

Appendix J

Truck Freight Model Findings

COLORADO HIGHWAY 71 *(Limon north to Colorado/Nebraska state line)* TRUCK FREIGHT DIVERSION FEASIBILITY STUDY

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SH-71 Multi-Unit Truck Model Findings

May, 2020

Chicago Systems Analysis Group

Lupa



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Assumptions

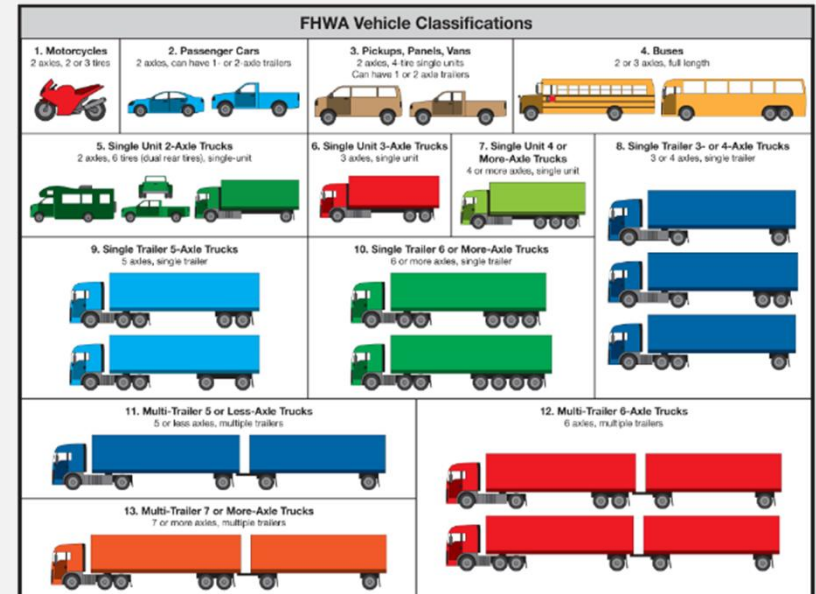
Assumptions

- Multi-Unit Trucks (MUTs) alone are modeled.
- 2018 base year was validated to recent MUT counts:
 - Over 130 CDOT counts
 - 10-15 Wyoming and Nebraska I-80 counts
 - Custom counts in the SH-71 study corridor
- CDOT's Colorado Statewide Model zone system and network adapted. Base year CDOT statewide network used throughout.
- Daily (24-hour) model; Denver area tolls are not used.
- SH-71 is the focus with I-25 also tabulated to capture diversion effects.
- Segment geography established for reporting purposes.
- Shortest path using time is used for assignment. Starting point was posted speeds from the National Highway Planning Network (NHPN)(1), expanded into Colorado.
- Demand tables extracted from the most recent Freight Analysis Framework (V4.3) truck commodity flow data.

1. <https://www.fhwa.dot.gov/planning/processes/tools/nhpn/>

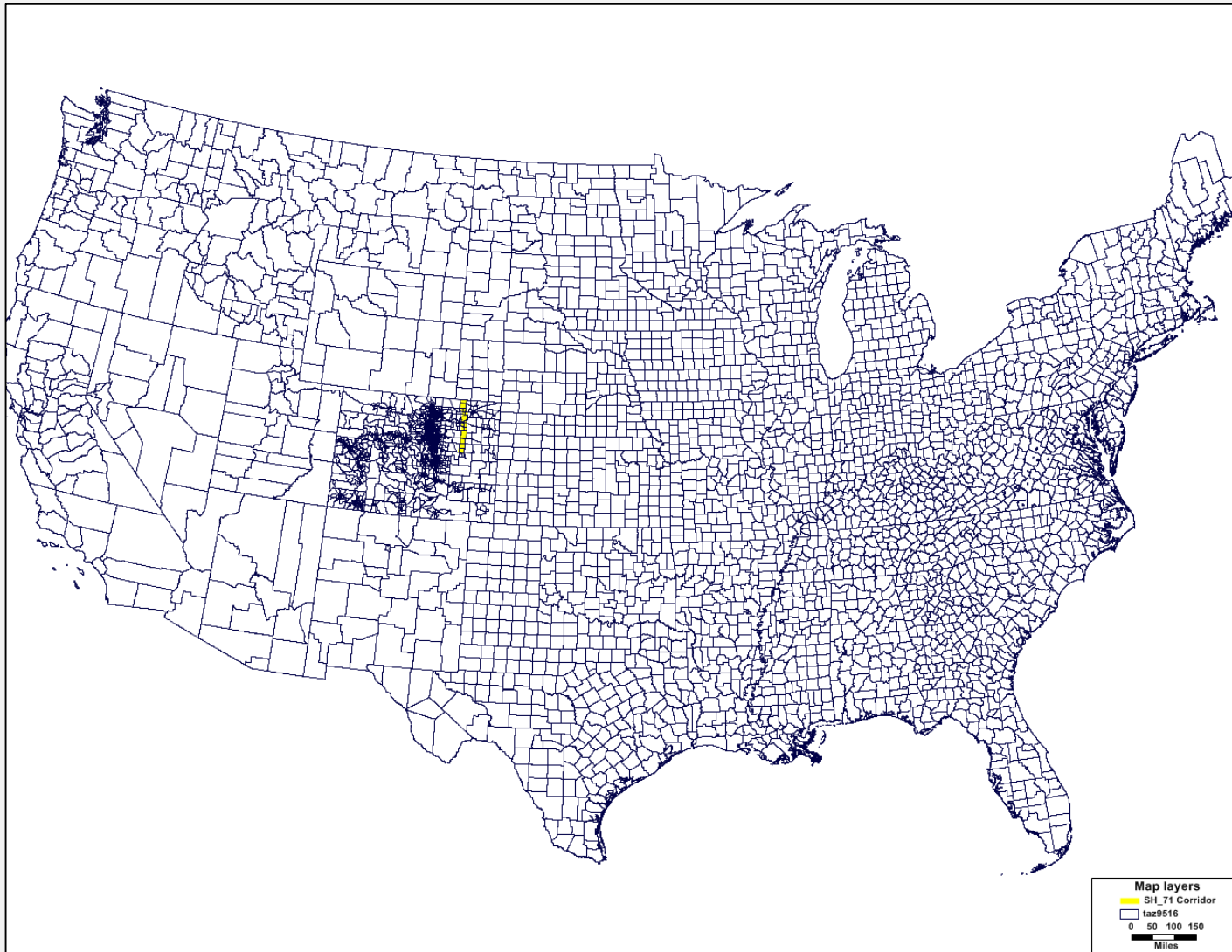
Definition of Multi-Unit Trucks

CDOT Category	FHWA ID	Description
Passenger Vehicles	Class 1	Motorcycles
	Class 2	Passenger Cars
	Class 3	Other Two Axle, Four Tire Single Unit Vehicles
Single-Unit Trucks	Class 4	Buses
	Class 5	Two Axle, Six Tire, Single Unit Trucks
	Class 6	Three Axle Single Unit Trucks
	Class 7	Four or More Axle Single Unit Trucks
Multi-Unit Trucks	Class 8	Four or Fewer Axle Single Trailer Trucks
	Class 9	Five Axle Single Trailer Trucks
	Class 10	Six or More Axle Single Trailer Trucks
	Class 11	Five or fewer Axle Multi Trailer Trucks
	Class 12	Six Axle Multi Trailer Trucks
	Class 13	Seven or More Axle Multi Trailer Trucks



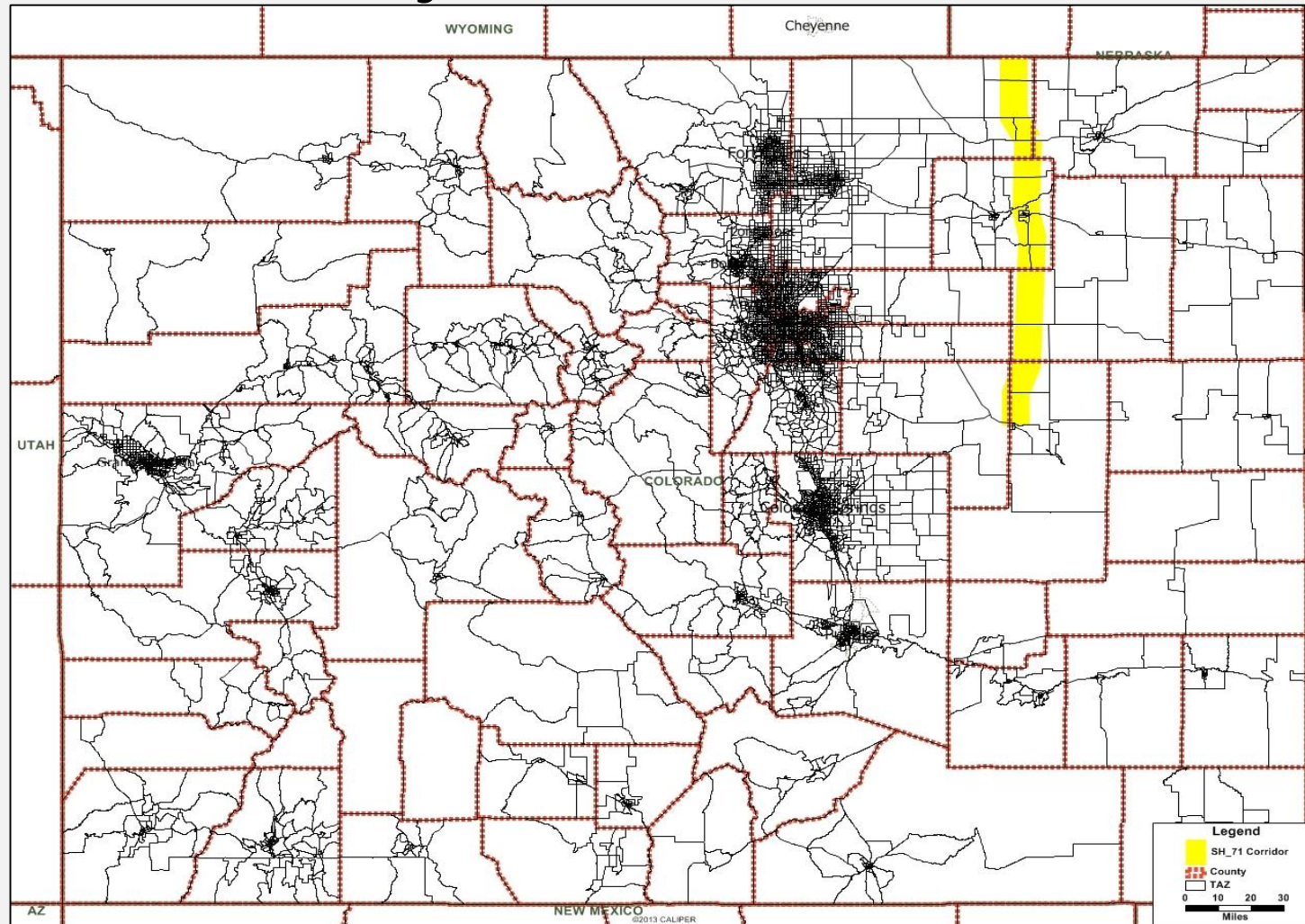
Source: FHWA: Office of Highway Policy Information, Travel Monitoring and Surveys Division

SH-71 Zone System (National)



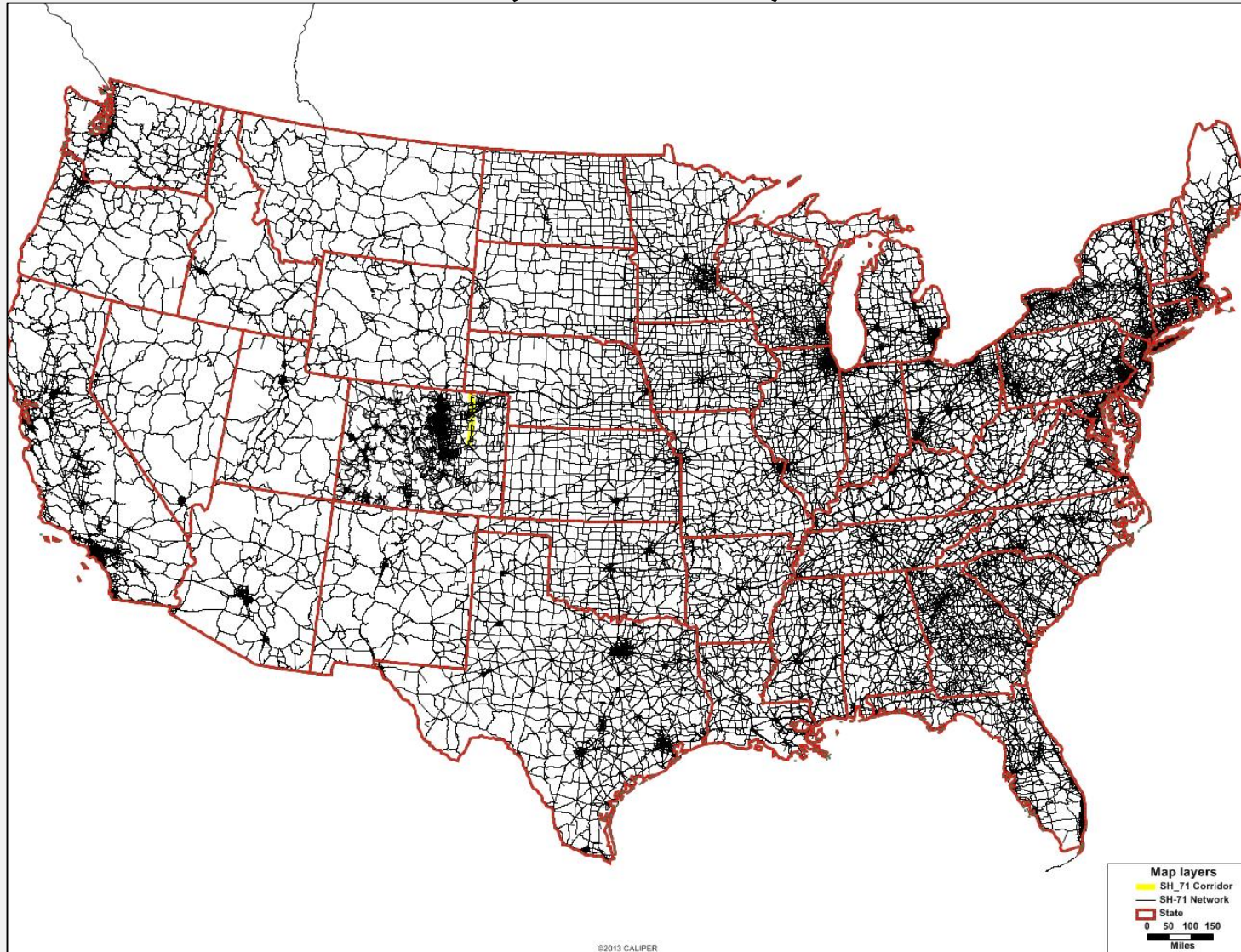
- County level outside of Colorado
- CDOT STM zones within Colorado
- Some extra detail added in the SH-71 corridor

SH-71 Zone System (Colorado)



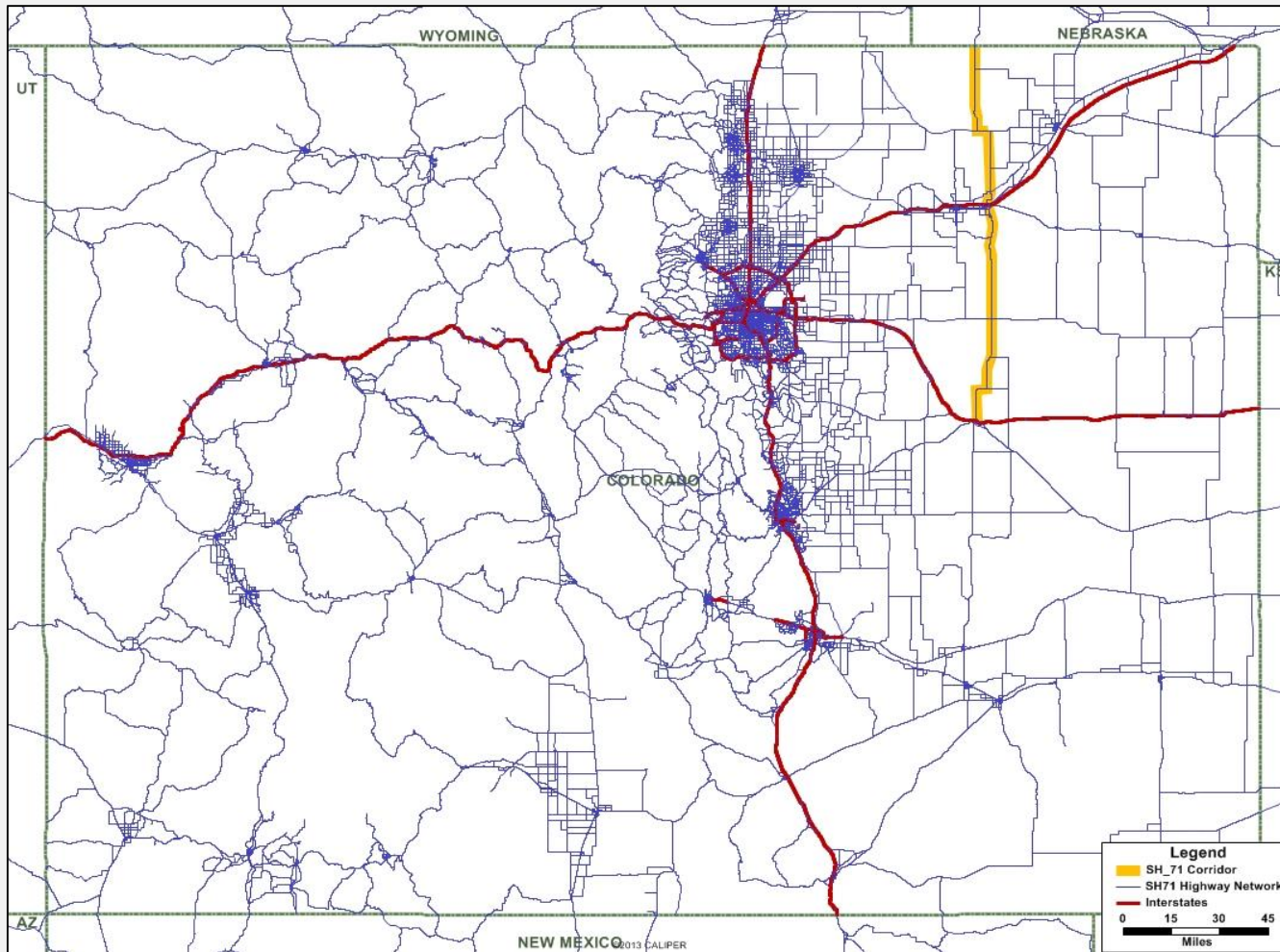
Source: Colorado DOT, 2017

SH-71 Network (National)



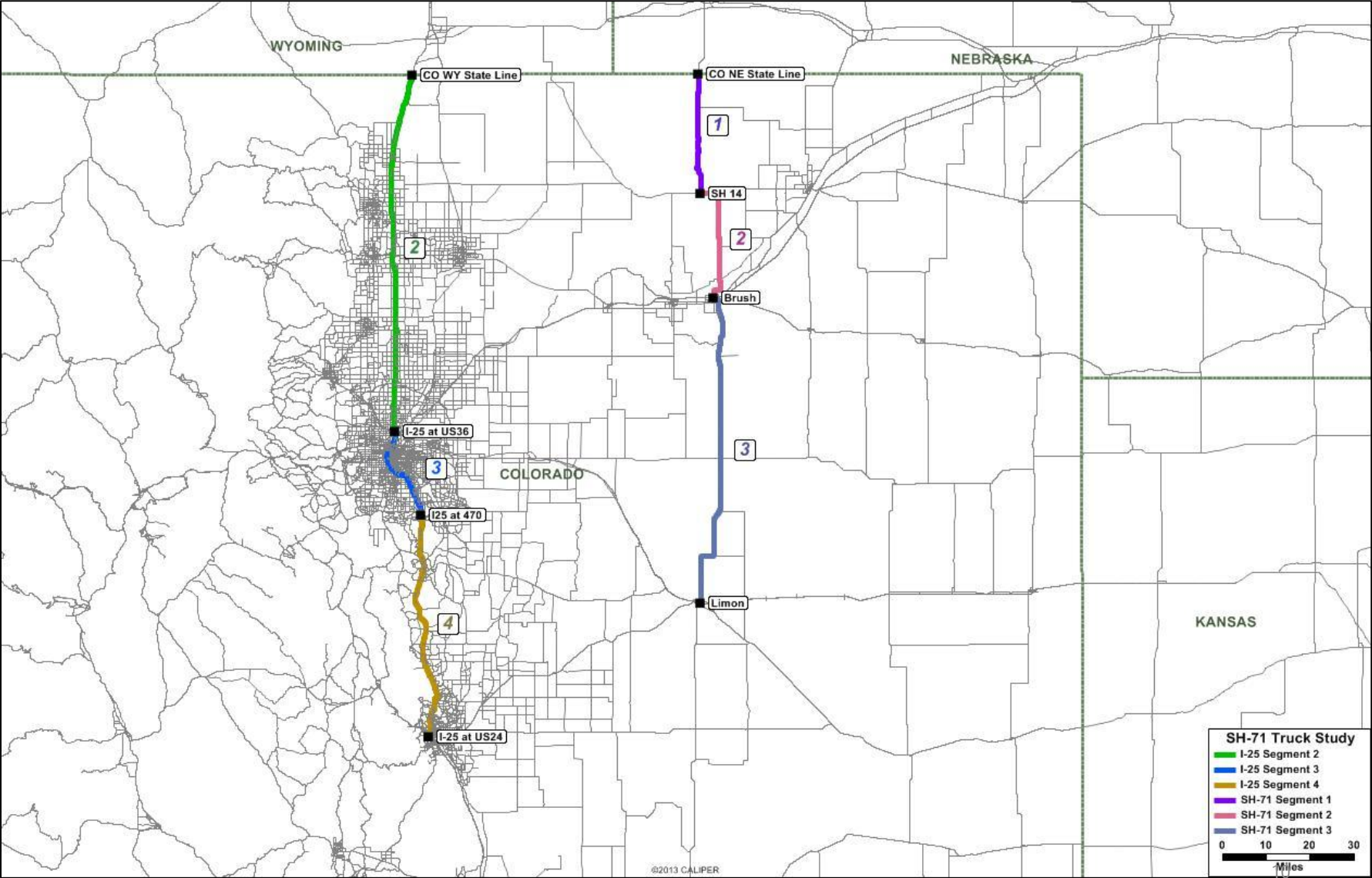
Source: NHPN & Colorado DOT Statewide Model, 2017

SH-71 Network (Colorado)



Source: NHPN & Colorado DOT Statewide Model, 2017

Segment Geography added for Clarity



SH-71 Scenarios

- 2018 Base Year
 - Establishes a validation year
 - Captures existing conditions
- 2040 Future Base
 - Consistent with CDOT future year
 - Reports on growth in trucks 2018-2040
- 2040_s1 – speed increase on SH-71 (70 mph)
- 2040_s2 – speed increase on SH-71 (75 mph)
- 2040_s3 – speed increase on SH-71 (80 mph)

- 2040_x1 – speeds reduced by 7% in the Front Range
- 2040_x2 – speeds reduced by 10% in the Front Range

- 2040_s1x1 – speed increase on SH-71 (70 mph) and speeds reduced by 7% in the Front Range
- 2040_s2x1 – speed increase on SH-71 (75 mph) and speeds reduced by 7% in the Front Range
- 2040_s3x1 – speed increase on SH-71 (80 mph) and speeds reduced by 7% in the Front Range
- 2040_s1x2 – speed increase on SH-71 (70 mph) and speeds reduced by 10% in the Front Range
- 2040_s2x2 – speed increase on SH-71 (75 mph) and speeds reduced by 10% in the Front Range
- 2040_s3x2 – speed increase on SH-71 (80 mph) and speeds reduced by 10% in the Front Range

Results

Scenario	Description with status of SH-71 segments	Front Range speed	Average MUT on SH-71
2018	2018 Existing Conditions	2018 base conditions	208
2040 Future Base	2040 Base Conditions with SH-71 speed set to 65 mph	2040 base conditions	313
2040_s1	2040 with SH-71 speed set to 70 mph	No change from base	642
2040_s2	2040 with SH-71 speed set to 75 mph	No change from base	801
2040_s3	2040 with SH-71 speed set to 80 mph	No change from base	835
2040_x1	2040 with SH-71 speed set to 65 mph	reduced by 7%	476
2040_s1_x1	2040 with SH-71 speed set to 70 mph	reduced by 7%	835
2040_s2_x1	2040 with SH-71 speed set to 75 mph	reduced by 7%	1,039
2040_s3_x1	2040 with SH-71 speed set to 80 mph	reduced by 7%	1,082
2040_x2	2040 with SH-71 speed set to 65 mph	reduced by 10%	518
2040_s1_x2	2040 with SH-71 speed set to 70 mph	reduced by 10%	891
2040_s2_x2	2040 with SH-71 speed set to 75 mph	reduced by 10%	1,110
2040_s4_x2	2040 with SH-71 speed set to 80 mph	reduced by 10%	1,156

Results

2040 Average Weekday MUT Traffic on SH-71																	
No Speed Factor						Speeds reduced by 7% in the Front Range						Speeds reduced by 10% in the Front Range					
Segment	Miles	65 mph	70 mph	75 mph	80 mph	Segment	Miles	65 mph	70 mph	75 mph	80 mph	Segment	Miles	65 mph	70 mph	75 mph	80 mph
SH-71 Seg 1	27	377	460	597	623	SH-71 Seg 1	27	384	534	693	723	SH-71 Seg 1	27	397	596	773	807
SH-71 Seg 2	29	259	389	551	577	SH-71 Seg 2	29	266	479	679	711	SH-71 Seg 2	29	280	518	734	769
SH-71 Seg 3	74	311	809	974	1,013	SH-71 Seg 3	74	593	1,085	1,307	1,360	SH-71 Seg 3	74	655	1,146	1,381	1,436
All Segs	131	313	642	801	835	All Segs	131	476	835	1,039	1,082	All Segs	131	518	891	1,110	1,156
VMT Change in the Front Range			-1.3%	-2.4%	-2.8%	VMT Change in the Front Range			-4.8%	-6.2%	-6.5%	VMT Change in the Front Range			-6.9%	-8.9%	-9.7%

SH-71 Speed Increase + No Speed Factor					SH-71 Speed Increase + Speeds Reduced by 7% on the Front Range					SH-71 Speed Increase + Speeds Reduced by 10% on the Front Range				
Speed	SH-71 Seg 1	SH-71 Seg 2	SH-71 Seg 3	2040 MUTs	Speed	SH-71 Seg 1	SH-71 Seg 2	SH-71 Seg 3	2040 MUTs	Speed	SH-71 Seg 1	SH-71 Seg 2	SH-71 Seg 3	2040 MUTs
65 mph	~350	~300	~400	~400	65 mph	~400	~300	~600	~600	65 mph	~450	~350	~700	~700
70 mph	~450	~400	~550	~550	70 mph	~500	~450	~1000	~1000	70 mph	~550	~500	~1100	~1100
75 mph	~550	~500	~700	~700	75 mph	~650	~600	~1300	~1300	75 mph	~700	~650	~1400	~1400
80 mph	~600	~550	~800	~800	80 mph	~700	~650	~1400	~1400	80 mph	~750	~700	~1450	~1450

No Speed Factor	Diff in MUT			
		65-70 mph	70-75 mph	75-80 mph
	SH-71 Seg 1	83	137	26
	SH-71 Seg 2	130	162	26
	SH-71 Seg 3	498	166	39
All Segs	329	159	34	
Speeds reduced by 7% in the Front Range	Diff in MUT			
		65-70 mph	70-75 mph	75-80 mph
	SH-71 Seg 1	150	159	30
	SH-71 Seg 2	213	200	32
	SH-71 Seg 3	492	222	52
All Segs	358	204	43	
Speeds reduced by 10% in the Front Range	Diff in MUT			
		65-70 mph	70-75 mph	75-80 mph
	SH-71 Seg 1	199	178	34
	SH-71 Seg 2	238	216	35
	SH-71 Seg 3	491	235	55
All Segs	374	219	46	

No Speed Factor	% Diff in MUT			
		65-70 mph	70-75 mph	75-80 mph
	SH-71 Seg 1	22%	30%	4%
	SH-71 Seg 2	50%	42%	5%
	SH-71 Seg 3	160%	20%	4%
All Segs	105%	25%	4%	
Speeds reduced by 7% in the Front Range	% Diff in MUT			
		65-70 mph	70-75 mph	75-80 mph
	SH-71 Seg 1	39%	30%	4%
	SH-71 Seg 2	80%	42%	5%
	SH-71 Seg 3	83%	20%	4%
All Segs	75%	24%	4%	
Speeds reduced by 10% in the Front Range	% Diff in MUT			
		65-70 mph	70-75 mph	75-80 mph
	SH-71 Seg 1	50%	30%	4%
	SH-71 Seg 2	85%	42%	5%
	SH-71 Seg 3	75%	20%	4%
All Segs	72%	25%	4%	

Base 2018

BASE 2018

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2018 (sum of two directions)*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	25	65.0	239	6,539	101
SH-71	2	SH 14	Brush CO	29	27	64.8	188	5,490	85
SH-71	3	Brush CO	Limon CO	74	69	64.9	205	15,252	236
TOTAL SH-71				131	121	64.8	208	27,281	421
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2018 (sum of two directions)*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	72	68.3	2,755	452,080	6,632
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	21	65.0	3,778	170,630	2,625
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.9	2,205	229,602	3,384
TOTAL I-25				157	139	67.6	2,720	852,312	12,640

*Weighted by Highway Segment Length

Report	2018	ALT	Diff	% Diff
SH-71				
Truck VMT	27,281	-	(27,281)	-100%
Truck VHT	421	-	(421)	-100%
I-25				
Truck VMT	852,312	-	(852,312)	-100%
Truck VHT	12,640	-	(12,640)	-100%

2018 BASE YEAR TRAFFIC FORECAST (MULTI-UNIT TRUCKS)

* weighted by road segment length

Future Base 2040

FUTURE BASE 2040

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	25	65.0	377	10,300	158
SH-71	2	SH 14	Brush CO	29	27	64.8	259	7,553	117
SH-71	3	Brush CO	Limon CO	74	69	64.9	311	23,130	357
TOTAL SH-71				131	121	64.8	313	40,983	632
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	72	68.3	4,669	766,061	11,237
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	21	65.0	7,713	348,321	5,359
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.9	4,050	421,613	6,213
TOTAL I-25				157	139	67.6	4,902	1,535,995	22,810
<i>*Weighted by Highway Segment Length</i>									
Report	2018	2040	Diff	% Diff					
SH-71									
Truck VMT	27,281	40,983	13,702	50%					
Truck VHT	421	632	211	50%					
I-25									
Truck VMT	852,312	1,535,995	683,684	80%					
Truck VHT	12,640	22,810	10,169	80%					

2040 FUTURE YEAR TRAFFIC FORECAST (MULTI-UNIT TRUCKS)

Wrap-up of 2018 and 2040 Base Scenarios

- 2018 MUT traffic at 272 directional locations validated to within plus or minus 5% of total observed MUT traffic.
- MUTs on SH-71 grow from a weighted average of 208 to 313.
- Truck VMT Change 2016 to 2040
 - SH-71 – 50%
 - I-25 – 80%

Speed Sensitivity on SH-71

2040_x1 – no speed increase on SH-71 (65 mph) –
this result is identical to the 2040 Future Base

2040_s1 – speed increase on SH-71 (70 mph)

2040_s2 – speed increase on SH-71 (75 mph)

2040_s3 – speed increase on SH-71 (80 mph)

FUTURE BASE 2040

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	25	65.0	377	10,300	158
SH-71	2	SH 14	Brush CO	29	27	64.8	259	7,553	117
SH-71	3	Brush CO	Limon CO	74	69	64.9	311	23,130	357
TOTAL SH-71				131	121	64.8	313	40,983	632
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	72	68.3	4,669	766,061	11,237
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	21	65.0	7,713	348,321	5,359
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.9	4,050	421,613	6,213
TOTAL I-25				157	139	67.6	4,902	1,535,995	22,810
<i>*Weighted by Highway Segment Length</i>									
Report	2018	2040	Diff	% Diff					
SH-71									
Truck VMT	27,281	40,983	13,702	50%					
Truck VHT	421	632	211	50%					
I-25									
Truck VMT	852,312	1,535,995	683,684	80%					
Truck VHT	12,640	22,810	10,169	80%					

2040 FUTURE YEAR TRAFFIC FORECAST (MULTI-UNIT TRUCKS)

Speed Sensitivity on SH-71

2040_x1 – no speed increase on SH-71 (65 mph)

2040_s1 – speed increase on SH-71 (70 mph)

2040_s2 – speed increase on SH-71 (75 mph)

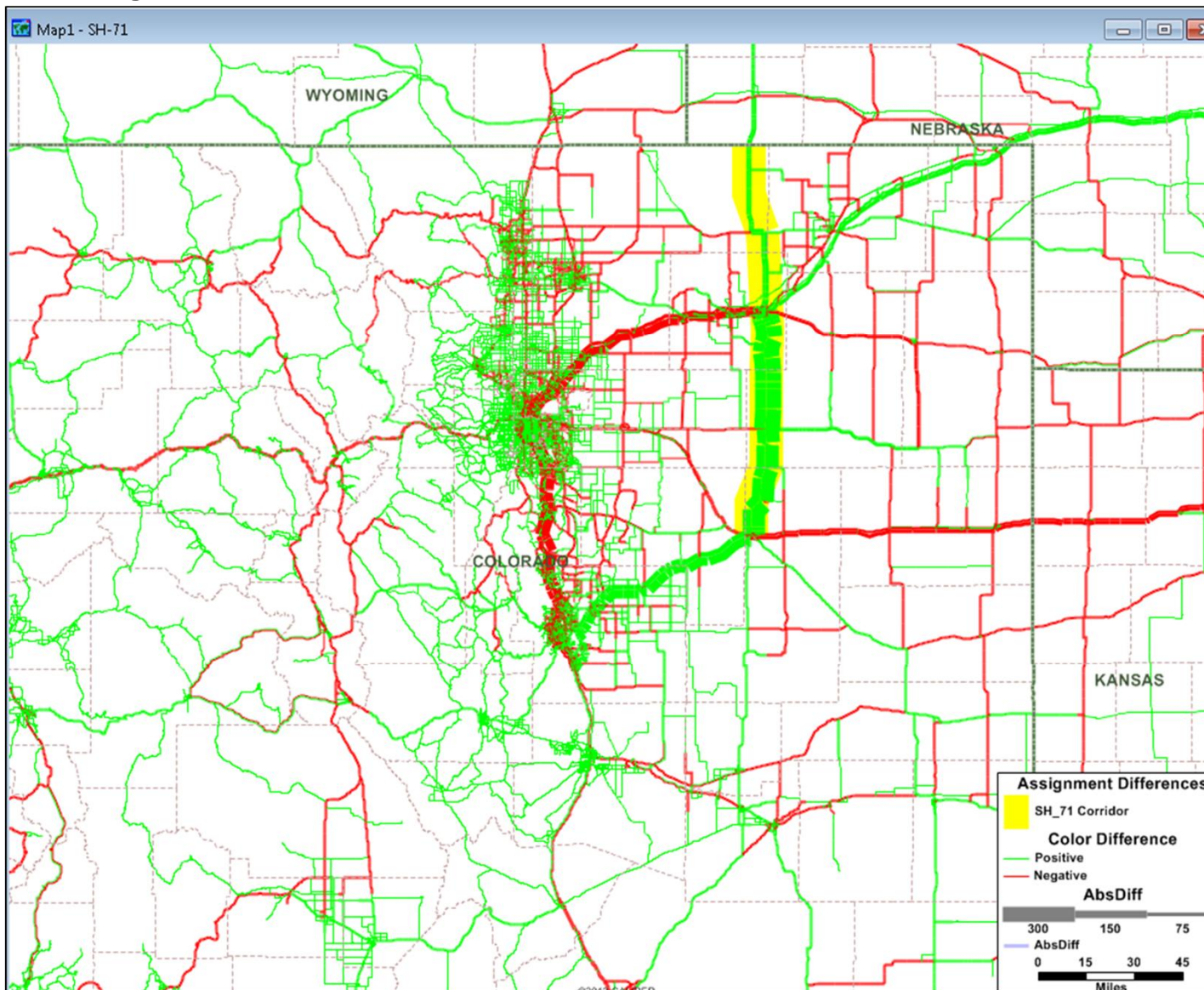
2040_s3 – speed increase on SH-71 (80 mph)

2040_s1

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	23	70.0	460	12,568	180
SH-71	2	SH 14	Brush CO	29	25	69.8	389	11,344	163
SH-71	3	Brush CO	Limon CO	74	64	69.8	809	60,167	863
TOTAL SH-71				131	113	69.7	642	84,079	1,206
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	72	68.3	4,661	764,731	11,218
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	21	65.0	7,625	344,354	5,298
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.9	3,940	410,249	6,046
TOTAL I-25				157	139	67.6	4,849	1,519,333	22,562
<i>*Weighted by Highway Segment Length</i>									
Report									
	2040 BASE	ALT	Diff	% Diff					
SH-71									
Truck VMT	40,983	84,079	43,096	105%					
Truck VHT	632	1,206	574	91%					
I-25									
Truck VMT	1,535,995	1,519,333	(16,662)	-1%					
Truck VHT	22,810	22,562	(248)	-1%					

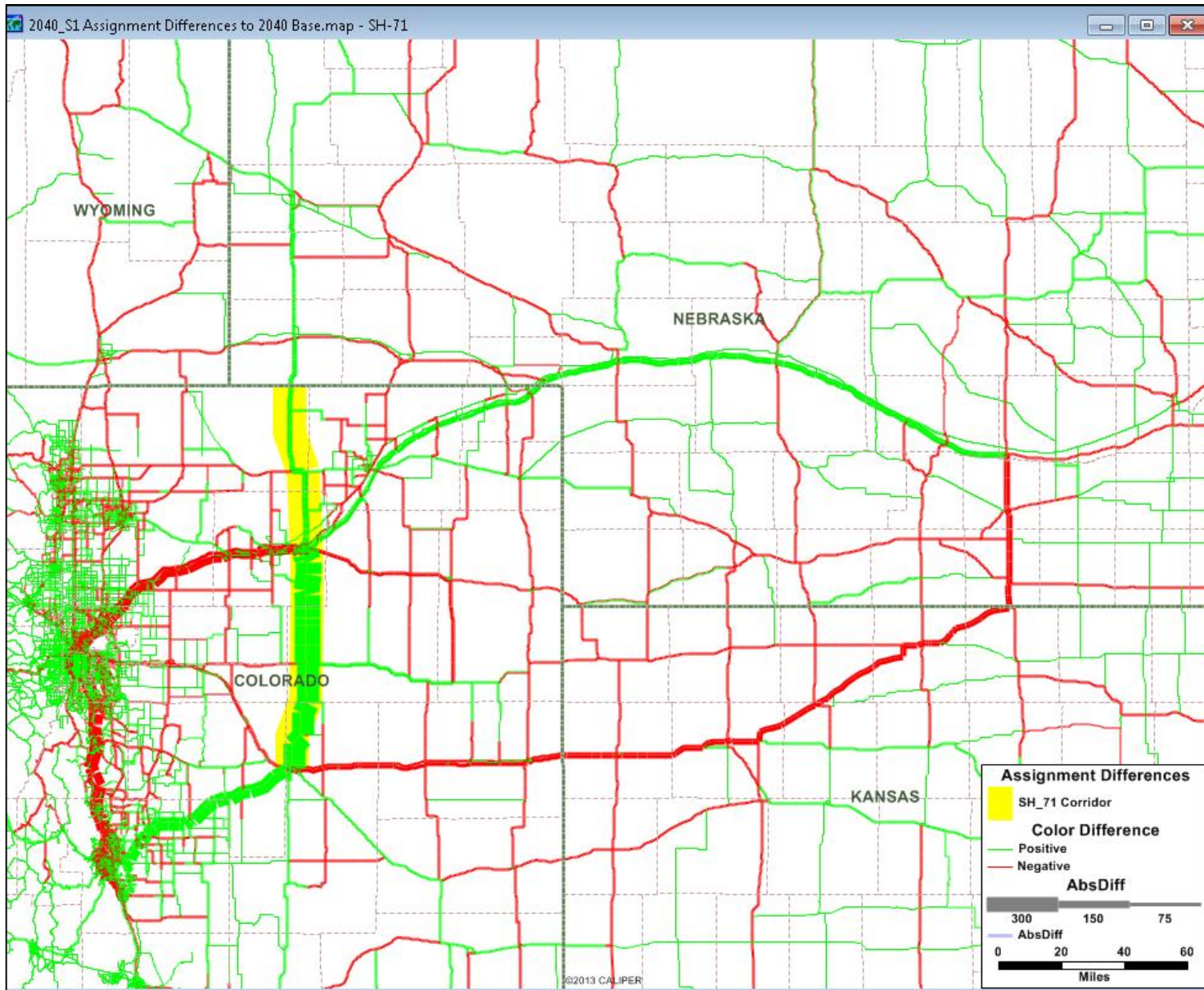
**2040 TRAFFIC FORECAST
 (MULTI-UNIT TRUCKS)
 SH-71 @ 70 mph**

Assignment Differences 2040_s1 and 2040 Base (1)



- MUT trips to/from Colorado Springs and points south use US-24 and SH-71 instead of I-76.
- SH-71 Limon to Brush performs best of the three segments.

Assignment Differences 2040_s1 and 2040 Base (2)



- Big picture: I-70 loses MUTs in Kansas while I-76 and I-80 gain them in Colorado and Nebraska as the trucks travel to and from points east.

Speed Sensitivity on SH-71

2040_x1 – no speed increase on SH-71 (65 mph)

2040_s1 – speed increase on SH-71 (70 mph)

2040_s2 – speed increase on SH-71 (75 mph)

2040_s3 – speed increase on SH-71 (80 mph)

2040_s2

SH-71 MULTI_UNIT TRUCK (MUT) REPORT

HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	22	75.0	597	16,311	217
SH-71	2	SH 14	Brush CO	29	23	74.7	551	16,068	216
SH-71	3	Brush CO	Limon CO	74	60	74.8	974	72,439	971
TOTAL SH-71				131	105	74.7	801	104,818	1,404
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	72	68.3	4,631	759,844	11,146
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	21	65.0	7,544	340,678	5,241
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.9	3,848	400,643	5,904
TOTAL I-25				157	139	67.6	4,791	1,501,165	22,292

*Weighted by Highway Segment Length

Report	2040 BASE	ALT	Diff	% Diff
SH-71				
Truck VMT	40,983	104,818	63,835	156%
Truck VHT	632	1,404	772	122%
I-25				
Truck VMT	1,535,995	1,501,165	(34,831)	-2%
Truck VHT	22,810	22,292	(518)	-2%

**2040 TRAFFIC FORECAST
(MULTI-UNIT TRUCKS)
SH-71 @ 75 mph**

Speed Sensitivity on SH-71

2040_x1 – no speed increase on SH-71 (65 mph)

2040_s1 – speed increase on SH-71 (70 mph)

2040_s2 – speed increase on SH-71 (75 mph)

2040_s3 – speed increase on SH-71 (80 mph)

2040_s3

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	20	80.0	623	17,021	213
SH-71	2	SH 14	Brush CO	29	22	79.7	577	16,826	212
SH-71	3	Brush CO	Limon CO	74	56	79.8	1013	75,339	947
TOTAL SH-71				131	99	79.6	835	109,187	1,372
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	72	68.3	4,568	749,502	10,994
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	21	65.0	7,483	342,909	5,199
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.9	3,790	394,545	5,814
TOTAL I-25				157	139	67.6	4,729	1,486,956	22,008
<i>*Weighted by Highway Segment Length</i>									
Report									
	2040 BASE	ALT	Diff	% Diff					
SH-71									
Truck VMT	40,983	109,187	68,204	166%					
Truck VHT	632	1,372	740	117%					
I-25									
Truck VMT	1,535,995	1,486,956	(49,040)	-3%					
Truck VHT	22,810	22,008	(802)	-4%					

**2040 TRAFFIC FORECAST
 (MULTI-UNIT TRUCKS)
 SH-71 @ 80 mph**

Wrap-up of Speed Sensitivity

- Averaged over all three segments in 2040, SH-71 attracts:
 - 313 MUTs @ 65 mph
 - 642 MUTs @ 70 mph
 - 801 MUTs @ 75 mph
 - 835 MUTs @ 80 mph
- The increase in speeds affects SH-71 truck traffic, but the effect is dampened as the speed approaches 80 mph.
- Using Assignment Difference plots, it can be seen that trucks traveling to and from Colorado Springs from the east use US-24 and SH-71 instead of I-76 and that SH-71 from Limon to Brush performs best of the three segments. – These findings are consistent with the previous SH-71 analysis

Sensitivity to speed assumptions on the Front Range

- SH-71 speeds were tested at 65, 70, 75 and 80 mph
- Each SH-71 speed scenario was tested with speed reductions assumed in the Front Range:
 - No speed reduction
 - Speeds reduced by 7%
 - Speeds reduced by 10%

Speed on SH-71 / Congestion on the Front Range Scenarios

- 2040_x1 – no speed increase on SH-71 (65 mph) and speeds reduced by 7% in the Front Range
- 2040_s1_x1 – speed increase on SH-71 (70 mph) and speeds reduced by 7% in the Front Range
- 2040_s2_x1 – speed increase on SH-71 (75 mph) and speeds reduced by 7% in the Front Range
- 2040_s3_x1 – speed increase on SH-71 (80 mph) and speeds reduced by 7% in the Front Range

- 2040_x2 – no speed increase on SH-71 (65 mph) and speeds reduced by 10% in the Front Range
- 2040_s1_x2 – speed increase on SH-71 (70 mph) and speeds reduced by 10% in the Front Range
- 2040_s2_x2 – speed increase on SH-71 (75 mph) and speeds reduced by 10% in the Front Range
- 2040_s3_x2 – speed increase on SH-71 (80 mph) and speeds reduced by 10% in the Front Range

Results are provided for these eight SH-71 / Front Range congestion combinations.

7% speed reduction on the Front
Range

2040_x1

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	25	65.0	384	10,492	161
SH-71	2	SH 14	Brush CO	29	27	64.8	266	7,757	120
SH-71	3	Brush CO	Limon CO	74	69	64.9	593	44,103	681
TOTAL SH-71				131	121	64.8	476	62,351	962
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	73	67.6	4,455	731,062	10,852
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	23	60.0	7,636	337,827	6,247
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.9	3,952	411,440	6,070
TOTAL I-25				157	142	66.3	4,746	1,480,329	23,169
<i>*Weighted by Highway Segment Length</i>									
Report									
	2040 BASE	ALT	Diff	% Diff					
SH-71									
Truck VMT	40,983	62,351	21,368	52%					
Truck VHT	632	962	330	52%					
I-25									
Truck VMT	1,535,995	1,480,329	(55,667)	-4%					
Truck VHT	22,810	23,169	359	2%					

**2040 TRAFFIC FORECAST
 (MULTI-UNIT TRUCKS)**
SH-71 @ 65 mph
7% speed reduction

2040_s1x1

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	23	70.0	534	14,590	208
SH-71	2	SH 14	Brush CO	29	25	69.8	479	13,968	201
SH-71	3	Brush CO	Limon CO	74	64	69.8	1085	80,694	1,158
TOTAL SH-71				131	113	69.7	835	109,252	1,567
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	74	66.9	4,357	714,936	10,754
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	25	55.3	9,398	344,099	6,447
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.8	3,807	396,355	5,854
TOTAL I-25				157	145	65.0	17,562	1,455,390	23,056
<i>*Weighted by Highway Segment Length</i>									
Report	2040 BASE	ALT	Diff	% Diff					
SH-71									
Truck VMT	40,983	109,252	68,269	167%					
Truck VHT	632	1,567	935	148%					
I-25									
Truck VMT	1,535,995	1,455,390	(80,605)	-5%					
Truck VHT	22,810	23,056	246	1%					

2040 TRAFFIC FORECAST
(MULTI-UNIT TRUCKS)
SH-71 @ 70 mph
7% speed reduction

2040_s2x1

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	22	75.0	693	18,934	252
SH-71	2	SH 14	Brush CO	29	23	74.7	679	19,801	266
SH-71	3	Brush CO	Limon CO	74	60	74.8	1307	97,205	1,303
TOTAL SH-71				131	105	74.7	1,039	135,940	1,821
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	74	66.9	4,344	712,875	10,723
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	25	55.3	7,379	334,229	6,431
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.8	3,781	393,648	5,814
TOTAL I-25				157	145	65.0	4,595	1,440,752	22,969
<i>*Weighted by Highway Segment Length</i>									
Report									
	2040 BASE	ALT	Diff	% Diff					
SH-71									
Truck VMT	40,983	135,940	94,957	232%					
Truck VHT	632	1,821	1,189	188%					
I-25									
Truck VMT	1,535,995	1,440,752	(95,243)	-6%					
Truck VHT	22,810	22,969	159	1%					

2040 TRAFFIC FORECAST
(MULTI-UNIT TRUCKS)
SH-71 @ 75 mph
7% speed reduction

2040_s3x1

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	20	80.0	723	19,754	247
SH-71	2	SH 14	Brush CO	29	22	79.7	711	20,734	261
SH-71	3	Brush CO	Limon CO	74	56	79.8	1360	101,147	1,272
TOTAL SH-71				131	99	79.6	1,082	141,634	1,780
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	74	66.9	4,290	703,897	10,588
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	25	55.3	7,358	341,286	6,581
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.8	3,760	391,469	5,782
TOTAL I-25				157	145	65.0	4,556	1,436,652	22,952
<i>*Weighted by Highway Segment Length</i>									
Report									
	2040 BASE	ALT	Diff	% Diff					
SH-71									
Truck VMT	40,983	141,634	100,651	246%					
Truck VHT	632	1,780	1,148	181%					
I-25									
Truck VMT	1,535,995	1,436,652	(99,343)	-6%					
Truck VHT	22,810	22,952	142	1%					

2040 TRAFFIC FORECAST
(MULTI-UNIT TRUCKS)
SH-71 @ 80 mph
7% speed reduction

10% speed reduction on the
Front Range

2040_x2

HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	25	65.0	397	10,847	167
SH-71	2	SH 14	Brush CO	29	27	64.8	280	8,165	126
SH-71	3	Brush CO	Limon CO	74	69	64.9	655	48,714	752
TOTAL SH-71				131	121	64.8	518	67,726	1,045
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	73	67.3	4,399	721,819	11,800
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	23	58.0	6,872	350,327	5,651
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.9	3,572	371,889	6,122
TOTAL I-25				157	143	65.8	4,481	1,444,035	23,573

*Weighted by Highway Segment Length

Report	2040 BASE	ALT	Diff	% Diff
SH-71				
Truck VMT	40,983	67,726	26,743	65%
Truck VHT	632	1,045	413	65%
I-25				
Truck VMT	1,535,995	1,444,035	(91,960)	-6%
Truck VHT	22,810	23,573	763	3%

**2040 TRAFFIC FORECAST
(MULTI-UNIT TRUCKS)
SH-71 @ 65 mph
*10% speed reduction***

2040_s1x2

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	23	70.0	596	16,284	233
SH-71	2	SH 14	Brush CO	29	25	69.8	518	15,106	217
SH-71	3	Brush CO	Limon CO	74	64	69.8	1146	85,231	1,223
TOTAL SH-71				131	113	69.7	891	116,620	1,673
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	76	66.0	4,278	702,026	10,793
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	28	48.8	7,261	338,880	6,726
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.7	3,731	388,488	5,749
TOTAL I-25				157	150	62.8	4,526	1,429,393	23,268
<i>*Weighted by Highway Segment Length</i>									
Report	2040 BASE	ALT	Diff	% Diff					
SH-71									
Truck VMT	40,983	116,620	75,637	185%					
Truck VHT	632	1,673	1,040	165%					
I-25									
Truck VMT	1,535,995	1,429,393	(106,602)	-7%					
Truck VHT	22,810	23,268	459	2%					

2040 TRAFFIC FORECAST
(MULTI-UNIT TRUCKS)
SH-71 @ 70 mph
10% speed reduction

2040_s2x2

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	22	75.0	773	21,120	282
SH-71	2	SH 14	Brush CO	29	23	74.7	734	21,404	287
SH-71	3	Brush CO	Limon CO	74	60	74.8	1381	102,709	1,377
TOTAL SH-71				131	105	74.7	1,110	145,233	1,946
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	76	66.0	4,269	700,464	10,769
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	28	48.8	7,242	313,129	6,708
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.7	3,703	385,568	5,706
TOTAL I-25				157	150	62.8	4,509	1,399,161	23,184
<i>*Weighted by Highway Segment Length</i>									
Report	2040 BASE	ALT	Diff	% Diff					
SH-71									
Truck VMT	40,983	145,233	104,250	254%					
Truck VHT	632	1,946	1,313	208%					
I-25									
Truck VMT	1,535,995	1,399,161	(136,835)	-9%					
Truck VHT	22,810	23,184	374	2%					

**2040 TRAFFIC FORECAST
 (MULTI-UNIT TRUCKS)
 SH-71 @ 75 mph
 10% speed reduction**

2040_s3x2

SH-71 MULTI_UNIT TRUCK (MUT) REPORT									
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
SH-71		FROM	TO						
SH-71	1	CO-NE State Line	SH 14	27	20	80.0	807	22,049	276
SH-71	2	SH 14	Brush CO	29	22	79.7	769	22,425	282
SH-71	3	Brush CO	Limon CO	74	56	79.8	1436	106,799	1,343
TOTAL SH-71				131	99	79.6	1,156	151,273	1,901
HIGHWAY	SECTION ID	SECTION DESCRIPTION		CENTERLINE MILES	TOTAL SEGMENT DRIVE TIME (MINUTES)	AVERAGE DAILY MUT SPEED	AVERAGE DAILY MUT TRAFFIC 2040*	MUT VMT	MUT VHT
I-25		FROM	TO						
I-25	1	CO-WY State Line	I-25 at US 36	82	76	66.0	4,096	672,098	10,333
I-25	2	I-25 at US 36	I-25 at 470 (S)	23	28	48.8	7,218	333,669	7,157
I-25	3	I-25 at 470 (S)	I-25 at US 24	52	46	67.7	3,677	382,809	5,665
TOTAL I-25				157	150	62.8	4,407	1,388,576	23,155
<i>*Weighted by Highway Segment Length</i>									
Report									
	2040 BASE	ALT	Diff	% Diff					
SH-71									
Truck VMT	40,983	151,273	110,290	269%					
Truck VHT	632	1,901	1,269	201%					
I-25									
Truck VMT	1,535,995	1,388,576	(147,420)	-10%					
Truck VHT	22,810	23,155	345	2%					

2040 TRAFFIC FORECAST
(MULTI-UNIT TRUCKS)
SH-71 @ 80 mph
10% speed reduction

Wrap-up of Front Range Congestion Sensitivity

- Changes in speeds in the Front Range were used to look at a sketch level of future congestion assuming:
 - Front Range speeds reduced by 7%
 - Front Range speeds reduced by 10%
- A 7% reduction in speeds in the Front Range increases MUTs on SH-71 from 313 to 476 – a 52% increase.
- A 10% reduction in speeds in the Front Range increases MUTs on SH-71 from 313 to 518 – a 65% increase.
- By comparison – even a modest speed increase of 65 to 70 mph on SH-71 increases MUTs from 313 to 642 – a 105% increase.
- Under congestion scenarios VMT generally decreases on the I-25 segments of the Front Range as traffic shifts from I-25 to arterials; VHT increases as traffic uses routes with lower speeds and classification.

Top Summary

Scenario	Description with status of SH-71 segments	Front Range speed	Average MUT on SH-71
2018	2018 Existing Conditions	2018 base conditions	208
2040 Future Base	2040 Base Conditions with SH-71 speed set to 65 mph	2040 base conditions	313
2040_s1	2040 with SH-71 speed set to 70 mph	No change from base	642
2040_s2	2040 with SH-71 speed set to 75 mph	No change from base	801
2040_s3	2040 with SH-71 speed set to 80 mph	No change from base	835
2040_x1	2040 with SH-71 speed set to 65 mph	reduced by 7%	476
2040_s1_x1	2040 with SH-71 speed set to 70 mph	reduced by 7%	835
2040_s2_x1	2040 with SH-71 speed set to 75 mph	reduced by 7%	1,039
2040_s3_x1	2040 with SH-71 speed set to 80 mph	reduced by 7%	1,082
2040_x2	2040 with SH-71 speed set to 65 mph	reduced by 10%	518
2040_s1_x2	2040 with SH-71 speed set to 70 mph	reduced by 10%	891
2040_s2_x2	2040 with SH-71 speed set to 75 mph	reduced by 10%	1,110
2040_s4_x2	2040 with SH-71 speed set to 80 mph	reduced by 10%	1,156

Some Findings from the SH-71 MUT Model Runs

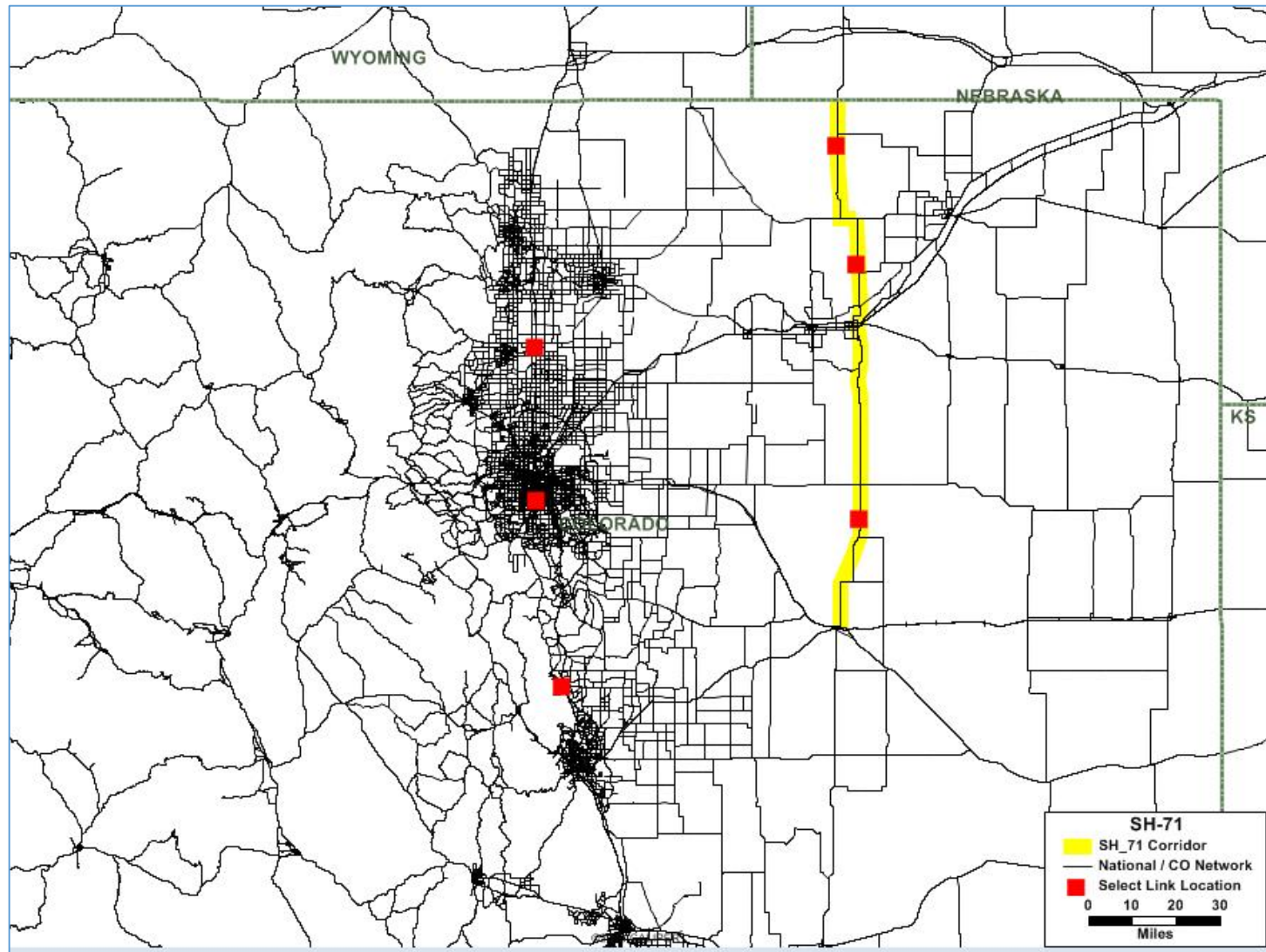
- Average 2040 (three segment, weighted by length) MUT traffic on SH-71 ranges from 313 in the future base to 1,156 MUTs daily in scenario s4_x2 (80 mph on SH-71 with speeds reduced by 10% in the Front Range).
- The speed increase on SH-71 has more influence over truck traffic change than does the assumption of congestion in the Front Range. This outcome is due to the distinct MUT markets in the SH-71 corridor – see Select Link slides to follow.
- The Limon to Brush segment of SH-71 consistently attracts the highest number of diverted MUT traffic. This outcome is due to this segments location between two interstates: I-76 and I-70, as well as to the specific north-south SH-71 market profile.
- These findings are similar to previous model runs.

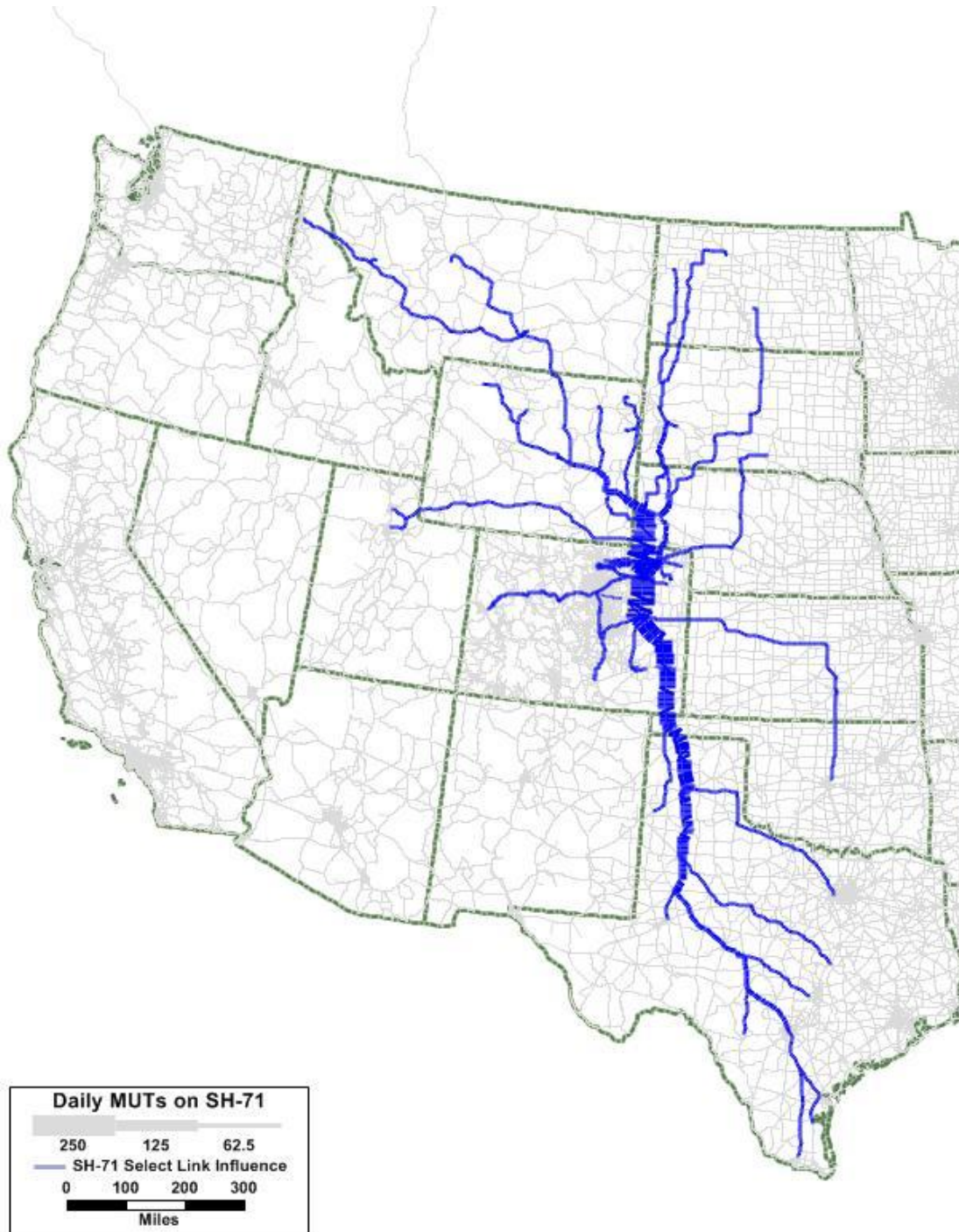
Select Link Analysis

Select Link Analysis

- Select link analysis provides information of where traffic comes from and goes to at selected links. Links are bi-directional road segments usually located at typical cross sections of the study corridor.
- The resulting graphics show the coverage, magnitude and influence of a road segment.
- Multiple select link points can be established; the result is a sum of the flows, i.e. if trucks traverse point A **or** point B **or** point C, or any combination of these three points, they are included as a truck trip in the bandwidth plot. Trucks are NOT counted twice.
- Three representative highway locations were identified on both SH-71 and I-25.
- 2040 MUT traffic was analyzed with select link settings with resulting truck traffic screened for very small flows (less than one MUT daily in 2040).

Select Link Location



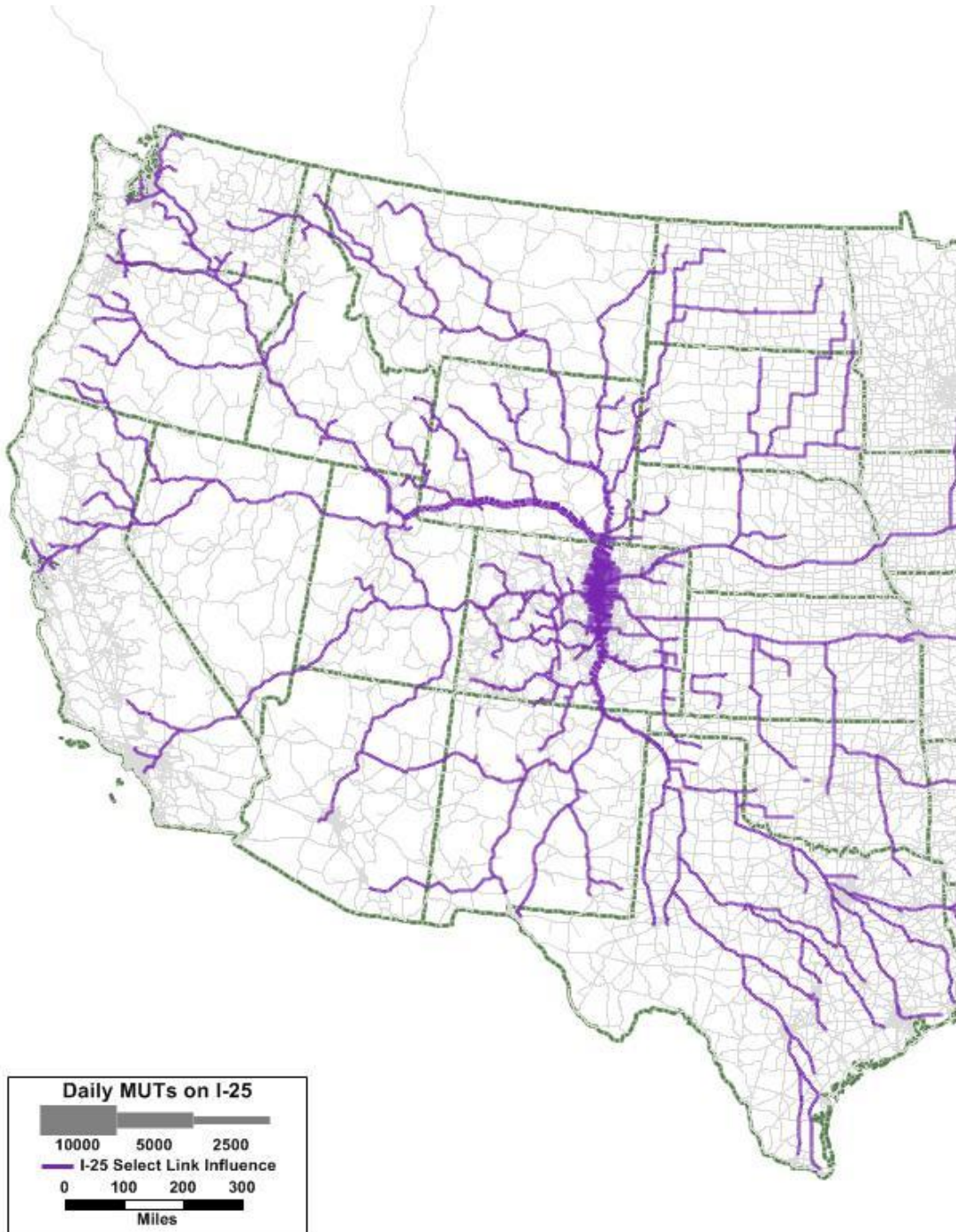


MUT select link on SH-71

- North-south orientation.
- Scale tops out at 250 daily MUTs.
- Accesses interstates while using all classes of roadways.
- Strong profile to and from Texas / Ports to Plains corridor.

MUT select link on I-25

- Universal orientation with strong showing on I-80 (Wyoming) west of I-25.
- Generally using interstates.
- Strong profile to and from the west coast.





MUT
select link
on SH-71
with
Interstates



MUT
select link
on I-25
with
Interstates

Trip Travel Time Tables

- Obtain travel times using the WSP national truck model highway network, with and without the improvements to SH-71.
- Scenario 1 – 2040 No-Build conditions: Assumes congestion in the greater Denver area with a .92 speed reduction factor and SH-71 at 65 mph.
- Scenario 2 – 2040 with Improved SH-71: Assumes congestion in the greater Denver area with a .92 speed reduction factor and SH-71 at 80 mph.
- Certain O-D pairs can take advantage of a part, not all, of the improved SH-71 corridor.
- Time savings range from 9 to 23 minutes.

Travel Time Tables

*Travel Times Scenario 1 (in minutes)
I-25 Congested Conditions
SH-71 at 65 mph (SH 71 Existing)*

Location	Dumas	Raton	Colorado Springs	Denver	Limon	Brush	Cheyenne	Scottsbluff	Douglas	North Platte
Dumas	0	172	302	344	272	333	435	443	544	418
Raton	172	0	133	210	206	273	301	380	420	417
Colorado Springs	302	133	0	84	87	148	172	259	284	300
Denver	344	210	84	0	89	85	98	184	211	230
Limon	272	206	87	89	0	68	176	186	288	222
Brush	333	273	148	85	68	0	115	108	235	148
Cheyenne	435	301	172	98	176	115	0	90	120	180
Scottsbluff	443	380	259	184	186	108	90	0	126	158
Douglas	544	420	284	211	288	235	120	126	0	283
North Platte	418	417	300	230	222	148	180	158	283	0

Travel Time Tables

*Travel Times Scenario 2 (in minutes)
I-25 Congested Conditions
SH-71 at 80 mph (SH 71 Improved)*

Location	Dumas, TX	Raton, NM	Colorado Springs, CO	Denver, CO	Limon, CO	Brush, CO	Cheyenne, WY	Scottsbluff, NE	Douglas, WY	North Platte, NE
Dumas, TX	0	172	302	344	272	321	430	420	544	418
Raton, NM	172	0	133	210	206	259	301	357	420	405
Colorado Springs, CO	302	133	0	84	87	138	172	236	284	288
Denver, CO	344	210	84	0	89	85	98	175	211	230
Limon, CO	272	206	87	89	0	56	174	163	283	209
Brush, CO	321	259	138	85	56	0	115	97	226	148
Cheyenne, WY	430	301	172	98	174	115	0	90	120	180
Scottsbluff, NE	420	357	236	175	163	97	90	0	126	158
Douglas, WY	544	420	284	211	283	226	120	126	0	283
North Platte, NE	418	405	288	230	209	148	180	158	283	0

Travel Time Tables

*Difference between Scenario 2 and Scenario 1
Minutes Saved*

Location	Dumas, TX	Raton, NM	Colorado Springs, CO	Denver, CO	Limon, CO	Brush, CO	Cheyenne, WY	Scottsbluff, NE	Douglas, WY	North Platte, NE
Dumas, TX	0	0	0	0	0	12	5	23	0	0
Raton, NM	0	0	0	0	0	14	0	23	0	12
Colorado Springs, CO	0	0	0	0	0	10	0	23	0	12
Denver, CO	0	0	0	0	0	0	0	9	0	0
Limon, CO	0	0	0	0	0	12	2	23	5	13
Brush, CO	12	14	10	0	12	0	0	11	9	0
Cheyenne, WY	5	0	0	0	2	0	0	0	0	0
Scottsbluff, NE	23	23	23	9	23	11	0	0	0	0
Douglas, WY	0	0	0	0	5	9	0	0	0	0
North Platte, NE	0	12	12	0	13	0	0	0	0	0

Summary

- A planning level Multi-Unit Truck (MUT) traffic model was assembled for use in SH-71 truck forecasting.
- It used a zone system and network with a broad brush nationally and a highly detailed scale in Colorado.
- Data sources were the National Highway Planning Network, Freight Analysis Framework 4.3, and the Colorado Statewide Traffic Model base year files provided by CDOT for this application.
- The approach used a time-based assignment, simplified speed reduction assumptions along the Front Range and scenarios tested in 5 mph speed increments on the 130 mile SH-71 corridor.
- The 2040 future base results provide assistance to decision makers in the region.