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Date 5 May 2008

Memorandum

To: Maya Rohr

CC: Steve Colman

From: David Reinke, Kamala Parks, Debbie Yeuh

Reference #: P 07098

Subject: Traffic Impacts of North Coast Railroad Authority Russian River Division Freight Rail Project – Draft Technical Memo, Revision 2c

1 Introduction

This memo presents the results of the traffic impact analysis for the North Coast Railroad Authority Russian River Division Freight Rail Project. Section 2 discusses the approach and assumptions for the analysis. The traffic impact analysis includes the following key impact areas:

- Vehicle delay (section 4)
- Queuing at nearby traffic signals (section 5)
- Emergency services (section 6)
- Truck traffic (section 7)

Section 2 describes the project setting, and section 3 discusses the study approach and assumptions.

2 Setting

2.1 Streets and Highways

The proposed North Coast Railroad Authority Russian River Division Freight Rail service would run from Lombard (Napa Junction) just southwest of Napa to Willits. There are 99 public at-grade crossings, which are listed in Appendix A.

The main corridor along the rail line is U.S. 101, which parallels the NCRA rail line from Novato to Willits. U.S. 101 is freeway for most of the length that parallels the NCRA rail line. Significant non-freeway sections are:

- The 8.5 mile section between Novato and Petaluma (the Narrows) is a four-lane expressway with uncontrolled access.
- A two-lane section from about 1-mile south of Hopland to south of Ukiah.

The Narrows section is a significant bottleneck to northbound and southbound traffic during peak hours. Other bottlenecks on sections parallel to the NCRA rail line occur in Petaluma, Rohnert Park, and Santa Rosa.

The following table shows average annual daily traffic (AADT) and daily truck volumes at several points along the U.S. 101 corridor parallel to the NCRA rail line.

Table 1. Average Annual Daily Traffic and Truck Volumes on U.S. 101, 2005

County	Postmile	Location	AADT		
			Total	Truck	% truck
Marin	19.085	Novato, Jct. Rte. 37 East	128,000	5,658	4.4%
Sonoma	2.925	South Petaluma Blvd	80,000	5,096	6.4%
Sonoma	3.664	Petaluma, South Jct. Rte. 116 East	91,000	4,550	5.0%
Sonoma	7.651	Petaluma, Old Redwood Highway	102,000	5,722	5.6%
Sonoma	12.682	Cotati, North Jct. Rte. 116	100,000	5,710	5.7%
Sonoma	19.646	Santa Rosa, Jct. Rte. 12	106,000	6,360	6.0%
Sonoma	20.74	Santa Rosa, College Avenue	114,000	5,928	5.2%
Sonoma	27.618	Shiloh Road South Healdsburg	67,000	3,973	5.9%
Sonoma	R43.373	Jct. Rte. 128 East Jct. Rte. 128 West	25,000	2,163	8.7%
Sonoma	R54.201	Jct. Rte. 128 West Hopland, Jct. Rte. 175	14,600	1,396	9.6%
Mendocino	10.89	Hopland, Jct. Rte. 175 East	14,600	1,256	8.6%
Mendocino	R21.59	Jct. Rte. 253 West Ukiah Jct 222 East	17,500	2,478	14.2%
Mendocino	R23.45	Ukiah Jct 222 East Jct. Rte. 20 East	19,900	2,374	11.9%

Source: Caltrans, Traffic and Vehicle Data Systems. 2005 Annual Average Daily Truck Traffic on the California State Highway System. November 2006.

2.2 Relationship to Other Transportation Plans and Programs

Several transportation plans and programs relate to NCRA service and the public at-grade crossings.

- The proposed SMART passenger rail service would run along the same track as NCRA service from Ignacio (SR 37) to Cloverdale. SMART would be responsible for all rail dispatching along this section of the line. Because of buffering separation requirements between passenger and freight trains, it is unlikely that freight service could operate along this section during peak-period SMART operation.

- The proposed SMART project would include a pedestrian/bicycle trail paralleling the tracks from Cloverdale to Larkspur.

- The Sonoma County Draft General Plan 2020 calls for upgrading SR 37 to a four-lane freeway; there is currently no funding for this project. This project would eliminate the at-grade crossing at SR 37 immediately east of SR 121 (crossing no. 6 in the table in Appendix A.)

- Golf Course Dr. is currently undergoing a Project Study Report to study extending Golf Course Dr. under the freeway to connect with Wilfred Ave. (crossing no. 34 in the table in Appendix A).

- The City of Santa Rosa plans to widen Hearn Ave. to 4 lanes near the at-grade crossing (crossing no. 39 in the table in Appendix A).

- The Sonoma County Draft General Plan 2020 calls for widening Fulton Rd. (crossing no. 52 in the table in Appendix A) to four lanes.

- The Sonoma County Draft General Plan 2020 specifies Airport Blvd. as a 4-lane arterial in the future (crossing no. 54 in the table in Appendix A).

2.3 Other Agencies and Jurisdictional Authority

The state, regional, and local agencies responsible for the area through which the proposed NCRA service would run are listed in Table 2

Table 2. Other agencies and jurisdictional authority

Agency	**Jurisdiction**
Marin County	
City of Novato Public Works Department	Streets & roads in City of Novato
County of Marin: Public Works	Streets & roads in unincorporated Marin Co.
Transportation Authority of Marin	Transportation planning agency for Marin Co.
Mendocino County	
City of Ukiah Public Works Department	Streets & roads in City of Ukiah
City of Willits Public Works Department	Streets & roads in City of Willits
Mendocino Council of Governments	Planning agency for Mendocino Co.
Mendocino County Department of Transportation	Streets & roads in unincorporated Mendocino Co.
Napa County	
Napa County Transportation Planning Agency	Transportation planning agency for Napa Co.
Napa County Department of Public Works	Streets & roads in City of Napa
Sonoma County	
City of Cloverdale Public Works Department	Streets & roads in City of Cloverdale
City of Cotati Public Works	Streets & roads in City of Cotati
City of Healdsburg Public Works Department	Streets & roads in City of Healdsburg
City of Petaluma Public Works Department	Streets & roads in City of Petaluma
City of Rohnert Park Public Works Department	Streets & roads in City of Rohnert Park
City of Santa Rosa Public Works Department	Streets & roads in City of Santa Rosa
Sonoma County Department of Transportation and Public Works	Streets & roads in unincorporated Sonoma Co.
Sonoma County Transportation Authority	Transportation planning agency for Sonoma Co.
Town of Windsor Public Works Department	Streets & roads in Town of Windsor
San Francisco Bay Area	
Metropolitan Transportation Commission	Regional transportation planning and funding agency for nine-county San Francisco Bay Area
State of California	
California Department of Transportation, District 01	State highways and transportation in Del Norte, Humboldt, Lake, and Mendocino counties.
California Department of Transportation, District 04	State highways and transportation in nine-county San Francisco Bay Area

3 Study Approach and Assumptions

3.1 Selection of Key Grade Crossings

The North Coast Railroad Authority Russian River Division Freight Rail Project would operate trains between Lombard (Napa Junction.) to Willits. There are 99 public at-grade crossings on this line, which are listed in the appendix.

Detailed delay analysis was carried out for the 25 grade crossings with the greatest traffic volumes. These are shown in Table 3 below.

Table 3. Key grade crossings

No.	Location	
4	Sonoma Co.	SR 12/121 - Carneros Hwy.
6	Sonoma Co.	SR 37 Sears Point Rd. E of Arnold Dr. (SR 121)
19	Petaluma	D St. west of Lakeville St.
20	Petaluma	Washington St. west of Lakeville St.
30	Cotati	E Cotati Av. east of Industrial Av.
31	Rohnert Park	Southwest Bl. east of Brenda Wy.
33	Rohnert Park	Rohnert Park Expwy.
34	Rohnert Park	Golf Course Dr. east of US-101 interchange
36	Sonoma Co.	Todd Rd. west of US-101 interchange
39	Santa Rosa	Hearn Ave. west of Dowd Dr.
42	Santa Rosa	3rd St. west of Wilson St.
46	Santa Rosa	9th St. west of Wilson
47	Santa Rosa	College Ave. west of Cleveland Ave.
48	Santa Rosa	Guerneville Rd. east of N Dutton Ave.
49	Santa Rosa	W Steele Ln. west of Coffey Ln.
50	Santa Rosa	Piner Rd. east of Plum Tree Ln.
52	Sonoma Co.	Fulton Rd. south of D St.
53	Sonoma Co.	River Rd. east of Hart Ln.
54	Sonoma Co.	Airport Blvd. west of US-101 interchange
55	Sonoma Co.	Aviation Blvd east of Concourse Bl.
56	Windsor	Shiloh Rd. west of Conde Ln.
64	Healdsburg	Healdsburg Av. at Vine St & Mill St
68	Healdsburg	Dry Creek Rd. east of Grove St.
84	Ukiah	Talmage Rd. west of US-101 interchange
86	Ukiah	E Perkins St. at Clay St.

3.2 Traffic Volumes at Key Grade Crossings

As discussed below, traffic volume is a key determinant of the possibility that a queue from an intersection downstream of an at-grade crossing could back up across the railroad tracks. For this analysis, the worst-case traffic volume was used: i.e., the peak 15-minute volume at each grade crossing. Traffic volumes for the opening year (2009) and cumulative impact year (2033) were estimated for each grade crossing as follows:

- Obtain the most recent available traffic count data from the site.
- Get the peak 15-minute volume from the traffic counts. If the peak 15-minute volume is not directly available from the counts, take the peak hour count

and apply an appropriate peak-hour factor (PHF) to the peak-hour count to get an estimate of the peak 15-minute traffic volume.[1]

- Compute an annual growth factor using base-year and future-year runs from a regional travel forecasting model. If the road segment at a particular grade crossing is not included in the travel model, compute a growth rate from a nearby parallel road segment.

- Apply the annual growth factor to the estimated peak 15-minute volume from the most recent traffic count to get the estimate traffic for 2009 and 2033.

3.3 Lane Configurations at Key Grade Crossings

Lane configuration is also a key determinant of vehicle delay and queuing from nearby traffic signals. For this analysis, the number of lanes at each crossing was determined by site inspection. Future lane configurations were taken from the general plan of the appropriate jurisdiction.

3.4 Vehicle Delay Analysis Calculations

The weight and braking characteristics of freight trains require that they be given priority over vehicular traffic (autos, trucks, pedestrians, bicyclists, etc.) at at-grade crossings. California generally follows federal regulations for traffic controls at highway-rail grade crossings included in the federal Manual on Uniform Traffic Control Devices (MUTCD).[2] The amount of delay to cross-street vehicles – the effective blockage time – is the sum of both fixed and variable components.

Fixed components: This time is occasioned regardless of the length or speed of the train crossing the intersection. When a train is detected, lights will begin to flash at the crossing at least 20 seconds prior to the arrival of the train. At a crossing with automatic gates, which includes all or nearly all public streets, the automatic gate arms must be in their horizontal (full down) position at least five seconds before the arrival of the train. When the train completes passage across the intersection, there is a further brief delay as the gates rise to their vertical position, and drivers react to the clearance to proceed; this is typically on the order of five to eight seconds. The total gate down time would be about 25 seconds plus the train passage time. But vehicles do not stop immediately upon the flashing of lights and ringing of bells. We

[1] The PHF is the ratio of the peak-hour volume to the peak 15-minute flow rate (in vehicles per hour) during that peak hour. The higher the PHF, the more uniform the traffic flow over the peak hour. Peak-hour factors for most roads range from 0.75 to 0.95, although higher values are possible for high-volume facilities.

[2] California Department of Transportation. California Manual on Uniform Traffic Control Devices, September 26, 2006. Available at: http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd.htm

therefore estimate the overall fixed delay to be 22 seconds per crossing to account for this. The 22 second fixed delay accounts for gate closure time plus time needed for traffic to start up once the gates open.

Older equipment used to be set to activate grade crossing warning devices (such as bells, lights, and gates) based on the fastest train to use the crossing. This would mean that more than 20 seconds advance warning would be given for slower trains. Modern train detection equipment can determine the speeds of the approaching train and adjust the warning time appropriately, so that a fixed-warning time is provided. When trains of differing speeds (e.g., freight and passenger) share the same track, this can significantly reduce delays. Because NCRA has indicated it would use constant warning time (CWT) track circuits to minimize delays at grade crossings, that was assumed in the analysis.

CWT track circuits not only monitor train movement toward the crossing, but also use train position and speed information to develop a relatively constant warning time. In essence, they predict when the train will arrive at the crossing, allowing the system to provide a relatively uniform warning time for trains approaching the crossing at any speed up to the design speed. The advantage of CWT track circuits is that when trains operate at widely varying speeds—as they would on the shared SMART/NCRA track—the circuitry will compensate for different speeds of trains. Conventional track circuits set the warning time based on the fastest train speed allowable: 79 mph, in the case of SMART. The problem with the conventional approach is that when slower trains (e.g., at 40 mph) approach a crossing, they will trigger the gates at the same location as a faster (e.g., 79 mph) train, which results in a doubling of the advance warning time. CWT allows gates to go up when a train is stopped (e.g., at a station) but with the "detection zone" of the grade crossing.

For cumulative impacts, it was assumed that no freight trains would block a public street while stopping for a SMART train to pass.

Variable component: Some delay time varies depending on the length of the train (e.g., how many cars there are), the speed of the train, and the width of the intersection. Clearly, shorter trains operating at higher speeds occupy a crossing for less time than longer, slower trains. The variable blockage time is simply the length of train divided by its speed, plus the time taken for the end of the last rail car to clear the intersection. This time is added to the fixed component noted above to get the total blockage time (t_b).

The average delay per vehicle that has to stop for a train for a single approach is given by the following formula:

$$t_{avg} = \frac{1}{2} t_b$$

Where t_{avg} is the total delay and t_b is the blockage time for the crossing (in seconds).

The variable blockage time is a function of the length of the train and its speed. For this analysis, the train speeds shown in the table in Appendix A were assumed. Train operations assumed for this analysis are shown in Table 4. In accordance with the assumptions used for the air quality analysis, these operations were assumed for both the opening year (2009) and the cumulative impact year (2033) of service.

Table 4. Summary of train operations

	Train 1 (Continuation of Train 2 w/fewer cars)	Train 2	Train 3	Train 4
Termini	Redwood Valley — Willits	Lombard — Redwood Valley	Lombard — Willits	Lombard — Santa Rosa
Train crossings per day+	2	2	2	2
Max cars per train	10	25	60	60
Length per car (ft)	67.6	67.6	67.6	67.6
No. engines	1	1	2	2
Engine length (ft)	62.5	62.5	62.5	62.5
Train length (ft)	738	1,752	4,180	4,180

+ Assumes each train makes one crossing in each direction per day.

For the crossings at SR 12/121 (Carneros Hwy.) at Schellville, a special procedure was used to estimate train crossing time. At Schellville, the track crosses the highway from the southeast, makes a loop north of the highway, and crosses the highway again about 1,450 feet west of the first crossing. The total loop length is about 2,100 feet, or less than the lengths of trains 3 and 4 shown in the table above. These two crossings were treated as one. Total train crossing time was assumed to be from when the train encountered the first crossing to the time when it cleared the second crossing.

At most of the key grade crossings there will be six train crossings per day. The average delay per stopped vehicle at the key grade crossingss is less than one minute.

3.5 Traffic Signal Preemption

Where a traffic signal is located near an at-grade crossing, there is a possibility that the queue extending backward from the signal may extend over the track. In such a situation, the recommended practice of the Institute of Transportation Engineers is as follows:[1]

> "… the railroad signal equipment and the traffic signal control equipment should be interconnected, and the normal operation of the traffic signals controlling the intersection should be preempted to operate in a special control mode when trains are approaching."

Signal preemption allows the queue at the traffic signal to clear so that vehicles are not left standing on the tracks.

For this analysis, we calculated the 95th percentile queue lengths based on the maximum 15-minute traffic volumes at each at-grade crossing, the number of lanes of traffic, and the amount effective red time at the traffic signal. The 95th percentile queue lengths are those queue lengths that will not be exceeded at least 95% of the time. Details of 95th percentile queue length calculations are presented in Appendix B.

3.6 Emergency Services

Traffic blockage due to train crossings could interfere with movement of emergency vehicles. Emergency services were located by contacting the various jurisdictions through which NCRA service would operate.

3.7 Impacts on Truck Traffic

Impacts on truck traffic were estimated by calculating the truckload equivalents hauled by each train. It was assumed that each train and each truck would be empty on the backhaul; accordingly, the number of truckloads removed from the highway was estimated to be equivalent to the capacity of each train movement.

4 Vehicle Delay

4.1 Opening Year

Impact T-1: The operation of freight trains would increase delays to motor vehicles, pedestrians, and cyclists at the 25 key grade crossings. (Less than significant)

None of the local agencies has significance criteria that deal specifically with impacts due to rail services. Hence, there can be no finding of a significant impact.

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[1] Institute of Transportation Engineers. Preemption of Traffic Signals Near Railroad Grade Crossings, An ITE Recommended Practice. Washington, DC: ITE, 2006

Instead, impacts have been identified and quantified where possible, but no finding of significant impact is made.

Estimated average delay per stopped vehicle for 2009 peak traffic volumes is shown in Table 5. Delay is expressed in seconds per vehicle. Because delays are dependent on train length, the minimum, maximum, and daily average are presented.

It should be noted that these are average delays only for vehicles that have to stop for a train crossing. The majority of vehicles on each facility will not encounter a train crossing, and will therefore not be delayed.

Table 5. Estimated delay per stopped vehicle at key grade crossings, 2009 – with project

Grade crossing		Delay per veh (sec)		
City/County	**Location**	*Min*	*Max*	*Avg*
Sonoma Co.	SR 12/121 (Carneros Hwy) at E 8th St (Schellville Rd) (2 crossings)	99	154	136
Sonoma Co.	Sears Point Rd. (SR 37) near Arnold Dr.	28	52	44
Petaluma	D St. west of Lakeville St.	35	68	57
Petaluma	Washington St. west of Lakeville St.	35	68	57
Rohnert Park	E Cotati Ave east of Industrial Ave.	35	68	57
Rohnert Park	Southwest Blvd. east of Brenda Wy.	35	68	57
Rohnert Park	Rohnert Park Expwy.	26	47	40
Rohnert Park	Golf Course Dr. east of US-101 interchange	26	47	40
Santa Rosa	Todd Rd. west of US-101 interchange	26	47	40
Santa Rosa	Hearn Ave. west of Dowd Dr.	26	47	40
Santa Rosa	3rd St. west of Wilson St.	35	68	57
Santa Rosa	9th St. west of Wilson	35	68	51
Santa Rosa	College Ave. west of Cleveland Ave.	35	68	51
Santa Rosa	Guerneville Rd. east of N Dutton Ave.	26	47	36
Santa Rosa	W Steele Ln. west of Coffey Ln.	26	47	36
Santa Rosa	Piner Rd. east of Plum Tree Ln.	26	47	36
Fulton	Fulton Rd. south of D St.	26	47	36
Fulton	River Rd. east of Hart Ln.	26	47	36
Windsor	Airport Blvd. west of US-101 interchange (east of Regional Pkwy)	26	47	36
Windsor	Aviation Blvd east of Concourse Blvd.	26	47	36
Windsor	Shiloh Rd. west of Conde Ln.	26	47	36
Healdsburg	Healdsburg Ave at Vine St & Mill St	35	68	51
Healdsburg	Dry Creek Rd. east of Grove St.	26	47	36
Ukiah	Talmage Rd. west of US-101 interchange	35	68	51
Ukiah	E Perkins St. at Clay St.	35	68	51

4.2 Cumulative Impacts

Cumulative impact scenario #1: Future year NCRA operation, no SMART operation.

Cumulative Impact T-2: The operation of freight trains in combination with increased traffic would increase delays to motor vehicles, pedestrians, and cyclists at the 25 key grade crossings. (Less than significant)

Estimated average delay per stopped vehicle for projected 2033 peak traffic volumes is shown in Table 6.

Table 6. Estimated delay per stopped vehicle at key grade crossings, 2033 – with project

Grade crossing		**Delay per veh (sec)**		
City/County	**Location**	*Min*	*Max*	*Avg*
Sonoma Co.	SR 12/121 (Carneros Hwy) at E 8th St (Schellville Rd) (2 crossings)	99	154	136
Sonoma Co.	Sears Point Rd. (SR 37) near Arnold Dr.*	N/A	N/A	N/A
Petaluma	D St. west of Lakeville St.	35	68	57
Petaluma	Washington St. west of Lakeville St.	35	68	57
Rohnert Park	E Cotati Ave east of Industrial Ave.	35	68	57
Rohnert Park	Southwest Blvd. east of Brenda Wy.	35	68	57
Rohnert Park	Rohnert Park Expwy.	26	47	40
Rohnert Park	Golf Course Dr. east of US-101 interchange	26	47	40
Santa Rosa	Todd Rd. west of US-101 interchange	26	47	40
Santa Rosa	Hearn Ave. west of Dowd Dr.	26	47	40
Santa Rosa	3rd St. west of Wilson St.	35	68	57
Santa Rosa	9th St. west of Wilson	35	68	51
Santa Rosa	College Ave. west of Cleveland Ave.	35	68	51
Santa Rosa	Guerneville Rd. east of N Dutton Ave.	26	47	36
Santa Rosa	W Steele Ln. west of Coffey Ln.	26	47	36
Santa Rosa	Piner Rd. east of Plum Tree Ln.	26	47	36
Fulton	Fulton Rd. south of D St.	26	47	36
Fulton	River Rd. east of Hart Ln.	26	47	36
Windsor	Airport Blvd. west of US-101 interchange (east of Regional Pkwy)	26	47	36
Windsor	Aviation Blvd east of Concourse Blvd.	26	47	36
Windsor	Shiloh Rd. west of Conde Ln.	26	47	36
Healdsburg	Healdsburg Ave at Vine St & Mill St	35	68	51
Healdsburg	Dry Creek Rd. east of Grove St.	26	47	36
Ukiah	Talmage Rd. west of US-101 interchange	35	68	51
Ukiah	E Perkins St. at Clay St.	35	68	51

*The Sonoma County Draft General Plan 2020 shows SR 37 as a 4-lane freeway in the future.

Cumulative Impact Scenario #2: Future year NCRA operation, SMART operation from Cloverdale to Larkspur.

Cumulative Impact T-3: Operation of SMART passenger train service would prevent NCRA trains from operating during the peak periods (0600 – 1000 and 1500 – 1900). NCRA trains would operate during non-peak traffic periods, reducing delays to traffic caused by NCRA operations. (Beneficial)

SMART service would operate primarily during the peak periods and would have priority on the SMART section of the NCRA line. Because of this and requirements on separation between freight and passenger trains, it is unlikely that NCRA freight trains would be able operate during the peak periods. This would reduce the delays directly attributable to NCRA freight service.

5 Queuing from Nearby Traffic Signals

5.1 Opening Year

Impact T-4. Traffic queue lengths at the intersections shown in Table 5 could exceed the available storage area in the opening year of NCRA freight operations, causing traffic to back up across the at-grade crossing upstream from the traffic signal.[1] (Less than significant with mitigation)

[1] The term “storage area” refers to the roadway space available for vehicles to wait to cross an intersection when the traffic signal is red. For this analysis, the storage area is the total lane length of roadway between the traffic signal and the rail grade crossing. For example, if the distance from the grade crossing to the traffic signal is 250 feet, and the average vehicle takes up about 25 feet of length (including spacing between vehicles), then one lane can “store” 10 vehicles that are waiting to cross the intersection.

Table 7. Study intersections where traffic queue may exceed storage area, 2009

Grade crossing		Intersection
City/County	Location	
Sonoma Co.	Sears Point Rd. (SR 37) near Arnold Dr. (SR-121)	Sears Point Rd. & Arnold Dr.
Rohnert Park	Southwest Bl. east of Brenda Wy.	Southwest Bl. & Seed Farm Dr.
Rohnert Park	Golf Course Dr. east of US-101 interchange	Golf Course Dr. & Roberts Lake Rd.
		Golf Course Dr. & Commerce Bl.
Santa Rosa	Hearn Av. west of Dowd Dr.	Hearn Av. & Dowd Dr.
Santa Rosa	3rd St. west of Wilson St.	3rd St. & Wilson St.
Santa Rosa	College Av. west of Cleveland Av.	College Av. & Cleveland Av.
		College Av. & N Dutton Av.
Santa Rosa	Guerneville Rd. east of N Dutton Av.	Guerneville Rd. & Coffey Ln.
		Guerneville Rd. & N Dutton Av.
Santa Rosa	W Steele Ln. west of Coffey Ln.	W Steele Ln. & Coffey Ln.
Sonoma Co.	River Rd. east of Hart Ln.	River Rd. & Fulton Rd.
Windsor	Shiloh Rd. west of Conde Ln.	Shiloh Rd. & Conde Ln.*
Ukiah	E Perkins St. at Clay St.	E Perkins St. & Hospital Dr.

* See text

Mitigation T-4: In cooperation with local jurisdictions, install interconnects between traffic signals and train crossing signals to preempt normal signal operations and allow queues to clear before the train crosses.

NCRA is currently working with the City of Windsor to establish an interconnect for the new traffic signal at Shiloh Rd. and Conde Ln, and with Caltrans to establish an interconnect at Sears Point Road (SR 37). Traffic signals at the other intersections listed above should also be interconnected with train crossing signals.

It should be noted that Caltrans and the City of Rohnert Park are currently studying extending Golf Course Dr. so that it crosses under the freeway. The study is currently undergoing a Project Study Report (PSR). It is recommended that NCRA coordinate with Caltrans and the City of Rohnert Park to take into account any planned changes on Golf Course Dr. near this crossing.

5.2 Cumulative Impacts

Cumulative impact scenarios #1 and #2: Future year with or without SMART operations.

Cumulative Impact T-5. Traffic queue lengths at the intersections shown in Table 6 could exceed the available storage area in future year NCRA freight operations, causing traffic to back up across the at-grade crossing upstream from the traffic signal. (Less than significant with mitigation)

In addition to the intersections listed in Table 7, traffic at the intersections listed in Table 8 could exceed the available storage area in future year NCRA freight operations.Table 7

Table 8. Additional intersections where traffic queue may exceed storage area, 2033

Grade Crossing		Intersection
City	**Location**	
Santa Rosa	Hearn Av. west of Dowd Dr.	Hearn Av. & Dutton Av.
Santa Rosa	Piner Rd. east of Plum Tree Ln.	Piner Rd. & Coffey Ln.
Healdsburg	Dry Creek Rd. east of Grove St.	Dry Creek Rd. & Grove St.

Mitigation T-5: Conduct engineering studies to monitor and analyze peak approach traffic volumes at these intersections every three years and calculate 95th percentile queue lengths. If the 95th percentile queue lengths approach the storage length, work with local jurisdictions and SMART to install interconnects between traffic signals and train crossing signals to preempt normal signal operations and allow queues to clear before the train crosses.

6 Emergency Services

Potential effects for emergency vehicles delays were also evaluated. NCRA would operate a maximum of 6 trains per day;but not all of those trains would run the full distance from Lombard to Willits. The maximum number of trains passing any given location is 6 between Lombard and Santa Rosa. The potential for delay would only apply to those emergency vehicles that needed to cross over the rail corridor and were not using a grade-separated crossing.

A number of emergency services facilities including hospitals, police and sheriff's departments, and fire stations are located within one mile from grade crossings. A list of the facilities is provided in Table 9.

Table 9. Emergency services within one mile of the NCRA line

City/County	Facility	Address	ZIP Code
Novato	Novato Fire District Station	7025 Redwood Blvd	94945
Novato	Novato Police Department	909 Machin Ave	94945
Sonoma	Schell Vista Fire Station	22950 Broadway	95476
Penngrove	Rancho Adobe Fire Station	11000 Main St	94951
Geyserville	Geyserville Fire Station	20975 Geyserville Ave	95441
Petaluma	Petaluma Police Department	969 Petaluma Blvd N	94952
Petaluma	Petaluma Fire Station	198 D Street	94952
Petaluma	Petaluma Fire Station	1001 N McDowell Blvd	94954
Sonoma Co.	Lakeville Volunteer Fire Station	8555 Lakeville HWY	94954
Rohnert Park	Rohnert Park Police Department	500 City Hall Dr	94928
Rohnert Park	Rohnert Park Fire Station	500 City Hall Dr	94928
Rohnert Park	Rohnert Park Fire Station	435 Southwest Blvd	94928
Rohnert Park	Rohnert Park Fire Station	1316 E Cotati Ave	94928
Rohnert Park	Rohnert Park Fire Station	5200 Country Club Dr	94928
Santa Rosa	Santa Rosa Fire Station	3311 Coffey Ln	95403
Santa Rosa	Santa Rosa Fire Station	830 Burbank Ave	95407
Santa Rosa	Sonoma County Department of Emergency Services	2300 County Center Drive	95403
Windsor	Windsor Fire District	8200 Old Redwood Hwy	95492
Windsor	Windsor Police Department	9291 Old Redwood Hwy	95492
Healdsburg	Healdsburg Police Department	238 Center St	95448
Healdsburg	Healdsburg Fire Department	601 Healdsburg Ave	95448
Healdsburg	Healdsburg District Hospital	1375 University St	95448
Cloverdale	Cloverdale Fire Protection District	116 Broad St	95425
Ukiah	Ukiah General Hospital	1120 S Dora St	94582
Ukiah	Ukiah Valley Fire District	1500 S State St	94582
Ukiah	Ukiah Police Department	300 Seminary Ave	94582
Ukiah	Ukiah Fire Department	301 Seminary Ave	94583
Ukiah	California Highway Patrol	540 S Orchard Ave	95482
Ukiah	Ukiah Valley Medical Center	275 Hospital Dr	95482
Ukiah	Mendocino Sheriff Department	951 Low Gap Rd	95482
Willits	Howard Frank R Memorial Hospital	1 Madrone St	95490
Willits	Little Lake Fire Protection District	74 E Commercial St	95490
Willits	Willits Police Department	125 E Commercial St	95490
Willits	Mendoino County Sheriff Department	125 E Commercial St	95491

In response to concerns about the implications of potential emergency vehicle delays at grade-crossings for the SMART project, SMART interviewed operations professionals with other agencies in the Bay Area that provide passenger/commuter or freight rail service. Persons contacted included: Robert Doty, Director of Rail Transportation at Caltrain, Brian Schmidt, Director of Rail Services at Altamont Commuter Express (ACE), David Kutrosky, Deputy Director of Finance and Planning with the Capitol Corridor, and Bill Capps, Service Planning Manager with the Valley Transportation Authority (VTA). (Note: While VTA does not operate commuter rail service, it does operate light rail service on freight tracks on its Vasona line. This service involves signals and gates at grade crossings.)

All four agency representatives stated that emergency vehicle delays created by passenger rail service had not presented significant issues or problems in the jurisdictions through which they operate. All four also confirmed that there is currently no mechanism that would allow trains to yield to emergency vehicles at grade crossings.

These agency representatives, however, did suggest that a key step to minimize the possibility of delay due to passenger train service was to ensure, through station design, that trains "fit" and do not block existing streets when they dwell at stations. For freight service it is assumed that trains would not be stopping at sidings that block crossing streets.

With respect to emergency vehicles dispatched from fire stations, the larger cities along the North Coast Rail corridor right-of-way, including San Rafael, Novato, Petaluma, Rohnert Park, and Santa Rosa, all have multiple (ranging from three to eight) fire stations with at least one on each side of the railroad tracks. This distributed approach to fire service coverage, and in some cases paramedic services as well, minimizes the probability of these emergency responders needing to cross tracks and potentially encountering a grade-crossing delay.

A reasonable mitigation measure to provide for emergency contingencies is to provide a means for emergency services to contact train dispatchers to request holding a train in the event that there is an emergency and emergency vehicles need to cross the train track. At the start of NCRA operation, NCRA would be responsible for train dispatching along the entire line. If SMART service is implemented, SMART would control all dispatching along the SMART portion of the rail line.

Impact T-6: Road blockages due to NCRA freight operations could interfere with movement of emergency service vehicles near the rail line. (Less than significant with mitigation)

Mitigation T-6: The emergency services operations that would be affected by the proposed project should be provided with an emergency hotline to the North Coast Rail dispatcher so that trains can be stopped or held back in the event of an emergency.

Cumulative Impact Scenario #2: Future year, SMART operation.

Cumulative Impact T-7: Road blockages due to both SMART and NCRA freight operations could interfere with movement of emergency service vehicles near the rail line. (Less than significant with mitigation)

Mitigation T-7: The emergency services operations that would be affected by the proposed project should be provided with an emergency hotline to the appropriate dispatchers (NCRA and SMART) so that trains can be stopped or held back in the event of an emergency.

7 Truck Traffic

Impact T-8: NCRA freight service would carry freight that would have otherwise been carried by trucks, reducing the number of trucks that would otherwise use the highway and reducing traffic congestion due to trucks. (Beneficial)

Future freight operations would have a beneficial impact by diverting freight that would otherwise travel by truck to freight trains. This impact would depend on the types of goods carried and whether they were formerly carried by trucks or not. This impact would favor the goal of reducing traffic congestion on Highway 101 on both weekdays and weekends. Because freight cars are larger (more volume) than a typical truck and can carry greater weight and bulk than are normally allowed on a highway, each full freight car diverted from the highway has the potential for eliminating up to four truck trips. For solid waste trains, one railcar is equivalent to one truck movement, since NCRA anticipates placing each truck trailer on one flatcar. Existing solid waste trucks always return to Sonoma County empty, since they are not suited to carrying other types of goods.

Table 10 shows the estimated number of truck equivalents per train for planned NCRA service; these are consistent with the estimates used for air quality analysis.

It is assumed that even though trains are loaded in only one direction that truck trips would be removed in both directions.[1]

Table 10. Truck equivalents per train

	Train 1	Train 2	Train 3	Train 4
Termini	Redwood Valley — Willits (Continuation of Train 2 w/fewer cars)	Lombard — Redwood Valley	Lombard — Willits	Lombard — Santa Rosa
Max cars per train	10	25	60	60
Truck equiv. per car	4	4	4	1
Truck equiv. per train	40	100	240	60
Total truck equiv (both directions)	80	200	480	120

* Assumes each train makes one crossing in each direction per day.

Considering US 101 as the primary route that would be affected by diversion of freight from truck to rail, it was assumed that the maximum total number of truck trips removed from US 101 in the project area would be 880 trips by large trucks in both direction on an average day. The one-directional truck traffic removed from US 101 would be 400 per day between Novato and Santa Rosa, 340 per day between Santa Rosa and Redwood Valley, and 280 per day between Redwood Valley and Willits.

To put this in perspective, Caltrans estimates that in 2005 there were about 3,200 trips by large trucks (with 3 or more axles) in both directions in the Marin-Sonoma Narrows of Highway 101 on an average day, and 3,600 large truck trips on the Cotati grade.[2] Hence, the maximum equivalent volume of trucks removed from these locations would be between 20% and 25% of 3+ axle trucks on Highway 101 on an average day in 2005, assuming these freight projections are realized.

This is a beneficial impact on the North Bay's transportation system both for congestion relief and pavement wear. According to the 2000 edition of the Highway Capacity Manual, each truck is equivalent to 1.5 passenger cars on flat terrain, and 2.5 passenger cars in rolling terrain.[3] For long upgrades of approximately three

[1]This assumption is somewhat different from the SMART analysis, which assumes 80% truck removal in the loaded direction and 20% removal in the reverse direction, to account for differences in backhaul behavior between trains and trucks.

[2]Caltrans 2006 Truck Counts. http://traffic-counts.dot.ca.gov/

[3] Transportation Research Board. Highway Capacity Manual. Washington, DC: 2000.

percent (e.g., Cotati grade) and five to six percent trucks, a single truck is uses the same amount of highway capacity as three passenger cars.

8 Construction Impacts

Construction work on the NCRA rail line would entail installing or re-installing gates at at-grade crossings. This could result in minor delays to traffic if some of the roadway is blocked during construction.

Impact T-9: Construction work at at-grade crossings could result in road blockages, leading to delays in traffic. (Less than significant)

Mitigation T-9: Work with local authorities to establish construction procedures and schedule hours of construction to minimize delays to traffic.

Appendix A – Public Grade Crossings and Train Speeds

The following table lists the public grade crossings and the train speeds assumed for each. The 25 key grade crossings for traffic impact analysis are shown in bold.

Crossing			**Train speed (mph)**
1	Napa Co.	Green Island Rd.	20
2	Sonoma Co.	Milton Rd.	10
3	Sonoma Co.	Skaggs Island Rd.	35
4	**Sonoma Co.**	**SR 12/121 Cameros Hwy.**	**15**
5	Sonoma Co.	Redding Rd.	35
6	**Sonoma Co.**	**SR 37 Sears Point Rd.**	**35**
7	Marin Co.	Reclamation Rd.	35
8	Marin Co.	(Roughly MP 20)	35
9	Marin Co.	Port Sonoma Rd.	35
10	Marin Co.	Grandview Ave.	10
11	Marin Co.	Parking Lot Access	10
12	Marin Co.	Stone Tree Ln.	10
13	Ignacio	Hanna Ranch Rd.	15
14	Novato	Grant Ave.	40
15	Novato	Olive Ave.	40
16	Novato	Golden Gate Pl.	40
17	Novato	Rush Creek Pl.	40
18	Marin Co.	County Dump Rd.	40
19	Petaluma	Hopper St.	25
20	**Petaluma**	**D St.**	**25**
21	**Petaluma**	**E Washington St.**	**25**
22	Petaluma	Lakeville St.	25
23	Petaluma	W Payran St.	25
24	Petaluma	Southpoint Bl.	40
25	Petaluma	N McDowell Bl.	40
26	Petaluma	Corona Rd.	40
27	Sonoma Co.	Ely Rd. North	40
28	Sonoma Co.	Main St.	40
29	Sonoma Co.	Adobe Rd.	40
30	Sonoma Co.	E. Railroad Av.	25
31	**Cotati**	**E. Cotati Av.**	**25**
32	**Rohnert Park**	**Southwest Bl.**	**40**
33	**Rohnert Park**	**Rohnert Park Expwy.**	**40**
34	**Rohnert Park**	**Golf Course Dr.**	**40**
35	Sonoma Co.	Scenic Av.	40
36	**Sonoma Co.**	**Todd Rd.**	**40**
37	Sonoma Co.	W. Robles Av.	40
38	Santa Rosa	Bellvue Av.	40
39	**Santa Rosa**	**Hearn Av.**	**40**
40	Santa Rosa	W Barham Av.	40

Crossing			**Train speed (mph)**
41	Santa Rosa	Sebastopol Rd.	25
42	**Santa Rosa**	**3rd St.**	**25**
43	Santa Rosa	6th St.	25
44	Santa Rosa	7th St.	25
45	Santa Rosa	8th St.	25
46	**Santa Rosa**	**9th St.**	**25**
47	**Santa Rosa**	**College Ave.**	**25**
48	**Santa Rosa**	**Guerneville Rd.**	**40**
49	**Santa Rosa**	**W. Steele Ln.**	**40**
50	**Santa Rosa**	**Piner Rd.**	**40**
51	Santa Rosa	San Miguel Rd.	40
52	**Sonoma Co.**	**Fulton Rd.**	**40**
53	**Sonoma Co.**	**River Rd.**	**40**
54	**Sonoma Co.**	**Airport Blvd.**	**40**
55	**Sonoma Co.**	**Aviation Blvd.**	**40**
56	**Windsor**	**Shiloh Rd.**	**40**
57	Windsor	Mitchell Ln.	40
58	Windsor	Windsor River Rd. / Windsor Rd	40
59	Windsor	Starr Rd.	40
60	Sonoma Co.	Limerick Ln.	40
61	Healdsburg	Grant Ave.	40
62	Healdsburg	Bailhache Ave.	40
63	Healdsburg	Front St.	25
64	**Healdsburg**	**Healdsburg Ave./Mill St./Vine St.**	**25**
65	Healdsburg	Matheson St.	25
66	Healdsburg	North St.	25
67	Healdsburg	Grant St.	40
68	**Healdsburg**	**Dry Creek Rd.**	**40**
69	Healdsburg	Grove St.	40
70	Sonoma Co.	Parking lot access near Parkland Farms Bl.	40
71	Sonoma Co.	Site access near Passalacqua Rd.	40
72	Sonoma Co.	Lytton Springs Rd.	40
73	Sonoma Co.	SR 128	40
74	Sonoma Co.	Washington School Rd.	40
75	Sonoma Co.	Kelly Rd.	40
76	Sonoma Co.	Asti Rd.	40
77	Cloverdale	E 1st St.	40
78	Hopland	SR 175	40
79	Mendocino Co.	Henry Station Rd.	40
80	Ukiah	Norgard Ln.	40

Crossing			**Train speed (mph)**
81	Ukiah	Airport Park Bl.	40
82	Ukiah	Commerce Dr.	40
83	**Ukiah**	**Talmage Rd.**	**25**
84	Ukiah	E. Gobbi St.	25
85	**Ukiah**	**E. Perkins St.**	**25**
86	Ukiah	Clara Ave.	25
87	Ukiah	Ford St.	25
88	Ukiah	Brush St.	25
89	Mendocino Co.	Ford Rd.	25
90	Mendocino Co.	Masonite Truck Rd.	40
91	Mendocino Co.	Hollow Tree Rd.	40
92	Mendocino Co.	Lake Mendocino Dr.	40
93	Mendocino Co.	Moore St.	40
94	Mendocino Co.	E. School Way	40
95	Mendocino Co.	Laughlin Way	20
96	Willits	E Hill Road	25
97	Willits	E San Francisco Av.	25
98	Willits	E Valley Road	25
99	Willits	E Commercial St.	25

Appendix B – Data for Delay and Queuing Calculations

Table B-1. Data for Delay and Queuing Calculations

Location		Dir.	Blockage time (sec)			Peak 15-min traffic volume (veh/hr)				Number of lanes			
			Train no.:			2009		2033		2009		2033	
			2	3	4	Dir 1	Dir 2	Dir 1	Dir 2	Dir 1	Dir 2	Dir 1	Dir 2
Sonoma County	SR 12/121 (Carneros Hwy) at E 8th St (Schellville Rd) (2 crossings)	E/W	198	308	308	1,208	1,195	1,336	1,214	1	1	1	1
Sonoma County	Sears Point Rd. (SR 37) near Arnold Dr.	E/W	56	103	103	1,110	856	878	1,121	1	1	1	1
Petaluma	D St. west of Lakeville St.	E/W	70	136	136	666	737	746	837	1	1	1	1
Petaluma	Washington St. west of Lakeville St.	E/W	70	136	136	1,250	1,851	1,784	3,064	2	2	2	2
Rohnert Park	E Cotati Ave east of Industrial Ave.	E/W	70	136	136	1,036	1,047	1,782	1,404	2	2	2	2
Rohnert Park	Southwest Blvd. east of Brenda Wy.	E/W	70	136	136	823	930	1,873	1,534	2	2	2	2
Rohnert Park	Rohnert Park Expwy.	E/W	52	93	93	1,398	1,287	1,571	1,728	2	2	2	2
Rohnert Park	Golf Course Dr. east of US-101 interchange	E/W	52	93	93	1,191	890	2,719	1,083	2	2	2	2
Santa Rosa	Todd Rd. west of US-101 interchange	E/W	52	93	93	654	733	612	779	1	1	1	1
Santa Rosa	Hearn Ave. west of Dowd Dr.	E/W	52	93	93	1,061	1,460	1,844	2,974	2	2	2	2
Santa Rosa	3rd St. west of Wilson St.	E/W	70	136	136	695	869	1,216	2,600	2	2	2	2
Santa Rosa	9th St. west of Wilson	E/W	70	136	--	824	636	1,442	1,185	1	1	1	1
Santa Rosa	College Ave. west of Cleveland Ave.	E/W	70	136	--	1,259	1,240	1,767	1,439	2	2	2	2
Santa Rosa	Guerneville Rd. east of N Dutton Ave.	E/W	52	93	--	1,967	1,873	2,662	2,379	2	2	2	2
Santa Rosa	W Steele Ln. west of Coffey Ln.	E/W	52	93	--	727	592	770	666	1	1	1	1
Santa Rosa	Piner Rd. east of Plum Tree Ln.	E/W	52	93	--	1,639	1,446	2,093	1,614	2	2	2	2
Fulton	Fulton Rd. south of D St.	N/S	52	93	--	1,091	1,163	2,030	1,915	1	1	2	2
Fulton	River Rd. east of Hart Ln.	E/W	52	93	--	904	611	1,246	897	1	1	2	2

Table B-1 (cont). Data for Delay and Queuing Calculations

Location		Dir.	Blockage time (sec)			Peak 15-min traffic volume (veh/hr)				Number of lanes			
			Train no.:			2009		2033		2009		2033	
			2	3	4	Dir 1	Dir 2	Dir 1	Dir 2	Dir 1	Dir 2	Dir 1	Dir 2
Windsor	Airport Blvd. west of US-101 interchange (east of Regional Pkwy)	E/W	52	93	--	833	1,084	1,648	1,681	1	1	2	2
Windsor	Aviation Blvd east of Concourse Blvd.	E/W	52	93	--	747	701	736	571	1	1	1	1
Windsor	Shiloh Rd. west of Conde Ln.	E/W	52	93	--	878	896	1,318	1,395	1	1	1	1
Healdsburg	Healdsburg Ave at Vine St & Mill St	N/S	70	136	--	791	419	1,069	628	1	2	1	2
Healdsburg	Dry Creek Rd. east of Grove St.	E/W	52	93	--	693	816	1,058	1,174	2	1	2	1
Ukiah	Talmage Rd. west of US-101 interchange	E/W	70	136	--	792	808	954	973	1	1	1	1
Ukiah	E Perkins St. at Clay St.	E/W	70	136	--	900	737	1,123	920	2	2	2	2

Appendix C – Queue Length Calculations

The 95th percentile queue length for traffic at a signal is the length of the queue that is not exceeded 95 per cent of the time. Assuming that traffic arrivals at a signal follow a Poisson distribution, the 95th percentile number of vehicles, N_{95}, is the minimum value of N for which

$$\sum_{k=1}^{N} \frac{\left[\left(V/3600\right)R\right]^k \exp\left[-\left(V/3600\right)R\right]}{k!} \geq 0.95$$

where V is the peak traffic flow in vehicles per hour and R is the effective red time (in seconds).

Assuming that the average car takes up 25 feet in the queue, and that a truck takes on average twice as much queue length as a car, the 95th percentile queue length in feet is given by:

$$L = \frac{25\left(1+p\right)N_{95}}{n}$$

where L is the queue length in feet, p is the fraction of heavy vehicles in traffic, and n is the number of approach lanes.