

REDLANDS PASSENGER RAIL PROJECT
Slope Analysis and Photodocumentation
San Bernardino, San Bernardino County, California

July 2012

Table 1. Summary of Existing Conditions of Embankment along Railroad Track

Station Nos	Photo Nos.	Existing Conditions
236+00 to 263+00	1 and 2	Slope face covered with trees, bushes and occasionally rocks
263+00 to 263+70	2 and 3	Concrete drop structure, approximately 11 feet in height
263+70 to 267+00	4	Rocks and boulders on slope face
267+00 to 269+00	5 and 6	Approximately 3 to 4 feet high of retaining structure at bottom of slope with rocks and boulders at bottom of Creek. Minor localized surficial/erosion failure or loss of soils behind retaining structure.
269+00 to 269+80	5 and 6	Tippecanoe Avenue Crossing
269+80 to 281+00	7	Unprotected slope face with gravel and cobbles and occasional rocks and boulders
281+00 to 290+40	8 and 9	Several localized surficial/erosion failures observed during site visit in March, 2011. Exposed slope face included garbage mixed with soils. New fills were already placed over localized failure areas during site visit in October 2011.
290+40 to 291+40	10	Retaining structure at bottom of slope with rocks and boulder at bottom of Creek. Encountered refusal on the south side of existing track at shallow depth due to possibly rocks and boulders.
291+40 to 292+00	10 and 11	Richardson Street Crossing
292+00 to 320+20	12, 13 and 14	Unprotected slope face with occasional rocks, boulders, asphalt concrete and concrete debris. Several localized surficial/erosion failures were observed during site visits. New fills were already placed over localized failure areas during site visit in October 2011. Rocks and boulders were observed at bottom of Creek at several locations.
317+00 to 320+20	15 and 16	Loose concrete debris observed on slope face and exposed steel pipe on slope face. Indication of loose surficial soils
320+20 to 321+00	14	Mountain View Avenue Crossing
321+00 to 323+00	17 and 18	Two concrete panels, possibly part of wing wall for adjacent bridge, were placed on slope face.
323+00 to 343+20	19, 20, 21 and 22	Unprotected slope face with occasional rocks, boulders and concrete debris. Observed signs of new fills placed on access road and slope face along existing railroad track. Several local surficial failure observed
326+00	19	Narrow access road, possibly loose soils due to the drainage outlet to Creek. Local surficial failure observed
343+20 to 347+40	23 and 24	I-10 overcrossing with slope face covered with rock and cement grouting
347+40 to 364+00	25 and 26	Unprotected slope face with occasional rocks and boulders. Observed signs of new fills placed on access road and slope face along existing railroad track.

Table 2. Summary of Slope Stability Analyses

Location	Station No.	Avg. Slope Angle	Approximate Height of Slope (feet)	Calculated Factor of Safety			
				Infinite Slope	Static	Pseudo-Static	Rapid Drawdown
Cross Section A-A'	236+20	2.05H:1V	25	1.3	2.242	1.656	1.217
Cross Section B-B'	252+00	1.45H:1V	20	4.7 ⁽³⁾	2.503	2.304	2.348
Cross Section C-C'	271+00	1.70H:1V	10	0.51	2.637	2.877	3.939
Cross Section D-D'	290+00	1.51H:1V	15	8.3⁽⁴⁾	2.447	2.075	2.472
Cross Section E-E' ^{(1)&(2)}	319+14	1.28H:1V	17	0.83	1.412	1.311	1.055
Cross Section F-F' ⁽²⁾	343+14	1.18H:1V	16	0.96	1.604	1.279	1.050
Cross Section G-G'	355+00	1.42H:1V	10	1.04	1.922	1.725	1.170
Cross Section H-H'	369+00	1.85H:1V	16	0.72	1.558	1.244	1.180

(1): need mitigation to increase safety factor to the code required for Static condition

(2): need mitigation to increase safety factor to the code required for Rapid Drawn Down condition

(3): subsurface soils for upper 5 feet consisted of silt and slope face within this area was covered with vegetations during our site visits.

(4): **subsurface soils for upper 5 feet consisted of silt. Slope face was unprotected in general at this location during our site visits. Soil type at the slope face may be sandy soils and a factor of safety could be less than 1.0 if sandy soils are saturated.**

Preliminary Recommendations

Based on the field observations of the existing embankment and slope stability analyses, existing slope areas between Station Nos approximately 305+00 and 349+00 should be mitigated to provide factor of safety greater than code required. The mitigation measures may be include, but not limited to, flattened existing slopes, slope protection, and/or retaining walls including mechanically stabilized earth walls and soil nail walls.

Also the existing slopes between Station Nos approximately 261+00 and 369+00 should be mitigated to minimize surficial/erosion failures. The artificial debris (garbage mixed with soils) observed within areas between Station Nos approximately 281+00 and 290+40 should be completely removed and replaced with compacted fill. An additional field exploration should be performed to verify our preliminary findings and recommendations within the above-named portion of the alignment.

PHOTO 1



Approx. Station 241, looking east
October 2011

PHOTO 2



Approx. Station 254, looking west
October 2011

PHOTOS 1 AND 2
MISSION ZANJA CREEK
REDLANDS PASSENGER RAIL PROJECT
COUNTY OF SAN BERNARDINO, CALIFORNIA

PROJECT NAME : RPRP
PROJECT NUMBER : 043-170063
DESIGNED/CHECKED BY: TM/TK

HDR



PHOTO 3

sink holes behind concrete

Approx. Station 254, looking southeast
July 2012



PHOTO 4

rocks and boulders

Approx. Station 265, looking southwest
October 2011

PHOTOS 3 AND 4
MISSION ZANJA CREEK
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PHOTOS 5 AND 6
 MISSION ZANJA CREEK
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PHOTO 7



PHOTO 8



PHOTOS 7 AND 8
MISSION ZANJA CREEK
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PHOTOS 9 AND 10
 MISSION ZANJA CREEK
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PHOTOS 11 AND 12
MISSION ZANJA CREEK
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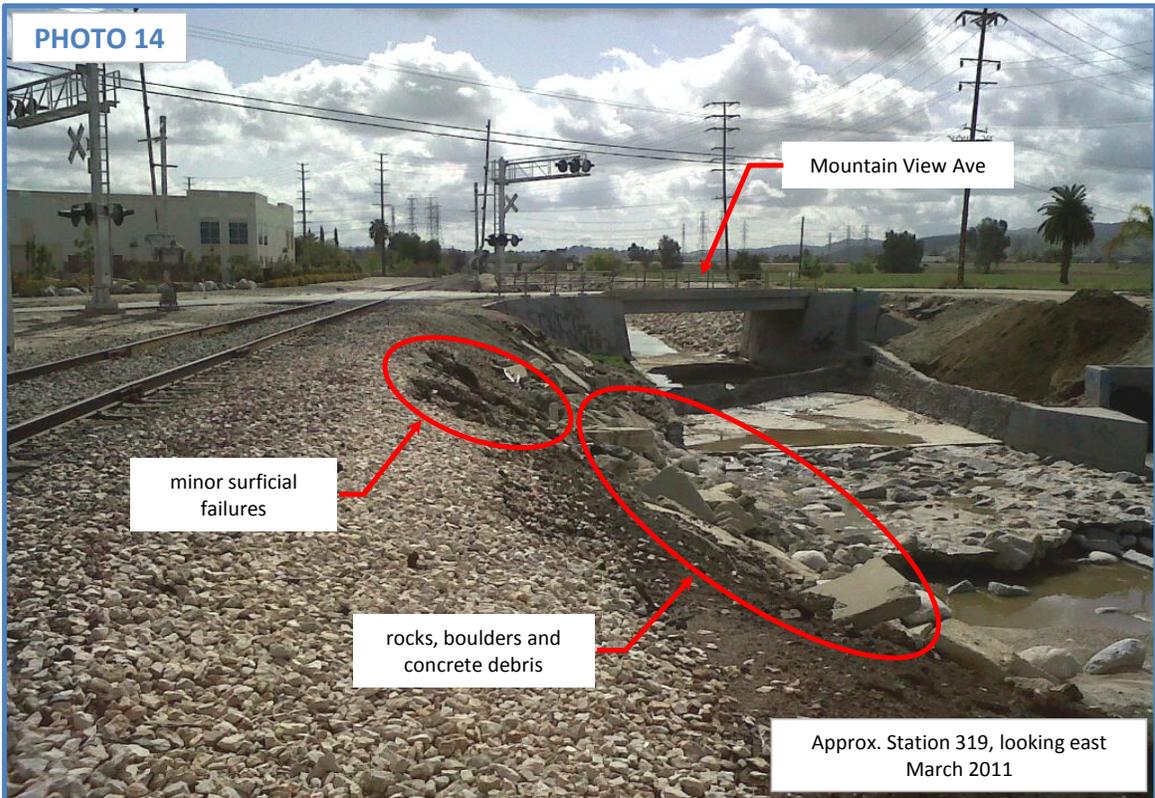


PHOTO 13



Approx. Station 319, looking west
March 2011

PHOTO 14



minor surficial
failures

rocks, boulders and
concrete debris

Mountain View Ave

Approx. Station 319, looking east
March 2011

PHOTOS 13 AND 14
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PHOTOS 15 AND 16
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PHOTOS 17 AND 18
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PHOTOS 19 AND 20
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PHOTO 21



PHOTO 22



PHOTOS 21 AND 22
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PHOTOS 23 AND 24
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PHOTOS 25 AND 26
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