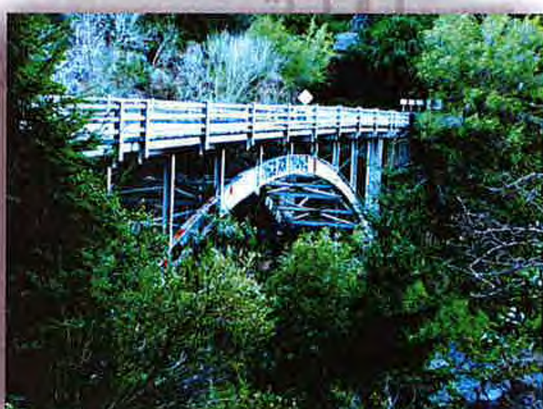
CALTRANS HISTORIC BRIDGES INVENTORY UPDATE: METAL TRUSS, MOVABLE, AND STEEL ARCH BRIDGES

PREPARED FOR:

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
ENVIRONMENTAL PROGRAM
1120 N STREET
SACRAMENTO, CALIFORNIA 95814



PREPARED BY:

JRP HISTORICAL CONSULTING
1490 DREW AVENUE, SUITE 110
DAVIS, CALIFORNIA 95616

VOLUME I

Revised
September 2004

Cover Images: (Top to bottom, left to right)
Bridge 42C0261, Italian Bar Road over San Joaquin River, Fresno County;
Bridge 29 0016F, SR120 / I-5 Connector over San Joaquin River, San Joaquin County;
Bridge 09C0014, Warren Hill Road over Slate Creek, Plumas County;
Bridge 01C0005, South Fork Road over South Fork of Smith River, Del Norte County;
Bridge 24 0121, SR160 at Three Mile Slough, Sacramento County;
Background from *California Highways and Public Works*, January 1943, 19.

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Caltrans Historic Bridge Inventory Update: Metal Truss, Movable, and Steel Arch Bridges

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VOLUME I: REPORT AND FIGURES

Prepared for:

State of California
Department of Transportation
Environmental Program
1120 N Street
Sacramento, California 95814

Prepared by:

____
Christopher McMorris

JRP Historical Consulting
1490 Drew Avenue, Suite 110
Davis, California 95616

Revised by Andrew Hope, Caltrans

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SUMMARY OF FINDINGS

JRP Historical Consulting (JRP) prepared this report for the State of California Department of Transportation (Caltrans) Environmental Program at Caltrans Headquarters in Sacramento as part of the department's program to update its historic bridge inventory. Caltrans intends to use this report to request from the State Historic Preservation Officer (Office of Historic Preservation, OHP) determinations regarding the eligibility of 262 metal truss, movable, and steel arch bridges built in California prior to 1960 to be listed in the National Register of Historic Places. The Federal Highway Administration (FHWA) and Caltrans will use these determinations to comply with applicable environmental and historic preservation laws and regulations as these pertain to historic properties. The historic bridge inventory update will, most importantly, help these agencies comply with Section 106 of the National Historic Preservation Act and the California Environmental Quality Act (CEQA).

Caltrans conducted its initial statewide historic bridge inventory between 1984 and 1986. The original inventory included the survey of metal truss, movable, and steel arch bridges together with timber truss bridges, with an emphasis on evaluating structures constructed prior to 1936, i.e. those structures more than fifty years old at the time. Caltrans began updating its historic bridge inventory in 2002 with Caltrans architectural historians and consultants preparing various components of the inventory. Initial steps for the project included the collection of data, preparation of a historic overview covering the period not addressed in the 1980s survey, and organization of the survey population of bridges to be inventoried and evaluated in detail. Caltrans staff also contacted local historical societies and other interested parties to ensure compliance with the public participation requirements of Section 106. Caltrans architectural historians organized the survey population into bridge types and decided to submit evaluations for the relatively few timber truss bridges in a separate report from the larger population of metal truss, moveable, and steel arch bridges. For the metal truss, movable, and steel arch bridge survey, Caltrans decided to continue use of the numeric point rating system that had been developed for the initial bridge survey. Caltrans revised the numeric system to adjust for the change in historic time frame and to remove an ineffectual category that provided a score for historical association. The rating scores given to the bridges were used as indicators of possible significance and evidence of which structures retained historic integrity. The scoring system was coupled with historical research and a thorough analysis to draw conclusions on which bridges appear to meet the criteria for listing in the National Register.

This document is divided into sections that provide information on the inventory evaluation update process as well as for historical background. The project description section provides information on the initial Caltrans bridge inventory and details on the current survey. This is followed by a description of the field and research methods used during this survey. This section includes a discussion of the numerical scoring system. Next is an historical overview that provides the historic themes and context by which appropriate evaluations can be made of the survey population. This is followed by a description of the survey population and the findings and conclusions of this study. The final component provides the preparers' qualifications and a list of works cited. Appendix A (included in Volume I) has letters received from the interested public during the public participation process, Appendix B (included in Volume I) has map figures, and Appendix C (Volume II-A and II-B) contains the bridge inventory rating sheets.

Figure 1 (Appendix B) illustrates the counties in which this survey was conducted and the number of bridges inventoried in each county. Figure 2 (Appendix B) provides a set of regional maps of California, based on Caltrans Districts, showing the location of each bridge studied for this report. The inventory rating sheets in Appendix C provide the scores of the 1980s survey, the scores from the current survey, photographs of each bridge, location data (including a location map), and historic evaluation information.

Of the 262 bridges studied for this report, sixty-five bridges were previously listed in or determined eligible for listing in the National Register, nine bridges appear to meet the criteria for listing in the National Register based on evaluation during this survey, 186 bridges do not appear to meet the criteria for listing, and the significance of two bridges has been left undetermined at this time. Among the bridges that appear ineligible, there is one bridge that was previously determined eligible, but has lost historic integrity and thus no longer appears to meet the criteria for listing in the National Register. The nine bridges that appear eligible are listed in Table 1. Two of the nine bridges are administrative corrections to Caltrans' database that lists historic eligibility by bridge number. One of these structures is part of a large, previously identified, historically significant bridge with multiple bridge numbers of which only one bridge number had been cataloged as eligible in the departments’ database. The other of these structures was previously determined eligible as a contributor to a historic district, but not identified by its bridge number in that evaluation.

Table 1: Bridges that appear to meet the criteria for listing in the National Register

County	Bridge #	Road / Street	Feature Intersected	Year Built	Truss or Bridge Type
Del Norte	01C0005	South Fork Road	South Fork Smith River	1948	Solid-Ribbed Arch
Humboldt	04C0055	Mattole Road (Honeydew)	Mattole River (Honeydew)	1920	Camelback
Mendocino	10 0136	State Route 1	Albion River	1944	Baltimore Petit / Timber Truss
Sonoma	20C0248	Lambert Bridge Road	Dry Creek	1915	Parker
Sacramento	24 0121	State Route 160	Three Mile Slough	1949	Lift
San Joaquin	29 0016F	W120-S5 Connector	San Joaquin River	1949	Bascule
	29C0023	Navy Drive	San Joaquin River	1941	Swing
Santa Cruz	36C0085	San Lorenzo Way	San Lorenzo River	1912	Spandrel-Braced Arch
Los Angeles	53C1880	Sixth Street	Los Angeles River	1932	Solid-Ribbed Arch

TOTAL: 9 bridges

Revisions, September 2004

This report was transmitted to OHP for review and concurrence on April 30, 2004. On August 27, Caltrans staff met with Steve Mikesell and Hans Kreutzberg of OHP to discuss the report. As a result of this meeting, the current section 4.1 was added to the report, and section 5.2 was expanded. These revisions were carried out by Caltrans architectural historian Andrew Hope, who is managing the statewide historic bridge inventory update. The revised and expanded sections provide additional information on changes to the population of metal truss bridges since the original statewide survey of the mid-1980s (section 4.1) and describe in more detail the analysis that was done to identify bridges that appear to be eligible for National Register listing (section 5.2). There have been no changes to the reports’ conclusions with respect to which bridges are eligible or ineligible for National Register listing.

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1. PROJECT DESCRIPTION – HISTORIC BRIDGE INVENTORY UPDATE

1.1. Background

Caltrans conducted its first comprehensive historic bridge inventory, for all bridge types, between 1984 and 1986. The department prepared reports and documentation, on behalf of the Federal Highway Administration, in order to consult with and obtain concurrence from the California State Historic Preservation Officer (California Office of Historic Preservation or OHP) regarding the eligibility of the state's roadway bridges for listing in the National Register of Historic Places. Caltrans prepared a report on trusses and movable bridges separate from the other types. It completed and received concurrence from OHP on the truss report in 1985. This report included 370 metal truss bridges, 85 of which were either determined eligible or remained eligible or listed, having been previously evaluated before the survey. Caltrans completed the reports on other bridge types in 1986 and OHP concurred with the findings of the remaining bridge types in 1987. Caltrans subsequently published bridge logs that listed the National Register eligibility for all bridges within its jurisdiction, including both those owned by the state and by local agencies. The department created two lists of bridges, those on state highways (including interstate highways, US routes, and state routes) and those on local agency roads, i.e. county or city roads / streets. Each list was organized by county name and bridge number. The historic eligibility categories were assigned as follows: 1) Listed in the National Register; 2) Eligible for the National Register; 3) Possibly Eligible for the National Register; 4) Historic Significance Not Determined; and 5) Not Eligible for the National Register.

From 1987 until the mid-1990s, Caltrans, local agencies, and others relied on the determinations cited in the historic bridge logs to indicate the historic significance of roadway bridges in California. These determinations were used, as applicable, for compliance with environmental and historic preservation statutes and regulations as they relate to historic resources, most often for compliance with Section 106 of the National Historic Preservation Act, National Environmental Policy Act, and California Environmental Quality Act.

By the mid-1990s, Caltrans began re-evaluating bridges (or requesting re-evaluations of bridges) on an individual basis as it became evident that the accuracy of the original survey was diminishing. First, bridges built in 1936 or later had not been 50 years old at the time of the first survey and now needed to be addressed under National Register criteria without consideration of exceptional importance. This accounted for hundreds of bridges that were built during a period when California's transportation system grew enormously in the late 1930s, 1940s, and early 1950s. Second, many older bridges, particularly metal trusses, had been replaced so that the population comparison of similar properties had been markedly reduced. Approximately 35 percent of the 370 bridges studied in the 1980s have either been demolished or relinquished to private ownership. Twenty-five of those bridges were either listed or eligible. This reduced the comparable properties and decreased the number of important representative examples. Third, there were also several innovative bridge types and technologies introduced for use on California's roadways during the 1930s, 1940s, a nd 1950s that had not been addressed in the 1980s survey. Case by case, project by project, evaluations continued throughout the late 1990s and into the 2000s. This method of re-evaluation, however, was generally inefficient and was, at times, inconsistent. Thus in 2002, Caltrans decided to conduct a thorough update of the 1980s survey. This update is important for producing more consistent and defensible results because it permits holistic, context-based evaluations to occur with statewide comparisons of similar properties and a thorough examination of new and innovative bridge types and technologies from the 1930s, 1940s, and 1950s.

1.2. Current Project

The Environmental Program at Caltrans Headquarters in Sacramento began the project to update the Caltrans historic bridge inventory in 2002. Caltrans architectural historians reviewed and assessed the 1980s inventory, collecting all records related to the survey and evaluation process. They carefully considered what elements of the previous inventory could be re-used and which elements needed to be revised. Caltrans and OHP agreed that the Historic Bridge Survey Update would include bridges constructed prior to 1960 so that individual bridge re-evaluations will not be necessary until 2010. Caltrans staff then assembled a database from the Office of Structures Maintenance and Investigation bridge logs, both for state bridges and local agency bridges, along with the logs listing the historical significance of bridges, to help derive a list of structures to be surveyed and evaluated. The database included information on the location, type, material, and construction date of each bridge. Caltrans architectural historians also examined other maintenance records, previous historical survey records, and recent historic evaluations to compile the survey population for the update project. Once the lists of bridges by type were completed, information on each bridge was collected, including rating sheets from the original survey, photographs, and bridge reports stored at Caltrans Office of Structures Maintenance and Investigation. Caltrans staff also contacted local historical societies and other interested parties to ensure compliance with public participation requirements within Section 106. Caltrans architectural historians and consultants conducted the field inventory work and historic evaluations for the update. As a part of the update project, JRP prepared a historical overview for all roadway bridges constructed in California between 1936 and 1959, and conducted a survey and evaluation program for metal truss, moveable, steel arch, concrete arch, concrete truss, suspension, and timber truss bridges. As described below, Caltrans had JRP inventory the metal truss, moveable, and steel arch bridges, as well as concrete arch bridges, using numeric rating systems. Caltrans had JRP inventory and evaluate bridge types with smaller populations, such as timber truss, concrete truss, and suspension bridges, using standard qualitative historical methods that included the preparation of DPR 523 forms and a separate report.

This report is part of the larger 2002-2004 Caltrans Statewide Historic Bridge Survey Update project that includes re-evaluations of all extant bridges surveyed and evaluated in the original 1986 Historic Bridge Inventory as well as evaluations of bridges that are now over 50 years old or built before 1960. This report deals specifically with the 262 metal truss, steel arch, and movable bridges and provides assessments of which structures appear eligible for listing in the National Register of Historic Places. Bridges that were determined eligible in the original survey, or in individual evaluations since that time, remained eligible unless they lost integrity because of substantial alterations.

2. FIELD AND RESEARCH METHODS

2.1. Compilation of Information and Research

Caltrans provided JRP the newly compiled database and a list of 262 metal truss, movable, and steel arch bridges, along with information on each individual bridge including scoring sheets from the original survey, copies of photographs, and bridge reports. JRP organized these records into field research sets. JRP entered data from the original scoring sheets into the database and added other data fields to be used during survey work. JRP located all bridges subject to the survey on road and street maps and collected field research sets into units based on location of bridges, generally by groups of counties and/or by Caltrans district.

JRP also conducted historical research for the bridges prior to and/or after conducting field work, to help assess the possible significance survey population bridges may have under Criterion A. JRP used previously collected information, including from the current and previous historic overviews, city, county, and state maps, United States Geological Survey quadrangle maps, and other sources to make a preliminary determination of whether or not specific bridges might be eligible under Criterion A. JRP restricted this research to those bridges that were not already listed in or determined eligible for listing in the National Register.

2.2. Fieldwork

Caltrans architectural historians revised the numeric system used in the original survey for the update survey. Prior to starting fieldwork, JRP staff familiarized themselves with the scoring system and conferred with Caltrans regarding recordation standards. JRP prepared field survey forms with each bridges location data, previous survey scores, current scoring fields, and notes fields. Caltrans specified that JRP take high-quality digital photographs of each bridge in the survey population. JRP used Olympus C-720 cameras taking three mega pixel photos at 1984x1488 pixel resolution.

2.2.1. Numerical Scoring System

The numerical scoring system to survey California's metal truss, steel arch, and movable bridges constructed prior to 1960 is a modified version of the scoring system Caltrans used for the original metal truss bridge survey conducted between 1984 and 1986. This system provides indicators of a bridge's possible significance under Criterion C. For this survey update project, Caltrans modified the original scoring system to account for bridges constructed after 1936 and to separate historical significance from the numerical system. The scoring system provides relational data that was then used to help assess which bridges appear eligible for listing in the National Register.

Caltrans developed the scoring system for the 1980s bridge inventory from those used in other states as well as from the City of San Francisco's historic building survey. It modified the various numeric system examples to reflect the distinctive qualities of California's bridges and to improve upon previous methodologies. Caltrans decided to continue use of the numeric system to provide continuity between the 1980s survey and the update. The eight categories of points in the revised scoring system represent variable elements of a bridge's possible significance. The system assigns points to each variable creating a weighted system. As with the 1980s study, this point system transforms ordinals into integer ratings and distinguishes between the relative importance of the variables.

For the update survey, Caltrans dropped one category from the original point system as it was found to mix considerations needed to distinguish between a bridge's possible significance under Criterion A and Criterion C. Originally, Caltrans assigned 10 points for bridges that appeared to be significant at the national level, 7 points for bridges that appeared significant on the state level, 3 points for bridges that appeared significant at the local level, and 0 points for bridges that did not appear to be significant or their significance was unknown. In the revised scoring system, no points were given based on historical association or significance within the theme of transportation. Rather, Criterion A significance has been evaluated separately from the numeric system.

In the revised system, Caltrans also modified the points given on the basis of a bridge's date of construction. Caltrans decreased the negative emphasis placed on the age of youngest categories of bridges in relation to other categories. At the same time, the new point system does not remove the value of age of the state's older bridges. In the 1980s, Caltrans assigned 4 points to bridges built between 1930-1937, 0 points to bridges built between 1937-1945, and -20 points to bridges built after 1945. In the new system, 4 points are assigned to bridges built between 1930-1945, and 0 points to bridges built between 1946-1959. The new scoring system provides a maximum score of 90 points, compared to 100 points for the 1980s system.

As shown on the following pages, the categories are divided into two general groups, both of which contribute to an assessment of a bridge's significance under Criterion C, including information to evaluate a structure's relative significance for its type, period, and method of construction. Points are also given for the relative importance of a bridge as the work of a master builder or designer. The first group of points are assigned to bridges based on historical and physical facts. These categories are its date of construction, number of spans, length of span, whether the structure is pin-connected and/or iron, and its rarity. The second group of categories is more subjective and requires interpretation of historical information, appraisal of decorative features, and assessment of aesthetics and historic integrity. These judgments were made when the bridges were recorded in the field, and also following completion of fieldwork when comparisons could be made between bridges from across the state. Caltrans decided generally to rely on scores from the previous survey that appeared correct or reasonable. JRP found it necessary, however, to conduct categorical assessments to provide greater consistency between the scores of similar bridges. In some cases, bridges appeared to be similar or the same as they were in the 1980s, but JRP altered points in particular categories so that those scores were consistent with scores in the overall bridge population and among similar structures. JRP adjusted scores for consistency in the categories for builder / designer significance, aesthetics, and integrity. Upon examination of the rarity (or surviving number) category, it was unclear what categories Caltrans used during the 1980s to assign the numeric score. JRP and Caltrans worked together to assemble a list of truss types that accurately reflected the various bridge types in this survey.

Revised Scoring System for Metal Truss Bridges

Category	Points
DATE OF CONSTRUCTION	
Pre-1900	20
1900-1909	16
1910-1919	12
1920-1929	08
1930-1945	04
1946-1959	00
BUILDER / DESIGNER	
Major example of significant builder / designer	12
Minor example of significant builder / designer	06
Builder / designer not significant, or not known	00
NUMBER OF SPANS	
1	00
2	02
3	04
4	06
5 or more	08
LENGTH OF SPAN (IN FEET)	
Pony <60; through <125; deck <150	00
Pony 60-80; through 125-150	04
Pony >80; through >150; deck >150	08
SPECIAL FEATURES	
Pin-connected	04
Not pin-connected	00
Iron	04
Not Iron	00
Decorative features (major)	04
Decorative features (minor)	02
No decorative features	00

AESTHETICS

Structural	
Excellent	05
Good	04
Fair	02
Poor	00

Setting	
Excellent	05
Good	04
Fair	02
Poor	00

TRANSPORTATION SIGNIFICANCE / HISTORICAL ASSOCIATIONS

Removed from current survey

SURVIVING NUMBER OF TYPE (RARITY)

1	20
2	19
3	18
4	17
5	16
6	15
7	14
8	13
9	12
10	11
11	10
12	09
13	08
14	07
15	06
16	05
17	04
18	03
19	02
20	01
>20	00

INTEGRITY

Location / Setting	
Excellent	0
Good	-3
Fair	-6
Poor	-9
Design / Materials / Workmanship	
Excellent	0
Good	-3
Fair	-6
Poor	-9
Feeling / Association	
Excellent	0
Good	-1
Fair	-2

2.2.2. Bridge Recordation

Prior to commencing with the main fieldwork, JRP undertook a series of test recordations with Caltrans to assess the efficiency of the revised scoring system and promote consistency to be achieved by various individual surveyors.

After completion of the test recordation steps and coordination regarding recordation standards, JRP conducted the fieldwork survey in two person field crews. Each of the 262 bridges was field checked and its existing score was confirmed or amended. Recordation included photography of each bridge, examination of any alterations to the structure, review of alterations to the setting, and assessment of the potential for the bridge to be considered part of an historic district or historic landscape. As discussed above, JRP revised some scores to improve the consistency of scores upon review of the entire survey population.

Each of the 262 bridges was given a score according to the system described above. Based on the results of the survey and scoring, JRP then identified bridges that appear to meet the criteria for listing in the National Register of Historic Places. In addition to scoring, other factors that were taken into account were the results of the public participation effort, whether or not the bridges examined appeared to be contributing resources to some larger historic district and/or historic landscapes, and an analysis of the subset of bridges that might be eligible under Criterion A.

2.3. Public Participation

In April 2003, Caltrans sent letters to the county planning departments of each county in California, nine cities, and 58 historical societies and historic preservation organizations, informing them of the statewide historic bridge survey update and inviting their comments. The only response related to metal truss bridges was from Tuolumne County Historical Society, requesting an opportunity to comment on the evaluation of bridges in that county.

Caltrans sent draft copies of this report on January 12, 2004 to the Sonoma County Landmarks Commission, the Sonoma County Department of Public Works, and the Tuolumne County Historical Society. These were abridged copies of the draft report, including Volume I and the bridge ratings sheets only for those bridges in Sonoma and Tuolumne Counties, respectively. No response was received from these organizations.

Architectural historian Don Napoli of Sacramento also requested a draft copy of the report, which was sent to him on January 26, 2004. Mr. Napoli responded on February 13, 2004 with a number of helpful review comments. His letter and Caltrans response are included in Appendix A.

3. HISTORICAL OVERVIEW

The following section provides the background and details regarding the historic themes and historic contexts with which metal truss, steel arch, and movable bridges built in California before 1960 may be associated. Emphasis has been placed on collecting information regarding the historic context of bridges that were not previously listed or determined eligible for listing in the National Register, particularly from the period between 1936 and 1959, which was not covered by the original Caltrans bridge survey in the 1980s. This historic overview is intended to provide the basis for the evaluation of bridges in this study's survey population whose significance is either being re-evaluated or evaluated for the first time. The first part of this section deals with important events and trends in transportation history before 1960 and the role bridges played within that context. The second part of the section provides information on the engineering, design, and construction of bridges in California prior to 1960.

3.1. Important Events and Trends in Transportation Development

Until the end of the nineteenth century, roadway bridge building in California was largely conducted by private companies or individuals, with little input from local or state government. Around the turn of the twentieth century, the state began to create legislation enabling counties to take over the role of establishing and maintaining roads and bridges. County officials continued to be the dominant players in bridge construction until the voters passed a series of bond measures beginning in 1910 that led to the creation of the California Highway Commission (later renamed the California Division of Highways). As motor vehicle use grew across California, the state, counties, and cities built ever-increasing numbers of bridges. With the growing demand, bridge design and construction methods changed and designers and builders sought innovative solutions to meet the changing requirements of the state's roadway system. Improved bridge design and construction methods helped provide safer more efficient roadways and highways in the state, required by the increasing volume of private and commercial vehicle traffic. Highway and bridge engineers developed the necessary infrastructure to service regional markets and to provide the means to transport local resources widely for manufacturing and the public's consumption. Over time and throughout the mid-twentieth century, first and second generation bridges dating from the nineteenth or early twentieth century were replaced as the state, counties, and local communities sought ways to provide appropriate transportation corridors to connect burgeoning towns and cities while accommodating the demands of an expanding state economy and growing population. During World War II and in the postwar years, bridges also became crucial links in a transportation system expanded to manage the movement of military personnel and equipment between the new military facilities located throughout the state. Naturally, bridges played a critical role in the state's roadway and highway system that continued in the 1940s and 1950s, as the nation's defense and growing transportation needs required reliable bridges in California to carry increasingly heavy loads and traffic volumes. Immense population and economic pressures following the war resulted in the construction of the freeway system that became a hallmark of mid-twentieth century California.

The following discussion divides the period 1880 to 1959 into six chronological periods. The first period addresses the changes that occurred at the turn of the twentieth century that brought county surveyors and engineers to the forefront of bridge building. The second period details the shift of bridge building responsibility from the county officials to the newly created bridge department of the California Division of Highways. The third period addresses roadway bridge building by the state government as California emerged from the Great Depression. During the late 1930s and into 1940 and 1941, the Division of Highways began to replace hundreds of old bridges, and developed plans and constructed the state's first freeways. During this period, the federal government also required California to improve its bridges as the country prepared for war. The fourth period details bridge construction and maintenance during World War II, a period when there was relatively little new bridge construction. The fifth period focuses on the decade immediately following World War II, when the state implemented its expansive plans for freeways and improved highways throughout the state, constructing hundreds of new bridges to meet the demands of the rapid economic and population growth of the period. The last section explores the enormous influence that the Federal Highway-Aid Act of 1956, and subsequent legislation, had on California's bridge program.

3.1.1. County Era: 1880 to 1910

In California as elsewhere, the nineteenth century truss bridge was chiefly a railroad bridge. California counties built few bridges prior to 1880 and it was not until the automobile age of the early twentieth century that substantial numbers of highway bridges were constructed by public agencies. Until the 1880s, highway bridge building in California was a predominantly private endeavor. While a few counties built public bridges as early as 1855, it was not until 1874 that the state legislature adopted a comprehensive program through which counties could establish road districts, road commissioners, and property taxes reserved for road construction. The ability of counties to undertake bridge construction was further enhanced by an 1893 state law mandating each county to seek the advice of its county surveyor on bridge design. This law had the effect of helping professionalize the office of county surveyor and attract trained bridge engineers to the office.[1] Though counties typically built trusses early in this period and then began to shift to reinforced concrete structures, the bridges built in each county often reflected the local traditions and preferences of the county surveyor.

An additional force that contributed to a change in design and construction of truss bridges in California was the organization of the American Bridge Company as a subsidiary of U.S. Steel. This created a national firm capable of overcoming the natural advantages enjoyed by California-based builders. American Bridge, at the time of its organization, controlled fifty percent of America's bridge building capacity and would come to dominate truss fabrication throughout the United States.

These developments, coupled with the large increase of the number of bridges being built, changed the role of the truss bridge. The typical truss bridge after 1900 was designed by a county surveyor to American Bridge standard specifications and was located at a major crossing. Extant examples remain in remote areas, such as the Basso's Ferry Bridge (38C0317Z) shown in Photograph 1. Further, the truss occupied a decreasing proportion of the total number of bridges being built. By the 1930s trusses were used less frequently for "ordinary" spans that were fixed and of moderate length, though they were utilized for extraordinary situations, particularly where a movable structure was needed or a long span was required.[2]

Photograph 1: Bassos Ferry Bridge (38C0317Z) over Tuolumne River, built 1911.
April 2003.

3.1.2. Early State Era: 1909 to 1929

The passage and approval of the State Highway Act in 1909-1910 provided funding for the construction and acquisition of a system of state highways. The California Highway Commission (later renamed the California Division of Highways) was created in 1911 to oversee this work and maintain the highway system. Though during much of this period many of the structures were still the responsibility of the counties, the state began to have increased influence on the design and construction of bridges throughout California. Beginning in 1912, the commission required that all structures built as part of the state highway project be designed by competent engineers and the plans, specifications, and workmanship be subject to the inspection and approval of the Highway Engineer. The Commission also established minimum width and live load guidelines for their designs and went on record in favor of the use of reinforced

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[1] Paul Bryan Israel, Spanning the Golden State: a History of Highway Bridges in California, (Masters Thesis, University of California, Santa Barbara, 1980).

concrete designs when possible.[3] The increase in workload caused by the design and approval requirements led to the creation of a Bridge Department within the Highway Commission. Reliance on the counties to furnish bridges had led to the bridgework lagging behind road construction on state highways. In response, the highway commission began requiring that all bridge design and construction on the state highway system be done under the direction of the Bridge Department beginning in 1923.[4]

3.1.3. Depression Era 1930 to 1940

Following the lowest point of the Great Depression in the early 1930s, bridge construction in California became an integral part of state and federal plans for economic recovery through public works projects. Government employment relief programs helped spur this recovery, and the federal government provided much of the funding for bridges constructed in the state during this period. Infused with New Deal money, the California Division of Highways added new highways, built new bridges, and upgraded county roads into the state highway system. During this period, the state struggled to deal with its "old bridge problem"—replacing inadequate often pre-automobile structures to accommodate a growing volume of vehicular traffic and to address new safety issues.[5]

3.1.3.1. The "Old Bridge Problem"

In October 1939, the head of California's Division of Highways' Bridge Department, Frederick W. Panhorst, presented a paper to the Bridge Committee of the American Association of State Highway Officials (AASHO)[6] entitled "The Old Bridge Problem." Panhorst summarized the issues California faced as its first and second generation highway and roadway bridges, built for horse and buggy, became obsolete in the face of increased automobile and truck traffic. This

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2 California Department of Transportation, *Historic Highway Bridges of California* (Sacramento: California Department of Transportation, 1990), 43.

3 Israel, "Spanning the Golden State," 56-60.

4 Israel, "Spanning the Golden State," 70.

5 "Agency History," Department History File, 1927-1971, California Department of Transportation Library.

6 The American Association of State Highway Officials is now known as the American Association of State Highway and Transportation Officials.

problem became one of statewide importance as the Division of Highways took over control of an increasing number of county and local roads across the state. In 1933, the Division of Highways took over secondary roads that included 1,235 bridges, thirty percent of which needed immediate repairs or required imposition of load limits. While many bridges were adequate, there was a distinct need for improved structures on highways used by trucks, which regularly damaged the old bridges, many of which were metal through trusses. Sometimes collisions led to collapse. Moreover, for newer vehicles, approaches were too narrow or too curved, bridge floors were not strong enough, and guardrails inadequate. During the 1920s and 1930s, trucks had increased not only in volume on California highways, but also in size and load. By the late 1930s, semi-trailers and other large vehicles were in common use crossing California bridges applying loads beyond the design limits of many bridges. Motorists demanded wider and safer bridges permitting higher speeds and straighter roadways. Statewide inspections of structures were limited at the time, and many older structures were coming to the end of their effective life. Despite an influx of federal funding into the state for roads and bridges, there were still insufficient funds to replace or upgrade all the bridges that needed improvement. Replacement of old bridges continued throughout the mid-twentieth century as can be seen in Photograph 2, when the old timber truss bridge at Rio Vista along the Sacramento River was replaced in the 1940s.

Photograph 2: Rio Vista Bridge on Sacramento River (23 0024) on right, replaced earlier timber structure. [*CH&PW*, January 1946, 16.]

3.1.3.2. Influx of Federal Funding Stimulated Bridge Construction

California, like all states, received large allocations of federal money during the Great Depression. The state and local agencies built many bridges constructed during the period before World War II, in some portion, with federal funding. During the Depression, local California governments sought to reduce their financial and road building responsibilities and lobbied the state and federal government to assume a greater burden of road and bridge improvements. In response, the legislature authorized Division of Highways to make improvements on city streets and county roads that connected with the State Highway System in 1931, and in 1933 the state provided further assistance with the introduction of a gas tax that reduced reliance on local property taxes.[7]

The state received funds from the federal government for highway and bridge construction from the National Industrial Recovery Act of 1933, the Hayden-Cartwright Act of 1934, the Emergency Relief Appropriation Act of 1935, the Public Works Extension Act of 1937, and the Federal Aid Highway Act of 1938. The federal government enacted these measures to provide jobs for the millions of unemployed Americans during the Depression. The money from these acts funded a majority of construction projects in the state during the 1930s.[8] Federally funded projects tripled the Bridge Departments’ work load, necessitating additional personnel. In 1936, the Bridge Department employed 205 personnel, nearly double the number employed by the department just two years earlier.[9] In the years preceding World War II, bridge construction demand grew as the country mobilized for possible war. The importance of infrastructure improvements was fully demonstrated in 1940 when the War Department demanded improvements to the state highway system as part of the national defense effort.[10]

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[7] David W. Jones, Jr., Californias’ Freeway Era in Historical Perspective, (Institute of Transportation Studies, University of California, Berkeley, June 1989), 152.

[8] California Department of Public Works, Division of Highways, *Tenth Biennial Report to the Governor of California by the Director of Public Works* (Sacramento: California State Printing Office, 1936), 69-70, 19, and 85. The Emergency Relief Appropriation Act not only required that work completed with funds from the act be done by previously unemployed workers, but also stipulated their rate of pay.

[9] Division of Highways, *Tenth Biennial Report*, 1936, 19 and 65.

[10] Division of Highways, *Twelfth Biennial Report*, 1940, 25.

3.1.4. World War II Era: 1941 to 1946

Preparations for entry into World War II created new challenges for the California Division of Highways as mobilization required immediate and widespread highway and bridge improvements. Even before the war began in Europe, the Division of Highways, in conjunction with the federal Public Roads Administration, began planning road and highway improvements that would link California with the National Defense Highway System. California's climate, Pacific Coast location, and available undeveloped land made it an attractive site for military training and war industries. The upgraded highway system, complete with new and upgraded bridges helped move military personnel and heavy equipment around the state. The period of wartime construction and building material shortages / restrictions began after the U.S. entered the war in 1941 and lasted through 1946.

In the period prior to and during World War II, the federal government located bases, airfields, shipyards, depots, and factories in the state, many of which were clustered in Southern California and in the San Francisco Bay area. In addition to moving the military, the goal of the National Defense Highway System was to maintain roadways that could connect raw materials and agricultural products with manufacturing and industrial centers. As part of the planning process, a Division of Highways' bridge study in December 1940 listed approximately 1,500 bridges on California highways that were to be part of the strategic military highway network. The study showed that nearly one half of the bridges on highways designated as necessary for military use needed repair or needed to be replaced, widened, or strengthened to War Department standards. The Division of Highways used both state revenues and regular federal appropriations including Federal Aid funds, Federal Aid Secondary funds, and Federal Aid Grade Crossing funds to make the necessary improvements to state highways required for the strategic road system in California and to build access roads to new military installations. Recognizing the need for additional funds to achieve highway and bridge construction defense needs, Congress passed the National Defense Highway Act of 1941 that appropriated and authorized additional expenditures for California's highway bridges. While the act eased some of the financial burden to California, the Department of Highways still needed to constantly reconsider and reevaluate the necessity of some of the proposed and planned projects in light of defense needs.[11]

The mobilization for war both in terms of personnel and materials During World War II impacted the Division of Highways along with other government entities along with private industries, was affected by the. Maintenance and construction programs were affected by the loss of a skilled and trained construction labor force to military service and defense work. By 1942, 1,200 employees had left the division to enter the military or work in various defense industries. Personnel issues became so dire that by 1944, the division was hiring high school and college age employees who were too young for the draft, and had women working in drafting rooms and other jobs typically filled by men. Most of these employees were terminated at wars end to allow returning service men to regain their jobs.[12] Scarcity of personnel and materials halted much of the scheduled repair and maintenance needed on bridges, and federal restrictions on use of structural steel, reinforcing steel, timber, and hardware mostly halted new bridge construction except those needed for defense purposes.

Bridge Department engineers adapted designs for the situation using substitute materials for new construction as well as for the repair of existing bridges. Steel was in the greatest shortage as the military controlled most of its use. Plates and rolled shapes for steel bridges as well as reinforcing steel for concrete structures were essentially unavailable for bridge construction. The bridge department used salvaged steel rails from old logging railroads, for instance, to construct or repair bridges. Engineers reused existing truss bridges, sometimes turning them upside down to fit the requirements of a new site, or had temporary timber superstructures built which could be replaced with steel when it became available. Some bridges constructed during this period were built with unusual and innovative designs combining various structural components to satisfy the engineering requirements. The Albion River bridge on SR1 built in 1944 (10 0136), shown in Photograph 3, is an example of a combination bridge. It is a timber truss bridge with a

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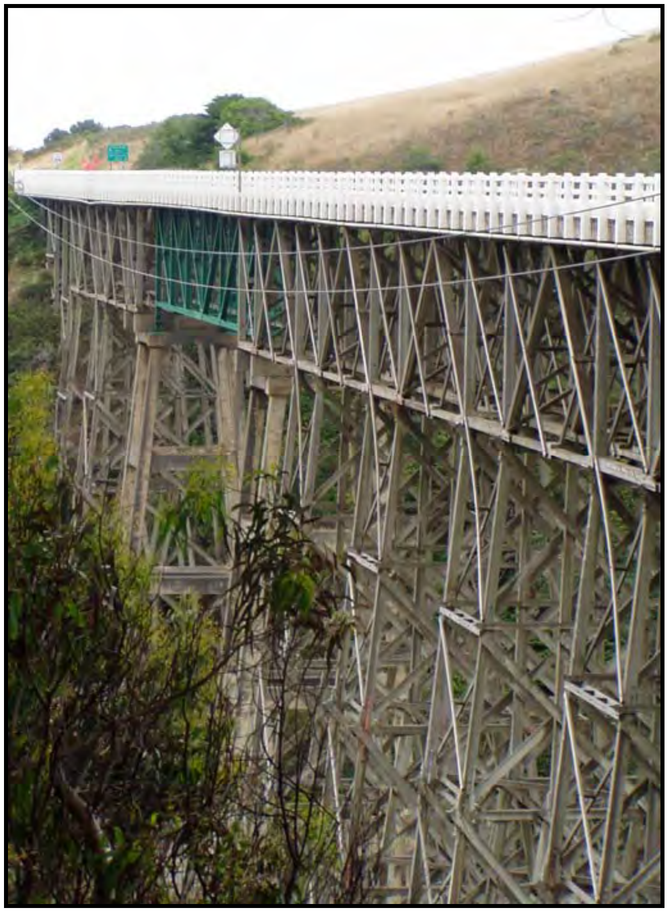
[11] F.W. Panhorst, 700 Bridges on Federal Military Highway Network, ; and Division of Highways, *Thirteenth Biennial Report*, 1942, 13-17.
[12] Division of Highways, *Thirteenth Biennial Report*, 1942, 40; and Division of Highways, *Fourteenth Biennial Report*, (Sacramento: California State Printing Office, 1944), 41.

steel Baltimore Petit truss over the waterway flanked by concrete tower bents. Its metal truss was reused from an abandon railroad line in Butte County.[13]



Photograph 3: Bridge 10 0136, SR1 over Albion River,
built 1944. August 2003.

As major bridge replacement projects faltered during the war years, the Bridge Department focused its limited resources on reducing its backlog of deferred maintenance. As discussed above, the state had taken over many local and county roads during the 1930s and found many of the bridges in need of repair or replacement. Most of these older bridges had not been regularly inspected or maintained by their former owners. During the war, the Bridge Department prepared inspection reports on each bridge within the state highway system. Based on the

[13] F.W. Panhorst, Lack of Material Forcing Engineers to Adopt Unusual Bridge Designs, *California Highways and Public Works,* February 1942, 2; and Division of Highways, *Fifteenth Biennial Report*, (Sacramento: California State Printing Office, 1946), 19-23, 45-51.

reports, all bridges were classified into groups, depending on their load capacities and structural safety. Maintenance and repair to steel truss bridges, for example, was divided into three classes: regular maintenance to preserve the structure; repair of accidental damage; and strengthening and improving clearances.[14]

During the war years, the division not only concerned itself with the national defense readiness of California's roads, but it also began long-range planning for postwar expansion and construction in partnership with the federal government. This was part of a government-wide effort to face the issues of postwar recovery. Starting in 1943 the Reconstruction and Reemployment Commission began planning and implementing a comprehensive program for transition to a peacetime economy. The influx of workers to defense industries in both northern and southern California, combined with the anticipated flood of returning service personnel, created a potential postwar unemployment problem. The commission identified a highway public works program, with bridge construction, as a key component of economic development in the postwar era as the labor-intensive construction projects could absorb much of the surplus manpower. In response, the Division of Highways developed a plan to modernize the state highway system that included replacing many of the state's aging bridges.[15] Passage of the Federal Aid Highway Act in December 1944 assured California of federal funds for post-war highway and bridge construction. Of primary importance, the act provided for the development of a national system of interstate highways, which in California totaled 2,820 miles of the initial system, connecting major metropolitan centers. It also provided funding for construction and maintenance of a secondary or feeder network of highways designed to connect rural areas to urban centers, complementing the primary interstate highway system.[16]

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[14] F.W. Panhorst, "700 Bridges on Federal Military Highway Network," 2-3; and J.S. McClelland and W.J. Yusavage, "California Bridges, Cost and Volume of Bridge Construction: 1934-1952," *California Highways and Public Works*, January-February 1953, 31; Harvey D. Stover, "State Highway Bridge Maintenance Involves Care of 4,633 Structures," *California Highways and Public Works*, March-April, 1944, 12; and R.J. Israel, "Bridge Maintenance Practice on California Highway System," *California Highways and Public Works*, May-June, 1945, 4.

[15] The program eventually led to the construction or reconstruction of approximately 465 miles of state highways, including 76 bridges and grade separations of varying sizes and types. "$87,829,500 Provided by Legislature for Postwar Reemployment, Reconstruction and Readjustment," *California Highways and Public Works,* Sept.-Oct., 1943, 1; and C.H. Purcell, "Defense Highway Program in California Reached Total of $52,880,000 August 1, 1942," *California Highways and Public Works,* August 1942, 1, 11, 18.

[16] Division of Highways, *Fifteenth Biennial Report*, 1946, 19-23, 45-51; Division of Highways, *Thirteenth Biennial Report*, 1942, 16-17; California Department of Public Works, Division of Highways, *Fourteenth Biennial Report*, 15; and California Department of Public Works, Division of Highways, *Fifteenth Biennial Report*, 14.

3.1.5. Postwar Period: 1947 to 1959

Following World War II, California and the United States began a period of enormous prosperity and expansion. The states' economy grew, and ever-increasing birth rates and migration expanded Californias' population from just under seven million in 1940 to 10.5 million in 1950 and nearly 16 million by 1960. Perhaps more than any other state in the country, California linked its fate to its transportation infrastructure. The progress was most vivid in Californias' metropolitan areas and encouraged the shift in population and wealth to the states' urban centers. Both in response and as a contributor to the economic recovery and growth of the period, the state built hundreds of miles of highways and thousands of bridges. Furthermore, automobiles and trucks continued to supplant railroad passenger travel and freight shipment during this period as Californians chose to ride in their cars, eschewing buses and trains, and companies chose to truck goods from point to point over the states' highways. Finally, some of the same attitudes that attracted the military to California, its natural resources, climate and scenery, induced tourists to visit and enjoy the states' natural beauty on remote scenic highways along the California coast or in its mountains. All of these historic events and trends had profound effects on highway and bridge construction in California during the decade following World War II.[17]

3.1.5.1. Funding for Postwar Bridge Construction

The Division of Highways and local agencies needed substantial and stable sources of funding for street, road, highway, and bridge construction programs to meet the demands of the spectacular urban-industrial growth in the state following World War II. California continued to receive some federal funds from the Federal-Aid Highway Act of 1944, but with uncertain future

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[17] Andrew F. Rolle, *California A History*, (New York: Crowell, 1969), 595, 598, 602; Warren A. Beck and David A. Williams, *California: A History of the Golden State*, (New York: Doubleday, 1972), 435; Ralph J. Roske, *Everymans' Eden* , (New York: Macmillan Company, 1968), 529; and Richard B. Rice, William A. Bullough, Richard J. Orsi, *The Elusive Eden: A New History of California*, 2nd ed., (New York: McGraw Hill, 1996), 498; William H. Chafe, *The Unfinished Journey: America Since World War II,* (New York: Oxford University Press 1986), 117, 123; Richard L. Forstall, "California Population of Counties by Decennial Census: 1900 to 1990," Population Division, US Bureau of the Census, March 27, 1995, accessed October 2002 online at: www.census.gove/population/cencounts/ca 190090.txt; Kenneth T. Jackson, *Crabgrass Frontier: The Suburbanization of the United States*, (New York: Oxford University Press, 1985), 112, 123, 233, 241; Tom Lewis, *Divided Highways: Building the Interstate Highways, Transforming American Life*, (New York: Penguin Group, 1997), 85.

federal funding, the state legislature established two committees in 1945 to study the states' transportation funding needs. The work of these committees resulted in passage of the Collier-Burns Act of 1947. The act became one of the most influential pieces of state legislation for California's highway system as it was the first concise, dependable, and large scale capital investment program for highway and bridge construction in the states' history. The funds raised were largely dispersed directly to cities and counties for road construction and maintenance, with one third of the total allocated to the state.[18]

At the same time the state began funding highway and bridge construction on a large scale through the Colliers-Burns Act, the Division of Highways and counties were able to build new bridges to address growing demands at the local level. The Federal Aid Highway Act of 1944 and the states' County Highway Aid Act of 1945 provided counties funding to replace structurally inadequate bridges, which accounted for roughly half of the bridges located on county roads at wars' end. The Division of Highways organized a new section under its engineer for Federal Secondary Roads, and the Bridge Department assigned a senior bridge engineer to assist counties. Most of these bridges were constructed to allow passage for the newer larger trucks and other heavy loads not permitted on older structures. In rural and forested counties, many of the replacement bridges constructed at this time were built to help improve transportation of agricultural and timber products or livestock to market, and in urban areas, cities and counties built new bridges to improve transportation routes in industrial areas. Counties built some bridges to improve links between new suburban residential areas and city and town centers. The state, cities, and counties built others as grade separations at railroad crossings, to bypass downtown streets, or with movable spans over navigable waterways. To a lesser degree, counties at this time were also considering improved access to recreational areas.[19]

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[18] Eleanor N. Wood, "California: Mud to Megalopolis: A History of the Division of Highways," Department History File, 1927-1971, California Department of Transportation Library, 13; and David W. Jones, "California's Freeway Era in Historical Perspective," 189-192.
[19] C.L. Hollister, "California Counties Launch Construction of 55 Bridges to Cost Approximately $5,575,000," *California Highways and Public Works*, March-April 1947, 1-8.

3.1.5.2. San Francisco Bay Area Bridges – Postwar Additions

Of the thousands of bridges constructed during the mid-twentieth century throughout California, the San Francisco Bay Area received many of the state's most extraordinary structures of this period. As the city gained national and international importance, the challenges of its geographical setting required exceptional engineering achievements in transportation to help it emerge and remain one of California's most im portant cities. While the region had 1920s-era bridges crossing the South Bay and the Carquinez Strait, two of the city's most spectacular bridges were completed within a year of one another in the 1930s. The San Francisco-Oakland Bay Bridge opened in 1936, and the Golden Gate Bridge opened in 1937 between San Francisco and Marin County. These bridges are among the best-known in the country and were crucial to the development of the Bay Area's highway system. In the 1940s and 1950s, the Division of Highways continued to plan for, build, and upgrade highways and freeways in the Bay Area including construction of, and additions to, bridges in the region.

The longest, and perhaps most complex San Francisco Bay Area Bridge constructed during the post-World War II period was the Richmond-San Rafael Bridge that connected Marin and Contra Costa counties. After five years of construction, the bridge opened to traffic in 1956 ending a long history of ferry service connecting the two counties.[20]

The Carquinez Strait Bridge, which spans the Carquinez Strait and connects Solano and Contra Costa Counties, was constructed in 1927 to meet the growing traffic demands. Traffic levels grew greatly across the Carquinez Strait following World War II. The Division of Highways completed a second span in 1958 to help alleviate the problem. As shown in Photograph 4, Caltrans continues to update the crossing at the Carquinez Strait.

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[20] "Record Span New Crossing," *California Highways and Public Works,* July/August, 1956, 1; "Aluminum Falsework" *California Highways and Public Works,* May/June, 1955, 45; and New Bridge Crossing" *California Highways and Public Works,* November/December 1953, 1.

Photograph 4: Carquinez Strait Bridges (23 0015L and 23 0015R), built 1927 and 1958, with new suspension bridge in foreground. February 2003.

3.1.5.3. Ascension to the Freeway Era: 1956 to 1959

While hundreds of bridges had been built along the state's roads, highways, and freeways in the late 1940s and early 1950s, the next fifteen to twenty years proved to be the largest bridge building period in California's history. The chief impetus of this surge was the massive increase in federal funding for highway construction starting, most importantly, with the Federal-Aid Highway Act of 1956, which put into place the funding to construct the country's interstate highway system. This surge was further bolstered by the Division of Highways' freeway master plan developed in 1958. By the mid-1950s, most bridge construction in California occurred as part of freeway or highway projects that incorporated new bridge designs and styles which further led to truss structures being designed and built less frequently. Most bridges in the state were built as undercrossings or overcrossings on highways and metal truss bridges were not used in those capacities, though they were used at small crossings in rural areas, albeit infrequently.

3.2. Engineering, Design and Construction

Steel truss bridges were built in great numbers on California roads and highways starting in the late nineteenth century. After the end of World War I, newer materials and designs, especially concrete arches and girders, began to replace truss bridges.[21] In the 1930s, 1940s, and 1950s, steel trusses continued to play an important role in bridge construction in California, particularly in Northern California. Of the steel truss bridges remaining in the state from this period, the most common truss type is the Warren truss. This is followed by the Pratt truss and its variables such as the Parker truss, Camel Back, and a few Pennsylvania Petit and Baltimore Petit. The other notable truss type used during this period, as describe below, was the Bailey truss, a type developed by the military during World War II. The greatest concentration of existing steel truss bridges are in the northern portion of the state in Caltrans District 2. This is followed by the San Francisco Bay area (District 4), the northern coast (District 1), and around Sacramento (District 3). Fewer metal trusses were constructed in the southern part of the state along the Central Coast (District 5), the southern Central Valley (District 6), and the Los Angeles region (District 7). No metal trusses from this period exist in Mono, Inyo, Riverside, Imperial, and Orange counties. The distribution of existing metal truss bridges in California indicate a concentration of this bridge type in Northern California where, in some rugged counties, access to concrete plants and equipment may have been difficult and where it would have been more economical to ship dismantled metal trusses to assembly sites in rural or mountainous areas. The following sections provide brief historical backgrounds to each truss type built between 1900 and 1959 and which are still represented among the existing bridges found in California today.

3.2.1. Truss Types

In general, truss bridges are classified by the position of the deck, or roadway, in relation to the trusses. Through truss bridges carry the deck on the lower chord, or support, with lateral supports overhead. The through truss configuration was used for large structures with long

[21] Carl W. Condit, *American Building Art: The twentieth Century*, (New York: Oxford University Press, 1961), 207-211.

spans, but because it was closed overhead, the vertical clearance was restrictive. A variation on the through bridge is the pony truss bridge which carries the deck on the lower chord, but has no lateral overhead supports. Pony trusses were more commonly used for smaller bridges with short spans. Deck truss bridges carry the roadway on the top chord with the truss extending below the deck level. Deck trusses were increasingly used during the 1930s, 1940s, and 1950s, as they could be built to carry greater loads and caused no problem with vertical clearance.

3.2.1.1. Warren Truss

Patented in 1848 by two British engineers, the Warren truss type was first used in the United States in 1849. The simplest of all truss forms designed at that time, the Warren truss featured diagonals alternately sloped in opposite directions. This triangular outline makes the Warren truss one of the most easily recognizable. The Warren truss became popular in the United States at the end of the nineteenth century, but in a form that utilized vertical posts and single diagonals.[22] The Warren trusses came into common use on California highways during the 1920s and 1930s. Most Warren trusses found in California are pony trusses with the later variations in the 1940s through the 1950s commonly including both vertical supports and polygonal top chords such as the Lights Creek Bridge (09C0012) shown in Photograph 5.

Approximately three quarters of the Warren truss bridges built during this period are located in Northern California, the greatest concentration of which is in Tehama and Plumas counties.[23]

3.2.1.2. Pratt Truss (including Baltimore Petit, Camelback, Parker, and Pennsylvania Petit)

Historian Carl Condit called the Pratt the first scientifically designed truss.[24] It was invented by Thomas Pratt, a Boston-born architect-engineer, and Caleb Pratt, his father. Thomas Pratt was active in bridge design from the 1830s through the mid-1870s. He patented the Pratt truss

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[22] Carl W. Condit*, American Building: Materials and Techniques*, 100.

[23] California Department of Transportation, *Historic Highway Bridges of California*, 46; and T. Allan Comp and Donald Jackson, *Bridge Truss Types: A Guide to Dating and Identifying*, (American Association for State and Local History Technical Leaflet 95, History News, Vol. 32, No. 5, May 1977), n.p..

form in 1844, describing the design as useful in wood and iron, or in iron alone. The truss was distinctive in that it included vertical compression members and diagonal tension members. As Thomas Pratt had foreseen, this form was especially adaptable to the all-metal bridges that were built in the United States in large numbers after the end of the Civil War. It is likely that many thousands of all-metal Pratt truss bridges were constructed in the United States, first in iron and later in steel such as the Butte Creek bridge shown in Photograph 6.

In time, variations developed building upon the basic Pratt design, but with improvements to facilitate longer spans and greater loads. These variations were also given proper names, reflecting their inventor or place of origin. The three most important variations on the Pratt truss were the Parker truss, the Pennsylvania Petit, and the Baltimore Petit design.[25] Railroad companies erected Pratt truss bridges in great numbers, but this bridge type was also used on many highways during the late nineteenth and early twentieth century when improved hard surface roadways expanded through rural areas linking towns and enhancing access to remote areas.

The Parker truss was an advancement in bridge engineering as an evolution of the Pratt truss. This truss type, developed by C.H. Parker, is a Pratt truss with a polygonal top chord. Stronger than a regular Pratt truss due to its arched top chord, the Parker truss' irregularly sized pieces sometimes made it more expensive to construct. Similarly, the camelback truss is a variation on the Parker truss, as its arched top is formed by five slopes rather than a single or multiple arched top chord. The camelback's design was popular across the United States because of its economical cost and improved stress distribution.[26] The Camelback design allowed both greater standardization of its members and better stress distribution. This design created lighter structures without losing strength and was often the most economical truss for many railroad and highway spans. Though this truss type was utilized throughout the country in the late nineteenth and early twentieth centuries, few of this important truss type remain in California. The Jelly's

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[24] Carl W. Condit, *American Building Art: The nineteenth Century*, 109.

[25] T. Allan Comp and Donald Jackson, *Bridge Truss Types*, n.p. For more information on truss types, see Bruce S. Cridlebaugh, "Bridge Basics," online at: http://pghbridges.com/basics.htm (accessed on November 21, 2002).

[26] T. Allan Comp and Donald Jackson, *Bridge Truss Types*, n.p.

Photograph 5: Lights Creek Bridge (09C0012) on Beckwourth-Greenville Road, built 1947. Example of a Warren truss. August 2003.

Photograph 6: Butte Creek Bridge on Durnell Road (12C0023), built in 1904. Example of a Pratt truss. August 2003.

Ferry Road Bridge (08C0043) in Photograph 7 is an example of a Parker truss bridge, and the Mattole Rivers Bridge (04C0055) in Photograph 8 is an example of a camelback truss.

In the 1870s, as trains began to carry larger and heavier loads, engineers devised variations on the Pratt truss which enabled them to span longer distances and carry greater loads. Railroads took advantage of a new truss that utilized sub-struts and sub-ties to provide additional support. The Baltimore and Ohio Railroad initially built several of this new form, which earned it the name "Baltimore Petit," in 1871. In 1875, the Pennsylvania Railroad added an arched top chord and called its version the "Pennsylvania Petit." Other railroad lines gradually adopted these two styles, and later these truss types were adapted for highway use.[27] The Lewiston Bridge (05C0032) in Photograph 9 is an example of a Baltimore Petit truss, and the Scott River Bridge (02C0021) in Photograph 10 is an example of a Pennsylvania Petit truss.

Photograph 7: Jellys' Ferry Road Bridge (08C0043) over Sacramento River, built 1949. Example of a Parker truss. June 2003.

[27] T. Allan Comp and Donald Jackson, *Bridge Truss Types*, n.p.; California Department of Transportation, *Historic Highway Bridges of California*, 45; and Carl W. Condit, *American Building: Materials and Techniques*, 143.

Photograph 8: Mattole River Bridge (04C0055), Mattole Road, built 1920.
Example of a Camelback truss. February 2003.

Photograph 9: Lewiston Bridge (05C0032), Turnpike Road over the Trinity River,
built 1901. Example of a Baltimore Petit truss. June 2003.

Photograph 10: Scott River Bridge (02C0021), Roxbury Drive, built 1915.
Example of a Pennsylvania Petit truss. January 2003.

3.2.1.3. Bailey and other Military Surplus Bridges

The Bailey truss bridge, also less commonly known as the Army truss, was first used for military efforts during World War II. Sir Donald Bailey, of Great Britains' Royal Engineers, designed the Bailey truss in 1940 to provide quickly built and sturdy bridges for use with the new generation of tanks built at the time, each weighing up to 35 tons. By the wars' end, the army had manufactured hundreds of miles of Bailey bridges, many remaining unused following hostilities. Surplus Bailey trusses became available after the war. The truss quickly proved its usefulness and was put into use by civilians. Bailey trusses were later manufactured for civilian use.

The popularity of this truss after World War II came from its interchangeable pre-fabricated steel components and its versatility. Bailey bridges could be assembled in seven different configurations up to three panels wide and two panels stacked on top of one another, each referred to as a "story." Successive sets of panels increased the structural strength of the bridge. The need for multiple panels became necessary because as the length of the span increased the load capabilities decreased. A single story, single truss Bailey bridge could span ninety feet, and safely carry 16 tons. Adding another truss to the bridge both increased the span length and allowable tonnage, so that a single story, double truss bridge could span up to 130 feet and handle up to 18 tons. Shorter spans with additional trusses could manage larger loads, such as the Rich Bar Road Bridge (09C0041), shown in Photograph 11.

Photograph 11: Rich Bar Road Bridge (09C0041) built over the East Branch of the North Fork of the Feather River in 1951 using abutments and piers from previous bridge built in 1932. Example of a Bailey truss. August 2003.

The largest Bailey trusses were built with a double story triple truss that could extend 160 feet and handle 35 tons.[28] The easily transported Bailey truss bridges were immediately adopted for use along California roads, even prior to the wars end. These br idges appear to have all been built along local roads, in rural or suburban areas. Baileys proved to be easily adaptable to many environments and were sometimes used to quickly replace older structures or used as temporary structures.

[28] Australia Defence Army, Royal Australian Engineers, History of the Bailey Bridge, online at: http://www.defence.gov.au/army/RAE/History/Bailey_Bridge.htm, (accessed November 7, 2002); and Bailey Bridge Equipment Company, Panel Bridge, Bailey Type, M1, Structures Maintenance Historical Collection, General Information File, File 3802, California Department of Transportation Library, Sacramento. There are no examples of the double story triple truss Bailey bridges in California built before 1960.

3.2.1.4. Cantilever

With the exception of minor bridges on rural roads, cantilever truss bridges were first constructed in the United States following the Civil War. In 1867, C.H. Parker designed an iron-truss cantilever bridge for the Solid Lever Bridge Company of Boston. Railroads soon adopted the form. The first railroad cantilever bridge in the United States was built in Kentucky in 1877, and the design gained popularity during the last decades of the nineteenth century. Cantilever bridges provide a distinct advantage by permitting a long uninterrupted span created by the two opposing trusses meeting without a center support. A prominent example of this type in California is the Carquinez Strait Bridge (23 0015L), built in 1927, which was the first large highway bridge built using a cantilever truss in the state. The Division of Highways added a second cantilevered bridge at this location in 1958.[29]

Cantilever bridges continued to be built, albeit somewhat infrequently, in California during the late 1930s, 1940s, and 1950s. The Division of Highways used cantilever bridges for some of the states largest bridges of th e period, including the 1956 Richmond-San Rafael Bridge (28 0100) and the East Carquinez Bridge (23 0015R) built in 1958, both of which are through cantilever trusses. Large deck varieties erected during this period include the Pit River Bridge (06 0021) across Lake Shasta along Interstate 5 (1940, widened in 1964), the Antler Bridge (06 0089) on Interstate 5 over the Sacramento River, built in 1941, and the cantilever bridge along Route 1 across Noyo Harbor at Fort Bragg (10 0176) from 1948. The Antler Bridge (06 0089) is shown in Photograph 12.

3.2.1.5. Steel Arch

Steel arch bridges are rare in California, and there are no iron arch bridges in the state. Generally, metal arches were more difficult and expensive to fabricate and construct than metal truss bridges, and as the twentieth century progressed bridge designers and builders found other bridge types to be more economical and easier to construct. During the early period of motor vehicle traffic in the state, steel arches were among the various metal bridges used to find effective and economical means to provide safe crossings. In some circumstances, the arch form was chosen for aesthetic reasons invoking the Classical architecture popular during the early twentieth century. There were also some environmental circumstances when an arch form was the best design solution for a setting, but where reinforced concrete was not economically feasible. Steel arches are built with parallel arches and support members, constructed in deck and through form. There are two designs found in California: spandrel-braced arch and solid-ribbed arch.[30] Spandrel-braced arches have webbed triangular members like trusses, but with a rounded bottom chord that forms an arch. They are built in deck form with spandrel columns and lateral braces. There are four historic spandrel-braced metal arches in operation in California. (The Gault Bridge over Deer Creek, built in 1903, was replaced with a replica in 1996.) Solid-ribbed arch have plate girder beams cast in a curved form. The deck is supported by metal posts or suspenders attached to the arch form. There are only three solid ribbed arches in operation in California, like the George E. Tyron Bridge (01C0005), shown in Photograph 13. The Division of Highways, and later Caltrans, continued to sparingly use this bridge type, yet sometimes to great effect. Later well known examples of this bridge type include the Cold Spring Canyon Bridge on State Route 154 in Santa Barbara County (51 0037) built in 1963 and the Gerald Desmond Bridge in Long Beach (53C0065) built in 1968.

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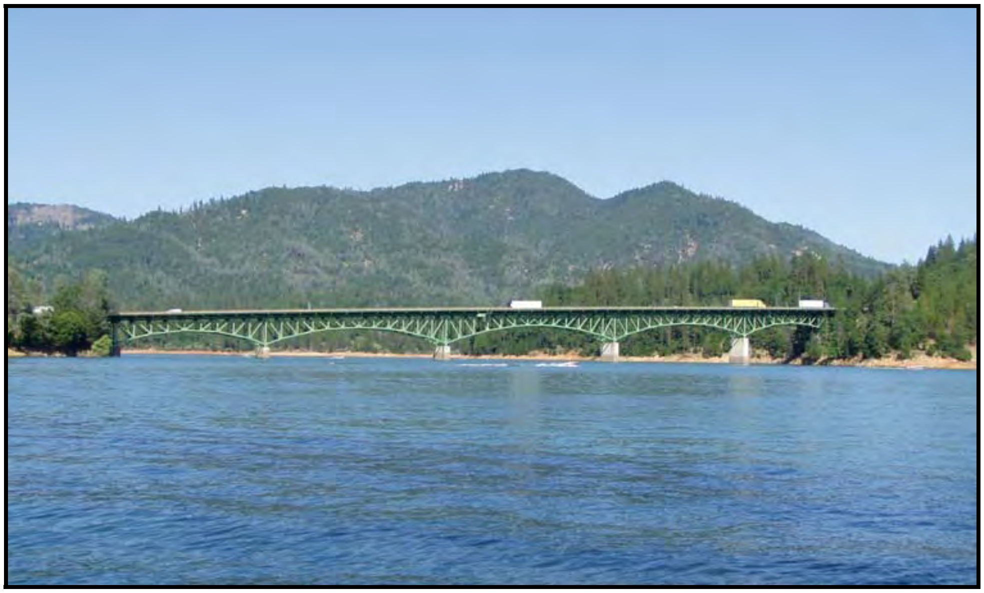
[29] Carl W. Condit, *American Building: Materials and Techniques*, 57, 144, 146, 219; California Department of Transportation, *Historic Highway Bridges of California*, 128.

[30] Arch bridges are also characterized by the degree of articulation, i.e. the location of the pin connections, or hinges, at the supports and arch crown. Bridges may be fixed or hingeless. They may also have pin connections that are used to permit some movement under rotational forces and can comprise of two or three hinges. Two-hinge arches have pin connections at the support. Three-hinge arches include a pin connection at the arch crown or midpoint of the arch. This characterization is less important than the form of arch using either ribs or truss forms.



Photograph 12: Antler Bridge (06 0089), at Shasta Lake, built in 1941. June 2003.

Photograph 13: George E. Tyron Bridge (01C0005) built 1948, South Fork Road over South Fork of Smith River. March 2003.

3.2.1.6. Movable: Swing, Lift, and Bascule

Into the mid-twentieth century, movable bridges continued to be constructed to carry vehicular traffic on highways over navigable waterways, separating highway / roadway and waterway traffic. There were three types of movable bridges built. Swing bridges were constructed with a central pivot. Lift bridges were constructed with a central span that could be raised. Bascule bridges, or drawbridges, were constructed with one or two leafs that could be raised vertically from an abutment to permit passage through the waterway. The vast majority of the movable bridges remaining in California are located along the waterways of the Sacramento-San Joaquin Delta. These delta bridges were constructed in order to support highway traffic in the area where the river once supported commercial navigation that began during the gold rush and continued well into the twentieth century. Navigation, largely recreational, is still evident today. Because movable bridges were expensive to build and operate, they were built only where absolutely necessary, a condition found only along major river transportation corridors. By the middle of the twentieth century, movable bridges fell out of favor as engineers opted to construct high, fixed span crossings. In recent decades, the state began to remove its movable bridges and replace them with fixed spans, eliminating the cost of staffing and maintaining them.[31]

3.2.1.6.1 SWING

Swing bridge types are the oldest movable bridge types and were first constructed in California in the nineteenth century, although the oldest remaining examples are from the 1910s. Symmetrical in design, swing bridges pivot from a central pier.

Popular in the nineteenth century because they were relatively easy to construct, swing bridges fell out of favor by the early twentieth century because of several disadvantages in their design: they operated slowly, had to be fully opened to allow vessels through, and, most importantly, they required a central pier in the center of a navigation channel. By the 1920s, California

[31] California Department of Transportation, *Historic Highway Bridges of California*, 111-112.

engineers favored bascule type bridges, yet continued to build some swing bridges.[32] Of the 34 remaining movable bridges in California, fifteen are swing bridges, such as the Garwoods Bridge (29 0050) over the San Joaquin River, shown in Photograph 14.

Photograph 14: Garwoods Bridge (29 0050) built in 1933 on State Route 4.
April 2003.

3.2.1.6.2 LIFT

Although small vertical lift bridges were constructed in Europe in the early nineteenth century, the first large vertical lift bridge built in the United States was the South Halstead Street Bridge in Chicago in 1892. Vertical lift bridges were slow to gain popularity, but early twentieth century improvements in design allowed for the construction of many lift bridges nationally. Unlike a swing bridge, a lift bridge lacks a central pier and consists of two large towers flanking the movable span and supporting the machinery that lifts the deck. Although the lift bridge is more expensive to construct and maintain than swing bridges when built with a short span and high lift, it is more economical and more widely used for long spans and low lifts.[33] Few lift bridges were ever built in California, some of which were replaced.

[32] California Department of Transportation, *Historic Highway Bridges of California*, 111.
[33] George Hool, et al, *Movable and Long-Span Steel Bridges*, (New York: McGraw-Hill Book Company, Inc., 1943), 158-160.

Two of the state's largest lift span bridges once resided in the San Francisco Bay Area. In 1927, a vertical lift span was included in the design of the first bridge to cross the San Francisco Bay, which was the longest bridge in the world at that time. The original Dumbarton Bridge, linking Menlo Park and Newark was a 6.5 mile structure consisting of 122 steel girder spans and nine steel through truss spans, one of which was a 228 foot vertical lift span. After 57 years of service, the bridge was demolished in 1984 after a replacement structure was completed. The Dumbarton Bridge did not remain the longest bridge in the world for long as the original San Mateo/Hayward Bridge, which also contained a vertical lift span, became the longest bridge in the world when it was completed in 1929. The total structure measured twelve miles and contained a 303 foot vertical lift span. This structure was removed soon after the completion of a replacement structure, a high-level fixed bridge, in 1968.[34]

Perhaps the most famous existing lift span bridge in California is the Tower Bridge (22 0021), linking Sacramento and Yolo counties. Built between 1934 and 1936 in the Streamline Moderne style, the Tower Bridge features exceptional parallel tower legs, adding to the vertical effect, and a steel through Warren truss.[35] Five lift bridges remain on California highways, all built or partially built between 1934 and 1949. An important example is the Commodore Schuyler F. Heim Lift Bridge in Long Beach (53 2618), which spans the Cerritos Channel connecting the ports of Los Angeles and Long Beach with Terminal Island. Its location between two of the west coast's busiest ports necessitated a long central span. Its 240 foot vertical lift through truss is raised by two 400 ton counterweights to an elevation 175 feet above the water when fully open to allow for ocean-going craft to pass. Another example is the Rio Vista Bridge (23 0024), shown in Photograph 15, which was built in two parts with the approach spans built in 1944 and the lift span built in 1960.

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[34] Bernard C. Winn, *California Draw Bridges, 1853-1995: The Link to California's Maritime Past,* (San Francisco: Incline Press, 1995), 38-41.
[35] California Department of Transportation, *Historic Highway Bridges of California*, 120.

Photograph 15: Rio Vista Bridge over Sacramento River (23 0024) built 1944/1960.
March 2003.

3.2.1.6.3 BASCULE (DRAWBRIDGE)

Early forms of bascule bridges were first constructed in Europe during the first half of the nineteenth century, but modern bascules were not developed until the 1880s. In the United States, the first bascule bridges were constructed in Chicago in 1893. They gained popularity in California in the early twentieth century as they solved many of the disadvantages that the earlier type of movable bridge, the swing bridge, faced. Bascule bridges feature a hinge, or a trunnion, which pulls the movable span upward and inward, thereby allowing vessels to pass through an unobstructed waterway. Bascules were preferred over swing types as they could be only partially raised to allow smaller boats through, thereby speeding the process. Unlike swing bridges, bascules do not need a central pier, which obstructed the shipping channel.[36]

The Strauss Bascule Bridge Company, under the direction of Joseph B. Strauss, built the majority of California's bascule bridges. Strauss, a Chicago-based engineer who maintained a San Francisco office, is best known for designing the Golden Gate Bridge. His Heel Trunnion

[36] George Hool, et al., *Movable and Long-Span Steel Bridges*, 24.

Bascule design features concrete counterweights, such as those shown in Photograph 16 of the Isleton Bridge (24 0051) that reduced the power needed to lift the leaf, or movable span. Four trunnions ensure that the counterweights are balanced.[37]

Photograph 16: Isleton Bridge, SR160 over the Sacramento River (24 0051), built 1923. March 2003.

3.2.2. Engineers, Designers, and Builders

Unlike other design endeavors, bridge design and construction is often an interwoven collective effort that includes government employees, private sector contractors, and public participation. By the mid-1930s, a majority of bridge design in California had shifted to state or county employees. This shift was particularly true during World War II when most private engineers were occupied in the military or defense industries. While the Division of Highways Bridge Department designed many of California's bridges during the 1930s, 1940s, and 1950s, particularly along state routes and freeways, many local bridges were the result of county engineer involvement or counties employing consulting engineers. Steel bridge manufacturers had established common bridge truss types that could be employed in a variety of situations, and

[37] California Department of Transportation, *Historic Highway Bridges of California*, 112.

concrete designs became increasingly standardized. While each bridge was designed for its specific location and loads, many formulas and bridge types could be repeated. State or county engineers could rely on a bridge manufacturers standa rd truss design. For constructing bridges, the state and counties commonly hired private contractors, many of whom worked in specific regions where they constructed a variety of bridges and other projects. Sometimes, steel bridge manufacturers were hired to install the bridges they fabricated.

County engineers examined requirements for bridges and weighed different designs for specific uses. They in turn consulted steel bridge manufacturers or state Bridge Department engineers to make final bridge design selections, often using standard bridge forms and components. For steel trusses, there were several prominent bridge manufacturers that fabricated bridges across the state. These manufacturers constructed trusses for specific installations using established truss types. Some counties did not have engineers on staff and hired consulting engineers, such as Harold B. Hammill, W.E. Emmett, or Clair A. Hill, to provide bridge design services. With expanded bridge funding from the Federal Aid Secondary Program (FAS) and the Collier-Burns Act in the 1940s, counties began assuming control over larger components of bridge design than they had during the 1930s.

Of the steel bridges in California built between 1900 and 1959, the two largest bridge manufacturers were the American Bridge Company and the Judson Pacific Murphy Company. The American Bridge Company was originally founded in 1870 in Chicago, Illinois and operated as an independent company in the Midwest. In the late 1890s independent bridge companies began consolidating and in 1900 twenty-eight of the largest steel fabricators and constructors consolidated into the American Bridge Company, taking the name of one of the contributing companies. The following year American Bridge Company became a subsidiary of United States Steel Corporation; the corporation formed by J. P. Morgan that virtually controlled the United States steel industry. American Bridge Company remained a subsidiary of United States Steel Corporation until 1987 and is now privately owned. With its powerful financial backing, immediately after consolidation in 1900 the new company commanded a great percentage of steel bridge building projects across the country and won major contracts throughout the world, using the projects to further develop the use of steel in bridge construction. In California, the

American Bridge Company contracted to build hundreds of bridge projects. As steel truss construction declined during the 1930s, the American Bridge Company focused more on suspension and cantilever bridge construction. A 1941 example of their work is the truss bridge over the Sacramento River at Antlers in Shasta County (06 0089). This 273-foot cantilever style bridge was constructed under a contract with the United States Department of the Interior, Bureau of Reclamation and the State of California as part of the Shasta Dam and Reservoir project.

The Judson Pacific Murphy Company was a successor to several metal fabrication and construction firms that had operated in California since the 1860s. The "Pacific" part of the name came from the Pacific Rolling Mill, a San Francisco firm founded in the 1860s. The "Judson" name came from Judson Manufacturing Company, which was formed in the 1880s. The two merged in 1928 to become the Judson Pacific Company and decided to go into bridge construction, specifically metal truss bridge fabrication and construction. This entry was late in the history of truss bridge construction. Truss bridge construction had declined dramatically after World War I, and by 1928, most of the local California firms that had specialized in truss bridge construction in the late nineteenth and early twentieth century had gone out of business. The absence of these important competitors provided a niche for Judson Pacific Company, and it responded. In 1945, Judson Pacific merged with J. Philip Murphy Corp. to become the Judson Pacific Murphy Company. This company was a general-purpose construction firm, and while it devoted most of its energy toward construction of large buildings, it continued to build steel truss bridges. According to its 1946 self-published history, the company supplied the steel and iron for California's railroads, San Francisco's early cable cars, and many of the buildings of San Francisco and Oakland skylines. Judson Pacific and Judson Pacific Murphy fabricated the steel for other large scale public and private enterprises, such as the intake tank towers at Boulder Dam (1936), the electric traveling cranes used by the Navy during World War II, and the gold dredgers working California's riverbeds.

The company also manufactured many bridges during the 1930s, 1940s, and 1950s. These included some small bridges such as the bascule bridge on State Route 113 over the Sacramento River at Knights Landing (22 0040) built in 1933 and the Nevada Street Bridge in Downieville

(13C0006) built in 1938, shown in Photograph 17, as well as medium to large scale bridges such as portions of the Golden Gate and Oakland Bay Bridges (1930s), the Highway 101 bridge over the Eel River at Scotia (04 0016R) (1941), and the Jellys Ferry Bridge (08C0043) that crossed the Sacramento River north of Red Bluff (1949).

Photograph 17: Nevada Street Bridge over North Fork Yuba River
(13C0006), built 1938. May 2003.

The firm incorporated as the Murphy Pacific Corporation in 1963 and constructed such projects as the San Mateo-Hayward Bridge, built in 1967, and the Coronado Bridge in San Diego constructed in 1969. The company also built the Fremont Bridge in Portland, Oregon in 1973. While the company continued to build bridges, it also shifted into marine salvage and other businesses.[38]

Another important steel bridge manufacturer in California was the Moore Dry Dock Company. The company was founded in San Francisco in 1905 by Robert S. Moore, John Scott, and Joseph

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[38] Judson-Pacific-Murphy Company, *A Romance in Steel in California*, (San Francisco: Judson-Pacific-Murphy Company, 1946); Murphy Pacific, Articles of Incorporation, March 15, 1963, Corporation C0447649; The Kiewit Judson Pacific Murphy Companys work on th e Glen Canyon Project is mentioned online at: http://www.kued.org/glencanyon/reclamation/surveyors.html (accessed August 2001). The telescope at the Lick Observatory is in a list compiled by John M. Hill, Steward Observatory, University of Arizona, March 22, 2001. The list is online at: http://abell.as.arizona.edu/~hill/list/bigtel99.htm (accessed August 2001).

A. Moore as Moore and Scott Iron Works. It continued under that name until 1918 when it became the Moore Shipbuilding Company after Robert Moore bought john Scotts interest in the company. In 1924, the name was again changed to Moore Dry Dock Company, which more accurately reflected the changing nature of the business following the acquisition of a large floating dry dock and the decline of shipbuilding after World War I. It was at this time that management decided that in view of the companys experience in the fabrication of steel for ships to engage in the fabrication and erection of structural steel for buildings, bridges, and other structures. In 1927, the Moore Dry Dock Company constructed and erected the nine steel truss spans, including one lift span, of the Dumbarton Bridge spanning the San Francisco Bay. Other works of the Moore Dry Dock Company include construction of the Warren truss Mad River Bridge (04 0025R) on U.S. 101 in Butte County in 1929 and the bascule Third Street Bridge (34C0025) in San Francisco in 1932.[39]

[39] James R. Moore, *The Story of Moore Dry Dock Company* (Sausalito, CA: Windgate Press, 1994), 6, 18-21.

4. DESCRIPTION OF SURVEY POPULATION

The survey population for this report consists of 262 metal truss, movable, and steel arch bridges. To comprehend their known or possible historic significance, they have been studied in various ways. The following discussion provides categorical descriptions of the survey population properties, including their location, age, type, size, and decorative elements. There is also an overall assessment of the historic integrity of the survey population. Each bridge is described on its rating sheet in Appendix C.

4.1. Changes Since the 1985 Bridge Survey

Of the 370 pre-1960 metal truss bridges evaluated in the original statewide survey, 129 (35%) have since been removed or relinquished to private ownership. Of these 129 bridges, more than half were north of Sacramento, reflecting the fact that the states' metal truss bridges are predominantly in Northern California. The counties which saw the greatest losses include Siskiyou and Tehama in Northern California (18 and 13 bridges, respectively) and Stanislaus County in Central California (15 bridges). Siskiyou County still has more than ten pre-1960 metal truss bridges, and Tehama County has more than twenty, while Stanislaus County has only three remaining. In addition, Lake County lost both of its pre-1960 metal truss bridges, while Orange, Riverside, and Imperial Counties lost their only remaining examples.

The metal truss bridges removed or relinquished since the mid-1980s include a high proportion of the oldest examples, as these are the most likely to be functionally obsolete or have severe structural deficiencies. Among the 129 bridges removed were nine of the 16 bridges dating to the nineteenth century, and 22 of the 43 dating from 1900 to 1909. Another 36 bridges lost since the original survey date from 1910 to 1919.

More than three-quarters of the metal truss bridges removed or relinquished since the original survey were Pratt or Warren trusses, reflecting the predominance of these two types in the overall population of truss bridges in California. Several different truss types make up the remainder of those lost, but there are no truss types which have completely disappeared from the state since the mid-1980s.

At the conclusion of the original bridge survey, 85 of the 370 pre-1960 metal truss bridges surveyed (23%) were either listed or eligible for listing on the National Register of Historic Places. Of the bridges removed or relinquished since that time, a slightly lower proportion were eligible for National Register listing (25 of 129, or 19%), reflecting the greater efforts typically made to avoid demolition of National Register properties. In addition, at least three of these 25 eligible bridges are extant but no longer have Caltrans bridge numbers, and currently serve as pedestrian and bicycle bridges. The 25 eligible bridges that have been removed or relinquished since the mid-1980s were evenly distributed throughout the state, with no county losing more than two of its eligible metal trusses bridges. This group also included a wide variety of truss types, and no more than three of any single truss type. As with the metal truss bridge population as a whole, it is the oldest of the eligible bridges which have been more likely to be removed. Among the 25 eligible bridges lost were seven dating to the nineteenth century, another seven dating from 1900 to 1909, and six dating from 1910 to 1919.

4.2. Location

The survey population of metal truss, movable, and steel arch bridges are located on local roads, city streets, and state highways throughout California. As shown in Figures 1 and 2 (Appendix B), these bridges are located in 47 of the states' 58 counties in a variety of topographical and cultural settings. Most of the bridges (79 percent) are located in the north half of the state in Caltrans Districts 1, 2, 3, 4, and 10, with nearly a quarter of the total survey population in District 2 alone. Although many of the bridges are in rural or mountainous settings, some are located in urban and suburban areas. Of the major urban areas, for example, there are many more survey population bridges in and around the San Francisco Bay Area than around Los Angeles. A third of the bridges are located in the Central Valley and Sierra Nevada counties in Districts 3, 6, and 10. Nearly ten percent are located in the Central Coast region of District 5, and only three percent are located east and south of Los Angeles County in Districts 8 and 11. Tehama County has the greatest number of survey population bridges of any single county (23), followed by Sonoma County (21). Most counties in the state have fewer than ten metal truss, steel arch, or movable bridges. There are no bridges from this survey population in all of District 9, Mono and Inyo counties, or in Lassen, Lake, Sutter, Alpine, San Mateo, Kings, Kern, Orange, Riverside, or Imperial counties.

4.3. Age

The survey population bridges were constructed between 1888 and 1959. The oldest bridge in the survey population is the Burger Creek Bridge (10C0109), which was originally constructed for railroad use in 1888 and then relocated for roadway use in 1934. The oldest bridge in the survey population in its original location is the Canyon Creek Bridge (17C0030), built in 1895. Both of these structures were determined eligible for listing in the National Register during the 1980s Caltrans Bridge Survey. Table 1 shows the distribution by date of construction periods of the entire survey population.

Table 2: Quantity of Bridges from Periods of Construction

Date of Construction	Number	Percentage of Total
Pre-1900	7	2
1900-1909	21	8
1910-1919	52	20
1920-1929	44	17
1930-1945	86	33
1946-1959	52	20

Nearly half of the bridges in the survey population were constructed before 1930, with the two decades of the 1910s and 1920s accounting for over a third of the survey population. Another third were constructed in the 1930s and before the end of World War II in 1945. Only one fifth of the bridges were built after the World War II.

4.4. Type

Bridge type is important to categorize so that one can understand the technological achievement embodied in any example. The vast majority of the bridges in this survey population are metal truss structures. They account for 85 percent of the total. Twelve percent of the survey population are movable structures: lift spans, bascule bridges, and swing bridges. The remaining three percent are steel arch bridges. Metal truss, movable, and steel arch bridges are most often categorized according to their configuration with the roadway and their truss or construction type. They are also categorized by their material and construction method. Of the 262 bridges, five are constructed of iron and the remaining bridges are steel. Many of the bridges were constructed using a method whereby their members were joined in key locations by large bolts and are referred to as pin-connected bridges. One purpose of pin connections was to allow the truss members to rotate about the pin under changes in loading conditions, thereby preventing the transfer of bending stresses from one truss member to another. In the early twentieth century truss fabricators began to replace the pins with riveted joints. This type of connection is referred to as rigid. Later, bridge builders incorporated welding into the construction of metal bridges. Of the survey population, 65 bridges (25 percent) are pin-connected and 197 (75 percent) are rigid connected. None of the bridges in this survey population are completely welded structures.

The survey population includes examples of all three truss roadway configurations: through, pony, and deck. On through-style trusses, the deck is carried on the lower chords with overhead lateral supports connecting the top chords. Similarly, the roadway is carried on the lower chords of a pony structure, but there are no overhead laterals. The roadway is carried atop of the top chord in a deck-style structure. Of the 224 metal truss structures, 27 (12 percent) are deck-style bridges, 102 (46 percent) are pony-style bridges, and the remaining 93 structures (42 percent) are through trusses. All movable bridges in the survey population are located along waterways where boat traffic required structures that could be opened to allow for passage. Technically, all of the movable bridges are through-style or pony-style bridges, but they are accounted for by their movable component. The seven steel arches are made up of five deck-style structures and two through arches, but again, they are usually categorized by their construction type.

There are eighteen different categories of truss or construction types represented in the survey population. These are listed below in Table 2. There are thirteen types of metal trusses, three types of movable bridge, and two types of steel arches. Nearly three quarters of the entire survey population are of two basic truss types or derivatives of those types. These are the Pratt truss, and its variations, and the Warren truss. Warrens (including the one concrete encased Warren truss) account for 30 percent of the survey population and Pratts account for twenty-nine percent. The Pratt truss and all of its derivative types, Parker, Camelback, Pennsylvania Petit, and Baltimore Petit, together account for 42 percent of the survey population. There are six other metal truss types, most of which are relatively rare in California: Bailey, K-truss, Whipple, Vierendeel, Rectangular, and Cantilever. The latter three of these are not based on the triangular based form of the other trusses, but rather are names given to their special construction method. Cantilevers are usually comprised of trusses like the Warren or Pratt, but are categorized by their construction method because of the engineering feat represented by this type of structure. The percentages given above do not account for the truss configurations of bridges categorized as cantilever or as one of the movable bridges.

Table 3: Truss or Construction Types

Truss / Construction Type	**Number**	**Percentage of Total**
Pratt	76	29
Warren	74	28
Bailey	19	7
Parker	19	7
Bascule	14	5
Swing	15	6
Cantilever	11	4
Pennsylvania Petit	8	3
Lift	5	2
Baltimore Petit	4	1
Spandrel-Braced Arch	4	1
Camelback	3	1
Solid-Ribbed Arch	3	1
Vierendeel	3	1
K-Truss	1	1
Rectangular	1	1
Warren-Concrete Encased	1	1
Whipple	1	1

The three types of movable truss bridges are bascule, swing, and lift. Bascule bridges, or drawbridges, are the earliest form of movable bridge. They have one or two leafs that open on a hinge, or trunnion, that pulls the leaf up to allow vessels to pass. Swing bridges rotate on a center pier to permit passage on the waterway. Lift spans have two towers by which a central span can be raised to allow for waterway passage. Of the three types of movable bridges, lift bridges are the rarest with only five remaining examples in California. There are 15 remaining examples of swing bridges and 14 bascule bridges. Because they are quite expensive to build and operate, movable bridges were only built where absolutely necessary, a condition found only along major navigation corridors. Historically, these conditions are found in essentially three places in California: along the Sacramento-San Joaquin delta waterways, in the port areas of the San Francisco Bay, and in the port area of Los Angeles. The current survey population demonstrates this through the distribution of movable bridges by location, 25 of the remaining 34 movable bridges in California are located within the Sacramento-San Joaquin delta region.

The two types of steel arch are spandrel-braced and solid-ribbed. Spandrel-braced arches in California are all deck style structures. On a spandrel-braced arch bridge, the bottom chord of the truss takes an arch form. As with other truss types, both the top and bottom chords share the load. Solid-ribbed arches (also referred to as tied arches), in both through and deck form, have only vertical members to transfer the load to the arch. There are four spandrel-braced arches and three solid ribbed arches in the survey population.

4.5. Size

Bridge size is measured in various ways and is important in understanding the boldness of engineering achievement or innovativeness of construction method that a structure may represent. Bridges in the survey population are measured by the number of spans, the length of the truss, span length, or contributing metal component(s). Of less importance, relative to engineering significance, bridges can be compared by their total length which may include non-metal components.

The engineering achievement of a structure can be analyzed through comparison of the number of spans and by the length of the main span. Most of the bridges in the survey population, nearly 70 percent, are single span bridges or have single truss spans. Twenty-three percent have two, three, or four spans, and eight percent have five or more spans. Bridges in the survey population were compared by their main span length, categorized into the roadway configuration (deck, through, or pony). The longest truss spans in the state are located along important freeways in the San Francisco Bay Area. The main cantilever span of the San Francisco Oakland Bay Bridge (33 0025) is 1,400 feet long, the main cantilever span of the Richmond-San Rafael Bridge (28 0100) is 1,070 feet long, and both cantilever mainspans of the Carquinez Straits Bridges (23 0015L and 23 0015R) are 1,100 feet long. The shortest mainspan in the survey population is 40 feet, found on 06C0221 across Lone Tree Creek in Shasta County. Different truss and bridge types were designed for different lengths. Thus comparison of size appropriately occurs between bridges of similar configuration and truss / bridge type.

4.6. Decoration

While most metal truss, movable, and steel arch bridges are generally designed to be utilitarian and functional in their appearance, in some cases designers did attempt to improve the aesthetic appeal of the structure through use of various decorative features. Only five percent of the survey population has major decorative features, while 23 percent has minor decorative features. The difference between major and minor decorative features relates to the size of those features and the volume of those features relative to the overall structure. Decorative features on the survey population bridges include ornamental bracing at top chord, patterned railings, and applied embellishment on functional features such as towers, control booths, and pylons. Some of these features have their origins in classical architectural forms, but many are added elements with no particular style or function except to improve a structures aesthetics. Later examples have more stylized decoration, if any. Several later bridges with clear aesthetic appeal have no decorative features as influenced by the tenets of mid-twentieth century Modernism.

4.7. Historic Integrity

A large majority of bridges in the survey population retain historic integrity. Although most of the bridges in the survey population have been maintained, with some small alterations or replaced components, these bridges look much like they did when they were constructed, and can convey their known or possible significance. Over 85 of the bridges surveyed exhibited little to no loss of integrity of location or setting, while 88 percent of bridges were found to have good or excellent integrity of design, materials, and workmanship. Similarly, 86 percent of the survey population bridges were considered to have good to excellent integrity of feeling and association. Bridges that had been moved were found to usually have lost the greatest amount of historic integrity. Not only do most moved bridges lose their original location and setting, but they are often altered. Thus, they also lose any remaining sense of their historic feeling and association. Other bridges lost integrity because of major alterations to a structure.

5. FINDINGS AND CONCLUSIONS

JRP used both historical research and the point rating scores to assess the significance of the survey population bridges under the National Register criteria. JRP also examined the historic integrity of each structure. Combining the two elements, JRP recommends conclusions to Caltrans regarding the National Register eligibility for the 262 metal truss, movable, and steel arch bridges built in California before 1960. Bridges that are listed in or eligible for listing in the National Register, with one exception, appear to retain historic integrity. A small group of bridges that were previously found not eligible now appear eligible for listing in the National Register, and most bridges that were previously found ineligible remain so. The historic significance of two bridges in this survey population has been left undermined at this time.

5.1. Evaluation Criteria

Bridges in California are usually evaluated under two National Register criteria: Criterion A, for their association with important events and trends, especially their contribution as links within the transportation system, and Criterion C, relating to possible significance in the field of engineering. Bridges are infrequently, if ever, found to be significant under Criteria B or D. Important historic persons associated with bridges are usually involved with their design, thus making them significant as a "work of a master" under Criterion C. Historic structures, such as bridges, can occasionally be recognized for the important information they might yield regarding historic construction materials or technologies making them significant under Criterion D. Bridges of this type built in California, however, are extremely well documented in written and visual sources, so they are not themselves principal sources of important information in this regard.

Under Criterion A, California highway bridges are potentially significant if they are importantly associated with trends and/or events in transportation development, regional or local economic development, community planning, or military history. Establishing this fact, though, should be done with certain principles in mind. Bridges, like other infrastructure, are inherently vital to communities as they are critical elements of essential city or regional planning, and they substantially impact communication and the distribution of people, goods, and services that affects development on both the local and regional levels. These common effects of bridge construction do not typically provide sufficient evidence to demonstrate how a structure may be deemed significant for its association with an important historic context; otherwise virtually any bridge would be shown to be important in this way. To be eligible for listing in the National Register, resource types such as bridges and other infrastructure must have demonstrable importance directly related to important historic events and trends, with emphasis given to specific demand for such facilities and the effects the structure had on social, economic, commercial, and industrial developments locally, regionally, or nationally. In this way, bridges may be significant as physical manifestations of important transportation and community planning developments on the local, regional, state, or national level. In this analysis, for example, a bridge that is the first in its location would be inherently more significant than one that is the second or third constructed at that location.

The most common instance in which a bridge might be considered under Criterion A would be if it were the first bridge at its site, thus providing expanded transportation opportunity and advancing economic development into previously isolated areas. As noted, most bridges and other infrastructure are inherently vital to their community or region. These types of effects commonly occur with the construction of bridges, and thus most bridges do not appear to be importantly associated to events and trends of planning, development, and transportation that would make them significant under Criterion A. Bridges that are possibly significant under Criterion A were likely built to meet specific demands, and their construction brought immediate and / or substantial effects to a geographic location. While this level of importance typically can be associated with the initial bridge at a particular location, it can be true of subsequent bridges in some cases.

In most cases, for instance, if a map shows a bridge and road existing in 1905, and the current bridge at that location was built in 1948, it is unlikely that the current bridge played a sufficiently important role in expanded transportation to merit consideration under Criterion A. Of course, analysis of individual cases may result in exceptions to this general rule. For example, a bridge may have been a small pre-automobile structure that was replaced in the mid-twentieth century. The first bridge may have been largely unusable by modern vehicles. Subsequently, upon the growing demand for an improved crossing, say for residential development or timber harvest, the state or a county replaced the old structure. This permitted immediate growth and development and greatly enhanced the area's transportation system. Such a replacement bridge may be significant under Criterion A for being importantly associated with the planning, development, and transportation of a community or region. This level of importance may even be significant on the statewide level.

Under Criterion C, California roadway bridges are possibly significant for their importance within the field of bridge engineering and design. This significance derives from a bridge embodying distinctive characteristics of its type, period, or method of construction, or representing the work of a master engineer, designer, or builder. The historic significance of bridges within the field of bridge engineering and design has been studied in great detail in California and other states as a result of dozens of historic bridge inventories sponsored by the Federal Highway Administration during the 1970s, 1980s, and 1990s. While bridge types and inventory methods varied from state to state, the many historic bridge inventories have generally established salient attributes that help define significance of structures within the field of bridge engineering and design. These attributes are as follows:

- Rarity – the number of remaining examples of a bridge construction type;
- Innovative design techniques or use of construction methods that advanced the art and science of bridge engineering;
- Boldness of the engineering achievement – representing the measures taken to overcome imposing design and construction challenges related to load, stress, and other engineering and environmental complexities;
- Aesthetics – the visual quality achieved in a bridge's individual design or with its appropriateness within the natural or man-made setting.

These attributes correspond directly to categories in the numeric systems used for the survey of metal truss, movable, steel arch, and concrete arch bridges. They contribute to the evaluation of all bridges in the assessment of their significance of type, period, or method of construction and importance within the work of a historically significant engineer and/or builder.

In order to be listed in the National Register, a bridge must have historical and/or engineering significance as well as historic integrity. Loss of integrity, if sufficiently great, will overwhelm the historical significance a bridge may possess and render it ineligible. Likewise, a bridge can have complete integrity, but if it lacks significance, it must also be considered ineligible. Integrity is determined through applying seven factors defined by National Register guidelines. Those factors are location, design, setting, workmanship, materials, feeling, and association. These seven can be roughly grouped into three types of integrity considerations, which again are reflected in the three integrity scores given to bridges surveyed using the numeric systems. Location and setting relate to the relationship between the property and its environment. Design, materials, and workmanship, as they apply to historic bridges, relate to construction methods and engineering details. Feeling and association are the least objective of the seven criteria and pertain to the overall ability of the property to convey a sense of the historical time and place in which it was constructed.

5.2. Conclusions from Assessment of Scoring System Points

The scoring system used for the inventory of metal truss, movable, and steel arch bridges provided indicators of the significance of these structures under Criterion C. Elements of the original point system that referred to possible significance under Criterion A were removed from the current scoring system. For many bridges, the scores for individual categories did not change from the 1980s survey to the current survey. The total scores as well as the individual category scores provided relative information regarding the significance of these structures and in what way they each may, or may not, embody the distinctive characteristics of a type, period, and method of construction. The first group of points assigned value based on historical or physical facts. These were for the age of the structure, the size of the structure, the surviving number of its type, and for special features that the bridge may possess. The second group of points was more subjective and included assessments of builder / designer significance, historic integrity, and aesthetic value.

As fieldwork progressed, JRP noticed that scores in the second, more subjective, group of points appeared to have been inconsistently applied in the 1980s survey. Similar bridge types or bridges with similar alterations were sometimes given different scores. This may have been a function of multiple historians working on the project compounded by the related challenges they may have faced preparing the entire historic bridge inventory. Caltrans architectural historians may have also found it difficult to manipulate the data to check for inconsistencies. JRP carefully examined these categories for relative inconsistencies between scores. This was achieved by organizing the data in various ways in the database used for this survey and by reviewing photographs.[40] JRP verified that the appropriate points were given to all bridges built or designed by significant builders or designers, and JRP scrutinized the integrity and aesthetic scores so that bridges of similar type and size or with similar alterations were given consistent scores.

Generally, the overall scores of these bridges provided an excellent means to assess the significance of bridges under Criterion C and the historic integrity of the structures. Total scores provided indicators, but were not the definitive factors to the evaluations. While generally higher scoring bridges are eligible or appear eligible, some bridges that are or appear eligible scored relatively low. There were also some high-scoring bridges that do not appear to be eligible, as discussed in more detail below. These results reveal the limits of a point-based system of evaluation. Although the scoring system is useful, the historic evaluation process still required careful analysis by a qualified architectural historian applying the National Register criteria. While evaluation under Criterion A necessarily involves consideration in the local context, a statewide context was used for evaluation under Criterion C. Most of the states' metal truss bridges are unique in their own local context, so a broader context was required to identify the significant examples of each truss type.

The highest possible score within this rating system was 90 points. The range of scores given to bridges in this survey ranged from a high of 79 to a low of 6. Fifty bridges scored more than 40 points, and only two of these are ineligible for National Register listing. 149 bridges scored less

[40] The database used for this survey was in Microsoft Access 2000.

than 28 points, and only one of these is eligible for National Register listing. (This is Bridge 09C0042, which scored only 23 points but is significant primarily under Criterion A.) The 63 bridges that scored between 28 and 40 points include a nearly even mix of eligible and ineligible bridges. It was this middle range which received the greatest attention in determining National Register eligibility, as bridges in this group appeared to have some potential significance under Criterion C. Each of these bridges was compared to other examples of the same truss type, taking into consideration the relative integrity, rarity of the type, and significant features of the individual bridges which are rare or unique among bridges of that type. Of the seven bridges proposed for promotion from ineligible to eligible in this survey, five scored from 33 to 40 points, with two others scoring more than 40 points. Since no bridges scoring less than 33 points were proposed for promotion to eligible, the rating sheets for individual bridges often state, “score of less than 30 points indicates a lack of significance under Criterion C.” This generalization was derived from the distribution of scores and analysis of the entire population of truss bridges, rather than being imposed as a predetermined cutoff for National Register consideration.

JRP submitted a draft of this report to Caltrans in November of 2003, which proposed four bridges for promotion to eligible (01C0005, 04C0055, 10-0136, and 29-0016F). The draft report was reviewed by Caltrans architectural historian Andrew Hope. Using a spreadsheet to facilitate comparisons, by allowing the population of bridges to be sorted by truss type and then ranked by score, age, and span length, Mr. Hope identified four additional bridges for which reconsideration appeared to be warranted (20C0248, 24-0121, 29-0050, and 36C0085). Following discussions between Mr. Hope and JRP staff, it was concluded that three of these meet National Register Criterion C, resulting in a total of seven bridges being proposed for promotion to eligible in this final report.

There are nine bridges in the survey population which remain ineligible for National Register listing in spite of having relatively high scores of 36 to 50 points. Five of these are cantilever truss bridges. These bridges scored high as a group, with the twelve examples scoring from 32 to 51 points. Cantilever trusses are capable of substantially longer spans that other truss types, with four pre-1960 examples in California having spans greater than 1,000 feet. (These are the cantilever portion of the Bay Bridge, the Richmond-San Rafael Bridge, and the two Carquinez Bridges.) Most of the smaller examples of this bridge type were found to lack significance under Criterion C, even though they scored relatively high among the entire population of metal truss bridges. The other high-scoring bridges which remain ineligible include:

- 23-0024, a 1944 lift span scoring 50 points. While the approach spans of this bridge date to 1944, the lift span was reconstructed in 1960.
- 33C0132, a 1941 camelback truss scoring 40 points. This is the lowest scoring, latest, and shortest of the states' three remaining camelback truss bridges.
- 44C0066, a 1916 Parker truss scoring 39 points. This bridge was moved to its present location in 1943, thus suffering a loss of integrity of location and setting. It received twelve points for age, since it was originally built in 1916. Scored as a 1943 bridge, however, it would receive only four points for age and a total of 31 points.
- 29C0127, a 1926 bascule bridge scoring 37 points. This bridge has suffered some loss of integrity due to alterations, and has been locked in place so that it no longer functions as a moveable bridge. Nine of the 14 bascule bridges in the survey population are eligible for National Register listing, but this bridge is not one of the more significant examples of the type.

As noted, the rating system has some limitations. In general, it is skewed to give greater weight to certain facets of Criterion C while disregarding other areas of possible significance. Many more points are given to older structures than newer structures, and bridges constructed by significant builders or designers are afforded many points. Points given for decorative features overlooks the design aesthetic of the mid-twentieth century that rejected ornament, and some insignificant bridge types are given points simply because there are few examples in the state. Conversely, the point system also can provide a limited assessment of variation between structures. For example, through truss bridges with a main span over 150 feet are given eight points with no difference between the 160 foot structure and the 1100 foot structure. It is unlikely that any point system can take into account all the variables presented in a survey population of 262 bridges. Thus, JRP used the point system as one of several components in evaluating the structures in the survey population.

5.3. Bridges in Historic Districts

Bridges can also be eligible for listing in the National Register as contributors to a significant historic district. This occurs when the structure is associated with the significant period of development of the adjacent properties. Bridges have been included in districts in California, along with adjacent buildings, as gateways to towns and as important transportation links to their regions. For example, the Lewiston Bridge (05C0032) over the Trinity River in Lewiston, Trinity County, is a contributor to the Lewiston Historic District, which includes 19 buildings plus the bridge. The districts significance de rived from its association with Trinity County mining from the 1860s through the 1910s. The Lewiston Bridge, a Baltimore Petit truss built in 1901, contributes to the district as the gateway to the historic town and for it importance within the regional transportation network.[41] Bridges have also been found eligible for the National Register as part of historic districts in other types of situations. Some are included in districts that have a central core property and adjacent buildings and structures, such as the Southern Pacific Railroad Depot Historic District in San Jose (Cahill Street Station) which includes The Alameda / Santa Clara Street underpass (37 0045). The underpass structure, built in 1932, was an integral part of a new railroad station and one of various buildings and structures that served a supporting role to this urban transportation development. Still others are listed in the National Register within historic districts that are largely, or completely, comprised of bridges. One such example is the Venice Canal Historic District in Los Angeles County, which is focused around the early 20th century bridges that cross the canals near Venice Beach. The potential for a bridge to be a contributor to a historic district depends on its historical associations or architectural compatibility with significant adjacent properties or other bridges in its vicinity.

Focusing on bridges that were previously found ineligible, JRP examined the potential for bridges in the survey population to be eligible as contributors to known or possible historic districts. JRP found two instances where there were potential historic districts. JRP did not discover any existing historic districts to which previously ineligible bridges should become contributors. In the two potential historic districts, the subject bridges were built later than the

[41] C. OSullivan, National Register of Historic Places Registration Form, Lew iston Historic District, October 1988; and JRP Historical Consulting Services, Finding of No Adverse Effect, Lewiston Bridge Rehabilitation

likely period of significance of those districts. A potential historic district may exist in Downieville, for instance, with a period of significance likely extending from 1850 through 1920. The three bridges in town (13 005, 13C0003, and 13C0006) played an integral role in the cohesion of the area, but would likely not be contributing elements to the district because they were all built in 1938 to replace previous structures that were destroyed by flood in 1937 and thus built after the towns period of signifi cance. Similarly, bridge 25C0004 has the role of an entry into the historic town of Coloma, but again this 1915 structure was built after the towns likely period of significance in the nineteenth century.

Bridges may be contributing elements to historic landscapes, also referred to as cultural landscapes, which are recorded and treated as a type of historic district. Historic landscapes that include structures are geographic areas that have undergone past modification by human design, were used in identifiable patterns, or were the sites of a significant event. They can be designed landscapes that present a conscious work of creation based on design principles of landscape architecture. Bridges along a parkway, for instance, could be eligible as part of the designed plans for that roadway. Historic landscapes that include structures can also be vernacular landscapes that have evolved through time. These reflect human activities or occupancy from a certain time. Of the two types of historic landscapes that can include structures, vernacular landscapes are more difficult to define and find eligible. Designed landscapes can be compared with original design intent, whereas the boundaries, significance, and integrity of vernacular landscapes can be difficult to distinguish. Nevertheless, it is possible that metal truss, movable, or steel arch bridges that do not appear to be eligible under evaluation in this survey could be eligible as part of a historic landscape. This could occur, for instance, in a rural area where there is not the concentration of buildings or structures to indicate the presence of a historic district. Rather, the bridge would be part of the visual character of an open space, perhaps agricultural, with no concentration of buildings or structures. To find a bridge eligible as part of a historic landscape, its contributing significance would need to be explicitly stated. Such a conclusion would occur only if the structures could not be otherwise understood as an individual structure or as a structure within a local, regional, or statewide transportation system as examined in this

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Project, Lewiston, Trinity County, California, Bridge No.5C-32, prepared for CH2MHill and Trinity County, September 1995. The district was listed in the National Register in 1989.

survey. JRP did not identify any bridge within the survey population that would be significance as part of a historic landscape.

5.4. Eligibility for Listing in the National Register of Historic Places

Of the 262 bridges studied for this report, sixty-five bridges were previously listed in or determined eligible for listing in the National Register, nine bridges appear to meet the criteria for listing in the National Register based on evaluation during this survey, 186 bridges do not appear to meet the criteria for listing, and the significance of two bridges has been left undetermined at this time. Among the bridges that appear ineligible, there is one bridge that was previously determined eligible, but has lost historic integrity and thus no longer appears to meet the criteria for listing in the National Register. The seventy-four structures that are listed in, eligible for listing in, or appear eligible for listing in the National Register account for a little over a quarter of the metal truss, movable, and steel arch bridges survey population. All of them were built prior to 1950. Two of the nine bridges that now appear eligible are administrative corrections to Caltrans' database that lists historic eligibility by bridge number. One of these structures is part of a large, previously identified, historically significant bridge with multiple bridge numbers of which only one bridge number had been cataloged as eligible in the departments database. The other of these struct ures was previously determined eligible as a contributor to a historic district, but not identified by its bridge number in that evaluation.[42]

Beyond this historic bridge inventory, some bridges within the survey population have been determined significant by methods other than the National Register criteria. These include designations by the American Society of Civil Engineers (ASCE) and by cities or counties. The ASCE designates important engineering features across the country as National Historic Civil Engineering Landmarks. These include both individual bridges as well as bridges that are

[42] There are other metal truss bridges in California that were not studied for this survey. Some are not within the jurisdiction of Caltrans or a local agency and may be used for pedestrian or equestrian traffic. Railroad Underpasses as well as flume, pipe, and conveyor overcrossings were not studied as part of this survey that was designed for the evaluation of roadway bridges. A few metal truss bridges in the Caltrans system built before 1960 were not studied for this survey because they appear to be on private property, or access to them is through private property. These structures may have been recently moved, or there are special ownership or access circumstances that prevented inventory as part of this group.

components of important highways. Most, if not all, bridges designated as civil engineering landmarks in California have also been listed in or determined eligible for listing in the National Register for their important design qualities. The ASCE designation does not have official status within the National Historic Preservation Act Section 106 process, but is useful in indicating structures of particular importance within the field of civil engineering.

Many cities and counties in California have local historic preservation ordinances that list buildings and structures as local landmarks. These local lists include a wide range of resources and some include bridges. Local authorities apply varying levels of protection to these resources. Some lists are honorary designations while other seek to physically protect the historic resources. Sonoma County and the cities of San Francisco, San Jose, and Los Angeles are among the local agencies to have designated bridges as local historic landmarks. These local designations do not have any direct bearing on the Section 106 process, but they do become an issue when Caltrans seeks to comply with the California Environmental Quality Act (CEQA) as it pertains to impacts to historical resources. Buildings and structures that are listed in, determined eligible for, or appear eligible for listing in the National Register are automatically eligible for listing in the California Register of Historical Resources, i.e. are historical resources for the purposes of CEQA. In addition to resources listed in or determined eligible for listing in the California Register, CEQA also takes into account locally designated resources. Such resources are also usually considered historical resources for the purposes of CEQA. Therefore, it is possible that a bridge determined not eligible as a result of this report could be a historical resource for the purposes of CEQA. Caltrans will need to clarify local designations of bridges on a project by project basis.

5.4.1. Bridges previously listed in or determined eligible for listing in the National Register

The following bridges have been re-examined, and they all retain sufficient historic integrity to continue meeting the criteria for listing in the National Register:

Table 4: Bridges previously listed in or determined eligible for listing in the National Register

County	Bridge #	Road / Street	Feature Intersected	Year Built	Truss Or Bridge Type
Siskiyou	02 0013	State Route 263	Shasta River	1931	Cantilever
	02C0021	Roxbury Dr	Scott River	1915	Pennsylvania Petit
	02C0041	Klamath River Rd	Klamath River	1901	Baltimore Petit
	02C0085	Eller Lane	Scott River	1910	Pratt
Trinity	05C0032	Turnpike Road	Trinity River	1901	Baltimore Petit
Shasta	06 0021	Interstate 5	Pit River Bridge & Overhead	1941	Cantilever
Tehama	08C0047	Rawson Rd	Thomes Creek	1898	Pratt
Plumas	09 0002	State Route 70	North Fork Feather River	1936	Parker
	09 0003	State Route 70	North Fork Feather River	1936	Warren
	09 0004	State Route 70	North Fork Feather River	1936	K-Truss
	09 0009	State Route 70	North Fork Feather River	1934	Solid-Ribbed Arch
	09 0015	State Route 70	Spanish Creek	1932	Warren
	09C0001	Dyson Lane	Middle Fork Feather River Overflow	1908	Pratt
	09C0042	Belden Town Rd	North Fork Feather River	1912	Pratt
Mendocino	10C0046	Gualala Rd	North Fork Gualala River	1899	Pratt
	10C0109	Laytnvlle-Dos Rios	Burger Creek	1888	Whipple
Glenn	11C0032Z	Stony Creek	None	1902	Pratt

County	Bridge #	Road / Street	Feature Intersected	Year Built	Truss Or Bridge Type
Butte	12 0038	State Route 70	North Fork Feather River	1932	Spandrel-Braced Arch
	12C0200	Feather River Pedestrian Overcrossing	Feather River Pedestrian Overcrossing	1907	Parker
Colusa	15C0008	Wilbur Springs Rd	Bear Creek	1910	Pratt
Yuba	16C0006	Waldo Rd	Dry Creek	1901	Pratt
Nevada	17C0006	Bloomfield Rd	South Yuba River	1904	Spandrel-Braced Arch
	17C0020	Auburn Rd	Wolf Creek	1897	Pratt
	17C0024	Purdon Rd	South Yuba River	1895	Pratt
	17C0030	Maybert Rd	Canyon Creek	1895	Pratt
Sonoma	20C0005	Geysers Rd	Big Sulphur Creek	1909	Pratt
	20C0065	Healdsburg Ave	Russian River	1921	Pennsylvania Petit
	20C0155	Wohler Rd	Russian River	1922	Parker
	20C0224	Stewarts Point-Skaggs Spring Rd	Haupt Creek	1909	Pratt
	20C0522Z	State Route 116	Russian river	1922	Parker
Yolo	22 0021	State Route 275	Sacramento River (Tower Bridge)	1934	Lift
	22C0153	I Street	Sacramento River	1911	Swing
Solano	23 0015L	I 80 Westbound	Carquinez Bridge & Overhead	1927	Cantilever
Sacramento	24 0051	State Route 160	Sacramento River Isleton	1923	Bascule
	24 0052	State Route 160	Steamboat Slough	1924	Bascule
	24 0053	State Route 160	Sacramento River (Paintersville)	1923	Bascule
	24C0001	Freeport	Sacramento River	1929	Bascule
	24C0022	Jibboom St	American River	1931	Swing

County	Bridge #	Road / Street	Feature Intersected	Year Built	Truss Or Bridge Type
El Dorado	25C0004	Mount Murphy Rd	South Fork American River	1915	Pratt
	25C0025	Happy Valley Rd	Camp Creek	1906	Pratt
Amador	26C0008	Pitt St	Middle Fork Jackson Creek	1902	Pratt
San Joaquin	29 0043	State Route 12	Mokelumne River	1942	Swing
	29 0045	State Route 4	Old River	1915	Swing
	29 0049	State Route 4	Middle River	1915	Swing
Calaveras	30C0016	Middle Bar Rd	Mokelumne River	1912	Pratt
Alameda	33 0025	I 80	SFOBB East Span	1936	Warren
	33C0026	High St	Oakland Estuary	1939	Bascule
	33C0027	Park St	Oakland Estuary	1934	Bascule
San Francisco	34 0019	U.S. Highway 101	Presidio Viaduct	1936	Pratt
	34C0025	Third St	Channel St Waterway	1932	Bascule
	34C0027	Fourth St	Channel St Waterway	1917	Bascule
Stanislaus	38C0168	Kilburn Road	Orestimba Creek	1906	Warren - Concrete Encased
	38C0317Z	Tuolumne River	Basso's Ferry	1911	Pennsylvania Petit
Merced	39C0013	Oakdale Rd	Merced River	1912	Pratt
Monterey	44C0007	San Lucas Rd	Salinas River	1915	Camelback
San Luis Obispo	49C0190	Las Pilitas Rd	Salinas River	1916	Parker
	49C0196	Bridge St	Arroyo Grande Creek	1908	Pratt
Ventura	52C0053	Bridge Rd	Santa Paula Creek	1911	Pratt

County	Bridge #	Road / Street	Feature Intersected	Year Built	Truss Or Bridge Type
Los Angeles	53 2618	State Route 47	Schuyler Heim Lift Bridge	1946	Lift
	53C0735	Glenoaks Blvd	Verdugo Wash	1938	Vierendeel
	53C0736	Geneva St	Verdugo Wash	1938	Vierendeel
	53C0741	Kenilworth Ave	Verdugo Wash	1936	Vierendeel
San Bernardino	54C0068	National Trails Highway	Mojave River	1930	Baltimore Petit
	54C0368	Greenspot Rd	Santa Ana River	1912	Pennsylvania Petit
San Diego	57C0416	First Ave	Maple Canyon	1931	Spandrel-Braced Arch

TOTAL: 65 bridges

Bridge 26C0002Z was determined eligible for listing in the National Register prior to the state-wide Caltrans historic bridge inventory in the 1980s. This structure has been moved and has been placed in a field on the side of the road where it once stood. The structure has also lost its deck. Therefore, bridge 26C0002Z has lost historic integrity and appears to no longer meet the criteria for listing in the National Register. The structure is listed below in Section 5.4.4.

Bridges 29C0023 and 53C1880 appear to have been determined eligible for listing in the National Register prior to the Caltrans historic bridge inventory update, however neither were specifically referred to by their bridge number. They are listed below in Section 5.4.2. because the determination of their eligibility needs to be confirmed, after which their status can be changed in the Caltrans administrative system.

5.4.2. Bridges that appear to meet the criteria for listing in the National Register

The following nine bridges appear to meet the criteria for listing in the National Register. Of these, seven of the nine appear to be eligible based on evaluations made during this survey. Bridge 29C0023 was evaluated prior to this survey and determined eligible as a contributor to a historic district. Bridge 53C1880 was evaluated in the 1980s survey as part of another bridge and determined eligible. See the historic bridge rating sheets for descriptions and evaluations.[43]

Table 5: Bridges that appear to meet the criteria for listing in the National Register

County	Bridge #	Road / Street	Feature Intersected	Year Built	Truss or Bridge Type
Del Norte	01C0005	South Fork Road	South Fork Smith River	1948	Solid-Ribbed Arch
Humboldt	04C0055	Mattole Road (Honeydew)	Mattole River (Honeydew)	1920	Camelback
Mendocino	10 0136	State Route 1	Albion River	1944	Baltimore Petit / Timber Truss
Sonoma	20C0248	Lambert Bridge Road	Dry Creek	1915	Parker
Sacramento	24 0121	State Route 160	Three Mile Slough	1949	Lift
San Joaquin	29 0016F	W120-S5 Connector	San Joaquin River	1949	Bascule
	29C0023	Navy Drive	San Joaquin River	1941	Swing

[43] Close examination of the bridges that are listed in, determined eligible for listing in, or appear eligible for listing in the National Register reveals that there are few Warren trusses in California eligible for the National Register. The Warren trusses previously listed include part of the east spans of the Oakland-San Francisco Bay Bridge (33 0025) and two bridges on the Feather River Highway (09 0015 and 09 003). They are also found in Cantilever structures, including some that are eligible such as bridge 06 0021, Pit River Bridge and Overhead on I-5. Warren trusses were invented in the mid-nineteenth century, but were not employed in California roadway bridges until the 1910s. The few early examples remaining in California do not exhibit distinctive characteristics of type, period, and method of construction. Larger Warren trusses were built later. These larger structures, though, do not represent significant bridges under Criterion C either because the technology was neither innovative nor representative of bold engineering achievement of the period. Most Warren trusses were used in modest bridges. Thus, JRP did not find that any additional Warren trusses appear eligible for listing in the National Register.

County	Bridge #	Road / Street	Feature Intersected	Year Built	Truss or Bridge Type
Santa Cruz	36C0085	San Lorenzo Way	San Lorenzo River	1912	Spandrel-Braced Arch
Los Angeles	53C1880	Sixth Street	Los Angeles River	1932	Solid-Ribbed Arch

TOTAL: 9 bridges

5.4.3. Bridges for which historic significance has not been fully determined

The survey concluded that there are two bridges for which their historic significance could not be fully determined within the confines of the state-wide historic roadway bridge inventory. These two bridges are the east span of the Carquinez Bridge (23 0015R) and the Richmond-San Rafael Bridge (28 0100). These are among the largest and most prominent structures built in California during the 1950s and their historic and engineering significance is not adequately addressed within the state-wide bridge inventory that is established to evaluate hundreds of small to moderately sized bridges. These structures are of such scale and possible significance that they deserve special consideration with a thorough analysis under Criteria A and C. Both should be examined carefully within the regional context of post-World War II highway and freeway development in the San Francisco Bay Area as well as within the context of their relative significance related to the field of bridge engineering.

Table 6: Bridges for which historic significance has not been fully determined.

County	Bridge #	Road / Street	Feature Name	Year Built	Truss Type
Solano	23 0015R	I 80 Eastbound	Carquinez Bridge & Overhead	1958	Cantilever
Contra Costa	28 0100	Interstate 580	Richmond-San Rafael Bridge	1956	Cantilever

TOTAL: 2 bridges

5.4.4. Bridges that do not appear to meet the criteria for listing in the National Register

The following 186 bridges do not appear to meet the criteria for listing in the National Register. Under Criterion A, they are not important for their association with significant historic events or trends. Under Criterion C, they are not significant within the field of roadway bridge engineering and do not embody distinctive characteristics of a type, period, or method of construction. They also are not important examples of master bridge builders or designers.

Table 7: Bridges that do not appear eligible for listing in the National Register.

County	Bridge #	Road / Street	Feature Intersected	Year Built	Bridge or Truss Type
Del Norte	01C0028	South Fork Rd	Rock Creek	1952	Bailey
	01C0031	Big Flat Rd	Hurdygurdy Creek	1948	Bailey
Siskiyou	02 0117	State Route 96	Klamath River	1953	Warren
	02 0119	State Route 96	Klamath River	1954	Parker
	02C0014	Callahan Dump Rd	Scott River	1909	Pratt
	02C0028	Scott Mt Rd	East Fork Scott River	1914	Warren
	02C0036	Louie Rd	Shasta River (Louie Bridge)	1935	Pratt
	02C0058	Front St	Cottonwood Creek	1935	Warren
	02C0064	Quartz Valley Rd	Lower Shackleford Creek	1935	Warren
	02C0068	County Rd 9K006	Cottonwood Creek	1915	Pratt
	02C0227	Elk Creek Rd	Klamath River	1953	Parker
Modoc	03C0091	County Road 75	Pit River	1919	Pratt
Humboldt	04 0015	State Route 283	Eel River Bridge & Overhead	1941	Cantilever
	04 0016R	U.S. Highway 101	Eel River	1941	Pennsylvania Petit
	04 0022L	U.S. Highway 101	Eureka Slough	1943	Parker
	04 0025R	U.S. Highway 101	Mad River	1929	Warren
	04 0144	State Route 96	Klamath River	1949	Cantilever
	04C0040	Fort Seward Rd	Eel River	1958	Warren

County	Bridge #	Road / Street	Feature Intersected	Year Built	Bridge or Truss Type
	04C0069	Old Mattole Rd	McNutt Creek	1926	Pratt
	04C0078	Mattole Rd	Mattole River	1929	Warren
	04C0116	Irr Bair Rd	Redwood Creek	1951	Pratt
	04C0121	Chezem Rd	Redwood Creek	1916	Pratt
Trinity	05C0183	Bridge St	Hayfork Creek	1948	Warren
Shasta	06 0031Z	Shotgun Creek	Interstate 5	1928	Warren
	06 0052	State Route 89	Lake Britton	1938	Cantilever
	06 0089	Interstate 5	Sacramento River (Antler)	1941	Cantilever
	06C0020	Parkville Rd	Bear Creek	1920	Pratt
	06C0024	Lower Gas Point Rd	North Fork Cottonwood Creek	1913	Pratt
	06C0202	Irr Cove Rd	Hatchet Creek	1950	Bailey
	06C0221	Lone Tree Rd	Lonetree Creek	1950	Bailey
	06C0231	Dog Creek Rd	Clear Creek	1930	Warren
	06C0238	Buzzard Roost Rd	Cedar Creek	1950	Bailey
	06C0281	Island Rd	Little Tule River	1950	Bailey
	06C0348	Soda Creek Rd	Soda Creek	1930	Pratt
Tehama	08 0068	State Route 32	Deer Creek	1939	Warren
	08C0004	Morrison-Bryan Rd	Burris Creek	1914	Pratt
	08C0009	Bowman Rd	South Fork Cottonwood Creek	1920	Warren
	08C0012	Vestal Rd	South Fork Cottonwood Creek	1914	Pratt
	08C0016	Lowrey Rd	North Fork Elder Creek	1942	Warren
	08C0020	Wildcat Rd	North Fork Battle Creek	1953	Bailey
	08C0021	Manton Rd	Digger Creek	1916	Pratt
	08C0022	Plum Creek Rd	Paynes Creek	1914	Pratt
	08C0026	Kansas Ave	Antelope Creek	1926	Pratt
	08C0032	Paskenta Rd	Elder Creek	1942	Warren
	08C0041	Lowrey Rd	South Fork Elder Creek	1942	Warren

County	Bridge #	Road / Street	Feature Intersected	Year Built	Bridge or Truss Type
	08C0043	Jellys Ferry Rd	Sacramento River	1949	Parker
	08C0049	Sherwood Blvd	Mill Creek	1940	Warren
	08C0063	Pettyjohn Rd	Cold Fork Cottonwood Creek	1941	Warren
	08C0064	Pettyjohn Rd	Cold Fork Cottonwood Creek	1941	Warren
	08C0072	Leininger Rd	Deer Creek	1920	Warren
	08C0073	Lassen Rd	Singer Creek	1938	Warren
	08C0086	McCarty Creek Rd	McCarty Creek	1893	Pratt
	08C0089	Ohio Ave	Jewett Creek	1929	Pratt
	08C0107	Butte Moutain Rd	Elmore Creek	1927	Pratt
	08C0267	Lowrey Rd	Middle Fork Elder Creek	1942	Warren
	08C0303	Hall Rd	West Burch Creek	1914	Pratt
Plumas	09C0008	Nelson St	Indian Creek	1941	Warren
	09C0012	Beckwourth-Greenville Rd	Lights Creek	1947	Warren
	09C0014	Warren Hill Rd / Queen City Rd / Port Wine Rd	Slate Creek	1910	Pratt
	09C0034	Keddie Resort Rd	Spanish Creek	1919	Warren
	09C0041	Rich Bar Rd	East Branch North Fork Feather River	1951	Bailey
	09C0061		Butte Reservoir Spillway	1941	Warren
	09C0134	Blarsden Gragle Rd	Middle Fork Feather River	1902	Pratt
Mendocino	10 0037	State Route 271	South Fork Eel River	1934	Parker
	10 0082	U.S. Highway 101	Russian River	1934	Warren
	10 0113	State Route 1	Garcia River	1938	Warren
	10 0134	State Route 1	Salmon Creek	1950	Warren
	10 0149	State Route 1	South Fork Eel River	1944	Warren
	10 0176	State Route 1	Noyo River	1948	Cantilever
	10C0070	Hearst-Willits Rd	Eel River	1911	Pratt

County	Bridge #	Road / Street	Feature Intersected	Year Built	Bridge or Truss Type
	10C0111	Hill Road	Mill Creek	1909	Pennsylvania Petit
	10C0113	County Road 301 East Hill	Davis Creek	1909	Pratt
	10C0174	Reynolds Highway	Outlet Creek	1955	Bailey
Glenn	11 0017	State Route 162	Sacramento River	1948	Swing
	11C0018	Soeth Rd	Stony Creek	1913	Pratt
Butte	12C0023	Durnell Rd	Butte Creek	1904	Pratt
	12C0062	Boucher Rd	Little Chico Creek	1920	Warren
	12C0066	Guynn Rd	Lindo Channel	1911	Warren
	12C0067	Grape Wy	Lindo Channel	1911	Warren
	12C0093	Cana-Pine Creek Rd	Pine Creek	1931	Warren
	12C0109	South End Alberton Ave	Little Chico Creek	1929	Warren
	12C0188	Lumpkin-Laporte Rd	Fall River	1929	Pratt
Sierra	13 0005	State Route 49	Downie River	1938	Warren
	13C0003	Pearl St	Downie River	1938	Warren
	13C0006	Nevada St	North Fork Yuba River	1938	Pratt
	13C0007	Mountian House Rd	North Fork Yuba River	1922	Warren
Yuba	16C0010	Timbuctoo Rd	Deep Ravine No 1	1909	Pratt
	16C0011	Timbuctoo Rd	Deep Ravine No 2	1903	Pratt
	16C0023	Scales Rd	Slate Creek	1939	Warren
	16C0033	Pike City Rd	Oregon Creek	1929	Warren
	16C0081	Blackford Rd	Bear River at Camp Farwest Wier	1916	Pennsylvania Petit
Placer	19C0071	Soda Springs Rd	North Fork American River	1937	Warren
	19C0117	Cook Riolo Rd	Dry Creek	1940	Warren
	19C0132	Gladdings Rd	Doty Creek	1938	Warren
	19C0139	McCourtney Rd	Coon Creek	1936	Warren

County	Bridge #	Road / Street	Feature Intersected	Year Built	Bridge or Truss Type
Sonoma	20 0038	State Route 128	Russian River	1932	Pratt
	20C0002	Crocker Rd	Russian River	1938	Warren
	20C0006	Alexander Valley Rd	Russian River-Jimtown	1948	Warren
	20C0017	Watmaugh Road	Sonoma Creek	1929	Warren
	20C0018	Bohemian Hwy	Russian River	1934	Pratt
	20C0037	River Rd	Russian River	1914	Parker
	20C0040	Westside Rd	Dry Creek	1934	Pratt
	20C0048	D Street	Petaluma River	1933	Bascule
	20C0094	Old Duncans Grade Rd	Austin Creek	1924	Pratt
	20C0141	Annapolis Rd	Gualala River (Clark Crossing)	1909	Parker
	20C0213	Arnold Dr	Sonoma Creek	1930	Parker
	20C0240	Hauser Br Rd	South Fork Gualala River	1947	Bailey
	20C0430	Old Cazadero Rd	Austin Creek	1950	Bailey
	20C0435	Bohn Dillon Rd	South Fork Gualala River	1950	Warren
	20C0440	Freestone Flat Rd	Salmon Creek	1955	Bailey
Napa	21 0075	State Route 121	Napa River (Maxwell Br)	1949	Lift
	21C0048	Bale Lane	Napa River	1937	Warren
	21C0064	Lodi Lane	Napa River	1930	Warren
Yolo	22 0040	State Route 113	Sacramento River-Knights	1933	Bascule
	22C0074	County Road 57	Cache Creek	1932	Pratt
	22C0075	County Road 25	Cottonwood Slough	1932	Pratt
Solano	23 0024	State Route 12	Sacramento River Bridge & Separation	1944	Lift
	23 0035	State Route 84	Miner Slough	1933	Swing

County	Bridge #	Road / Street	Feature Intersected	Year Built	Bridge or Truss Type
Sacramento	24C0005	Walnut Grove Crossing	Sacramento River	1950	Bascule
	24C0011	Sutter Slough Bridge Rd	Sutter Slough	1939	Swing
	24C0042	Tyler Island Bridge Rd	Georgiana Slough	1940	Swing
	24C0053	Twin Cities Rd	Snodgrass Slough	1931	Swing
	24C0056	Michigan Bar Rd	Cosumnes River	1947	Bailey
	24C0076	H Street	American River	1932	Parker
El Dorado	25C0037	Salmon Falls Rd	South Fork American River	1953	Warren
Amador	26C0002Z	Sutter Creek	Bike Path	1910	Pratt
	26C0005	Broadway	South Fork Jackson Creek	1911	Pratt
Marin	27 0023	State Route 1	Lagunitas Creek	1929	Warren
Contra Costa	28C0295	Civic Park Pedestrian Overcrossing	Walnut Creek	1914	Pratt
San Joaquin	29 0050	State Route 4	San Joaquin River (Garwoods)	1933	Swing
	29C0037	Peltier Rd	Mokelumne River	1947	Pennsylvania Petit
	29C0127	Manthey Rd	San Joaquin River	1926	Bascule
	29C0131	Walnut Grove Rd	Mokelumne River	1955	Swing
	29C0219	Eight Mile Rd	White Slough (Honker Canal)	1936	Pratt
	29C0392	Thornton Rd	Mokelumne River	1950	Swing
Calaveras	30C0024	Calaveritas Rd	Calaveritas Creek	1928	Warren
Tuolumne	32C0003	Wards Ferry Rd	Deer Creek (Wards Ferry Rd)	1909	Pratt
	32C0022	Buchanan Rd	North Fork Tuolumne River	1935	Warren

County	Bridge #	Road / Street	Feature Intersected	Year Built	Bridge or Truss Type
Alameda	33 0046Y	Creek	Arroyo De La Laguna	1914	Parker
	33 0086	State Route 61	San Leandro Bay	1953	Bascule
	33C0132	Bernal Ave	Arroyo De La Laguna	1941	Camelback
San Francisco	34 0048	18th Street Pedestrian Overcrossing	US101	1953	Rectangular
Santa Cruz	36C0066	Kings Creek Rd	Kings Creek	1925	Warren
Santa Clara	37C0539	Gilroy Hot Springs Rd	Coyote Creek	1906	Pratt
Stanislaus	38C0009	Crabtree Rd	Dry Creek	1911	Pratt
Mariposa	40C0028	Oak Grove Rd	Striped Rock Creek	1912	Pratt
	40C0038	Dogtown Rd	Maxwell Creek	1926	Pratt
Madera	41 0008	State Route 99	San Joaquin River	1928	Warren
	41C0161	County Road 210	Fine Gold Creek	1924	Warren
	41C0165	County Road 800	Mid Fork Chowchilla River	1912	Pratt
	41C0167	County Road 800	Speciman Springs	1912	Pratt
	41C0174	Avenue 21 1/2	Berenda Slough	1954	Warren
Fresno	42C0261	Italian Bar Rd	San Joaquin River	1952	Warren
	42C0264	Jose Basin Rd	Bald Mill Creek	1947	Bailey
San Benito	43C0006	South Side Rd	Tres Pinos Creek	1940	Warren
Monterey	44C0009	Nacimiento Lake Dr	San Antonio River	1922	Pratt
	44C0019	Old Coast Highway	N Fork Little Sur River	1950	Bailey
	44C0020	Old Coast Highway	S Fork Little Sur River	1950	Bailey

County	Bridge #	Road / Street	Feature Intersected	Year Built	Bridge or Truss Type
	44C0036	Cholame Road	Little Cholame Creek	1915	Pratt
	44C0050	Bradley Rd	Salinas River	1931	Warren
	44C0066	Elm Ave	Arroyo Seco River	1916	Parker
	44C0089	Lewis Creek Rd	Lewis Creek	1919	Pratt
	44C0101	Cattlemen Rd	Salinas River	1930	Warren
	44C0145	Parkfield/Clng Rd	Little Cholame Creek	1915	Pratt
Tulare	46C0119	M319	South Fork Kaweah River	1945	Warren
	46C0185	Road 120	Deer Creek	1925	Warren
	46C0195	M348	South Fork Kaweah River	1952	Bailey
	46C0199	M348 S Fork Dr	South Fork Kaweah River	1937	Warren
San Luis Obispo	49C0037	Dover Canyon Rd	Jack Creek	1920	Warren
	49C0109	Bello St	Pismo Creek	1913	Pratt
	49C0143	Branch Mill Rd	Tar Springs Creek	1949	Bailey
	49C0158	Via Ave	Atascadero Creek	1948	Bailey
	49C0307	Grove Dr	Estrella River	1910	Parker
Santa Barbara	51 0097R	State Route 1 Northbound	Santa Ynez River	1944	Warren
	51 0140	State Route 150	Rincon Creek	1927	Pratt
	51 0141	State Route 150	Rincon Creek	1927	Pratt
Ventura	52C0110	Santa Ana Rd	Coyote Creek	1924	Pratt
Los Angeles	53 0113	State Route 39	San Gabriel River	1935	Warren
	53C0070	East Fork Rd	North Fork San Gabriel River	1949	Warren
	53C0160	Riverside Dr	LA River, Ave 19, SPTCO	1928	Warren
	53C0742	Concord Street	Verdugo Wash	1940	Pratt
	53C1141	Colfax Ave	Los Angeles River	1956	Warren
	53C2045	Whittier Blvd.	Rio Hondo	1921	Warren

County	Bridge #	Road / Street	Feature Intersected	Year Built	Bridge or Truss Type
San Bernardino	54C0088	1st Ave	Barstow Overhead	1930	Parker
	54C0420	Garnet St	Mill Creek	1925	Pratt
San Diego	57C0322	Hill St / Pacific Coast Highway	San Luis Rey River	1930	Warren

TOTAL: 186 bridges

6. PREPARERS QUALIFICATIONS

Principals Rand Herbert and Stephen Wee directed this project. Mr. Herbert (M.A.T. in History, University of California at Davis), and Mr. Wee (M.A. in History, University of California, Davis) have more than 27 years experience each in conducting historic resources inventory and evaluation studies. Based on their levels of education and experience Mr. Herbert and Mr. Wee qualify as historians and architectural historians under the United States Secretary of the Interior's Professional Qualification Standards (as defined in 36 CFR Part 61).

JRP senior architectural historian Christopher McMorris was the general project manager / lead historian for the project. Mr. McMorris directed research and field survey crews, data management and graphics production, and prepared the contextual statement and evaluations. Mr. McMorris holds a M.S. in Historic Preservation from Columbia University in New York. He has been with JRP since 1998, conducting historic survey and evaluation studies and other historic preservation projects. Mr. McMorris also qualifies as historian and/or architectural historian under the United States Secretary of the Interior's Professional Qualification Standards (as defined in 36 CFR Part 61).

Staff historians for this project were Amanda Blosser and Toni Webb. Staff historians conducted the field surveys of historic bridges, performed research and contributed to the evaluation analysis, as well as data management. Staff historians also contributed to the production of the narrative context developed for the study area. Ms. Blosser received a M.S. in Architecture from Texas Tech University with a specialization in historic preservation and has over three years of experience in public history and historic preservation. Ms. Webb received a B.F.A. in Historic Preservation from the Savannah College of Art & Design and has over four years of experience in public history and historic preservation. Ms. Blosser, and Ms. Webb also qualify as historians and/or architectural historians under the United States Secretary of the Interior's Professional Qualification Standards (as defined in 36 CFR Part 61).

Research assistants and technicians on this report were Brandon De Lallo, Stacie Ham, Susan Hotchkiss, Eric Johnson, Nella Cornwall, Cindy Toffelmier, and Andrew Walters. The assistants and technicians assisted with field survey and research tasks, as well as data management, graphics production, and word processing. Many of the research assistants at JRP are recent graduates or current students of the Public History program at California State University, Sacramento. Others are graduates of the University of California, Davis or California State University, Sacramento, with bachelor degrees in history or related fields.

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ATTACHMENTS

APPENDIX A:
LETTERS FROM
THE INTERESTED PUBLIC

APPENDIX B:
FIGURES

APPENDIX C:
BRIDGE RATING SHEET FORMS

See Volume II-A and Volume II-B

Caltrans Historic Bridges Inventory Update: Metal Truss, Movable, and Steel Arch Bridges

Prepared For:

State of California
Department of Transportation
Environmental Program
1120 N Street
Sacramento, California 95814

Prepared By:

JRP Historical Consulting
1490 Drew Avenue, Suite 110
Davis, California 95616

Volume IIA

March 2004

Caltrans Historic Bridge Inventory Update: Metal Truss, Movable, and Steel Arch Bridges

Contract: 43A0086
Task Order: 01
EA: 43-984433

VOLUME II-A:
BRIDGE RATING SHEET FORMS
DEL NORTE COUNTY (01) - SONOMA COUNTY (20)

Prepared for:

State of California
Department of Transportation
Environmental Program
1120 N Street
Sacramento, California 95814

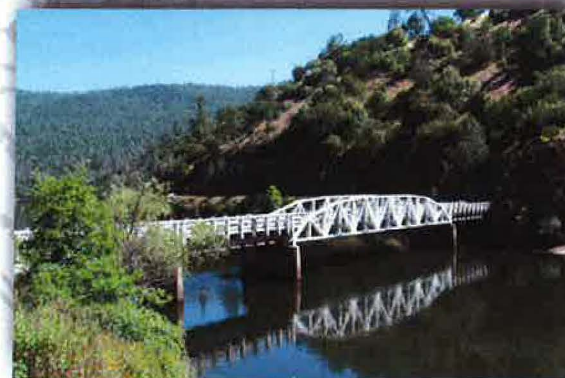
Prepared by:

Christopher McMorris

JRP Historical Consulting
1490 Drew Avenue, Suite 110
Davis, California 95616

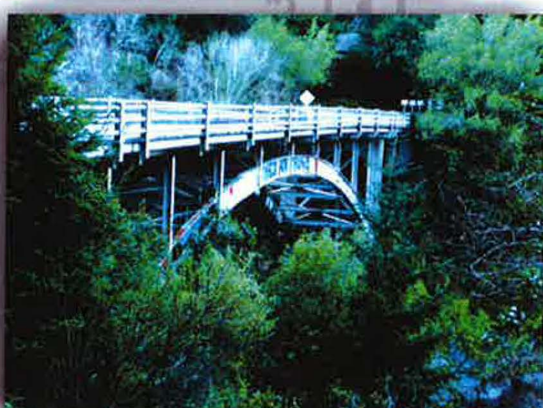
March 2004

CALTRANS HISTORIC BRIDGES INVENTORY UPDATE: METAL TRUSS, MOVABLE, AND STEEL ARCH BRIDGES



PREPARED FOR:

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
ENVIRONMENTAL PROGRAM
1120 N STREET
SACRAMENTO, CALIFORNIA 95814



PREPARED BY:

JRP HISTORICAL CONSULTING
1490 DREW AVENUE, SUITE 110
DAVIS, CALIFORNIA 95616

VOLUME IIB

MARCH 2004

Caltrans Historic Bridge Inventory Update: Metal Truss, Movable, and Steel Arch Bridges

Contract: 43A0086
Task Order: 01
EA: 43-984433

VOLUME II-B:
BRIDGE RATING SHEET FORMS
NAPA COUNTY (21) – IMPERIAL COUNTY (58)

Prepared for:

State of California
Department of Transportation
Environmental Program
1120 N Street
Sacramento, California 95814

Prepared by:

Christopher McMorris

JRP Historical Consulting
1490 Drew Avenue, Suite 110
Davis, California 95616

March 2004