594	5,020	68	86
SR 99 - Rosedale Highway to Truxtun Avenue	65	65	16,751	18,487	-9	-20
Total			29,663	30,194	-18	4
<i>Decreased Speed on Street Across Screenline - Coffee Road from Brimhall Road to Truxtun Avenue</i>						
Stockdale Highway - Jewetta Avenue to Buena Vista Road	35	35	3,324	3,477	1	13
Calloway Drive - Brimhall Road to Stockdale Highway	45	45	4,482	3,348	410	63
Coffee Road - Brimhall Road to Truxtun Avenue	45	35	5,074	4,831	-452	-103
SR 99 - Rosedale Highway to Truxtun Avenue	65	65	16,770	18,536	10	29
Total			29,650	30,192	-31	3

Source: Fehr & Peers, 2013

Add Toll

Select a corridor of a State Route within the vicinity of a defined screenline. Add tolling to the subject corridor.



Expectation

Screenline facilities parallel to the State Route should show an increase in volume. Facilities perpendicular to the State Route may show slight volume decreases. Screenline should show volume increase.

Model Response

Initial tests used a value of \$3 per mile and the screenline facilities parallel to the subject State Route showed an increase in volumes, but the model was too sensitive and all trips were shifted from the subject corridor due to tolling. This was a very high toll and the cost was reduced incrementally until results were reasonable. The results below are for a toll of \$0.10 per mile. For tolls less than \$0.50 per mile the model behaves reasonably. If tolls greater than this need to be modeled, further calibration may be needed.

**TABLE 4:
 SUMMARY OF MODEL PERFORMANCE – TRAVEL COST (ADD TOLL RATES)**

Screenline Roadways	Peak Hour Volume		Volume Change	
	NB/EB	SB/WB	NB/EB	SB/WB
<i>State Route Corridor - SR 99 from Houghton Road to SR 204</i>				
Stockdale Highway - Jewetta Avenue to Buena Vista Road	3,645	3,572	322	109
Calloway Drive - Brimhall Road to Stockdale Highway	4,507	3,587	435	302
Coffee Road - Brimhall Road to Truxtun Avenue	5,954	5,612	428	677
SR 99 - Rosedale Highway to Truxtun Avenue	14,115	15,419	-2,645	-3,088
Total	28,221	28,190	-1,460	-2,000

Source: Fehr & Peers, 2013

Reduce Roadway Capacity

This test consists of reducing by half the roadway capacity on a State Route within the County. Due to the widespread impact of such a major change, the full model was run to allow for distribution and mode choice to be adjusted through the feedback loop process.



Expectation

Percent change in VMT should increase as capacity is halved. Calculated short-term elasticity should be comparable to results found in research literature. Cervero for example, estimated a short-term elasticity = 0.20-0.50.

Model Response

Percent change in VMT was observed and the model was in the middle of the range. The model responded appropriately.

**TABLE 5:
SUMMARY OF MODEL PERFORMANCE – INTERSTATE CAPACITY REDUCTION**

Performance Measure	Base Scenario	Reduce Roadway Capacity	% Change
Lane Miles	7,419.41	6,689.00	-9.84%
VMT	21,387,326	20,562,331	-3.86%
Elasticity			-0.39

Source: Fehr & Peers, 2013

LAND USE TESTS

The tests of model sensitivity to changes in land use density, design, diversity, destination-proximity, distance to transit, etc. are often referred to as the “Ds” tests. To implement these tests, land use developments by Traffic Analysis Zone (TAZ) were classified into place types and selected to be changed either geographically (move all the development to a different place but retain the development and demographics) or by place type (keep the development in the same location but modify the place type to reflect different “D” variables). The response of the model to these land use changes is compared to results from a well-validated small scale Ds analysis process known as MXD



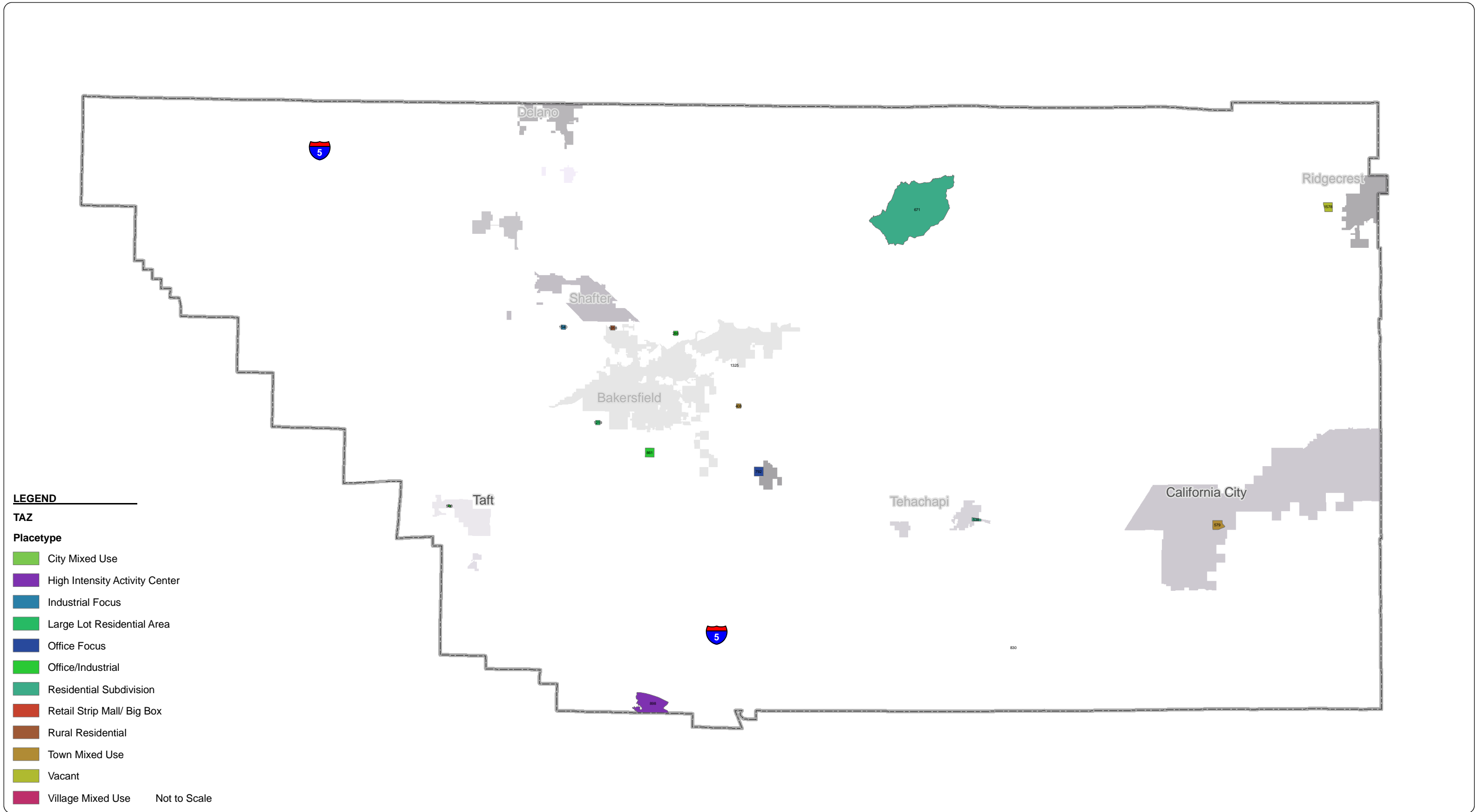
Expectation

When Vehicle Trip (VT) changes due to land use changes predicted by the model are plotted against changes predicted by MXD, the test points should cluster along a diagonal line.

Model Response

The model results show that the model and MXD results do cluster along diagonal line. It should be noted that the California Statewide Ds project developed post-processors to adjust model results for a greater sensitivity to small-scale land use change beyond what was evaluated in this comparison. Many of the variables included in the Statewide Ds processors are sub-TAZ level, and would be useful for enhancing the analysis of large zones or zones near high-quality transit. These tools were delivered to COG staff as part of the Statewide Ds project and could be used in scenario refinement.

The following pages contain the list of zones where land uses were changed, a map showing their location, and the scatter plot of expected vs. observed VMT reduction.



TAZs Used in Land Use Testing
FIGURE 1

SJV MIP - Placetype Summary - Kern

TestNumber	TestType	ZoneType	TAZ_Before	TDFVT_Before	MXDVT_Before	RawModelPT_Before	TAZ_After	TDFVT_After	MXDVT_After	RawModelPT_After	TDFVT_%Delta	MXDVT_%Delta
1	GeographyChange	Primary	803	1	1	1	1540	1	1	1	45%	5%
1	GeographyChange	Primary	1540	650	959	852	803	670	837	907	3%	5%
1	GeographyChange	Adjacent	546	695	1,033	1,177	546	710	1,049	1,167	2%	2%
1	GeographyChange	Adjacent	560	946	1,357	1,649	560	916	1,316	1,540	3%	3%
1	GeographyChange	Adjacent	808	35	48	44	808	34	46	43	3%	4%
1	GeographyChange	Adjacent	1537	218	341	342	1537	214	335	338	2%	2%
1	GeographyChange	Adjacent	1539	216	344	330	1539	210	335	324	3%	3%
1	GeographyChange	Adjacent	1541	3	3	3	1541	3	3	3	2%	3%
1	GeographyChange	Adjacent	1543	0	0	0	1543	0	0	0	99900%	99900%
1	GeographyChange	Adjacent	1611	0	0	0	1611	0	0	0	99900%	99900%
2	GeographyChange	Primary	579	472	707	740	1687	504	750	949	7%	6%
2	GeographyChange	Primary	1687	1,262	2,068	2,518	579	1,461	2,112	2,285	16%	2%
2	GeographyChange	Adjacent	577	620	921	1,033	577	625	924	1,023	1%	0%
2	GeographyChange	Adjacent	578	293	436	485	578	299	442	480	2%	1%
2	GeographyChange	Adjacent	580	235	349	392	580	247	364	409	5%	4%
2	GeographyChange	Adjacent	654	0	0	0	654	0	0	0	99900%	99900%
2	GeographyChange	Adjacent	660	0	0	0	660	0	0	0	99900%	99900%
2	GeographyChange	Adjacent	760	1	1	1	760	1	1	1	0%	0%
2	GeographyChange	Adjacent	914	38	55	60	914	38	56	60	1%	2%
2	GeographyChange	Adjacent	925	1	2	2	925	1	1	2	3%	5%
3	GeographyChange	Primary	169	14	20	23	830	17	26	22	26%	29%
3	GeographyChange	Primary	830	3	5	5	169	3	4	4	24%	26%
3	GeographyChange	Adjacent	167	113	165	169	167	129	186	234	15%	13%
3	GeographyChange	Adjacent	168	511	728	744	168	539	759	869	5%	4%
3	GeographyChange	Adjacent	170	24	33	36	170	20	27	35	17%	18%
3	GeographyChange	Adjacent	827	0	0	0	827	0	0	0	99900%	99900%
3	GeographyChange	Adjacent	831	4	5	5	831	3	5	4	5%	6%
3	GeographyChange	Adjacent	832	0	0	0	832	0	0	0	99900%	99900%
3	GeographyChange	Adjacent	833	73	105	104	833	73	106	102	0%	1%
3	GeographyChange	Adjacent	1310	67	97	89	1310	64	93	87	4%	4%
4	GeographyChange	Primary	538	118	174	197	1502	667	973	1,041	466%	458%
4	GeographyChange	Primary	1502	998	1,517	1,672	538	477	740	812	52%	51%
4	GeographyChange	Adjacent	2	0	0	0	2	0	0	0	99900%	99900%
4	GeographyChange	Adjacent	539	414	616	692	539	421	624	686	2%	1%
4	GeographyChange	Adjacent	544	477	701	783	544	480	697	812	1%	1%
4	GeographyChange	Adjacent	545	483	710	766	545	489	698	770	1%	2%
4	GeographyChange	Adjacent	549	2,425	3,411	3,738	549	2,318	3,192	3,675	4%	6%
4	GeographyChange	Adjacent	797	0	0	0	797	0	0	0	99900%	99900%
4	GeographyChange	Adjacent	1009	0	1	1	1009	0	1	1	0%	0%
4	GeographyChange	Adjacent	1503	2,474	4,155	3,148	1503	2,492	4,115	3,226	1%	1%
4	GeographyChange	Adjacent	1507	1,893	2,899	3,178	1507	1,960	3,012	3,150	4%	4%
4	GeographyChange	Adjacent	1508	1,576	2,398	2,637	1508	3,495	5,664	4,438	122%	136%
4	GeographyChange	Adjacent	1513	1,058	1,729	1,446	1513	1,156	1,883	1,417	9%	9%
4	GeographyChange	Adjacent	1514	1,121	1,801	1,627	1514	1,233	1,979	1,597	10%	10%
4	GeographyChange	Adjacent	1563	1,992	2,965	2,655	1563	2,067	3,077	2,610	4%	4%
4	GeographyChange	Adjacent	1643	0	0	0	1643	0	0	0	99900%	99900%
5	GeographyChange	Primary	454	298	439	621	500	434	614	603	46%	40%
5	GeographyChange	Primary	500	596	801	805	454	439	589	791	26%	26%
5	GeographyChange	Adjacent	455	369	541	714	455	326	478	694	11%	12%
5	GeographyChange	Adjacent	501	2,268	3,336	3,802	501	2,294	3,403	3,766	1%	2%
5	GeographyChange	Adjacent	512	135	201	234	512	135	202	232	0%	0%
5	GeographyChange	Adjacent	514	98	129	164	514	98	127	162	0%	1%
5	GeographyChange	Adjacent	515	253	370	474	515	212	299	354	16%	19%
5	GeographyChange	Adjacent	768	82	119	124	768	81	118	123	1%	1%
5	GeographyChange	Adjacent	769	4	5	4	769	4	5	4	1%	1%
5	GeographyChange	Adjacent	1676	267	399	572	1676	264	382	611	1%	4%
6	PlacetypeChange	Primary	266	194	266	295	266	192	263	292	1%	1%
6	PlacetypeChange	Adjacent	262	1,173	1,763	1,962	262	1,162	1,751	1,946	1%	1%
6	PlacetypeChange	Adjacent	265	697	1,030	1,191	265	708	1,046	1,179	2%	2%
6	PlacetypeChange	Adjacent	270	0	0	0	270	0	0	0	99900%	99900%
6	PlacetypeChange	Adjacent	1365	0	0	0	1365	0	0	0	99900%	99900%
7	PlacetypeChange	Primary	792	364	527	715	792	9	16	21	98%	97%
7	PlacetypeChange	Adjacent	521	569	798	997	521	538	751	979	5%	6%
7	PlacetypeChange	Adjacent	522	217	296	367	522	214	292	361	1%	2%
7	PlacetypeChange	Adjacent	689	204	295	372	689	200	290	367	2%	2%
7	PlacetypeChange	Adjacent	690	123	168	226	690	120	163	222	3%	3%
7	PlacetypeChange	Adjacent	845	55	80	89	845	54	80	89	1%	0%
7	PlacetypeChange	Adjacent	849	4	7	8	849	4	7	8	1%	1%
8	PlacetypeChange	Primary	1578	0	0	0	1578	0	0	0	99900%	99900%
8	PlacetypeChange	Adjacent	731	34	49	46	731	34	48	46	1%	1%
8	PlacetypeChange	Adjacent	735	12	18	20	735	13	19	20	1%	3%
8	PlacetypeChange	Adjacent	758	6	8	7	758	6	7	7	1%	1%
8	PlacetypeChange	Adjacent	842	134	199	220	842	133	198	218	1%	0%
8	PlacetypeChange	Adjacent	981	2	3	3	981	2	3	3	1%	2%
8	PlacetypeChange	Adjacent	982	2	2	2	982	2	2	2	2%	2%
8	PlacetypeChange	Adjacent	1579	0	0	0	1579	0	0	0	99900%	99900%
9	PlacetypeChange	Primary	671	0	1	1	671	12	19	18	4246%	3241%
9	PlacetypeChange	Adjacent	670	9	13	15	670	9	13	14	1%	1%
9	PlacetypeChange	Adjacent	672	480	709	812	672	486	720	805	1%	2%
9	PlacetypeChange	Adjacent	706	0	1	1	706	0	1	1	11%	13%
9	PlacetypeChange	Adjacent	708	3,755	5,204	6,171	708	3,672	5,090	6,056	2%	2%
9	PlacetypeChange	Adjacent	776	2,206	3,173	3,394	776	2,183	3,143	3,364	1%	1%
9	PlacetypeChange	Adjacent	860	1	2	2	860	1	2	2	1%	2%
9	PlacetypeChange	Adjacent	950	1	1	2	950	1	1	2	1%	3%
10	PlacetypeChange	Primary	898	113	166	186	898	570	789	814	404%	375%
10	PlacetypeChange	Adjacent	633	2,216	3,211	3,591	633	2,157	3,108	3,560	3%	3%
10	PlacetypeChange	Adjacent	896	0	0	0	896	0	0	0	99900%	99900%
10	PlacetypeChange	Adjacent	960	7	9	8	960	7	8	8	5%	7%
10	PlacetypeChange	Adjacent	962	4	5	5	962	4	5	5	2%	2%
11	PlacetypeChange	Primary	408	582	835	1,049	408	294	438	511	50%	47%
11	PlacetypeChange	Adjacent	199	193	270	354	199	189	260	348	2%	4%
11	PlacetypeChange	Adjacent	1066	0	0	0	1066	0	0	0	99900%	99900%
11	PlacetypeChange	Adjacent	1067	0	0	0	1067	0	0	0	99900%	99900%
11	PlacetypeChange	Adjacent	1068	86	124	140	1068	85	122	139	2%	2%
11	PlacetypeChange	Adjacent	1069	7	10	10	1069	7	10	10	3%	4%
11	PlacetypeChange	Adjacent	1251	0	0	0	1251	0	0	0	99900%	99900%
11	PlacetypeChange	Adjacent	1253	0	0	0	1253	0	0	0	99900%	99900%

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