



Appendix D

**STREETS
CONCURRENCY
MANAGEMENT
SYSTEM**

Appendix D. Street Concurrency Management System

Street Concurrency Management System Overview

This document provides an overview of the concurrency management system that the City of Brighton will use to build the thoroughfare network by 2040. Two metrics will be used to pace public and private sector investments in the City's streets (one for arterial and collector streets and another for local streets):

Street Classification	Metric	Benchmark
arterials & collectors	lane miles	LOS D criterion using AADT applied at a district level
local streets	intersection density	minimum of 140 intersections per square mile

Arterial/ Collector Street Lane Miles Analysis

A lane miles analysis was used to determine the number of future lane miles of arterial and collector street that will be needed by district in 2015, 2025 and 2040 based on DRCOG population and employment forecasts within the Brighton Planning Area. The following steps were used to conduct this analysis:

Districts

The Brighton Planning area was first divided into eight districts that closely align with existing planning districts. They include the Brighton Core, Bromley Park, Prairie Center, South Sub-Area, Adams Crossing, Todd Creek, Weld County and Barr Lake (see a the map of district boundaries on page 3). With the exception of the Weld County district, the district boundaries correspond with existing DRCOG transportation analysis zone (TAZ) boundaries to allow for use of DRCOG population and employment forecast data (TAZs are identified in the map). Since the Planning Area boundary cuts across the two TAZs in the Weld County district, this district covers part, but not all, of two TAZs. It is estimated that about 70% of the forecast population and forecast employees in the TAZs within this district will be within the portion of the TAZ that falls within the Brighton Planning Area.

Vehicle Miles Traveled (VMT) Generation Rates

Average vehicle miles traveled (VMT) generated by land use within the Brighton Planning Area was estimated using ITE trip generation rates, National Household Travel Survey (NHTS) trip length data, Brighton housing mix data and other factors as presented in Table 1A and 1B. The resulting VMT rates were then converted to average VMT generated by household and employee within the Brighton Planning Area, as summarized in Table D-1, in order to correspond with DRCOG data.

Level of Service (LOS) D Criterion

The Brighton TMP identifies LOS D as the traffic benchmark indicating that the potential need for additional capacity on the affected arterial or collector street should be addressed (through widening or construction of a parallel street). The average annual daily traffic (AADT) thresholds that will be used to determine when a given roadway reaches LOS D in Brighton are shown in Table D-2. This table also shows the maximum AADT per lane that would meet the LOS D threshold for 2-lane, 4-lane and 6-lane roads. The lowest of the three equates to an average of 6,000 vehicles per lane per day. To be conservative, this was the number used for the district-level lane miles analysis.

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Arterial/Collector Lane Miles Analysis by District

Based on the VMT generation rates and DRCOG land use forecasts, the minimum number of arterial and collector lane miles that would be needed in each district to stay within the LOS D benchmark was determined for the years 2015, 2025 and 2040 (see Tables D-3, D-4 and D-5 respectively). The results were then compared to the existing paved lane miles of arterial and collector streets within each district to determine the number of additional lanes miles that would needed to meet the LOS D benchmark by the given year.

It should be noted that it was conservatively estimated that 55% of VMT generated by land uses within the Brighton Planning Area would occur along arterial and collector streets within the Brighton Planning Area. The other 45% of VMT generated by land uses in Brighton would occur along highways, local streets or roads outside the planning area. This ratio also accounts for pass-through traffic on the arterial/collector street network not generated by Brighton land uses. Two factors were used to makes this estimation. First, based on DRCOG origin-destination data it was found that about 29% of VMT generated within the Brighton Planning Area occurs outside of the Brighton City limits. Secondly, based on DRCOG average traffic volume forecasts, it was found the around 45% of VMT within the Brighton Planning Area occurs on the arterial/collector street network.

Findings

The arterial/collector lane miles analysis show that as of 2015 all districts have more than enough lane miles of collector and arterial roads to mead the district-wide LOS D criterion (see Tables D-3, D-4, and D-5) . Additionally, in all but the Brighton Core, there is already more than enough lane miles of collector and arterial road to meet the forecast population and employment growth through the year 2040. This means that much of the existing arterial and collector street network outside the Core Area is overbuilt. However, even though there is more than enough lane miles of arterial and collector streets to meet traffic demand through 2040, new lanes miles of collector and arterial are - and will be - needed to address missing gaps in the street network through much of the Planning Area. This means that virtually all of the new lane miles of collector and arterial streets that will be required by 2040 are likely to be triggered by corridors approaching the LOS D threshold (as oppose to districts), in which case new lane miles should be added that address gaps in the build-out thoroughfare network (missing parallel links) before widening a corridor is considered.

Within the Brighton Core, the results of the lane miles analysis show that an additional 8 lane miles of arterial and collector street will likely be needed by 2025 and an additional 21 lane miles by 2040 to meet the district LOS D benchmark. While some new lane miles can be added to the Brighton Core through future construction projects identified in the CIP (for example, extending Miller Ave north of Bridge Street and restriping), its unlikely 21 lane miles could be added as much of the Brighton Core street network is already built-out and most street corridors are constrained by existing development. Alternatively, given the unique nature of the Brighton Core as compared to other districts, several factors should allow a portion of the future traffic demand to be met without adding new lane miles. These factors include:

- **existing local street grid** - because of the existing, well-connected gridded street network in the Brighton Core, local streets will be able to absorb a higher portion of future traffic demand than other districts where most traffic will typically be directed to the collector/arterial street network.
- **investments in transit and the active transportation network** - (as outlined in the TMP) these investments will pay the most dividends and absorb a higher portion of future travel demand in the Brighton Core where density, land use mix and street connectivity are higher than other parts of the City.
- **rerouting SH-7 from Bridge to Baseline** - (study identified in the CIP) this project, if implemented, will alleviate some of the future traffic demand in the Brighton Core, although further analysis as part of a future study is needed to estimate the specific impact on traffic.

CONCURRENCY MANAGEMENT SYSTEM ZONES

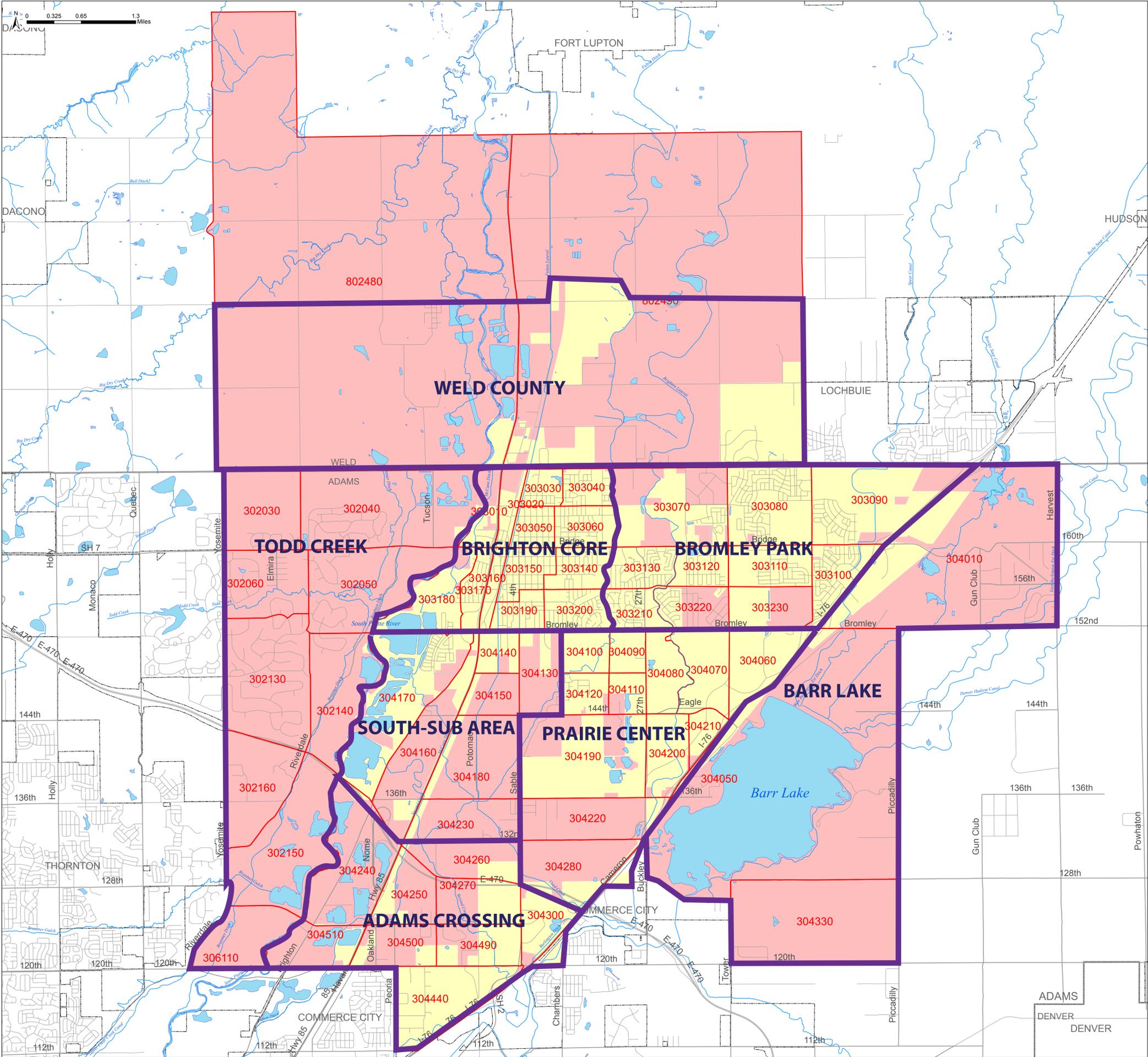
updated 12.30.15

Legend

- Brighton TAZs
- Brighton City Limits

TAZID

- 30203
- 30204
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- 30611
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- 80249



LANE MILES MAP

EXISTING PAVED LANE MILES
FUTURE ARTERIAL/COLLECTOR NETWORK

196 paved centerline miles
342 paved lane miles*

*includes thru lanes and continuous center turn lanes and
73 lane miles along the planning area boundary

updated 12.30.15

Legend

Local or Dirt Road

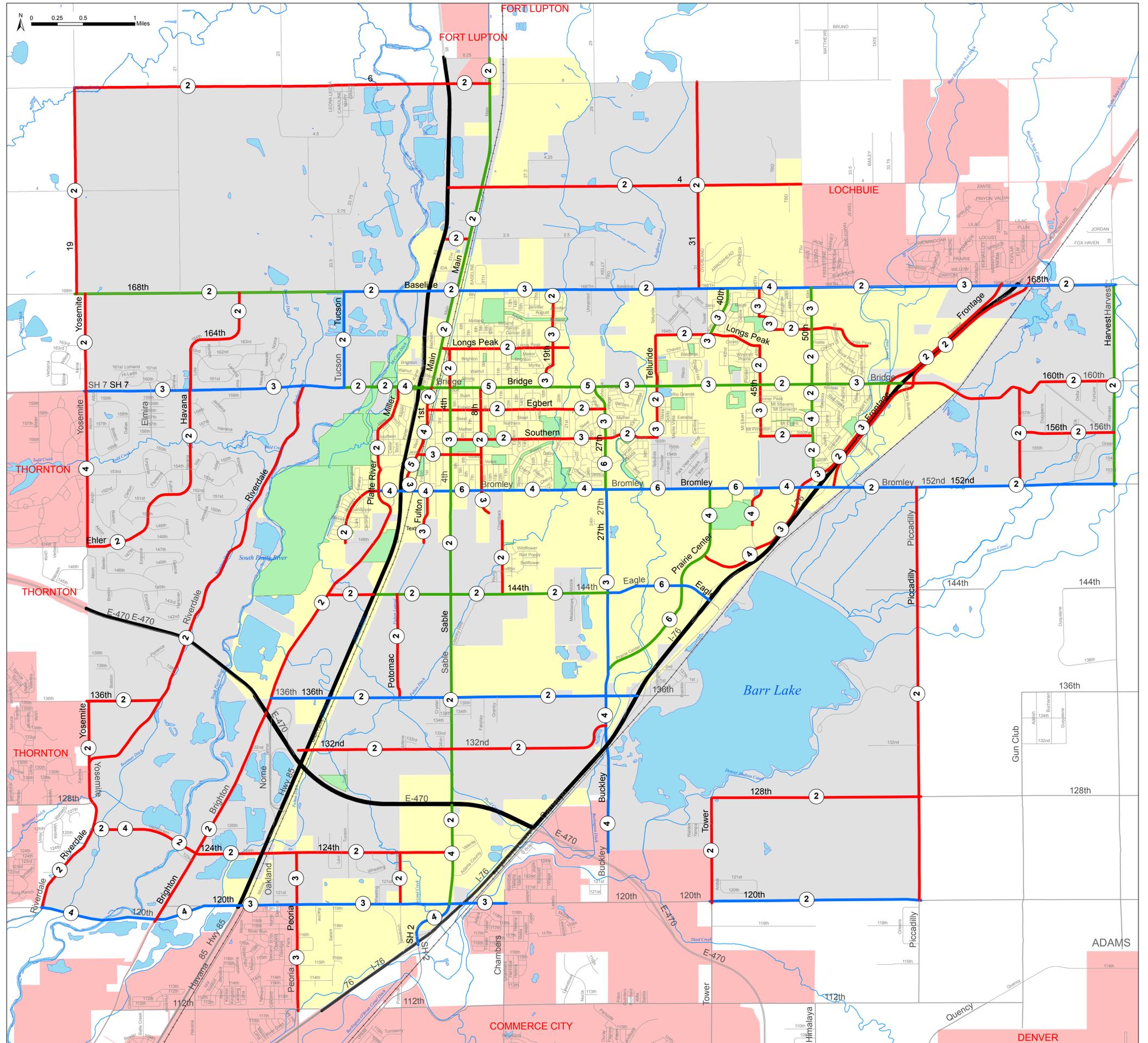
Future Classification

Highway

Major Arterial

Minor Arterial

Collector



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Table D-1. VMT generated by land use

Land Use	VMT per HH or KSF	KSF per employee	VMT per HH or employee
HH's	54	n/a	54
Industrial	25	0.50	12
Office	39	0.30	12
Commercial	90	0.25	23

Table D-2. Brighton LOS D Thresholds

Lanes	AADT	AADT per lane
2	12,000	6,000
3	15,000	n/a
4	32,000	8,000
6	50,000	8,333

Table D-3. 2015 Lane Miles Analysis

District	Households	Industrial Employees	Office Employees	Commercial Employees	Daily VMT Generated	VMT on Brighton Art./Coll. Network	LOS D Minimum Lane Miles (AADT/ 6,000)	2015 Actual Lane Miles	Lane Miles Needed	% Lane Miles Achieved
VMT per unit	54	12	12	23		(55%)				
Brighton Core	6,050	142	3,718	3,324	446,375	245,506	41	43	-2	105%
Bromley Park	4,488	101	1,509	799	278,838	153,361	26	54	-28	211%
Prairie Center	1,425	44	1,829	2,249	149,510	82,231	14	54	-40	394%
South-Sub Area	1,077	56	586	1,927	109,062	59,984	10	26	-16	260%
Adams Crossing	1,402	24	793	447	95,236	52,380	9	29	-20	332%
Todd Creek	1,418	47	232	540	91,899	50,545	8	41	-33	487%
Weld County	688	13	358	828	60,109	33,060	6	30	-24	544%
Barr Lake	529	5	221	496	42,348	23,292	4	33	-29	850%
Total Planning Area	17,077	432	9,246	10,610	1,273,378	700,358	117	310	-193	266%

Table D-4. 2025 Lane Miles Analysis

District	Households	Industrial Employees	Office Employees	Commercial Employees	Daily VMT Generated	VMT on Brighton Art./Coll. Network	LOS D Minimum Lane Miles (AADT/ 6,000)	2015 Actual Lane Miles	Lane Miles Needed	% Lane Miles Achieved
VMT per unit	54	12	12	23		(55%)				
Brighton Core	7,615	144	4,474	3,986	554,539	304,996	51	43	8	85%
Bromley Park	6,059	89	1,416	973	366,188	201,404	34	54	-20	161%
Prairie Center	2,175	16	2,234	2,598	202,205	111,213	19	54	-35	291%
South-Sub Area	2,086	59	625	2,152	169,009	92,955	15	26	-11	168%
Adams Crossing	2,234	70	868	780	149,032	81,968	14	29	-15	212%
Todd Creek	2,608	48	185	535	155,380	85,459	14	41	-27	288%
Weld County	986	261	496	1,019	85,138	46,826	8	30	-22	384%
Barr Lake	1,199	4	130	352	74,130	40,771	7	33	-26	486%
Total Planning Area	24,962	691	10,428	12,395	1,755,621	965,591	161	310	-149	193%

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Table D-5. 2040 Lane Miles Analysis

District	Households	Industrial Employees	Office Employees	Commercial Employees	Daily VMT Generated	VMT on Brighton Art./Coll. Network	LOS D Minimum Lane Miles (AADT/ 6,000)	2015 Actual Lane Miles	Lane Miles Needed	% Lane Miles Achieved
VMT per unit	54	12	12	23		(55%)				
Brighton Core	10,025	108	4,744	4,266	693,458	381,402	64	43	21	68%
Bromley Park	7,770	52	1,572	930	458,803	252,341	42	54	-12	128%
Prairie Center	2,970	16	2,343	2,823	251,402	138,271	23	54	-31	234%
South-Sub Area	2,873	63	623	2,084	209,915	115,453	19	26	-7	135%
Adams Crossing	3,091	69	880	879	197,580	108,669	18	29	-11	160%
Todd Creek	4,067	47	179	522	233,634	128,499	21	41	-20	191%
Weld County	1,255	262	482	977	98,559	54,208	9	30	-21	332%
Barr Lake	2,038	3	119	351	119,182	65,550	11	33	-22	302%
Total Planning Area	34,089	620	10,942	12,832	2,262,533	1,244,393	207	310	-103	149%

Table D-6. Lane Miles Needed by Year

District	2015	2025	2040
Brighton Core	-2	8	21
Bromley Park	-28	-20	-12
Prairie Center	-40	-35	-31
South-Sub Area	-16	-11	-7
Adams Crossing	-20	-15	-11
Todd Creek	-33	-27	-20
Weld County	-24	-22	-21
Barr Lake	-29	-26	-22
Total Planning Area	-193	-149	-103

Table D-7. Change in Lane Miles Needed From 2015

District	2025	2040
Brighton Core	10	23
Bromley Park	8	16
Prairie Center	5	9
South-Sub Area	5	9
Adams Crossing	5	9
Todd Creek	6	13
Weld County	2	4
Barr Lake	3	7
Total Planning Area	44	91

**Table 1A - Land Use to Vehicle Miles Traveled (VMT)
City of Brighton**

ITE Code	Land Use	Unit ¹	(A)	(B)	(C)	(D)	(A)x(B)x(C)x(D) = VMT
			Trip Generation Rates ²	Trip Rate Adj. Factor ³	Trip Length Weighing Factor ⁴	Average Miles per Trip ⁵	
			Avg. Weekday				
210	Single Family	DU	9.52	0.50	126%	9.7	58.2
220	Apartment	DU	6.65	0.50	126%	9.7	40.6
240	Mobile Home	DU	4.99	0.50	126%	9.7	30.5
110	Industrial	KSF	6.97	0.50	73%	9.7	24.7
710	Office	KSF	11.03	0.50	73%	9.7	39.1
820	Commercial	KSF	42.70	0.33	66%	9.7	90.2

¹DU = Dwelling Unit; KSF = 1000 Square Feet

²Source: "Trip Generation" Institute of Transportation Engineers, 9th Edition, 2012

³To convert trip ends to vehicle trips, the standard adjustment factor is 50%. Due to pass-by trips, commercial trip adjustment factors are lower as derived from the following formula (0.50*(1-passby pct)) Pass-by pct = 34% on average.

⁴As documented in Table 6 of the 2009 National Highway Travel Survey (NHTS) by FHWA, vehicle trips from residential development are approximately 126% of the average trip length. Conversely, shopping trips are approximately 66% of the average trip length and other nonresidential development typically accounts for trips that are 73% of the average for all trips.

⁵Average Vehicle Trip Length (All Purposes) from Table 6 of the 2009 National Highway Travel Survey (NHTS)

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Table 1B. Average Brighton Household VMT Generation Rates

HH Type	% in Brighton (2013) ¹	VMT per HH ²	VMT per HH (average in Brighton)
Single Family	79%	58.2	45.9
Apartment	16%	40.6	6.3
Mobile Home	6%	30.5	1.7
Total	100%		53.9

Source:

1. American Community Survey (single family = 1 unit attached and detached; apartment = 2 or more units; mobile home = mobile home or RV)
2. see Table 1A for how VMT rates per household were estimated

Local Street Intersection Density

Per Chapter 2 of the Brighton TMP, the City of Brighton will use a benchmark of a minimum of 140 intersections per square mile to guide future development of the local street network. The City will use LEED-ND (Neighborhood Development) guidelines to measure intersection density.

LEED-ND Standards

Page 47 of *LEED 2009 for Neighborhood Development* states the **intersection density requirements** as follows:

"Option 1. Projects with Internal Streets

Design and build the project such that its internal connectivity is at least 140 intersections per square mile (54 intersections/square kilometer). All streets and sidewalks that are counted toward the connectivity requirement must be available for general public use and not gated. Gated areas are not considered available for public use, with the exception of education and health care campuses and military bases where gates are used for security purposes."

Page 50 of *LEED 2009 for Neighborhood Development* states **the definition of intersection density** as follows:

"connectivity the number of publicly accessible intersections per square mile (square kilometer), including any combination of streets, dedicated alleys, transit rights-of-way, and nonmotorized rights-of-way. If one must both enter and exit an area through the same intersection, such an intersection and any intersections beyond that point are not counted; intersections leading only to cul-de-sac are also not counted. The calculation of square mileage (square kilometer) excludes water bodies, parks larger than 1/2 acre (0.2 hectares), public facility campuses, airports, rail yards, slopes over 15%, and areas nonbuildable under codified law or the rating system. Street rights-of-way may not be excluded."

2015 Brighton Intersection Density Analysis

All street and trail intersections (as defined by the LEED-ND) were mapped by district in the Brighton Planning Area (see map on next page). The intersection density as of 2015 was estimated for each district (see table below). The results show that the only district with an intersection density above the minimum standard of 140 intersections per square mile (as set forth by the TMP) is the Brighton Core, which has 178 intersections per square mile. In the future intersection density will be tracked as part of the City's transportation indicators dashboard.

District	Intersections	Area (sq mi)	Excluded Area* (sq mi)	Included Area (sq mi)	Intersection Density (intersections per sq mi)
Brighton Core	507	3.8	1.0	2.9	178
Bromley Park	438	6.4	0.3	6.1	71
Prairie Center	82	6.4	0.4	6.0	14
South Sub-Area	76	5.1	1.1	4.1	19
Adams Crossing	46	5.7	0.6	5.1	9
Todd Creek	85	10.4	2.6	7.8	11
Weld County	89	14.3	0.4	13.9	6
Barr Lake	40	12.7	6.7	6.0	7
Brighton Planning Area	1,272	64.9	13.1	51.9	25

* Please note: all parks larger than 0.5 acres (including land preserved for open space and trail corridors), water bodies, public facility campuses (including school campuses, municipal campuses and medical campuses) and airports were estimated and excluded from the land area calculation per LEED-ND standards. However, slopes over 15% and other nonbuildable land was not estimated and thus not excluded. More detailed analysis will be needed in the future to identify and exclude these areas from future intersection density analyses.

INTERSECTION DENSITY

within Brighton Planning Area
updated 1.7.16

• Intersections

