



Memorandum

June 22, 2016

Project: Fortuna Highway 101/Riverwalk Connectivity Study

Subject: **Review of Safety and Design Standards**

Client: Humboldt County Association of Governments Job no.: 11109149

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Introduction / Objective

This memo is intended to provide a brief summary of the existing conditions and identify potential non-standard features for the Highway 101 interchanges at 12th Street and Kenmar Road. Existing facilities were compared against the applicable standards and guidelines for the roadway being analyzed. For example, standards for the Highway 101 on and off ramps and other State owned facilities are based on the Caltrans Highway Design Manual. Local facilities are based on the local agency or Federal guidance or standards (generally whichever are more stringent). Local facilities located within the State right-of-way crossing over or under a freeway or expressway and connecting to the state facility are based on the State's design standards. Below is a list of public standards which are commonly used.

Common Public Design Standards and Guidelines

State of California

Caltrans Highway Design Manual – This manual was developed by the California Department of Transportation (Caltrans) to establish uniform policies and procedures to carry out the State highway design functions of the department. Design standards include items such as roadway geometry, pavement engineering, drainage, bicycle transportation and other miscellaneous design standards.

California Manual on Uniform Traffic Control Devices (CA MUTCD) – This manual provides uniform standards and specifications for all official traffic control devices in California. Design standards include items such as signs, markings, signal and temporary traffic control for vehicular, rail and bicycle facilities. The CA MUTCD is based on Federal Highway Administrations (FHWA) *2009 National Manual on Uniform Traffic Control Devices* with California revisions and amendments.

Federal

AASHTO Geometric Design of Highways and Streets – Similar to the Highway Design Manual, these guidelines are intended to provide roadway design standards with operational efficiency, comfort, safety and convenience of the motorist in mind. Design standards include items such as highway function, design controls and elements of design for various functional classifications of roadways (freeways, arterials, collectors, local roads, etc.).



US Department of Justice's ADA Standards for Accessible Design – These standards are based on the Americans with Disabilities Act of 1990 (ADA) and provide standards to prohibit discrimination and ensure equal opportunity for persons with disabilities. Design elements include standards for accessible routes, general site and building elements (residential and commercial) and recreational facilities.

AASHTO Guide for the Development of Bicycle Facilities – This manual was developed to provide an overview of planning and design considerations, as well as recommendations for operation and maintenance of various types of bicycle facilities.

NACTO Urban Bikeway Design Guide – Similar to the AASHTO Guide for the Development of Bicycle Facilities, this manual was developed to provide guidance for the planning and design of bicycle facilities. This manual however, was developed by cities for cities based on the experience of the best cycling cities in the world.

As discussed later in this memo, there are currently no pedestrian or bicycle facilities in the immediate vicinity of the interchanges, therefore the later three of the manuals identified above were not used when evaluating the existing conditions.

Condition Assessment

A reconnaissance level condition assessment was performed and used to identify fundamental deficiencies as compared to the current design standards. The results presented below are based on a preliminary level characterization to provide background information and guidance for evaluating the existing conditions. For example, the characterization is based on notable qualitative characteristics visually observed and/or measured during a site walk, rather than a detailed investigation or survey of the existing conditions.

The characteristics noted are based on observable features that are relevant to the evaluation of the current layout. The characterization is intended to serve as a planning tool to provide additional information to be considered when recommending improvement alternatives. The primary factors being investigated are items such as horizontal alignment, geometric cross section, design vehicles, clearances, and sight distance.

Results

The results of the condition assessment for each segment of roadway can be found on the following pages.



12th Street and US Highway 101 Interchange

12th Street/Riverwalk Drive

Existing Roadway Characteristics		Design Standards	Meets Standards (√ = yes)	Reference to Standard
Facility Type	Local Facility			
Functional Classification	Minor Arterial / Major Collector			
No. of Lanes	2			
Rural/Urban	Rural			
Bike Facilities (Y/N)	N			
Pedestrian Facilities (Y/N)	N			
Posted Speed/Design Speed (mph)	30/35	45 ¹		HDM Index 101.1
Lane Width (ft)	12	12	√	HDM Index 301.1 / AASHTO
Overcrossing Width (ft)	28	32		HDM Index 308.1
Right Shoulder Width (ft)	Var. 2' - 8' (between NB and SB ramps)	4		HDM Index 302.1 & 308.1 / AASHTO
Curve Radii (ft)	300+/-	425		HDM Index 203.2
Decision Sight Distance (ft)	400 ²	525		HDM Index 201.7
Intersection Spacing (ft)	0' (Between SB ramps and Dinsmore Dr) & 300' (between NB ramps and Newburg Rd)	500		HDM Index 504.3
Horizontal Clearance (ft)	4'+ (w/out curb) & 1.5'+ (w/ curb)	4' (w/out curb) & 1.5' (w/ curb)	√	HDM Index 309.1
Vertical Clearance (ft - in)	15' - 5" ³	16' - 6"		HDM Index 309.2
Stopping Sight Distance (ft)	250+	250	√	HDM Index 201.1
Design Vehicle	Cal Legal - 50 ⁴	Cal Legal - 50		HDM Index 404.4



¹ Design Standard applies to connections to freeways or expressways

² The roadway geometry could probably accommodate the minimum Decision Sight Distance, but some trees might need trimming or be removed.

³ This location is an overcrossing so the vertical clearance shown here is for US Hwy 101.

⁴ A Cal Legal - 50 Truck could probably navigate the turns, but may be required to travel outside the lane slightly and use the gore area or adjacent shoulder.

- Posted Speed/Design Speed – When feasible, the design speed of local facilities connecting to a freeway or expressway should be 45 mph, but shall be a minimum of 35 mph.
- Overcrossing Width – The adjacent sections of roadway approaching the overcrossing are urban in nature and contain 12' travel lanes with 8' shoulders. At the overcrossing, the section narrows to 12' travel lanes, 2' paved shoulders and a concrete curb/vehicular railing which begins at the edge of the shoulder.



- Right Shoulder Width – The shoulder width decreases to only 2' within the overcrossing area and again on the Strongs Creek Bridge (which is located at the southern extents of this segment). All other portions of this segment have shoulders which meet the minimum design standard of 4' wide. The widths vary, but are generally around 8' in width.
- Intersection Spacing –
 - At the southern extent of this segment, Dinsmore Road intersects Riverwalk Drive immediately adjacent to the SB ramps. Due to its proximity and configuration, Dinsmore Road appears more like a 5th leg of the Riverwalk Drive and SB ramp intersection rather than its own. Drivers appear to be confused and have been observed traveling directly from Dinsmore Drive to the SB ramp or northward towards the downtown area.
 - At the northern extent of the segment, the NB on and off ramps are located approximately 300' south of the Newburg Road and 12th Street intersection. The preferred distance between intersections (from curb return to curb return) is 500', but shall be a minimum of 400'.
- Curve Radii - 12th Street is a relatively straight section of road, but contains a few curves near the interchange. The first curve heading south towards Highway 101 is slightly smaller than recommended based on the speed of the roadway through that section.
- Decision Sight Distance - Near the overcrossing, there are a number of large conifers that restrict visibility. The sight distance could be improved and would likely meet the standards if the trees were trimmed or removed.
- Vertical Clearance – Since this is an overcrossing, the vertical clearance described here is for the vehicles on Highway 101.
- Design Vehicle – In all cases, it appears as though a Cal Legal-50 truck could navigate the turns and stay within the paved roadway area; however, due to the tight radii entering and exiting the ramps and turning on and off the side streets (Dinsmore Drive and Newburg Road), large trucks would need to encroach slightly into the oncoming travel lane and or gore area.



Newburg Road

Existing Roadway Characteristics		Design Standards	Meets Standards (√ = yes)	Reference to Standard
Facility Type	Local Facility			
Functional Classification	Major Collector			
No. of Lanes	2			
Rural/Urban	Rural			
Bike Facilities (Y/N)	N			
Pedestrian Facilities (Y/N)	Y (north side only)			
Posted Speed/Design Speed (mph)	25/30	25	√	AASHTO
Lane Width (ft)	12	12	√	HDM Index 301.1 / AASHTO
Right Shoulder Width (ft)	8 / 4	2	√	HDM Index 302.1 & 308.1 / AASHTO
Curve Radii (ft)	300+	300	√	HDM Index 203.2
Decision Sight Distance (ft)	450+	450	√	HDM Index 201.7
Angle of Intersection (Degree)	45	75		HDM Index 403.3
Horizontal Clearance (ft)	3'+/- (in areas w/out curb)	4' (w/out curb) & 1.5' (w/ curb)		HDM Index 309.1
Stopping Sight Distance (ft)	200+	200	√	HDM Index 201.1
Design Vehicle	Cal Legal - 50 ¹	Cal Legal - 50		HDM Index 404.4



¹ A Cal Legal - 50 Truck could probably navigate the turns, but would be required travel outside its lane.

- Angle of Intersection – Newburg Intersects 12th Street at a 45 degree angle. Provided there are no physical constraints, the interior angle should be 90 degrees or as close to 90 degrees as practical, but should not be less than 75 degrees.
- Horizontal Clearance – The southern half of the roadway contains a number of utility poles that are very close to the edge of the travel lane.
- Design Vehicle – Newburg Road intersects 12th Street at an acute angle. Due to the angle and tight radii, large trucks need to encroach into oncoming travel lane to navigate the turns and stay within the existing pavement.



Dinsmore Drive

Existing Roadway Characteristics		Design Standards	Meets Standards (√ = yes)	Reference to Standard
Facility Type	Local Facility			
Functional Classification	Local Road			
No. of Lanes	2			
Rural/Urban	Rural			
Bike Facilities (Y/N)	N			
Pedestrian Facilities (Y/N)	N			
Posted Speed/Design Speed (mph)	25/30	25	√	AASHTO
Lane Width (ft)	12	12	√	HDM Index 301.1 / AASHTO
Right Shoulder Width (ft)	2	2	√	HDM Index 302.1 & 308.1 / AASHTO
Curve Radii (ft)	300+	300	√	HDM Index 203.2
Decision Sight Distance (ft)	450+	450	√	HDM Index 201.7
Horizontal Clearance (ft)	4'+/- ¹	4'	√	HDM Index 309.1
Stopping Sight Distance (ft)	200+	200	√	HDM Index 201.1
Design Vehicle	Cal Legal - 50 ²	Cal Legal - 50		HDM Index 404.4



¹ Power poles are very close to the edge of the pavement.

² A Cal Legal - 50 Truck could probably navigate the turns, but would be required travel outside its lane.

- Design Vehicle – Dinsmore Drive intersects 12th Street as one of the five legs of this intersection. As a result, the intersection is tight and confusing. Due to the tight radius and close proximity of the bridge to the intersection, large trucks heading or coming from the south leg of the intersection are required to swing wide and encroach into oncoming travel lanes.



US Highway 101 Northbound Ramp

Existing Roadway Characteristics		Design Standards	Meets Standards (√ = yes)	Reference to Standard
Facility Type	Freeway / Expressway			
Functional Classification	Freeway / Expressway			
No. of Lanes	1			
Rural/Urban	Rural			
Bike Facilities (Y/N)	N			
Pedestrian Facilities (Y/N)	N			
Posted Speed/Design Speed (mph)	35/40	25/50 ¹		HDM Index 504.3
Lane Width (ft)	12	12	√	HDM Index 301.1
Right Shoulder Width (ft)	8	8	√	HDM Index 302.1 & 308.1 / AASHTO
Curve Radii (ft)	400 / 600	550		HDM Index 203.2
Decision Sight Distance (ft)	425+/-	600		HDM Index 201.7
Horizontal Clearance (ft)	4'+ (w/out curb) & 1.5'+ (w/ curb)	4' (w/out curb) & 1.5' (w/ curb)	√	HDM Index 309.1
Stopping Sight Distance (ft)	300+	300	√	HDM Index 201.1
Design Vehicle	STAA ²	STAA		HDM Index 404.4



¹ Design speed should be 25 mph when traffic is expected to make a turning movement at the terminus and 50 mph when entering, exiting a ramp or when a "through" movement is provided at the terminus.

² An STAA truck could probably navigate the turns, but would be required travel outside its lane.

- Posted Speed/Design Speed – The design speed of ramp can vary depending on the alignment and controls at each end. An acceptable approach is to set 25 mph and 50 mph design speeds for the ramp terminus and exit nose, respectively. The NB off ramp terminates at an intersection where traffic is expected to make a turning movement; therefore, the design speed should be 25 mph nearing this portion of the ramp.
- Curve Radii – The design standard for the minimum curve radius of the northbound on and off ramps are based on the posted speed limit entering the on ramp from Highway 101. The curve radius identified below as not meeting the standard are is located on the northbound on ramp just before entering Highway 101. This particular section of road has no posted speed limit, but traffic entering Highway 101 at this location is accelerating and approaching speeds in excess of 40 mph. If considerations are made for improvements to this interchange, this radius should be increased to meet the current design standards.
- Decision Sight Distance – Similar to the 12th Street overcrossing, there are a number of large



conifers (Redwoods) along the right side of the off ramp that restrict visibility. The sight distance could be improved and would likely meet the standards if the trees were trimmed or removed.

- Design Vehicle – In all cases, it appears as though an STAA truck could navigate the turns and stay within the pavement; however, due to the tight radii entering and exiting the ramps and turning on and off 12th Street, large trucks would need to encroach slightly into the oncoming travel lane or gore area.



US Highway 101 Southbound Ramp

Existing Roadway Characteristics		Design Standards	Meets Standards (√ = yes)	Reference to Standard
Facility Type	Freeway / Expressway			
Functional Classification	Freeway / Expressway			
No. of Lanes	1			
Rural/Urban	Rural			
Bike Facilities (Y/N)	N			
Pedestrian Facilities (Y/N)	N			
Posted Speed/Design Speed (mph)	25/30	25/50 ¹		HDM Index 504.3
Lane Width (ft)	12	12	√	HDM Index 301.1
Right Shoulder Width (ft)	8	8	√	HDM Index 302.1 & 308.1 / AASHTO
Curve Radii (ft)	300 / 650	300	√	HDM Index 203.2
Decision Sight Distance (ft)	450+	450	√	HDM Index 201.7
Horizontal Clearance (ft)	4'+ (w/out curb) & 1.5'+ (w/ curb)	4' (w/out curb) & 1.5' (w/ curb)	√	HDM Index 309.1
Stopping Sight Distance (ft)	200+	200	√	HDM Index 201.1
Design Vehicle	STAA ²	STAA		HDM Index 404.4



¹ Design speed should be 25 mph when traffic is expected to make a turning movement at the terminus and 50 mph when entering, exiting a ramp or when a "through" movement is provided at the terminus.

² An STAA truck could probably navigate the turns, but would be required travel outside its lane.

- Posted Speed/Design Speed - The design speed of ramp can vary depending on the alignment and controls at each end. An acceptable approach is to set 25 mph and 50 mph design speeds for the ramp terminus and exit nose, respectively. The SB off ramp terminates at an intersection where traffic is expected to make a turning movement; therefore, the design speed should be 25 mph nearing this portion of the ramp.
- Design Vehicle – In all cases, it appears as though an STAA truck could navigate the turns and stay within the pavement; however, due to the tight radii entering and exiting the ramps and turning on and off 12th Street or Dinsmore Drive, large trucks would need to encroach slightly into the oncoming travel lanes or gore area.



Kenmar Road and US Highway 101 Interchange

Kenmar Road

Existing Roadway Characteristics		Design Standards	Meets Standards (√ = yes)	Reference to Standard
Facility Type	Local Facility			
Functional Classification	Other Principal Arterial / Major Collector			
No. of Lanes	2			
Rural/Urban	Rural			
Bike Facilities (Y/N)	N			
Pedestrian Facilities (Y/N)	N			
Posted Speed/Design Speed (mph)	35/40	45 ¹		HDM Index 101.1
Lane Width (ft)	12	12	√	HDM Index 301.1 / AASHTO
Right Shoulder Width (ft)	8	4	√	HDM Index 302.1 & 308.1 / AASHTO
Curve Radii (ft)	600 / 75	550		HDM Index 203.2
Decision Sight Distance (ft)	230+/-	600		HDM Index 201.7
Horizontal Clearance (ft)	4'+ (w/out curb) & 1.5'+ (w/ curb) or shielded	4' (w/out curb) & 1.5' (w/ curb)	√	HDM Index 309.1
Vertical Clearance (ft - in)	14' - 10" ²	15		HDM Index 309.2
Stopping Sight Distance (ft)	125+/-	300		HDM Index 201.1
Design Vehicle	Cal Legal - 50 ³	Cal Legal - 50		HDM Index 404.4



¹ Design Standard applies to connections to freeways or expressways

² This location is an undercrossing so the vertical clearance shown here is for Kenmar Rd.

³ A Cal Legal - 50 Truck could probably navigate the turns, but would be required travel outside its lane.

- Posted Speed/Design Speed - When feasible, the design speed of local facilities connecting to a freeway or expressway should be 45 mph, but shall be a minimum of 35 mph.
- Curve Radii – Most of Kenmar is relatively straight, but near the southern portion of the interchange there is a tight radius. The curve radius here is significantly smaller than recommended based on the speed of the roadway through that section.
- Decision Sight Distance – As a result of the tight radius identified above and dense vegetation growing outside of the right of way, visibility is obstructed.
- Vertical Clearance – Kenmar Road is an undercrossing at this location so the vertical clearance described here is for the vehicles on Kenmar Road.
- Stopping Sight Distance – Similar to Decision Sight Distance, the tight radius and dense vegetation obstructs visibility reducing the available stopping sight distance.



- Design Vehicle – In all cases, it appears as though a Cal Legal-50 truck could navigate the turns and stay within the paved roadway area; however, due to the tight radii entering and exiting the ramps and small curve radius identified above, large trucks would need to make wide turns and encroach slightly into the oncoming travel lane or gore area.



Eel River Drive

Roadway Segment: Eel River Dr				
	Existing Roadway Characteristics			
Facility Type	Local Facility			
Functional Classification	Major Collector			
No. of Lanes	2			
Rural/Urban	Rural			
Bike Facilities (Y/N)	N			
Pedestrian Facilities (Y/N)	N			
		Design Standards	Meets Standards (√ = yes)	Reference to Standard
Posted Speed/Design Speed (mph)	30/35	30	√	AASHTO
Lane Width (ft)	11	9	√	HDM Index 301.1 / AASHTO
Right Shoulder Width (ft)	2+	2	√	HDM Index 302.1 & 308.1 / AASHTO
Curve Radii (ft)	85	425		HDM Index 203.2
Decision Sight Distance (ft)	525+	525	√	HDM Index 201.7
Intersection Spacing (ft)	150' (Between NB ramps and Eel River Dr)	500'		HDM Index 504.3
Horizontal Clearance (ft)	4'+/-	4' (w/out curb) & 1.5' (w/ curb)	√	HDM Index 309.1
Stopping Sight Distance (ft)	250+	250	√	HDM Index 201.1
Design Vehicle	Cal Legal - 50 ¹	Cal Legal - 50		HDM Index 404.4



- **Curve Radii** – Most of Eel River Drive is relatively straight, but near its intersection with Kenmar Road there is a tight radius. The curve radius here is significantly smaller than recommended based on the speed of the roadway through that section; however, at this point the road is approaching the STOP sign so speeds would be lower. If considerations are made for improvements to this interchange, the curve radius or approach angle should be evaluated.
- **Intersection Spacing** – The SB on and off ramps are located approximately 150' south of the Eel River Drive and Kenmar Road intersection. The preferred distance between intersections (from curb return to curb return) is 500', but shall be a minimum of 400'.
- **Design Vehicle** – Eel River Drive intersects Kenmar Road at an acute angle. Due to the angle and tight radii, large trucks need to encroach into the oncoming travel lane to navigate the turns and stay within the existing paved roadway.



US Highway 101 Northbound Ramp

Existing Roadway Characteristics		Design Standards	Meets Standards (√ = yes)	Reference to Standard
Facility Type	Freeway / Expressway			
Functional Classification	Freeway / Expressway			
No. of Lanes	1			
Rural/Urban	Rural			
Bike Facilities (Y/N)	N			
Pedestrian Facilities (Y/N)	N			
Posted Speed/Design Speed (mph)	35/40	25/50 ¹		HDM Index 504.3
Lane Width (ft)	12	12	√	HDM Index 301.1
Right Shoulder Width (ft)	8	8	√	HDM Index 302.1 & 308.1 / AASHTO
Curve Radii (ft)	N/A	550	√	HDM Index 203.2
Decision Sight Distance (ft)	600+	600	√	HDM Index 201.7
Horizontal Clearance (ft)	4'+ (w/out curb) & 1.5'+ (w/ curb)	4' (w/out curb) & 1.5' (w/ curb)	√	HDM Index 309.1
Stopping Sight Distance (ft)	300+	300	√	HDM Index 201.1
Design Vehicle	STAA ²	STAA		HDM Index 404.4



Roadway Segment: US Hwy 101 Northbound (On and off ramps)

¹ Design speed should be 25 mph when traffic is expected to make a turning movement at the terminus and 50 mph when entering, exiting a ramp or when a "through" movement is provided at the terminus.

² An STAA truck could probably navigate the turns, but would be required travel outside its lane.

- Posted Speed/Design Speed - The design speed of ramp can vary depending on the alignment and controls at each end. An acceptable approach is to set 25 mph and 50 mph design speeds for the ramp terminus and exit nose, respectively. The NB off ramp terminates at an intersection where traffic is expected to make a turning movement; therefore, the design speed should be 25 mph nearing this portion of the ramp.
- Design Vehicle – In all cases, it appears as though an STAA truck could navigate the turns and stay within the pavement; however, due to the tight radii entering and exiting the ramps and turning on and off Kenmar Road, large trucks would need to encroach slightly into the oncoming travel lane or gore area.



US Highway 101 Southbound Ramp

Existing Roadway Characteristics		Design Standards	Meets Standards (√ = yes)	Reference to Standard
Facility Type	Freeway / Expressway			
Functional Classification	Freeway / Expressway			
No. of Lanes	1			
Rural/Urban	Rural			
Bike Facilities (Y/N)	N			
Pedestrian Facilities (Y/N)	N			
Posted Speed/Design Speed (mph)	35/40 ¹	25/50 ²		HDM Index 504.3
Lane Width (ft)	12	12	√	HDM Index 301.1
Right Shoulder Width (ft)	8	8	√	HDM Index 302.1 & 308.1 / AASHTO
Curve Radii (ft)	N/A	550	√	HDM Index 203.2
Decision Sight Distance (ft)	600+	600	√	HDM Index 201.7
Horizontal Clearance (ft)	4'+ (w/out curb) & 1.5'+ (w/ curb)	4' (w/out curb) & 1.5' (w/ curb)	√	HDM Index 309.1
Stopping Sight Distance (ft)	300+	300	√	HDM Index 201.1
Design Vehicle	STAA ³	STAA		HDM Index 404.4



¹ The southbound on ramp didn't have a speed limit sign, but was assumed to be 35 mph based on the northbound on ramp and ramp geometry.

² Design speed should be 25 mph when traffic is expected to make a turning movement at the terminus and 50 mph when entering, exiting a ramp or when a "through" movement is provided at the terminus.

³ An STAA truck could probably navigate the turns, but would be required travel outside its lane.

- Posted Speed/Design Speed - The design speed of ramp can vary depending on the alignment and controls at each end. An acceptable approach is to set 25 mph and 50 mph design speeds for the ramp terminus and exit nose, respectively. The SB off ramp terminates at an intersection where traffic is expected to make a turning movement; therefore, the design speed should be 25 mph nearing this portion of the ramp.
- Design Vehicle – In all cases, it appears as though an STAA truck could navigate the turns and stay within the pavement; however, due to the tight radii entering and exiting the ramps and turning on and off Kenmar Road, large trucks would need to encroach into the oncoming travel lane or gore area.