Transportation Gap Analysis and Refined Corridor/Intersection Analysis Report (Tasks 3.6 and 4.2)

THE GRAND VISION™
Land Use & Transportation Strategy

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1.0 Introduction

The purpose of this report is to utilize the Social, Economic, and Environmental (SEE) data compiled in task 3.5 to examine the needs for the region's transportation system on a corridor segment level. The data used to prepare the report for task 3.5 was based on a green infrastructure inventory and a right-of-way inventory. For this report, each of the 11 corridors of significance is analyzed for projected capacity issues on a segment-by-segment basis. Segments that have projected level of service D or worse are identified as transportation gaps. Then, using the SEE data in conjunction with the community vision established through the public involvement process, physical improvements are identified that are necessary to fill the transportation gaps within each corridor.

The recommended mitigation strategies for high crash concentration locations are included in each corridor's proposed improvement discussion, where applicable. For details on the crash analysis methodology, refer to the *Task 3.1.6 Crash Analysis Report*.

2.0 Transportation gap analysis methodology

For the "Villages" land use scenario, the anticipated 2035 service conditions for corridor segments have been calculated. To perform these calculations, two key components were necessary:

(1) 2035 directional design hour traffic volumes, and
(2) Link directional design hour capacity.

This section details the methodology utilized to calculate these two components.

2.1 2035 Directional Design Hour Traffic Volumes calculation

The exact method for calculating future traffic volumes varies depending on the available data for the corridor. The Michigan Department of Transportation maintains a sufficiency database for state trunklines. The sufficiency data for 2007 average daily traffic (ADT) is utilized where it is available for the corridors. For city and county roads, the 2007 ADT from the travel demand model is utilized. The procedure for calculating the 2035 Directional Design Hour Traffic Volumes for these two situations is outlined below.

2.1.1 For county and city roads

1. The 2007 ADT was identified. This is the ADT based on actual traffic counts as calculated in the *Travel Demand Methodology (TDM) Report*.
2. The 2007 TDM ADT from the validation model run was identified. This is the modeled ADT based on existing roadway network conditions.
3. The 2035 TDM ADT from the validation model run was identified. This is based on the "Villages" land use scenario with the Hammond Road link from Keystone to LaFranier included.
4. The growth rate from the 2007 TDM ADT to the 2035 TDM ADT was calculated.
5. The calculated growth rate was applied to the 2007 ADT from step 1 above to obtain the 2035 ADT.
6. A peak hour factor and a directional factor were applied to the 2035 ADT to obtain the 2035 Directional Design Hour Traffic Volume. The peak hour factors and directional factors are taken from recommended values in the Highway Capacity Manual.

2.1.2 For state trunklines

1. The 2007 ADT was identified. This is the ADT from MDOT's 2007 sufficiency data.
2. The 2007 TDM ADT from the validation model run was identified. This is the modeled ADT based on existing roadway network conditions.
3. The 2035 TDM ADT from the validation model run was identified. This is based on the "Villages" land use scenario with the Hammond Road link from Keystone to LaFranier included.
4. The growth rate from the 2007 TDM ADT to the 2035 TDM ADT was calculated.
5. The calculated growth rate was applied to the 2007 ADT from step 1 above to obtain the 2035 ADT.

6. A peak hour factor and a directional factor were applied to the 2035 ADT to obtain the 2035 Directional Design Hour Traffic Volume. The peak hour factors and the directional factors are taken from the 2007 MDOT sufficiency data.

2.2 Link Directional Design Hour Capacity

As in the traffic volume calculations, the method for determining roadway capacity varies depending on the data available. For state trunklines, the capacity information is taken directly from 2007 sufficiency data. For city and county roads, the capacity for each link is calculated by the method outlined below.

The directional design hour capacity for each city and county link in the roadway network was calculated based on the specific methodology prescribed in Chapter 30 of the *Highway Capacity Manual*, 2000 edition (HCM). The HCM is published by the Transportation Research Board and is the industry accepted standard for determining highway capacity. Chapter 30 is entitled "Areawide Analysis Methodology" and it provides equations and values necessary to calculate link capacity. Page 30-4 of the HCM outlines specific capacity calculations for four system subtypes: freeways, rural multilane highways, rural two-lane highways and arterials. For the TC-TALUS study area, the freeway subtype does not apply because there are no facilities of this type within the study boundary. The remaining three subtype capacity calculations are detailed below.

2.2.1 Rural multilane highways

The capacity for this subtype is based on generally uninterrupted flow and is calculated according to equation 30-1 of the HCM:

$$c = Q * N * f_{HV} * f_p * PHF$$

where

- c = Capacity in vehicles per hour
- Q = Passenger Car Equivalent Capacity (PCE) in passenger cars/hour/lane
- N = Number of through lanes (not including auxiliary lanes)
- f_{HV} = Heavy vehicle adjustment factor
- f_p = Driver population adjustment factor
- PHF = Peak-hour factor

The selection of the factors for equation 30-1 is based on a combination of generally accepted default values and, where possible, values based on specific knowledge of the corridor link. The specific values for each rural multilane corridor link and the resulting capacity calculation are detailed in the **Rural Multilane Capacity Table**.

Table 1 Rural Multilane Capacity

Per equation 30-1, HCM

		Q	N	f_{HV}					f_p	PHF	c
Segment	**Free Flow Speed**	**PCE Capacity**	**Number of Through Lanes**	**Percent Trucks**	**Percent RV's**	**Passenger car equivalent for trucks**	**Passenger Car Equivalent for RV's**	**Heavy Vehicle Adjustment Factor**	**Driver Population Factor**	**Peak Hour Factor**	**Capacity**
S. Airport (Garfield to Townline)	45	1900	2	0.08	0.02	2.5	2	0.88	1	0.88	2933
S. Airport (Townline to 3 Mile)	45	1900	1	0.08	0.02	2.5	2	0.88	1	0.88	1467
3 Mile (S. Airport to US-31)	45	1900	2	0.08	0.02	2.5	2	0.88	1	0.88	2933
Garfield (Hammond to Boone)	45	1900	2	0.05	0.02	2.5	2	0.91	1	0.88	3054
Silver Lake (Barnes to Division)	45	1900	2	0.05	0.02	2.5	2	0.91	1	0.88	3054

2.2.2 Rural two-lane highways

The capacity for two-lane rural roads with generally uninterrupted flow is calculated according to equation 30-2 of the HCM:

$$c = Q * f_{HV}$$

where

c = Capacity in vehicles per hour

Q = 1700 passenger cars/hour/lane

f_{HV} = Heavy vehicle adjustment factor

The selection of the heavy vehicle factor for equation 30-2 is based on specific knowledge of the corridor link. The specific values for each rural two-lane corridor link and the resulting capacity calculation are detailed in the **Rural Two-Lane Capacity Table**.

Table 2 Rural Two-Lane Capacity

Per equation 30-2, HCM

		f_{HV}					
Segment	**Q**	**Percent Trucks**	**Percent RV's**	**Passenger car equivalent for trucks**	**Passenger car equivalent for RV's**	**Heavy Vehicle Adjustment Factor**	**Capacity**
Keystone	1700	0.08	0.02	1.9	1.1	0.93	1583
3 Mile (Garfield to S. Airport)	1700	0.08	0.02	1.9	1.1	0.93	1583
Hammond (3 Mile to 5 Mile)	1700	0.08	0.02	1.9	1.1	0.93	1583
Garfield (3 Mile to Hammond)	1700	0.04	0.02	1.9	1.1	0.96	1638
W. Silver Lake (US-31 to Barnes)	1700	0.04	0.02	1.9	1.1	0.96	1638
N. Long Lake Road	1700	0.04	0.02	1.9	1.1	0.96	1638
Cass (Keystone to 14th)	1700	0.04	0.02	1.9	1.1	0.96	1638
S. Airport (Townline to 3 Mile)	1700	0.04	0.02	1.9	1.1	0.96	1638

2.2.3 Arterials

For purposes of this capacity calculation, an arterial is defined as a corridor segment in an urbanized area with traffic flow interrupted regularly by stop or traffic signal controlled intersections. The capacity of arterials is calculated according to equation 30-3 of the HCM:

$$c = s_o * N * f_w * f_{HV} * f_g * f_p * f_{bb} * f_a * f_{LU} * f_{LT} * f_{RT} * f_{Lpb} * f_{Rpb} * PHF * g/C$$

where

- c = Capacity in vehicles per hour
- s_o = Base saturation flow rate per lane
- N = Number of through lanes
- f_w = Lane-width adjustment factor
- f_{HV} = Heavy vehicle adjustment factor
- f_g = Grade adjustment factor
- f_p = Parking lane / parking activity adjustment factor
- f_{bb} = Bus blockage adjustment factor
- f_a = Area adjustment factor
- f_{LU} = Lane usage adjustment factor
- f_{LT} = Left-turns adjustment factor
- f_{RT} = Right-turns adjustment factor
- f_{Lpb} = Pedestrian adjustment for left turns
- f_{Rpb} = Pedestrian/bicycle adjustment for right turns
- PHF = Peak-hour factor
- g/C = Effective green time per cycle

The selection of the factors for equation 30-3 is based on a combination of generally accepted default values and, where possible, values based on specific knowledge of the corridor link. The specific values for each arterial corridor link and the resulting capacity calculation are detailed in the **Arterial Capacity Table**.

Table 3 Arterial Capacity

Per Equation 30-3, HCM

Segment	s_o Saturation Flow Rate	N Number of Through Lanes	f_w Lane Width	f_w Lane Width Adj.	f_{HV} Percent Commercial	f_{HV} Heavy Vehicle Adjustment	f_g Grade %	f_g Grade Adj.	f_p Parking Maneuvers per hour	f_p Parking Adjustment (1 for no parking)	f_{bb} Buses stopping per hour	f_{bb} Bus Blockage	f_a Area Type	f_{LU} Lane Util.	f_{LT} LT Adj.	f_{RT} RT Adj.	f_{Lpb} LT ped.	f_{Rpb} RT ped.	PHF	g/C	c Capacity
Hammond (Keystone to 3 Mile)	1900	2	12	1	8	0.93	0	1	n/a	1	0	1.00	1	1	1	1	0.99	0.99	0.93	0.5	1604
S. Airport (W. Silver Lake to US-31)	1900	1	12	1	8	0.93	0	1	n/a	1	0	1.00	1	1	1	1	0.99	0.99	0.93	0.5	802
S. Airport (US-31 to Garfield)	1900	2	12	1	8	0.93	0	1	n/a	1	4	0.98	1	0.95	1	1	0.99	0.99	0.93	0.5	2099
Garfield (Boon to Carver)	1900	2	12	1	8	0.93	0	1	n/a	1	4	0.98	1	0.95	1	1	0.99	0.99	0.93	0.5	2099
Garfield (Carver to US-31)	1900	1	12	1	8	0.93	0	1	n/a	1	4	0.98	1	1	1	1	0.99	0.99	0.93	0.5	1105
14th (Division to Cass)	1900	1	12	1	4	0.96	0	1	n/a	1	0	1.00	1	1	1	1	0.99	0.99	0.93	0.5	1166
Cass (14th to 8th)	1900	1	12	1	4	0.96	0	1	n/a	1	4	0.98	1	1	0.95	0.85	0.99	0.99	0.93	0.5	926
8th (Cass to Garfield)	1900	2	12	1	4	0.96	0	1	n/a	1	4	0.98	1	1	0.95	0.85	0.99	0.99	0.93	0.5	1852

2.3 Volume to capacity ratio

The ratio of the directional design hour traffic volume to the directional design hour capacity is an indicator of how the corridor link is expected to function. This ratio is expressed as a decimal percentage and is known as the volume to capacity ratio or v/c ratio. A corridor link's congestion level is directly proportional to its v/c ratio.

2.4 Level of service

The v/c ratio of each link is an indicator of how the link will function. The v/c ratios of each link are grouped into ranges that indicate operational characteristics. These operational characteristics are analogous to the Level of Service (LOS) categories as shown in **Table 4**.

Table 4 Level of Service Definitions

Level of Service	Definition	Volume to Capacity Ratios
A	Conditions of free flow; speed is controlled by driver's desires, speed limits or physical roadway conditions	0.0 to 0.34
B	Conditions of stable flow; operating speeds beginning to be restricted; little or no restrictions on maneuverability from other vehicles	0.35 to 0.50
C	Conditions of stable flow; speeds and maneuverability more closely restricted; occasional backups behind left-turning vehicles at intersections	0.51 to 0.74
D	Conditions approach unstable flow; tolerable speeds can be maintained but temporary restrictions may cause extensive delays; little freedom to maneuver; comfort and convenience low; some motorists at intersections, especially motorists making left turns, may wait through one or more signal changes	0.75 to 0.89
E	Conditions approach capacity; unstable flow with stoppages of momentary duration; maneuverability severely limited	0.90 to 0.99
F	Forced flow conditions; stoppages for long periods; low operating speeds	Greater than 1.00

Using the above definitions, level LOS C is used as the threshold for evaluating segments for future service condition improvements. Recommendations for corridor improvements are based on links that have LOS D or below.

2.5 Analysis results

The results of the two analysis methods are presented in **Tables 2 and 3**, and again in individual corridor tables. The results show the anticipated level of service during the 2035 design year for the defined

segments of each corridor. Segments with an anticipated level of service of “D,” “E” or “F” are highlighted in the tables according to the manner in which the capacity issue is proposed to be addressed.

Segments highlighted in green are those segments for which physical improvements are both feasible and in alignment with the regional Vision. These are segments of roadway that can be physically widened and are outside of the areas identified as higher density, walkable downtowns or cities in the regional Vision. Capacity improvements on these segments will help them more efficiently serve as longer distance connectors between the higher density nodes identified in the regional Vision.

Segments highlighted in yellow are segments that exhibit one or both of these traits: 1) located within the higher density downtown or city areas in the regional Vision and/or 2) segments of roadway that already have two through lanes of traffic in each direction. To remain in alignment with the established regional Vision, capacity issues on these segments will be addressed with policy directives and multi-modal improvements rather than direct physical through lane type capacity improvements. The policy directives are identified in each corridor section. More details on policy direction are provided in the reports for task 4.3 for multimodal elements and task 5.1 for overall regional transportation direction.

Table 5 Segment capacity gaps (Trunkline Corridors)

Volume to capacity and LOS calculations
Trunkline
Methodology

Street Name	From	To	2007 Sufficiency AADT	TDM Growth rate	2035 ADT	2035 Directional Design Hour Volume	Directional Capacity	Volume to Capacity Ratio	LOS
Corridor 1									
M-72	W. of Bugai	Bugai	4913	68.47%	8277	539	1600	34%	A
M-72	Bugai	Carter	7229	47.58%	10668	526	1600	33%	A
M-72	Carter	TC West City Limits	7229	54.73%	11185	551	1600	34%	A
M-72	TC West City Limits	M-22	7230	54.53%	11173	551	2464	22%	A
M-72 (eastbound)	M-22	US-31 (Division)	11916	11.07%	13235	1231	2437	51%	C
M-72 (westbound)	M-22	US-31 (Division)	11916	11.07%	13235	1231	2437	51%	C
M-72 (Grandview EB)	US-31 (Division)	Hall	12603	13.26%	14274	1327	2415	55%	C
M-72 (Grandview WB)	US-31 (Division)	Hall	12603	13.26%	14274	1327	2415	55%	C
M-72 (Grandview)	Hall	Union	27637	16.55%	32212	1648	2425	68%	C
M-72 (Grandview EB)	Union	Front	16161	16.62%	18847	1753	3464	51%	C
M-72 (Grandview WB)	Union	Front	16161	16.62%	18847	1753	3464	51%	C
M-72	Front	Garfield	31963	17.02%	37404	1913	2425	79%	D
M-72	Garfield	TC East City Limits	25731	17.82%	30315	1494	2402	62%	C
M-72	TC East City Limits	3 Mile	29516	17.82%	34775	1779	2415	74%	C
M-72	3 Mile	4 Mile	38324	17.82%	45152	2477	2425	102%	F
M-72	4 Mile	US-31 (Acme)	30479	17.82%	35909	1870	2415	77%	D
M-72	US-31 (Acme)	.4 miles E. of US-31	15571	9.84%	17104	859	2669	32%	A
M-72	.4 miles E of US-31	Lautner Rd.	15571	9.77%	17092	858	1100	78%	D
M-72	Lautner Rd.	Arnold Rd.	15571	10.08%	17140	861	1600	54%	C
M-72	Arnold Rd.	Williamsburg Rd.	15571	-1.41%	15351	771	1600	48%	B
M-72	Williamsburg Rd.	Kalkaska CL	12624	44.13%	18195	931	1600	58%	C
Corridor 3									
M-37	M-113	Blair Townhall Road	14306	12.71%	16124	870	1600	54%	C
M-37	Blair Townhall Road	Vance Rd.	14306	10.69%	15835	854	1600	53%	C
M-37	Vance Rd.	US-31	14306	40.48%	20098	1084	1100	99%	E
M-37	US-31	Rennie School Road	22455	40.16%	31474	1639	2641	62%	C
M-37	Rennie School Road	S. Airport Road	22455	41.92%	31868	1660	2641	63%	C
M-37	S. Airport Road	TC South City Limits	30951	23.99%	38375	2034	2229	91%	E
M-37	TC South City Limits	Silver Lake Road	28522	8.93%	31069	1474	2402	61%	C
M-37	Silver Lake Road	Front St.	25646	-3.00%	24877	1226	2402	51%	C
M-37	Front St.	M-72	22327	-10.00%	20094	1028	2390	43%	B
Corridor 4									
(Trunkline portion)									
US-31	Benzie CL	M-137	10386	5.11%	10917	579	1600	36%	B
US-31	M-137	W. Silver Lake Road	15029	10.98%	16680	884	1100	80%	D
US-31	W. Silver Lake Road	M-37	19368	13.07%	21899	1161	1100	106%	F
(county portion)									
Beitner	US-31	W. River Road	4701	30.00%	6111	341	1583	22%	A
Keystone	W. River Road	Cass	13010	10.50%	14376	802	1583	51%	C
Keystone	Cass	Birmley	12350	27.00%	15685	875	1583	55%	C
Keystone	Birmley	Hammond	10700	219.00%	34133	1905	2900	66%	C
Keystone	Hammond	S. Airport Rd.	10700	26.00%	13482	752	1583	48%	B
Corridor 8									
West Bay Shore (M-22)	M-72	Cherry Bend Road	19447	41.33%	27485	1304	1100	119%	F
West Bay Shore (M-22)	Cherry Bend Road	N. of Crain Hill Road	9527	29.10%	12299	583	1100	53%	C

Gaps to be addressed with physical improvements and policy direction
Gaps to be addressed with policy direction only

Table 6 Segment capacity gaps (County and City Corridors)

Volume to capacity and LOS calculations

Local Road Methodology

Street Name	From	To	2007 Validation ADT	TDM Growth rate	2035 ADT	2035 Directional Design Hour Volume	Directional Capacity	Volume to Capacity Ratio	LOS
Corridor 2									
S. Airport	W Silver Lake	US-31	12009	18.66%	14249	795	802	99%	E
S. Airport	US-31	Garfield Ave	35955	7.49%	38648	2157	2099	103%	F
S. Airport	Garfield	Townline Rd E	12724	13.35%	14423	805	1467	55%	C
S. Airport	Townline Rd E	3 Mile	12890	12.97%	14562	813	1467	55%	C
Corridor 5									
Garfield	3 Mile	Potter	7538	35.25%	10195	569	1638	35%	B
Garfield	Potter	Birmley	5559	35.41%	7528	420	1638	26%	A
Garfield	Birmley	Hammond	16129	-7.92%	14852	829	1638	51%	C
Garfield	Hammond	S. Airport	17804	37.23%	16262	907	3054	30%	A
Garfield	S. Airport	Boon	20011	27.19%	25452	1420	3054	47%	B
Garfield	Boon	Carver	21283	17.91%	25096	1400	2099	67%	C
Garfield	Carver	US-31	26886	20.00%	32263	1800	1105	163%	F
Corridor 6									
Hammond	Keystone	LaFranier	0	New link	21845	1219	1604	76%	D
Hammond	LaFranier	Garfield Ave	11805	206.38%	36168	2018	1604	126%	F
Hammond	Garfield	3 Mile	18266	36.23%	24883	1388	1604	87%	D
Hammond	3 Mile	4 Mile	15009	47.47%	22134	1235	1583	78%	D
Hammond	4 Mile Rd	5 Mile	10387	52.55%	15846	884	1583	56%	C
Corridor 7									
3 Mile	Garfield	Hammond	5823	-25.75%	4324	241	1583	15%	A
3 Mile	Hammond	S. Airport	8077	9.00%	8804	491	1583	31%	A
3 Mile	S Airport	US-31	18910	10.06%	20813	1161	2933	40%	B
Corridor 9									
W Silver Lake	US-31	Lillian Ln	5874	127.16%	13343	745	1638	45%	B
W Silver Lake	Lillian Ln	Boone Rd	5874	64.36%	9654	539	1638	33%	A
W Silver Lake	Boone Rd	Barnes Rd.	6489	62.43%	10540	588	1638	36%	B
W Silver Lake	Barnes Rd	S Division St	15380	35.01%	20764	1159	3054	38%	B
14th	S Division St	S Cass St	19106	40.42%	26828	1497	1166	128%	F
Cass	14th	8th	12778	30%	16611	618*	926	67%	C
8th	Cass	Midtown	14019	22.26%	17140	638*	926	69%	C
8th	Midtown	Barlow	14019	22.26%	17140	956	1852	52%	C
8th	Barlow	Garfield	14019	22.26%	17140	956	926	103%	F
8th	Garfield	US 31	2248	13.79%	2558	143	1852	8%	A
Corridor 10									
N Long Lake Rd	Benzie CL	Zimmerman Rd.	6625	68.21%	11144	622	1638	38%	B
N Long Lake Rd	Zimmerman Rd	Barnes	10746	67.24%	17971	1003	1638	61%	C
Barnes	N Long Lake Rd	Briarcliff Rd	7495	67.68%	12568	701	1638	43%	B
Corridor 11									
Cass	Keystone	S. Airport	6720	108.77%	14029	783	1638	48%	B
Cass	S. Airport	14th	12778	19.11%	15220	849	1638	52%	C

Gaps to be addressed with physical improvements and policy direction

Gaps to be addressed with policy direction only

*2035 Directional design hour volume for segment has been reduced by 1/3 in anticipation of construction of Boardman Lake Avenue from 14th to 8th

Each corridor is described below to provide a context and rationale for proposed improvements based on the findings of the gap analysis methodology and within the context of the regional Vision.

3.0 Corridor 1

The M-72 corridor is located in both Leelanau County and Grand Traverse County and shares portions of its route with US-31 and M-22. The corridor is approximately 16.2 miles long from Bugai Road on the west to Williamsburg Road on the east. It ranges from two to five lanes with posted speeds of 35 miles per hour to 55 miles per hour and has a functional classification of Minor Arterial from the intersection with US-31, M-37 to the west and Principal Arterial to the east. Key intersections include Lautner Road, Holiday Road, 4 Mile Road, 3 Mile Road, Fair Street, Garfield Avenue, Front Street, Union Street, Division Street (US-31, M-37), M-22 and Bugai / Gray Road.

Corridor 1 Vision discussion: Corridor 1 runs east and west through the center of the Grand Vision region on the south side of the Grand Traverse Bay. It is an important route for local transportation through Traverse City and also connects travelers to development nodes in every direction. M-72 continues east to Kalkaska where it connects to US-131. M-72 connects to M-22 in Greilickville and then goes north to village developments along West Grand Traverse Bay. M-72 continues west to a connection with M-22 in Empire on the west side of Leelanau County.

The west end of the corridor connects travelers from smaller development nodes in western Leelanau and Benzie Counties and is outside the urban development area. The east end of the corridor connects to the development node in Acme, which is identified as another downtown development node in the regional Vision. This route has existing urban development along the length of the corridor.

The downtown area of Traverse City is located in the center of this corridor. This is the largest downtown area in the six-county region. Travel along the Grand Traverse Bay is scenic and land use between the road corridor and the water is limited to parkland and recreational uses near the downtown to provide access to recreation and important viewsheds. Urban development spans the length of the corridor with more intense nodes at major intersections and in connection with the downtown. Three activity centers, Munson Health Center, downtown Traverse City and Northwestern Michigan College, are adjacent to this corridor.

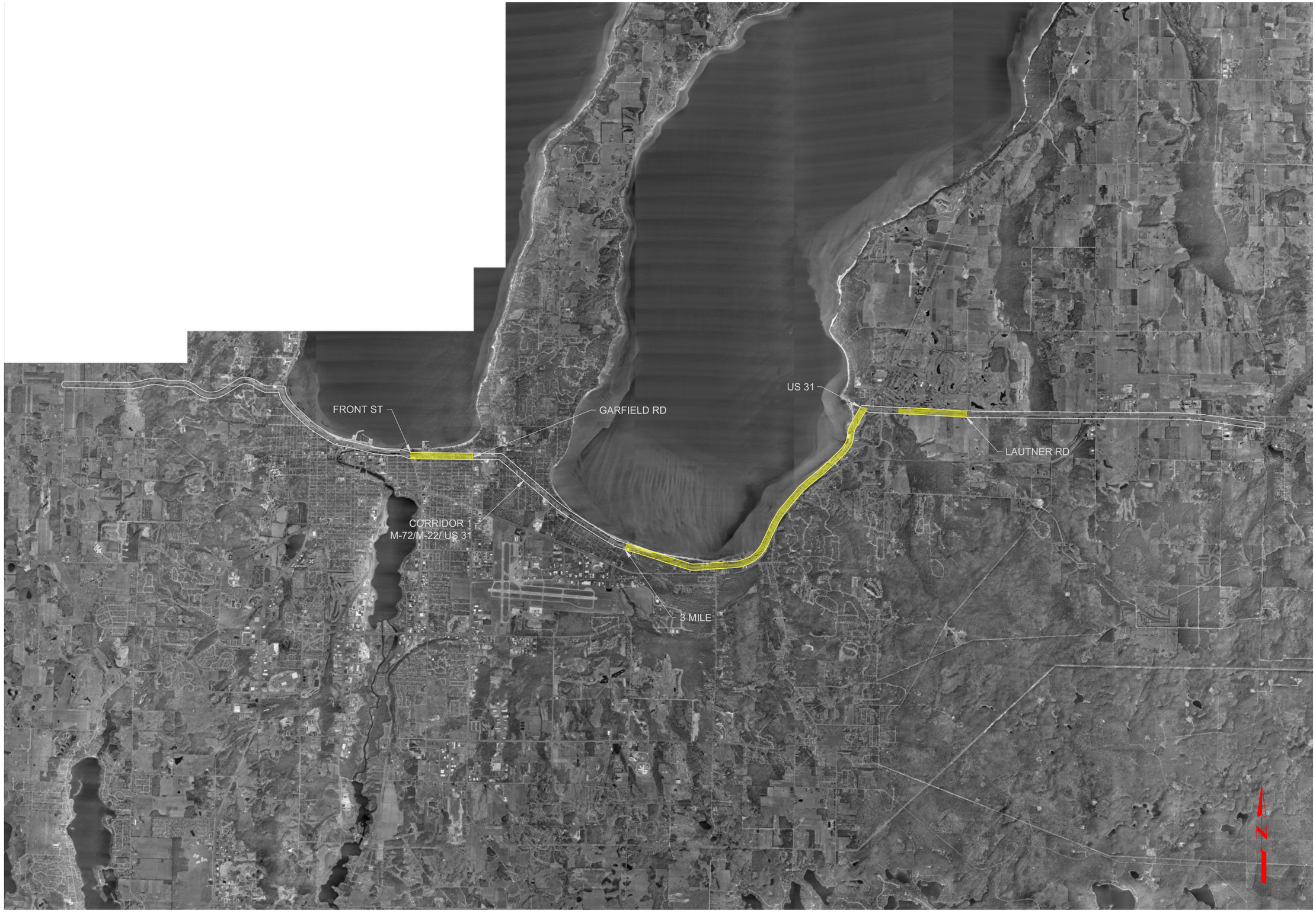
Mode choices: The TART Trail is well-established along this route beginning at the intersection of M-22 where the Leelanau Trail connects. It runs along the Bay, continues east to Railroad Avenue and then follows the previous railroad line. Opportunities for non-motorized travel along this route exist currently and will continue as an alternative for making short trips within the congested urban center or for travel along the length of the corridor.

The central transfer facility for the Bay Area Transportation Authority (BATA) is located at Hall Street to the south of this corridor. Fixed route local transit service currently runs parallel to this corridor to the south on Front Street and State Street. Two regional connectors currently run west along the corridor to the intersection with M-22 and then continue into Leelanau County. Currently, there is not a regional connector to the east but it would be well-served by transit service connecting Acme with downtown Traverse City. Private shuttle service or rideshare programs may also be successful along this route.

Current land use: The west end of the corridor is currently a mix of agricultural, forest, open land and low density residential development until the commercial development node at M-22. From M-22 east, there is urban development along the length of the corridor. It is a mix of residential, commercial and industrial uses with a central area of public/semi-public land use along the Grand Traverse Bay in Traverse City.

Future land use discussion from 3.5 report: The regional Vision describes new development along this corridor in nodes downtown and at major intersections. This new development will happen in the form of redevelopment and selective infill projects. The nodes have two- and three-story buildings in place of existing single story buildings. The intersection of US-31 and M-72 has its most dense development pattern in this scenario. The denser land use pattern prevents sprawling land use beyond the limits of this corridor and at the west end of this corridor. Planned development is effective in the high-density nodes where there is redevelopment pressure and access management is an effective tool. Some redevelopment along the corridor also occurs in a planned, mixed use pattern. Re-development expands the amount and variety of housing choices, especially at major intersections.

Proposed improvements: There are three areas of projected future congestion along this corridor. One is the section from Front Street to Garfield in the urban core area. The other segment with projected future congestion is located east of Traverse City connecting to Acme Center. No physical infrastructure improvements are proposed for either of these areas as they are all located in a central urban area. In this area, congestion will be addressed through other tools including land use and demand-side congestion management techniques. It is essential along this corridor area that land use policies continue to support the regional Vision by encouraging new urban growth to occur in higher density patterns at central development nodes. See **Figure 1.**



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CORRIDOR 1

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Table 7 Corridor 1 Segment Capacity Gaps

Street Name	From	To	2007 Sufficiency AADT	TDM Growth rate	2035 ADT	2035 Directional Design Hour Volume	Directional Capacity	Volume to Capacity Ratio	LOS
Corridor 1									
M-72	W. of Bugai	Bugai	4913	68.47%	8277	539	1600	34%	A
M-72	Bugai	Carter	7229	47.58%	10668	526	1600	33%	A
M-72	Carter	TC West City Limits	7229	54.73%	11185	551	1600	34%	A
M-72	TC West City Limits	M-22	7230	54.53%	11173	551	2464	22%	A
M-72 (eastbound)	M-22	US-31 (Division)	11916	11.07%	13235	1231	2437	51%	C
M-72 (westbound)	M-22	US-31 (Division)	11916	11.07%	13235	1231	2437	51%	C
M-72 (Grandview EB)	US-31 (Division)	Hall	12603	13.26%	14274	1327	2415	55%	C
M-72 (Grandview WB)	US-31 (Division)	Hall	12603	13.26%	14274	1327	2415	55%	C
M-72 (Grandview)	Hall	Union	27637	16.55%	32212	1648	2425	68%	C
M-72 (Grandview EB)	Union	Front	16161	16.62%	18847	1753	3464	51%	C
M-72 (Grandview WB)	Union	Front	16161	16.62%	18847	1753	3464	51%	C
M-72	Front	Garfield	31963	17.02%	37404	1913	2425	79%	D
M-72	Garfield	TC East City Limits	25731	17.82%	30315	1494	2402	62%	C
M-72	TC East City Limits	3 Mile	29516	17.82%	34775	1779	2415	74%	C
M-72	3 Mile	4 Mile	38324	17.82%	45152	2477	2425	102%	F
M-72	4 Mile	US-31 (Acme)	30479	17.82%	35909	1870	2415	77%	D
M-72	US-31 (Acme)	.4 miles E. of US-31	15571	9.84%	17104	859	2669	32%	A
M-72	.4 miles E of US-31	Lautner Rd.	15571	9.77%	17092	858	1100	78%	D
M-72	Lautner Rd.	Arnold Rd.	15571	10.08%	17140	861	1600	54%	C
M-72	Arnold Rd.	Williamsburg Rd.	15571	-1.41%	15351	771	1600	48%	B
M-72	Williamsburg Rd.	Kalkaska CL	12624	44.13%	18195	931	1600	58%	C

4.0 Corridor 2

The S. Airport Road corridor is located in Grand Traverse County in the townships of East Bay and Garfield. The corridor is approximately 6.1 miles long, and it begins at Silver Lake Road and terminates at 3 Mile Road. It ranges from two to five lanes with posted speeds of 35 miles per hour to 45 miles per hour and has a functional classification of Minor Arterial. Key intersections include 3 Mile Road, Townline Road, Garfield Road, La Franier Road, Park Drive, Cass Road, Veterans Drive, Division Street (US-31) and W. Silver Lake Road.

Corridor 2 Vision discussion: Urban development patterns in the Grand Vision reach S. Airport Road along two corridors of north-south development at Division Street (US-31) and Garfield Road. The corridor has already experienced complete build out between the two roads with a very auto-oriented development pattern. There are opportunities for infill development or redevelopment of existing properties around the intersection nodes to create more walkable areas. Mixed use developments and the addition of grid street connections around the intersections are both tools to consider. Natural features including water and slopes and land use regulations such as those requiring single uses, deep setbacks and large amounts of surface parking will all need to be addressed.

Mode choices: This corridor has the opportunity to be transformed by new corridor designs to support non-motorized transportation and facilitate transit stops. Currently, there are only assorted segments of sidewalk along the corridor. They are not conducive to a pleasant pedestrian environment due to high numbers of curb cuts and proximity to road traffic and surface parking lots on each side. The TART Mall Trail reaches the intersection at Division Street (US-31) but does not connect to facilities on this corridor. The Grand Traverse County Road Commission is taking steps to provide a grade-separated crossing for the Boardman River Trail at S. Airport Road which may provide access to the corridor but will not facilitate east-west travel along the corridor. Two separate BATA routes serve the corridor from Division Street (US-31, M-37) to the Airport and the Express route has several stops along this corridor including the BATA South station at the Cass Road intersection.

Current land use: The western end of this corridor is agricultural, open and residential land uses until the intersection with Division Street (US-31, M-37). East of Division Street (US-31, M-37) through the intersection with Garfield Road, the corridor is a highly urbanized and auto-oriented corridor. There are stretches with commercial, industrial and planned single-family residential developments. East of Garfield, the corridor returns to a low density development pattern with some industrial uses, forest and single family residential. This corridor is also adjacent to the Cherry Capital Airport.

Future land use discussion from 3.5. report: Major intersections serve as a type of village center at the intersection with Division Street (US-31, M-37) and possibly at Garfield Road as well. In these areas, there is more redevelopment with new multistory, buildings replacing small retail stores and surface parking lots. There are mixed-use developments and multi-family housing in these areas along with new commercial and office uses.

Proposed improvements: The S. Airport Road corridor from W. Silver Lake Road to Garfield Avenue is projected to reach failing level of service ratings over time. This corridor is at the southern end of the urbanized downtown center of the Grand Vision. There is a village center development node proposed in this location and the corridor already carries two lanes of traffic west of Division Street (US-31, M-37). As a result, no infrastructure improvements are proposed to add vehicle carrying capacity to this corridor. Congestion will be addressed through other tools including access management, improved multi-modal design, land use policies, and demand-side strategies to shift travel modes, routes and times. See **Figure 2.**

Table 8 Corridor 2 Segment Capacity Gaps

Street Name	From	To	2007 Validation ADT	TDM Growth rate	2035 ADT	2035 Directional Design Hour Volume	Capacity	Volume to Capacity Ratio	LOS
Corridor 2									
S. Airport	W Silver Lake	US-31	12009	18.66%	14249	795	802	99%	E
S. Airport	US-31	Garfield Ave	35955	7.49%	38648	2157	2099	103%	F
S. Airport	Garfield	Townline Rd E	12724	13.35%	14423	805	1467	55%	C
S. Airport	Townline Rd E	3 Mile	12890	12.97%	14562	813	1467	55%	C

Several intersections along Corridor 2 have high crash concentrations. The crash analysis indicates that the intersections with Division Street (US-31, M-37), Garfield Road, Barlow (LaFranier) Street and Cass Road are among the top 5 crash locations among all corridors.

At the S. Airport Road / US-31 intersection, 871 crashes resulting in 132 injuries were reported from 2000 to 2009. The most prevalent crash type reported was rear-end accidents. There were 106 rear-end accidents at the east approach on S. Airport Road, 83 on the south US-31 approach, and 80 on the north US-31 approach.

At the S. Airport Road / Garfield Road intersection, 584 crashes resulting in 77 injuries were reported from 2000 to 2009. The most prevalent crash type reported was rear-end accidents. There were 99 rear-end accidents at the west approach on S. Airport Road, 60 on the north Garfield Road approach, and 52 on the South Garfield Road approach.

At the S. Airport Road / Barlow (LaFranier) Street intersection, 452 crashes resulting in 80 injuries were reported from 2000-2009. The most prevalent crash type reported was rear-end accidents. There were 76 rear-end accidents at the west approach on S. Airport Road, 66 on the east S. Airport Road approach, and 46 on the south Barlow Street approach.

At the S. Airport Road / Cass Street intersection, 444 crashes resulting in 75 injuries were reported from 2000-2009. The most prevalent crash type reported was rear-end accidents. There were 91 rear-end accidents on the east S. Airport Road approach and 76 on the west S. Airport Road approach.

NCHRP Report 500, Volume 12 *A Guide for Reducing Collisions at Signalized Intersections* provides recommended strategies for mitigating the types of accidents found at these locations:

- Install larger advance warning signs
- Optimize clearance intervals
- Employ signal coordination

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5.0 Corridor 3

The M-37 corridor is located in Grand Traverse County in the townships of Garfield and Blair and in the City of Traverse City. The corridor is approximately 13.0 miles long; it begins at M-113 on the south and terminates at Grandview Parkway on the north. Portions of its route are shared with US-31. It ranges from two to five lanes with posted speeds of 35 miles per hour to 55 miles per hour and has a functional classification of Principal Arterial. Key intersections include M-113, Vance Road, Beitner Road / US-31 / M-37, S. Airport Road, Marketplace Circle, Meijer, 14th Street, 11th Street, 7th Street, Front Street and Grandview Parkway (US-31, M-37, M-72).

Corridor 3 Vision discussion: Corridor 3 runs north and south along the west side of Traverse City from the Bay to Beitner Road. It is an important route for local transportation to the existing auto oriented commercial development along the corridor and also connects travelers to development nodes north to villages along M-22, west to US-131, and south to M-115 that connects to US-131. It is a major travel route for people coming to Traverse City from the south and west. The existing urban development pattern continues and increases in density along the corridor with infill development and large village-like development nodes at S. Airport Road and Beitner Road (Chum's Corners).

Mode choices: The BATA Express route covers the Mall, the Horizon Outlet and Meijer along this corridor. One fixed-route comes south along the corridor as far as Meijer and another comes west to the mall along S. Airport Road. There is currently no transit service to other commercial locations at the intersection with Beitner and no service south of that intersection. As village nodes develop, transit service can provide an efficient connection along the corridor and into downtown Traverse City.

This corridor has continuous sidewalk on the west side north of 14th Street. TART's Mall Trail goes south from 14th Street to the intersection at S. Airport Road. The auto oriented land use patterns along the corridor pose several challenges to developing a vibrant pedestrian environment. Pedestrian connections will evolve along with the village-style land use patterns at major intersection nodes.

Current land use: The south end of this corridor is agricultural, open and forest lands with a small number of large lot residential units fronting on the corridor. There is existing commercial use at the intersection with Beitner Road and with S. Airport Road. In between, there are a few planned residential developments with access roads connecting to the corridor, pockets of industrial development and some commercial uses fronting on the corridor. Some of this area remains open or agricultural. North of S. Airport Road, there is dense urban development along the corridor except for the Grand Traverse Commons area. North of Silver Lake Road, the existing grid street pattern connects to the corridor at regular intervals. The land use is a combination of established neighborhoods with single-family homes and commercial uses in a node at 14th Street and along the corridor from Front Street to the Bay.

Future land use discussion from 3.5 report: This corridor experiences land use growth along its full extent with dense development patterns at the corridor's north end near Grandview Parkway (US-31, M-37, M-72) and at major intersections including 14th Street, S. Airport Road and Beitner Road. Planned growth,

including access management, is very effective, especially where development pressure drives infill and redevelopment. Higher density brings more housing options and new commercial, office and activity center uses.

Proposed improvements: There are two areas along the corridor that are projected to experience Level of Service E ratings. One is the corridor south of the Beitner Road intersection to Vance Road and the other is from S. Airport Road north to the limits of Traverse City. A road widening is proposed between Beitner and Vance Roads. This section of road lies on the south side of the urban area. It has a signalized intersection at Beitner Road which reduces its carrying capacity which is the reason for the drop in LOS rating.

No physical improvements are proposed for the segment from S. Airport Road to the limits of Traverse City because it is located in a central urban area. In this area, congestion will be addressed through other tools including land use patterns and demand-side congestion management techniques. It is essential along this corridor area that land use policies continue to support the regional Vision by encouraging new urban growth to occur in higher density patterns at central development nodes.

Table 9 Corridor 3 Segment Capacity Gaps

Street Name	From	To	2007 Sufficiency AADT	TDM Growth rate	2035 ADT	2035 Directional Design Hour Volume	Directional Capacity	Volume to Capacity Ratio	LOS
Corridor 3									
M-37	M-113	Blair Townhall Road	14306	12.71%	16124	870	1600	54%	C
M-37	Blair Townhall Road	Vance Rd.	14306	10.69%	15835	854	1600	53%	C
M-37	Vance Rd.	US-31/Beitner	14306	40.48%	20098	1084	1100	99%	E
M-37	US-31	Rennie School Road	22455	40.16%	31474	1639	2641	62%	C
M-37	Rennie School Road	Airport Road	22455	41.92%	31868	1660	2641	63%	C
M-37	Airport Road	TC South City Limits	30951	23.99%	38375	2034	2229	91%	E
M-37	TC South City Limits	Silver Lake Road	28522	8.93%	31069	1474	2402	61%	C
M-37	Silver Lake Road	Front St.	25646	-3.00%	24877	1226	2402	51%	C
M-37	Front St.	M-72	22327	-10.00%	20094	1028	2390	43%	B

The segment from Vance Road to US-31 in Chum's corners is projected to operate at Level of Service E. Capacity improvements along this segment will involve roadway widening to add through traffic movements. Adding one lane of through traffic in each direction for this segment will increase the capacity to 3088, making the anticipated volume to capacity ratio of 0.36. This action would improve the anticipated future level of service to B.

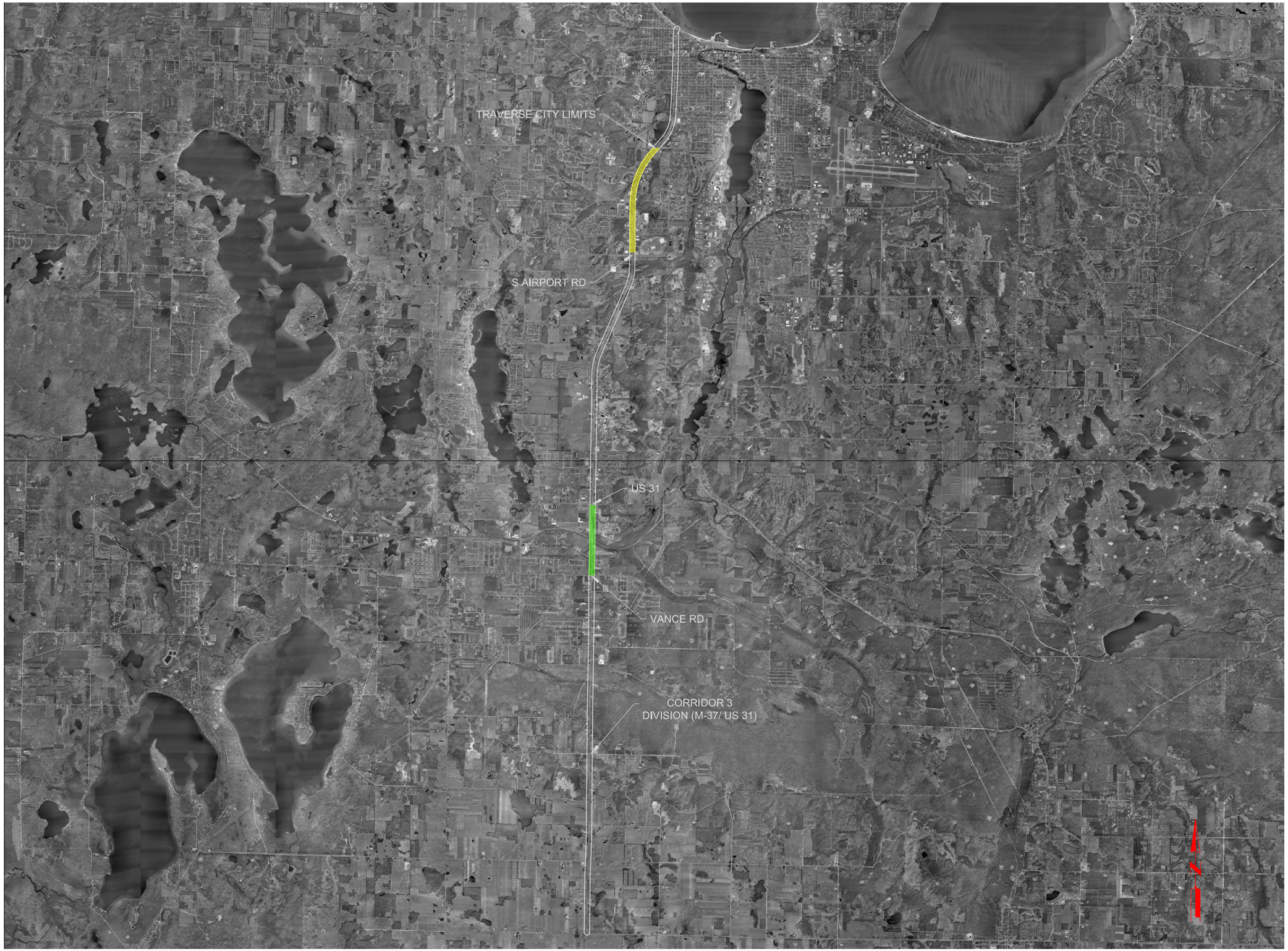
As depicted in the *Task 3.5 Environmental Impact Report*, the environmental impacts associated with widening this segment of roadway include:

- One potential oil / gas hazardous material site in the northwest quadrant of the Great Lakes Central railroad crossing
- Lands designated as prime / unique farmland soils from the Great Lakes Central railroad crossing north to the intersection M-37 and US-31 in Chum's Corners
- Flood prone areas at the Great Lakes Central railroad crossing are noted, however the structure carrying M-37 over the railroad is currently wide enough to accommodate future traffic lanes. Impacts to the flood area are unlikely.

- Wetland areas to the immediate north of the Great Lakes Central railroad crossing
- Wild and scenic rivers / natural rivers

Adding through lanes to this segment would require a 3 to 5 lane widening from Vance Road north to approximately 500 feet north of the Great Lakes Central railroad. At an average per-mile cost of $5.5 million, this ½ mile portion of the widening is expected to cost $2.5 million.

From 500 feet north of the Great Lakes Central railroad northerly to the intersection of M-37 and US-31 in Chum's Corners, a lane needs to be added to the southbound direction of traffic only. Adding a single lane for this ½ mile portion is expected to cost $1,850,000, based on an average per-mile cost of $3,700,000 to widen from 4 lanes to 5 lanes. The total cost of the physical improvements for this segment is estimated at $4,350,000 in 2010 dollars. See **Figure 3.**



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CORRIDOR 3

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6.0 Corridor 4

The US-31, Beitner, Keystone corridor is located in Grand Traverse County in the townships of Green Lake, Blair, and Garfield. The corridor is approximately 13.8 miles long, and it begins at the Benzie County line and continues to S. Airport Road. It has two lanes with posted speeds of 45 miles per hour to 55 miles per hour and has a functional classification of Principal Arterial west of the US-31, M-37 intersection and Minor Arterial to the east. Key intersections include South Long Lake Road / M-137, W. Silver Lake Road, Beitner Road, Williams Road, River Road, Cass Road, Birmley Road, Hammond Road and S. Airport Road.

Corridor 4 Vision discussion: The trunkline section of West US-31 is an east-west route that connects Benzie County with the Traverse City urban area. Along the way, it passes by Interlochen, and the development nodes referred to as "Grawn" at W. Silver Lake Road and "Chums Corners" at Beitner Road or M-37. Outside of the development areas, the land use along the corridor is primarily agricultural and forest with some large lot rural residential homes and a few rural, large lot subdivisions. The regional Vision calls for this area to remain essentially the same overall with new growth concentrated in development nodes at Interlochen and Chums Corners. The auto-oriented development pattern at Beitner Road will transition to more of a mixed-use development pattern with the addition of some grid streets around the intersection and some infill development.

The county portion of the corridor is a rural route which turns to a north-south route. It is far enough south of the urban center that it should not experience growth along the corridor although there is some development at the intersection of S. Airport Road. The regional Vision will concentrate growth in other areas and protect corridors like this one from sprawling urban growth patterns.

Mode choices: There are no sidewalks along this road and it is not an area where sidewalks would be expected in the future. TART Trails is planning a future route along the railroad running parallel to this corridor. When complete, it will connect Traverse City to Interlochen and continue on to the Betsie Valley Trail in Benzie County. This is an excellent recreational connection but would not be used by many for daily transportation due to the length of the trip. It could facilitate trips between Grawn and Chums Corners as those areas continue to develop.

There is no fixed route or regional bus service along this corridor. As population densities rise at the nodes, an express transit route connecting those points could develop. Initially, this would be an ideal route for a van pool or ride share program. Opportunities to use the rail line at some point in the future could also be explored.

Current land use: The corridor is largely undeveloped other than the development nodes noted above. Most of the land use along the corridor is open land, forest land, large lot residential and agricultural. The railroad runs parallel to the corridor and there is some industrial development in Grawn and another industrial area on Keystone. Outside of the development node areas, there is some additional concentrated residential development next to Keystone Pond.