TECHNICAL MEMORANDUM

TO: Matthew Langhorst, Assistant City Engineer, City of Glenwood Springs

FROM: Ron Nies, PE, SGM
Dan Cokley PE, PTOE SGM

DATE: November 14, 2017

RE: **South Midland Avenue Reconstruction Project: Turn Lane Warrants**

Purpose of Memorandum

This memorandum presents the results of the turn lane warrant analysis performed for existing intersections along Midland Avenue within the South Midland Avenue Reconstruction project limits.

Project Description

The South Midland Avenue Reconstruction Project is a design project initiated by the City of Glenwood Springs to make improvements to existing South Midland Avenue. These improvements include:

- Reconstruction of existing asphalt pavement
- Widening of roadway
- Addition of curb and gutter
- Addition of sidewalks or multi-use paths
- Rock fall mitigation and slope stabilization
- Improve intersection alignments and profiles
- Consolidate/improve driveways along Midland Avenue

The limits of the project are from just south of the 27th Street Roundabout (north end) to just south of the 4-Mile Road intersection (south end). South of 4-Mile Road, Midland Avenue becomes Airport Road. The intersecting roadways are Hager Lane, Park West, Old Cardiff Bridge Road, 3-Mile Road, Mt. Sopris Drive, and 4-Mile Road. A new single-lane roundabout at Midland Avenue and 4-Mile Road is part of this project.

In 2003, the City secured federal funding to study a connection from S. Midland to SH 82 which has culminated in the *South Bridge Environmental Assessment (EA)*. Traffic originating or destined for SH 82 eastbound would use this southern river crossing to access the state highway instead of traveling 3-4 miles out of direction, going north to 27th Street and then back south/east on SH 82 to cross the river (today's route).

The analysis presented in this memo anticipates that South Bridge will be in place during the long-term (20-year) design scenario, so traffic projections have been included in the turn lane warrant study that reflect this new link to the system. Long-term analysis volumes assume that South Bridge will divert 40% of the existing traffic that uses Midland Avenue to the south for access to SH 82, instead of going north. This diversion percentage originated from the EA Traffic Analysis conducted by Jacobs Engineering for South Bridge. Applying this diversion to the AM and PM peak hour traffic originating or destined for South Midland Avenue produces the future or Long-term (2036) traffic conditions.

Turn Lane Analysis

Based on the *State Highway Access Code (SHAC)* paragraph 3.12, Midland Avenue is designated as a Non-rural Arterial Low Speed (NR-C) roadway. A left turn deceleration lane is required on a NR-C when the peak hour entering volume exceeds 25 vehicles per hour. A right turn deceleration lane is required on an NR-C roadway when the peak hour entering volume exceeds 50 vehicles per hour. The posted Speed limit for Midland Avenue is 25 mph.

Actual turning traffic counts were obtained for Mt. Sopris Drive only. For the other intersections, turning movement volumes are based on the ITE Trip Generation tables, 9th Edition, and are provided in the attached appendix. Below is a summary for each intersection analyzed:

Hager Lane-

Forty-two single-family detached housing units use the south portion of Hager Lane and an estimated 36 residential Condominium/Townhouse units come from the north portion of Hager. 2017 peak hour turn movements for southbound Midland Avenue exceeds the left-turn lane warrant of 25 vehicles per hour. The South Bridge connection will reduce left turns, but a turn lane is still warranted for southbound Midland.

Park West-

Two accesses currently exist for the Park West subdivision off of Midland Avenue. Approximately 60% of all units in the Park West subdivision use the north access for ingress and egress with Midland Avenue. Because this subdivision is fully built out, and has two access points, turn lanes are not warranted in either direction for either the current or future (South Bridge) condition.

Three Mile Road

Three-mile Road intersects Midland from the west side. Due to the seasonal nature of an estimated 50% of the residences along Three-Mile Road, the peak hour turn volumes do not warrant turn lanes on Midland Avenue at this location in either direction.

Mt. Sopris Drive

This intersection is the main access to Mt. Sopris Elementary School, and experiences high peak hour volumes for student drop off and pick up. A south bound left turn lane is warranted in the current condition, and a right turn for northbound Midland Avenue becomes warranted once the South Bridge connection is created.

Conclusions / Recommendations

Based on a posted speed of 25 mph and assumptions in this report, a left turn deceleration lane is required by the SHAC 3.13 (4) at two locations (Hager Lane and Mt. Sopris Drive) and a north bound right turn lane at one location (Mt. Sopris Drive). Although the Mt. Sopris right turn lane is not warranted until the South Bridge connection is made, it is included in the scope of this project design.

If you have any questions pertaining to this information please contact me.

Sincerely,

Ron Nies, P.E., SGM
South Midland Avenue Reconstruction Roadway Design Manager

Appendix A

Trip Generation Reports
Mt. Sopris Drive Traffic Counts

S. Midland Avenue Reconstruction

Turn Lane Traffic Warrants- Summary

11/14/2017

2017	from SB Midland Ave		From NB Midland Ave				
Entering Site traffic (DHV)	**AM**	**PM**	**AM**	**PM**			
Hager Lane	17	51	2	6	lt turn lane warrant (>25)		
Park West- north access	7	24	1	3			
Park West- south access	5	16	1	2			
Three-Mile Road	21	42	2	5			
Mt. Sopris Drive		149		8	lt turn lane warrant (>25)		
2036	**from SB Midland Ave**		**From NB Midland Ave**				
Entering Site traffic (DHV)	**AM**	**PM**	**AM**	**PM**			
Hager Lane	9	28	9	28	lt turn lane warrant (>25)		
Park West- north access	4	13	4	13			
Park West- south access	3	9	3	9			
Three-Mile Road	12	23	12	23			
Mt. Sopris Drive		89		68	rt turn lane warrant (>50)		

Hager Lane, S. Midland Avenue, Glenwood Springs

RESIDENTIAL

Code	Land Use	Unit Type	# of Units	Daily Rate	AM In Rate	AM Out Rate	PM In Rate	PM Out Rate	Daily	AM TOT	AM In	AM Out	PM TOT	PM In	PM Out
210	Single-Family Detached Housing	DU	42.0	9.52	0.19	0.56	0.63	0.37	400	32	8	24	42	26	16
					Regression Equation				473	39	10	29	48	30	18
230	Res. Condominium/Townhouse	DU	36.0	5.81	0.07	0.37	0.35	0.17	209	16	3	13	0	13	6
	(North end of Hager Lane)		*(estimated)*		Regression Equation				410	35	9	26	42	26	16
	Rate Totals								609	47	11	37	42	39	22
	Regression Equation Totals				Regression Equation				883	74	19	56	90	57	33
	Difference								274	27	8	19	29	18	12

Regression Totals are 45.00% higher than totals calculated by average rate

Source:

***ITE TRIP GENERATION*, 9th EDITION (2012)**

Trip Distribution Calculations

40% 2036 Diversion from South Midland travelshed toward South Bridge

Using Regression Equation Results:

Estimated Trip Distribution

	2017	2036
Exiting Site Traffic		
To 27th St (rt onto Midland Ave)	90%	50%
To Mt Sopris Ave (lt onto Midland Ave	10%	50%
Entering Site Traffic		
From SB Midland Ave	90%	50%
From NB Midland Av	10%	50%

	2017 AM	2036 AM	2017 PM	2036 PM
To 27th St (rt onto Midland Ave)	50	28	30	17
To Mt Sopris Ave (lt onto Midland Ave	6	28	3	17
Total Exiting	56	56	33	33
From SB Midland Ave	17	9	**51**	**28**
From NB Midland Av	2	9	6	28
Total Entering	19	19	57	57

Park West, S. Midland Avenue, Glenwood Springs

RESIDENTIAL

Code	Land Use	Unit Type	# of Units	Daily Rate	AM In Rate	AM Out Rate	PM In Rate	PM Out Rate	Daily	AM TOT	AM In	AM Out	PM TOT	PM In	PM Out
210	Single-Family Detached Housing	DU	65.0	9.52	0.19	0.56	0.63	0.37	619	49	12	36	65	41	24
					Regression Equation				707	55	14	41	71	45	26
230	Res. Condominium/Townhouse	DU	1.0	5.81	0.07	0.37	0.35	0.17	0	0	0	0	0	0	0
					Regression Equation				0	0	0	0	0	0	0
	Rate Totals								619	49	12	37	65	41	24
	Regression Equation Totals				Regression Equation				707	55	14	41	71	45	26
	Difference								88	6	1	5	6	4	2

Regression Totals are 14.19% higher than totals calculated by average rate

Source:

***ITE TRIP GENERATION*, 9th EDITION (2012)**

Trip Distribution Calculations

Using Regression Equation Results:

Estimated Trip Distribution

	60% 2017	60% 2036	40% 2017	40% 2036
Exiting Site Traffic	north acc	north acc	south ac	south access
To 27th St (rt onto Midland Ave)	90%	50%	90%	50%
To Mt Sopris Ave (lt onto Midland Ave	10%	50%	10%	50%
65 total units				
26 use s access				
39 use north access				
Entering Site Traffic				
From SB Midland Ave	90%	50%	90%	50%
From NB Midland Av	10%	50%	10%	50%

40% Diversion from South Midland travelshed toward South Bridge

	2017 north AM	2017 south AM	2017 north PM	2017 south PM	2036 north AM	2036 south AM	2036 north PM	2036 south PM
	22	15	14	9	12	8	8	5
	2	2	2	1	12	8	8	5
Total ExitingTraffic:	25	17	16	11	25	17	16	11
	north AM	south AM	north PM	south PM	north AM	south AM	north PM	south PM
	7	5	24	16	4	3	13	9
	1	1	3	2	4	3	13	9
Total Entering Traffic	8	6	27	18	8	6	27	18

Three Mile Road, S. Midland Avenue, Glenwood Springs

RESIDENTIAL

Code	Land Use	Unit Type	# of Units	Daily Rate	AM In Rate	AM Out Rate	PM In Rate	PM Out Rate	Daily	AM TOT	AM In	AM Out	PM TOT	PM In	PM Out
260	Recreational Housing	DU	31.0	3.50	0.14	0.15	0.14	0.17	109	9	4	5	10	4	5
	(seasonal)				Regression Equation				217	20	10	10	19	8	11
210	Single-Family Detached Housing	DU	31.0	9.52	0.19	0.56	0.63	0.37	295	23	6	17	31	20	11
	(seasonal)				Regression Equation				358	31	8	24	37	23	14
230	Trailer Park	DU	20.0	9.52	0.19	0.56	0.63	0.37	190	15	4	11	0	13	7
					Regression Equation				239	24	6	18	25	16	9
	Rate Totals								594	47	14	33	41	36	24
	Regression Equation Totals				Regression Equation				813	75	23	51	80	47	33
	Difference								219	28	9	18	20	11	9

Regression Totals are 36.94% higher than totals calculated by average rate

Source:

***ITE TRIP GENERATION*, 9th EDITION (2012)**

Trip Distribution Calculations

Using Regression Equation Results:

Estimated Trip Distribution

	2017	2036
Exiting Site Traffic		
To 27th St (lt onto Midland Ave)	90%	50%
To Mt Sopris Ave (rt onto Midland Ave	10%	50%
Entering Site Traffic		
From SB Midland Ave	90%	50%
From NB Midland Av	10%	50%

40% 2036 Diversion from South Midland travelshed toward South Bridge

	2017 AM	2036 AM	2017 PM	2036 PM
	46	26	30	17
	5	26	3	17
Total Exiting	51	51	33	33

	AM	AM	PM	PM
	21	12	**42**	**23**
	2	12	5	23
Total Enterin	23	23	47	47

SGM
118 W. 6th Street
Suite 200
Glenwood Springs, Colorado, United States 81601
(970) 945-1004 leeb@sgm-inc.com

Count Name: S. Midland
Site Code:
Start Date: 05/25/2017

Turning Movement Data

Start Time	Midland Southbound					Mt Sopris Westbound					Midland Northbound					
	Thru	Left	U-Turn	Peds	App. Total	Right	Left	U-Turn	Peds	App. Total	Right	Thru	U-Turn	Peds	App. Total	Int. Total
5:00 PM	58	49	0	0	107	24	2	0	2	26	5	31	0	0	36	169
5:15 PM	68	43	0	2	111	41	1	0	0	42	2	31	0	0	33	186
5:30 PM	62	22	0	0	84	27	3	0	0	30	0	35	0	0	35	149
5:45 PM	43	35	0	1	78	12	0	0	1	12	1	35	0	1	36	126
Grand Total	231	149	0	3	380	104	6	0	3	110	8	132	0	1	140	630
Approach %	60.8	39.2	0.0	-	-	94.5	5.5	0.0	-	-	5.7	94.3	0.0	-	-	-
Total %	36.7	23.7	0.0	-	60.3	16.5	1.0	0.0	-	17.5	1.3	21.0	0.0	-	22.2	-
Lights	226	148	0	-	374	102	6	0	-	108	8	129	0	-	137	619
% Lights	97.8	99.3	-	-	98.4	98.1	100.0	-	-	98.2	100.0	97.7	-	-	97.9	98.3
Buses	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Buses	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Trucks	5	1	0	-	6	0	0	0	-	0	0	3	0	-	3	9
% Trucks	2.2	0.7	-	-	1.6	0.0	0.0	-	-	0.0	0.0	2.3	-	-	2.1	1.4
Bicycles on Road	0	0	0	-	0	2	0	0	-	2	0	0	0	-	0	2
% Bicycles on Road	0.0	0.0	-	-	0.0	1.9	0.0	-	-	1.8	0.0	0.0	-	-	0.0	0.3
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	0.0	-	-	-	-	0.0	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	3	-	-	-	-	3	-	-	-	-	1	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	100.0	-	-	-	-	100.0	-	-

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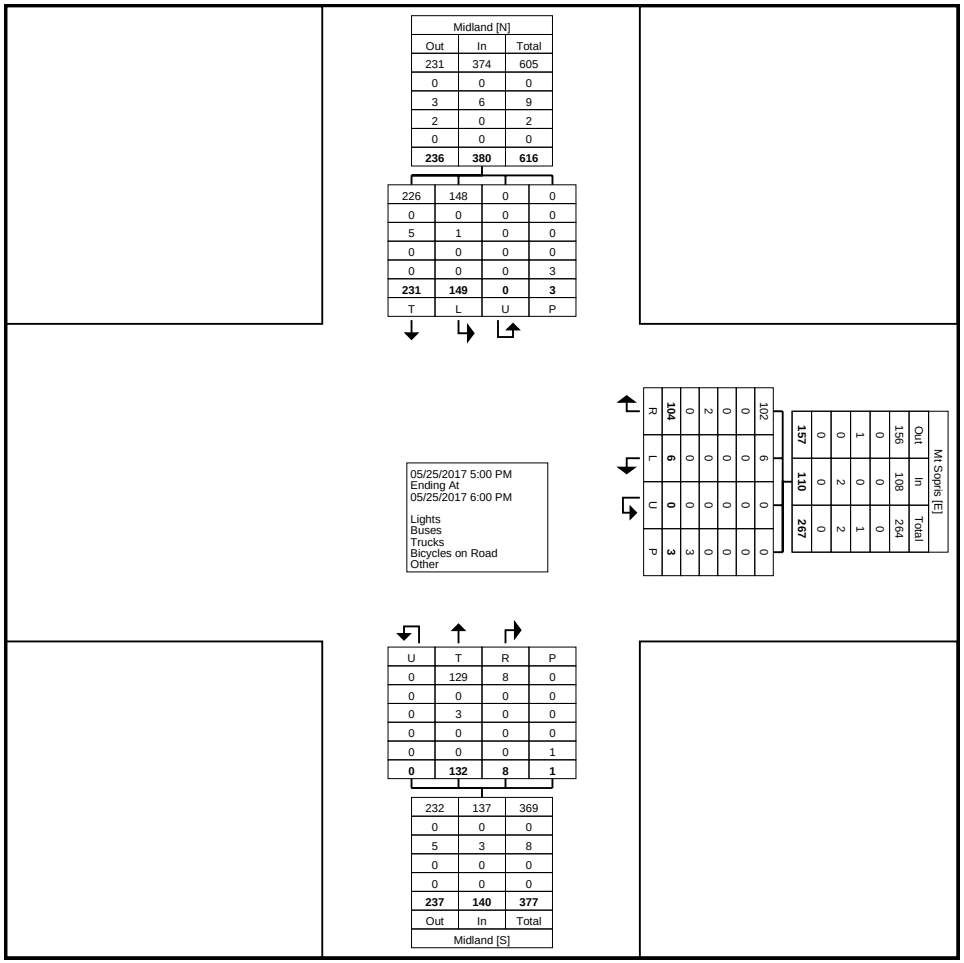
Site Code:
Start Date: 05/25/2017



Turning Movement Data Plot

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(970) 945-1004 leeb@sgm-inc.com

Count Name: S. Midland
Site Code:
Start Date: 05/25/2017

Turning Movement Peak Hour Data (5:00 PM)

Start Time	Midland Southbound					Mt Sopris Westbound					Midland Northbound					
	Thru	Left	U-Turn	Peds	App. Total	Right	Left	U-Turn	Peds	App. Total	Right	Thru	U-Turn	Peds	App. Total	Int. Total
5:00 PM	58	49	0	0	107	24	2	0	2	26	5	31	0	0	36	169
5:15 PM	68	43	0	2	111	41	1	0	0	42	2	31	0	0	33	186
5:30 PM	62	22	0	0	84	27	3	0	0	30	0	35	0	0	35	149
5:45 PM	43	35	0	1	78	12	0	0	1	12	1	35	0	1	36	126
Total	231	149	0	3	380	104	6	0	3	110	8	132	0	1	140	630
Approach %	60.8	39.2	0.0	-	-	94.5	5.5	0.0	-	-	5.7	94.3	0.0	-	-	-
Total %	36.7	23.7	0.0	-	60.3	16.5	1.0	0.0	-	17.5	1.3	21.0	0.0	-	22.2	-
PHF	0.849	0.760	0.000	-	0.856	0.634	0.500	0.000	-	0.655	0.400	0.943	0.000	-	0.972	0.847
Lights	226	148	0	-	374	102	6	0	-	108	8	129	0	-	137	619
% Lights	97.8	99.3	-	-	98.4	98.1	100.0	-	-	98.2	100.0	97.7	-	-	97.9	98.3
Buses	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
% Buses	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.0
Trucks	5	1	0	-	6	0	0	0	-	0	0	3	0	-	3	9
% Trucks	2.2	0.7	-	-	1.6	0.0	0.0	-	-	0.0	0.0	2.3	-	-	2.1	1.4
Bicycles on Road	0	0	0	-	0	2	0	0	-	2	0	0	0	-	0	2
% Bicycles on Road	0.0	0.0	-	-	0.0	1.9	0.0	-	-	1.8	0.0	0.0	-	-	0.0	0.3
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	0.0	-	-	-	-	0.0	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	3	-	-	-	-	3	-	-	-	-	1	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	100.0	-	-	-	-	100.0	-	-

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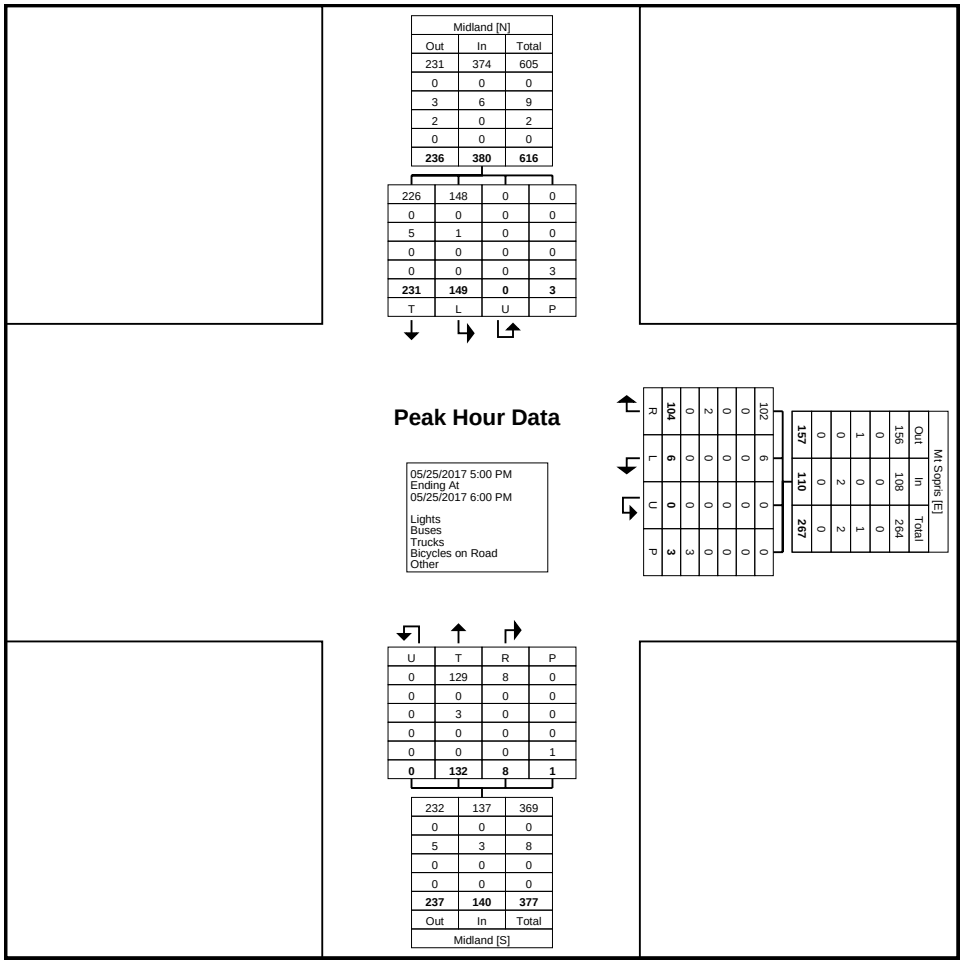

Turning Movement Peak Hour Data Plot (5:00 PM)

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