



APPENDIX B: EXISTING CONDITIONS TECHNICAL MEMORANDUM

Memorandum

To: Project File

From: Brad Lucas, P.E.
H.W. Lochner, Inc.

Date: April 21, 2008

Subject: I-15, MP 0-42 Existing Roadway Conditions

The geometric deficiencies for the project were analyzed by looking at the 12 critical elements and the 14 design waivers. Each of the 12 critical elements and 14 design waivers were evaluated using as-built-drawings, aerial imagery, or field review. The following is a summary of each of these elements and a summary of the deficiencies identified in the field.

12 Critical Elements

Design Speed

The design speed for the project is 80 mph from MP 0.0 to 4.2 and from MP 11.5 to 42.2. The design speed is 70 mph in the urban area from MP 4.2 to 11.5.

Lane Width

The lane width for the project is 12 ft. The existing lanes widths meet this criterion.

Shoulder Width

The shoulders throughout the project are 4 ft inside and 10 ft outside. However at the interchanges in the urban area, the shoulder widths vary. A summary of the shoulder widths can be seen in Table 1. The existing shoulder widths meet the project design criteria of 4 foot inside shoulders and 10 foot outside shoulders.

Table 1 – Shoulder Widths

From MP	To MP	Inside Shoulder	Outside Shoulder
0.0	6.0	4	10
6.0	8.0	4	10

8.0	8.5	4	12
8.5	9.3	6	12
9.3	10.4	6	10
10.4	11.3	10	10
11.3	43.0	4	10

Horizontal Alignment

The minimum horizontal curve radius for a 70 mph design speed is 2040 ft. The minimum horizontal curve radius for an 80 mph design speed is 3050 ft. I-15 was originally designed with a 65 mph design speed. With the increase in the speed limit several horizontal curves have become deficient. A summary of the deficient horizontal alignments and superelevations can be seen in Table 2.

Table 2 – Deficient Horizontal Alignment

Direction	MP	Existing Radius (feet)	Existing Superelevation (e)	Notes
SB	0.02	2864.95	4.9	65 mph design speed
SB	0.33	2864.79	4.9	65 mph design speed
SB	14.54	2291.8	5.5	65 mph design speed
SB	23.22	2864.93	5.5	65 mph design speed
SB	23.62	2864.93	4.9	65 mph design speed
SB	34.75	2864.90	4.9	65 mph design speed
SB	38.00	2292.00	5.5	65 mph design speed
NB	14.54	2291.80	5.5	65 mph design speed
NB	23.22	2864.93	4.9	65 mph design speed
NB	23.62	2864.93	4.9	65 mph design speed
NB	34.75	2864.90	4.9	65 mph design speed
NB	38.00	2292.00	5.5	65 mph design speed

Vertical Alignment

Vertical Alignment deficiencies are based on sag or crest K-values. The minimum sag K-value is 181 for a 70 mph design speed and 231 for an 80 mph design speed. The minimum crest K-value is 247 for a 70 mph design speed and 384 for an 80 mph design speed. Using the as-built drawings for I-15, the vertical alignment deficiencies were determined and are summarized in Table 3.

Table 3 – Deficient Vertical Alignment

Direction	MP	K	Notes	Type
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SB	0.60	272.73	65 mph design speed	CREST
NB	0.64	260.87	65 mph design speed	CREST
NB	0.86	162.60	60 mph design speed	CREST
NB	1.44	296.30	65 mph design speed	CREST
SB	1.50	296.30	65 mph design speed	CREST
NB	3.66	303.03	65 mph design speed	CREST
SB	15.96	239.64	65 mph design speed	CREST
NB	16.40	200.00	65 mph design speed	SAG
SB	17.09	305.34	65 mph design speed	CREST
SB	24.91	240.38	65 mph design speed	CREST
NB	26.42	255.10	65 mph design speed	CREST
NB	26.64	182.48	65 mph design speed	SAG
SB	26.67	147.1	55 mph design speed	CREST
NB	26.67	147.1	55 mph design speed	CREST
NB	27.64	267.9	65 mph design speed	CREST
NB	28.60	206.2	65 mph design speed	CREST
SB	29.63	173.1	65 mph design speed	SAG
SB	30.07	138.0	55 mph design speed	CREST
SB	32.10	161.3	65 mph design speed	SAG
NB	32.10	301.2	65 mph design speed	CREST
NB	32.33	233.6	66 mph design speed	CREST
SB	33.53	107.3	50 mph design speed	CREST
NB	33.53	107.32	50 mph design speed	CREST
SB	34.43	86.4	45 mph design speed	SAG
NB	34.43	86.43	45 mph design speed	SAG
SB	36.06	203.8	65 mph design speed	CREST
NB	36.06	203.83	65 mph design speed	CREST
SB	37.34	228.0	65 mph design speed	CREST
NB	37.35	228.02	65 mph design speed	CREST
SB	37.59	135.0	55 mph design speed	SAG
NB	37.59	134.95	55 mph design speed	SAG
SB	38.05	258.4	65 mph design speed	CREST
NB	38.05	265.96	65 mph design speed	CREST
SB	39.05	247.5	65 mph design speed	CREST
NB	39.05	247.52	65 mph design speed	CREST
SB	40.25	156.3	60 mph design speed	SAG
NB	40.25	156.25	60 mph design speed	SAG
SB	40.35	142.9	55 mph design speed	CREST
NB	40.35	142.86	55 mph design speed	CREST
SB	41.18	60.0	40 mph design speed	CREST
NB	41.18	60.01	40 mph design speed	CREST
SB	42.07	259.7	65 mph design speed	CREST
NB	42.07	259.74	65 mph design speed	CREST

Profile Grades

From the UDOT Roadway Design Manual of Instruction, the minimum allowable grade for pavements with no curb is 0.2%. The maximum allowable grade is based on the terrain and varies from 3-5%, which corresponds to flat, rolling, or mountainous terrain. Although the project has several grades greater than 5%, few of these grades are deficient, because the UDOT MOI allows for a 1% increase in grade if the grade lasts for 500 ft or less. Only one grade exceeds the maximum grade limit and that grade is 5.3% and it extends for 1200 ft. A summary of all deficient grades can be seen in Table 4.

Table 4 – Deficient Profile Grades

Direction	From	To	Grade
NB	0.59	0.70	0.00
NB	8.25	8.55	-0.16
SB	8.25	8.55	-0.16
SB	9.27	9.38	-0.15
NB	27.94	28.17	-0.15
NB	29.41	29.64	-5.28
NB	40.32	40.38	0.00
SB	40.32	40.38	0.00
NB	42.39	42.54	0.00
SB	42.39	42.54	0.00

Stopping Sight Distance

The design stopping sight distance for the project is 910 ft for an 80 mph design speed and 730 ft for a 70 mph design speed. Table 5 summarizes the locations with deficient sight distance.

Table 5 – Deficient Stopping Sight Distance

Direction	From	To	Notes
NB	23.1	23.3	NB sight distance is limited by cut wall
SB	34.8	35	SB vegetation blocking view
SB	37.3	37.5	SB vegetation blocking view

Cross Slope

No deficiency in cross slope was observed.

Superelevation

The maximum superelevation allowed by UDOT is 6%. Since superelevation is tied with the horizontal alignment, the deficient superelevations are listed with the horizontal alignment. Superelevations not associated with horizontal alignment deficiencies appeared to be sufficient.

Structural Capacity

Condition of the structure was obtained from UDOT Structures. Table 6 is a summary of each structures evaluation for each structure.

Table 6 – Structural Evaluation

Bridge Key	Year	Direction	MP	SR	Feature Intersected	Deck	Super	Sub
1D 664	1962	NB	1.7	97.5	Atkinsville Wash	8 Very Good	7 Good	6 Satisfactory
3F 315	1971	SB	1.7	97.5	Atkinsville Wash	8 Very Good	8 Very Good	8 Very Good
1F 291	1972	NB	4.6	97	CO. RD. to Bloomington	8 Very Good	6 Satisfactory	7 Good
3F 291	1972	SB	4.6	97	CO. RD. to Bloomington	8 Very Good	8 Very Good	8 Very Good
1C 333	1961	NB	5.3	85	Virgin River	7 Good	7 Good	7 Good
3C 374	1972	SB	5.3	96.2	Virgin River	7 Good	7 Good	7 Good
1D 673	1961	NB	5.6	83	Santa Clara River	7 Good	7 Good	7 Good
3F 314	1972	SB	5.6	93.1	Santa Clara River	8 Very Good	6 Satisfactory	7 Good
OC 588	1972	NA	6.323	88.4	SR-18 Bluff Street	7 Good	7 Good	7 Good
1F 288	1972	NB	7.6	96.2	700 South Street	7 Good	7 Good	7 Good
3F 288	1972	SB	7.6	95.2	700 South Street	7 Good	7 Good	7 Good
1F 289	1972	NB	8.4	97.2	100 South Street	7 Good	8 Very Good	8 Very Good
3F 289	1972	SB	8.4	95.2	100 South Street	7 Good	7 Good	7 Good
OF 290	1972	NA	8.656	84	SR-34, St George BLVD	7 Good	7 Good	7 Good
1C 914	2003	NB	10.9	96	SR-212, SPUI Int. X-Road	7 Good	8 Very Good	8 Very Good
3C 914	2003	SB	11	98	SR-212, SPUI Int. X-Road	7 Good	8 Very Good	8 Very Good
0E1329	1964	NA	11.8	67	Mill Creek	N N/A (NBI)	N N/A (NBI)	N N/A (NBI)
1D 738	1964	NB	12	90.2	Washington Main Street	7 Good	6 Satisfactory	7 Good
3D 738	1964	SB	12	90.2	Washington Main Street	7 Good	8 Very Good	8 Very Good
OC 922	2005	NA	13.421	99.9	Washington Parkway	8 Very Good	8 Very Good	8 Very Good
1D 724	1964	NB	15.9	81.5	SR-9, Intchg. X-Road	7 Good	5 Fair	7 Good
3D 724	1964	SB	15.9	92.6	SR-9, Intchg. X-Road	7 Good	7 Good	8 Very Good
3E1301	1963	SB	19	85.5	Cottonwood Creek	N N/A (NBI)	N N/A (NBI)	N N/A (NBI)
1D 555	1956	NB	19.4	94.6	Cottonwood Creek	6 Satisfactory	6 Satisfactory	7 Good
1E1081	1956	NB	20.2	97.6	Harrisburg Creek	N N/A (NBI)	N N/A (NBI)	N N/A (NBI)
3E1296	1963	SB	20.2	97.6	Harrisburg Creek	N N/A (NBI)	N N/A (NBI)	N N/A (NBI)
OD 665	1962	NA	22.639	69.5	SR-228, Intchg. X-Road	7 Good	7 Good	7 Good
1D 680	1962	NB	23.7	95.6	SR-228, Intchg. X-Road	7 Good	7 Good	7 Good
3D 680	1962	SB	23.7	95.6	SR-228, Intchg. X-Road	7 Good	7 Good	7 Good
1D 630	1959	NB	27.4	97	SR-17, Intchg. X-Road	7 Good	7 Good	7 Good

3D 630	1959	SB	27.4	97	SR-17, Intchg. X-Road	7 Good	7 Good	7 Good
OD 629	1959	NA	30.685	90.3	Browse Interchange	7 Good	7 Good	7 Good
0D 627	1959	NA	31.1	85	South Ash Creek	7 Good	7 Good	7 Good
1D 628	1959	NB	31.9	96	CO. RD. Int. X-Rd	8 Very Good	8 Very Good	7 Good
3D 628	1959	SB	31.9	96	CO. RD. Int. X-Rd	7 Good	7 Good	7 Good
1D 523	1949	NB	33.1	96.6	Leap Creek	6 Satisfactory	6 Satisfactory	6 Satisfactory
3D 635	1959	SB	33.2	97.6	Leap Creek	7 Good	7 Good	7 Good
OD 636	1959	NA	33.421	90.3	CO RD, INT. X-RD	7 Good	7 Good	7 Good
1D 644	1959	NB	36.8	93	CO. RD. Intchg. X-Road	7 Good	8 Very Good	6 Satisfactory
3D 644	1959	SB	36.8	93	CO. RD. Intchg. X-Road	7 Good	7 Good	7 Good
0E1209	1960	NA	37.2	70	Ash Creek Res. Spillway	N N/A (NBI)	N N/A (NBI)	N N/A (NBI)
1D 633	1959	NB	40.2	94	Park Road - Inter. X-Road	7 Good	7 Good	7 Good
3D 633	1959	SB	40.3	93.5	Park Road - Inter. X-Road	6 Satisfactory	7 Good	7 Good
0E1128	1959	NA	40.9	65	Dry Creek	N N/A (NBI)	N N/A (NBI)	N N/A (NBI)
1D 632	1959	NB	42.2	93	New Harmony Rd, Int. X-Rd	7 Good	6 Satisfactory	7 Good
3D 632	1959	SB	42.2	94	New Harmony Rd, Int. X-Rd	7 Good	7 Good	7 Good

Vertical Clearance

The minimum vertical clearance required by AASHTO is 16'-0"; UDOT prefers the clearance to be 16'-6" to allow for an overlay to be placed on the highway. The vertical clearance of structures on the project will be broken up into three categories, those that fail to meet 16'-0" (fails), those that are 16'-6" or greater (acceptable), and those that fall in-between (caution). All structures and their vertical clearance can be found in Table 7.

Table 7 – Vertical Clearance

ID	Year	Direction	MP	Clearance	Feature Crossed	Notes
1F 291	1972	NB	4.653	15.8	I-15 over CO. RD. to Bloomington	Fails
3F 291	1972	SB	4.653	15.8	I-15 over CO. RD. to Bloomington	Fails
OC 588	1972	NA	6.323	15.8	I-15 Under SR-18 Bluff Street	Fails
1F 289	1972	NB	8.408	15.3	I-15 Over 100 South Street	Fails
3F 289	1972	SB	8.408	15.3	I-15 Over 100 South Street	Fails
OF 290	1972	NA	8.656	15.9	I-15 Under SR-34, St George BLVD	Fails
1D 738	1964	NB	12.042	13.9	I-15 Over Washington Main Street	Fails
3D 738	1964	SB	12.05	13.9	I-15 Over Washington Main Street	Fails
3D 724	1964	SB	15.954	16.2	I-15 Over SR-9, Int. X-Road	Caution

1D 724	1964	NB	15.973	16.2	I-15 Over SR-9, Int. X-Road	Caution
1D 680	1962	NB	23.729	15	I-15 Over SR-228, Int. X-Road	Fails
3D 680	1962	SB	23.729	15	I-15 Over SR-228, Int. X-Road	Fails
OD 629	1959	NA	30.685	16.2	I-15 Under Browse Interchange	Caution
3D 628	1959	SB	31.833	16.3	I-15 Over CO. RD. Int. X-Rd	Caution
OD 636	1959	NA	33.42	16	I-15 Over CO. RD. Int. X-Rd	Caution
1D 633	1959	NB	40.274	16.2	I-15 Over Park Road - Int. X-Road	Caution
3D 633	1959	SB	40.274	16.2	I-15 Over Park Road - Int. X-Road	Caution
1D 632	1959	NB	42.176	16.4	I-15 Over New Harmony Rd, Int. X-Rd	Caution
3D 632	1959	SB	42.176	16.4	I-15 Over New Harmony Rd, Int. X-Rd	Caution

Bridge Width

A 2 ft barrier offset is required for any shoulder width at structural locations. Table 8 contains the structures with no barrier offset.

Table 8 – Deficient Barrier Offset

Bridge Key	Year	Direction	MP	Bridge Width	Shoulder	Feature Intersected
0D 627	1959	NA	31.1	148	10 ft outside, 4 ft inside	South Ash Creek
Bridge Key	Year	Direction	MP	Bridge Width	Shoulder	Feature Intersected
1C 333	1961	NB	5.3	31.2	2 ft outside, 4 ft inside	Virgin River
1D 523	1949	NB	33.1	38.1	10 ft outside, 4 ft inside	Leap Creek
1D 555	1956	NB	19.4	40	10 ft outside, 4 ft inside	Cottonwood Creek
1D 628	1959	NB	31.9	38.1	10 ft outside, 4 ft inside	CO. RD. Int. X-Rd
1D 630	1959	NB	27.4	38.1	10 ft outside, 4 ft inside	SR-17, Intchg. X-Road
1D 632	1959	NB	42.2	38.1	10 ft outside, 4 ft inside	New Harmony Rd, Int. X-Rd
1D 633	1959	NB	40.2	38.1	10 ft outside, 4 ft inside	Park Road - Inter. X-Road
1D 644	1959	NB	36.8	38.1	10 ft outside, 4 ft inside	CO. RD. Intchg. X-Road
1D 664	1962	NB	1.7	39	10 ft outside, 4 ft inside	Atkinsville Wash
1D 673	1961	NB	5.6	31.5	2 ft outside, 4 ft inside	Santa Clara River
1D 680	1962	NB	23.7	38.1	10 ft outside, 4 ft inside	SR-228, Intchg. X-Road
1D 724	1964	NB	15.9	38.1	10 ft outside, 4 ft inside	SR-9, Intchg. X-Road
1D 738	1964	NB	12	38.1	10 ft outside, 4 ft inside	Washington Main Street
1F 288	1972	NB	7.6	40.4	10 ft outside, 4 ft inside	700 South Street

1F 291	1972	NB	4.6	40.4	10 ft outside, 4 ft inside	CO. RD. to Bloomington
3C 374	1972	SB	5.3	40.4	10 ft outside, 4 ft inside	Virgin River
3D 628	1959	SB	31.9	38.1	10 ft outside, 4 ft inside	CO. RD. Int. X-Rd
3D 630	1959	SB	27.4	38.1	10 ft outside, 4 ft inside	SR-17, Intchg. X- Road
3D 632	1959	SB	42.2	38.1	10 ft outside, 4 ft inside	New Harmony Rd, Int. X-Rd
3D 633	1959	SB	40.3	38.1	10 ft outside, 4 ft inside	Park Road - Inter. X-Road
3D 635	1959	SB	33.2	42	10 ft outside, 4 ft inside	Leap Creek
3D 644	1959	SB	36.8	38.1	10 ft outside, 4 ft inside	CO. RD. Intchg. X- Road
3D 680	1962	SB	23.7	38.1	10 ft outside, 4 ft inside	SR-228, Intchg. X- Road
3D 724	1964	SB	15.9	38.1	10 ft outside, 4 ft inside	SR-9, Intchg. X- Road
3D 738	1964	SB	12	38.1	10 ft outside, 4 ft inside	Washington Main Street
3E1296	1963	SB	20.2	38.1	10 ft outside, 4 ft inside	Harrisburg Creek
3F 288	1972	SB	7.6	40.4	10 ft outside, 4 ft inside	700 South Street
Bridge Key	Year	Direction	MP	Bridge Width	Shoulder	Feature Intersected
3F 291	1972	SB	4.6	40.4	10 ft outside, 4 ft inside	CO. RD. to Bloomington
3F 314	1972	SB	5.6	40.4	10 ft outside, 4 ft inside	Santa Clara River
3F 315	1971	SB	1.7	40.4	10 ft outside, 4 ft inside	Atkinsville Wash
OD 665	1962	NA	22.639	27.9	4 ft outsides	SR-228, Intchg. X- Road
OD 629	1959	NA	30.685	24	2 ft outsides	Browse Interchange
OD 636	1959	NA	33.421	24	2 ft outsides	CO RD, INT. X-RD

14 Design Waivers

The 14 design waivers were broken up into the following categories:

1. Clear Zone
 - Horizontal Clearance
 - Steep sideslopes
 - Unprotected obstacles
 - Deficient Guardrail
 - Texas turndown end sections
 - Short guardrail
 - Deficient length of need

2. Ramp Deficiencies
3. Intersection Sight Distance
4. Shoulder/Travel way (gutter pan) & Curb Configuration

Clear Zone

The minimum clear zone for the project is 30 to 34 ft. Locations denoted in Table 9 & 10 as being deficient are due to steep sideslopes or obstacles in the clear zone.

Table 9– Deficient Clear Zone

Direction	From MP	To MP	Notes
SB	7.63	7.89	Steep sideslopes
NB	7.50	8.10	Steep sideslopes
SB	8.30	8.50	Steep sideslopes
SB	9.30	9.60	Steep sideslopes
SB	11.46	12.02	Steep sideslopes
NB	11.46	11.90	Steep sideslopes
SB	13.12	13.28	Steep sideslopes
NB	14.00	14.30	Steep sideslopes
SB	14.00	14.45	Steep sideslopes
NB	16.30	16.70	Steep sideslopes
SB	17.47	17.81	Steep sideslopes
NB	19.85	20.00	Steep sideslopes
NB	19.12	20.01	Steep sideslopes
SB	21.20	21.70	Steep sideslopes
NB	22.20	22.60	Steep sideslopes
NB	23.06	23.61	Steep sideslopes
Median	27.60	28.70	Trees located in clear zone
NB	29.42	30.06	Steep sideslopes
SB	30.17	30.44	Trees located in clear zone
Median	31.20	31.60	Trees located in clear zone
NB	33.20	33.60	Steep sideslopes
SB	33.20	33.60	Steep sideslopes
Median	34.50	35.40	Steep sideslopes
SB	35.60	36.50	Steep sideslopes
Median	35.60	36.50	Trees located in clear zone
NB	36.90	37.10	Steep sideslopes
SB	36.86	37.14	Steep sideslopes
SB	41.60	41.90	Trees located in clear zone

Table 10 – Culverts in Clear zone

Direction	MP	Notes
SB	14.452	Culvert in clear zone
NB & SB	26.386	Culvert in clear zone
NB & SB	26.947	Culvert in clear zone
NB	32.616	Culvert in clear zone
SB	35.520	Culvert in clear zone
NB	36.506	Culvert in clear zone
NB & SB	38.723	Culvert in clear zone
NB & SB	39.040	Culvert in clear zone
NB & SB	39.210	Culvert in clear zone
NB & SB	39.688	Culvert in clear zone
NB & SB	39.987	Culvert in clear zone
NB & SB	40.840	Culvert in clear zone
NB & SB	41.198	Culvert in clear zone
NB & SB	41.260	Culvert in clear zone
NB & SB	41.438	Culvert in clear zone
NB & SB	41.510	Culvert in clear zone
NB & SB	41.800	Culvert in clear zone
NB & SB	42.184	Culvert in clear zone

Deficient guardrail was defined as guardrail that did not meet the height standard of 32 inches, guardrail with Texas turndown end sections, and guardrail/barrier with insufficient length of need. As a general note, no barrier offset was found at any guardrail or barrier location on the project. A summary of the deficient guardrail is located in Table 11 and a summary of barrier with deficient length of need is located in Table 12.

Table 11 – Deficient Guardrail

Direction	MP	Notes
NB	1.67	short guardrail
SB	7.59	Texas Turndown
SB	7.64	Texas Turndown
NB	9.35	Texas Turndown
NB	11.93	Texas Turndown
NB	12.45	short guardrail
SB	12.23	Texas Turndown
SB	12.48	short guardrail
NB	15.45	Texas Turndown
SB	16.08	Texas Turndown
NB	16.20	Texas Turndown
NB	16.86	Texas Turndown
SB	36.25	short guardrail
SB	37.80	short guardrail

Table 12 – Insufficient length of need

Direction	MP	Notes
SB	7.59	Insufficient length of need
SB	12.45	Insufficient length of need
NB	12.73	Insufficient length of need
SB	12.73	Insufficient length of need
SB	15.45	Insufficient length of need
NB	15.79	Insufficient length of need
SB	16.30	Insufficient length of need
NB	16.30	Insufficient length of need
NB	16.84	Insufficient length of need
SB	17.23	Insufficient length of need
SB	17.23	Insufficient length of need
SB	17.70	Insufficient length of need
SB	18.28	Insufficient length of need
NB	18.28	Insufficient length of need
SB	19.07	Insufficient length of need
SB	19.10	Insufficient length of need
SB	19.50	Insufficient length of need
SB	20.36	Insufficient length of need
SB	20.80	Insufficient length of need
SB	21.21	Insufficient length of need
SB	21.97	Insufficient length of need
NB	22.93	Insufficient length of need
SB	24.38	Insufficient length of need
NB	26.54	Insufficient length of need
SB	26.54	Insufficient length of need
NB	26.64	Insufficient length of need
SB	27.70	Insufficient length of need
SB	28.90	Insufficient length of need
NB	28.87	Insufficient length of need
SB	31.09	Insufficient length of need
NB	31.09	Insufficient length of need
NB	31.40	Insufficient length of need
NB	33.10	Insufficient length of need
NB	34.80	Insufficient length of need
SB	35.40	Insufficient length of need
SB	38.41	Insufficient length of need

Ramp Deficiencies

Table 13 summarizes the deficient ramp acceleration/deceleration lengths. Table 14 summarizes the ramp terminal/entrances deficiencies.

Table 13 – Deficient Ramp Acceleration/Deceleration Lengths

Direction	MP	Existing Length	Type	Notes
SB Accl	15.61	770.0	Parallel	Deficient acceleration
SB Decel	15.79	262.0	Tapered	Deficient deceleration
NB Decel	22.15	215.0	Tapered	Deficient deceleration
SB Accl	22.48	425.0	Tapered	Deficient acceleration
NB Accl	23.86	519.0	Parallel	Deficient acceleration
SB Accl	27.30	441.0	Tapered	Deficient acceleration
SB Decel	27.62	218.0	Tapered	Deficient deceleration
NB Decel	30.29	170.0	Tapered	Deficient deceleration
NB Accl	30.39	164.0	Tapered	Deficient acceleration
SB Accl	30.54	226.0	Tapered	Deficient acceleration
SB Decel	30.86	155.0	Tapered	Deficient deceleration
NB Decel	31.73	205.0	Tapered	Deficient deceleration
NB Accl	31.96	344.0	Tapered	Deficient acceleration
Direction	MP	Existing Length	Type	Notes
SB Accl	31.73	400.0	Tapered	Deficient acceleration
SB Decel	31.96	132.0	Tapered	Deficient deceleration
NB Decel	33.30	103.0	Tapered	Deficient deceleration
NB Accl	33.55	363.0	Tapered	Deficient acceleration
SB Accl	33.30	266.0	Tapered	Deficient acceleration
SB Decel	33.55	150.0	Tapered	Deficient deceleration
NB Decel	36.70	133.0	Tapered	Deficient deceleration
NB Accl	36.82	280.0	Tapered	Deficient acceleration
SB Accl	36.70	313.0	Tapered	Deficient acceleration
SB Decel	36.82	60.0	Tapered	Deficient deceleration
NB Decel	40.10	210.0	Tapered	Deficient deceleration
NB Accl	40.40	250.0	Tapered	Deficient acceleration
SB Accl	40.10	510.0	Tapered	Deficient acceleration
SB Decel	40.40	133.0	Tapered	Deficient deceleration
SB Accl	42.00	358.0	Tapered	Deficient acceleration
SB Decel	42.30	186.0	Tapered	Deficient deceleration

Table 14 – Deficient Ramp Terminals/Entrance

Direction	MP	Type	Notes
SB Decel	27.635	Tapered	Deficient terminal 6.5 degrees
NB Accl	30.388	Tapered	Deficient entrance 1.5:1 taper
NB Decel	31.716	Tapered	Deficient terminal 7.3 degrees
SB Decel	31.964	Tapered	Deficient terminal 7.0 degrees

NB Decel	33.277	Tapered	Deficient terminal 8.7 degrees
SB Decel	33.576	Tapered	Deficient terminal 7.5 degrees
NB Decel	36.64	Tapered	Deficient terminal 8.5 degrees
SB Accl	36.675	Tapered	Deficient entrance 30:1 taper
SB Decel	36.838	Tapered	Deficient terminal 13.0 degrees
SB Decel	40.48	Tapered	Deficient terminal 7.8 degrees

Intersection Sight Distance

No deficient intersection sight distance was observed.

Shoulder/Travel way (gutter pan) & Curb Configuration

Not applicable, no curb and gutter located on I-15.

Drainage

The major drainage issues for the project were located in the north part of the project. One existing problem is at the Kolob Canyon culvert. According to the maintenance supervisor the culvert fills with debris every 5 to 10 years and water from the drainage overflows onto I-15. Ponding is another drainage problem in this same area. Ponding occurs around most of the culverts from MP 37 to 42. This is due to defined drainages from the canyons through UDOT right-of-way, but beyond the right-of-way there is no defined channel for the runoff. This causes many of the culverts to fill with silt and cause ponding along this segment of I-15. Table 15 contains the locations where ponding occurs.

Table 15 - Ponding

Direction	From	To
SB OFF Ramp	13.50	13.70
NB	37.30	37.60
SB	37.30	37.60
SB	40.86	41.56
NB	40.89	41.62

Another drainage issue for the project is ponding located outside UDOT right-of-way. At Bluff Street and 100 South in St George, the local municipality is reporting ponding in areas near I-15. Consideration should be given to coordinate their drainage issues with other I-15 projects.

Pavement

The pavement for the project was tested for its rideability, rutting, cracking, wheel path cracking, and skid resistance. From this data a dTIMS Model was created to generate a pavement maintenance and rehabilitation plan. Table 16 below summarizes the pavement condition of the project.

Table 16 – Pavement Condition

Direction	Begin	End	RIDE	RUT	CRCK	WPCK	SKID	dTIMS Model Recommendations
NB	0.000	6.000	53.1	79.0	70.0	78.9	50.0	Major Rehab 2008 and High Seal 2023
NB	6.000	10.659	55.4	71.3	70.0	59.4	48.5	Major Rehab 2008 and High Seal in 2018 and 2026
NB	10.659	11.157	68.9	86.4	90.0	53.8	56.2	Minor Rehab 2009 and Functional Repair 2021
NB	11.157	19.414	58.7	69.4	70.0	83.9	54.1	Minor Rehab 2009, High Seal 2017 and Minor Rehab 2025
NB	19.414	27.287	81.6	85.5	100.0	88.1	57.2	High Seal 2015 and Minor Rehab 2027
NB	27.287	34.324	64.4	68.3	50.0	90.7	58.1	Minor Rehab 2012 and High Seal 2020
NB	34.324	42.198	71.7	67.8	70.0	96.3	59.1	Minor Rehab 2010, High Seal 2018 and Functional Repair 2026
SB	0.000	6.000	52.3	81.5	90.0	68.9	54.0	Major Rehab 2008 and High Seal 2023
SB	6.000	10.659	54.9	82.1	90.0	87.6	50.1	Major Rehab 2008 and High Seal in 2018 and 2026
SB	10.659	11.157	62.9	82.8	90.0	82.0	51.3	Minor Rehab 2009 and High Seal 2022
SB	11.157	19.414	62.1	75.9	50.0	92.8	52.3	Minor Rehab 2009, High Seal 2017 and Minor Rehab 2025
SB	19.414	27.287	83.7	85.7	100.0	99.5	59.3	High Seal 2013 and Minor Rehab 2027
SB	27.287	34.324	61.6	72.6	100.0	94.7	56.1	Minor Rehab 2015 and High Seal 2023
SB	34.324	42.198	71.8	68.0	90.0	91.7	56.8	Minor Rehab 2010, High Seal 2018 and Functional Repair 2026

From the pavement condition model a remaining service life (RSL) of the pavement was determined. The RSL is based on rutting, cracking, and wheel path cracking. The RSL is typically assumed to be the lowest of the RSL. From the RSL a proposed pavement

strategy was developed. Table 17 shows the RSL and the proposed pavement strategy.

Table 17 – Remaining Service Life

Direction	Begin	End	RUT RSL	Crack RSL	WCRACK RSL	Proposed Strategy
NB	0.000	6.000	16.0	12.3	16.0	2007 Minor Rehab. SMA placed. 2020 High Seal.
NB	6.000	10.659	12.8	12.3	8.5	2008 Minor Rehab. SMA to be placed. 2022 High Seal
NB	10.659	11.157	19.8	22.1	6.7	2009 Major Rehab. 5" deep reinforced overlay including SMA 2023 High Seal
NB	11.157	19.414	12.0	12.3	18.5	2009 Major Rehab. 5" deep reinforced overlay including SMA 2023 High Seal
NB	19.414	27.287	19.3	30	20.9	Minor Rehab 2015 and High Seal 2030
NB	27.287	34.324	11.6	5.5	22.6	Minor Rehab 2013 and High Seal 2028
NB	34.324	42.198	11.4	12.3	27.3	Minor Rehab 2011 and High Seal 2026
SB	0.000	6.000	17.2	22.1	11.8	2007 Minor Rehab. SMA placed. 2020 High Seal.
SB	6.000	10.659	17.5	22.1	20.6	2008 Minor Rehab. SMA to be placed. 2022 High Seal.
SB	10.659	11.157	17.9	22.1	17.5	2009 Major Rehab. 5" deep reinforced overlay including SMA 2023High Seal.
SB	11.157	19.414	14.7	5.5	24.1	2009 Major Rehab. 5" deep reinforced overlay including SMA 2023 High Seal.
SB	19.414	27.287	19.5	30	30.0	Minor Rehab 2015 and High Seal 2030
SB	27.287	34.324	13.3	30	25.8	Minor Rehab 2013 and High Seal 2023
SB	34.324	42.198	11.5	22.1	23.2	Minor Rehab 2011 and High Seal 2026

Accident Clusters

The accident clusters for the project were determined using Google Earth. Using Google Earth's visual capabilities, accident clusters were able to be identified by identifying grouping locations. Table 18 below contains the location of the accident clusters on the project.

Table 18 - Accident Clusters

MP	Description
4.7	Interchange, accidents near ramps and roundabouts.
6.57	Interchange
13.24	Accidents cluster developed during construction?
15.75	Interchange, SB poor acceleration ramp and merge area, constant flow of traffic SB on ramp during peak hours vehicles on I-15 must merge to outside lane. Also interchange has deficient SB deceleration.
19.4	Located in a sag, both grades to sag about 3%. All accidents speed related.
22.02	Interchange; poorly designed interchange NB off ramp and OLD-US 91 ends at ramp confusing drivers.
23.25	Deficient curve, super not sufficient for posted speed. Speed needs to be 65 mph to meet curve. NB has deficient site distance. Cut wall blocking site distance
28.5	Accident related to speed. Insufficient length of need for guard rail. Guardrail does not cover all obstacles. Median has trees in clear zone.
31.7	Interchange, all ramps have poor acceleration and deceleration lengths
34.2	Speed caused by SB vehicles coming down 6% grade
36.2	Deficient clear zone
37.45	Deficient horizontal curve, super does not meet speed. Poor horizontal and vertical site distance. Icy road on curve do to cold winds coming down from canyon.