
Sacramento Railyards
SMUD Museum of Science and Curiosity
Jibboom St
Schetter Electric, Inc
N B St
Specialty Motorsports
Iron Mechanical Inc
Two Rivers Wellness
N D St
Dos Rios St
Swallowtail Ave
Commerce Printing Services
N 12th St
Smt Tunl Ave
Smt Tunl Ave
Smt Tunl Ave
Loaves & Fishes
Sims Metal
Salvation Army
Railyards Blvd
B Street River Access
Sacramento River
5th St
The A.J
6th St
7th St
A St
N 14th St
Ahern St
N A St
2nd St
Southern Pacific Railway Workshops
KCRA
Burnett & Sons
720 D St. Parking
D St
Mid Century Sacramento
10th St
Creamery Ln
8th St
E St
City Park Apartments
11th St
12th St
15th St
14th St
I St Bridge
F St
City of Sacramento Lot 297
Taqueria Jalisco
C St
California State Railroad Museum
Public Parking Lot
Hiso
Barber Blues
J St
H St
Sacramento Valley
Gordon D. Schaber Sacramento County...
9th St
Fat Aly
River Walk Park
Old Sacramento Waterfront
4th St
Kaiser Permanente Pharmacy
H Salt Fish & Chips
DOCO - Downtown Commons
K St
Sacramento Railyards Vicinity Map

HISTORIC AMERICAN ENGINEERING RECORD
SOUTHERN PACIFIC COMPANY, SACRAMENTO SHOPS
(Central Pacific Railroad Company, Sacramento Shops)
(Southern Pacific Locomotive Works)

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In 2001 the Historic American Engineering Record (HAER) began a two year documentation project at the Southern Pacific's (SP) Sacramento Shops, a railroad maintenance and repair facility built by the Central Pacific Railway (CP) in the 1860s and which remained in operation until 1999. Other HAER documents describe the maintenance of steam and diesel locomotives at the shop, issues surrounding the railroad's shift from steam to diesel motive power, and the history and construction of the buildings still present on the site. This report describes work and employment at the shops, the products that the shops maintained, repaired and constructed, and unusual details of the shops' history, including the work of notable inventors and innovators.

Construction began on this site, 20 acres of filled-in slough donated by the City of Sacramento, in 1863. The CP built two buildings for materials storage and car repair (locomotives were initially stored outside) and a third, containing one forge, for locomotive repair. In 1864 another car shop and another locomotive shop were constructed, and in 1866 the first car construction building was completed. By 1877 the complex had grown to 50 acres. In 1922 the shops covered 145 acres; by the 1930s they had grown to their current size of about 200 acres.

By 1877 the CP had already developed auxiliary shops in Oakland, Tulare, Los Angeles, Mojave, Rocklin, Truckee, Wadsworth, Carlin, Winemucca, Terrace, Wells and Red Bluff. Some of these shops, as well as additional facilities acquired in mergers, became important equipment maintenance, repair, and even construction sites after the turn of the century, though the Sacramento site remained the railroad's largest shop facility until it was closed down in 1999.

At its height, in the 1930s and '40s, the Sacramento site had more than 90 buildings. Only eight now remain; others have since been destroyed or demolished, though plans on paper and foundations and pads on the site remain to indicate their locations and footprints. The Boiler Shop and Erecting Shop were documented in 2001; the construction and history of the other six buildings were addressed in 2002.

The Central Pacific Railroad (CP) was founded in 1861; by 1869 it controlled and operated lines in California, Nevada and part of Utah and by 1872 was responsible for 1,219 miles of main and branch lines. Although its location on the west coast shielded it somewhat from trends and incidents that affected railroads nationwide, particularly strikes and labor unrest, the company's cycles of expansion and stagnation reflected the "boom and bust" of the nation's economy. Between 1869 and 1874 the CP's earnings increased yearly, until the Panic of 1873 led to four years of depression which were exacerbated in the West by the mining crisis and drought of 1876. This depression culminated in a series of wage cuts and resulting strikes and riots on railroads in the East throughout the summer of 1877.

American railroads, including the CP, continued to suffer a decline in gross earnings per mile through 1880; earnings remained low until around 1885 though the CP began to make a profit again in 1884. By 1880 the Sacramento Shops employed only about 600 men, and the only new work was machinery for two Sacramento River steamboats. In 1885 the Central Pacific Railroad and the Southern Pacific Railroad were subsumed under the Southern Pacific Company, a holding company incorporated in Kentucky; after that the name Central Pacific began to be supplanted by the name Southern Pacific.

In 1900 Edward Henry Harriman, then president of the Union Pacific (UP), took over management of the Southern Pacific Company, which included the Central Pacific; the Harriman Lines ultimately controlled more than 8,000 miles of rail. The Harriman era was a boom decade for railroads nationwide, as they transported increasing amounts of freight, expanded operations, and consolidated. During this period Harriman spent $240 million on repair and upgrade of track, buildings, engines and rolling stock.

The boom came to an end with the brief Panic of 1907, which affected capital businesses more strongly than consumer businesses; the Sacramento Shops laid off many workers, reduced hours to half time, and finally closed in July 1908. The railroads never really recovered from this downturn because the Hepburn Act, passed in 1906, gave the Interstate Commerce Commission (ICC) the authority to regulate railroad rates, and the ICC did not permit rate increases for the following decade. While traffic and revenues increased, railroads found it difficult to meet demand; profits dropped and maintenance was deferred.

In 1913 the federal government began to review the Harriman Lines monopoly. A court order in 1917 required the SP to sell its CP stock, but public outcry against the chaos that would result caused the legislature to pass laws allowing the ICC to authorize control of one railroad by another, and the ICC eventually authorized the SP to control the CP in 1923. The beginning of World War I at first caused a downturn in revenues as the volume of freight dropped, but military mobilization and a reduction in maritime freight increased rail traffic in 1916 and 1917. Between June 1918 and February 1920, after the United States entered the war, the United States Railway Administration (USRA) took control of all American railroads including the Southern Pacific.

In 1928 and 1929 the SP earned the highest revenues in its history. By 1932, however, ton-miles were half of what they had been in 1929, and in 1933 half of the SP's employees were laid off and many shop facilities closed permanently. 1936 saw an upturn in business; during this period the Sacramento Shops were kept busy remodeling rolling stock as the SP modernized both passenger and freight services to compete with car and truck transportation.

During World War II the demand for rail service and the shortage of labor caused the shops to increase their workload and hiring significantly for both railroad operations and other wartime projects. The SP bought its first diesel engine in 1939, but did not start large scale replacement of steam by diesel until the late 1940s, a change which, along with the SP's new interest in efficiency and rationalization, spurred significant alterations in the operation of the shops. This process continued through the 1960s and 1970s.

The recession that began in 1974 had a significant effect on the SP. No new engines were bought until 1984, and the diesel locomotive rebuilding program that had begun at the Sacramento Shops in 1969 was reduced. In 1997 the SP merged with the UP, and facilities were consolidated; the Sacramento Shops were finally closed in December 1999 when the last contractors, no longer railroad employees, moved to new facilities in Rocklin, near the UP maintenance facility in Roseville.

Maintenance and construction of locomotives and rolling stock required a large assemblage of diverse skilled trades under one roof; additionally, it required teamwork and close relationships between and within these trade divisions. Because of the complexity and diversity of equipment and tasks, and because locomotives and rolling stock were continually being adapted and improved, the work was never really mechanized or automated, though it was eventually systematized and streamlined.

When the shops opened in 1863 the staff consisted of 15 men. By 1878 the shops employed 1,700 men, reduced to 1,300 men by 1883. By 1898 the staff had increased to nearly 3,000 men. In 1908 all employees were laid off and the shops closed temporarily; the shops reopened and hired employees shortly thereafter, but in 1914 layoffs reduced their numbers once again. Although in 1914 shops were only running six to seven days a month, by 1915, they employed 2,000 men six days a week. Another wave of layoffs in late 1916 eliminated 200 to 250 jobs. By the late 1910s, however, 2,200 people worked at the shop, and the SP was desperate to hire more; by 1920 the shops employed 3,500 workers. During World War II as many as 7,000 people worked three shifts, but after the war the staff dropped to about 3,000, a number that gradually declined as staff and operations were transferred elsewhere until the shops closed.

Unlike at railroad shops in other parts of the country, the staff at the Sacramento Shops did not include large proportions of immigrants or slaves; through most of the 20th century virtually all shop employees were white men. Initially the shops employed mostly Scots, Irishmen, and Cornishmen, though by 1906 the city's work force included Japanese, Mexicans, Italians, Jews, Yugoslavs, and Hindis. By the 1950s many Italians, Eastern Europeans and Russians were employed in the shops; and by the 1960s Hispanics were represented. Though as late as the 1960s it appeared that very few African-Americans or Asians worked at the shops, one source mentions that engine wiper was "usually a Chinaman" and during the war the shops employed at least one all-black cleaning crew and one former employee recalls a "black lady" who ran the turntable in the roundhouse. Black workers were apparently recruited in the South to work on the SP in California, but they were employed in Oakland, Los Angeles and Portland rather than Sacramento. During World War II Mexican nationals were imported to work on American railroads, and some worked in the Sacramento Shops during this period.

Though workers in Sacramento did not appear to be as divided by ethnicity, language or race as in other work settings, minority workers did not appear able to rise in the hierarchy, perhaps because they were not taken on as apprentices. White workers denied any ethnic discrimination, but one Hispanic worker claims that he was passed over for promotion and got his rights only through the intervention of the union. Nevertheless, the SP seems to have established a relatively nondiscriminatory work environment, and in 1962 was the first railroad to support John F. Kennedy's equal opportunity platform before the passage of the Civil Rights Act.

The first women employees at the Sacramento Shops were hired during the labor shortage of World War I, and performed largely "housekeeping" activities like car cleaning and scrap sorting. Although many women left the shops (often after marrying other shop workers), some women remained on the payroll; most of these women did certain types of "fine work" in the pattern department and other shops. They were apparently considered equal to men under union agreements; a 1921 agreement states that women should receive the same pay rate as men doing the same jobs.

In addition to returning retirees and Mexican nationals, the shortage of labor during World War II caused the Sacramento Shops to hire hundreds of women, mostly from railroad families; by the end of 1942 the shops employed nearly 2,000 "railroadettes." Unlike the previous generation of women workers, however, these women were clerks, riveters, painters, locomotive cleaners, machinery operators, and drafters, as well as workers in more traditionally feminine roles. Although it appeared that the quality of their work was high and they worked well with the other employees, they disappeared rapidly from the shops when the previous workers returned from military service. Almost all of the women who remained in the shops were transferred to "pink collar" jobs as clerks or secretaries in the storeroom or offices.

Although the historical evidence is very clear that women who worked in the trades during the war were proud of their work, their skills, and their paychecks, it was often claimed after the war that "women never desired to secure those types of jobs." One woman reported that a job she had applied for in the early 1950s "wasn't open to women," but that she was able to get it after her husband, a railroad employee, intervened in her behalf. She also reported that although she had mechanical experience from wartime work at the shipyards, at that time "they weren't taking women for mechanical at all." Though women were not accepted as apprentices for several years after the war, they once again started working in heavy industry around the 1970s. Former employees recall seeing and working with women machinists and electricians during this period, and a photo of a female boilermaker apprentice appears in the SP Bulletin.

Initially, the Sacramento Shops, like other West Coast railways, offered opportunities for shopmen unable to obtain promotion on the East Coast. After the turn of the century, however, most shop workers appear to have been hired locally and trained onsite. It was typical to obtain a position at the shops through a relative who worked there, often in the same craft as the new employee; many families all worked at the shops. This was partly the result of family members employed at the shops being aware of job openings, and recommending relatives to hirers; it was also, however, due to the fact that the SP was the local economy's largest employer. Everyone in town had some connection to the railroad.

By the beginning of the 20th century almost all shop workers started as helpers or apprentices. The SP's first formal apprentice school, for boys aged 16 to 21, opened in Oakland in 1913; by 1925 a dozen or so more had opened and nearly 1,000 apprentices had completed the program. The largest program was at the Sacramento Shops, which trained nearly a quarter of the 1,318 apprentices enrolled in 1925. Seventy to eighty percent of apprentices that went through the program stayed with the railroad, a high number compared to other apprentice programs. Because of safety concerns and union regulations, apprentices didn't work with heavy equipment or work nights, nor did they receive holiday or sick pay.

Before the widespread unionization of the 1880s work rules tended to be flexible and somewhat arbitrary. In the shops, master mechanics had total authority over hiring, firing and work assignment, and it was common for them to summarily suspend or dismiss employees for any infraction. After unionization, companies acceded to workers' demands for more centralization and standardization in hiring, firing, work rules and discipline. Unions fought for promotion and job assignments based on seniority rather than merit, because merit was often used capriciously and arbitrarily.

Both unions and management saw benefits in the "Brown system" of discipline, named after George R. Brown, General Superintendent of the Fall Brook Railway. Instead of levying suspension or dismissal for every infraction, which was hard on both the railway and on employees, a "virtual suspension" was entered into an employee's record. These "brownie points" could be erased by subsequent months of good conduct. The system, however, didn't keep employees from being fired on the spot for serious enough offenses. This system also provided the unforeseen advantage of standardizing appropriate procedures for dealing with particular situations, and appropriate penalties for failing to do the correct thing.

Although foundry work was reported to be done "by contract" in 1891, unlike several other American railroads, the SP apparently never tried to institute piecework at the Sacramento Shops. At various times some shops, like the blacksmith shop, the brass foundry and the air room, had quotas for individual employees. Other shops, like Car Shop 9 and the truck shops, worked on an assembly line and had a daily quota of cars or other equipment to turn out. The air brake shop ran on an assembly line, and purchased parts from Westinghouse. But this was not typical; generally jobs took as long as they took and workers were not generally pressured to work quickly (though they were able and willing to work quickly when required by emergency or other deadlines). Around the middle of the century the car truck shop turned out 20 trucks a day, though could put out as many as 125 at maximum production; the schedule was set by demand from the car shop.

By the 20th century the shops were run strictly by union rules. Job assignments, overtime and vacation schedules were assigned strictly by seniority. When layoffs were necessary, senior employees "bumped" people with less seniority to lower level jobs in the same craft. Employees were only permitted to work in their own crafts, which occasionally caused problems at the shops, as carmen's crafts were separate from locomotive crafts and neither was permitted to work on the other's equipment. Despite what sometimes appears to be the unreasonable rigidity of union rules, workers were generally positive about their craft unions, recognizing that they defended workers' interests and acknowledging that wages and working conditions in the shops wouldn't be as good without union support.

At least through the late 1930s shop workers generally worked six days a week, though many shopmen often got Saturday afternoons off as well as Sundays. Ten hour days were typical until 1916. By the late 1930s the shops generally ran two eight-hour shifts, though hours were increased during emergencies or rush jobs and reduced during the winter or in slack periods. During World War II the shops ran on two ten hour shifts due to shortage of labor; maintenance and a few other departments were staffed around the clock. Employees recall that the shop was regulated by the steam whistle, which had its own boiler room, near the end of the blacksmith shop; it blew five minutes before shift, at shift, at lunch, and at end of shift.

Working conditions varied in the different shops. Starting in the 1920s most carmen worked outdoors in Car Shop 9. If it rained, carmen brought their own rain gear. In winter they burned scrap lumber and waste in empty paint and oil drums, and spent as much time as they could huddling around the fires. In the summer in Car Shop 9 replacing wood interiors inside steel boxcars could be like working in an oven. Car Shop 3, by contrast, was heated with oil burning stoves by the 1950s; because precision work required a fairly constant temperature, the air room was heated by steam radiators. Other interior spaces were heated by space heaters and cooled by electric fans.

Interior work spaces were not always more pleasant environments, however. The foundry was dark, dirty and unventilated. The fine dust produced by the grinders in the brass shop was both unpleasant and unhealthy. Workers indoors breathed in the asbestos in boiler jackets and passenger car linings. One carman mentioned that miserable as Car Shop 9 was, at least it wasn't dusty like the cabinet shop. The erecting shop was extremely noisy, with cranes, riveting, and pounding on boilers.

Contrary to what some people have believed, the SP never had a policy of requiring employees to use the restrooms at specific times–no employee interviewed for oral history was familiar with this practice, though it was apparently used as a way for a foreman to harass an employee.

The shop environment was made as attractive as possible for employee health and safety as well as for morale. In 1906 the highly flammable eucalyptus trees that had been planted around 1876 to reduce the risk of malaria were chopped down, though by 1915 there were still green spaces on the shop grounds and a few of the palm trees planted on the site are still growing south of the locomotive transfer table. It was typical for interior walls in shops to be whitewashed to reflect light. In the 1940s machines and walls were repainted light colors to provide more interior light, and machines were painted bright contrasting colors to make moving parts easier to see. Lines were painted on the floors to indicate storage areas and machine clearances.

The shops supplied some workers' tools; workers bought or made others. Union agreements required provision of clean, dry and sanitary workspaces, water and ice where necessary, safe equipment, and in some cases protective clothing. As these items began to come into regular use, the railroad began to supply goggles, hard hats and other safety equipment, though employees bought their own work clothes. Each foreman held his own safety meetings, generally for five minutes at the beginning of each shift. The Sacramento Shops appear to have had a good safety record throughout their history; from 1940 to 1942 the Sacramento shops earned the safety award for all Southern Pacific shops.

Although until well into the 20th century railroads generally did not take responsibility for worker injuries or deaths, companies often paid medical bills and portions of salaries, or lump sum payments to survivors, on a case by case basis. The SP did not appear to have a formal workers' compensation policy until mandated by state law in 1913, but did employ injured workers as a "crippled class" in less physically demanding positions. In 1868 the railroad built the CP (later the SP) Hospital, the first industrial hospital in the world, for employees as well as passengers injured in railway accidents. This nonprofit institution was funded by employee contributions, company funds, and grants and gifts from several sources, which paid for all required staff, drugs, and food and supplies for patients as well as fifteen emergency facilities around the divisions. Several doctors saw patients at the hospital during certain hours, but major surgery was performed at the SP hospital in San Francisco.

The first hospital, a four story wood building located on the southwest corner of 13th and C Streets, accommodated 125 patients and also housed an employee library. Between 1868 and 1877 it served about 3,600 patients and accommodated about 7,750 office visits; of this number only 148 died. By 1904 this hospital had been replaced by a brick building located just northeast of the current site of the California State Railroad Museum. In 1963 the hospital department was reorganized, and the railroad started using private employee insurance. The building had become vacant by the 1970s and was torn down in 1986.

Shop workers were forced to retire at 70, at which time it was apparently traditional for fellow employees to provide a party and a gift–generally a watch, though a blacksmith once received an easy chair. In 1903 the SP created a Board of Pensions; by 1922 the Southern Pacific was spending more than $500,000 a year on pensions for retired or disabled workers.

In 1942 the railroad instituted paid vacation for employees. Employees received one week of vacation until they had worked for the railroad for five years, increasing incrementally to five weeks after 25 years of service. According to the rules, casual time off, including medical time off, was not paid for, but this rule was apparently extremely flexible and foremen ignored casual time off if employees didn't abuse the privilege.

From the railroad's earliest days it was apparently customary for the company to issue travel passes to employees; in the early days a laid off employee could request a travel pass in order to seek work elsewhere. Employees who had worked at the railroad for ten years received individual travel passes for the division; travel privileges for the employee and his family increased incrementally until employees with 25 years of service received family system passes. The railroad also awarded travel passes annually for meritorious service. In addition to individual and family travel passes, the SP occasionally provided excursion trains to Reno or the Sierras for groups of employees.

Until 1894 the CP and SP had avoided significant labor disputes; the railroad did not become a closed shop until 1952, but wages on the west coast were relatively high and working conditions were good. Railway management was on good terms with the railroad employee brotherhoods, particularly the "Big Four" brotherhoods of the running trades (engineers, conductors, firemen and trainmen). The widespread strikes that affected many of the nation's railroads in the summer of 1877 were averted at the Central Pacific by management's rescinding their decision to reduce wages by 10%. In the early 1880s, however, like other railroads the CP laid off both shop and railway workers, reduced hours, and later cut shopmen's and railwaymen's wages by 10%. Dissatisfied employees organized a work stoppage, though apparently no real strike took place.

Shopmen's unions never became as organized or interconnected as the running trades unions. None of the "Big Four" brotherhoods was a shopmen's union, and the first shopmen's unions (of boilermakers, machinists, sheet metal workers, blacksmiths, carmen, and electricians) were not founded until the 1880s. In the absence of strong craft unions, shopmen, particularly Western shopmen, initially joined the Knights of Labor or unions affiliated with it, which later affiliated with the American Railway Union (ARU). The ARU was popular among SP employees; the first California chapter of the ARU was organized in Los Angeles about six months before the Pullman boycott in June of 1894, and by early 1894 several thousand SP workers in northern California belonged to 40 local ARU lodges.

The state militia was called in to force work to resume at the shops and trains to move along the line, but many of the local National Guard were also railwaymen and ARU members, and the militia was unable to stop the strike. Five hundred federal army troops were then called in from San Francisco, and Sacramento was occupied for two months, a month longer than any other city in the country. Initial community support declined as the strike dragged on, and after Eugene Debs and other ARU officials were arrested in mid-July; the first train finally left Sacramento on July 11, and within a month the traffic was rolling again. The railroad fired and blacklisted participants, and wages of unskilled workers were eventually cut, though not those of skilled workers.

After this nationwide labor crisis, the federal government attempted to mediate between railroad labor and management, passing the Erdman Act of 1898 and the Railway Labor Act of 1926 which guaranteed more rights to unions and workers in exchange for strict injunctions against union action. Worker unrest continued sporadically at the Sacramento Shops, though subsequent actions were relatively insignificant. The shops participated in a general strike in 1911, but the company hired replacements. On July 1, 1922, the machinists' union organized a shop workers' strike over a federal decision to lower wages to 1920 rates; most Sacramento Shops employees stayed on the job, and although the nationwide strike lasted several weeks the Southern Pacific was only shut down for three days. Workers who stayed on the job received "recognition payments" from the SP.

Unlike most similar facilities, the Sacramento Shops were located in an urban area rather than a rural setting or isolated "company town." In addition to the railroad and government, Sacramento served farmers in the Central Valley, industries connected to the railroad, and industries like canneries that needed access to rail and water transport. Sacramento became the capitol of California in 1854, and the capitol building was completed in 1869, but the railway was the largest employer in Sacramento until well into the 20th century. Although census information records occupation but not employer, it appears that between the 1880s and the 1920s about 15% of Sacramento's workers worked in the shops, though around 1900 this figure may have been as high as 25%.

The owners of the Central Pacific moved with the railroad's headquarters to San Francisco in the 1870s, so railroad owners and managers did not have much direct effect on the politics of Sacramento. Though the local Chamber of Commerce cooperated with the railway, and one of the city's newspapers, the Record-Union, was controlled by the railroad, no CP or SP official was involved at a high level in local government. Railroad workers rather than managers had strong roots in the community. The railroad, and particularly the shops, had such a strong presence in the city that almost everyone had some connection with the business. Around the turn of the century, the leaders of both the Democratic machine and the progressive opposition had connections to the railroad. Edward James Caraghan owned a restaurant that catered to many SP employees, and Thomas Fox, an insurance executive, had worked in the shops as a rivet heater at age 16. Michael J. Burke, elected to the city's board of trustees between 1900 and 1912 by the Municipal Voters' League to oppose the Democratic machine, was a blacksmith at the shops.

Former employees describe the social atmosphere at the shops as very pleasant, and the employees as a "good natured bunch," throwing parties and socializing outside work hours. The SP Club on 15th Street held social and athletic events. The shops sponsored an SP Band and Glee Club as well as various athletic teams. In addition, shopmen would have associated with each other through Masonic organizations. Andrew Jackson Stevens was active in the Masons, and D. L. Joslyn was a Scottish Rite Mason and member of the Ben Ali Temple of the Shrine; this was probably typical of shopmen.

In 1872 an observer found at the shops "a host of busy and intelligent mechanics…all evidently happy and contented, and having an individual pride in the excellence of their work." In subsequent oral histories and accounts of the shops it was clear that employees generally took pride in their work and their personal accomplishments on the job. Workers may have experienced the Sacramento Shops positively for several reasons. Apprentices received regular raises, and other workers received yearly raises; the shops' career ladder was clear, with frequent opportunities for improvement and promotion. In Working for the Railroad, Walter Licht points out that "only a minority of railwaymen in the nineteenth century achieved the benefits of homeownership"; however, the Sacramento Bee reported when the City of Sacramento decided to finance a larger water main to the shops that 90% of shop employees were homeowners.

Although this was more true in the running trades than in the shops, in the absence of constant supervision workers exercised autonomy, and were able to act on ideas for improvement of the shops or their products. The work was unusual and diverse. Shopmen were proud of working with what was then often the latest and most technologically advanced equipment available. And, finally, railroading was a culturally important occupation, and the source of a great deal of American lore and media; being associated with such an enterprise lent workers an air of importance and belonging.

The most typical type of work at the Sacramento Shops was the routine maintenance and repair of the railroad's locomotives and rolling stock. In the early days of railroading, engineers and engine crews performed inspections, cleaning, maintenance and minor repairs of their engines in the roundhouse. By the end of the 1870s, however, engineering and other running trades had become more narrowly defined and engineers and engine crews no longer did locomotive maintenance work; Sacramento Shops workers were responsible for the cleaning, maintenance, running repairs and heavy repairs, both scheduled and nonscheduled, of all the locomotives on the line.

This task was made challenging by the number of types of engines the railroad operated. In its early days the Central Pacific was short of money, and could only afford to buy one engine at a time; these engines were generally chosen for their low cost rather than their performance characteristics. Not only were the railroad's engines from several different manufacturers, but even engines from the same manufacturer were of different designs. By 1883 the Sacramento Shops was maintaining 480 locomotives of 48 different types and from 15 different manufacturers. To maintain such a collection it would have been easier for shop staff to fabricate new parts than to stock and catalog spare parts for every type of engine.

In addition to required maintenance, shop staff continually upgraded and improved engines sent in for maintenance and repair, replacing equipment and adding new accessories. Engines from other manufacturers were constantly being fitted with new, improved and sometimes experimental parts. The first engine to be comprehensively rebuilt in this fashion at the Sacramento Shops was the CP #173, a Norris Lancaster 4-4-0. This engine had been built in 1864, and wrecked in 1868. A. J. Stevens, the shops' Master Mechanic, rebuilt this engine experimentally in November 1872; this engine became the model for the first ten locomotives built at the Sacramento Shops.

After the United States entered World War II, the pressing need for troop and supply mobility caused a huge demand for steam locomotive repair in the shops and more than 100 steam engines, some built as early as the turn of the century, were brought back into service. Less than a decade after the war, however, the SP abandoned steam in favor of diesel motive power. In 1957 specialized steam support equipment began to be scrapped. The last recorded steam engine work in the shops was done in 1969, when a steam engine was cosmetically converted into a replica of the Jupiter for the 100th anniversary of the driving of the Golden Spike. This engine, the Virginia and Truckee No. 12, has since been restored to its original appearance and is in the collection of the California State Railroad Museum.

American railroads started using diesel locomotives between the 1930s and the 1950s. Aside from being a new and unfamiliar technology, diesel traction had some perceived disadvantages. Aside from initially costing more than steam engines, diesel engines required new fuels, parts, and maintenance techniques, they required more advanced and precise technology to operate and maintain, and they were not specialized for different types of loads and lines. This last issue was a difficult one for shop master mechanics, who commonly custom designed every steam engine they bought or built to meet individualized performance criteria.

However, diesels could start and stop more quickly than steam engines, travel three times farther before needing overhauls, and could be operated as switchers all day without tiring the drivers. It was calculated that for every dollar expended in fuel for a steam locomotive a diesel would only require 43 cents. When it was time to replace engines that had been running through the Depression and World War II, American railroads opted for diesels. The SP was relatively slow to adopt diesels; in 1952 it still ran more steam than diesel engines.

The first diesel maintenance equipment at the Sacramento Shops was installed in 1949, initiating major changes in the operation and layout of the shop facilities. Part of the erecting shop was turned over to diesel repair, and Car Shop 3, formerly used to construct passenger cars, was converted to shops for repairing air brakes, governors and injectors. The manufacturer of SP's diesel engines, General Motors Electromotive Division, assisted the SP in laying out the new maintenance facilities.

The Sacramento Shops rebuilt its first diesel engine in 1956. Until the late 1960s diesels came in for repairs only when they failed, with specific instructions from operators; in 1969 the SP began the GRIP program (General Repairs and Improvement) in which the Sacramento Shops completely overhauled diesel engines on a rotating basis for two thirds of the cost of buying new equipment. Because of the shops' expertise in overhauling existing locomotives, the SP was able to avoid purchasing new diesel engines until 1984. Rebuilding diesel engines allowed shop staff to make recommendations for either changes in design or changes in operation; for example, workers modified locomotives' cabinet design to improve ease of maintenance.

Despite the extensive alterations the Sacramento Shops underwent to accommodate diesel maintenance operations, most diesel work was gradually transferred to newer shops in Los Angeles, Roseville, Ogden and Houston. In 1965 general maintenance on diesel locomotives was transferred from Sacramento to Roseville, but the Sacramento Shops continued to do major maintenance and locomotive rebuilding, including a second GRIP program between 1986 and 1989, until they were closed down.

The Sacramento Shops were also responsible for maintaining and repairing all of the railroad's rolling stock. Freight cars were frequently damaged by careless loading and unloading and by loads shifting in transit; they often needed walls unbowed and wood interiors removed and replaced. Car Shop 9, an open air shop built around 1917, was initially the site of freight car maintenance, repair and renovation, where wood and steel boxcars were converted to all-steel boxcars with wooden decks, though by 1930 Car Shop 9 had been converted solely to freight car construction.

As with locomotives, in addition to repair and maintenance the Sacramento Shops added to and upgraded cars as they came in. Westinghouse introduced the straight air brake in 1869; the CP began to use them only three years later, long before the Federal Safety Appliance Act of 1893 required their use. The railroad installed these brakes first on passenger locomotives and cars and then on freight cars; in the late 1880s the railroad began to install automatic air brakes, and soon upgraded these with new quick-action control valves.

By the late 1930s the Sacramento Shops, as well as shops in El Paso and Los Angeles, were adding steel sheathing, improved air brakes, and power hand brakes to boxcars. Boxcar doors were widened in the shops starting in 1963. Sometimes cars were redesigned to perform different functions; flatcars, for example, were converted to welded rail trains–couplers, trucks and sills were replaced and decking was removed and replaced with racks with rollers to hold the rails.

During the 1930s passenger rail began to compete with cars and cross-country buses for customers. During the late 1930s and early 1940s the shops overhauled the passenger car fleet to improve both safety and comfort, installing foam rubber seats, fluorescent lights, and air conditioning, and adding hydraulic control of horizontal movement for a smoother and quieter ride. Private automobiles at that time didn't have air conditioning, so air conditioned passenger cars were a major incentive for customers to take the train. In 1932 ice-activated air conditioning, in which cold air was blown into the car from a 6,000 pound vat of ice bolted underneath, was installed in fourteen dining cars. Between 1934 and 1936 this type of air conditioning was installed in 165 coaches and other passenger cars. In addition to adding the air conditioning equipment, cars were modified by adding 6-wheel trucks to carry the extra weight and removing the roof vents. The more advanced Waukesha air conditioning system was introduced in passenger cars beginning in 1937. The shops hired new workers to add air conditioning systems as well as to modernize passenger cars and rebuild passenger cars into lounge cars, club cars, bar cars, observation cars and coffee shop cars.

During the war passenger travel increased, but afterwards train travel saw a steady decline as competition with cars and airlines increased. In the late 1950s prewar passenger rolling stock was comprehensively inventoried, and either scrapped, restored or maintained. Because fewer people now travelled in sleeping cars, many Pullman sleepers were remodeled into other types of cars. The Sacramento shops converted sleepers and other cars into buffet cars, dining cars, and seventeen automat cars with vending machines that served hot meals 24 hours a day. These cars were apparently a hit with the Sacramento Shops staff, but fared less well with the travelling public; Amtrak discontinued automat service when it adopted SP's passenger routes in 1971. The automat cars may not have been popular, but the dome cars, rebuilt from other passenger cars for service on the City of San Francisco line from Oakland to Chicago, were a success. The first test run of the dome cars was in 1954; the Sacramento shops later remodeled ten in all.

After Amtrak was formed in 1971, the Southern Pacific ran only the San Jose-San Francisco passenger line. The SP contracted with Amtrak to do some repair and upgrade work, but by and large no more passenger cars were maintained at the Sacramento Shops. In 1980, the equipment and staff that performed freight car repair and maintenance work for the division were moved from Car Shop 9 to the rehabilitated Pacific Fruit Express shop in Roseville.

Maintenance and repair of locomotives and rolling stock was the principal function of the Sacramento Shops, but the shops' skilled craftsmen also had the opportunity to design and construct locomotives, rolling stock, other equipment for the railroad, and even commissions for other clients.

The Central Pacific's first engine, the "Governor Stanford," was purchased in 1862 from Richard Norris and Son in Philadelphia. Although most of the steam locomotives used by the Southern Pacific were built on the East Coast by Cooke and Rogers, Schenectady, the Baldwin Locomotive Works, and other manufacturers, the Sacramento Shops were capable of constructing locomotives of as high a quality as any locomotive manufacturer on the east coast. The shops manufactured steam locomotives during two periods, between 1873 and 1889 and between 1917 and 1931.

The railroad undertook the design and construction of locomotives at the shops for several reasons. The additional work kept skilled craftsmen, difficult to replace if they were laid off, busy during slack periods. During boom times, when the general demand for new engines was high, busy locomotive manufacturers generally requested cash up front, which the SP could not afford, and manufacturers' backlog required railroads to wait for engines at the very times when they needed motive power immediately. And, finally, although by the mid 1860s many railway master mechanics had suggested the creation of standard specifications for locomotives, many railway shops' Master Mechanics, including Sacramento's Andrew Jackson Stevens, were eager for the chance to build locomotives of their own design.

Before the railroad's management agreed to commit resources to building engines, shop workers demonstrated that they were capable of doing the work. In addition to rebuilding the CP #173 described above, the shop workers showed their mastery of heavy forging technique by successfully fabricating a 6.5 ton wrought iron main shaft for the bay steamer "El Capitan" from scrap iron. The Sacramento Shops started its career in locomotive construction in 1873 with the design and construction of twelve new 4-4-0 locomotives modeled after the CP #173. These engines were built almost entirely from local and reclaimed material, including iron from used horseshoes that had arrived in Sacramento as ship ballast, and parts and materials salvaged from scrapped engines; the only purchased parts were steel castings from San Francisco and steel tires from the east coast. Almost all of these engines were kept in service past the turn of the century; one of them still survives at the Nevada State Railroad Museum.

In 1881 A. J. Stevens designed and the shops constructed seven double headed 2-6-2T tank engines for a suburban commuter line in Oakland. These engines were used on the Seventh Street corridor until it was electrified in 1911-12; some of them were later used as switching engines, and upgraded with steel cabs and acetylene headlights. An engine of this type still exists, unrestored, in Sunol, California; the California State Railroad Museum in Sacramento has recently acquired it, and it will probably be moved to the museum in the fall of 2002. During this period Stevens also designed and built a 4-8-0 locomotive, the world's largest until Stevens' next creation, which was sent east as a model for Cooke and Rogers to build 25 more.

In 1884 the shops completed what was then the largest steam locomotive in the world, "El Gobernador," designed to pull heavy loads over the Sierra Nevada. This engine was the last SP locomotive to be given a name as well as an identification number, and was the first new engine to include Stevens' patented "monkey motion" valve gear design. This 4-10-0 locomotive weighed 154,000 pounds, and could theoretically pull almost 600 tons up the 2.5% Tehachapi grade. It was so huge it was kept in Sacramento for nearly a year, not allowed on sidings, and had to travel to its line in five pieces for fear that it would damage bridges. Because the boiler was too small to generate enough steam for its enormous cylinders, it was never a success and was returned to the shops for redesign, but was instead broken up in 1894.

Between 1884 and 1889 the shops built several locomotives of three different types, all of which included the Stevens valve gear and other characteristic Stevens engine design elements. Several of the 4-6-0s built during this period were initially wood-burning, but were later converted to coal- and oil-burners; a photo of one of these engines, CP #177, shows an ornate locomotive with a teak cab and red lines on the wheels. Some of these engines ended up in Oregon; the last was scrapped in 1927. The shops also constructed additional 4-4-0 and 2-8-0 engines; the 2-8-0s were an experiment for Stevens who had believed that two-wheel lead trucks caused excessive wear on the front wheels.

Only one locomotive was built at the Sacramento shops between Stevens' death in 1888 and 1917. At that time the SP, desperate for motive power and dissatisfied with the locomotives that had been designed by the United States Railroad Authority, began again to manufacture locomotives in-house, building 120 between 1917 and 1931.

These engines were not the innovative machines of Stevens' day, but were generally modeled after engines the SP had purchased earlier, and the creators of these engines were not Sacramento shop mechanics but designers based in San Francisco. The first two designs, the M-6 2-6-0 and the P-3, were built of spare parts from outdated designs of the Harriman era. These engines were of several types–4-6-0s, 2-8-0s, 0-6-0s, 4-4-2s, and 49 4-8-2 Mountain class passenger locomotives, the biggest ever built at the Sacramento Shops. These engines were modeled after those purchased from Alco-Schenectady, and were the SP's premier passenger locomotives until the introduction of new streamliner service in 1937.

The nine Class SE-4 0-8-0 engines built in 1930 and 1931 were the last new locomotives built in Sacramento. The frame and cylinders were integrated into one cast steel unit, and boilers were salvaged from scrapped Atlantic locomotives. The last of these locomotives was scrapped in 1960. The last recorded use of a Sacramento Shops locomotive in regular service was in 1961.

The Central and Southern Pacific railroads carried an unusual diversity of types of freight, eventually consisting of nearly equal percentages of agricultural products, finished goods, forest products and mining materials, as well as merchandise and animal products, including livestock. Such diverse cargoes required many types of freight cars, and the SP became a pioneer in the design of modifications and adaptations to facilitate the transport of different kinds of freight by rail. Although the railroad generally bought freight and passenger cars from east coast builders, the Sacramento Shops built many freight cars and a few passenger cars.

By the 1930s Car Shop 9 had been converted from a freight car repair area to a freight car construction shop that employed a system of "unit construction" modeled after automobile assembly lines. At one end of a half-mile track, wheels and trucks from the car machine shop were assembled. The car-in-process was then pulled along to the following stations:

Body bolster and steel draft sills
Wood sills, framing, flooring
Superstructure, siding, linings
Trimmings, ladders, doors
Roofing
Spray painting
Lettering
Weighing
Stenciling
Inspection

Using this system Car Shop 9 could turn out a car every 50 minutes, or about ten cars a day (a damaged or wrecked car, by contrast, could take up to two months to repair); nearly three times more cars were built per year than were built in the late 1910s. The unit system was also safer for employees, as materials did not need to be lifted over workers' heads and workers were not required to climb the cars.

Car Shop 9 was being used and improved at least through the 1950s, and the shops built more than 10,000 freight cars between the middle of 1905 and the end of 1954. The shops built 1,500 automobile cars between 1950 and 1951, along with 1,000 gondola cars and 2,000 boxcars. By the early 1940s, however, construction of complicated rolling stock like refrigerator cars was being phased out at the Sacramento Shops, and Car Shop 9 finally ceased operation in 1980 when all car construction was transferred to Roseville.

The Sacramento Shops constructed its first passenger cars, 24 first class passenger coaches, in 1874. At that time a passenger coach took two weeks to build, and an additional two weeks to paint, varnish and finish. Though most of the railroad's passenger cars were ordered from Pullman and other car builders, Car Shop 3 turned out several passenger cars in the 1870s and '80s, as well as private cars ("business cars") for railway officials. The most ornate of these was the "Stanford," for the president of the Southern Pacific, Leland Stanford, in 1883, which contained a parlor, bedrooms, dining rooms, a porter's room, and a kitchen, and was furnished in rosewood and mahogany.

Around the turn of the century railroads began to use steel instead of wood passenger and freight cars, to address safety concerns for passengers and employees and to meet United States Postal Service regulations protecting the mail from fire and collision. In 1905 the Sacramento Shops built the first experimental steel-framed passenger car, with a frame constructed in the boiler shop instead of the car shop. This car had a high arched roof, was finished with mahogany from the cabinet shop, had gas and electric light, and was heated by steam and hot water. Later passenger cars included no wood at all, though steel surfaces were sometimes painted in faux mahogany finish. The shops constructed the first all-steel passenger car and an experimental steel postal car in 1908; though the Sacramento Shops pioneered these designs, subsequent new steel cars were ordered from Pullman and other manufacturers. The shops constructed the last new wood passenger car in 1905; the last wood passenger cars were purchased for the SP in 1910. By 1911 the Southern Pacific was purchasing only all-steel cars for passenger service; in 1913 almost one third of its passenger cars were all-steel.

In addition to passenger cars and freight cars, the shops built several other types of rolling stock including baggage cars, mail cars and cabooses.

The shops also built rolling stock for the other companies owned or controlled by the Southern Pacific. The shops built 160 cable cars for the Market Street Cable Railway in San Francisco between 1882 and 1888; most of these were "Combination Grip and Passenger Cars, San Francisco Pattern," although some were open cars. Apparently two of these cars still exist, though they were altered from open cars to California-style double ended cars in 1907. Market Street Railway Sacramento-Clay cable car #17 is stored in the Smithsonian Museum, and #19 is part of the San Francisco Municipal Railway's historical collection.

The shops also constructed twenty passenger coaches for San Francisco's Park & Ocean Railroad in 1882; in 1902 most of these cars were sold to the Pacific Electric Railway in Los Angeles and were used until the late 1920s, the last one being scrapped in 1947. The Sacramento Shops also designed and built cars for the San Francisco steam railway that ran from Golden Gate Park to the ocean, and for Oakland's Seventh Street Locals. In the 1870s the shops may also have built horsecars for San Francisco streetcar lines and for the Market Street Railway in Oakland.

In addition to constructing locomotives and rolling stock, the Sacramento Shops turned out and maintained an array of railroad machinery for the Southern Pacific. In 1920 45% of the equipment in the Southern Pacific's Pacific Division had been manufactured in Sacramento. Shop staff designed and built most of the tools, equipment and machines at the shops, including all of the equipment used in the foundry. By the early 1960s, however, a former tool room worker found that the tool room had deteriorated because the railroad was now buying tools rather than making them at the shops.

The Sacramento Shops were involved in the creation of various devices to clear the track through the Sierras of snow during the winter. The shops installed snow pilots on locomotives operating on these lines. Later, they constructed ten bucker plows between 1866 and 1884; these wood and iron structures, designed by George Allan Stoddard and constructed by the carmen under Master Mechanic Benjamin Welch, weighed as much as 19 tons and were set on two freight car trucks. As many as eleven steam locomotives propelled them at high speeds toward snowdrifts, a dangerous but apparently effective way to clear snow off the tracks. A device somewhere between the snow pilot and the bucker plow was the headlight plow, which covered the front ends of specially modified locomotives.

These devices were replaced in 1890 by steam powered snowplows of various types. In 1887 the SP purchased a rotary snowplow from Cooke which was not used for two years. During the winter of 1889-90 it saw hard use, and was sent to the Sacramento Shops for repairs to the blades and the installation of a new boiler. The SP later purchased two more of these. In 1937 the SP bought two new rotary snowplows, the largest in the world, from American Locomotive Works; one of these is still used on the line in very bad weather.

In addition, the SP bought a Cyclone snowplow, with a gimlet on the front to remove snow, despite the fact that it had performed poorly during a test arranged by the railroad. Shop staff reduced the Cyclone's cylinder size, and increased its boiler capacity, but it was still unsuccessful under Sierra conditions. The SP had intended to purchase ten more, but the additional machines were never purchased and the original snowplow was dismantled in 1894. Henry J. Small, Superintendent of Motive Power at the time, liked the design of the Cyclone, and he and T. W. Heitzelman patented a supposedly improved version, which they called the Pacific Snow Excavator, in 1891. A prototype model constructed in the Sacramento Shops in 1890 failed miserably and was also scrapped. In 1957 the Sacramento Shops began converting the rotary snowplows to electric power supplied by four standard diesel traction motors which could be removed and used elsewhere during the summer.

The lines through the Sierras were impassable in the winter, but also dangerous in the summer. The Sacramento Shops modified four locomotives to serve as fire trains to protect the wooden snowsheds over the tracks during the summer, as well as to put out fires started by sparks from engines. In 1870 the shops installed steam-powered water pumps on the boilers of the "Governor Stanford," the "Grey Eagle," the "Unicorn," and the "Merced"; later they modified ten wheeled locomotives and added water nozzles on each side of the headlights attached to water pumps and 2-inch fire hoses. This system of fighting fires lasted until dieselization; after that, self contained water tank cars with pumps and fire hoses were attached to diesel engines when they were needed. The shops also fitted water sprinklers under the tenders of locomotives on these lines, to keep the sparks created by air brakes from igniting brush around the tracks.

In addition to machinery for the railroad itself, the Sacramento Shops were known for the large and complex machinery they created for the railroad's steamship companies. In 1872 they fabricated a wrought iron main shaft for the Central Pacific steamboat "El Capitan." This shaft was 28 feet long and 11 to 14 inches in diameter, and weighed 6.5 tons. It was fashioned entirely from scrap, heated and then pounded into slab iron, at half the cost of buying the piece from the east coast. In 1879 the shops built the machinery for the river steamers "Modoc" and "Apache," and later for about seventeen more steamboats of several types. In 1922 the shops constructed the gigantic walking beam casting, 23 feet long and weighing 15 tons, for the San Francisco paddlewheel steamer "Newark."

In addition to creating mechanical equipment, the Sacramento Shops also fabricated structural metalwork. In 1867 the shops built truss rods for bridges, and in three days during December 1964 they constructed three emergency spans to repair the washed out bridge at Noisy Creek, Oregon. The shops also built desks, tables and chairs, cast iron stoves, hand trucks, clipboards, restaurant silver services and even moustache curlers. The sheet metal shop turned out step stools, buckets, garbage cans, and drinking fountains, among other things. The foundry turned out all sorts of castings for railroad machinery and structures, including, in 1925, a ballast crusher for Santa Ana that weighed 23 tons, a record for the shops. In 1930 the foundry cast the bronze elements for the memorial to Theodore Judah which now stands at the corner of Second and L Streets in Sacramento. This statue, designed by J. A. MacQuarrie of San Francisco and paid for by the donations of thousands of SP employees, honored the original surveyor of the Central Pacific Railway. It was cast in the brass foundry by Joseph Blasofsel, the only man in the shops with the skill and background to make such a casting.

It was occasionally assumed that everything on the railroad was made in the Sacramento Shops: "The doughnuts [on the Bay ferries] were things of wonder, and customers had an often-voiced opinion that they came from the foundry of the Sacramento shops…." This apparently didn't keep them from being consumed in huge numbers.

The shops also occasionally turned out work for other clients. In 1877 the City of Sacramento commissioned the Sacramento Shops to build a new pump for the waterworks, which remained in use until 1903. This pump was designed by George Allan Stoddard and A. J. Stevens, who requested that Leland Stanford allow the city to pay for the pump in installments. The shops also built equipment for the Empire Mine in Nevada. During World War II the shops manufactured six "hot metal cars" for Kaiser in Fontana, California and for Sheffield Steel in Houston–these allow steel to be transported while molten instead of being poured into "pigs," allowed to cool, and then reheated at the furnace. In 1942, the Sacramento Shops also supplied steel plate bending rollers for Kaiser Portland, to shape the hulls of Liberty Ships. These projects were the shops' first and only direct wartime production.

Until the turn of the century work in the shops was done almost entirely without what modern engineers would consider necessary specification and control. "Mechanical drafting to produce detailed plans would seem integral to any heavy engineering work, but many nineteenth-century machine builders felt otherwise." At that time the drafter's job was basically to assemble and organize part drawings, and to supply foundry foremen with drawings and pattern numbers for the castings required by machinists. In 1878 the Baldwin Locomotive Works employed only 16 drafters to produce more than 500 engines of more than 50 different types.

Instead of complete sets of plans, Baldwin and other machine shops used a "card system" of standardized components, drawn on cards (durable enough to last in the shop environment) at full scale. Machinists crafted these components by measuring the full scale drawings to produce the piece required. It was not until the 1880s, when the use of blueprinting allowed multiple copies of drawings to be widely distributed, that scale drawings began to be generally used. By the turn of the century this design and drawing method had been generally adopted; the card system or "ABC Process" was considered inefficient as "[t]he time saved in the drawing office is lost many times over in the shops." The SP may have been an early adopter of the use of complete sets of scale drawings, as an SP representative gave a talk on this subject at a professional meeting in 1910. By this time the SP drawing office was using common standards and forms for engineering drawings:

There are many who refuse to be bound by [common standards], and these will declare that their use bars progress and trammels inventive genius. Such, however, is not the case and their adoption and maintenance, where good judgment is used, are highly beneficial from an economical standpoint.

The size, location, and staffing of drawing rooms at the Sacramento Shops changed with the status of drawing and design. The first formal offices were located in an annex just north of the northmost varnish room of the Painting Shop in 1873; these housed the General Master Mechanic, Master Car Builder, Master Mechanic, General Foreman, Chief Clerk of Shops and the Drawing Room. In 1888 some offices were moved to the lower floor of the car shop building, though before that the mechanical offices had been moved to a building attached to the west side of the erecting shop. An observer in 1891 noted several offices and drawing rooms located around the shop site.

In 1905 a separate three story office building was erected south of the locomotive transfer table. On the first floor were offices for the Chief Clerk of the Shops, clerks for the Master Mechanic and Master Car Repairer, Master Mechanic, Chief Clerk for the Superintendent of Motive Power, Superintendent of Motive Power, and the Superintendent of Shops, as well as the telegraph office and file room. The second floor contained accounting and stores, the division storekeeper, emergency hospital and a nurse's room. The third floor held the office of the Chief Clerk, the drafting room, laboratory and blueprint room (photos show blueprints hanging out of the windows to develop in the sun). The low-ceilinged fourth floor of this building was called the Sky Room and was used for safety meetings and other gatherings.

The administrative offices of the railroad had moved from downtown Sacramento to San Francisco in 1873; by the 1910s design and administration functions had moved from the shops to San Francisco, and the remaining Sacramento offices were left to oversee shop work. By the late 1950s, though, the Sacramento Shops drawing room was helping to design and lay out machinery for other division shops and railroad plants, and did industrial engineering for the divisions. Louie Oberkamp, the Sacramento shop superintendent, employed a "genius gang" of longtime shop employees who did design/build work for the divisions which was considered better than that of engineering school graduates.

Throughout the 19th century it was difficult to standardize shop practice as the SP operated so many different kinds of equipment. This problem only became worse when the SP was consolidated into the "Harriman Lines" around the turn of the century, and management was centralized in San Francisco and New York. The enormous increase in the number of lines and types of equipment forced management to consider new techniques, some based on military models. During this period the title Master Mechanic was discontinued, the administration was reorganized, and clearer lines of communication and authority were established. Shop workers and engineers started keeping more careful and detailed records of engine repairs and use of materials like fuel and sand.

Streamlining and rationalization efforts during this period, and during dieselization and reorganization in the 1950s and '60s, required the shops to adopt new management and work practices; these changes, however, took place largely on a site designed in the 1860s. Although plans from 1904 and 1906 show proposed new layouts, the railroad never redesigned the shop site, and rarely tore down and rebuilt buildings to accommodate new practices. Even after the fires of 1898 and 1916 the damaged buildings were rebuilt to the same footprints. With plenty of room to expand, the shops built new facilities such as Car Shop 9 rather than demolishing older ones; new processes were also accommodated in newer shops in other locations. Buildings were built for particular purposes, and then either torn down or reused instead of rebuilt or redesigned.

The Sacramento Shops are what Stewart Brand would describe as "low road" buildings, "too hot in the summer, too cold in the winter, Spartan in [their] amenities, often dirty, and implacably ugly." Low Road buildings foster creativity because occupants have total freedom to alter them to suit their needs; evidence that such alterations were common is visible in the remaining shop buildings.

Over the course of their history the Sacramento Shops successfully performed their principal function, maintaining and repairing railroad equipment. That they also created new equipment, adapted to changing circumstances and technologies, and invented new machines and methods is due to the skill, talents, effort and creativity of the men who worked in the shops over the years.

Craftsmen like Benjamin Welch, the Central Pacific's first Master Car Builder, designed bucker snowplows for the railroad, as well as the Emigrant Sleeper passenger car. Stephen Uren, foreman of the blacksmith shop, obtained eight patents between 1870 and 1900 for devices to recycle scrap iron and manufacture nuts, brake shoes, links, spikes, and slotted bolts.

Others started in the crafts, but contributed to the development of the shops through their design and analytical skills. George Allen Stoddard, the shops' first draftsman and the Central Pacific's first official photographer, designed and constructed a rolling mill, two wheel foundries, and an innovative steam-powered locomotive transfer table. After graduating from the University of California in 1877, Howard Stillman began work with the CP as an apprentice machinist, working his way up to engineer of tests in San Francisco.

Still others contributed to the shops as managers. Henry J. Small, Superintendent of Motive Power and Machinery at the Sacramento Shops between 1888 and 1902, promoted standardization and efficiency, reducing the number of standard patterns from 550 to 44. In the 1890s he designed standard-sized boilers for rebuilding locomotives, designed tests for wheels and other equipment, and increased fuel efficiency by introducing compound cylinders on locomotives. Small was also the advocate who finally converted the shops from steam to electrical power.

The man who perhaps most affected the style of the shops, and who demonstrated craft skill, design flair, and enlightened management, was Andrew Jackson Stevens, General Master Mechanic between 1870 and his death in 1888. Stevens was "not so glamorous, perhaps, as the highly touted Big Four, but infinitely more useful." Born in Vermont in 1833, he appears to have had no formal training as an engineer, starting his apprenticeship as a machinist at the Northern Railroad in Concord, New Hampshire in 1850. He later worked at the Vermont Central Railroad and was an engineer as well as machinist and shop foreman on the Chicago, Burlington & Quincy Railroad in Aurora, Illinois, the same railroad where A. N. Towne, later Second Vice President of the CP, was a conductor. He and Towne came out to California together in 1861.

Stevens worked at the Market Street Steam Railway in San Francisco, the San Francisco and Alameda Railroad, and the San Francisco/Oakland Railroad. He also worked at the Vulcan Iron Works with his brother C. W. Stevens, who designed steam engines for West Coast railroads. He started work at the CP in 1869, and was soon appointed to replace Mr. Perkins, who returned to the East Coast, as General Master Mechanic in Sacramento.

Stevens was soon able to persuade railroad management, which included his friend and colleague A. N. Towne, to accept his plan to turn the shops into a locomotive and marine engine construction facility. "When Mr. Stevens urged that locomotives could be turned out at the Sacramento Shops for less than their cost in the East he found little encouragement among the managers of the road… Mr. Stevens met every objection and his persistency at last induced his superiors to give his proposition a trial….To Stevens, more than to any other man, Sacramento owes the existence of the great and growing railroad shops within her limits."

Master mechanics, positioned between railroad operations and locomotive manufacturers, were in the best position to identify areas of improvement and create design innovations. Stevens argued that locomotives designed for the east coast were not suited to west coast conditions, which included scarce and expensive fuel, unusually long hauls, poorly laid and unstable track, steep grades, alkali water, fire hazards, and the need to lubricate valves on long uphill grades where it was impossible to turn off the steam. He also argued, as did many mechanics of the time, that each locomotive should be designed for the unique conditions under which it would serve: passenger or freight, switch, branch or main line, load weights, required speeds, and lines (grades, curves, track weight and condition).

Stevens' designs for new locomotives and improvements to locomotives the railroad had purchased from other manufacturers attempted to address some of these issues. He invented and patented a water purifier which allowed deposits to settle out of boiler water, where they could be easily removed before they entered the boiler. A version of this invention appears in a photograph of a Schenectady 4-4-0 take in the mid-1880s; this device, which Stevens referred to as a "boiler economizer," was not as effective as Stevens had thought it would be, and was removed from several engines after Stevens' death.

Stevens patented three improvements in boilers and fireboxes intended to increase the heat in the boiler and to use fuel more efficiently, as well as to prevent the cracking of the flues that occurs from too rapid a change in temperature. One of Stevens' boiler patents includes a "breather box" in the center of the boiler, which appears in a boiler design patented by J. Millholland in 1852. Stevens' patent drawing shows this feature in a marine boiler; it appears to have been used in at least one locomotive built in the Sacramento shops but there is no way to tell now as boilers of that time have been either destroyed or replaced.

Stevens later patented a device that allowed hotter and more even burning of oil in a firebox. He designed a locomotive firebox which extended around the locomotive's rear axle, to allow him to construct engines with smaller wheelbases. Henry J. Small, Stevens' successor, installed more conventional fireboxes and lengthened wheelbases, as by that time track conditions had improved and Small considered maneuverability less important than stability.

Stevens' inventiveness was legendary: "[w]hen there is a particular demand it is explained to him with the request that some appliance be perfected to meet the case. So far as the Gazette reporter is aware this request has never been made in vain." Many of these appliances were patented; Stevens obtained 23 between 1861 and 1887. His first patent, filed while he was working at the CB&Q, was for a balanced slide valve, an idea which he continued to refine and for which he applied for six additional patents. One of the later patents for this valve allows for the piston to be lubricated when the throttle is closed on a downgrade.

Stevens argued for and later designed the SP rail ferries that crossed the Sacramento River, arguing that building and operating ferries was cheaper than building a bridge. Each ferry had two paddlewheels on separate shafts, which permitted extraordinary maneuverability. The first of these ships, the "Solano," came into service in 1879, and the ferries took trains across the river until the Carquinez Bridge opened in 1930. From his experience with steamers, Stevens designed a power steering mechanism for ships that used a differential drum powered by a small motor. Two additional patents or this device showed a more complex and sensitive design later in the year, and an improved brake/damper for it in 1881.

Stevens also patented a hoisting crane for coal and freight, several of which were constructed and used in the shops; the California State Railroad Museum now has the pieces for one of these cranes, without its boiler. Some of his other inventions included a steam-driven rotating plow on a machine like a combine which incorporated a seeder and harrow. D. J. Joslyn lists several other inventions that Stevens apparently didn't patent–equalized steam brakes for locomotives, steam operated fire engines for cities, a rail curving machine, a deep well pump, a brick making machine, improved switch and switch stand.

Stevens' most well-known invention at the time was the eccentric, or "monkey motion," locomotive valve gear, which caused cylinder valves to open and shut in a quick, discontinuous motion. Stevens obtained his first patent for this device in 1883, and patented a refinement of the mechanism in 1885. By Stevens' death about sixty engines had been supplied with this type of valve gear. According to D. J. Joslyn, the Stevens valve gear never became a success because mechanics found the unfamiliar mechanism difficult to adjust; the valve gear was used only on engines built or rebuilt in Sacramento, and only during Stevens' lifetime. At other shops during Stevens' lifetime and at the Sacramento Shops after his death the similar Walschaert valve gear was the standard. In 1904, however, after Stevens' patent had expired, the monkey motion valve gear was installed on an Oregon Short Line engine; it was also apparently installed on other locomotives in 1943.

Stevens tested his inventions and shared the results, writing letters to trade journals and creating and distributing indicator diagrams that described the performance of his new and rebuilt engines. According to Kyle Williams Wyatt of the California State Railroad Museum, Stevens was not only an innovator himself, his enthusiasm and interest helped to create an environment for experimentation and innovation. A series of four letters from the engineer of "El Gobernador" to another party about his efforts to operate this engine showed that although the machine was a design failure, the engineer delighted in the intercourse between himself and Stevens, trying different ways to achieve acceptable performance. Upon Stevens' death, the engineer lost interest in the project and requested to be transferred to another engine.

Aside from his genius and inventiveness, his staff honored him for his respect for working men. Stevens did not permit work on Sunday, did not permit blacklisting, and fought the managers of the railroad to prevent layoffs and wage cuts. In 1877, when other railroads were experiencing labor unrest because they cut wages, Stevens encouraged management to cut hours rather than pay and the railroad avoided a strike. When Stevens died in 1888 he was mourned by more than 2,000 people marching in the streets of Sacramento. Shop workers raised $5,000 to construct the statue of Stevens, sculpted and cast in San Francisco, which still stands in Cesar Chavez Park. A speaker at the statue's dedication ceremony stated that "[f]or the first time in the history of the world the people of a city are gathered together for the purpose of witnessing the unveiling, by mechanics, of the statue of a mechanic."

After World War II the Sacramento Shops continued to produce innovations in rolling stock design. In 1953 the Stanford Research Institute investigated freight claims problems on the Southern Pacific, which led to the shops' and Stanford's invention of the "Hydra-Cushion" boxcar in 1955 (the patent and rights were sold to other manufacturers in 1958). Other innovations in rolling stock at the Sacramento Shops during this period included the following:

The Hy-Cube car, developed in 1963 to carry auto parts
The Sky Box for large parts like jet engine stabilizers
The high roof car, a boxcar with a roof raised 2.5 feet, first built in 1965 to transport Sears appliances
The Vert-A-Pac car developed in 1968 to ship Chevrolets, which held 30 cars in a vertical position
The Star-Pak car, another system to ship cars, developed in 1972

During this period the shops also developed techniques to ship such unusual cargoes as observatory telescope mirrors and nuclear reactor chambers for Rancho Seco. Their isolated location and the fortuitous influx of creative and talented people given free rein to devise their own solutions the challenges they faced promoted a culture of innovation which allowed the Sacramento Shops to adapt to changing needs, both in designing new railroad equipment and in redesigning themselves.

References

Sacramento Railyards - Wikipedia

California Rail History

Historic American Engineering Record (HAER)

Railyard Venture, LLC

The Railyards History

Preserving the Legacy of the Railyards Central Shops

A Tour of the Sacramento Railyards Districts

The Cultural and Historic Roots of the Sacramento Railyards

What's Being Built In the Railyards in 2024?