

Chapter 2 Project Alternatives

This chapter describes the project alternatives developed and analyzed in this Environmental Assessment/ Draft Environmental Impact Report (EA/DEIR). It includes a description of the process used to develop the alternatives, a detailed description of the alternatives under consideration, a description of the alternatives considered and withdrawn, and a summary of project costs and schedule.

2.1 Alternatives Development Process

The Highway 101 corridor is the primary transportation corridor in Sonoma County. As outlined in Chapter 1, Purpose of and Need for Project, Highway 101 has been the subject of transportation planning and engineering studies over the past 20 years. These studies have concluded that the transportation issues in this corridor require a multi-modal solution.

The Highway 101 High Occupancy Vehicle (HOV) Lane Widening and Improvements Project is one of several projects within the corridor that address the highway component of the needed transportation improvements. This project would widen Highway 101 between Old Redwood Highway in Petaluma and Rohnert Park Expressway in Rohnert Park from four to six lanes by constructing a new high-occupancy vehicle (HOV) lane in each direction and making a series of related highway operations and safety improvements.

The alternatives development process began with a detailed survey of existing conditions within the project limits, identification of purpose and need for the project, and what would be required to address the defined purpose and need. The alternatives being considered in this EA/FEIR are the recommendation of these studies; the purpose of the environmental analysis is to evaluate these alternatives in detail. In June 2003, studies were formally initiated on the project and the project purpose and need and alternatives were presented to the public for their comments on important issues for study or factors that should be considered in the development of the project.

Several alternatives were considered and withdrawn from further consideration as described in Section 2.3, Alternatives Considered and Withdrawn. These included an additional mixed-flow lane alternative, a transit/transportation system management (TSM) alternative, and several variations on the Build Alternative. The mixed-flow lane and transit/TSM alternatives were withdrawn from further consideration prior to detailed study, for the reasons presented in Section 2.3, Alternatives Considered and Withdrawn. The variations on the Build Alternative were investigated in more detail and focused on improvement of traffic operations.

Alternative geometric concepts were developed to address operations issues at the West Railroad Avenue and SR 116 (Gravenstein Highway) interchanges, and several design variations were investigated for the climbing lane over the Cotati Grade. Before developing the interchange concepts, criteria for their evaluation were established and agreed upon by the Project Development Team (PDT), a multidisciplinary technical advisory team assembled specifically for this project. The PDT includes representatives from the Federal Highway Administration (FHWA), the California

Department of Transportation (Caltrans), the Sonoma County Transportation Authority (SCTA), local agencies, and the consultant team.

Interchange concepts were developed and evaluated against criteria summarized as follows:

- Would the design alleviate congestion, improve safety, and encourage carpooling and the use of alternative travel modes, including pedestrian and bicycle facilities?
- Would the interchange meet current state design standards?
- Would traffic operations improve?
- How feasible would it be to construct the interchange, maintain traffic during construction, and maintain the interchange after construction?
- What was the potential for environmental impacts?
- What would be the right-of-way costs and impacts?
- What would be the costs of construction?

The PDT used the evaluation criteria to determine which were the most viable concepts that should be developed in greater detail and included in the Build Alternative. The No-Build and Build Alternatives are discussed in Section 2.2.2, No-Build Alternative, and Section 2.2.3, Proposed Project (Build Alternative). Conceptual alternatives developed and evaluated, but withdrawn from further study are described in Section 2.3, Alternatives Considered and Withdrawn.

2.2 Project Alternatives

This section presents the two alternatives considered in the environmental analysis and starts with a description of existing conditions. *The Build Alternative has been identified as the Preferred Alternative.*

2.2.1 Existing Conditions

Within the project limits, Highway 101 consists of two mixed-flow lanes in each direction with an unpaved median with guard rail. There are no auxiliary lanes. There is an existing truck brake inspection area in the southbound direction at the Cotati Grade Summit at approximately kilometer post (KP) 17.9 [Post Mile (PM) 11.0].

The mixed-flow lanes are 3.6 meters (m) (12 feet [ft]) wide. The outside shoulders vary in width from 2.4 m (8 ft) to almost 3.0 m (10 ft). The inside shoulders are 1.5 m (5 ft) wide. Median width ranges from 12.2 m (40 ft) to 14.0 m (46 ft) and includes a double guard rail barrier in the median separating opposing directions of traffic. Existing side cut and fill slopes are predominantly at a vertical to horizontal ratio of 1:2 except for cut slopes of 1:1.5 on the high cuts along the Cotati grade, and the existing highway grade varies from -3.83 to +3.0 percent.

The highway has three full interchanges within the project limits: Old Redwood Highway–Petaluma Boulevard North, State Route (SR) 116 (Gravenstein Highway), and Rohnert Park Expressway. There are three partial interchanges within the project limits. From south to north, the first partial interchange is a diagonal on-ramp from Pepper Road to southbound Highway 101. The second is at Railroad Avenue where there is a northbound diagonal off-ramp. The third partial interchange is at West Sierra Avenue where there are southbound diagonal on- and northbound diagonal off-ramps. None of the on-ramps are metered.

The highway has five roadway/pedestrian crossings, one pedestrian undercrossing, three bridges, and one cattle pass within the project limits. Most of these were built when the highway was constructed in 1955 although several have been improved in the intervening years. These structures are summarized from south to north in Table 2.2-1, Bridges and Crossings.

Name	Kilopost (Post Mile)	Bridge Number	Construction Date	Type	Notes
Old Redwood Highway	12.31 (7.65)	20-159	1955	Overcrossing – Four-span	
Willow Brook	12.95 (8.05)	20-161 R/L	1956	Bridge	
Cattle Pass	15.79 (9.82)	N/A	1955	Cattle Pass	2.7 x 3.0 m reinforced concrete box culvert
Railroad Avenue	17.17 (10.67)	20-166 R/L	1956	Undercrossing – Three-span	Widened in 1994.
Sierra Avenue	19.30 (12.00)	20-167 R/L	1956	Undercrossing – Three-span	Widened in 1994.
School Street	19.96 (12.28)	20-168	1956	Pedestrian Undercrossing	
SR 116 (Gravenstein Highway)	20.41 (12.68)	20-169 R/L	1956	Separation Structures – Three-span	Widened in 1994.
Laguna de Santa Rosa	21.07 (13.09)	20-016 L 20-016 R	1919 1956	Bridge – Single-span Bridge – Two-span	Southbound bridge; widened in 1994.
Copeland Creek	21.74 (13.51)	20-015 L 20-015 R	1918 1956	Bridge – Two span Bridge – Two span	Southbound bridge; widened in 1929. Northbound bridge; widened in 1994.
Rohnert Park Expressway	22.34 (13.88)	20-235	1973	Overcrossing – Two-span	Widened 1999.

Source: Parsons 2004.

The local street network provides alternate routes of travel parallel to Highway 101. West of Highway 101, these streets include Stony Point Road and Redwood Drive. On the east side, they include Old Redwood Highway and Commerce Boulevard.

2.2.2 No-Build Alternative

The No-Build Alternative offers a basis of comparison with the Build Alternative in the opening year of 2010 and the future analysis year of 2030. This alternative would provide the same lane configuration as currently exists between Old Redwood Highway and Rohnert Park Expressway. The No-Build Alternative consists of currently planned and/or programmed improvements to the highway. These consist of routine maintenance and four other Highway 101 HOV lane widening projects in Sonoma County as follows:

- Highway 12 to Steele Lane and Steele Lane Interchange Improvements (Fully Funded)
- Rohnert Park Expressway to Santa Rosa Avenue, including Wilfred Avenue Interchange
- Steele Lane to Windsor River Road
- Marin-Sonoma Narrows¹

¹ Note that the Marin-Sonoma Narrows project is not anticipated to start construction until 2010; therefore, it is not included in the No-Build conditions in the opening year proposed project comparison. The Marin-Sonoma Narrows project is included in the No-Build conditions in the future analysis year (2030) proposed project comparison.

These projects are described in Section 1.3.3, Related Projects.

2.2.3 Proposed Project (Build Alternative) (Preferred Alternative)

The proposed project would widen Highway 101 for approximately 10.3 km (6.4 mi) from its current four lanes to six lanes by adding one HOV lane in each direction from Old Redwood Highway to the Rohnert Park Expressway. The project also would provide auxiliary lanes, interchange modifications and ramp improvements. At the southerly limit, the project would be compatible with improvements proposed under the Marin/Sonoma Narrows Project (by others), and at the northerly limit, the project would conform to improvements proposed under the Rohnert Park Expressway to Santa Rosa Avenue Project (by others). *A climbing lane in the northbound direction over the Cotati Grade is included to improve safety and operations and facilitate truck movements.*

The proposed project is described in terms of mainline and interchange improvements. Most of these improvements can be accommodated within the existing right-of-way; however, some improvements would require acquisition of additional right-of-way. Acquisition of additional right-of-way would be required primarily at the Old Redwood Highway–Petaluma Boulevard North and SR 116 interchanges; at the Pepper Road southbound on-ramp; and at one spot location to accommodate embankment widening just north of Pepper Road. See Sections 3.2.1.4, Environmental Consequences (Land Use) and 3.4.3, Relocations. Plans depicting the Build Alternative are included in Appendix A.

The No-Build Alternative would not meet the project purpose and need. Without capacity and operational improvements, traffic congestion and travel delay would continue to worsen over time. The Build Alternative would fulfill the project purpose and need by greatly reducing traffic congestion for motorists and transit riders using the HOV lanes. Additionally, the Build Alternative would reduce travel time through the corridor, address highway capacity constraints and increasing travel demand, and improve mainline traffic operations and on and off movements, none of which needs would be met by the No-Build Alternative. On the basis of the traffic operations results and other environmental impact findings presented in the Draft Environmental Document and in consideration of all of the public and agency comments received, the Build Alternative has been identified as the preferred alternative for the Highway 101 HOV Lane Widening and Improvements Project.

Due to current funding limitations the project will be constructed in phases. The first phase will be from just south of Railroad Avenue to Rohnert Park Expressway with the remainder to be constructed in a subsequent phase.

2.2.3.1 Mainline Improvements

The proposed project would add one high occupancy vehicle (HOV) lane in each direction, thus widening the freeway from four to six lanes. The proposed 6.6-m (22-ft) wide median would accommodate a 3.0-m (10-ft) wide shoulder in each direction and a median barrier separating each direction of traffic. The median barrier would be made of concrete, except in the vicinity of the Old Redwood Highway–Petaluma Boulevard North interchange where a double guard rail barrier would be used for drainage reasons. The freeway mainline alignment would generally be widened

symmetrically about the existing alignment except in the vicinity of the Cotati Grade where the alignment *would* be shifted to the west to accommodate the northbound climbing lane and improve sight distance. The vertical alignment would typically follow the existing profile.

These improvements would be designed to be consistent with current highway geometric standards: travel lanes would be 3.6 m (12 ft) wide, inside shoulders would be 3 m (10 ft) wide, and outside shoulders would be 3 m (10 ft) wide. Achieving these geometric standards would require widening along the existing outside edges of the traveled way in most locations. The roadway cross section would be essentially the same as in the recently reconstructed segment of Highway 101 from Wilfred to SR 12. In addition to the two HOV lanes, auxiliary lanes would be constructed between the SR 116 and Rohnert Park Expressway interchanges (see Appendix A, Figure A–Sheets 13a/b-15). Auxiliary lanes are roadway segments from one interchange’s on-ramp to the following interchange’s off-ramp and are used to help traffic enter and exit the highway. The auxiliary lanes would be 3.6 m (12 ft) wide and approximately 1.1 km (0.7 mi) in length. In the southbound direction along the auxiliary lane, a concrete barrier, similar to the proposed concrete median barrier with chain link fencing placed on top, would separate the auxiliary lane and Redwood Drive.

The proposed project includes a 5.0-km (3.1-mi) long, 3.6-m (12-ft) wide climbing lane in the northbound direction from near Orchard Lane, approximately 1.6 km (1.0 mi) north of Old Redwood Highway to the West Sierra Avenue northbound off-ramp (see Appendix A; Figure A–Sheets 5-11). The climbing lane would reduce congestion caused by slow moving vehicles traveling up the 4.2-km (2.6-mi) long Cotati Grade. From just north of Willow Brook to just south of West Sierra Avenue, the mainline alignment would be shifted approximately 3.6 m (12 ft) to the west (see Appendix A, Figure A–Sheets 3-11). The horizontal curve at the summit would be straightened and the southbound inside shoulder would be widened to provide standard stopping sight distance.

A brake inspection area for trucks on southbound Highway 101 is currently located at the top of the Cotati Grade approximately 1.2 km (0.75 mi) south of West Sierra Avenue (see Appendix A; Figure A–Sheet 9). As part of the proposed project this brake inspection area would be reconstructed to conform to the widened highway and better meet current geometric standards. The pavement edge in this area would be extended slightly to provide standard shoulders in the inspection area and along the access ramps.

Three bridges and a cattle pass would require modification to accommodate the mainline improvements. At Willow Brook, the existing parallel bridges carrying Highway 101 would be widened into the median and joined (see Appendix A; Figure A–Sheet 3). The cattle pass located between Pepper Road and West Railroad Avenue would be lengthened along the west side of Highway 101 (see Appendix A; Figure A–Sheet 6). The northbound bridges at Laguna de Santa Rosa and Copeland Creek would be widened on the outside and joined in the median to replacement southbound bridges (see Appendix A; Figure A–Sheet 14). No additional right-of-way is anticipated to be required with these bridge and underpass modifications.

Retaining walls would be required at several locations to minimize right-of-way and environmental impacts. At the southbound exit ramp to Old Redwood Highway–Petaluma Boulevard North, a 90-m (295-ft) long retaining wall is proposed to minimize right-of-way acquisition (see Appendix A;

Figure A–Sheet 2). Near the crest of Cotati Grade, approximately 1.1 km (0.7 mi) north of West Railroad Avenue and along the east side of Highway 101, a retaining wall approximately 180 m (590 ft) long is proposed to avoid wetland impacts and right-of-way acquisition (see Appendix A; Figure A–Sheet 10). Retaining walls would also be required at the SR 116 Interchange and are discussed in Section 2.2.3.2, Interchange Improvements (see Appendix A; Figure A–Sheets 13a and 13b). Maintenance vehicle pullouts would be provided at intervals along the highway at the outside shoulders, where possible. Specific locations will be determined in the design phase.

2.2.3.2 Interchange Improvements

The proposed project includes a series of interchange modifications to improve safety and operations and to conform to the mainline widening. These modifications would upgrade the interchanges to current geometric standards where possible. All interchange on-ramps would be improved to accommodate ramp metering (including HOV preferential treatments at the Old Redwood Highway northbound diagonal and SR 116 northbound and southbound on-ramps, and California Highway Patrol (CHP) enforcement areas). CHP enforcement areas can also be used by maintenance vehicles during non-peak traffic periods. While the decision to implement ramp metering would not be made as part of this project, these ramp metering improvements would be constructed as part of the current project to minimize disruption and facilitate future implementation. The following interchange improvements are included in the proposed project:

Old Redwood Highway–Petaluma Boulevard North Interchange – The existing partial cloverleaf interchange configuration at Old Redwood Highway would remain, but the diagonal ramps would be reconstructed to accommodate the Highway 101 widening (see Appendix A; Figure A–Sheet 2). The diagonal on-ramps would be realigned to improve safety and transition to the highway by increasing the acceleration distance on the ramp and improving sight distance for safer merges. The northbound diagonal on-ramp from Old Redwood Highway would be reconstructed with a larger radius curve and to accommodate one mixed-flow ramp-metered lane, an HOV preferential lane and a CHP enforcement area. The southbound diagonal on-ramp from Petaluma Boulevard North would be reconstructed with a larger radius curve and would accommodate one mixed-flow, ramp-metered lane. The entrance taper on both the northbound and southbound loop on-ramps would be improved to current standards. The interchange’s northbound off-ramp to Old Redwood Highway would be reconstructed to provide standard deceleration distance. The southbound off-ramp to Petaluma Boulevard North would be reconstructed to provide standard deceleration distance and a two-lane exit ramp. *The existing bus pads at the Petaluma Boulevard North/Old Redwood Highway on-ramps are currently not used. Consideration of bus pad replacement at this location will be deferred to the overcrossing widening and replacement project to be sponsored by the City of Petaluma.*

Pepper Road Interchange – The southbound on-ramp at Pepper Road would be reconstructed to accommodate the mainline widening (see Appendix A; Figure A–Sheet 4). The on-ramp would be rebuilt with a larger radius and realigned to transition to the freeway by increasing the acceleration distance on the ramp and improving sight distance for safer merges.

West Railroad Avenue Interchange – The West Railroad Avenue Undercrossing structures would be replaced to accommodate the Highway 101 widening, the planned widening of West Railroad

Avenue (by others) and a possible future interchange at West Railroad Avenue (by others) (see Appendix A; Figure A–Sheet 8). No changes are proposed to the existing exit ramp.

West Sierra Avenue Interchange – The existing West Sierra Avenue Undercrossing structures would be widened into the median and joined to accommodate the Highway 101 widening (see Appendix A; Figure A–Sheet 11). The existing southbound on-ramp would be reconstructed to accommodate one mixed-flow ramp-metered lane, an HOV preferential lane and a CHP enforcement area, and to improve the merge taper to current standards. *New traffic signals are proposed at the intersection with the southbound on-ramp and the northbound off-ramp to maintain a satisfactory level of service (LOS) at both ramp intersections. Level of Service or LOS is a measure used to rate roadway facilities based on their traffic conditions. The level of service criteria for intersection analysis are presented in Table 3.1-1 in Chapter 3.* At this interchange the climbing lane would become an exit-only lane and northbound Highway 101 would become a three-lane cross section.

SR 116 (Gravenstein Highway) Interchange – Near-term improvements are proposed at this interchange under a separate contract by others. These improvements will include widening the northbound exit ramp to three lanes, restriping the eastbound approach to the SR116/Old Redwood Highway intersection to provide two left-turn lanes, and adding a traffic signal at the Old Redwood Highway/Commerce Drive intersection.

Additional interchange improvements are proposed under the present project, and include two design options: Option A and Option B (*see Appendix A; Figure A–Sheets 12a, 12b, 13a, and 13b*). Both options would retain the existing interchange configuration, but provide improvements to accommodate the mainline widening and to meet future traffic demand. The northbound on-ramp would accommodate one HOV preferential lane, two mixed-flow ramp-metered lanes, and a CHP enforcement area. The southbound on-ramp would accommodate one mixed-flow ramp-metered lane, an HOV preferential lane, and a CHP enforcement area. Both options involve realigning the intersection at Old Redwood Highway/Commerce Boulevard and the northbound entrance ramp to improve vehicle turning movements and sight distance. In addition, SR 116 would be widened to the south between Redwood Drive and the southbound entrance ramp to provide an additional right turn lane; and between the northbound off-ramp and Old Redwood Highway intersections to provide three westbound lanes, and dual left, one through/right and one dedicated right-turn lane in the eastbound direction. *Locations for providing bus pads at the Highway 101/116 Interchange will be evaluated in the final design phase, and bus pads will be incorporated where feasible. Caltrans prefers that bus stops be provided at park-and-ride facilities where these are located close to an interchange, rather than on the ramps.* Under **Option A**, the existing Highway 101 mainline and bridge structure would be widened into the median and the structures joined to accommodate the mainline widening.

Option B (*preferred option for this interchange*) would involve regrading the mainline to meet current vertical alignment and clearance standards, and would entail replacing the existing SR116 bridge structure and reconstruction of the ramps to accommodate the raised profile. The Highway 101 mainline profile would be raised up to 3 m (10 ft) above the existing highway over a distance of 900 m (2,950 ft) to provide standard stopping sight distance on the mainline, and at SR116 the existing structures would be placed and raised approximately 1.4 m (6 ft) to provide

standard vertical clearance and falsework clearance during construction over SR 116. Approximately 200 m of Redwood Drive would be realigned to accommodate the southbound off-ramp realignment.

Three retaining walls would be required under Option B to minimize right-of-way and sensitive habitat impacts:

1. Along the west side of the southbound on-ramp, a 180-m (590-ft) long retaining wall would be required to avoid sensitive habitat.
2. Along the west side of the southbound off-ramp, a 180-m (590-ft) long retaining wall would be required to minimize right-of-way acquisition and relocation requirements on Redwood Drive. This retaining wall would tie into the concrete barrier separating the southbound auxiliary lane and Redwood Drive.
3. Along the east side of the northbound on-ramp, a 310-m (1,020-ft) long retaining wall would be required to minimize right-of-way acquisition and relocation requirements along Commerce Boulevard.

Rohnert Park Expressway Interchange – The existing northbound off-ramp and southbound on-ramp would be reconstructed to accommodate the mainline widening and the proposed auxiliary lanes to/from the SR 116 interchange. In addition, an HOV preferential lane would be added to the southbound on-ramp, and the existing connections to and from the park-and-ride lot reconfigured to accommodate this. A CHP enforcement area would also be provided.

2.3 Alternatives Considered and Withdrawn

The alternatives analysis process considered a broad range of alternatives to address transportation on Highway 101 within the project limits. The following alternatives were evaluated and withdrawn from further consideration based on feasibility, impacts to environmental resources, and cost.

2.3.1 Mixed-Flow Lane Alternative

A Mixed-Flow Lane Alternative was considered and withdrawn from further consideration because HOV lanes and not mixed-flow lanes *provide an incentive for motorists to form carpools, thus reducing congestion in the existing mixed flow lanes, which is consistent with the project purpose*. As discussed in Section 1.3.1, Project History, there have been more than 20 years of planning for improvements along Highway 101, including several studies that have focused on HOV lanes. Two of the most recent studies are the Metropolitan Transportation Commission's (MTC) *A High-Occupancy Vehicle Lane Master Plan Update for the San Francisco Bay Area* (DKS Associates, 2003) and the SCTA's *Comprehensive Transportation Plan for Sonoma County* issued in 2004.

The HOV Master Plan Update identified HOV lane alternatives as having superior air quality and mobility benefits, both locally and regionally. The Master Plan Update also documented that HOV lanes are an effective measure for carrying more people per lane than mixed-flow lanes. In Marin County to the south, HOV lanes carry three times the number of people per lane as the mixed-flow lanes. The SCTA's *Comprehensive Transportation Plan* identifies HOV lanes as a recommended measure to reduce congestion by reducing the number of cars using Highway 101 and making ridesharing a more attractive travel alternative. For these compelling public policy reasons, the

Mixed-Flow Lane Alternative was withdrawn from further study as it was not consistent with planning for the Highway 101 corridor or with local agency goals.

2.3.2 Transit/Transportation Systems Management Alternative

A combination of Transit and Transportation Systems Management (TSM) strategies as a “stand alone” alternative was considered and withdrawn from further consideration early in the evaluation process. This alternative envisioned increased bus transit service and HOV use to consolidate traffic into fewer vehicles, to increase throughput without increasing capacity. This alternative would have been a lower-cost alternative to new construction; however, the alternative would not have been able to meet the project’s purpose and need without additional capacity to accommodate buses and other HOVs on Highway 101. To make the TSM Alternative into a viable alternative would require mainline capacity increases to enable buses and HOVs to bypass congestion—in short, HOV lanes would be required. Without HOV lanes, the Transit/TSM alternative is not a viable alternative and was therefore withdrawn from further consideration.

2.3.3 Variations on the Build Alternative

Variations on the basic build alternative were studied at three locations: the Cotati Grade, the West Railroad Avenue Interchange, and the SR 116 Interchange. After study, only the Build Alternative with two variations, at the SR 116 interchange, was carried forward and all other variations were withdrawn from further study. The design concepts and variations and the reasons they were withdrawn from study are described in this section.

2.3.3.1 Widening along Cotati Grade

The PSR considered widening for the northbound climbing lane by cutting into Meacham Hill. Geotechnical investigations conducted during the current studies determined that this may aggravate existing slope stability issues. This alternative was withdrawn from further consideration in favor of holding the easterly edge of traveled way and widening on embankment to the west to provide the required roadway cross-section based upon recommendations from the geotechnical engineering investigation.

2.3.3.2 West Railroad Avenue Interchange

When the project studies were initiated, a full interchange at West Railroad Avenue was identified as a possible improvement to be included in the project, and two interchange concepts were investigated at this location. Either concept would have required replacing the Highway 101 structure to accommodate the needed improvements on West Railroad Avenue at the interchange. Improvements proposed at this location with the project would accommodate and not preclude future widening of West Railroad Avenue and an interchange. The two interchange concepts investigated are described below.

Ultimately, traffic studies demonstrated that providing a full interchange at this location is outside the purpose and need for this HOV lane widening project. This does not mean that there is no need for an interchange at this location.

Tight-Diamond Interchange Concept

This interchange concept would have added the three missing diagonal ramps for full traffic access at this interchange. A conventional “tight” diamond configuration was considered to minimize right-of-way requirements. An interchange would require widening West Railroad Avenue through the interchange area to provide left-turn pockets and would require traffic signals at the ramp intersections. Relocation of portions of Birch Lane and Debbie Hill Road, or high retaining walls, would be required to accommodate the ramps on the north side of West Railroad Avenue. This concept was withdrawn because of these impacts and because traffic studies determined that providing full access at Railroad Avenue was beyond the purpose and need for the HOV lanes project.

Partial-Cloverleaf (“Pitchfork”) Concept

This interchange concept would have constructed all ramps on the south side of West Railroad Avenue to take advantage of the existing landform and minimize the extent of roadway cut and fill required. The existing northbound off-ramp would have been realigned to the east and a northbound loop on-ramp from West Railroad Avenue to northbound Highway 101 would have been added between the northbound off-ramp and Highway 101. This configuration would have been mirrored on the west side of Highway 101, with a loop southbound off-ramp from Highway 101 to West Railroad Avenue and a diagonal southbound on-ramp from West Railroad Ave to Highway 101. As with the diamond configuration, an interchange would require widening West Railroad Avenue through the interchange area to provide left-turn pockets and would require traffic signals at the ramp intersections and would create the impacts described in the previous paragraph. As with the diamond configuration, the partial-cloverleaf concept was also withdrawn because traffic studies showed that providing full traffic access at Railroad Avenue was beyond the purpose and need for the HOV lanes project.

2.3.3.3 SR 116 (Gravenstein Highway) Interchange

The SR 116 Interchange is where SR 116, the primary east-west access route in Sonoma County, intersects Highway 101, the County’s primary north-south access route. The northbound on-ramp is separated from the other on- and off-ramps and is integrated with Old Redwood Highway/Commerce Boulevard in an indirect manner.

Preliminary traffic studies indicated that the high traffic volumes traveling through the interchange coupled with the indirect access to northbound Highway 101 would result in less than acceptable traffic operations affecting both routes unless modifications were made. Furthermore, the existing Highway 101 vertical alignment through the interchange area does not meet current design standards. To improve safety and operations at this interchange, ten interchange improvement concepts were developed for evaluation by the PDT. The PDT recommended that the nine conceptual improvements described below be withdrawn from further study based upon factors including operational performance, environmental impact, and cost. The tenth concept, a “hybrid” of the Minimal Improvements and Modified Current Interchange concepts, was recommended by the PDT for development as part of the Build Alternative with two Highway 101 profile variations (described in Section 2.2.3.2, Interchange Improvements, as Options A and B). These concepts were presented to

the Sonoma County Transportation Authority Board of Directors on September 13, 2004; they concurred with the findings and direction of the PDT. All of the conceptual interchange alternatives developed, evaluated, and withdrawn from further study are described in this section along with the reasons for their withdrawal from further study.

No Interchange Improvements

This concept would join the two existing Highway 101 bridges by widening them into the median to provide space for the new HOV lanes. It would not make any other improvements to the interchange. This concept would allow construction of the new mainline HOV lanes, but would not improve operations or safety of the interchange or SR 116. It would not adequately handle traffic operations and for this reason, was withdrawn from further study.

Minimal Interchange Improvements

This concept alternative would accommodate the proposed Highway 101 HOV lanes in the median, provide an eastbound turn lane on SR 116 to the southbound on-ramp, add an eastbound and westbound through lane on SR 116 just west of the Old Redwood Highway intersection, and add a northbound through-lane on the southern approach of the SR 116/Old Redwood Highway intersection. The benefit of this concept is that it would reduce traffic congestion and improve traffic operations to acceptable levels with the additional lanes and enhanced signal timing modifications with fewer impacts, although it would not improve safety or operations of the northbound Highway 101 on-ramp or the vertical alignment of the mainline in this area. Although this concept would operate at acceptable levels, it would not provide as much benefit as the “hybrid” included in the Build Alternative and was therefore withdrawn from further study.

Existing Interchange with Roundabouts

This concept would accommodate the proposed Highway 101 HOV lanes in the median and construct at-grade roundabouts at the intersections of SR 116/Old Redwood Highway and Old Redwood Highway/Commerce Boulevard/northbound Highway 101 on-ramp. This concept was withdrawn from further study because the proposed roundabouts could not provide acceptable levels of service with the projected intersection volumes and would not improve safety at the northbound on-ramp.

Modified Current Interchange

This concept would accommodate the new Highway 101 HOV lanes by replacing the structure, regrading and raising the mainline profile to meet current design standards, and realigning and reconstructing the northbound on-ramp. Although operations and safety would improve at the Old Redwood Highway/Commerce Boulevard/northbound on-ramp intersection, the concept would not provide acceptable levels of service for the intersections on SR 116, and was therefore withdrawn from further study.

Diamond Interchange

This concept would replace the structure, regrade Highway 101 through the interchange to improve vertical alignment, add turn lanes at the intersections of on- and off-ramps with SR 116, construct a new Highway 101 northbound diagonal on-ramp to provide a conventional diamond-shaped interchange, and eliminate the existing northbound on-ramp for a new smooth connection between

Old Redwood Highway and Commerce Boulevard. The new diagonal on-ramp would intersect SR 116 at the Highway 101 northbound off-ramp and enter Highway 101 near where the existing northbound on-ramp enters Highway 101 today. Construction of the new diagonal northbound on-ramp would require acquisition and relocation of three residences and at least one business. This concept was withdrawn from further study because of these impacts and because the traffic analysis showed that this interchange configuration would not operate as well as the “hybrid” included as the Build Alternative, due to the heavy left turn movement from northbound Old Redwood Highway to westbound SR 116, and had greater right-of-way impacts.

Single-Point Diamond Interchange

This concept would replace the structure and regrade and raise Highway 101 through the interchange area to accommodate the deeper structure depth required and to improve vertical alignment. All on- and off-ramps would intersect SR 116 at a single intersection under the new Highway 101 structure. A portion of Redwood Drive would be realigned. The existing northbound on-ramp would be eliminated to provide a new smooth connection between Old Redwood Highway and Commerce Boulevard. As part of reconstructing the interchange, additional turn lanes and capacity on SR 116 would be added to address traffic congestion. This concept would also address the existing indirect access to Highway 101 northbound and improve mainline operations and safety by improving the vertical alignment. It would require the relocation of three residences and at least one business. This concept was one of the most expensive evaluated and, even given its impacts, it did not operate as well as the “hybrid” due to the heavy left turn movement from northbound Old Redwood Highway to westbound SR 116. Therefore, it was withdrawn from further consideration.

Partial Cloverleaf Interchange

This concept would replace the structure, regrade and raise the profile of Highway 101 through the interchange area to improve the vertical alignment, and reconstruct the interchange as a partial cloverleaf (Par-Clo) by adding and reconfiguring on- and off-ramps. New ramps would include a northbound diagonal on-ramp, a southbound Highway 101 to eastbound SR 116 loop off-ramp in the interchange’s southwest quadrant, and a southbound diagonal on-ramp adjacent to the loop off-ramp. The existing northbound on-ramp would be eliminated to provide a new smooth connection between Old Redwood Highway and Commerce Boulevard. As part of reconstructing the interchange, additional turn lanes and capacity on SR 116 would be added to address traffic congestion. Although this concept would address the non-conventional access to Highway 101 northbound, it was withdrawn from further study because it would require the relocation of six residences and two businesses (resulting in greater right-of-way impacts than most concepts), would not operate as well as the “hybrid” due to the heavy left turn movement from northbound Old Redwood Highway to westbound SR 116, would be more expensive than most of the other concepts investigated, and would not provide any substantial transportation, environmental, or engineering advantages over the other concepts.

Northbound Exit Ramp Realignment

This concept would replace the structure, regrade and raise the profile of Highway 101 through the interchange area to improve vertical alignment, reconstruct the Highway 101 northbound exit-ramp to

cross over SR 116 on a new structure, and then form the fourth leg of a reconfigured intersection with Old Redwood Highway/Commerce Boulevard/Highway 101 northbound entrance-ramp. Additional turn lanes and capacity on SR 116 would be added to address traffic congestion. An advantage of this interchange concept would be that the northbound on- and off-ramps would be in the same location (although this location would be quite a distance from the southbound Highway 101 on- and off-ramps). This concept would require the acquisition and relocation of three residences and one business. While it would locate the Highway 101 northbound on- and off-ramps in the same location and be comparable in cost to the “hybrid” concept on new mainline alignment, this concept would increase the amount of out-of-direction travel over that for other concepts, would have greater right-of-way impacts, and would not provide any substantial transportation, environmental, or engineering advantages. It was therefore withdrawn from further consideration.

Roundabout Interchange

This concept was studied at the request of a member of the public and an elected official. It would replace the structure with two new structures, re-grade Highway 101 through the interchange to improve the vertical alignment, and replace all interchange ramps. The SR 116 roadway would be eliminated through the interchange area. The ramps and SR 116 would be connected to a large roundabout approximately 100 meters in diameter with flared on- and off-ramps to and from Highway 101 and SR 116. This concept would force all ramp traffic and SR 116 traffic traveling through the interchange onto the roundabout. It was withdrawn from further study because it would not operate at an acceptable level of service; would require relocation of seven residences, at least 14 businesses, and an existing park and ride lot; would have the highest cost of any concept investigated; and would be the most difficult to construct and to maintain traffic during construction.

2.4 Project Costs

The No-Build Alternative would not require any immediate investment of capital other than ongoing operations and maintenance costs and the costs of the other programmed transportation improvements. The Build Alternative would require funds for construction right-of-way, acquisition, and agency costs. With the Highway 101 / SR 116 Interchange Option A, total costs are estimated at \$164.6 million with construction costs of \$117.2 million, right-of-way acquisition costs of \$8.5 million and environmental mitigation costs of \$6.0 million *in 2007 dollars*. With Option B (*Preferred*), total costs are estimated at \$178.3 million with construction costs of \$128.1 million, right-of-way acquisition costs of \$8.5 million, and environmental mitigation costs of \$6.0 million *in 2007 dollars*. Costs for final design, construction management, and agency costs are estimated to be \$32.9 million with Option A and \$35.7 million with Option B (Table 2.4-1).

**Table 2.4-1: Costs for Highway 101 Improvements–
Old Redwood Highway to Rohnert Park Expressway (2007 \$)**

Cost	Amount	
	Design Option A ¹	Design Option B (<i>Preferred</i>) ¹
Costs:		
Construction	\$117,200,000	\$128,100,000
Right-of-Way	\$8,500,000	\$8,500,000
Environmental Mitigation ²	\$6,000,000	\$6,000,000
Subtotal	\$131,700,000	\$142,600,000
Design, construction management, and agency costs.	\$32,900,000	\$35,700,000
Total Costs	\$164,600,000	\$178,300,000

Notes:

1. Two variations are proposed for the Highway 101 / SR 116 Interchange. Refer to Section 2.2.3.2, Interchange Improvements, for a description of these design options.
2. Environmental mitigation costs are provisional pending agency consultation.

Source: Parsons 2007.

2.5 Project Schedule

The schedule for the proposed project anticipates environmental approval in *August 2007*; design, utility relocation and right-of-way acquisition work beginning in 2007; and construction beginning in 2009. *Due to current funding limitations, the project will be constructed in phases. The first phase will be from just south of Railroad Avenue to Rohnert Park Expressway, with the remainder to be constructed in a subsequent phase.*