

**THEODORE JUDAH AND THE
BLAZING OF THE
FIRST TRANSCONTINENTAL
RAILROAD OVER
THE SIERRA NEVADA**

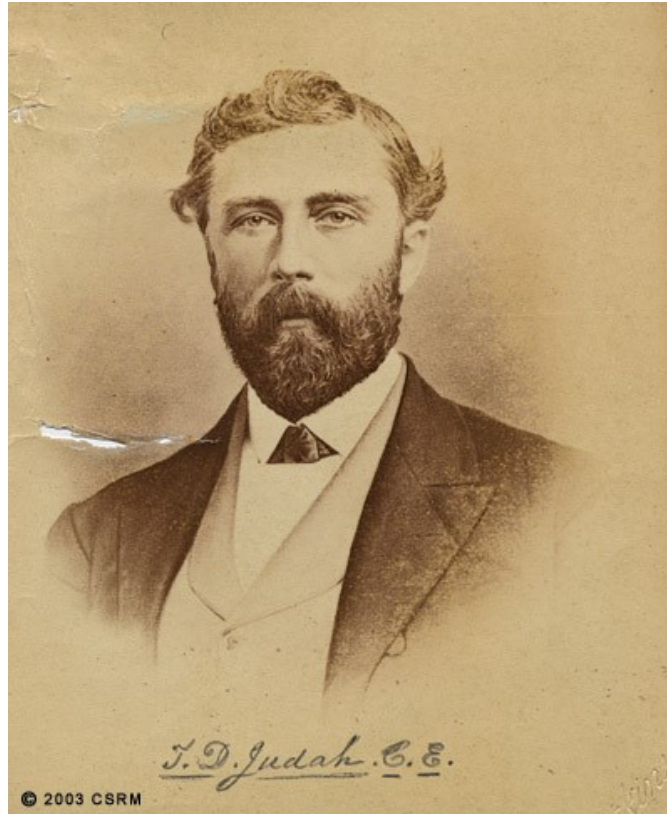
by

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Theodore Dehone Judah, C.E., M.ASCE (1826-1863)

Consider a World without Theodore Judah

In considering the development history of the west, we feel it's pretty certain that without Theodore Judah the first of the five principal transcontinental links would never have been completed before 1876-79. Nor would we have had a "Central Pacific Railroad" emanating from, and indigenous to, the west coast. With no line emanating from California, we also would not have had the Central Pacific Railroad's five Associates¹, the Southern Pacific, or the evolution of California as we know it today. There would also be no Stanford University, Crocker Art Museum or many other accomplishments of the Central Pacific Railroad Associates and their heirs.

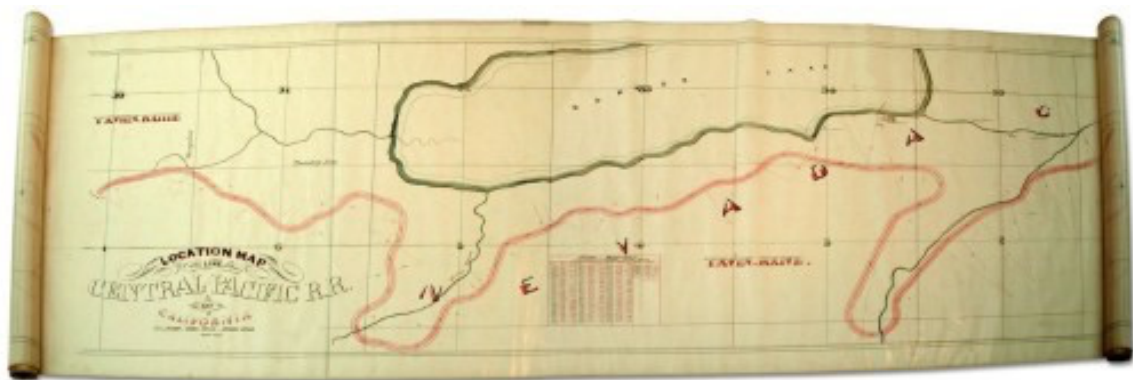
The question of "a world without Theodore Judah" is almost like asking what history would have been like without Abraham Lincoln. But, think about it for just a second. We could suppose that Durant/Dillon & Co. (the Union Pacific) could probably have constructed a rail line to California, possibly via Beckwourth or Donner Pass, by the mid to late 1870s. But it's a real toss-up as to whether Congress could have continued subsidizing the Credit Mobilier throughout the tenure of the Grant Administration (1868-76). Secondly, the logistics of transporting everything to a railhead 1,450+ miles west of Omaha would have become increasingly burdensome. Most saw the Salt Lake Valley as one of the few sources

of income for freight traffic west of the Continental Divide, little freight or passenger profit could have been generated between Cheyenne, Wyoming and the Sacramento Valley.

The best explanations of the engineering of the Central Pacific are included with John Debo Galloway's book *The First Transcontinental Railroad*², published posthumously in 1950 (and re-printed many times thereafter). Galloway was a partner in the firm Galloway and Markwart, one of San Francisco's preeminent civil engineering consultants between 1906-43. Their primary focus was structural engineering, which included considerable bridge design work for the Southern Pacific and Western Pacific Railroads. Galloway spent much of his professional life working on his book, and it was only his untimely death in 1943 (during the Second World War) that prevented it from being published in his lifetime.

Evolution of Railroads in the 1850s

The federally mandated surveys of 1854-57 crossed mountain ranges by skirting major river valleys, following the principal water courses to take advantage of the normally gentle grades of river-cut canyons. When the grade of the canyon became too severe, switchbacks, or "horseshoe curves," like those used at Cape Horn and Blue Canyon on the western slope and Coldstream Cañon³ above Truckee. When encountering near vertical walls of hard crystalline rock the only option was "holing through" the crest of major divides using tunnels (this approach had failed terribly during excavation of the 4.75 mile long Hoosac Tunnel in western Massachusetts between 1851-75). Tunnels were seen as the only option to keep maximum grades below 3%, which the Baltimore & Ohio Railroad had employed sparingly on their line that ran parallel to the upper Potomac River through Harper's Ferry on its way to Cumberland Narrows, which was reached in 1842, and reached the Ohio River at Wheeling, Virginia in 1852.



Judah's original concept for twin ascending turns in Coldstream Cañon and Strong's Cañon, just west of Truckee. These allowed the line to climb 828 vertical feet, on its way to the 7,046 ft high Donner Summit. Part of 66-foot map. (California State Archives)

Spurred by the B&O's westward push to the Ohio River, in 1846 the Pennsylvania Legislature chartered the Pennsylvania Railroad to allow competition with the B&O for The Ohio Valley region. In 1853-55 the Pennsylvania Railroad completed an ambitious

upscaling of its mainline between Philadelphia and Pittsburgh. The project included two of the largest railroad tunnels ever undertaken up to that time and the highest embankment fill ever attempted up until that time in the United States. “Horseshoe Curve” near Altoona carried a continuous double track mainline traversing the summit of the Allegheny Mountains. When it was completed in 1855, the line was arguably the “state-of-the-art” in civil engineering technology, which also employed double-track tunnels at Gallitzin and the 135 feet high fill at Horseshoe Curve.

The completion of the double-track Pennsy line across the foreboding Alleghany Mountains had been undreamed-of a decade previous (in the 1840s). These achievements spurred dreams of building railroads across the North American Continent, including imposing mountain ranges that stood in the way. The day was fast approaching when no physical obstacles would be deemed beyond the realm of modern engineering prowess.

The eruption of the Civil War in April 1861 impacted the transcontinental railroad dream in two ways: first, the political requirement for “southern compromises” as a route-of choice was removed; and secondly, there was the sudden realization that a rail connection to the west was in the strategic interest of the Union to secure the movement of California gold and Nevada silver to federal-controlled interests on the eastern seaboard. By 1860 some 30,000 miles of track had been laid in the United States, mostly in the North, and east of the Mississippi River. Although the Civil War stymied new railroad construction, its utilization by the military was of unquestionable value in altering the logistics of sustained combat operations. During the War the Northern States nationalized the rail system and placed it under the coordinated control of the Army Corps of Engineers. This cadre of Union military engineers perfected the art of employing timber trestles to cross great rivers in a matter of hours using standardized designs with jigs that allowed prefabrication of most of the timber bridge elements, once the supports were installed or the original supports retrofitted to accommodate new spans when existing spans were destroyed by Confederate forces. Prior to 1861 railroads almost exclusively employed multiple masonry arch bridges, which could take years to construct, using timber scaffolding and supports. The Union military engineers experience with constructing temporary timber trestles during the Civil War had a dramatic impact on post-1865 construction in the western United States.

The logistical tether and force mobility afforded by the railroad network in the North during the Civil War proved that railroads would serve as the keystone for industrial and commercial progress in the future. During the last four decades of the 19th Century entire towns would burst into existence or dry up and die according to their proximity to railroad alignments. The barons of business that built or owned these lines also exercised significant influence over the Country’s political affairs for the next 75 years.

The Federal Railroad Surveys of 1853-55

During the rapid expansion of railroad construction in the East in the early 1850s, representatives of the more remote western states lobbied hard for federal assistance in bringing railroads to the West⁴. In 1853 Federal legislation was passed to extend surveys

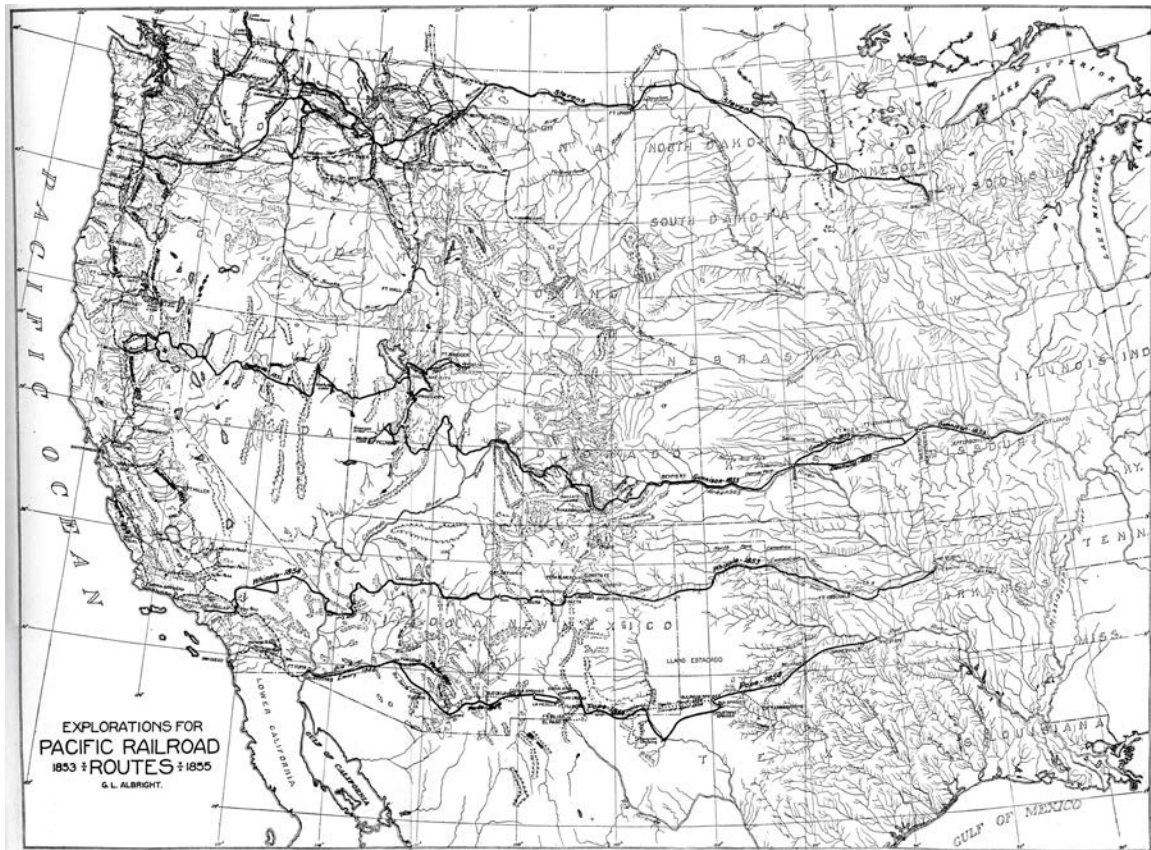
for possible railroad links west of the Mississippi Valley. Later that year Army Topographical Engineers embarked on the now-famous series of railroad surveys across the Continent. Completed by 1855, the surveys identified five principal routes by which the Pacific Ocean could be reached from the Mississippi. These were published as *The Pacific Railroad Surveys of 1853-55*, a 12-volume work detailing the topography, geology, flora and fauna found along the proposed routes. Dollar for dollar, the surveys were probably the best investment made by the Federal government in that era. In a little over 2-1/2 years, each of the five basic transcontinental routes were explored sufficiently to guide detailed route surveys over the following decades. The quality of this work was superb, considering the primitive conditions under which the data were collected.

For those few engineers possessing vision of things to come (in the mid-1850s), like Theodore Judah, the building of the Pennsylvania and B & O across great mountain barriers and the federal railroad surveys, it seemed only a matter of time before railroad interconnection of the Eastern and Western United States would become a reality. However, some enormous stumbling blocks remained. For starters, none of the eastern railroads had extended any great distance when initially completed. The one exception was the Pennsylvania Railroad, which stretched some 245 miles west of its point of origin, but its terminus was Pittsburgh, a bustling commercial center on the Ohio River, with established riverine connections to St. Louis and New Orleans. The Pennsylvania Railroad's only competition was a cumbersome state-run combination canal/cog-tram railway system. The geographic situation had all of the economic components in place to secure fiscal success of whoever was able to push a rail line across the Alleghenies.

For the far West, the situation was so incredibly different that it's almost impossible to comprehend today. Prior to 1855, California lay at the end of a perilous 17,000-mile sea voyage around Cape Horn. This voyage could take four to nine months, depending on the weather. The completion of the Panama Railroad in 1855 reduced the time of personnel travel between New York and San Francisco to about 25 days, and this railroad became the single-greatest profit-making enterprise of the 19th Century. But, the Isthmus connection carried with it a burdensome price tag for freight. Once Collis Huntington began using the connection to ship iron rails and locomotives (in June of 1868), he soon discovered that it cost four times as much to transfer an eastern-built locomotive across the isthmus as it did to send it around Cape Horn. The penalty of going around Cape Horn was an arrival date four months later one utilizing the Panamanian isthmus.

The federal surveys for the so-called "central route" north of the Sierra Nevada to Sacramento brought the line through northeastern California, via Honey Lake, the Madeline Plains, thence down the gorge of the Pit River to the upper Sacramento River, where Shasta Dam now sits. An alternative had this line heading southwest from Honey Lake, along the trail blazed by Noble through what is now Lassen National Park. The Federal surveyors, working under then-Secretary of War Jefferson Davis discounted a crossing of the Sierra Nevada as impractical because of the heavy snows (the adverse publicity associated with the Donner Party's grisly crossing of that pass in 1846-47 appears to have stymied any consideration of this route up until the actual construction of the

Central Pacific). With Jefferson Davis as a cabinet member, the Pierce Administration concluded that the southern route was most favorable.



Possible routes for transcontinental railroads reconnoitered by Army Corps of Topographical Engineers in 1853-56 (from Official Explorations for Pacific Railroads by George Leslie Albright, 1921).

State Surveys of Trans-Sierra Routes

Disappointed with Washington's decision, Californians embarked on a campaign to build a wagon road from Sacramento to Salt Lake City. State legislation to that effect was signed by Governor Bigler on April 28, 1855, providing for construction of a wagon road from Sacramento eastward to the state line near the Carson Valley. A plethora of surveys soon emerged, too numerous to summarize herein⁵. Some of these followed emigrant routes over the Sierra, with the idea of improving these "paths" to all season wagon roads, while most of the remaining efforts centered upon attracting commerce through road construction, hoping that new emigrants would take these routes to the settlements sponsoring the roads.

Probably the most important of these routes was that blazed by Col. (or wagon master) J.B. Johnson in 1852 between the Carson Valley and Placerville. With the Donner tragedy fresh in everyone's minds, "alternate routes" seemed the fashion of the time. Johnson's cut-off, as it became known, cut up the center of the Carson Mountains across Walton's Pass, what is now referred to as Spooner Summit (elevation 7,146) on U.S. Highway 50. This route came into the Tahoe Basin dead center on the east side of Lake Tahoe, then cut across a series of steep canyons, skirting the south side of Tahoe and rising 1,000 feet in $\frac{3}{4}$ mile to the crest of Johnson's Pass (now called Echo Summit), thence down the South Fork of the American River towards Placerville. Johnson's cutoff quickly became the route of choice, besting the Carson Pass route. The route had less snow and ample water.

In 1855 State Surveyor General H.S. Marlette embarked on a series of surveys seeking to blaze an all-weather wagon road between Sacramento and Utah Territory's Carson Valley, the favored terminus of emigrant trains traveling the Humboldt River overland trail. By mid-1855 enough money was raised to enable Sherman Day⁶, a civil engineer as well as State Senator, to begin the surveys. In June 1855 he began the survey of three potential routes over the Sierra. The first route started from Georgetown surveying one of the emigrant trails that led up over the crest of the Sierras via Wentworth Springs, thence across the South Branch Middle Fork American River (now called the Rubicon River), over Burton Pass to the west shore of Lake Tahoe. In July 1855 Day surveyed the second route, the well-used Carson Pass route, leaving the South Fork of the American at Kyburz, leading up the Silver Fork of the American, over Carson Pass (elevation 8,573) and down the Carson River. On the trip back, Day looked at Luther's Pass (elevation 7,740) into the south Tahoe Basin, between the Carson and Johnson cut-off routes. The following September, Day once again set out to survey the third route, this time following Johnson's cut-off, beginning just above the confluence of Silver Creek (not to be confused with Silver Fork) with the South Fork of the American, below what is now Pollack Pines. This was essentially the route of Johnson's cut-off.

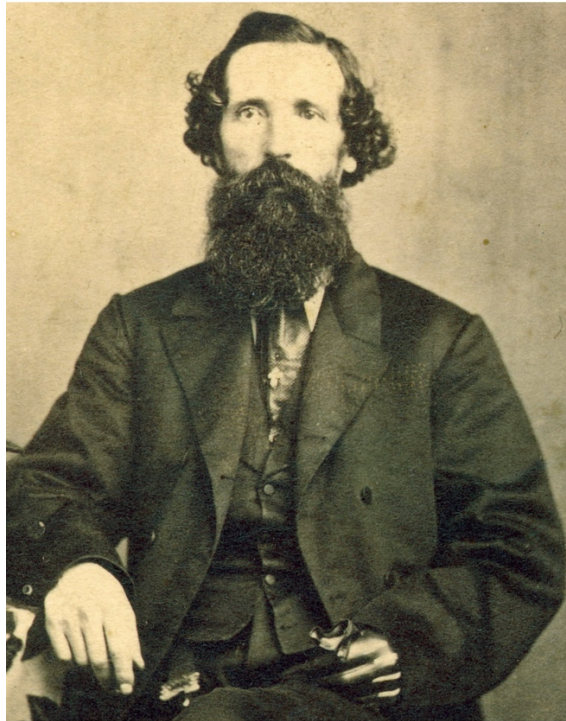
After careful comparison, the improvement of Johnson's route over Johnson's Pass (now called Echo Summit) was chosen over Carson Pass, mostly on the basis of its directness and less accumulation of snow. But, the State funded wagon road died in legislative debate in December 1856.

Alternative Surveys

Other communities within the Mother Lode soon became suspicious of any new thoroughfare which would bypass their own communities, thereby making the Sacramento merchants even richer. As a consequence of the Day surveys, most of the other communities set about sponsoring surveys of their own, all the while attempting to filibuster any State attempt to fund the Placerville-Carson Valley route. These "alternative surveys" were accomplished between 1856-60, during the period that Judah was attempting to secure funding for his own surveys, which were the most exacting of any contemplated at that time. Judah, one of the few civil engineers in California with railroad location survey

experience, couldn't have been in the area at a more opportune time, in the middle of this route surveying frenzy.

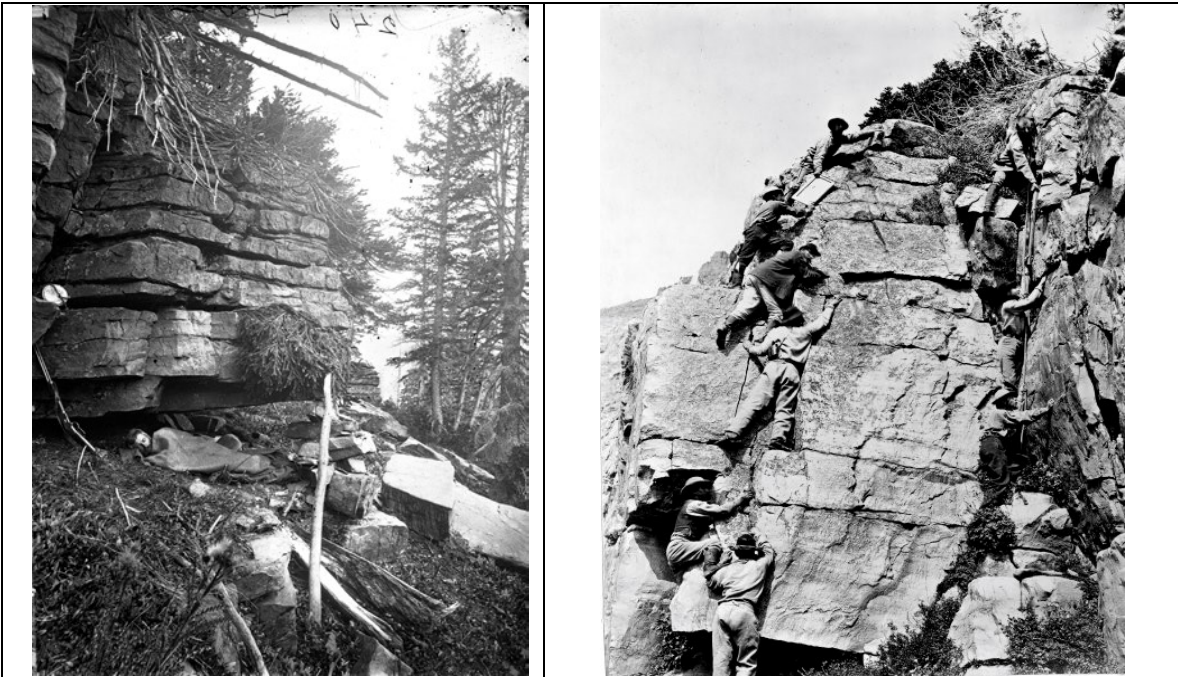
It was upon this stage then that Judah found himself engaged in his five route surveys in 1860-61, where he would have been accorded "celebrity status" in the many mining camps which he visited. Daniel W. Strong of Dutch Flat was but another in the long line of advocates that lobbied for a route through their own community, believing that a certain rush of commerce would inevitably arrive when the main road, or railroad, was built through their town or village.



Daniel W. Strong (1822-1899) was a druggist in Dutch Flat. In 1860 he joined Judah on his trip to reconnoiter Donner Pass, and he and Judah became fellow zealots for the favorable aspects of that route. Strong also became one of the first investors and Directors of the newly created Central Pacific Railroad. (from Margret Galbraith)

In 1856 D.B. Scott made a survey of the Henness Pass Route from the Truckee River to Camptonville and reported this to the State Surveyor General, H.S. Marlette. On the heels of this effort A.P. Chapman surveyed a new route which left Henness Pass Road just south of Goodyears Bar, crossed over Yuba Pass, and crossed the divide via Beckwourth Pass (opened up to wagon trains by mountain man Jim Beckwourth in 1852). Then O.B. Powers of Calaveras County made a report to the Surveyor General describing a new route from the Calaveras Big Trees over the Sierras to the Carson Road in Hope Valley. Construction of this wagon route began in August 1856, and due to its publicity, this became the favored emigrant route (over Johnson's cutoff) during 1857-58, after which it fell into disrepair.

In August 1856 John A. Brewster, the newly elected State Surveyor General, made his own reconnaissance from Downieville, over the Yuba and Beckwourth Passes to the Truckee River. Similar to the routes reconnoitered by Chapman and Scott, nonetheless, none of these efforts resulted in the construction of any new roads. Still more surveys followed upon these. Another new route was laid out from and funded by the citizens of Marysville (who were also competing to be the terminus of any emigrant migration). This route headed over the range via Magalia, Humbug Valley, Big Meadows (what is now Lake Almanor) and joined up with Nobles Emigrant Road near the headwaters of the Susan River.



Route surveys in unpopulated lands of the mid-19th Century involved weeks or months of hiking and bivouacking and were fraught with innumerable dangers. These views show a lodging beneath a natural overhang and a group of civil engineers trying to ascend a cliff in Utah to ascertain its height and volume (Andrew J. Russell Collection of the Oakland Museum of California).

The State Legislature evaluated the competing alignments and ruled that Johnson's cutoff from Placerville to Carson Valley seemed the most favorable, both in terms of cost and all-weather capability. Donner Pass, so scared by the horrors that befell that emigrant party in the winter of 1846-47, never seems to have been accorded any serious consideration in Sacramento or Washington, D.C. But, the legislature's choice for the Placerville Road met with stiff political resistance from the competing gold camps. 1856 passed and no funds were forthcoming from the legislature for construction of a new road.



Transcontinental surveys and construction grade staking required much more logistical support for sustained operations for as many as four or five years. This shows a group of civil engineers working on the Union Pacific Railroad pushing westward from Council Bluffs, Iowa (Andrew J. Russell Collection of the Oakland Museum of California).

Federal Wagon Road

But, the following year (1857) a new movement evolved petitioning for a federally funded wagon road across the central United States. In that year a transcontinental stage line had been incorporated and its directors appealed to the populace to petition their representatives in Washington. Such petitions found their way to the halls of congress, with no less than 70,000 signatures! The route the petitioners asked for was the “Central Overland Trail” via Salt Lake City to Sacramento, California. The Military Wagon Road Act was signed by President Pierce in February 1857, while the latter awaited the inauguration of James Buchanan as President.

Because of the political situation of the time, \$200,000 was accorded to the construction of a “southern overland route” while the remaining \$300,000 was earmarked for the central route sought in the petitions of most westerners. The catch to all of this was that the terminus of the central route was to be Honey Lake, about 30 miles north of Beckwourth Pass, near the California-Nevada border. This was in keeping with the recently completed Federal railroad survey that anticipated a northern entry into the state. At that time California’s elected representatives assumed a new railroad would push northward from Folsom towards Marysville. In anticipation, the California Stage Company soon moved its

headquarters to Marysville. In 1860, Marysville was the third largest town in California, behind San Francisco and Sacramento⁷.

As local factions continued to feud, the State cared little for a Federally funded route that bypassed the Carson Valley, as rumors of silver deposits began circulating (Carson Valley is about 80 miles southeast of Honey Lake). Out of this quagmire, the State created a Board of Wagon Roads in mid-1857. The Counties of Yolo, Sacramento and El Dorado raised \$50,000 for the construction of an improved road between Placerville and Carson Valley. By the summer of 1857 work was under way and the State let their first construction contract in June 1858. This became the first maintained wagon road over the Sierra Nevada and was completed in November 1858. The route followed the basic line of the Day-Marlette Survey of September 1855, beginning at McManus, near what is now the El Dorado Powerhouse below Pollack Pines. The road was cut into the north wall of the canyon of the South Fork, following that up to Johnson's Pass (now called Echo Summit), parallel to the present alignment of U.S. 50 above Pacific House (between Riverton and Pollack Pines).

Among those speculators involved in the freight wagon route from Folsom to Carson City via Placerville were Leland Stanford and Collis Huntington, sponsors of the newly formed "Wagon Road Company." Stanford, Huntington and eight other directors met in Placerville in June 1857 to discuss improvements to the road to Slippery Ford. After the meeting convened these same individuals traveled Johnson's cut-off route to Carson City.

When stage service commenced over the Day-Marlette/Johnson's cut-off road in late 1858, the original alignment across Walton's Pass (now called Spooner Summit) was abandoned in favor of Luther's Pass over the South Tahoe divide and into Hope Valley and the upper Carson Valley. By 1860 the U.S. Mail was also carried over this route until Washington politics detoured mail to the southern route, along the Butterfield Stage line, through Yuma and the Anza-Borrego Desert of southeastern California.

The Toll Road Franchises

The announcement in 1859 that silver ore had been discovered in the Washoe region east of the Carson Valley located in Utah Territory brought a new-found importance to the area. By 1860 the rush was on, and the favored route, once again, was via the South Fork of the American River. It wasn't long before alternative routes and improvements sprang up with abandon. The State, tired of regional factionalism over road construction, created a policy of granting franchises to collect tolls for those persons who undertook construction of new roads or maintained the existing ones. The decision was timely. In September 1860 Kingsbury Grade over Daggetts Pass (elevation 7,334 ft) was completed as another alternative to Walton's Pass (Spooner Summit). This thrived for two years until Walton's Road was completed over Walton's Pass in November 1863.

In the fall of 1861 one of the most important links in the trans-Sierra chain was undertaken by a Mr. Oglesby grading a toll road along the south bank of the South Fork of the American

River, between Placerville and Riverton. This cut-off to “the County Road” at Riverton soon became the route of choice for freight wagons crossing the Sierra from 1860-64, and parallels the right-of-way of U.S. Highway 50 between Placerville and Riverton, through Pollack Pines along the ridgetop. During the severe winter of 1861-62 floods damaged much of the existing road network, and travel by wagon ceased 25 miles east of Placerville.

By 1865 the Placerville Road operated as a lucrative toll road by a number of individuals who made improvements or maintained various sections of the line. The route was generally improved with each passing year. With the construction of Walton’s Road over Walton’s Pass, the entire line became known as the “Lake Tahoe Wagon Road” for the next 60 years. Over this the principal commerce to the Washoe traveled until the competing Dutch Flat & Donner Lake Wagon Road was completed by the Central Pacific partners in June 1864, and stagecoaches began operating from the Central Pacific railhead. Although displaced completely by the railroad in mid-1868 (when the CPRR reached Reno), the Lake Tahoe Wagon Road over Johnson’s Pass became the first State highway over the Sierra in 1895 and was incorporated into the national Lincoln Highway a few years later (1916), thence becoming U.S. Highway 50. U.S. 40, paralleling Judah’s transcontinental railroad line over Donner Pass, was not completed until 1929.



During construction of the Central Pacific over Donner Pass passengers embarking in Sacramento were taken to the current railhead and transferred to Wells Fargo & Co. Express stagecoaches, to complete their journeys to Virginia City. Note the eight-horse teams (Alfred Hart Collection-Stanford Archives).

The Sacramento Valley Railroad

In mid-May 1854 Theodore Dehone Judah arrived in California from the east to assume the duties of Chief Engineer of the newly formed Sacramento Valley Railroad (SVR) and grading of the line began in February 1855. By January 1, 1856 the Sacramento Valley Railroad (SVR) commenced operations between Sacramento and Alder Creek. By February 22nd the line reached Folsom. The rail line to Folsom cut a full day off of the normal travel time from Sacramento to the gold fields of the American River drainage.

When Judah arrived in Sacramento, he created his own civil engineering consulting firm, *T.D. Judah & Company, Civil Engineers & Railroad Contractors*, with an office in the Hastings Building on 2nd Street. He had two young civil engineers working for him, his younger brother Edward D. Judah, and Benjamin Leete. It is not clear whether Judah worked for the SVR as an employee or as a contractor through *T.D. Judah & Co.* Either way, Judah did not continue working for the SVR after construction was completed. A monetary crisis erupted in 1855 as profits from the placer mines fell off and the populations of the gold towns fell dramatically. Many disenchanted miners left for the lowlands to become farmers or returned to their families in the east. This downturn precluded any further extension of the Sacramento Valley Railroad line.

Judah's Early Lobbying Efforts in Washington, D.C.

The SVR entertained thoughts of evolving a transcontinental connection, and quite logically, Judah was the idea's chief sponsor and spokesman. In mid-1856 Judah embarked on the first of three trips east to solicit interest in and, then lobby for, a transcontinental railroad emanating from California. Judah termed his dream the "Pacific Railroad."

Judah's first trip east was from March 1856 to March 1858. He had not yet identified a railroad route over the central Sierra Nevada, but he was familiar with the Federal railroad surveys of 1853-55. In his initial visit to Congress in 1856 he encountered little interest. During his 1857 visit to Congress., Judah outlined his dream for a Pacific Railroad with a pamphlet entitled "*A Practical Plan for Building the Pacific Railroad*"⁸. Suitably packaged, he distributed this work to all members of Congress. A review of the booklet immediately reveals its authorship by a practicing civil engineer, because it is filled with the practical realities germane to undertaking such an enormous project. Judah specifically focused on the up-front need for detailed engineering surveys of sufficient detail to cost-out the proposed line. He opined that the Federal surveys, being of a reconnaissance level, were of insufficient detail to realistically estimate construction costs. Judah concluded that only the Federal government possessed the resources necessary to fund such a detailed survey and was seeking sponsorship of a bill that would fund him to perform detailed surveys. Sensible as these proposals were, Congress was wrestling with other issues threatening the very fiber of the nation, such as the issue of balancing slave versus free states. Added to this were increasing suspicions by Southerners of "northern lines" connecting the country and vise-versa.

The Pacific Railroad Convention of 1859

Disappointed by the dismal prospects for Federal assistance, Californians looked upon themselves, feeling that if anything was to be accomplished, Westerners would have to initiate action of their own accord. On April 5, 1859 the California Legislature voted for a Pacific Railroad Convention, to be held September 20 at Assembly Hall in San Francisco. It would be composed of delegates from various parts of California, as well as Oregon, and the territories of Arizona and Washington.

Judah returned from Washington, D.C. in time to serve as a delegate from Sacramento. Fresh from his lobbying efforts in the nation's capital, he convinced his fellow delegates that the only way to obtain passage of enabling federal legislation was to skirt the routing dilemma and add the proviso that any private corporation undertaking construction of a transcontinental rail line should be free to choose its own route.

Regional factionalism between San Franciscans and Sacramento delegates arose, but Judah convinced those present that nothing could be expected from possible sources of financing without first developing an engineered plan developed from surveying the potential routes. The second issue discussed at great length was how the Federal government could properly extend aid to such a colossal venture. Judah put forth "the central line" as the happy compromise, one which would elude all form of regional factionalism, and that whoever embarked on such a cause would be forced to settle on a central alignment.

The Pacific Railroad Convention formally requested that Congress lend aid by granting federal lands to California, by guaranteeing interest on construction bonds through the granted territories, and by remitting the federally-imposed duties on railroad rails for the entire distance. The convention asked that, in California, the line commence in San Francisco, run around the South Bay (San Jose), via Stockton to Sacramento. From Sacramento the line was to ascend the Sierras over whatever route the legislature might select. Most importantly, the Convention raised funds and appointed Judah as their accredited agent to lobby for such legislation in Washington, D.C. Nine days later Judah was again sailing for the nation's capital, via Panama.

Judah's 1859-60 Lobbying Efforts in Washington, D.C.

On the ship to Panama and thence up the Atlantic, Judah befriended a congressman from California (J.C. Burch) and senator from Oregon (General W. Lane). A result of this acquaintance was draft legislation outlining a method of assistance for completing a Pacific railroad while in transit to the East Coast! Shortly after his return to the Capitol, Judah secured an audience with President Buchanan on December 6, 1859. Upon reviewing the Pacific Railroad Convention Memorial, Buchanan expressed favor to the concept. Freshman Congressman Burch then introduced the legislation he had authored with Judah during their voyage. A compromise of this bill was subsequently submitted by Senator Gwen of California. While waiting for congressional approval, Judah established an office

in the capitol, filling it with maps and other engineering data meant to enlighten the members of congress. But, other pressing business prevented the bill's passage in 1860. The bills did form the basis of legislation that eventually passed in 1862, following the secession of the southern states the year previous.

On January 29, 1859 he sent a report to the *Sacramento Daily Union*⁹ from Washington, stating that President Buchanan was only supportive of the extreme Southern Route to the Pacific, and that he would veto any bill for other routes to the Pacific Coast. Judah was learning that technical arguments, no matter how sound, have little relevance to politics.

During the 1859-60 visit back east, Judah spent considerable time witnessing the many advances in railroad engineering that had occurred in the East since his departure in 1853. He made these journeys at his own expense, wandering as far west as Chicago. He likely traveled the Baltimore & Ohio westward, via Harper's Ferry, and appears to have returned via the Pennsylvania Railroad, making detailed studies of the mountain crossings of both lines, then considered the finest examples of railroad engineering in the world. In the interim, since his move to California in 1853, steam locomotives had become increasingly powerful. On several of the "mountain lines" he found that grades as steep as 350 feet per mile (6.6% grade) were being used, far beyond that felt practicable a few years before.

After the disappointments of the 1859-60 congressional session, Judah returned to California once again, convinced that Congress would not act on a compromise "central route" until the project was outlined with proper surveys, estimates, and proposed organizations for its construction were completed.

Judah Surveys the Sierras in 1860-61

Theodore Judah was the only person who foresaw a more direct railroad route across the heart of the high Sierras, thence into Sacramento and on to the San Francisco Bay area, via Benicia or Stockton. But, Judah's challenge was greater than any other engineering endeavor undertaken up until that time. None had seriously contemplated building a railroad across a 7,000+ feet high divide. Not that some engineers didn't think it technically possible, but most discarded the idea based on the excessive cost and time of construction.

From the very start, Judah's main concern as a civil engineer would have been how to route a mainline railroad through the Sierra Nevada. Upon his return to Sacramento in July 1860, Judah headed for the Sierra in search of possible routes across the Great Western Divide, which rose to as much as 14,495 ft (Mt. Whitney). In August 1860, Charles Wilson hired *T.D. Judah & Co.* to construct the Eastern Extension Railroad from Lincoln to Gold Hill in the Sierra Foothills. *T.D. Judah & Co.* was also hired by the SVR as an agent to offer "liberal inducements" for freight wagons connecting to Folsom. In one of these reconnaissance trips Judah met Daniel Strong, the druggist at Dutch Flat, who joined him in reconnoitering the Lake Pass route (now called Donner Pass). Like every other resident of the Sierra foothills, Strong lobbied hard for a rail route through his town (Dutch Flat), which lay a short distance up the slope from Bear River and the old California emigrant

trail, utilized between 1844-50. While Judah was back east, Daniel Strong had written to Sam Montague¹⁰, a civil engineer in Sacramento (later hired by the CPRR), requesting his help in surveying a wagon road over Lake Pass (Donner Pass).

Judah began his barometrical surveys in the mountains by exploring many of the same routes blazed in the late 1850's, such as Henness Pass, Georgetown Pass (Burton Pass), and Lake (Donner) Pass. Civil engineer Simon G. Elliott had explored the route from Dutch Flat over Lake Pass in the summer of 1860, for a wagon road, so Judah would have been familiar with the route.

As with his surveying predecessors, Judah's presence likely stirred the hopes of local businessmen, in the throes of recession since 1855. We can catch a glimpse of the "hype" accompanying Judah's mere presence in that the citizenry of Dutch Flat subscribed to support a "survey by Judah" of the (Donner) emigrant route uphill of their settlement for the purposes of ascertaining its suitability for a Pacific railroad across the crest of the Sierra.

In Judah's 1860 trip over Lake Pass (Donner Pass), Strong and Judah narrowly avoided being "snowed in" (as in, for the winter, like the Donner party). But Judah had seen enough to convince him that this path appeared most promising of those he had reconnoitered up to that time. Upon their return to Dutch Flat, Judah drew up a stock subscription for the "*Central Pacific Railroad*," the first record of that name. Drawing up articles of association, he offered Strong whatever share of the enterprise he should desire. The future investors down in Sacramento had yet to hear of any such venture.

Once in the mountains, Judah went to work as only can a man suddenly being able to realize long-sought dreams. Judah was accompanied by Charles Marsh, a civil engineer from the town of Nevada (today's Nevada City), in exploring the Henness Pass route. After completing his reconnaissance surveys of the three routes, Judah, Strong, and Marsh agreed that the Lake Pass route, with a summit elevation of about 7,056 feet, was the best, and began soliciting investors for their newly christened *Central Pacific Railroad*. In November 1860 Judah published a pamphlet¹¹ and brief prospectus for potential investors that included his recommended route over Donner Pass. In January 1861 Judah held a gathering in the St. Charles Hotel in Sacramento that included many prominent business leaders of the City. Over the next several months, a group of businessmen agreed to invest in the railroad. They included James Bailey, Charles Crocker, Mark Hopkins, and Collis Huntington. A group of seven of the investors agreed to fund Judah in preparing more detailed instrument surveys of the most promising routes across the Sierra.

Five Competing Routes across the Sierra

In 1861 Judah prepared instrument surveys of the three routes over which he had previously conducted as reconnaissance surveys. Maps and profiles were prepared for filing with the California Secretary of State and to Congress to garner support for the next Pacific Railroad Bill. On April 8, 1861 Mark Hopkins sent out an invitation to all of the shareholders to attend a meeting on April 30th. At this meeting the shareholders adopted Articles of

Association and elected a Board of Directors and Board of Commissioners. On June 28, 1861 the *Central Pacific Rail Road Company of California* (CPRR) was officially incorporated. In 1861 and 1862 Judah surveyed five basic routes across the Sierra¹². All of these routes were refinements or variations of the wagon road surveys completed between 1855-60.

These included:

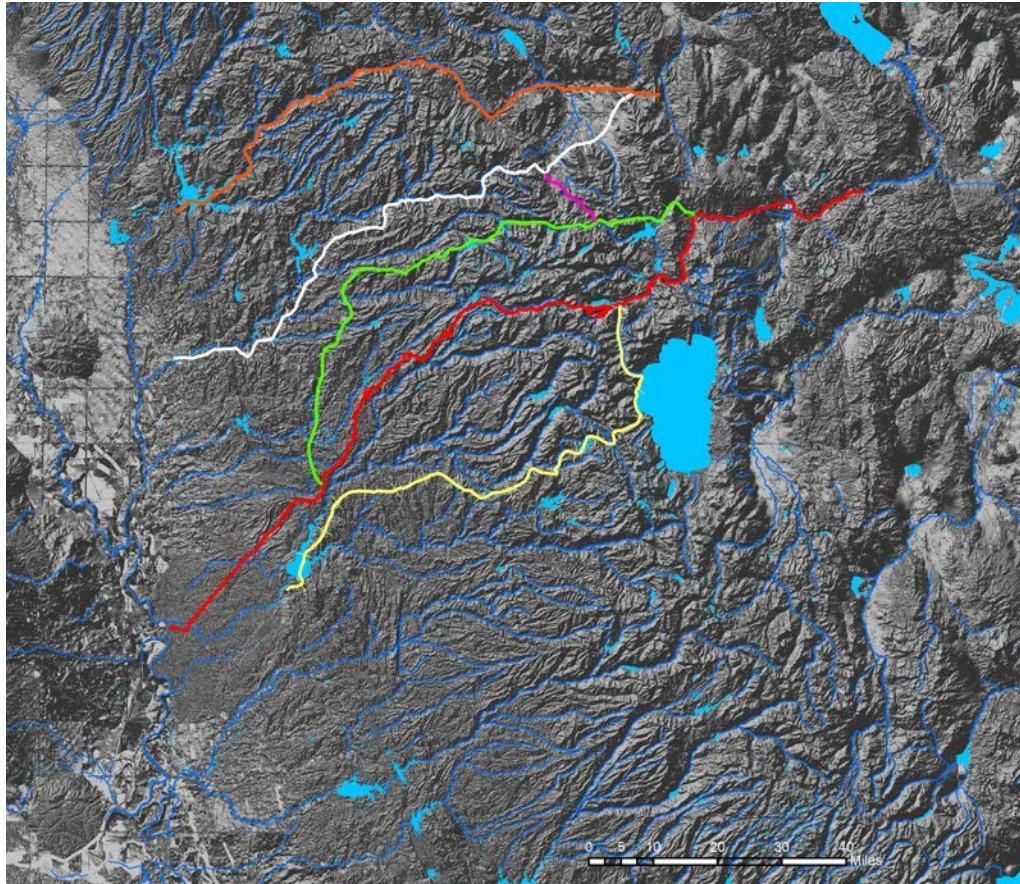
1. The “***Folsom, Greenwood and Georgetown***” route emanating from the terminus of the Sacramento Valley Railroad at Folsom, ascending the ridgeline between the Middle and South Forks of the American, through Georgetown, and across the divide at the headwaters of the South Fork of the Middle Fork of the American (now called the Rubicon River) over Burton Pass, into the Tahoe Basin and down the Truckee River. This route required grades of 150 feet/mile, or 2.85%, and involved several losses in elevation before climbing the summit pass.
2. The “***Auburn and Illinoistown, Dutch Flat and Donner Pass***” route, often referred to as the “Dutch Flat Route” by that town’s more vocal backers. This line crossed the crest of the Sierra at Donner Pass, and was the transcontinental line eventually selected and built. This route and the Feather River route were the only paths that afforded near-constant ascending grades to the summits, without loss of elevation that needed to be regained, which increased the length and energy expenditure of the line.
3. A third route ascended the Sierras via “***Nevada and Henness Pass.***” This line also began at Folsom, but headed north through Mountain House, over the divide at Dutch Ravine and then up Dry Creek north of Auburn. It crossed the Bear River and then through the towns of Grass Valley and Nevada (now called Nevada City) and then across the South Fork of the Yuba River and over Henness Pass. Judah’s reconnaissance survey of the Henness Pass route involved multiple changes in elevation from crossings of deep canyons, including the South Fork of the Yuba River, before crossing Henness Pass at 6,800 feet. After crossing the pass, the route proposed several alternatives, including one path going over Dog Mountain to the Truckee River, and the other following the Little Truckee River down to the Truckee. Civil engineer Charles Marsh accompanied Judah on this survey.
4. A fourth line was blazed just north of the third, and Judah christened this the “***Downieville and Yuba Gap***” route. It began at the end of the California Central Railroad at Lincoln, headed north, then turning east south of the Yuba River. It crossed the canyons of the South and Middle Forks of the Yuba and continued up the North Fork of the Yuba via Downieville and over the Sierra Crest via Yuba Pass at an elevation of 6,700 feet. From the pass it would continue northward through Sierra Valley and over Beckwourth Pass at an elevation of 5,212 feet. This route crossed two summits and required many crossings of ravines and canyons that forced the line to drop elevation that it then needed to gain back.

5. The fifth and northernmost route was that via the Middle Feather River Canyon, above Oroville. Judah dubbed this the “***Oroville, Bidwell’s Bar, Middle Feather River and Beckwourth’s Pass***” route. This alignment began in Oroville following the Middle Fork of the Feather and crossing the Sierra crest over Beckwourth Pass. This route had the advantage of lighter grades (1%) and a lower crest elevation than all of the other routes. Like the Dutch Flat-Donner Pass route, it allowed a constant grade up to the summit, without loss in elevation. Its biggest disadvantage is that it would involve costly and time-consuming construction in the forbidding bedrock chasm of the Middle Fork, where hard unweathered granite formed a tight chasm above the river channel (no road has ever been built through this canyon). 42 years later (in 1903) the North Fork of the Feather River was utilized by the Western Pacific Railroad and christened the “Feather River Route.” The 1903 Feather River Route includes 34 tunnels and 41 large steel bridges. The longest tunnel, the Spring Garden Tunnel, is 7,344 ft long, which is longer than all 15 of the Central Pacific tunnels combined. 65 miles longer than the Donner Pass route, it was an extremely costly line to build and operate. The Western Pacific bypasses Reno, joining the Humboldt River at Winnemucca. In the mid-1930s, State Highway engineers spent the better part of 10 years completing the first paved highway (two lane) through the granite domes that typify the North Fork of the Feather River Canyon. Judah clearly saw the advantages of the Middle Fork, using two pages in his report describing it, compared to about a half page for each of the other three routes. But, hindsight suggests that if the Central Pacific had decided to utilize this route, they would have taken many more years to complete than their line over Donner Pass, which would have resulted in the Union Pacific extending itself all the way across Utah and Nevada to the California state line.

Most of the early civil engineers and advocates of various routes across the Sierra Nevada were fixated on the passes across the crest of the Sierras and their relative elevations, as well as the amount of snow. They ignored the often-difficult routes leading up to these passes, with the gain and loss of elevation, as these routes crossed cañons and rivers to get to the summit passes.

The Dutch Flat-Donner Pass Route

The aim of the “Dutch Flat-Donner Pass Route” was to cross the Sierra above Summit Valley, what we now call Norden. Summit Valley lies within the headwaters of the South Fork of the Yuba and along the Overland Emigrant Trail that has carried so many pioneers to California between 1844-52 (when other routes to the north and south of Donner Pass became more popular).



Map showing the five railroad routes across the Sierra Nevada Mountains surveyed by Theodore Judah in 1861-62. The red line is the Dutch Flat-Donner Pass Route emanating from Sacramento which was chosen by the Central Pacific Railroad. (prepared by Prof. J.D. Rogers)

The most troubled portion of the Dutch Flat-Donner Pass Route was the initial ascension of the Sierra foothills. This portion of the line underwent major changes on at least four occasions. Initially, Judah brought the alignment up out of the Sacramento Valley via Folsom, heading towards Auburn via a circuitous northern route to Lincoln, about seven miles west of Auburn. This route foresaw a railroad junction at Lincoln, between the CPRR and the California Central Railroad, intended to connect with Marysville, about 30 miles to the northwest. From Lincoln, the Central Pacific ascended the foothills along several ravines, eventually using Dry Creek, just north of the town of Auburn. He later modified the route to go directly from Sacramento to Lincoln, bypassing Folsom and the Sacramento Valley Railroad.

The early surveys to Auburn were based on attaining the elevation of the town (now Old Town Auburn), which is situated in a ravine. In his July 1, 1863 Chief Engineers Report, Judah made a major change, deciding to bypass Auburn. He followed a route which brought him up the ridge between the American River/Secret Ravine on the south and Dutch

Ravine/Auburn Ravine on the north. The route went through the town of Newcastle and bypassed old Auburn, establishing a new Auburn Depot about a mile north and 150 feet higher than the original town center. From Newcastle to Auburn the rails encounter their steepest grades on the western slope of the Sierras, reaching 2.2%, and making difficult crossings of Antelope and Newcastle Ravines, where impressive timber trestles carried the original line, before being infilled with rock and soil fills.

At Colfax the proposed line reached an elevation of 2,149 feet, just 1.4 miles north of the North Fork of the American River (at an elevation of 1,155 ft), for an elevation differential of 994 feet between the river and the tracks. Three miles above Colfax the projected rail bed made a climbing turn at Cape Horn, with a spectacular descending slope 1,322 feet above the North Fork of the American River.

Dutch Flat was located in an area of hydraulic mining, about 650 feet above the Bear River, in the heart of the Mother Lode. But, getting out of Dutch Flat and up to Summit Valley would be no easy trick. Judah refined the alignments on three occasions. In the end he decided to hug the high ground along the southern side of Dutch Flat, keeping 300+ feet above the town and 800 feet above the Bear River. From here the line hugged the natural drainage divide, making for the headwaters of the Bear River and the gentle watershed divide with the South Fork of the Yuba with the North Fork of the American River bounding their southeastern slope. By the time the line reached Casa Loma the railroad bed was at 3,979 feet, overlooking Eucher Bar on the North Fork of the American, only a mile distant, now more than 2,000 feet below.

At Blue Canyon Judah's proposed line was obliged to make two climbing horseshoe turns to achieve an elevation of 5,225 feet at Emigrant Gap. From here the line hugged the northern side of a linear hogback ridge, overlooking the South Fork of the Yuba River, and heading for Yuba Gap, where most of the pre-Civil War wagon trains followed the Yuba and Bear Rivers to Johnson's Rancho, at the base of the foothills in the Sacramento Valley. At Soda Springs the line reached an elevation of 6,758 feet and passed Donner Summit at an altitude of 7,011 feet, which was 1,589 rail miles west of Omaha, Nebraska. The line then descended towards the eastern shore of Donner Lake, where the railroad town of Truckee was established. This was accomplished by using climbing turns in Lakeview (Strong's Cañon) Canyon and Coldstream Cañon to Truckee, thence along the Truckee River Canyon to the Nevada State Line. The state line was assumed by the Union Pacific to be the realistic limits of what the Central Pacific could be expected to achieve by the time they completed their line to the California-Nevada boundary.

It was a non-conventional approach, but Judah had already come to the realization that riding the crest of ridges, between some of the major watercourses, allowed rights-of-way less steep than the incised river valleys. In addition, the ridgeline alignment offered much more acceptable grades (no greater than 116 feet per mile, or less than 2.2%) to the Sierra Crest that most (even Judah) had previously thought possible.

Being the consummate engineer, Judah proceeded to survey the route up to and over the barren granite crags of Donner Pass. Critics of Donner Pass had cited the difficulty in traversing the steep eastern escarpment, a natural barrier much more foreboding than any of the alternate passes discussed previously. Again, there was some credence to this criticism. Early emigrant trains, like the Donners, had found the rocky escarpment (of the pass) too difficult to traverse by foot, even with mild amounts of snow on the ground (the Donner Party had become snow-bound in October 1846). Bringing wagons up the east-facing escarpment of Donner Summit was the most difficult reach along the entire emigrant trail. Post-Donner Party (after 1847) emigrants often opted for Coldstream Cañon and either Coldstream Pass or Roller Pass, southwest of Truckee, between Mt. Judah and Mt. Lincoln (where Sugar Bowl ski resort now lies), and crossing the watershed divide a full 700 feet higher than Donner Summit. Although higher than Donner Pass, the line was not choked by steep, treeless rock outcrops (trees being important to cinch the ropes that pulled wagons up the steep grades). Given this background, it is not surprising that Judah brought his route through Coldstream Cañon into the Truckee River Valley. Within the headwalls of Coldstream Cañon, Judah laid out an impressive “horseshoe curve,” almost identical in radius to that built along the Pennsylvania Railroad near Altoona in 1855.

As Judah pieced together his survey, it became apparent that a ridgetop route was both conceivable and workable, with most ruling grades of less than 2% all of the way up the western slope of the range (the maximum grades of 2.2% occurred between Newcastle and Auburn, and on the eastern slope between Truckee and Donner summit). Unlike today’s engineers, Judah had no topographic maps by which to make detailed comparisons of his routes and refine alignments to create the most efficient rights-of-way. Working in the field without any base maps, he was left on his own to “lay out the route as-you-go,” visually tracking from one spot to another, usually up the proposed grade. Prepared as a plan-view “strip map,” the route could be refined on the return trip, back over the mountains. In 1861 a plan of the proposed line 66 feet in length was produced. Profiles were prepared which were used to compare and evaluate relative grades, actual track distances, and volume of proposed excavation required for the various alignments.

The reason for the favorable topography along the Dutch Flat-Donner Pass route was entirely geological. The regional tilt of the Sierra Nevada is from northeast-to-southwest, with the eastern block of the range having vertically “lifted” over the past 66 million years, giving the western slope a very gentle, and thereby favorable, regional “tilt” (try to envision a hinged door on its side, slowly opening. The open end would represent the eastern escarpment of the Sierra). This was the type of gentle gradient usually excavated by major rivers.

By ascending the divide east of Newcastle and Auburn, the railroad would be situated almost 2,000 feet above the canyon of the North Fork of the American and 1,000 feet above the Bear River, an enormous engineering advantage in attaining the watershed divide between the Bear and South Fork of the Yuba, from whence Summit Valley was easily gained. Both Bear and Summit Valleys were geological perturbations, or exceptions to the norm. River gradients normally steepen as their respective watershed areas diminish,

thereby creating the most unfavorable topography near their respective headwaters. Any break in this ever-steepening profile was of great benefit to a railroad, as it allowed for easy right-of-way construction, sidings for helper engines, and a chance to build “run-up” for steeper grades lying ahead.

Selling the Dutch Flat-Donner Pass Route

Upon completion of the Dutch Flat-Donner Pass reconnaissance survey and the hasty formation of the Central Pacific Railroad, Judah, Daniel Strong, and Charles Marsh began subscribing stockholders, falling in line with his plan to return to Washington, D.C. with a surveyed route, estimated construction costs, and a California company willing to build the line. In his zeal he was able to subscribe \$46,500 from the citizenry of Dutch Flat, Illinoistown, near present-day Colfax, Grass Valley, and the town of Nevada. Since the length of Judah’s proposed alignment was 115 miles to the Utah Territory border, he needed an additional \$68,500 to conform to California law governing stock subscriptions for railroads. The law at the time required subscriptions of \$1,000 per mile of railroad, with 10% paid at the time of the subscription. He planned to raise the balance from wealthier investors in Sacramento and San Francisco.

Armed with new pamphlets and engineering data, in December 1860 a hopeful Judah struck out for San Francisco. But his heady optimism was soon shattered. San Franciscan investors had funded the Sacramento Valley Railroad and were still smarting from the losses that line had incurred. These investors estimated that such a line could only be built with Federal assistance, and even then, would take 10 to 20 years to complete, not the seven years forecast by Judah. In this respect, Judah was much more attuned to the whims of Washington politics than his audience, who after years of setbacks from Washington, held little hope that things would change dramatically. According to his wife Anna¹³, upon return to his hotel, Judah informed her that they were leaving for Sacramento and that the men who had turned him down that evening would lament their decision in but two years (this assertion seems similar to that made by Collis Huntington to the board members of the Southern Pacific Railroad shortly before his death in 1900, recounted later in our story).

Upon his return to Sacramento in December 1860, a meeting was organized of about 30 businessmen at the St. Charles Hotel¹⁴. According to Leland Stanford, Judah’s friend, wealthy jeweler James Bailey, introduced Judah to Stanford and other local businessmen, including the other three of the future five Associates, Collis Huntington, Charles Crocker, and Mark Hopkins. Initially disinterested, the businessmen discussed the scheme and became sufficiently curious to listen to Judah’s presentation. Also, in attendance that evening were Lucius A. Booth, Cornelius Cole (a Sacramento lawyer who later served as a congressman and senator), one of Judah’s civil engineers, Benjamin Lette, and several others. The Robinson brothers, Lester and John, owners of the Sacramento Valley Railroad, may have also attended.

Judah began the meeting by stating that he had crisscrossed the Sierra trying to ascertain the most favorable route, claiming to have crossed the crest (of the Great Western Divide)

no less than 23 times. He then set forth the advantages of the Dutch Flat-Donner Pass Route and the need to acquire subscribers. In 1889, Anna Judah¹³ related her husband's pitch as follows: "*You are the tradesmen of Sacramento City. Your property and your businesses are here; help me make this survey and I will make you the Company; and when the bill is passed (in Washington, D.C.), you will have control of business interests that will make you a fortune in trade, if nothing more.*" But, Anna claimed, Judah's clincher was: "*Why, you can have a wagon road if not a railroad.*"

Collis Huntington was skeptical, feeling the project was so enormous that it would be years before any profit could be realized. But, the thought of a competing wagon road to the Washoe was a venture that held short-term promise. He knew well that the preeminent route to the Washoe lay along the Lake Tahoe Wagon Road, established in 1858 between Carson Valley and Placerville. Refinements of this route continued well through the early 1860s, as the Washoe traffic continued to bear profit. Having been involved in that enterprise in 1858, the four businessmen understood the creation of a competing byway likely promised a fair return on their investment. If a railroad could subsequently be built along such a path with government assistance, so much the better.

Without the freight market arising from the newly discovered Comstock Lode Silver Mining District, there may not have been a Central Pacific Railroad established in 1861. The mere existence of such a lucrative freight market was for Judah what Pittsburgh had been for the Pennsylvania Railroad: a commercial market within reasonable distance, especially via rail. Huntington persuaded six others to join him to pay one-seventh of the costs of the survey. The group financing the first sponsored instrument survey thereby included Huntington, Stanford, Hopkins, Charles Crocker, Lucius Booth, Charles Marsh, and James Bailey¹⁵.

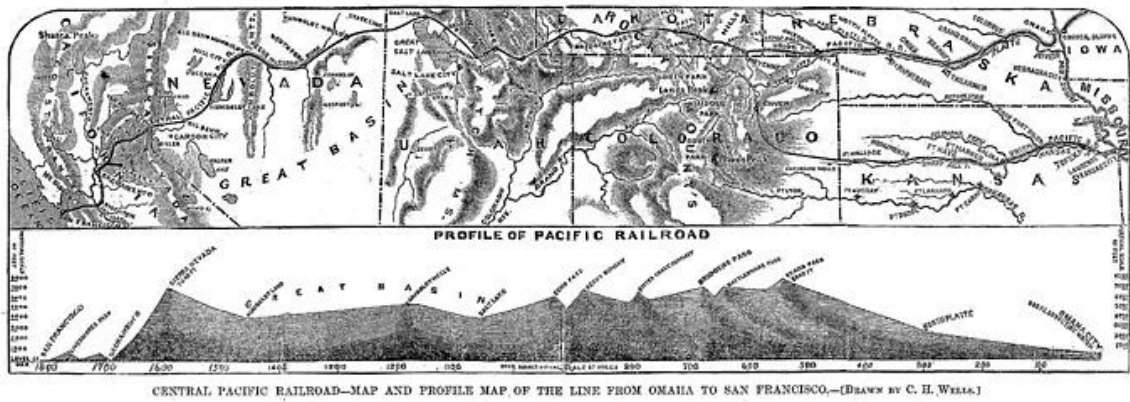
Situation in Washington, D.C. in 1861

Meanwhile, Judah's lobbying efforts in Washington, D.C. were beginning to bear fruit. During the 1860 Elections the construction of a Pacific Railroad was an integral part of the new Republican Party's political platform, and all of the CPRR Associates were staunch Republicans. During the 1860-61 congressional session, the House passed a compromise Pacific Railroad Act which provided for two railroads to simultaneously construct a transcontinental line from the Missouri River westward and from California, eastward. The Senate amended the bill to call for three railroads and the House retaliated by refusing to take action on the Senate bill. Despite the impasse, the realization of serious backing from the Federal government suddenly brought credence to Judah's dream.

In early 1861 the southern states seceded from the Union, culminating in the outbreak of the American Civil War on April 12, 1861 when Fort Sumter was attacked and surrendered to Confederate forces. Two long-standing impediments quickly changed: first, the "southern roadblock," which had consistently vetoed anything but the far southern route to California, was removed; and second, it was now of strategic importance to tie the west to the Union because of California's gold and Nevada's silver. As the war extended into a

prolonged conflict, the Federal government nationalized the northern railroads. Their importance to the war effort soon became appreciated, with whole divisions of soldiers being transported hundreds of miles in a few days' time, something unheard of in military strategy a few years previous.

The construction of a Pacific Railroad was suddenly perceived to be of strategic necessity in Washington. With President Lincoln's blessing, word was sent to California that during the next session of Congress (1861-62) a Pacific Railroad bill was a certainty.



Judah worked tirelessly to put a credible face on the proposal for a transcontinental rail link between Omaha, Nebraska and Sacramento, California. This shows a plan map and profile view of the colossal project that appeared in harpers Weekly of December 7, 1867, while the line was under construction.

Incorporation of the Central Pacific Railroad

Jubilant in his success at finally attracting investors, Judah returned to the Sierra foothills in late March 1861 to finish his surveys of the Dutch Flat - Donner Pass Route (the entire eastern slope still necessitated a careful survey). On April 8, 1861, while Judah was away, Mark Hopkins, Treasurer of the newly incorporated Central Pacific Rail Road Company of California, called a meeting of the stockholders in Sacramento for April 30th. The group, led by the Sacramento businessmen (Bailey, Huntington, Stanford, C. Crocker, Hopkins, Strong, and Marsh), drew up articles of association to which 31 stockholders affixed their signatures, subscribing a total of 1,258 shares.

With Charles Crocker serving in the California Assembly, the State legislature passed a new act governing the incorporation of railroads on May 20, 1861. The new railroad was formally incorporated under the tenants of this new law on June 28th, naming Judah as Chief Engineer. Capital stock was set at \$8,500,000, divided into 85,000 shares at \$100 each. The portion owned by the five largest investors was 900 shares (worth \$90,000), but only 10% was contributed towards their shares (\$9,000). It was a paltry sum with which

to set upon constructing the greatest civil engineering achievement of the age, but somehow, it sufficed.

During the summer of 1861, several of the officers of the company (Stanford, Huntington, C. Crocker, and Strong) joined Judah in the mountains, letting him guide them along the proposed Dutch Flat-Donner Pass Route. Upon reaching the crest, the specter of Donner Pass appeared formidable. Donner Lake lay 1,200 feet below a sheer granite slope, while precipitous cliffs with avalanche chutes stretched 2,000 feet above them. The group soon engaged in conversation as to the practicality of pushing a railroad through so formidable a natural barrier. In the end they concluded that if the only competition was to be the oxen and mule teams then plying over the rough paths and trails over the Sierra crest, they could compete with such means.

Meanwhile, Mark Hopkins busied himself with the collection of economic intelligence. That summer (1861) commerce over the Placerville-Carson Valley Road had reached an all-time high. Hopkins counted the numbers of wagon teams and passengers traveling over this route in order to estimate the amount and value of commerce. In late November 1861, Stanford, Huntington, Hopkins, C. Crocker, E.L. Bradley, and Strong incorporated the Dutch Flat and Donner Lake Wagon Road Company¹⁶. That same month the Nevada Railroad Company was organized with the stated intent of constructing 275 miles of connecting railroad lines in Nevada Territory. This was followed in short order by favorable legislation from the Nevada Territorial Legislature, formed in March 1861 (previous to this Nevada had been a part of Utah Territory). It was clear that the Sacramento businessmen were beginning to take charge. Careful study of their activities reveals that their exacting research and political efforts took much of the risk out of the grand adventure on which they were embarking.

Judah completed his detailed survey of the Donner Pass Route in early August 1861. He devoted the remainder of August and all of September to plotting his surveys, drafting plans and profiles, and making comparisons of various alignments. During the more detailed 1861 surveys, Judah re-aligned his ascent of the Sierra foothills starting in Sacramento rather than Folsom and heading directly to Lincoln. He was now ready to submit his report on a feasible crossing of the Sierra Nevada to congressional scrutiny. During the balance of the summer the Directors of the railroad were taken up in Stanford's gubernatorial campaign, his second attempt on the Republican ticket. He won the election on September 4, 1861 and served as Governor in 1862-63.

On October 1, 1861, Judah published his first Chief Engineers Report. He also prepared maps and profiles of his proposed alignment for submittal to the California Secretary of State as part of the CPRR's incorporation.



Title block of 66-foot-long strip map of the Central Pacific Railroad across Donner Pass prepared by Chief Engineer Theodore Judah and co-signed by the line’s President Leland Stanford on October 10, 1861, just before Judah was dispatched to Washington, DC.

Judah’s 1861- 1862 Visit to Washington, D.C.

On October 9, 1861 the Central Pacific’s directors voted to send Judah back to Washington, D.C. as “the accredited agent of the Central Pacific Company of California, for the purpose of procuring appropriations of land and U.S. Bonds from government, to aid in the construction of this road.” On October 11th Judah boarded a steamer in San Francisco and sailed for Panama to lobby Congress to pass the Pacific Railroad Act. Judah soon acquainted himself with Aaron A. Sargent, congressional representative from California. While embarked, Judah prepared a very detailed report of the season’s refined surveys, contracting for 1,000 copies to be printed upon disembarking in New York.

This time Judah was greeted warmly by some of the key members of Congress, including Senator James McDougall of New York, Chairman of the Senate’s Pacific Railroad Committee. Passage of a Pacific Railroad bill was now a fait accompli. Upon McDougall’s recommendation, Judah arrived in Washington a week before the hearings were scheduled to begin and helped author the desired legislation. The matter was introduced in the House, where Congressman Sargent’s only committee assignment had been to the Special Committee on Pacific Railroads. Clearly, when politicians do get a mind to do something the wheels of motion are sufficiently greased to make things happen.

On January 31, 1862 Congressman Sargent took the floor of the House to plead the military necessity of building a Pacific Railroad. Sargent’s move was a bold one for a freshman member of the House. He held up Judah’s detailed surveys as the only practicable route now existing upon which to finance a rail link across the Sierra Nevada. A subcommittee was created to draw up the necessary legislation, with Sargent as the Chair and Judah as the clerk of the committee. Judah was named as Secretary of the Senate Pacific Railroad

Committee chaired by McDougall. Without these key appointments, which gave Judah semi-official standing, it is doubtful that the 1862 Pacific Railroad Act could have been guided through Congress with appropriate engineering, logistical, and geographic details. Judah was now given charge of all railroad committee documents, in both the House and Senate. There is no evidence that Judah ever served himself in this capacity, his aspirations seemed to have been just and honorable, seeking only to see that a transcontinental railroad be built to tie the Union together.



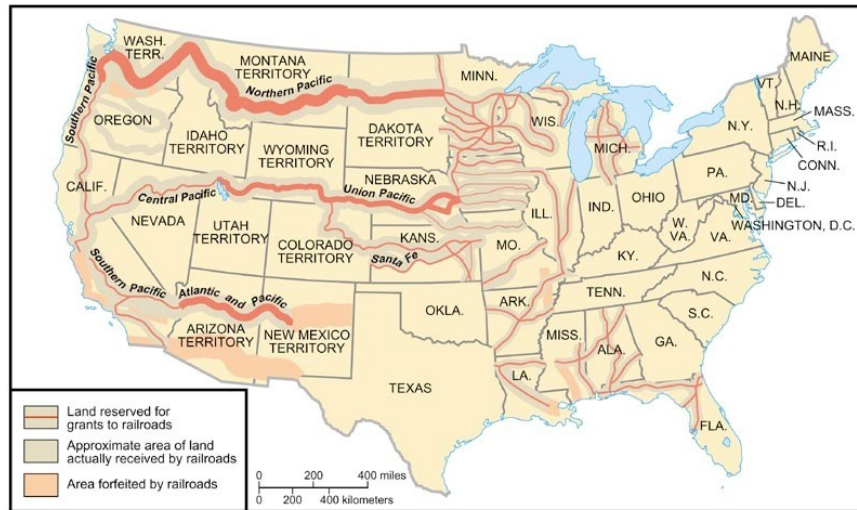
Theodore Judah as he appeared in 1862, while serving as the Clerk of the House Subcommittee on the Pacific Railroad and as Secretary of the Senate Pacific Railroad Committee.

On March 4, 1862 the Pacific Railroad bill was formally introduced in the House by Congressman Sargent and was referred to the House Pacific Railroad Committee. It was reported upon 10 days later, finding its way back to the House on April 8th. The debate raged as to the potential benefit to the builders as opposed to the government.

Pennsylvania's Representative Campbell, who chaired the House Committee, seemed cautious (his State had built the Pennsylvania Railroad and that line was now being operated by Federal forces, and considered a critical logistical cog in the war effort).

The central argument that had to be overcome (in Washington, D.C.) was that the United States government was not simply going to make a small group of California investors rich at the taxpayers/voters' expense. In the end the 1862 Act as modified by the 1864 Act stipulated that the investors would receive 1st mortgage 30 year six percent bonds which they would sell, usually at a discount, to finance the railroad. The bonds would be for \$16,000, \$32,000, or \$48,000 per mile, depending on the terrain. Land grants were

included in the Act, with the railroads receiving a strip of land 400 feet wide for their tracks and 6,400 acres (ten square miles) of land in alternate square mile sections for each mile of railroad completed (at a land value of \$2.50 per acre), extending ten miles from either side of the track.



FEDERAL LAND GRANTS TO RAILROADS AS OF 1871

Federal land grants to various railroads between 1862-71 (from HistoryIncubator.com).

In a subsequent act, this offset was increased to 20 square miles (12,800 acres) for each mile of track, or every other square mile within a band 40 miles wide. Congress’ other fears included guarantees on the percentage of payments which should be required on subscribed capital stock, and the possibility that the transcontinental line might begin construction from its eastern and western limits but end up uncompleted somewhere in the middle if either railroad went bankrupt. If either railroad was not completed by July 4, 1876 their assets were to be forfeited to the federal government.

Another look at the Feather River Route

Huntington was already back in California when Judah arrived in August 1862, having departed D.C in June. With the passage of the Pacific Railroad Act in July, Huntington’s attentions returned to the proposed line over the Sierras. The widespread prejudice against Donner Pass was still very much alive, and many believed the much lower elevation of Beckwourth Pass offered a more manageable grade. With a summit elevation of 5,212 feet, it was 1,800 feet lower than Donner Pass, an efficiency of effort that could not be ignored by a hard-nosed businessman like Huntington.

On September 7, 1862, Judah, Huntington, Congressman Sargent, and civil engineer Charles Marsh departed Sacramento on a reconnaissance to investigate the passes north of Donner Pass. They crossed over Yuba Pass and continued northward to Sierra Valley, just

west of Beckwourth Pass. The Beckwourth summit is so gradual as to almost be missed, with the broad flat character of Sierra Valley lying beyond this gentle crest. In this area one hardly feels “in the mountains” like at Donner Pass.

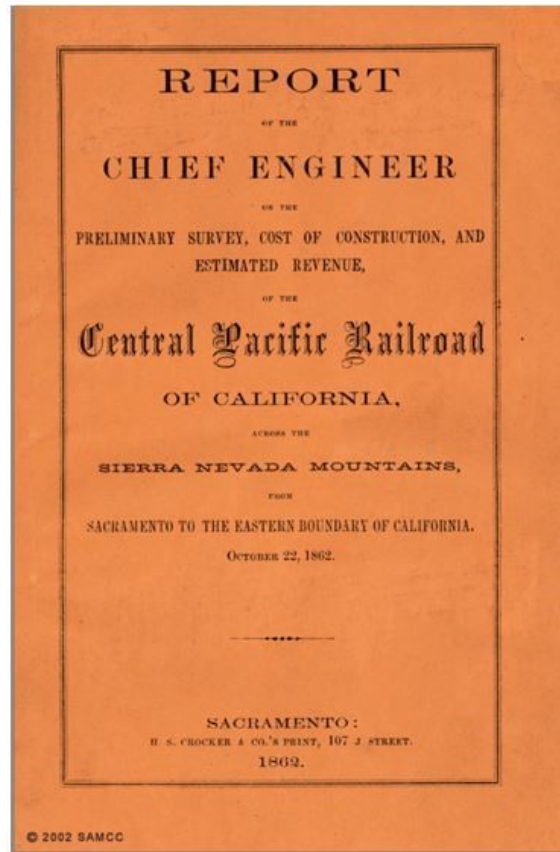


Grizzly Dome Tunnel was bored through solid granite between 1928-36 as part of the Feather River Highway (State Route 70), which runs along the Middle and Northern Forks of the Feather River. In 1862 the only option for a railroad was to employ hand-driven drilling tools and employ crude explosives, a dangerous and time-consuming process that more often than not, precluded completion of such ventures far beyond original estimates (photo State of California DWR).

Within Sierra Valley are marshes that mark the headwaters of the Middle Fork Feather River, which begins a lazy descent towards the west. In these headwaters the river gives no hint of the deeply incised chasm lying downstream. Judah was aware that the Middle Fork of the Feather offered the only serious competition for his Dutch Flat-Donner Pass Route, allowing a constant grade to the summit, without the need to ascend and descend incised bedrock canyons. In his description of the Middle Fork route, Judah used two pages compared to the half page description of each of the other three routes. He clearly considered it an option worth a closer look. On September 16th Sargent left the group, and Judah, Huntington, and Marsh followed the Middle Fork into an ever-deepening granite gorge.

Over a seven-day period the three men continued their reconnaissance of the Middle Fork, utilizing Indian porters downstream of Nelson’s Creek, where the river is contained in a spectacular granite gorge, leaving no place to pass adjacent to the rushing river. Here the cliffs extend 2,000 to 3,000 vertical feet above the river. The party eventually worked their way to Bidwell’s Bar (now beneath Lake Oroville), a distance of 70 miles. Judah estimated that upwards of 30 or 40 tunnels would be needed (Western Pacific Railroad excavated 34 tunnels in the canyon of the North Fork 42-45 years later) to accommodate a rail line, and

that virtually 100% of the line in the gorge would require costly and time-consuming blasting. Added to this were miner's stories about the river rising as much as 75 feet during heavy rains. As a result of this reconnaissance, the route was deemed impractical because it would require much greater expense and time of construction as compared to the route over Donner Pass.



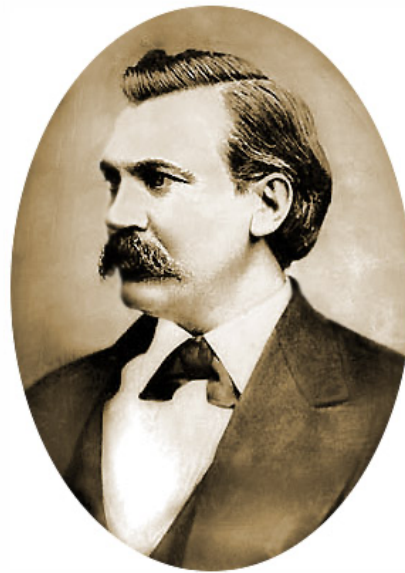
Judah's official survey, cost estimates, and estimated revenue to be generated by a trans-Sierra rail line using the Dutch Flat-Donner Pass Route, dated October 22, 1862. This pamphlet was designed to attract investors to the Central Pacific. (California State Library)

Deviations from Judah's Alignment during Construction of the Central Pacific

When the Dutch Flat-Donner Pass line was constructed in 1865-66 there were several deviations from Judah's 1863 alignment. One of those deviations was in the future town of Colfax. In Judah's 1860 pamphlet he noted that the "greatest depression from a uniform grade occurs between Illinoistown (just south of present-day Colfax) and Dutch Flat." Judah tried to minimize this depression by following the ridge above Illinoistown Gap on the Bear River side of the ridge and crossing Long Ravine near its headwaters, before curving around to reach Cape Horn.

Judah's successor as the Central Pacific's Chief Engineer was Samuel Montague. He altered Judah's route to follow the ridge from Illinoistown Gap on the American River side. This path was shorter, avoided a proposed tunnel on the line, and provided a relatively flat area just northeast of Illinoistown for the new town of Colfax, with sufficient room for railroad facilities. The track from Colfax to the Long Ravine Bridge is currently the only significant downslope along the steady climb to Donner Summit.

Another alteration was in the crossing of the Bear River/South Yuba Divide above Dutch Flat. In Judah's original survey, he laid out the proposed line as directly as possible towards Bear Valley, thence up into the South Yuba, following the river to Summit Valley.



Left: Samuel S. Montague (1830-1883) was hired by Theodore Judah in 1859 to help engineer the Sacramento Valley railroad's planned additions. In February 1862 Judah hired him as his principal assistant for the Central Pacific. He succeeded Judah as Chief Engineer of the Central Pacific Railroad in 1863. Right: Lewis M. Clement (1837-1914) was also hired by Judah in 1862. Montague named him Chief Assistant Engineer for the Central Pacific following Judah's death in 1863. After completion of the transcontinental line, both men continued working for the Central Pacific and its successor, the Southern Pacific Railroad, building rail lines throughout the southwestern United States.

When the line reached Dutch Flat in early 1865, Samuel Montague considered the merits of holding his elevation gain and keeping to the sides of the mountain above Yuba Bottom while heading for Summit Valley. In this area the dividing ridge between the Upper Yuba and American Rivers narrows, leaving little room to work. In the end the railroad considered the cost of excavation as well as the grade changes and concluded that it would be less costly and more efficient to hold to the ridgeline.

As built, the original alignment skirted Bear Valley, staying roughly 100 feet above the valley floor. But, east of Emigrant Gap, the “Montague alignment” rides the knife-edge ridge between the South Fork of the Yuba and North Fork of the American (more deeply incised to the south). Above Yuba Gap (around 5,700 feet elevation), the steepness of the mountain sideslope diminishes, as the North Fork of the American strays further to the south. Here Montague essentially paralleled Judah’s alignment, but held the road 280 to 480 feet above the river, building the line on a sidehill cut, skirting a big bend in the stream about 1-1/2 miles southwest of Soda Springs.

Utilizing this side-hill cut alignment, the line eventually ascended Summit Valley at an elevation of 6,800 feet. Above the eastern end of Summit Valley, a tunnel 1,659 feet long was to be bored through the divide, 124 feet below the natural summit, giving the railroad a crest elevation of 7,042 feet. This was the highest point of any railroad in the United States until the Union Pacific was completed across Sherman Summit in Wyoming at an elevation of 8,247 feet on April 5, 1868.

Holding to the ridgeline between Dutch Flat and Summit Valley was one of the few significant deviations from Judah’s original survey, filed with the Federal government on June 30, 1862. The decision to “hold to the side of the mountain” was really no different than envisioned by Judah east of Donner Summit, the most spectacular part of the line, where the original grades reached 105 feet per mile (2% grade).

Judah’s Departure from the Conventional Wisdom

Judah, and no one else, courted the idea of building a railroad FROM California, a thought deemed to be preposterous by most civil engineers working in the east, relatively close to the industrial centers fabricating all of the structural components germane to railroad construction. The thought of building a railroad from California seemed outlandishly expensive, given that everything would have to be taken by ship, either around Cape Horn, or across the Isthmus of Panama. In this assertion, the critics were somewhat justified. Every iron rail, spike, fishplate, locomotive, wheels, and other cast hardware had to be purchased in eastern markets and shipped thousands of miles to California. Only the wooden frames of the rolling stock were fabricated in California; the wheels, couplers, brakes, and other cast iron hardware were shipped from the eastern seaboard. The interval between order, purchase, and implementation could easily take an entire year, without generating revenue.

Judah’s decision to run a railroad along a steep watershed divide was in stark contrast to engineering experience of his era. In crossing mountain barriers, the conventional wisdom sought to parallel major rivers which cut across the grain of the range, much like the Yuba, American, or Truckee River systems. However, in those instances where major rivers ran parallel to the ridges, such as in the Appalachian Mountains, railroads followed major water courses, gaining elevation in the valley bottoms with the passing of successive ridges.

Eventually the watershed divides were crossed via tunnels, like the Pennsylvania Railroad's Gallitzin Tunnels under the summit of the Allegheny Mountains.

In the Far West the mountains were much more formidable. When rivers didn't cut across the grain of a mountain range, carving a railroad could quickly become uneconomic. Take, for instance, Southern Pacific's 20-year effort to cross Siskiyou Pass between Shasta, California and Ashland, Oregon. Here the Klamath River runs westerly, parallel to the mountain crest. This was the worst of all situations, for the railroad was obliged to drop to cross a major river (around 2,200 feet) then climb to a divide at 4,500 feet over Ashland Pass, in just over 7 miles. The Southern Pacific began their attempt in the late 1870s, finishing the line 18 years later, with 23 tunnels. The completed line utilized grades of 3.3%, the steepest on the Southern Pacific system.

In his Chief Engineer's Report of October 8, 1864, Samuel Montague remarked on the soundness of Judah's surveys:

“The construction of over one hundred miles of mountain road, and that, too, across one of the most formidable ranges on the continent, where so few important streams are crossed, and so small an amount of expensive bridging actually required, will certainly present an anomaly in the history of railroad enterprises.”

John D. Galloway, in a November 1941 article in *Civil Engineering* magazine¹⁷, quoted William Hood, who joined the Central Pacific railroad in 1867 and retired in 1920 as the Chief Engineer of the Southern Pacific Railroad:

“...were there now no railroad over the Sierra, the Donner Lake route would still be selected over all others as the best possible.”

Had Judah attempted to follow the North Fork of the American River Canyon to its headwaters just below The Cedars (8 miles south of Soda Springs), a tunnel six miles long through solid granite would have been required to reach Coldstream Cañon, above Truckee. Given the difficulties associated with completing the 4.75-mile-long Hoosac Tunnel under similar geologic conditions in western Massachusetts (the project began in 1851 and was not completed until 1875 at a cost of \$421 million, more than ten times greater than originally anticipated). It is doubtful that such a line would ever have been completed by the Central Pacific.



Two views of Emigrant Gap Ridge between Bear Valley and the North Fork of the American River at an elevation of 5300 to 5500 feet. The original railroad grade is shown above in 1867, while the lower image was taken in 2015, showing Interstate 80 sharing the narrow drainage divide, with the rail line crossing beneath (upper image is from the Alfred Hart Collection-Stanford Archives; lower image from Donner Summit Historical Society).

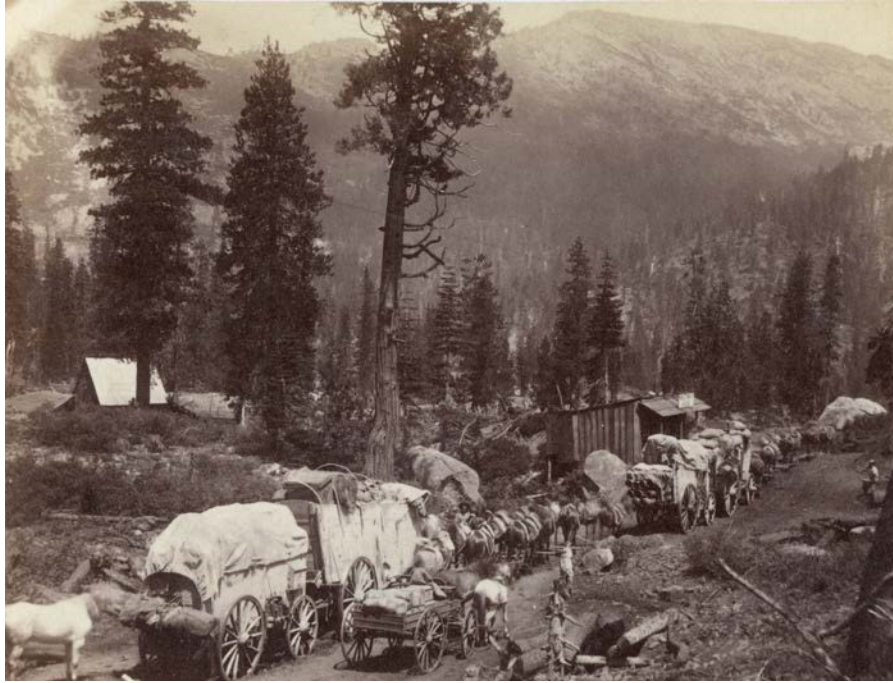
Even with the Federal bonds, there were insufficient funds to construct the line across the Sierra Nevada. East of Arcade Creek, the federal government increased their bonds from \$16,000 to \$48,000 per mile for the 150 miles of track leading to and over the mountains to a point just west of Reno. The federal government's 2nd mortgage bonds were discounted in order to attract investors, who paid about 80% (\$36,000) of the bond's face value in currency. Since they were "currency bonds," the interest was paid using paper money. Because the CPRR had to pay all of their expenses in the west using gold, they were obliged to convert the \$36,000 from the bond sales to gold, making the discount even greater. The CPRR was then able to sell their own 1st mortgage bonds at the same value (\$48,000) as the government bonds, but at a similar discount. The CPRR bond interest was paid in gold. This amounted to an actual face value of close to \$72,000 per mile, which helped them immensely.

CPRR records indicate that the actual costs were something between \$100,000 and \$150,000 per mile across the Sierra. In subsequent congressional hearings (held in 1887) the CPRR Associates would claim that they lost about \$5 million building the line across the Sierra; and in retrospect, their statement does not seem overly exaggerated. Had they been unable to "make up" for this loss in the dash across Nevada and western Utah it is doubtful that the CPRR could have remained solvent. This issue was debated in the 1880s when many observers assumed that the CPRR began generating cash with the completion of the line to Reno in June 1868 (serving the Comstock Lode), a full year before the Union Pacific had anticipated their arrival.

Other historians of the CPRR/SPRR have noted that, in their later years, both Huntington and Charlie Crocker revealed some of the frustrations experienced in undertaking such a magnanimous enterprise. Crocker said that "if I had known what we were getting into (in 1861), I may very well have not chosen to embark on such a long, costly and difficult enterprise." Shortly before his death, on May 16, 1900, Collis Huntington addressed the officers of the Southern Pacific in San Francisco: "I remember well, when we were organizing the Central Pacific Railroad movement, how some of your wisest men here [in San Francisco] laughed at us and shrunk away when we asked them to share the risks with us, and the gain, if there should be any."

Dutch Flat and Donner Lake Wagon Road

Another of the construction problems associated with the Dutch Flat-Donner Pass route was the absence of any established road network east of Dutch Flat, as no mining occurred above the Mother Lode outcrops in the Sierra foothills. From Sacramento to Dutch Flat, the railroad was able to utilize the network of existing wagon roads to move supplies to their railhead. In 1860, a year before Judah's Donner Pass survey, another survey for a wagon road over Donner Pass (Lake Pass) was made by civil engineer S.G. Elliot, and in March 1861, the Lake Pass Turnpike Company was organized to complete a wagon road to Reno, but insufficient funding precluded its completion.



Freight wagons backed up along the Dutch Flat and Donner Lake Wagon Road not far from Cisco. The lucrative toll road provided much needed cash for a number of the CPRR's senior investors (Alfred Hart Collection-Stanford Archives).

When the construction of the CPRR was being planned after incorporation in June of 1861, it became apparent that a supply road would be needed to support construction of the railroad right-of-way east of Dutch Flat. At this juncture, several shareholders (E.L. Bradley, C. Crocker, Hopkins, Huntington, Stanford, and Daniel Strong) organized the “Dutch Flat and Donner Lake Wagon Road” (DFDLWR). In this respect the shareholders made one of their most savvy business decisions, likely drawing on their previous association and experience with the Placerville Wagon Road mentioned earlier. This 90-mile-long road was built for a cost of \$100,000, commencing in late October 1862. Only a few miles were built before operations were ceased due to the onset of winter. Work resumed in June 1863 and continued through November. The road was opened on June 15, 1864 and connected through existing roads to the CPRR railhead at Newcastle. From the outset this road generated significant revenue servicing the Comstock mines surrounding Virginia City.

In its three years of operation the Dutch Flat and Donner Lake Wagon Road played a significant role in allowing the advance staging of railroad construction out of Truckee (then called Coburns Station), well ahead of the Coldstream Cañon gap in the railroad that was not completed until June 1868. In fact, four locomotives were pre-positioned in Truckee, packed in over the wagon road, and used to affect the simultaneous construction of the alignments east of the summit tunnels. In this manner the summit tunnel was bored from four active headings simultaneously (west portal, east portal, middle shaft portals digging in both directions). The summit tunnel was completed in August 1867. With rails

already laid above and below Truckee, only a seven-mile gap existed in Coldstream Cañon by the end of 1867. The gap was completed on June 18th, and the first through train to Reno was the following day. The use of quadruple headings in the summit tunnel and pre-positioning of advance work trains at Truckee likely saved the railroad about a year of linear construction. Remnants of the 1863 DF DLWR are still visible at the summit, and shown in the Biennial Reports of the State Engineer in 1912.

Epilogue for Judah

Any who have studied his exploits would conclude that Theodore Judah was a man of tremendous tenacity. The man was so possessed by his dream that he simply wouldn't accept a "no" answer. But Judah was no fool either. He spent the greater part of four years trying to secure investors to fund route alignment surveys, a professionally engineered document, not some sort of "visionary dream" sketched on a map. Judah's writing and business dealings reveal a deeply felt consciousness that led him to conduct himself in a truthful and honorable manner. Judah's skill as a civil engineer was revealed to the professional colleagues who succeeded him. Engineers of the Southern Pacific, most familiar with his layout work, revered his exploits in the half century following his untimely death, eventually leading the American Society of Civil Engineers to dedicate a monument to his memory at Southern Pacific's Sacramento Depot in April 1930.

Without Charles Lincoln Wilson traveling across the United States to find a civil engineer for his Sacramento Valley Railroad, the history of the American West would be very different. Prior to the Civil War there were few civil engineers in California with any railroad experience. William J. Lewis had surveyed the route for the Pacific & Atlantic Railroad in 1851, three years before Judah arrived in California. Lewis later became chief engineer for the San Francisco & San Jose Railroad (the new name of the old Pacific & Atlantic) which was completed in 1864. Sherman Day, who arrived in California in 1849, prepared some of the early wagon road surveys across the Sierra Nevada in 1855, and was involved with the San Francisco & San Jose Railroad with Lewis. Francis A. Bishop arrived in California in 1853 and was later involved in Lester Robinson's San Francisco & Washoe Railroad. It is unknown now why Wilson didn't utilize any of the engineers already working in California.

Judah's moral fortitude likely had its roots in his Christian upbringing as the son of an Episcopal minister. For Judah, his only options in the conduct of his daily affairs were those he deemed to be "Christian" and "just." This in mind, he proceeded in a most conventional manner, which presumed securing a professionally prepared alignment survey before proceeding any further. Most railroad schemes of that era were considerably less scrupulous, with "salesman-visionaries" over-selling a proposed route, subscribing stock based on un-surveyed alignments. Most of these schemes fell through because their construction costs were imaginary or unfounded. For Judah, any sort of speculative "scheme" was ungentlemanly; as he had attended the nation's premier engineering school, Rensselaer Institute (now the Rensselaer Polytechnic Institute) in Troy, New York. Judah

studied civil engineering at Rensselaer Institute over the 1837 – 1838 term without obtaining a degree, but considered himself an educated professional.

There has been some criticism of Judah by historians related to his work with Lester Robinson and the Sacramento Valley Railroad. In Robinson's February 1865 letters to the Nevada State Legislature, he states that "When Mr. Judah undertook the first explorations across the mountains he was in our employ." Judah was an "agent" for the SVRR helping to promote the use of the railroad to teamsters heading up the mountains, but there is no factual basis, other than Robinson's later claim, that Judah was being paid by the SVRR to explore the Sierra for wagon or railroad routes. Judah's work for the SVRR was probably through his consulting firm, *T.D. Judah & Co.*, not as an employee of the SVRR. In his letters, Robinson also accused Judah of incompetence, fraud, corruption, and lying, and bases his support of his proposed rail line through Placerville and over Johnson's Pass on very poor engineering. The San Francisco & Washoe Railroad climbed from Folsom up to Placerville, followed the ridge east before dropping down to the South Fork American River, then following the canyon up to Johnson's Pass, dropping into the Lake Tahoe Basin before climbing the Carson Range and crossing over Walton's Pass. If a railroad had ever been constructed along this route, it would be a nice bike path today, and another company would have constructed a railroad over the best route, which is Donner Pass. Today the Union Pacific owns both the Donner Pass and the Feather River routes. Most of the trains go over Donner Pass; the longer Feather River route is used for longer, slow commodity trains.

As civil engineers, we are left to conclude that there is no transcontinental rail link across the central Sierras in 1869 without Theodore Judah. The completion of this link, the subsequent formation of SPRR, and that line's acquisition by Edward H. Harriman (who spent vast sums of money upgrading the lines to modern engineering standards, thereby securing the healthy future enjoyed by those lines), are probably the most important events in the opening of California and its emergence as a leading agricultural and industrial power in the 20th Century. Without the railroads, there would have been no eastern market for California agribusiness.

In purely engineering retrospect, Judah's achievements would seem nothing short of providential, especially in comparison to modern route surveying efforts. With a minimal survey crew utilizing crude instruments and only draft animals for transportation, Judah was able to lay out a remarkably accurate alignment across the most difficult natural obstacles undertaken up until that time (1861). He did not have the benefit of any peer review, but was obliged to compare each route on its own merits, those commonly being grade, curvature, estimated volumes of cut/fill, and tunnels (the need for snow sheds and winter right-of-way maintenance over Donner Pass were discovered later).

When we look at the original transcontinental route between Omaha, Nebraska and Sacramento, California, it makes a remarkably efficient traverse of the country, deviating at most only 40 miles from a great circle route drawn between these two points (this

deviation being in the Promontory Mountains of Utah, which were subsequently bypassed by the Lucin Cutoff Trestle-Causeway across the Great Salt Lake in 1904).

In the years that followed, larger and more efficient earthmoving equipment evolved which allowed several generations of re-alignments of the original line, including the construction of a second track in the early 1920s. A new summit tunnel 10,300 feet long now connects Donner Summit with Strong's Cañon, between Tunnels 12 and 13. This avoids the exposed cliffs overlooking Donner Lake. Most of the snowsheds have been shorn as snow removal equipment became more capable and reliable in the wake of the record snowfall of 1951-52. But, as the line now stands, it is essentially true to the layout originally envisioned by Theodore Judah. In 1941 Southern Pacific engineers named the highest peak adjacent to Donner Pass "Mount Judah," which rises to 8,243 feet, overlooking the Sugar Bowl ski resort at Norden.

Judah's vision also altered the course of human history in America. The steel ribbons that delineate the path he blazed through the woods and cliffs of a harsh mountain range serve as a fitting memorial to his foresight and engineering prowess, 150 years later. Few engineers have so altered the course of human events in such a brief lifespan. Judah died of yellow fever in New York City on November 2, 1863 at age 37. Two months later, Edwin Bryant Crocker joined the Central Pacific Railroad as their Attorney and General Agent. Like Judah, Edwin Crocker had attended Rensselaer Institute, receiving a bachelor's degree in engineering in 1833, then remaining to engage in graduate studies in engineering the following year. After only a few years working as a civil engineer, he turned to law and became a respected attorney and judge in Sacramento (appointed by Governor Leland Stanford). E.B. Crocker was one of the five Associates that led the Central Pacific during the transcontinental railroad construction, and the only one with any formal technical education and experience.

We hope that some of this may be of help to you in your efforts to accurately portray Theodore Judah, the engineer, the visionary and the politician. Personally, it seems incredulous that more recognition hasn't been made of his lobbying efforts in Washington, D.C., which would seem to have been watershed events in securing a two-pronged transcontinental link. It is indeed fortunate that history has a way of unraveling the efforts of Judah and recognizing his tenacity for doing whatever it took to get the job done, but within his own moral limits.



On April 26, 1930 a memorial honoring the professional contributions of Theodore Judah was commemorated in front of the Southern Pacific passenger station in Sacramento, championed by W.H. Kirkbride, M. ASCE, Chief Engineer of the Southern Pacific Company, seen above standing on the dais constructed for the event (Galloway Collection Colorado Railroad Museum).



The front of the Judah Monument in Sacramento, which now stands at the southeast corner of Old Sacramento (Galloway Collection Colorado Railroad Museum).



The graves of Theodore Dehone Judah (1826-1863) and his wife Anna Ferona Pierce Judah (1828-1895) in Greenfield, Massachusetts (from findagrave.com).

End Notes

1. The five Associates during construction of the Central Pacific Railroad were Charles Crocker, Edwin Crocker, Mark Hopkins, Collis Huntington, and Leland Stanford.
2. *The First Transcontinental Railroad – Central Pacific – Union Pacific*, John Debo Galloway C.E., Simmons-Boardman Publishing, 1950.
3. The Spanish spelling, cañon, was universal in the western United States in the 19th century. The current spelling, canyon, is a modern change.
4. *Reports of Explorations and Surveys, to Ascertain the most Practicable and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean 1853-4*, under the direction of the Secretary of War, 1855; Library of Congress.
5. California Highways and Public Works, Centennial Edition, California Division of Highways, September 9, 1950, *Crossing the Sierra*, Stewart Mitchell, Principal Bridge Engineer; Internet Archive
6. *Survey with Marlette*, Sacramento Daily Union, July 28, 1855; California Digital Newspaper collection, University of California Riverside.
7. 1850-2010 Historical US Census Populations of Counties and incorporated Cities/Towns in California; California State Data Center, Demographic Research Unit, Department of Finance, 2012.
8. *A Practical Plan for building the Pacific Railroad*, by T.D. Judah, Civil Engineer, Washington D.C., January 1, 1857, Henry Polkinhorn, Printer 1857; Central Pacific Railroad Photographic History Museum.
9. *Changes at Washington*, Sacramento Daily Union, January 29, 1859; California Digital Newspaper Collection, University of California Riverside.
10. Letter from S.S. Montague to Dr. D.W. Strong, Folsom, December 10, 1861, printed in testimony by D.W. Strong to The United States Pacific Railway Commission, Vol. V, page 2972; Library of Congress
11. *Central Pacific Railroad Company of California*, November 1, 1860, T.D. Judah, San Francisco; California State Library.
12. *Report of the Chief Engineer upon Recent Surveys, Progress of Construction and an Approximate Estimate of Cost of First Division of Fifty Miles of the Central Pacific Railroad of Cal.*, July 1st, 1863; California State Library.
13. Letter written by Anna Judah in 1889, original hand-written letter at California State Railroad Museum Archives, copy of letter printed in Sacramento Themis, December 14, 1889, titled *Early Pacific Railroad History*; online at University of California Online Archive of California (OAC).
14. *The Inside Man, The Life and Times of Mark Hopkins of New York, Michigan, and California*, Salvador A. Ramirez, 2010, pages 178, 1154; *A Sketch of the Life of Theodore D. Judah*, Carl I. Wheat, California Historical Society Quarterly, Vol IV, No. 3, September 1925, pages 244, 245.
15. *The Inside Man, The Life and Times of Mark Hopkins of New York, Michigan, and California*, Salvador A. Ramirez, 2010, pages 181, 1155.
16. *Collis Potter Huntington*, Cerinda W. Evans, 1954, page 97.
17. *Theodore Dehone Judah-Railroad Pioneer*, John D. Galloway, American Society of Civil Engineers, Civil Engineering magazine, October and November 1941