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Engineering Report Title Page

Title: 43-0434 Bridge Inspection Report 2019

Report Date: 15 August, 2019

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August 15, 2019

Richie Mondragon, STR
LOG-MSM Logistics
MS P901
P.O. Box 1663
Los Alamos, NM 87545

Dear Mr. Mondragon:

Please find enclosed the NMSU inspection documentation for the Los Alamos Canyon Bridge. The documentation includes the following:

1. 2019 NMDOT Bridge Inspection Report including Element Level Data Collection (in hardcopy and digital formats prepared by NMSU) – conforms to the National Bridge Inspection Standards and AASHTO Manual for Bridge Element Inspection
2. 2019 Supplemental Report (in hardcopy and digital formats prepared by NMSU) – provides detailed information related to current condition of major bridge components
3. 2019 Inspection Pictures (in digital format prepared by NMSU)
4. 2019 Delamination Map (in hardcopy format prepared by LANL)

During the 2019 inspection, a critical finding was reported by email on June 22, 2019 regarding the condition of the north joint. The joint had suffered impact damage, possibly due to snow plows. This damage resulted in the seal being pulled out and the exposure of the reinforcing steel plate which was bent upward and in direct alignment with the vehicle wheel path. This was reported as a critical finding because the steel plate posed a serious hazard that could result in a punctured tire to vehicles, motorcyclists and/or bicyclists, and ultimately loss of control. This issue was immediately addressed and the hazard was eliminated by June 23, 2019.

Based on the 2019 inspection, the bridge deck is rated in "fair" condition. Chain dragging the deck identified several areas with delamination. The delaminations are concentrated near the expansion joints, in the closure joint of the deck near the bridge centerline, and at the south end northbound lanes. The chain drag performed during the 2019 inspection revealed 34,620 sq. in. (240 sq. ft.) of delaminations (not including the sidewalk). It is recommended that the delaminations and spalls with exposed rebar be repaired. The "delaminated area" map for the 2019 inspection is provided in the supplemental report.

The superstructure is rated in "fair" condition due primarily to moderate to heavy corrosion of the superstructure elements with section loss. The floor beams including the outriggers and the spandrel girders of the Los Alamos Canyon Bridge are classified as fracture critical members. The National Bridge Inspection Standards (NBIS) defines a fracture critical member as a steel member in tension or with a tension element whose failure may cause a portion of or the entire bridge to collapse. The NBIS requires that fracture critical members be visually inspected within "arm's length" to assure the structural integrity of the bridge. During the 2019 inspection, the NMSU team used the underbridge access unit to reach the fracture-critical members. Particular attention was given to the connections of the spandrel girders and floor beams for signs of deterioration, damage, and distortion. The tension areas of the floor beams and spandrel girders were also checked for defects and fatigue cracks. In the inspection of the arch rib members, areas with corrosion and pitting were found on the top flange plate and bottom flange angles. The arch column to arch rib connections are corroded with pack rust. Corrosion / pack rust is also present at the corners between the plates of the built-up columns where the paint does not thoroughly cover the steel. The steel protective coating (paint) is in fair condition; however, paint failures are progressing leading to corrosion of the structural members. In general, the surface area of paint failures and affected locations continues to increase along with corrosion.

The substructure is rated in "poor" condition, specifically due to the condition of the abutments. The abutment concrete continues to degrade, particularly on the south end. The full width of the south abutment has numerous defects including cracking, delaminations, spalling, leaching, efflorescence, and corrosion of the reinforcement is evident from the rust staining. Additionally, the anchor bolts at the south abutment are in contact with the bearing device due to transverse movement in the east direction. Crack patterns and bridge seat surface measurements indicate settlement of the north abutment towards the west side of the bridge. The piers have numerous defects including cracking, delamination, spalling, efflorescence, rust staining, salt build up, and abrasion. Some cracks were previously sealed with epoxy but the cracks have progressed through the epoxy at several locations and the cracks continue to propagate and widen.

It is recommended that the south and north expansion joints be repaired or replaced. To accommodate the significant thermal movements experienced by a bridge of this size, the recommended types of joints are finger joints or modular expansion joints, the latter of which is currently being used. Due to possible misalignment of the "fingers" and increased water leakage through the joint, the finger joint type is not recommended for the Los Alamos Canyon Bridge. Installation of an approach slab may improve the transition on/off the bridge and help to minimize joint damage. It is also recommended that the use of "jointless" bridge technologies be investigated to effectively move the joint away from the abutment areas. This alternative could potentially improve the approach-to-bridge transitions, decrease the amount of water leaking through the joints and reaching the abutment, and reduce equipment-caused damage (e.g., snow plowing). It is imperative that proper design and installation procedures be followed for all joints. To gain a better understanding of the bridge behavior (specifically thermal movement) throughout the year, installation of a network of sensors at the abutment areas and periodic monitoring of the measured deformations is recommended. The bridge deformations collected throughout the year may provide meaningful information regarding the global movement of the

bridge that is leading to problems with the expansion joints.

It is recommended that the configuration of the pedestrian rail be improved to meet the AASHTO LRFD Bridge Design Specifications. LRFD Sections 13.8 and 13.9 provide guidelines to protect individuals from falling through. In general, openings between horizontal or vertical members on pedestrian railings must be small enough to prohibit a 6-inch sphere from passing through in the lower 27 inches. For the portion of pedestrian railing that is higher than 27 inches, the openings should be spaced to prohibit an 8-inch sphere form passing through. Repair of the bridge rails is also recommended including repair of damaged concrete, replacement of missing / damaged anchors at the metal bridge rail connections to the concrete barrier rails, and repainting of the metal bridge rails.

Based on the 2019 inspection findings, the immediate, short-term, and long-term recommendations are summarized below:

- Immediate – 1. Install drainage system on west side of pedestrian walkway. 2. Repair North approach guardrail. 3. Upgrade pedestrian rail to current standards.
- Short-Term – 1. Repair concrete on north and south abutments. 2. Repair the deck locations with delaminations and spalls, particularly those with exposed rebar. 3. Repaint and continue to clean movable bearings at abutments. 4. Repair concrete of CBR and repaint metal railing on top of CBR on east and west sides. 5. Monitor substructure elements for problems associated with soil erosion due to water runoff. 6. Monitor drainage at north and south joints. 7. Conduct detailed study of joint design alternatives to determine best option (including addition of approach slab). 8. Install erosion protection in areas surrounding abutments and piers, particularly in areas with undermining and scour.
- Long-Term – 1. 1. Repair collision damage to metal railing on top of CBR on west side near north end of pedestrian fence and near the north end expansion joint. 2. Perform ultrasonic testing of pins at abutment, pier, and arch bearings. 3. Repaint arch rib and outriggers (including seated channel connections to pier columns and spandrel girder). 4 Monitor vertical alignment between deck and approach roadway on south end of bridge and check for associated joint damage. 5. An in-depth inspection of the bottom connections of arch columns (including the rivets and angles) using rope access methods to ensure the connections are sound. 6. Measure section loss (or remaining section) on members with moderate to heavy corrosion.

In summary, the NMSU team found several concerns during the 2019 inspection of the Los Alamos Canyon Bridge. The steel superstructure and bearing devices continue to corrode. The outrigger beams and stringer on the west side of the bridge are heavily corroded due to the lack of an adequate drainage system off of the pedestrian walkway. Additionally, the condition of the substructure continues to get worse, in particular the south abutment due to poor drainage of the water runoff. The substructure elements were previously repaired, however, the concrete repairs continue to deteriorate. In addition, the steel protective coating on the west arch rib is deteriorating due to the poor drainage. The bridge also experiences significant and atypical movement (likely due to temperature) that continues to distress the expansion joints (particularly

on the south end). Since the bridge is a critical link between the City of Los Alamos and the LANL, and the bridge services a large volume of traffic, it is important that the issues summarized in this report be addressed.

Following this letter, you will find recommendations for updating the load rating or its assumptions. Additionally, a discussion of issues that would necessitate an immediate review/update of the load rating is included. This is followed by information and recommendations for inspections of the bridge following a seismic event. These recommendations are based on the findings of the Load Rating and Seismic Screening reports provided by LANL.

Should you have any questions regarding this letter, please get in touch with either David Jauregui at 575-646-3801 (work), 915-346-5170 (cell), or by e-mail at jauregui@nmsu.edu or Brad Weldon at 575-646-1167 (work), 575-993-4323 (cell), or by email at bweldon@nmsu.edu. Thank you for your attention.

Sincerely,

David V. Jáuregui, Ph.D., PE
Professor and Head
Department of Civil Engineering
New Mexico State University

Brad D. Weldon, Ph.D.
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Department of Civil Engineering
New Mexico State University

Los Alamos Canyon Bridge Inspection and Rating Report

Floor Beams and Outriggers

Table 1 summarizes the inventory rating (RF_i) and operating rating (RF_o) factors for the Strength I limit state determined by Bohannon Huston, Inc. (BHI) in the evaluation of the floor beams and outriggers. In addition, the condition states of the bridge elements determined in the 2019 inspection by NMSU are reported in the table. The rating factors for moment of the floor beam were controlled by positive bending near the centerline of the bridge width and by the local buckling resistance of the compression flange which is a non-compact element (i.e., $\lambda_{pf} < \lambda_f < \lambda_{rf}$). Note that the $b_f / 2t_f$ ratio exceeded 12, however, this limit applies to welded not riveted members. For shear, the floor beam rating factors were controlled by shear near the spandrel beams and by the end panel shear resistance (i.e., no tension field action) of the floor beam.

Table 1. Rating factors and condition states of floor beams.

Component	RF_i, RF_o for Strength I *		Condition State
	Moment	Shear	
FB#3	1.03, 1.34	0.54, 0.71	Good condition – paint peeling on top flange of outrigger (west side); distortion of floor beam bottom flange (near girder G2 on east side)
FB#7	1.12, 1.45	0.57, 0.74	Fair condition – paint peeling and minor corrosion on top flange of outrigger (west side); distortion of floor beam flange (near midspan and under stringer S5 near girder G2 on east side); minor corrosion on top flange of outrigger (east side)
FB#15	1.33, 1.73	0.64, 0.83	Good condition – paint peeling and minor corrosion on top flange of outrigger (west and east sides)
FB#22	0.99, 1.28	0.56, 0.73	Fair condition – minor corrosion on top and bottom flanges of outrigger (west side); paint peeling under stringer S2 near girder G1 on west side); poor paint job between stringers S2 and S4; minor corrosion on top flange of outrigger (east side)
FB#27	0.82, 1.06	0.71, 0.92	Fair condition – minor corrosion on top and bottom flanges of outrigger (west side); pack rust on bottom flange connection between outrigger and spandrel beam (east side)

* Note: Controlling RF_i and RF_o values for outrigger beam equaled 1.47 and 1.91 (for moment), and 1.45 and 1.89 (for shear)

ACTION: Since the floor beams are in good condition and no signs of corrosion were observed on the floor beam flanges or web between the spandrel beams (i.e., no section loss), there is no immediate need to rerate the floor beams for moment or shear. Furthermore, deterioration of the floor beam elements is not anticipated since these elements are not directly exposed to rain, snow, or water runoff.

For the outriggers, the critical locations are at the end connection to the east spandrel beam G2 for moment and at the exterior stringer S6 for shear. The web and flange proportions were met for the outriggers. The moment capacity was controlled by flange yielding of the compression flange which is a compact element (i.e., $\lambda_f < \lambda_{pf}$) and the shear capacity was controlled by shear buckling with tension field action.

ACTION: The outriggers at four of the floor beams listed in Table 1 (FB#3, FB#7, FB#15, and FB#22) have minor corrosion on the top flanges on the west and/or east sides, mainly in the area under the exterior stringers. The top flange corrosion is not a significant concern for bending since the moment capacity is more critical at the spandrel beam connection location. The two outriggers at FB#22 and FB#27 also have minor corrosion on the bottom flange and the outrigger at FB#27 has pack rust (on east side); however, no corrosion was observed on the outrigger webs. There is no immediate need to rerate the outriggers, however, it is recommended that section loss be measured on the outrigger bottom flanges with pack rust.

Columns

Table 2 summarizes the Strength I rating factors determined by BHI and the condition states determined by NMSU for the pier (PC), skewback (SC), and arch (AC) columns. The rating factors for the columns considered axial force and bending moment interaction and the member capacities were controlled by local buckling of the non-compact compression plate elements (i.e., $\lambda_{pf} < \lambda_f < \lambda_{rf}$).

Table 2. Rating factors and condition states of columns.

Component	RF_i, RF_o for Strength I	Condition State	
	Interaction	East Side	West Side
PC#1	1.10, 1.43	Good	Good
PC#2	1.21, 1.57	Good	Good
SC#1	2.01, 2.60	Good	Good
AC#1	1.41, 1.88	Good	Fair
AC#2	1.03, 1.33	Good	Fair
AC#3	0.90, 1.17	Good	Fair
AC#4	0.80, 1.04	Good	Fair
AC#5	0.62, 0.81	Good	Good
AC#6	0.52, 0.67	Good	Good
AC#7	0.72, 0.93	Good	Good
AC#8	0.92, 1.19	Good	Good
AC#9	0.52, 0.67	Good	Fair
AC#10	0.55, 0.72	Good	Fair
AC#11	0.70, 0.91	Fair	Fair
AC#12	0.81, 1.05	Fair	Fair
AC#13	0.95, 1.24	Fair	Fair
AC#14	1.37, 1.78	Fair	Fair
SC#2	1.63, 2.19	Good	Good
PC#3	1.24, 1.60	Good	Good
PC#4	1.18, 1.53	Good	Good

ACTION: As shown in Table 2, arch columns #1 through #4 were rated in fair condition on the west side arch due to corrosion at the interior angles connecting the plates. Since the angles are positioned in the interior of the built-up section, quantifying the extent of corrosion is difficult. However, the corrosion has not progressed to the outside faces of the plate elements and thus, there is no immediate need to rerate these four columns. However, the use of advanced techniques to determine the level of corrosion in the interior angles is recommended. Arch columns #9 through #14 on the west side were also rated in fair condition due to corrosion at the bottom connections of the columns and/or corrosion of the arch rib top flanges at these connection locations. Arch columns #10 through #14 on the east side arch were also rated in fair condition due to corrosion of the arch rib top flanges at the bottom column connections. The corrosion observed at columns #9 through #14 may reduce the stiffness of the column connection to the arch rib top flanges which was assumed as a "fully rigid connection" in the load rating study conducted by BHI. Since the assumed connection stiffness results in the worst case

scenario (i.e., lowest rating factors), there is no immediate need to rerate these six columns. However, an in-depth inspection of the bottom connections of arch columns #9 through #14 (including the rivets and angles) on the north side of the arch is suggested using rope access methods to ensure the connections are sound.

Spandrel Beams

Table 3 summarizes the Strength I rating factors determined by BHI and the condition states determined by NMSU for the spandrel beams. The rating factors for moment of the spandrel beam were controlled by positive bending near midspan and negative bending near the column locations of the 62' end spans. The spandrel beams are composite with the reinforced concrete deck in Bays 1-2 and 27-28, and non-composite in Bays 5-6 and 22-23. In the positive moment region of the non-composite section, the local buckling resistance of the compression flange which is a non-compact element (i.e., $\lambda_{pf} < \lambda_f < \lambda_{rf}$) controlled the moment capacity. For shear, the spandrel beam rating factors were controlled by shear buckling with no tension field action.

Table 3. Rating factors and condition states of floor beams.

Location	RF_i for Strength I *	RF_o for Strength I *	Condition State
	+Moment	-Moment	
Bays 1-2 and Bays 27-28	1.37	1.78	+Moment (composite section) – fair condition due to pack rust at outrigger connections to spandrel beam -Moment (composite section) – good condition
Bays 5-6 and Bays 22-23	0.67	0.87	+Moment (non-composite section) – fair condition due to pack rust at outrigger connections to spandrel beam -Moment (non-composite section) – good condition

* Note: Controlling RF_i and RF_o values for spandrel beam equaled 1.60 and 2.07 (for shear)

ACTION: Although the spandrel beams were rated in fair condition at midspan of the 62' end spans (due to pack rust at the outrigger connections), only freckled rust (i.e., no section loss) was observed on the bottom flanges of the spandrel beams at these midspan locations. The top flanges and web have isolated areas with paint peeling but minimal corrosion was observed. Thus, there is no immediate need to rerate the spandrel beams for moment or shear.

Stringers

Table 4 summarizes the Strength I rating factors determined by BHI and the condition states determined by NMSU for the stringers. The stringer rating factors for moment were controlled by negative bending between Bays 2-3, near midspan of Bay 8, and near midspan of Bay 27. The moment and shear capacities of the stringers were controlled by plastic behavior (i.e., plastic moment and shear yielding).

Table 4. Rating factors and condition states of stringers.

Location	RF_i, RF_o for Strength I *	Condition State
	Moment	
Bays 2-3	1.01, 1.35	-Moment of interior stringer (composite section) – good condition, paint peeling on top flange of interior stringers
Bay 8	1.79, 2.41	-Moment of exterior stringer (non-composite section) – good condition, paint peeling and freckled rust on bottom flange of exterior stringer on east side
Bay 27	1.17, 1.57	-Moment of interior stringer (composite section) – good condition, minor deterioration

* Note: Controlling RF_i and RF_o values for spandrel beam equaled 2.01 and 2.71 (for shear)

ACTION: Since the stringers are in good condition and signs of only freckled rust were observed (i.e., no section loss), there is no immediate need to rerate the stringers for moment or shear. Furthermore, the exterior stringer in Bay 8 is more directly exposed to rain, snow, or water runoff but the rating factors exceed those of the interior stringers.

Arch Ribs

The controlling rating factors for Strength I determined by BHI for the east arch rib were RF_i = 1.19 and RF_o = 1.80 for the maximum axial case and RF_i = 0.85 and RF_o = 1.11 for the maximum moment case. The web and flange proportions and the slenderness limits were met for the arch ribs. The moment capacity was controlled by elastic lateral torsional buckling and the axial capacity was controlled by inelastic flexural buckling.

ACTION: Findings from NMSU's latest inspection of the arch ribs included the following: (1) west arch – heavy corrosion on top flange on north side of arch rib, moderate corrosion on bottom flanges on south side of arch rib; and (2) east arch – heavy corrosion on top flange on north side of arch rib. As previously discussed, the south side of the east arch rib had the lowest rating factors and this portion of the arch is currently in good condition. There is no immediate need to rerate the arch ribs, however, it is recommended that section loss be measured on both ribs using rope access methods.

Post Seismic Event Assessment Recommendations

Based on the findings of the Seismic Screening Report by Bohannan Huston Inc., the seismic performance of the bridge is governed by the columns. The flexural column capacities are limited by local buckling of the non-compact or slender built-up plate elements. As a result, flexure failure will not be ductile where yielding of the cross-section allows for significant displacement (and energy dissipation) of the member prior to a catastrophic failure. This can, potentially lead to a progressive collapse where as a column fails, the load is transferred to other members. As the load is transferred, these members are overloaded causing additional failures.

Two seismic events were evaluated in the Seismic Screening Report, a lower level and an upper level. In both these seismic events, the bridge was found to have a strong beam-weak column condition where the global strength of the frame is controlled by the strength of the columns. This condition is highly susceptible to creating a "weak story" collapse mechanism. Because the column members' capacities are controlled by localized buckling, a non-ductile failure condition exists and the failure of the columns would limit the deflection capacity and energy dissipation of the structure.

Under the lower level seismic event, the floor beams, spandrel beams, arch ribs and the majority of the columns were found to be adequate. However, arch columns No. 7 and 8 on the west and east face of the bridge as well as the tops of the skewback columns on the east face of the bridge were found to exceed their capacity in flexural-axial interaction. For the upper level seismic event, the floor beams, spandrel beams, arch ribs, and some columns were found to be sufficient. However, the majority of the columns were found to exceed their capacity in flexural-axial interaction. The column members' capacities are controlled by localized buckling (non-compact section). This will lead to a non-ductile failure condition and are susceptible to a progressive collapse of the structure. The following columns exceed the flexural-axial interaction limits during the upper level earthquake event:

East skewback columns 1 and 2, arch columns 7, 8, 9, 10, 11 and 12
West skewback columns 1 and 2, arch columns 7, 8, 9, 10, 11 and 12

Based on the findings presented in the Seismic Screening Report, following a seismic event, the following steps are recommended to assess the state of the bridge:

- A cursory, visual inspection from the ground to identify any structural damage.
  - General walk around the bridge.
  - Check vertical and horizontal alignment.
  - Evaluate settlement or damage to abutments.
  - Particular attention should be place on the arch columns, skew-back columns, connections to the arch, and bearing devices. Any damage should be noted, photographed and assessed.
  - Assess the damage to the bridge and determine if the damage to the bridge warrants a structural review or if the bridge is safe to conduct a more in-depth, physical inspection.

- Using a rope access inspection team, each column and the arch ribs should be inspected for damage including local buckling, damage / loss of rivets of the built up section, and connection damage to the arch and or bearing device.
    - Damage should be noted, photographed and assessed (e.g., distortion, tear out, local buckling, failure of connectors, etc.).
    - If deemed necessary, a structural analysis should be conducted to ensure the adequacy of each member.
    - Once the support structure (e.g., columns, piers, and abutments) has been deemed adequate, a full inspection of the bridge is recommended.
- Using a rope access team and under-bridge access unit, a full bridge inspection of the bridge should be conducted.
    - The entire superstructure should be inspected. Particular attention should be given to rivets of the built up sections, splice plates, and non-redundant members.
    - If necessary, nondestructive methods should be employed to identify the state of damage.
    - Damage should be assessed, and if necessary, a structural review should be conducted. Load ratings should be re-assessed based on the recorded damage from the post-earthquake inspections.

New Mexico State Highway and Transportation Department
BRIDGE INSPECTION REPORT

(8) Structure No.	7622	(2) District No.	5	(90) Insp. Date	06/21-23/19
Patrol No.	N/A	(3) County	Los Alamos	(4) Town/City	Los Alamos
(21) Maintenance Responsibility	Federal	(91) Inspection Frequency	12 Months	Last Inspection Date	06/15-17/18
(7) Route/Facility Carried	NM-501	Route/Facility Carried	N/A	Route/Facility Carried	N/A
(11) Milepost	4.5	Milepost	N/A	Milepost	N/A
Route Under	Omega Road	Route Under	N/A	Route Under	N/A
Milepost	N/A	Milepost	N/A	Milepost	N/A
(112) NBIS>20'?	Yes	(41) Status	A	(49) Str. Length	819'-7"
(6) Feature(s) Intersected	Omega Road, West Road and Los Alamos Canyon.				
(9) Location	Junction of NM-501 and Omega Road.				
(43) Description	1 442'-6" steel arch center span, and 2 sets of 3 continuous 62'-0" approach spans with a stringer (rolled steel) – floor beam (riveted steel) – spandrel girder (riveted steel) floor system. Concrete stub abutments, steel columns and steel skewback columns on concrete pier pedestals and concrete footings, and CIP concrete deck sealed with HMWM and metal SIP forms.				

(92) Fracture Critical? Yes or No	Yes	Underwater Inspection? Yes or No	No	(113) Scour Critical? Yes, No & Unknown	No		
Other Special Inspection Req'd? Yes or No	Yes	If Yes, complete the following.	Type of Inspection & Special Personnel or Equipment Req'd	Rope Access Team	Next Special Inspection Date & Interval	2020 / 3 years (recom'd)	

Special Equipment Used During this Inspection	Underbridge Access Unit		
Significant Previous Work Completed on Bridge	HMWM protective coating applied to deck (09/08-13/14). SW bearing realigned and keeper plate replaced (08/06-13/14). Erosion control installed near south skewback column (Spring 2014). Roadway and deck were restriped (prior to 2016 inspection). Paving on South approach roadway (2018).		
Inspection Performed by: (List Members Present)	NMSU (D. V. Jauregui-PE, K. R. White-PE. B. D. Weldon-EIT, G. P. Baca-PE); and McClain & Co. (W. Santiago)	Weather Conditions at Time of Inspection	81/56 deg F / moderate wind (6/21/19) 75/48 deg F / moderate wind (6/22/19) 71/50 deg F / moderate wind (6/23/19)
List Additional Attachments Included with this Report	Element level data (NBE and BME), supplemental report and photographs.		

Additional attachments should be listed and may include Vertical Clearance sheets, Channel Plan & Profiles, Photographs, Sketches, Deck Survey Sheets, Load Rating Calculations or other documents included as part of this report.

General Comments	None.						
Team Leader	David V Jauregui, PhD, PE			Reviewer	Kenneth R White, PhD, PE		
Signature		Date	8/15/19	Signature		Date	8/15/19
Title	NMSU Bridge Inspector			Title	NMSU Bridge Coordinator		

STRUCTURE NO. 7622 Inspection Date 06/21-23/19

(58) Deck Condition:

Deck (roadway)	Top and sides of deck have transverse, longitudinal, and map cracks, isolated spalls, exposed rebar, and pop-outs. Amount of spalls have increased and existing spalls are increasing in size. Deck sealed with HMWM protective coating but not overlayed. Underside of deck has SIP forms with areas of rectangular cutouts, minor crushing, bulging, and light leaching with efflorescence on top of stringers. SIP forms have isolated locations of corrosion. Deck edges have map cracks with leaching. Deck near joints has isolated spalls (some of which were patched). Chain drag identified areas of delamination particularly near expansion joints, along closure joint, and within northbound lanes, particularly in the first 2/3 of the northbound lanes. Refer to element level data, supplemental report, pictures, and LANL delamination map for additional details.	Rating	6
Wearing Surface	Top of CIP concrete deck acts as wearing surface; HMWM protective coating applied but not overlayed.	Rating	N
Expansion Joint Devices Type & Cond. Do the joints leak?	The **south expansion joint** was replaced prior to the 2015 inspection. The joint has significant damage which has exposed the steel plates. Alignment issues previously observed between the bridge and the south approach roadway continue. The **north expansion joint** was replaced prior to the 2012 inspection and has been damaged. Refer to element level data, supplemental report and pictures for additional details.	Rating	N
Pedestrian Walkway	Concrete walkway on the west side has transverse, longitudinal, and map cracks. Walkway also has signs of abrasion / wear and spalls with exposed rebar at a few street light pedestals. Delamination and spalling observed near pedestrian rail baseplates. Sidewalk was chain dragged and delaminations were identified. Refer to element level data, supplemental report and pictures for additional details.	Rating	7
Bridge and Pedestrian Rails	CBR has vertical, horizontal, and map cracks with traffic damage, and top of CBR has several areas with spalls, delaminations, and map cracks where metal rail attaches to CBR. East CBR has a spall (greater than 1 in. deep and 6 in. diameter) near the pedestrian fencing. West CBR has impact damage (with spalling and delamination) near north end of pedestrian fencing. Metal rails have moderate corrosion throughout and heavy corrosion at rail connections (missing bolts at several locations) to CBR. In general, west rail is in better condition than east rail. Pedestrian rail does not meet the required standard to provide a safe passageway for pedestrians to cross the bridge. One major issue is that the spacing between the rails is greater than the maximum permitted to prevent an individual from falling through. Refer to element level data, supplemental report and pictures for additional details.	Rating	N
Deck Drains	None. Deck drains from south to north. Pedestrian walkway lacks a drainage system to collect and divert rainwater runoff. As a result, the rainwater spills over the west side of the pedestrian walkway which is leading to significant problems (e.g., corrosion, debonding of steel protective coating) of the superstructure in particular the exterior stringer, outriggers / connection plates, spandrel beam / splice plates, and arch rib located on the west side. Additionally, the deck overhang on the west side has spalling, delaminations, leaching, and efflorescence.	Rating	N

(58) Deck Rating 6

STRUCTURE NO. 7622 Inspection Date 06/21-23/19

(59) Superstructure Condition:

Arch ribs	Isolated areas of steel members have minor to moderate section loss. There are areas of paint peeling on the webs with minor corrosion and paint failure / moderate corrosion on top plate and bottom flange. Pack rust at the spandrel column to arch rib connections is evident. In general, west arch rib is in worse condition than east arch rib. There is isolated impact damage to the arch rib. Refer to element level data, supplemental report and pictures for additional details.	Rating	5
Spandrel girders	Spandrel girders are in satisfactory condition but there are areas of paint peeling on the webs and bottom side of top flanges with minor corrosion (refer to supplemental report and pictures for illustrations of "steel protective coating loss" on west girders). Spandrel girders have impact damage at a few locations. There is also moderate corrosion and pack rust with distortion between the bottom flange plates of numerous spandrel girder splice connections on the east and west girders. West girder is in worse condition than the east girder due to water runoff.	Rating	6
Pier, Skewback, and Arch Columns	Steel columns above piers 1-4 and steel columns above arch are in satisfactory condition. There is minor corrosion along the corners and the interior angles of a few spandrel columns on the east and west sides of the bridge. Skewback columns have paint failure and corrosion of sway bracing (particularly on web of X bracing and top flange of horizontal members).	Rating	6
Floorbeams	In general, paint failure and moderate to heavy corrosion with section loss exists on the outrigger beams (particularly on the west side) due to the water runoff. There is also moderate to heavy corrosion and pack rust / distortion at the bottom channel connection to the columns. In the interior areas, the floorbeams are missing a bolt at the top bracket connection to the spandrel girders (typical) and there are locations with impact damage on the bottom flange angle. Failure of the steel protective coating on the top flanges of the outriggers (particularly on the west side) has resulted in corrosion and section loss. Abutment 2 steel plate above floorbeam has a full depth crack between stringers 3 and 4 at the NE corner and corrosion between stringers 1 and 2 at the NW corner. Isolated locations of corrosion are present on the floorbeams. Several bird nests exist at interior ends of floorbeams on top of gusset plates connecting lateral bracing. Refer to element level data, supplemental report and pictures for additional details.	Rating	5
Stringers	Stringers are in satisfactory condition but there are areas of paint peeling and corrosion on the top flange. In addition, the bottom flanges (particularly the top sides) of the exterior stringers show minor corrosion. Stay-in-place forms are cutout and damaged at several locations with one area haphazardly supported by timber shoring.	Rating	6
Bearings	Several bearings have paint failure, corrosion, and section loss; pack rust and debris are present at rocker bearings. Refer to element level data, supplemental report and pictures for additional details.	Rating	N
Coating System	Paint system has isolated areas of minor loss throughout with a few areas of heavy loss. Overall paint system on floor system (spandrel girders, floorbeams, and stringers) and arch ribs is in fair condition. Overall paint system is in satisfactory condition on steel columns with areas of paint failure and corrosion at corners. In general, the steel protective system was not applied to the superstructure components as thoroughly on the South side of the bridge as North side. Paint quantities and condition states provided in element level data.	Rating	N

(59) Superstructure Rating 5

STRUCTURE NO. 7622 Inspection Date 06/21-23/19

(60) Substructure Condition:

Abutments	**At south abutment**, backwall and breast wall were sealed with concrete protective coating but there is moderate to major cracking and peeling. Horizontal cracks and delaminations exist below the bridge seat and extend the full width and almost the full height of breast wall. The top front edge of the bridge seat is delaminated between the bearings. Leaching and efflorescence found throughout breast wall with rust staining and salt build up. Concrete protective coating has debonded from breast wall leading to spalling of original concrete and exposed rebar and on the bridge seat exposing the original concrete surface which is in poor condition. **At north abutment**, backwall and breast wall was sealed with concrete protective coating. Seal has debonded throughout length of breast wall and on bridge seat exposing the original concrete surface which is in poor condition and resulting in leaching and efflorescence. Debonded areas vary in size and the steel reinforcement is corroded. Spall on the east side of the abutment is present. On east side, debonding observed on backwall along with map cracking, leaching, and spalling of breast wall. Map cracking exists on East and West side of backwall. Cracks in the West wingwall and the East side of the backwall are visible through the epoxy seal previously applied. Refer to element level data, supplemental report and pictures for further details. The bridge seat has a slight settlement to the west side. The pedestal attached to the wingwall has a 4"x4" delamination, but it does not extend into the wingwall.	Rating	4
Piers	Concrete piers are in fair condition (Southwest pier column #2 has most advanced deterioration). The piers have moderate to heavy defects including cracking, delamination, spalling, efflorescence, rust staining, and abrasion. Some cracks were previously sealed with epoxy but the cracks have progressed through the epoxy at several locations. Refer to the element level data, supplemental report and pictures for further details.	Rating	5
Foundations Settlement Noted?	Evidence of minor settlement at North abutment.	Rating	N
Slope Protection	Sparsely dumped riprap. Erosion protection installed on East embankment and West pier column near North abutment. Unprotected areas around abutments and piers have significant erosion. Erosion protection also previously installed on pathway towards the South arch supports.	Rating	N
Coating System	Coating in good condition on concrete pedestals at North arch supports (no coating at South arch supports). No coating on concrete pedestals at column supports.	Rating	N

(60) Substructure Rating 4

STRUCTURE NO. 7622 Inspection Date 06/21-23/19

(61) Channel and Channel Protection

Channel Description and Alignment.	N/A	Rating	N/A
Scour, Erosion, Silt and/or Obstructions	N/A	Rating	N/A
Channel Protection	N/A	Rating	N/A
High Water Marks	N/A		

(61) Channel and Channel Protection Rating N/A

Approach Roadway Condition

Pavement	Transitions between approaches and bridge deck experience advanced impact loading due to vertical and horizontal alignment and use of roadway equipment. Approach roadway was repaved prior to 2012 inspection on North end of bridge and repaving was completed in 2018 on the South end. **South expansion joint** replaced prior to 2015 inspection. Alignment problems around horizontal curve on south end, slight dip in roadway at drainage inlet, and use of roadway equipment continue to cause impact damage to south joint. **North expansion joint** replaced prior to 2012 inspection. Refer to element level data, supplemental report and pictures for additional details.
Shoulders	None.
Embankment	Mild to moderate slopes with heavy vegetation. Erosion protection installed on east embankment near north abutment.
Bridge Signing	Speed and directional signage for vehicular traffic is in good condition. Pedestrian traffic signage is in good condition on north and south ends of west sidewalk (light vegetation on NW corner of bridge).

Approach Roadway Rating N

Approach Roadway Widths with Shoulders for Roadways

Route	Direction(s)	Roadway Width	Measured from ( ) to ( )
NM-501	S,N	44'-0"	2'-2" guardrail to 2'-2" guardrail.

(36) Traffic Safety Features

Over	1	1	1	1
Under	0	0	0	0
	1	2	3	4

Rating Table (0, 1 or N)
1 - Adequate
0 - Inadequate
N - Not Needed

		Over	Under
1	Bridge Railings	Metal rail attached to top of CBR. See element level data, supplemental report for additional details.	Guardrail on timber posts without blockouts on south side of span 7, none on north side of span 7.
2	Transitions	12" "W" rail bolted to CBR.	None.
3	Approach Guardrail	12" "W" rail with blockouts on timber posts at north and south approaches. Southeast approach guardrail has 10' of minor damage at two locations. Missing / damaged timber posts on the northwest approach guardrail.	None.
4	Approach Rail Ends	Breakaway anchors.	None.

STRUCTURE NO. 7622 Inspection Date 06/21-23/19

(68) Deck Geometry . . . . . .

Provide curb-to-curb, rail-to-rail or curb-to-rail horizontal measurements for each route on the bridge. In the event that rail-to-rail & curb-to-curb conditions exist, list both. Also specify curb heights and widths.

Route	Direction(s)	Horizontal Measurements	Measured from ( ) to ( )
NM-501	S,N	44'-1"	Bottom of 2'-9" CBR to bottom of 2'-9" CBR.

Minimum Vertical Clearance Over Roadway Unlimited

(69) Under Clearances . . . . . .

Provide information for each route under. Provide information sheet(s) for Vertical Clearances and for the 10' Selected Path, if changes are noted.

Route or Feature	Direction(s)	Vertical Measurements	Signed Clearance	Horizontal Clearance	Measured from ( ) to ( )	Lateral Left	Lateral Right
Omega Road	W,E	over 25'	N/A	N/A	N/A	N/A	>12'-0"

Is Vertical Signing Adequate? N/A If no, Explain N/A

(70) Bridge Posting Rating. . . . 5

If Load Capacity is Revised Attach Computations. Legal Load N/A

(66) Invent. Rating HS- 15.2 (64) Oper. Rating HS - 22.8 (70) Bridge Posted? No Describe N/A

(71) Waterway Adequacy Rating . . . . . N/A

N/A

(72) Approach Roadway Alignment Rating 6

Horizontal curve at North and South approaches. Minor speed reduction required.

STRUCTURE NO. 7622 Inspection Date 06/21-23/19

Recommendations:

Immediate	1. Install drainage system on west side of pedestrian walkway. 2. Repair / replace missing timber post on approach guardrails. 3. Replace joint on north end of bridge. 4. Upgrade pedestrian rail to current standards.
Short Term	1. Repair concrete on north and south abutments. 2. Repair the deck locations with delaminations and spalls, particularly those with exposed rebar. 3. Repaint and clean movable bearings at abutments. 4. Repair concrete of CBR and repaint metal railing on top of CBR on east and west sides. 5. Monitor substructure elements for problems associated with soil erosion due to water runoff. 6. Monitor drainage at north and south joints. 7. Conduct detailed study of joint design alternatives to determine best option (including addition of approach slab). 8. Install erosion protection in areas surrounding abutments and piers, particularly in areas with undermining and scour.
Long Term	1. Repair collision damage to metal railing on top of CBR on west side near north end of pedestrian fence and near the north end expansion joint. 2. Perform ultrasonic testing of pins at abutment, pier, and arch bearings. 3. Repaint arch rib and outriggers (including seated channel connections to pier columns and spandrel girder). 4 Monitor vertical alignment between deck and approach roadway on south end of bridge and check for associated joint damage. 5. An in-depth inspection of the bottom connections of arch columns (including the rivets and angles) using rope access methods to ensure the connections are sound. 6. Measure section loss (or remaining section) on members with moderate to heavy corrosion.

Element Level Data Collection

Structure No. 7622 District No. 5 Inspection Date 06/21-23/19

Route No. NM-501 Mile Post N/A County Los Alamos

QUANTITY BY CONDITION STATE

ELEMENT CONDITION								
Structure Number: 7622 - Omega Bridge @ Los Alamos								
Element Number	Element Description	Unit of measure	Total Quantity	CS1 Good	CS2 Fair	CS3 Poor	CS4 Severe	Notes or other defects
12	Reinforced Concrete Deck	ft²	45487	44145	1314	28		
1080	*Delam/Spall/Patch*	ft²	720		712	8		
1090	*Exposed Rebar*	ft²	2		2			
1120	*Efflor/Rust*	ft²	20			20		
1130	*Cracking*	ft²	600		600			
521	Concrete Protective Coating	ft²	36675	36671		6		
3230	*Effectiveness*	ft²	36677	36671		6		
330	Metal Bridge Rail (E)	ft	820	170		650		East
1000	*Corrosion*	ft	650			650		
515	Steel Protective Coating	ft²	4607	1377	1300	1930		
3440	*Effectiveness*	ft²	3230		1300	1930		
330	Metal Bridge Rail (W)	ft	820	683		137		West
1000	*Corrosion*	ft	130			130		
1010	*Cracking*	ft	7			7		
515	Steel Protective Coating	ft²	2685	645	220	1820		
3440	*Effectiveness*	ft²	2040		220	1820		
330	Metal Bridge Rail	ft	820	665	155			Pedestrian
1000	*Corrosion*	ft	155		155			
515	Steel Protective Coating	ft²	9454	8254	1200			
3440	*Effectiveness*	ft²	1200		1200			
331	Concrete Bridge Rail (E)	ft	820			820		East
1080	*Delam/Spall/Patch*	ft	6			6		
1130	*Cracking*	ft	814			814		
331	Concrete Bridge Rail (W)	ft	820			820		West
1080	*Delam/Spall/Patch*	ft	8			8		
1130	*Cracking*	ft	812			812		
303	Assembly Joint Seal (N)	ft	56			51	5	North
2310	*Leakage*	ft	25			25		
2330	*Seal Damage*	ft	29			24	5	
2360	*Adj. Deck Header*	ft	2			2		
303	Assembly Joint Seal (S)	ft	56	0	9	38	9	South
2310	*Leakage*	ft	25			25		
2330	*Seal Damage*	ft	24		6	9	9	
2360	*Adj. Deck Header*	ft	7		3	4		
141	Steel Arch	ft	845	395	400	50		
1000	*Corrosion*	ft	450		400	50		
515	Steel Protective Coating	ft²	21754	14749	2865	4140		
3440	*Effectiveness*	ft²	7005		2865	4140		

QUANTITY BY CONDITION STATE

Element Number	Element Description	Unit of measure	Total Quantity	CS1 Good	CS2 Fair	CS3 Poor	CS4 Severe	Notes or other defects
107	Steel Open Girder - Spandrel	ft	1629	1505	100	24		
1000	*Corrosion*	ft	110		90	20		
1020	*Connection*	ft	12		8	4		
1900/7000	*Distortion/Damage*	ft	2		2			
515	Steel Protective Coating	ft²	45136	44831	245		60	
3410	*Chalking*	ft²	5		5			
3420	*Peeling*	ft²	280		240		40	
3440	*Effectiveness*	ft²	20				20	
152	Steel Floor Beams	ft	1442	1144	244	54		
1000	*Corrosion*	ft	261		207	54		
1020	*Connection*	ft	19		19			
1900/7000	*Distortion/Damage*	ft	18		18			
515	Steel Protective Coating	ft²	14634	14436	198			
3420	*Peeling*	ft²	198		198			
113	Steel Stringers	ft	4887	4644	243			
1000	*Corrosion*	ft	240		240			
1900/7000	*Distortion/Damage*	ft	3		3			
515	Steel Protective Coating	ft²	27256	26656	600			
3420	*Peeling*	ft²	600		600			
311	Movable Bearings	Each	8		2	6		
1000	*Corrosion*	Each	8		2	6		
313	Fixed Bearings	Each	8	4	2	2		
1000	*Corrosion*	Each	8	4	2	2		
316	Other Bearings	ft	4		4			
1000	*Corrosion*	ft	4		4			
215	Reinforced Concrete Abutment	ft	111	47	19	34	11	
1080	*Delam/Spall/Patch*	ft	4				4	
1090	*Exposed Rebar*	ft	3			3		
1120	*Efflor/Rust*	ft	45		10	28	7	
1190	*Abrasion/wear*	ft	12		9	3		
521	Concrete Protective Coating	ft²	334		200	72	62	
3520	*Peeling/bubbling*	ft²	334		200	72	62	
202	Steel Columns	Each	12		12			
1000	*Corrosion*	Each	12		12			
515	Steel Protective Coating	ft²	6623	6473	150			
3520	*Peeling/bubbling*	ft²	150		150			
205	Concrete Columns	Each	12	1	9	2		
1080	*Delam/Spall/Patch*	Each	5		4	1		
1130	*Cracking*	Each	7	1	5	1		

Form No. M-212
Rev. 6-94

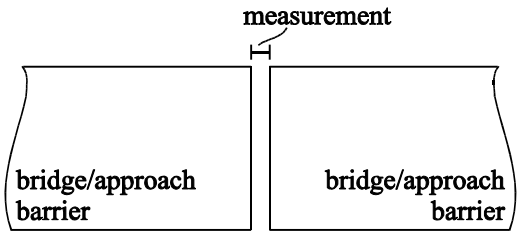
Joint Gap Measurements

Structure No. 7622 District No. 5 Inspection Date 06/21-23/19

Route No. NM-501 Mile Post N/A County Los Alamos

Location		Measurement (in.) [2019 (2018)]
South	East	3.0 (2 -1/2)
	West	2.0 (3.0)
North	East	3-1/2 (3-1/2)
	West	4-1/4 (4.0)

Note: Measurement was taken at the top at the joint between the approach barrier and the bridge barrier.



NBIS Items not included on M212

Item No.		Description		
1		State Code		356
5	A	Inventory Route - Record Type		1
5	B	Route Signing Prefix		3
5	C	Designated Level of Service		1
5	D	Route Number		501
5	E	Directional Suffix		0
10		Inventory Route, Minimum Vertical Clearance		9999
12		Base Highway Network		1
13		LRS Inventory Route, Subrout Number		0000NM050100
14		(Reserved)		
15		(Reserved)		
16		Latitude		35 52' 48"
17		Longitude		106 19' 19"
18		(Reserved)		
19		Detour Length		14.91
20		Toll		3
22		Owner		60 Other Fed Agencies
23		(Reserved)		
24		(Reserved)		
25		(Reserved)		
26		Functional Class		Long Enough
27		Year Built		1952
28	A	Lanes on		2
28	B	Lanes over		2
29		ADT		8265
30		Year of ADT		2017
31		Design Load		4 M 18 (H 20)
32		Approach Roadway Width (w/ shoulders)		44
33		Median		0 No Median
34		Skew		0
35		Structure Flared		0 No Flare
37		Historical Significance		4 Hist sign not determined
38		Navigation Control		N
39		Navigation Vertical Clearance		0000
40		Navigation Horizontal Clearance		0000
41		Posting Status		A Open, no restriction
42	A	Type of Service on		5 Highway-pedestrian
42	B	Type of Service under		6 Highway-waterway
44	A	Structure Type		3
44	B	Approach Span		2
45		Number of Spans Main Units		1
46		Number of Approach Spans		6
47		Horizontal Clearance		44
48		Length of Maximum Span		442.91
50	A	Curb/Sidewalk Width L		7.87
50	B	Curb/Sidewalk Width R		0
51		Width Curb to Curb		44
52		Width Out-to-Out		55.45
53		Minimum Vertical Clearance Over Bridge Roadway		9999
54		Minimum Vertical Underclearance		H9999
55		Minimum Lateral Underclearance (R)		12
56		Minimum Lateral Underclearance (L)		327.76
57		(Reserved)		

62		Culvert		N/A
63		Operating Rating Method		1 LF Load Factor
64		Operating Rating		HS25.5
65		Load Rating Method		1 LF Load Factor
66		Inventory Rating		HS15.0
67		Str Evaluation		5 Above Min Tolerable
73		(Reserved)		
74		(Reserved)		
75		Type of Work		351
76		Length of Structure Improvement		814.5
77		(Reserved)		
78		(Reserved)		
79		(Reserved)		
80		(Reserved)		
81		(Reserved)		
82		(Reserved)		
83		(Reserved)		
84		(Reserved)		
85		(Reserved)		
86		(Reserved)		
87		(Reserved)		
88		(Reserved)		
89		(Reserved)		
91		Frequency		12 months
92	A	Fracture Critical Details		Y12
92	B	Underwater Inspection		(Blank)
92	C	Other Special Inspection		(Blank)
93	A	Fracture Critical Details Inspection Date		Y0618
93	B	Underwater Inspection Date		(Blank)
93	C	Other Special Inspection Date		(Blank)
94		Bridge Improvement Cost		Unknown
95		Roadway Improvement Cost		Unknown
96		Total Project Cost		Unknown
97		Year of Improvement Cost Estimate		NA
98		Border Bridge		(Blank)
99		Border Bridge Structure Number		(Blank)
100		Defense Highway		0 Not a STRAHNET hwy
101		Parallel Structure Designation		N
102		Direction of Traffic		2 2-way traffic
103		Temporary Structure Designation		(Blank)
104		Highway System		0 Not on NHS
105		Federal Lands Highways		0
106		Year Reconstructed		1992
107		Deck Type		1 Concrete-Cast-in-Place
108	A	Wearing Surface / Protective System		5
108	B	Membrane		0
108	C	Deck Protection		8
109		Truck ADT		14%
110		Designated National Network		0
111		Pier or Adutment Protection (for Navigation)		(Blank)
112		NBIS Length		06 Rural Minor Arterial
114		Future ADT		Unknown
115		Year of Future ADT		NA

STRUCTURE NO. 7622 Inspection Date 06/21-23/19

Recommendations:

Immediate	1. Install drainage system on west side of pedestrian walkway. 2. Repair / replace missing timber post on approach guardrails. 3. Replace joint on north end of bridge. 4. Upgrade pedestrian rail to current standards.
Short Term	1. Repair concrete on north and south abutments. 2. Repair the deck locations with delaminations and spalls, particularly those with exposed rebar. 3. Repaint and clean movable bearings at abutments. 4. Repair concrete of CBR and repaint metal railing on top of CBR on east and west sides. 5. Monitor substructure elements for problems associated with soil erosion due to water runoff. 6. Monitor drainage at north and south joints. 7. Conduct detailed study of joint design alternatives to determine best option (including addition of approach slab). 8. Install erosion protection in areas surrounding abutments and piers, particularly in areas with undermining and scour.
Long Term	1. Repair collision damage to metal railing on top of CBR on west side near north end of pedestrian fence and near the north end expansion joint. 2. Perform ultrasonic testing of pins at abutment, pier, and arch bearings. 3. Repaint arch rib and outriggers (including seated channel connections to pier columns and spandrel girder). 4 Monitor vertical alignment between deck and approach roadway on south end of bridge and check for associated joint damage. 5. An in-depth inspection of the bottom connections of arch columns (including the rivets and angles) using rope access methods to ensure the connections are sound. 6. Measure section loss (or remaining section) on members with moderate to heavy corrosion.

Supplemental Inspection Report

Omega (Los Alamos Arch) Bridge #7622

Dates of Bridge Inspection: June 21 – 23, 2019

Inspection Crew: NMSU (Dr. David Jáuregui, PE, Dr. Kenneth White, PE, Dr. Brad Weldon, EIT, Mr. George Baca, PE); and McClain & Co. (Mr. Wilbert Santiago)

Summary of Deck Condition

Chain dragging the deck identified several areas with delamination. The delaminations are concentrated near the south expansion joint, in the closure joint of the deck near the bridge centerline, and near previously patched areas. **At the south joint**, delaminated areas were found on the adjacent header areas of the bridge deck and approach roadway. See pictures LANL 1, LANL 2, and LANL 3. Patch repairs at both the north and south expansion joints are adhering but there are cracks and delaminations at both joints. See pictures LANL 4 and LANL 5. **In the deck closure joint near the bridge centerline**, there were several delaminated areas found throughout the total length of the bridge; the delaminations usually extend the full width (1-ft., 4-in.) of the closure joint. In addition, corrosion of the stay-in-place deck forms has initiated at spot locations. See picture LANL 6.

A chain drag was performed on the deck and the sidewalk during the 2019 inspection The delaminated area map for the 2019 inspection is attached. In addition, there are several spalls located on the west edge of the deck concentrated at the pedestrian rail post locations. See picture LANL 7.

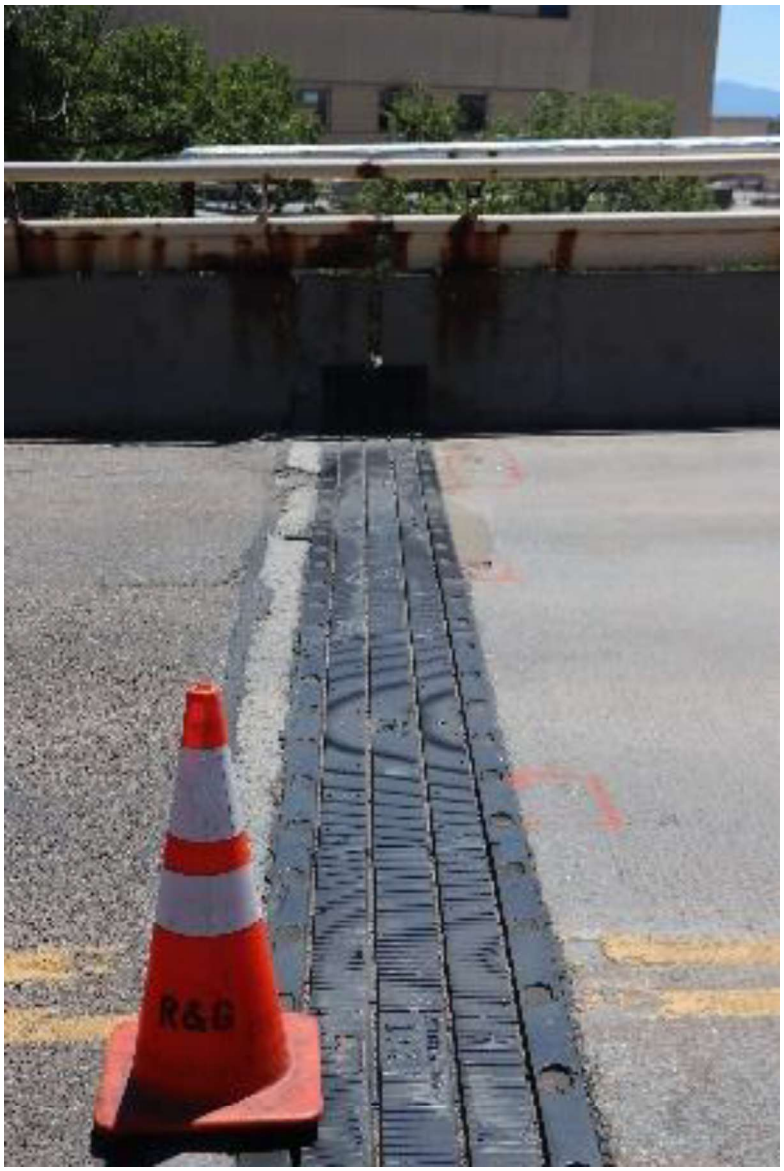
The **deck edges** adjacent to the east and west bridge barriers have map cracking, leaching, and several spalls. This condition is likely caused by the accumulation of water which drains transversely in the east and west directions and then from the south to north end of the bridge. Alignment issues were observed between the bridge and the south approach roadway and there is new joint damage possibly caused by roadway equipment and the overall bridge movement. See pictures LANL 1, LANL 2, and LANL 3. The **north expansion joint** has significant damage and replacement of this joint is recommended. See pictures LANL 4, and LANL 5.

Overall the deck is rated in fair condition. Element level data for the reinforced concrete deck (NBE 12) with concrete protective coating (BME 521) and assembly joint seals (BME 303) on the north and south ends of the bridge are attached at the end of this report.

LANL 1 (Picture IMG_1154.jpg)

LANL 2 (Picture IMG_1156.jpg)

LANL 3 (Picture IMG_1278.jpg)



LANL 4 (Picture IMG_1395.jpg)

LANL 5 (Picture IMG_1394.jpg)

LANL 6 (Picture IMG_5502.jpg) (2017)

LANL 7 (Picture IMG_5562.jpg [2017]; IMG_0261 [2019])

Summary of Abutment Condition

South Abutment (#1): Backwall and breast wall were previously sealed with a concrete protective coating but there is heavy cracking and peeling. Horizontal cracks exist below the bridge seat and extend the full width and almost the full height of the breast wall. The top front edge of the bridge seat is delaminated between the bearings. Leaching exists throughout the breast wall with rust staining (evidence of corrosion of the reinforcement) and buildup of efflorescence. See picture LANL 8. The efflorescence has advanced on several cracks and the concrete protective coating has debonded on the breast wall and bridge seat exposing the original concrete which has resulted in spalling of original concrete and exposed rebar. Spalls greater than 1 in. deep and 6 in. diameter are present, and the exposed rebar has section loss. See pictures LANL 9 and LANL 10. Soil has accumulated at the east and west bearings and the masonry plates are corroded with paint failure. At the southwest location, the bearing was realigned and the keeper plate was replaced (between 08/06/14 and 08/13/14); both elements were also repainted. See pictures LANL 11 and LANL 13. Pack rust and section loss are present at the east and west bearings and some abrasion of the masonry plates has occurred. The protective coating on the bottom of the southwest bearing and the baseplate on the southeast bearing is no longer effective. See picture LANL 14. The anchor bolts are in contact with the bearing device due to transverse movement in the east direction. See picture LANL 12. Periodic cleaning and repainting of the bearing elements and ultrasonic testing of the pins is recommended.

North Abutment (#2): Abutment was previously sealed with a concrete protective coating which has debonded throughout the length of the breast wall and on the bridge seat resulting in exposure of the original concrete surface and leaching. The debonded areas vary in size. See picture LANL 15. On the east side, debonding was observed on the backwall along with map cracking, leaching, and spalling (greater than 1 in. deep, 6 in. diameter) of the breast wall. Overall, adhesion of protective coating to original concrete is poor. Bridge seat has soil accumulation, and the bearing elements are corroded with paint failure and pack rust exists at the east and west bearings. There is section loss on the base plate on the northwest bearing and the protective coating is no longer effective. Periodic cleaning and repainting of the bearing elements and ultrasonic testing of the pins is recommended. Map cracking exists on east and west sides of the backwall. Cracks in the west wingwall and the east side of the backwall have been sealed with epoxy. The steel top plate just under the expansion joint has cracked through the full thickness between stringers 3 and 4 (initially observed in 2006). See picture LANL 16. East side of breast wall has undermining and the asphalt landing at the top of slope has eroded. See pictures LANL 17 and LANL 18. Slight settlement of the west end of the bridge seat is evident.

Overall the substructure is rated in poor condition. Element level data for the reinforced concrete abutments (NBE 215) with concrete protective coating (BME 521) and movable bearings (NBE 311) on the north and south ends of the bridge are attached at the end of this report.

LANL 8 (Picture IMG_0923)

LANL 9 (Picture IMG_0918.jpg)

LANL 10 (Picture IMG_1269.jpg)

LANL 11 (Picture IMG_0955.jpg)

LANL 12 (Picture IMG_0947.jpg)

LANL 13 (Picture IMG_0945.jpg)

LANL 14 (Picture IMG_1126.jpg)

LANL 15 (Picture IMG_1118.jpg)

LANL 16 (Picture IMG_1111.jpg)

LANL 17 (Picture IMG_1806.jpg)

LANL 18 (Picture IMG_1122.jpg)

Summary of Pier Condition

Overall the substructure is rated in poor condition. Element level data for the reinforced concrete columns (NBE 205), movable bearings (NBE 311), fixed bearings (NBE 313), and other bearings (NBE 316) are attached at the end of this report.

South Pier Columns (#1)

East Concrete Column	
Location	Notes/Comments
North Face	- 12” x 12” spall has been patched on 55” to 61” exposed face - Map cracking up to 0.010” wide at 9” spacing
South Face	- Two small spalls on corners of 28” to 33” exposed face plus map cracking (0.007” wide) and single vertical crack (0.013” wide)
East Face	- Minor scaling plus map cracking (0.007” wide at less than 6” spacing) on 27” to 55” exposed face
West Face	- 25” to 47” exposed surface - Minor rust straining from form steel - Minor horizontal and vertical cracking 0.013” wide
Top Face	- Bolts not fully engaged - Moderate scaling with cracks on chamfers (extend shallow into vertical faces) - Pack rust under bearing and above masonry plate - Minor paint peeling and 100% corrosion of masonry plate on west side plus 50% corrosion on bottom of concave surface over plate length (otherwise coating is sound) - Pitting on east and west sides of masonry plate (more on west side - Likely through full width) - Section loss on masonry plate at bearing contact area - Cracks up to 0.02” wide at approximately 12” spacing

West Concrete Column	
Location	Notes/Comments
North Face	- 47” to 64” exposed surface with map cracking - 9” wide x 18” long x ½” deep spall and map cracking up to 0.016”
South Face	- Minor scaling - 6” diameter spall - 0.01” vertical crack - Map cracking (0.007” wide at 8” spacing) - Exposed surface continues to increase due to erosion (22” to 42”)
East Face	- 41” to 65” of exposed surface with minor scaling - Map cracking up to 0.009” - Vertical crack extending ¾” depth of pedestal with leaching and minor rust staining
West Face	- 25” to 47” exposed surface

	- Minor rust straining from form steel - Minor horizontal and vertical cracking 0.013” wide
Top Face	- Bolts not fully engaged - Moderate scaling with cracks on chamfers (extend shallow into vertical faces) - Pack rust under bearing and above masonry plate - Minor paint peeling and 100% corrosion of masonry plate on west side plus 50% corrosion on bottom of concave surface over plate length (otherwise coating is sound) - Pitting on east and west sides of masonry plate (more on west side - Likely through full width) - Section loss on masonry plate at bearing contact area - Cracks up to 0.02” wide at approximately 12” spacing

South Pier Columns (#2)

East Concrete Column	
Location	Notes/Comments
North Face	- 9'-9" exposed face has minor scaling and map cracking (0.013" wide)
South Face	- Minor scaling plus map cracking (0.016" wide at 6" spacing)
East Face	- Minor scaling and map cracking up to 0.016" (primarily towards top) - Single vertical crack (0.016" wide) down 36" from top
West Face	- 7' to 11'-6" exposed face has two vertical cracks (0.013" wide) down 12" from top, and minor scaling and map cracking up to 0.013" (primarily towards top), horizontal crack at mid-height
Top Face	- Moderate cracking, 0.013" wide (extends down into vertical faces about 6 to 8 inches) - Fixed bearing coating sound, all bolts in place - Minor corrosion on base of nut on masonry plate with section loss - Freckled rust on base of masonry plate

West Concrete Column	
Location	Notes/Comments
North Face	- Moderate scaling plus map cracking (up to 0.016" wide) - Rust staining due to formwork - Efflorescence on West corner
South Face	- 57" exposed surface with moderate scaling and map cracking (0.013" wide) sealed with epoxy - Horizontal cracks (0.060" wide) and delamination towards top extending half the width of the column - Epoxy seal broken on many cracks
East Face	- Moderate scaling towards top and minor scaling towards bottom - Cracks sealed with epoxy - Map cracking towards top (0.010" at 4" spacing) - Vertical crack (0.030" wide) extending approximately 36" down - Epoxy seals broken
West Face	- Moderate scaling towards top and minor scaling towards bottom - Cracks sealed with epoxy - Map cracking (up to 0.013" wide) - Efflorescence forming on cracks - Staining near the top of the column
Top Face	- Moderate to heavy scaling (more on west region) - Moderate cracking and delamination on north and south regions - Delaminations beginning to spall - Rust staining originating from anchor bolts on west side - Fixed bearing coating sound - Corrosion extends to bottom of column including rivets

	- Epoxy seal broken - Staining towards top from masonry plate - Map cracking more significant towards top - Cracking towards edge (0.007” wide)

Summary of Pier Condition (cont.)

North Pier Columns (#3)

East Concrete Column	
Location	Notes/Comments
North Face	- 0” to 27” exposed face with 4” x 4” spall approx. 8” from NW corner - Hairline map cracking (0.002” wide)
South Face	- Map cracking on 36” to 53” exposed face (less than 6” spacing and 0.016” wide) - Minor spall (1”x1”) - Vertical cracks 0.016” at < 6” spacing
East Face	- Map cracking (0.007” wide) plus full-depth vertical crack (0.010” wide) on 0” to 22” deep exposed face
West Face	- Map cracking on 29” to 53” exposed face - Two full-height vertical cracks at 12” spacing and 0.010” wide with leaching - Small spalls along vertical cracks with staining
Top Face	- Moderate to heavy scaling - Several spalls measuring 4” x 4” to 6” x 6” exposing square rebar - Minor corrosion around perimeter of masonry plates and anchor bolts - Paint starting to pull away from plate - Metal exposed with surface rust - Pop-outs on chamfer

West Concrete Column	
Location	Notes/Comments
General	- Cracks sealed previously are worse on west side; map cracking; horizontal cracking from 10”-12” down and around south face - Scaling on top surface (aggregate exposed) - Corrosion with section loss on bolts and masonry plate
North Face	- Minor scaling and map cracks up to 1/32” with leaching out of cracks on 8” to 24” exposed face - Horizontal crack approx. 12” down with leaching (continues around to south face) - Cracks previously sealed
South Face	- Minor scaling and map cracks up to 1/32” on 63” to 68” exposed face - Scaling top west corner - Staining on bottom center; 6”x6” delamination West side toward the top - Spall bottom center 6”x6”
East Face	- Minor scaling and map cracks up to 0.010” wide at 12” spacing with leaching out of cracks on 30” to 62” exposed face
West Face	- Minor scaling and map cracks up to 0.020” wide (at 8” spacing horizontally and 4” vertically) with leaching out of cracks on 32” to 67” exposed face - Horizontal crack 0.025” wide extending from north to south face
Top Face	- Moderate scaling and cracking (0.030” wide at 6” spacing, extend down into vertical faces) - 4” x 4” spall on northwest corner of masonry plate - Heavy corrosion around perimeter of masonry plates and anchor bolts (coating is sound)

Summary of Pier Condition (cont.)

North Pier Columns (#4)

East Concrete Column	
Location	Notes/Comments
North Face	- Covered with soil (not visible)
South Face	- 10” exposed face with map cracking - 1/32” crack on SE corner
East Face	- 3” to 6” exposed face with map cracking - Crack on south corner from spall on top face
West Face	- Partially exposed with map cracking - Cracks at approx. locations of anchor bolts - Minor scaling
Top Face	- Minor scaling and map cracks up to 0.009” wide at 12” spacing - Anchor bolts do not extend through top nuts - Minor corrosion around perimeter of masonry plates and anchor bolts - Spall on SE corner with cracks down south and east faces up to 1/32”

West Concrete Column	
Location	Notes/Comments
North Face	- Covered with soil (not visible)
South Face	- 6” to 12” exposed face with map cracking
East Face	- Covered with soil (not visible) - Minor crack on northeast corner
West Face	- 3” to 12” exposed face with map cracking - Minor undermining of southwest corner - Riprap added to help prevent erosion
Top Face	- Minor scaling and map cracks up to 0.030” wide at 10” spacing - East anchor bolt does not extend through top nut - Minor corrosion around perimeter of masonry plates and anchor bolts - (Coating is sound) - Small spall on SE corner - Fretting corrosion around pin - Pack rust at bearing/masonry plate

NOTE: Rip-rap and netting installed to control erosion on the embankment near west concrete column

LANL 19 (Picture IMG_6370.jpg) (2018)

LANL 20 (Picture IMG_0874.jpg)

Summary of Pier Condition (cont.)

South Skewback Columns (#1)

East Concrete Column	
Location	Notes/Comments
General	- Top half concrete finish is no longer effective
North Face	- Moderate cracking visible in the concrete finish - 25% debonding toward top of finish - Rust staining at top end - 3, 0.020" to 0.040" vertical cracks at 11" spacing (40% of height) – cracks in line with anchor bolt - Efflorescence - Small spall near top 6" x 6" - Abrasion with exposed aggregate on original concrete (1' x 1' + 1' x 2' + 1' x 1')
South Face	- Moderate cracking visible in the concrete finish - Map cracking at about 1' spacing (0.040" - 0.050" wide) - Two cracks starting at top end from bolts (entire height) - 2' x 2' delaminated patch at base of seal - Variable sounding - Efflorescence along vertical cracks - Debonding of concrete finish - Delamination approximately at mid-height 12" x 12"
East Face	- Moderate cracking visible in the concrete finish - Scaling of finish - Map cracking (0.020" wide) approx. 8' from top - Debonding of finish toward top (10%)
West Face	- Moderate cracking visible in the concrete finish - Scaling and debonding (30%) of finish about half the depth - Vertical crack at center of face (full-depth, 0.025" wide) - 2 full depth cracks 6" apart - Surface concrete finish debonding - Entire column has abrasion with exposed aggregates (loss of aggregates) - Finish over entire column is bubbling and trapping moisture, has some efflorescence
Top Face	- Not visible - Minor rust staining visible towards top of vertical faces (possibly originating from top face)

*Note: Scour hole (6' x 4') on southwest corner of column exposing bare concrete

West Concrete Column	
Location	Notes/Comments
North Face	- Moderate cracking visible in the concrete finish - Scaling and debonding (15-20%) of finish near top and middle of column - Rust staining at top end; major crack at middle of pier over full height (0.060" wide) – debonding along length of crack - Heavy vegetation surrounding column - Original concrete exposed
South Face	- Cracking in the concrete finish - Scaling, bubbling, and debonding (100%) of finish on column (along with rust staining) - Vertical crack on bottom half of height - Two vertical cracks (>0.050" wide) - Larger cracks near top and bottom - Efflorescence on surface finish and concrete - Separate casting of concretes
East Face	- Cracking visible in the concrete finish - Scaling of finish (debonding along height) - Two major cracks at middle of pier over full height (0.060" wide) - Vertical crack 0.020" full height - Scaling/debonding of finish with rust staining near top - Concrete exposed with exposed aggregate near mid-depth with efflorescence - Efflorescence is concentrated near debonded areas (more towards bottom
West Face	- Moderate cracking in the concrete finish - Two vertical cracks on bottom half of height (0.050" wide) plus some map cracking starting to show - Debonding (5%) of surface concrete finish over height - Exposed concrete in isolated areas
Top Face	- Not visible - Minor rust staining visible towards top of vertical faces (possibly originating from top face)

South Arch Abutments/Fixed Bearings/East
Notes/Comments
- Rust on exposed masonry plate (5%) - No surface concrete finish on abutment - Bearing covered with soil/debris on west side and east side - Pack rust between arch and bearing

South Arch Abutments/Fixed Bearings/West
Notes/Comments
- Minor corrosion (approximately 25%) on inside plates - No surface concrete finish on abutment - Map cracking (0.020” wide) at approximately 8” spacing - Delamination of east side, 24”x12” with efflorescence - Bearing partial covered with soil/debris on west side and east side

Summary of Pier Condition (cont.)

North Skewback Columns (#2)

East Concrete Column	
Location	Notes/Comments
General	- Majority of cracks on top half of column (most have previously been sealed, crack exposed through seal) - Edges of cracks have small "spalls"
North Face	- Minor to moderate cracking - Abrasion on bottom half and discoloration on full height - Moderate scaling - Cracks sealed with epoxy near top (1' spacing) but showing through seal - Map cracking (0.010" wide) on top ¾ of column height - Exposed aggregate (abrasion) on corners
South Face	- Light scaling - Effective patched spall at top end (4'x4') - Map cracks (0.016" wide at 12" spacing) over full height of column - Small aggregate pop-outs near bottom (approximately 1") - Resurfaced area (3'x3') toward top in good condition - Reeling along edges of patch (pop outs near bottom of patch) - Sealed towards bottom, starting to honeycomb with exposed - Patch with honeycombing near bottom (delamination 6" x 6" near bottom)
East Face	- Moderate map cracking (0.016" – 0.020" wide at approximately 12" spacing) over full height of column - 12" x 12" spall has been patched, cracks forming along edge of patch and spalling of patch on top corner - Sealed cracks showing through epoxy - Two spots of corrosion near bottom (form steel) - Abrasion with pop outs and abrasion on corners
West Face	- Moderate map cracking (0.020" wide between 9" and 12" apart) and scaling - Cracks sealed with epoxy and extend full height - Cracks propagated through epoxy
Top Face	- Not visible

*Note: North-West corner has small delamination

West Concrete Column	
Location	Notes/Comments
General	- Crack widths get larger starting at mid-height - Sealed ~ 3' near top - Cracks showing through
North Face	- Vertical cracks extend full height of column (0.016" – 0.040" wide and spaced at 8" - 12" apart) and horizontal cracking at mid-height - Moderate cracking (top end sealed similar to abutment) - Vertical crack 0.016" – 0.030" wide near west edge of north face - Efflorescence (continues to grow) approximately 1/8 of height near west face - Concrete seal has cracks through near top - Cracking is towards west side (>0.050") but is only on one face (North)
South Face	- Light scaling - Vertical cracks extend full height of column (0.016" wide at 12" spacing) - ~ 6' from top, horizontal crack extends 1/3 of width - Abrasion visible on west side, bug holes/pop outs
East Face	- Light scaling toward bottom and moderate map cracking - Top sealed (3' height) - Vertical cracks extend full height of column (0.020" wide spaced 6" apart) - Top, east side of column has delaminations extending down
West Face	- Vertical cracks (0.020" wide) extend full height of column (spaced at about 4" - 6") - Efflorescence on cracks near top; map cracking 2" – 4" apart - Abrasion in chamfer area with exposed aggregates but aggregate still secure (near areas with efflorescence) - Moderate crack on NW corner – 0.040" wide
Top Face	- Not visible

North Arch Abutments/Fixed Bearings/East
Notes/Comments
- Map cracking at about 6” spacing (0.020” – 0.025” wide) - Erosion on east side exposing unpainted concrete
- Honeycombing (exposed aggregate) at top of East side (1’ x 4’) near top and West side (3’x8”) and 3’x4” along top edge
- Surface concrete finish good (on abutment and bearings) - Starting to flake in isolated areas (~ 5’ x 5’)
- Pack rust between bearing and arch rib - Stains extend to concrete bearing
- Two bolts on top not fully engaged with nuts
- Delamination on West side of masonry plate (18”x12”)
- Delamination on East side of skewback (3’x6”)
- Honeycombing with exposed aggregate (in line with delamination)
- Bottom of masonry plate has corrosion with section loss
- Top concrete finish spalling off
- NE corner – delaminations with initiation of spalling - Corrosion around perimeter

North Arch Abutments/Fixed Bearings/West
Notes/Comments
- Map cracking at about 4” – 6” spacing (0.009” – 0.020” wide)
- Honeycombing and abrasion (6”x6”)
- Surface concrete finish moderate (on abutment and bearings) - Starting to peel
- Pack rust between bearing and arch rib - Corrosion around masonry plate - Staining extends to concrete - Section loss on masonry plate
- Isolated corrosion of base metal (about 1%)
- Protective top plate has corrosion
- More staining and corrosion than east side (due to more water runoff - Observed during rain)
- 6” x 6” spall on east side with delamination (6”x6”)
- 12” x 6” spall on west side of masonry plate
- Efflorescence on West side cracks - Cracks larger on the West side
- Protective finish on west face in good condition - Moderate on east side
- Erosion has exposed bare concrete around base (no surface protective finish on west side and front of skew back)
- Concrete spall at bottom of masonry plate
- Abrasion throughout

LANL 21 (Picture IMG_0774.jpg)

LANL 22 (Picture IMG_0060.jpg [2016], IMG_0788.jpg [2019])

LANL 23 (Picture IMG_0751.jpg)

LANL 24 (Picture IMG_0739.jpg)

LANL 25 (Picture IMG_0095.jpg) [2017]

Summary of Bridge Rail Condition

In general, the concrete barrier rail (CBR) on the east and west sides of the bridge have vertical, horizontal, and map cracks with isolated areas of traffic damage. Additionally, there are several delaminations on the CBR, each approximately 1 ft. in length. Many of the delaminations are near the connections to the steel railing. The vertical cracks are concentrated near the drain holes at the bottom of the CBR and extend the full thickness of the CBR. The top of the CBR has several areas with isolated spalls greater than 6 in. in diameter and map cracks where the metal rail attaches to the CBR. The metal rails have areas of moderate to heavy rust. In particular, the brackets attaching the steel rails to the CBRs have moderate to heavy corrosion (on the side of the brackets exposed to vehicular traffic) along with paint failure; anchor bolts are also missing on the bracket connections at several locations. The concrete has spalled under the connection plates at several locations. **At the west bridge rail**, there is collision damage (consisting of severe cracking, delamination, and spalling) at a location adjacent to the north end of the pedestrian fencing and a longitudinal crack in the rail towards the south end. See pictures LANL 26, LANL 27, and LANL 28. **At the east bridge rail**, there is a large spall (measuring greater than 1 in. deep and greater than 6 in. diameter), a horizontal crack with delamination, and major scaling at the bottom half of the CBR located along the length of the pedestrian fencing. The bridge rail also has scrape marks with moderate corrosion on the north and sound ends and major corrosion on the south side of the pedestrian fencing. See pictures LANL 29 and LANL 30. The steel bridge rail on the east side of the roadway is in worse condition than the west side.

In the element level data attached at the end of this report, the bridge rails located on the east and west sides of the roadway were separated based on material. The reinforced concrete bridge railing (NBE 331) corresponds to the CBRs located on both sides of the roadway. The metal bridge railing (NBE 330) corresponds to the steel pipe rails attached to the top of the CBRs. In addition, a metal bridge rail was used to describe the rail located on the west side of the pedestrian walkway. Furthermore, data for the steel protective coating (BME 515) for the metal bridge railings are provided.

LANL 26 (Picture IMG_1286.jpg)

LANL 27 (Picture IMG_1162.jpg)

LANL 28 (Picture IMG_1163.jpg)

LANL 29 (Picture IMG_1005.jpg)

LANL 30 (Picture IMG_0995.jpg)

Summary of Approach Guardrail Condition

The approach guardrails consist of a steel guardrail with timber blockouts on timber posts or rubber blockouts on steel posts.

Damage has occurred on the west side at the end of the **north approach guardrail**, two timber posts are missing and two have sustained damage and need to be replaced. See pictures LANL 31, LANL 32, and LANL 33. There is collision damage to the CBR and bridge rail approximately 3 ft. from the north expansion joint. See picture LANL 34. The northeast guardrail is in good condition. See pictures LANL 35, LANL 36, and LANL 37.

At the south approach guardrail, collision damage was observed; the steel guardrail was deformed and some of the timber posts were split along their height and/or deformed at the base See pictures LANL 38, LANL 39, and LANL 40.

Element level data is not applicable to the approach guardrails.

LANL 31 (Picture IMG_1193.jpg)

LANL 32 (Picture IMG_6639.jpg)

LANL 33 (Picture IMG_1183.jpg)

LANL 34 (Picture IMG_1397.jpg)

LANL 35 (Picture IMG_1274.jpg)

LANL 36 (Picture IMG_1013.jpg)

LANL 37 (Picture IMG_1018.jpg)

LANL 38 (Picture IMG_6767.jpg)

LANL 39 (Picture IMG_1216.jpg)

LANL 40 (Picture IMG_1211.jpg)

Summary of Approach Roadway Condition

At the north approach roadway, the roadway was repaved / restriped and the expansion joint was replaced prior to the 2012 inspection. Minimal defects and deterioration (i.e., a few longitudinal cracks on the southbound / northbound lanes and transverse cracks adjacent to the expansion bearing which have been sealed) were observed on the roadway. The spall and delaminations are located on the header near the expansion joint. See pictures LANL 41 through LANL 44. The grate openings for drainage on the east and west sides are free of debris.

NOTE: the north approach roadway was repaved / restriped and expansion joint was replaced prior to the 2012 inspection.

At the south approach roadway, the roadway was repaved at the time of the 2018 inspection; the expansion joint seal was replaced prior to the 2015 inspection. Damage to the seal is present, possibly caused by roadway equipment. During the 2018 inspection, free flow of water through the joint was observed as it rained. In addition, several spalls were found on the header areas of the southbound traffic lanes. See pictures LANL 45 through LANL 48. The grate opening for drainage is free of debris on the east and west sides.

NOTE: the south approach roadway repaving was in progress during the 2018 inspection; expansion joint was replaced prior to the 2015 inspection.

Element level data is not applicable to the approach roadway.

LANL 41 (Picture IMG_1023.jpg)

LANL 42 (Picture IMG_1029.jpg)

LANL 43 (Picture IMG_1035.jpg)

LANL 44 (Picture IMG_1037.jpg)

LANL 45 (Picture IMG_1305.jpg)

LANL 46 (Picture IMG_1049.jpg)

LANL 47 (Picture IMG_1065.jpg)

LANL 48 (Picture IMG_6936.jpg) (2018)

Summary of Pedestrian Walkway Condition

In general, the concrete sidewalk on the west side of the bridge has areas of abrasion / wear with transverse, longitudinal and map cracks due to environmental (e.g., snow, rain) and human (e.g., pedestrian foot and bike traffic) factors. There are numerous spalls (less than 1 in. deep, 6 in. diameter) and delaminations located adjacent to the base plates of the pedestrian rail connecting to the concrete sidewalk. See picture LANL 49. Other observations include minor leaching and scaling of the concrete sidewalk adjacent to the CBR, minor corrosion of the pedestrian rail, and minor debris buildup on the sidewalk. See pictures LANL 50, LANL 51, and LANL 52.

NOTE: the pedestrian walkway lacks a drainage system to collect and divert rainwater runoff. As a result, the rainwater spills over the west side of the pedestrian walkway which is leading to significant problems (e.g., corrosion, debonding of steel protection) of the superstructure in particular the outriggers / connection plates, spandrel beam / splice plates, and arch rib located on the west side. See picture LANL 53. In addition, the pedestrian rail does not meet the required standard to provide a safe passageway for pedestrians to cross the bridge. One major issue is that the spacing between the rails is greater than the maximum permitted to prevent an individual from falling through.

Overall the deck is rated in fair condition. Element level data for the reinforced concrete deck (NBE 12) and assembly joint seals (BME 303) on the north and south ends of the bridge are attached at the end of this report. Element level data for the metal bridge railing (NBE 330) with steel protective coating (BME 515) are also provided.

LANL 49 (Picture IMG_1157.jpg)

LANL 50 (Picture IMG_1292.jpg)

LANL 51 (Picture IMG_1281.jpg)

LANL 52 (Picture IMG_1150.jpg)

LANL 53 (Picture IMG_0348.jpg)

Summary of Superstructure Condition

The steel arch bridge members are in fair condition with moderate paint failures at isolated locations particularly on the west side. As noted in previous inspections, there are missing bolts and poor welds at the channel connection to arch column. Failure of the steel protective coating on the top flanges of the outriggers (particularly on the west side) has resulted in corrosion and section loss and isolated pack rust at the arch column to arch rib connections. In general, the steel protective system was not applied to the superstructure components as thoroughly on the south side of the bridge as the north side. The west arch rib has minor to moderate section loss on several rivet heads and areas with section loss are present on the top and bottom flanges of the arch rib. There are some empty bolt holes or rivet holes at the top of several arch columns on both the west and east faces. Furthermore, there is minor corrosion and pack rust along the corners and the interior angles of several spandrel columns.

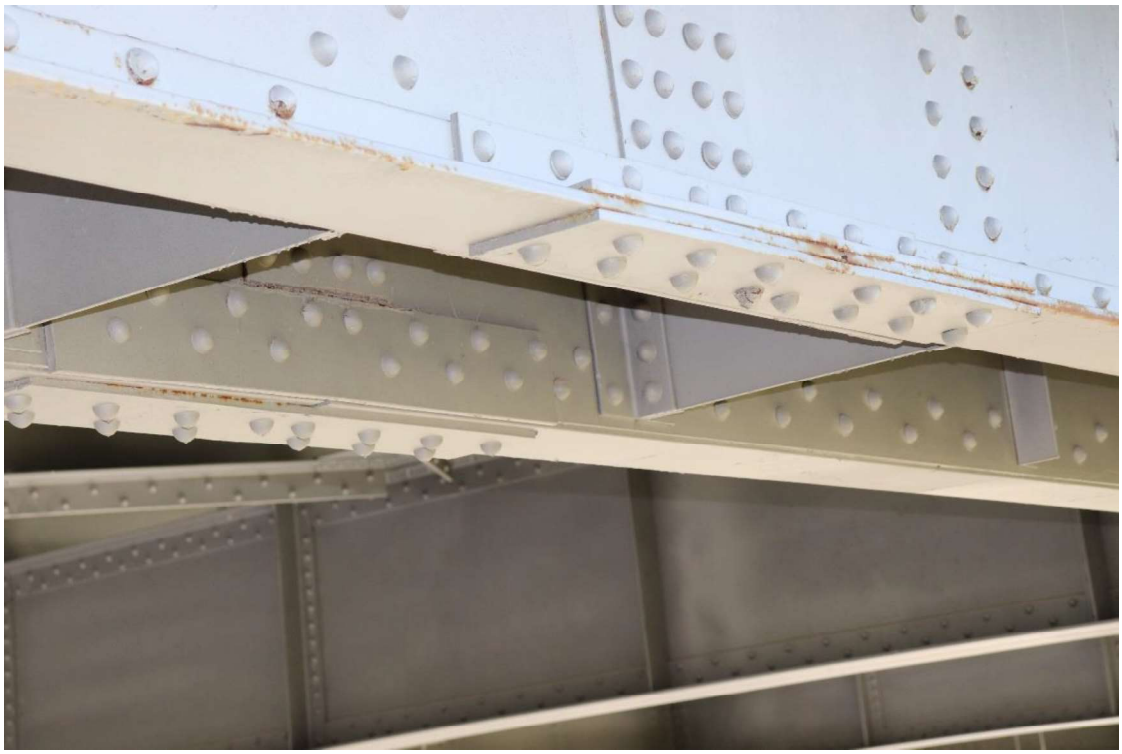
There are isolated areas of paint peeling on the web of the arch ribs with minor corrosion and paint failure / moderate corrosion on the top plate and bottom flange. The debonding of the steel protective system (i.e., paint) continues to grow each year and there are new locations with early stages of corrosion. In general, the west arch rib is in worse condition than the east arch rib mainly due to water spilling over the pedestrian walkway and the lack of a drainage system on the west side of the bridge. Spandrel girders are in good condition but there are isolated areas of paint peeling with minor corrosion on the web and bottom side of the top flanges. In addition, there is moderate corrosion and pack rust between the bottom flange plates of numerous spandrel girder splice connections particularly on the west side. Similar to the arch ribs, the west spandrel girder is in worse condition than the east spandrel girder due to the rainwater runoff. The east spandrel girder has minor impact damage at the bottom flange angle between the skewback column and pier column on the north end and the arch rib also has impact damage. In general, paint failure and moderate to heavy corrosion with section loss exists on the outrigger beams particularly on the west side; there is also moderate corrosion and pack rust / distortion at the bottom channel connection to the columns. In the interior, there are several locations where the floorbeams are missing a bolt at the top bracket connection to the spandrel girders and also there are isolated locations with impact damage on the bottom flange angle. Stringers are in good condition but there are areas of paint peeling and corrosion on the top and bottom flanges, particularly at the exterior stringers 1 and 6 (on the east and west sides of the bridge). The stay-in-place forms are cutout and damaged at several locations with one area haphazardly supported by timber shoring. Additionally, leaching and efflorescence is present along the top flanges of the stringers and spandrel girders.

Overall the superstructure is rated in fair condition. Element level data for the steel arches (NBE 141), steel columns (NBE 202), steel spandrel girders (NBE 107), steel floor beams including outriggers (NBE 152), and steel stringers (NBE 113) are attached at the end of this report. In addition, data for the steel protective coating (BME 515) for all steel members are provided.

(a)

(b)

Paint failure on spandrel girder and missing bolts / poor welds at channel connection to spandrel column (2011).



Corrosion and pack rust on bottom flange splice connection at west spandrel girder (IMG_0249).

Paint failure and corrosion on west outrigger top flange at south abutment (2014).

(a)

(b)

Moderate paint peeling on spandrel girder and column (IMG_8793.jpg (2018) / IMG_0270).

(a)

(b)

Moderate paint peeling on arch rib (IMG_0278, [2017]).

(a)

(b)

Pack rust at spandrel column to arch rib connections (IMG_8757.jpg [2018]) and corrosion on top flange of arch rib (2017).

(a)

(b)

Heavy corrosion at top of spandrel columns (2017).

(a)

(b)

West arch rib (typical): paint failure / corrosion of top plate (IMG_0310) and paint peeling on web (IMG_0828)

East arch rib (typical): minor paint peeling on web (IMG_0180)

West spandrel girder (typical): paint peeling on web and minor corrosion (IMG_0215)

East spandrel girder: impact damage to bottom flange angle (2012)

Arch rib: impact damage to top plate (IMG_3771 [2018])

West outrigger beam (typical): paint failure / moderate corrosion of beam and corrosion / pack rust / distortion at bottom channel connection to column (IMG_0262)

West outrigger beam (typical): paint failure / heavy corrosion of beam and corrosion / pack rust / distortion at bottom channel connection to column (2013)

Stringer: note leaching, paint failure, and corrosion at top flange (2012)

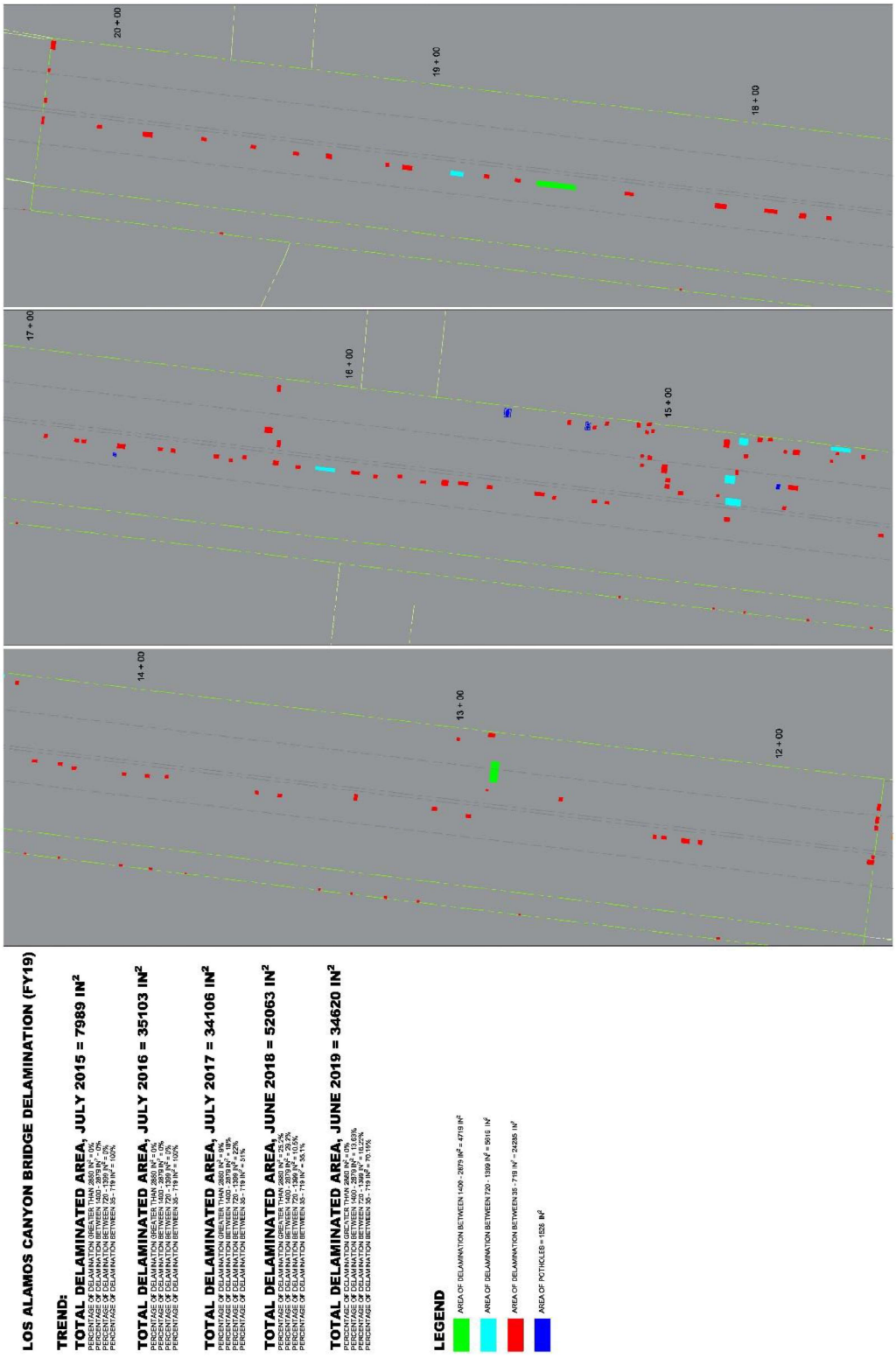
Stay-in-place forms: note haphazard support by timber shoring (IMG_0173)

Distortion (typical) of outriggers (2016)

East Arch, typical paint peeling/cracking and surface corrosion on top flange

East arch, column 14, 1/16” pack rust at base

East arch, column 8, knee brace at floorbeam 15, outside face, typical corrosion



2019 Delamination map