THEODORE JUDAH AND THE BLAZING OF THE

FIRST TRANSCONTINENTAL RAILROAD OVER

THE SIERRA NEVADAS

by

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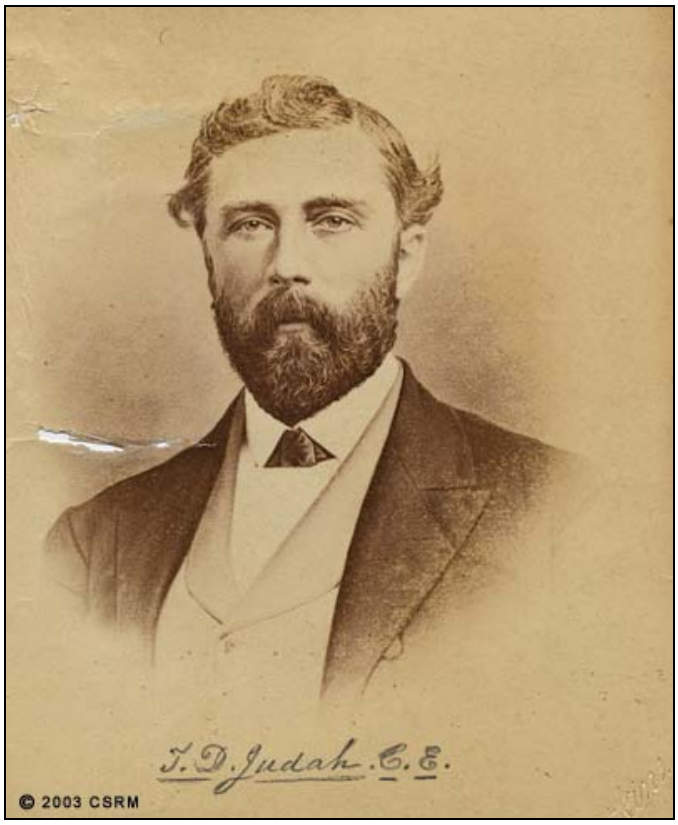

Theodore Dehone Judah, C.E. (1826-1863)

Consider a World Without Theodore Judah

In considering the development history of the west, I think it's pretty certain that the first of the five great transcontinental links would never have been completed before 1876-79 without Theodore Judah. 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 "Big Four", the Southern Pacific, and the evolution of California as we know it.

The question of "a world without Theodore Judah" is almost like asking what history would have been like without someone much more noticed, like Abraham Lincoln. But, think about it for just a second. We could suppose that Durant/Dillon & Co. (the Union Pacific) could probably have finished the line to California, probably via Donner or Beckwourth Passes, 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 1,500+ miles west of Council Bluffs 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 running 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 **The First Transcontinental Railroad**, published posthumously in 1950 (and re-printed in 1979). Galloway was one of the Country's preeminent civil engineering consultants (a partner in the firm Galloway and Markwart), based in San Francisco from 1906-43. In addition to being classical structural engineers, they did a lot of bridge design work for the Southern Pacific and Western Pacific Railroads. From what I've been able to tell, Galloway worked on this book most of his lifetime, and it was only his untimely death during World War II that prevented it from being published in his lifetime.

Evolution of Railroads in the 1850s

The federally-mandated surveys of 1854-57 crossed steep mountain ranges by skirting major river valleys, following these up, through the mountains via river-cut canyons. When the grade of the natural canyon became too severe, switchbacks, or "horseshoe turns" (like that used in Coldstream Valley above Truckee), would be proposed, followed by "holing through" the crest of major divides in tunnels. In this manner the maximum grades were generally kept below 3%. Such engineering approaches had been implemented in the east, first on the Baltimore & Ohio RR leading into (what later became) West Virginia (specifically, on the line that traversed Harper's Ferry) in the early 1850s. Around that same time (1853-55), the Pennsylvania Railroad completed two great tunnels and "Horseshoe Bend" (across the crest of the Appalachians) in its mainline connection to Pittsburgh. At the time of its completion (1855), this line came to represent the "state-of-the-art" in civil engineering technology, employing the largest fill embankments ever undertaken (upwards of 150 feet high), a double track mainline, and some of the most extensive tunnels ever undertaken (double track width).

The technological achievement of the Pennsy line across the Alleghany Mountains had been undreamed-of a decade before (in the 1840s). Such achievements launched dreams of railroads everywhere: extending rail lines across the Mississippi, across the great plains, and any mountain range that stood in the way, including the great Sierra Nevada. Suddenly, nothing was deemed beyond the realm of modern engineering prowess.

The eruption of the Civil War in 1861 made two things happen: first, the handicap of providing for "southern compromises" as to the route-of-choice was removed; secondly, there was the sudden perception that rail connection to the west was in the strategic interest of the Union. By 1860 some 30,000 miles of track had been laid, mostly in the 1850s in the north. Although the war stymied new railroad construction for the most part, its utilization by the military was of unquestionable value in forever changing the logistics of sustained combat operations. Now, great rivers were crossed in a matter of hours with prefabricated timber bridge elements when before the war a multiple masonry arch bridge might have taken several years to complete. The explosion of temporary

timber trestles utilized by Federal engineers had a dramatic effect of post-1865 construction out west.

By the end of the civil war few questioned that railroads would serve as the keystone upon which industrial and commercial progress would rest. In the later half of the 19th Century whole towns would burst into existence or dry up and die in proximity to railroad alignments. The barons of business that built or owned these lines would exercise incredible influence over the Country's affairs for the next 75 years.

The Federal Railroad Surveys of 1853-55

During the explosion of railroad building activity in the east in the early 1850s, representatives of the more remote western states lobbied hard for federal assistance in bringing railroads to the frontier. In 1853 Federal legislation was authored to extend surveys for possible railroad links west of the Mississippi Valley. Later that year Army Engineers embarked on the now-famous series of railroad surveys across the continent. Completed by 1856, 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 what later became the five basic transcontinental routes was essentially surveyed. The quality of this work was superb, especially considering the conditions under which the data were collected.

For those few engineers possessing vision of things to come (in the mid 1850s), like Judah, the building of the Pennsylvania and B & O across great mountain barriers and the detailed federal railroad surveys, it seemed simply a matter of time before railroad interconnection of the entire 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 extended some 245 miles west from 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 railroad's only competition was a cumbersome state-run combination canal/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 through.

For the far west, the situation was incredibly different. In fact, it was so different that it's almost impossible to comprehend today. At that time (the mid-1850s) California lay at the end of a perilous 18,000 mil sea voyage around Cape Horn. This voyage could take anywhere between 4 and 9 months, depending on the weather. The completion of the Panama Railroad in 1855 greatly reduced the time of personnel travel, 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. For instance, once Collis Huntington began using the connection to ship iron rails and locomotives (in 1863), 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 only penalty was an arrival date four months later.

The federal surveys for the so-called "central route" 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 out rightly 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 as a cabinet member, the Pierce administration concluded that the southern route was most favorable.

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 the Governor on April 28, 1855, providing for construction of a wagon road from Sacramento eastward to the state line near Carson Valley. A plethora of surveys soon emerged, almost too numerous to summarize herein. 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 what is now referred to as Spooner Summit (elevation 7146) 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 ¾ mile to the crest of Echo Summit, thence down the South Fork of the American River towards Placerville. Johnson's cut-off quickly became the route of choice, besting the Carson Pass route. The route had little 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 Nevada'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 Day, a civil and mining engineer as well as State Senator, could begin the surveys. In June 1855 he began from Georgetown surveying one of the emigrant trails that led up over the crest of the Sierras via Wentworth Springs, thence down the Rubicon River to the west shore of Lake Tahoe. In

July 1855 Day surveyed 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 8573) and down the Carson River. On the trip back, Day looked at Luther's Pass (elevation 7740) into the south Tahoe Basin, between the Carson and Johnson cut-off routes. The following September, Day once again set out, 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 Spooner Summit, then called Johnson's Pass) was chosen over Carson Pass, mostly on the basis of its directness and relative lack 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 ever 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, the only civil engineer with railroad 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. Dr. 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, to be built through their town.

In 1856 D.B. Scott made a survey of the Henness Pass Route on the east crest of the divide, between the Truckee River and Camptonville and reported these to the State Surveyor General. On the heels of this effort A.P. Chapman surveyed a new route up the Yuba which left Henness Pass Road just south of Goodyears Bar, crossing 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 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 won 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.

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 any road.

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 did find 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 westerners. The catch to all of this was that the terminus of the central route was to be Honey Lake, in keeping with the recently-completed Federal railroad survey. Anticipating a northern entry into the state, a new railroad was pushed northward from Folsom to Marysville. The California Stage Company soon moved its headquarters to Marysville in anticipation.

As local factions continued to feud and the State cared little for a Federally-funded route that bypassed Carson Valley. 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 formally let a contract in June 1858. This route, the first road over the Sierra Nevada, was completed in November 1958. 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 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 the Johnson cut-off route over to Carson City.

When stage service actually commenced over Day-Marlette/Johnson's cut-off road in late 1858, the original alignment across Spooner Summit was abandoned in favor of Luther's Pass over the South Tahoe divide and into the upper Carson Valley. By 1860 the U.S. Mail was also carried over this route until Washington politics altered the mail to the southern route, via the Butterfield stage, through the Anza-Borrego Desert.

The Toll Road Franchise

The discovery of gold in the Comstock Lode in 1859 brought a new found importance to the Carson Valley area. By 1860 the rush was on, and the favored route, once again, was via the South Fork of the American River. Now 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 to those persons who undertook to construct new roads or maintained the existing ones. The decision was timely. In September 1860 Kingsbury Grade over Daggetts Pass (elevation 7334) was completed as yet another alternative to Spooner Summit. This thrived for two years until Walton's Road was completed over Spooner Summit in November 1863.

In the fall of 1861 one of the most important links in the trans-Sierra chain was undertaken by Oglesby building a toll road on the south face of the South Fork of the American, 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, and essentially parallels the route now taken by Highway 50 between Placerville and Riverton, through Pollack Pines along the ridgetop. During the severe winter of 1861-62 floods destroyed much of the existing road network, and travel by wagon ceased 25 miles east of Placerville.

By 1865 the Placerville Road was 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 Spooner Summit, the entire line became known as the "Lake Tahoe Wagon Road" for the next 60 years. Over this the principal commerce to the Comstock Lode traveled until the competing Dutch Flat Wagon Road was completed by the Central Pacific in June 1864, and stage coaches 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 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.

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) grading of the line began in February 1855. By January 1, 1856 the Sacramento Valley Railroad (SVR) commenced operations between Sacramento to 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.

But, a monetary crisis arose 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 railroad line and Judah was suddenly left looking for other gainful employment.

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 what would be four trips east to solicit interest in, then lobby for, a transcontinental railroad emanating from California. Judah termed his dream the "Pacific Railroad".

On his first trip he encountered little interest. He returned again in 1857, this time visiting Washington, D.C., after having carefully studied the Federal railroad surveys of 1853-55. During his 1857 stay in Washington, Judah detailed his dream for a in a pamphlet entitled "A Practical Plan for Building the Pacific Railroad". Suitable packaged, he distributed this work to members of Congress. A review of the work immediately reveals its authorship by a practicing civil engineer; the booklet is filled with the practical realities germane to undertaking such an enormous project. Judah specifically focused on the up-front need for detailed civil engineering surveys of sufficient detail to cost-out the line. He opined that the Federal surveys, being of a reconnaissance level, were of insufficient detail to take to investors who would inevitably ask the question: "how much is this going to cost?" Judah concluded that only the Federal government possessed the resources necessary to fund such a detailed survey, and was basically seeking sponsorship of a bill that would fund him to carry out the work. Sensible as these proposals were, Congress was wrestling with other issues threatening the very fiber of the Union, such as slavery. Added to this was the basic suspicion held by Southerners of any "northern line" connecting the country and vise versa.

Judah next visited Washington in the winter of 1858-59. On January 29, 1859 he reported in the Sacramento *Union* 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 any other route to the Pacific. Judah was learning that technical arguments, no matter how sound, have no relevance to politics.

The Pacific Railroad Convention of 1859

Disappointed by the dismal prospects for any Federal assistance, Californians looked upon themselves, feeling that if anything was to be accomplished the West would have to move of its 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 capitol, Judah convinced his fellow delegates that the only way to obtain passage of enabling federal legislation was to skirt the routing dilemma and provide that any private corporation undertaking the construction of a transcontinental link 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 and 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 to lend aid by granting 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 Washington, D.C. Nine days later Judah was again sailing for the nation's capitol.

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). One result of this acquaintance was that bills outlining a method of assistance for completing a pacific railroad were drafted aboard the ships while in transit to the east. 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 on the ships. A compromise of this bill was subsequently by Senator

Gwen of California. While waiting for congressional approval, Judah established and 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 that year. But, the bills did form the basis of legislation that eventually passed in 1862, following the secession of the southern states the year before.

During the 1859-60 trip east Judah spent considerable time traveling to look at the many advances in railroad engineering that had occurred in the east since his departure in late 1853. He made these travels 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 RR, making exacting studies of the mountain crossings of both those lines, then considered the finest examples of railroad engineering in the world. In the interim since his original departure for California in 1853, steam locomotives had become increasingly more 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 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 divide. Not that some engineers didn't think it technically possible, most discarded the idea simply based on excessive cost.

So, from the very start, Judah's main concern as a civil engineer would have been how to route a mainline railroad through the Sierra Nevadas.

Upon his return, Judah took to the Sierra Nevada in October 1860, once again in the employ of the financially strapped Sacramento Valley Railroad. The SVR hired him to make surveys for possible "freight wagon roads across the Sierra and to solicit freight for the SVR". Thus he was returned to the mountains and soon appears to have "fallen in" with an old friend from Dutch Flat, Dr. Strong, the mining camps' druggist. Like every other resident of the Sierra foothills, Strong likely lobbied hard for a rail route through Dutch Flat, which lay a short distance up the slope from Bear River and the old California emigrant trail, utilized from 1844-50.

Judah appears to have begun by exploring many of the same routes explored in the late 1850's, such as Henness Pass. He gave Dr. Strong credit for exploring the merits of Donner Pass, which lay above Dutch Flat, and up until this juncture, does not appear to

have been considered as a possibility by anyone, even during the road survey/building "frenzy" of the previous 5 years.

Once in the mountains, Judah went to work as only can a man suddenly being able to realize long-sought dreams. Between 1860-62 he surveyed five basic routes across the Sierra. With the exception of Donner Pass, most of these routes appear to be refinements or variations of the road surveys completed between 1855-58. These included: a route emanating from Folsom at the terminus of the Sacramento Valley Railroad, up the ridgeline between the Middle and South Forks of the American, through Georgetown, and across the divide at the headwaters of the Middle fork of the American, into the Tahoe Basin and down the Truckee River. This route required grades of 150 feet/mile, or 2.85%. The second route was the one over Donner summit, which appears to have been overlooked by everyone else, and over which the transcontinental line was eventually built.

A third route paralleled the old California Trail, beginning at Johnson's Ranch (not to be confused with Johnson's cut-off), just east of Wheatland, moving northeasterly through Rough-and-Ready, Indian Springs, close to Bloomfield, Snowtent, Eureka camp, Bowman, and over the Sierra Crest via Henness Pass. This route came close to Nevada City, and was the favored emigrant route for the '49s coming over Donner Pass (which deviated from the original 1844 trail near Greenhorn Crossing according to Graydon, as quoted in Steed and Steed, 1991). This route, known as Henness Pass Road (which still exists), was opened in 1853 and followed the divide between the North and Middle Forks of the Yuba River. It became the popular emigrant route of the late 1850s in that it made the most direct connection with the Yuba gold fields that were then flourishing. Judah's adaptation of the Henness Pass route involved multiple crossings of deep canyons near the Sierra crest (at 6800 feet) and traversed the divide about 13 miles north of Yuba Gap (on Donner Pass) and ran along the Little Truckee River to Truckee Meadows.

A fourth route was just north of the third. This alignment crossed the canyons of the South and Middle forks of the Yuba and continued up the north fork of the Yuba via Downieville and Yuba Pass (elevation 6700 feet), thence northward, through Beckwourth Pass (elevation 5212 feet).

The fifth and northernmost route was that via the Feather River Canyon, above Oroville. This alignment followed the Middle Fork of the Feather, crossing the Sierra Crest at Beckwourth Pass. This route had the advantage of lighter grades and a lower crest elevation than all of the other routes, but would involve very costly and expensive construction in the forbidding bedrock chasm of the Middle Fork, where hard unweathered granite formed a tight chasm about the river channel (no road has ever been built through this canyon). The North Fork of the Feather River was eventually utilized by the Western Pacific RR in 1903, as was the State highway in the mid-1930s. An extremely costly line, the Western Pacific bypasses Reno, hooking up with the Humboldt River at Winnemucca, and is 65 miles longer than the Donner Pass route. In the 1930's State Highway engineers spent the better part of 10 years completing the first paved highway (2 lane) through the same Canyon.

The Dutch Flat Route

Strong actually wrote to Judah while he was engaged surveying further north. Upon receipt of a letter from Strong stating that "he had discovered a passage through Donner Summit", Judah supposedly came to Dutch Flat. As with his surveying predecessors, Judah's presence likely stirred the hopes of local businessmen, in the throws of recession since 1855. We can catch of 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. That Judah could undertake in such goings-on while supposedly in the employment of the SVR is the only blemish I could ever uncover in his brief, but remarkably honest career.

Upon reaching Donner Summit (presumably for the first time, in late 1860), Strong and Judah narrowly missed being "snowed in" (as in, for the winter, like the Donner party). But, Judah had apparently seen enough. 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 "Big Four" down in Sacramento had yet to hear of any such venture.

Apparently, Judah's "wanderings" about for a trans-Sierra rail line aroused the ire of his employer, the Sacramento Valley Railroad, who heard of his "Dutch Flat Route" through the newspapers without any prior consent or knowledge of the railroad. Judah was thereupon discharged from the SVR's service, the only blemish on his professional record of which we are aware.

The aim of the "Dutch Flat Route" was to cross the Sierra at Summit Valley, what we now call Norden (much of which is now beneath Lake Van 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 1844-1852 (when other routes, to the north and south, became more popular).

The most troubled portion of the "Dutch Flat Route" was the initial ascension of the Sierra foothills. This portion of the route 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 Centralia, about 7 miles west of Auburn. This route foresaw a railroad junction at Centralia, between the SVR and the California Central Railroad, leading northward to the Yuba and Feather mines. The junction of the three lines was to be called "Auburn Junction", but was actually located well below Auburn, about 5 miles north of Newcastle. From Centralia, the original alignment climbed the Bear River watershed, hugging the south side of the canyon of the Bear River.

Sometime after the March-August 1861 survey, Judah shifted the alignment more southerly, apparently up the North Fork of the American River, directly below Auburn.

But this left the railroad in a "hole" that made reaching Dutch Flat a practical impossibility. A compromise route was found, emanating directly from Sacramento, via Roseville, Rocklin and Newcastle. From Newcastle to Auburn the Donner Pass route makes its steepest climb on the west side of the summit, reaching 2% grades and making difficult crossings of Antelope and Newcastle Ravines, impressive trestles for their day.

Dutch Flat was located in an area of hydraulic mining, about 650 feet above the Bear River, in the heart of the Mother Lode. Strong was persuasive in his argument for the Dutch Flat Route, citing the gentle grades of the wagon roads then serving the settlement (from Auburn), the potential freight market (for the hydraulic mines) and the competing connection that could be made to the Comstock Lode in Nevada.

But, getting out of Dutch Flat and up to Summit Valley would be no easy trick. Judah refined the alignments on three occasions, in 1860, 1861 and 1862. In the end he decided to hold the high ground out of Dutch Flat, staying several hundred feet above the Bear River while making for Bear Valley, at the headwaters of the Bear and adjacent to the gentle watershed divide with the South Fork of the Yuba. 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, offered much less steep than the incised river bottoms. In addition, the ridgeline alignment offered much more acceptable grades (no greater than 105 feet per mile, or less than 2%) to the Sierra Crest than anyone (even Judah) had previously felt possible.

Being the consummate engineer, Judah proceeded to survey the route up to and over the barren granite crags of Donner Summit. 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 with even mild amounts of snow on the ground (they had been snowed in on September 25th, 1844). Bringing wagons over the crest was the most difficult link along the entire emigrant trail. Post-Donner (after 1847) emigrants often opted for Coldstream Valley, southwest of Truckee, following this stream to its source, 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 Valley into the Truckee Valley. Within the headwalls of Coldstream Valley Judah laid out an impressive "horseshoe curve", almost identical in size and layout to that built along the Pennsylvania Railroad across the Allegheny crest in 1855 (and the most impressive example of American railroad engineering at the time).

As Judah pieced together his survey, it eventually became apparent that a ridgetop route was both conceivable and workable, with grades of less than 2% all of the way down the western slope of the range (the maximum grade of 2% occurred on the west slope between Newcastle and Auburn and on the eastern slope, between Truckee and the

summit). Unlike today's engineers, Judah had no overall topographic maps by which to make detailed comparisons of his routes and refine alignments to create the most efficient lines. Working in the field without any fashion of 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 the end a cross sectional profile of the proposed line was produced and these could be compared to evaluate relative grades, distances and volume of proposed excavation required for the various alignments.

Unbeknownst to Judah, the reason for the favorable topographic situation of the Dutch Flat route was entirely geological. The regional tilt of the Sierra Nevada was from east-to west, with the eastern block of the range having been 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 sitting 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 get a "run-up" at steeper grades lying ahead.

Selling the Dutch Flat Route

Upon completion of the Dutch Flat Route survey and the hasty "incorporation" of the Central Pacific Railroad, Judah immediately began to subscribe stockholders, falling in line with his plan to return to Washington, D.C. with a surveyed route, construction cost details, 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 (which later became Colfax), Grass Valley and Nevada City. Since the length of Judah's proposed alignment was 115 miles to the Nevada border, he needed an additional $70,000 to conform to California law governing stock subscriptions for railroads. He planned to raise the balance from San Francisco and Sacramento investors.

Armed with new pamphlets and engineering data 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. It was at this juncture in his career that Judah was emblazoned with this description "crazy Judah", a well meaning soul but one devoid of any economic reality in these men's view. The San Francisco investors estimated that such a line could only be built

with Federal assistance, and even then would take 10 to 20 years, 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.

Much discouraged, upon return to his hotel, Judah informed his wife Anna 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 the board of the Southern Pacific shortly before his death in 1900, recounted later in our story).

Upon his return to Sacramento in March 1861 Judah called for a meeting of Sacramento's most influential businessmen, as well as his friend Dr. Strong. About 30 men attended the presentation he gave at the St. Charles Hotel. The "Big Four": Stanford, Huntington, Crocker and Hopkins, had been introduced to Judah through one of Judah's enthusiasts, Sacramento Jeweler James Bailey. At first uninterested, the four businessmen discussed the scheme and became sufficiently curious as to attend Judah's get-together. Also in attendance that evening were Lucius A. Booth, James Bailey, Conelius Cole (a Sacramento lawyer who later served as both a congressman and senator), one of Judah's surveyors, B.F. Lette, and several others. Kraus (1969) speculates that the Robinson Brothers, owners of the Sacramento Valley Railroad, may have also attended.

Judah began the meeting by stating that he had criss-crossed 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 Route and the need to acquire subscribers. In later years, Anna Judah quotes her husbands 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, 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 Comstock Lode was a real-time venture, one that could hold short-term promise. They knew well that the preeminent route to the Comstock Lode lay along the Lake Tahoe Wagon Road, established in 1858 between Carson Valley and Placerville. Refinements of this route continued well through the early 1860's, as the Comstock traffic continued to bear profit. Having been involved in that enterprise in 1858, the Big Four understood the creation of a competing byway promised a fair return on the investment. If a railroad could subsequently be built with government assistance, so much the better.

Without the Virginia City/Comstock Lode market, there may not have been a Central Pacific Railroad. The mere existence of such a lucrative freight market was for Judah what Pittsburgh had been for the Pennsylvania Railroad: a lucrative commercial market

within reasonable distance. Huntington persuaded six others to join him, who all agreed to pay one-seventh of the costs of the Survey. The group thereby included Huntington, Stanford, Hopkins, Crocker, both, Charles Marsh, James Bailey and Judah.

The Situation in Washington, D.C. in 1861

Meanwhile, Judah's lobbying efforts in Washington, D.C. were beginning to be felt. During the 1860-61 congressional session, the House passed a compromise Pacific Railroad Act which provided for two railroads to build a transcontinental link: one from the east and another from California. 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 shelled. Suddenly, two things occurred: 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. 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 being able to be transported hundreds of miles in only a few days time, something unheard of in military strategy before the war.

Now the construction of a Pacific Railroad was seen 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.

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 Route (the entire eastern slope still necessitated a careful survey). On April 30, 1861, while Judah was away, Mark Hopkins, Treasurer of the newly-incorporated Central Pacific Railroad, called a meeting of the stockholders in Sacramento. The group, led by the "Big Four" (Huntington, Stanford, Crocker and Hopkins), drew up articles of association to which 31 stockholders affixed their signatures, subscribing a total of 1,250 shares.

With Crocker serving in the 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 Big Four and Judah was something around $159,000. 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 the Big Four joined Judah in the mountains, letting him guide them through the Dutch Flat Route. Upon reaching the crest, the specter of Donner Summit appeared formidable. Donner Lake lay 1,200 feet below, down a sheer granite slope, while 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, 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 busied himself counting the numbers of wagon teams and passengers traveling over this route in order to ascertain the amount and value of commerce. By late November the Big Four incorporated the Dutch Flat and Donner Lake Wagon Road Company. The same month these same four organized the Nevada Railroad Company with the stated intent of constructing 275 miles of connecting railroad lines in Nevada. This was followed in short order by favorable legislation from the Nevada legislature. Clearly the Big Four 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 embarked.

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 mapping his surveys, drafting cross sections and making comparisons of various alignments. During the more detailed 1861 surveys Judah re-aligned his ascent of the Sierra foothills through Lincoln and Newcastle instead of Folsom. 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 Big Four were taken up in Stanford's campaign for governor. He was running a third time for Governor on the republican ticket. This time he won the election on September 4, 1861.

Following the election, Huntington's attentions returned to the proposed rail line over the Sierras. The popular prejudice against Donner Pass was still alive, and many believed the benign divide offered by Beckwourth Pass offered a more manageable grade. Besides, at an elevation of 5,212 feet, it was 2,000 feet lower than Donner summit, an efficiency of effort that could not be ignored by a man such as Huntington. It would appear that Huntington brought this concern before Judah and Judah conceded toa reconnaissance of the Feather River route in company with Huntington.

During late October and early November of 1861 the pair appear to have made the traverse from east to west, most likely crossing the Sierras via Donner Summit thence northward to Long Valley, which runs north-south just east 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 Donner Pass. Within Sierra Valley are marshes that mark the headwaters of the Middle Fork, which begins a lazy descent towards the west. In this area the river

gives no hint of the deeply incised chasm lying downstream. The pair followed the Middle Fork, into an ever-deepening granite gorge.

Over a seven day period Huntington and Judah trekked down 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 trek adjacent to the rushing river. Here the cliffs reach 2,000 to 3,000 feet above the river. It took the party 7 days to work 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 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 (and this was prior to the record precipitation which soon befell the area during the winter of 1861-62). As a result of this reconnaissance, the route was deemed impractical and of much greater expense in comparison to that over Donner Pass.

Judah's 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." Judah sailed on October 11th. As in past trips, Judah soon acquainted himself with Aaron A. Sargent, congressional representative from California. While embarked Judah authored his detailed report of the season's refined surveys, contracting for 1,000 copies to be printed upon disembarking in New York.

This time around 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 start and immediately set about helping to author the desired legislation. As the matter would first be taken up 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 mountains. A subcommittee was chaired to draw up the necessary legislation, with Sargent as the clerk. Judah was then 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. Judah was now given charge of all 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 a transcontinental railroad built.

The Pacific Railroad bill was formally introduced in the House by Congressman Sargent on March 4, 1862, 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 link 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 (as the 1862 Act was worded) the investors would be required to pay half of the costs, the government offering the balance in gold-secured bonds. Land granting would come awhile later, in subsequent acts. 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 would be started from either end and left uncompleted in the middle.

Deviation from the Judah Alignment During Construction of the Central Pacific

When the Donner Pass line was actually built east of Dutch Flat in 1865-66, the only deviation from Judah's final (June 1862) alignment was in the crossing of the Bear River/South Yuba divide. In Judah's original survey, he routed the line directly as possible towards Bear Valley, thence up into the South Yuba, following the river to Summit Valley. Beyond Auburn (upgrade), the grades were well below the 2% maximum needed to assault the foothills.

When the line reached Dutch Flat in early 1865, Judah's successor as Chief Engineer, Samuel Montague, considered the merits of holding his elevation gain and keeping to the sides of the mountain above the Yuba bottom in heading for Summit Valley. In this area the dividing ridge between the Upper Yuba and American 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 line 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 (considerably more deeply incised to the south). Above Yuba Pass (around 5700 feet elevation), the steepness of the mountain sideslopes 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 1-1/2 miles west of Soda Springs.

Utilizing this side-hill cut alignment, the line eventually ascended Summit Valley (Norden) 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, making it the highest of all the through-going transcontinental routes until the Denver and Salt Lake Railroad completed Moffat Tunnel in the Rocky Mountains at an elevation of 9198 feet in 1924 (a tunnel so expensive it forced the line into insolvency, whereupon it was purchased by the Rio Grande Southern).

Holding to the ridgeline between Dutch Flat and Summit Valley was the only significant deviation taken 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 that 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 fellow civil engineers, working in the east, relatively close to the industrial centers fabricating all of the iron and steel components germane to railroad construction. The thought of building a major line from California seemed outlandishly expensive, given that everything would have to be taken by ship, either around Cape Horn, or across the Panamanian isthmus. In this assertion, the critics are somewhat justified. Every piece of iron rail, spikes, tieplates, locomotives, wheels and other machined or cast hardware had to be purchased in eastern markets and shipped to California. Only the wooden frames of the railstock were fabricated in California; the wheels, couplers, brakes and other cast iron hardware were brought from the east. The time between order, purchase, and implementation could easily take 2 years, all the while without generating revenue.

Judah's decision to run a railroad atop a 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 systems. However, in those instances where major rivers ran parallel to the ridges, such as in the Appalachian Mountains, railroads followed major streams, gaining elevation in the valley bottoms with the passing of successive ridges. Eventually the watershed divides were crossed via tunnels (like Horseshoe Bend).

Out in the west, however, the mountains were much more formidable. When rivers didn't cut across the grain of the mountain range, affecting a railroad could soon become uneconomic. Take, for instance, the Southern Pacific's 20-year effort to cross Siskiyou Pass between Shasta, CA and Ashland, OR. Here the Klamath River runs westerly, parallel to the mountain crest. This was the worst of all situations, for the railroad must drop to cross a major river (around 2,200 feet) and then climb to a divide at 4,500 feet over Ashland Pass, in jut over 7 miles. The Southern Pacific began their attempt in the late 1870's, finishing after 18 years of effort, several realignments, some with over 20

tunnels. The completed line utilized grades of 3.3%, the steepest on the Southern Pacific system. Today the SP routes traffic along a more circuitous route, through Klamath Falls, in order to save costs.

Had Judah attempted such a complicated and steep mountain crossing, I have doubts that the line would ever have been completed by the Central Pacific. Even with the Federal subsidy bonds, there were insufficient funds to construct the line across the Sierra Nevada. East of Penryn, the federal government increased their subsidy from $16,000 per mile to $48,000 for the 150 miles of track leading to over the mountains to Reno. Of the issued $48,000 per mile, $36,000 was actually made in gold, and the CPRR issued construction bonds for an equivalent amount ($36,000); thereby making available $72,000 per mile of "mountain construction". CPRR records, however, indicate that the actual costs were something between $100,000 and $150,000 per mile across the Sierras. In subsequent congressional hearings (held in 1887 in Washington, D.C.) the "Big Four" would claim that they lost about $5 million building the line across the Sierra; in retrospect, a statement that 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 (although this issue was debated in the 1880s since the CPRR began to generate cash with the completion of the line to Reno in June 1868, a full year before the Union Pacific had expected them to arrive).

Other historians of the CPRR/SPRR have noted that, in their later years, both Huntington and 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".

<u>Dutch Flat and Donner Lake Wagon Road</u>

Another of the construction problems associated with the Dutch Flat/Donner Pass route was the complete absence of any existing road network east of Dutch Flat, as no mining occurred above the Mother Lode outcrops. Up until late 1862, the railroad had utilized the network of existing mining roads to get supplies to their railhead. In 1860, a year before Judah's Donner Pass survey, another survey for a wagon road was made by S.G. Elliot, and in March 1861, the Lake Pass Turnpike Company was organized, but insufficient funding never allowed for completion of the line to Reno.

When the railroad reached Dutch Flat in late 1862 it soon became apparent that a supply road was going to be needed to effect construction of their right-of-way east of that point. At this juncture the "Big Four" organized the "Dutch Flat and Donner Lake Wagon Road" (in this respect the "Big Four" 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 Sierra winter. Work resumed in June 1863 and continued once again through November. The road was finally completed in June 1864, and on July 16th the California Stage Company began operating stages from the railhead at Clipper Gap over the crest to Virginia City.

In its three years of operation we can assume that some of the investment was recovered, its necessity is certainly unquestionable, **and it played a major role in staging construction out of Truckee, well ahead of the summit tunnel.** In fact, four locomotives were pre-positioned in Truckee, packed in over the wagon road, and used to effect the simultaneous construction of the alignments east of the summit tunnel. In this manner the summit tunnel was bored from four active headings simultaneously (west portal, east portal, middle portal 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 between Coldstream Valley and Tunnel 12 by the end of 1867. The summit alignment was completed to Truckee on April 3, 1868 and the last few miles to Reno by June 19th. Quadruple heading of the summit tunnel and pre-positioning Truckee had saved the railroad about a year. Remnants of the 1863 road were still visible in the 1930s according to Galloway (1950), and are clearly shown in 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 let him to conduct himself on only the most-honorable manner. Judah's skill as a civil engineer was revealed to those profession al 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 dedicating a monument at the Sacramento SPRR station in April 1930 (see enclosed article by W.L. Huber).

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" (unlike the activities of "the Big Four"). This in mind, he proceeded in a most conventional manner; which presumed securing a professionally-prepared railroad route survey before proceeding any further. [In that era, the process usually worked less scrupulously. Most railroad schemes failed, and these failures were usually due to some "salesman/visionary" over-selling "a route", subscribing stock based on an un-surveyed alignment and thereby deriving unfounded construction costs, then discovering that such a line could not be constructed within the

price and time ranges promised]. For Judah, any manner of speculative "scheme" was simply inconceivable, he was an educated professional.

All in all, as civil engineers, we are left to conclude that there is no transcontinental rail link across the central Sierra Nevada 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 leading to 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 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 donkeys for transportation, Judah was able to effectively lay out a remarkably accurate alignment across the most difficult natural obstacle ever undertaken on any of the five basic transcontinental routes. He did not have benefit of any manner of "overview", but had to compare each route on its own merits, that commonly being percent grade and the estimated volume of cut/fill and tunnels.

When we look at the original transcontinental route between Council Bluffs, Iowa 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 Salt Lake cutoff in 1903)!

In the years that followed, larger and more efficient earthmoving equipment evolved which accommodated many re-alignments of the original line. In fact, a new tunnel, some 10,300 feet long, now connects Donner summit with Coldstream Valley, avoiding the cliffs overlooking Donner Lake (although the old alignment is still utilized). Most of the snowsheds have been shorn as snow removal equipment became more capable and reliable. But, as the line now stands, it is essentially true to the layout originally envisioned by Theodore Judah. Southern Pacific engineers named the highest peak adjacent to Donner summit "Mount Judah", which crests at 8243 feet, overlooking what is now the Sugar Bowl ski resort at Norden.

Judah's vision altered the course of human history within his native country. The steel ribbons that delineate the path he blazed through the woods and cliffs of a harsh mountain range as a fitting memorial to his foresight and engineering prowess, 130 years later. Few engineers have so altered the course of human events in such a brief lifespan.

I 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.

Their goal was to get 4014 rolling again in time to celebrate one of the greatest rail accomplishments ever: the Transcontinental Railroad, built at the urging of President Lincoln. Dickens said, "It's very humbling. All of the sacrifice, all of the tremendous human effort to build something as complex as a set of railroad tracks across territory that many people have never even been across before."Â When construction of the railroad began in 1864, the Chinese were not the first choice to work on it. Chang said, "There was belief that they were either temperamentally or physically unfit for railroad work.Â They took on the most challenging portion of the Transcontinental Railroad: California's granite mountain range, the Sierra Nevada. Houghton Mifflin. Theodore Judah was called Crazy Judah for a good reason. Getting from the East Coast to the West took four to six months by ship or wagon. Everyone was eager to speed the process up, but they thought his idea for a transcontinental railroad was nuts. It was inconceivable that anyone could construct one over the Rockies and Sierra Nevadas, but Judah found a way. Work started in 1863 and wasnâ€™t completed until six years later, with shifts working day and night, at a cost of $100 million (equivalent to $2.4 billion today).Â Mastermind of the transcontinental railroad. Overcame: Finding a cost-effective route through enormous mountain ranges. Lesson: To offer a better proposal, provide a detailed critique of the competition. Theodore Judah, architect of the Transcontinental Railroad and first chief engineer of the Central Pacific. Lewis M. Clement, Chief Assistant Engineer and Superintendent of Track. Theodore Judah was a fervent supporter of the central route railroad.Â From January or February 1861 until July, Judah and Strong led a 10-person expedition to survey the route for the railroad over the Sierra Nevada through Clipper Gap and Emigrant Gap, over Donner Pass, and south to Truckee. They discovered a way across the Sierras that was gradual enough to be made suitable for a railroad, although it still needed a lot of work.[30]. The Big Four[edit]. Main articles: The Big Four and Central Pacific Railroad.

Theodore Dehone Judah (March 4, 1826â€“November 2, 1863) was an American railroad engineer who dreamed of the first Transcontinental Railroad. He found investors for what became the Central Pacific Railroad (CPRR). As chief engineer, he performed much of the land survey work to determine the best possible route for the railroad over the Sierra Nevada mountains. Early life and education.Â As the chief engineer of the Central Pacific Railroad, Judah surveyed the route over the Sierra Nevada along which the railroad was to be built during the 1860s. Failing to raise funds for the project in San Francisco, he succeeded in signing up four Sacramento merchantsâ€”the "Big Four": Leland Stanford, Collis P. Huntington, Mark Hopkins, and Charles Crocker. Americaâ€™s first steam locomotive made its debut in 1830, and over the next two decades, railroad tracks linked many cities on the East Coast. By 1850, some 9,000 miles of track had been laid east of the Missouri River. During that same period, the first settlers began to move westward across the United States; this trend increased dramatically after the discovery of gold in California in 1849.Â Before the building of the Transcontinental Railroad, it cost nearly $1,000 dollars to travel across the country. After the railroad was completed, the price dropped to $150 dollars.Â Chinese laborers at work on construction for the railroad built across the Sierra Nevada Mountains, circa 1870s. Bettmann Archive/Getty Images. First transcontinental railroad over. The sierra nevada. J. David Rogers, Ph.D., P.E., P.G., F.ASCE. Professor and Karl F. Hasselmann Chair in Geological Engineering Missouri University of Science & Technology Rolla, MO.Â In considering the development history of the west, we feel itâ€™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 â€œCentral Pacific Railroadâ€ emanating from, and indigenous to, the west coast. With no line emanating from California, we also would not have had the Central Pacific Railroadâ€™s five Associates, the Southern Pacific, or the evolution of California as we know it today. Theodore Dehone Judah (March 4, 1825 â€“ November 2, 1863) was an American civil engineer who was a central figure in the original promotion, establishment, and design of the First Transcontinental Railroad. He found investors for what became the Central Pacific Railroad (CPRR). As chief engineer, he performed much of the route survey work to determine the best alignment for the railroad over the Sierra Nevada, which was completed six years after his death. The First Transcontinental Railroad in North America was built in the 1860s, linking the well developed railway network of the East coast with rapidly growing California. The main line was officially completed on May 10, 1869. The vast number of people who traveled the line, and the complex web of connecting routes that followed, set the USA on the path to economic abundance. It also ended the centuries old way of life of the Native Americans and greatly altered the environment. The rail line was an important goal of President Abraham Lincoln, fostered during the early portion of his term and

The first railroad in California was completed in 1856 by a promising engineer named Theodore Judah. After finishing the railroad, Judah threw himself into lobbying for a transcontinental railroad.Â The primary obstacle to a transcontinental railroad had been the debate over the expansion of slavery in the Union, but the start of the American Civil War (1861-1865) on April 21, 1865, ensured that the Platte route would be chosen. Once the Southern states had seceded, the representatives of the remaining states dominated Congress, and they should have been willing to approve the transcontinental railroad, but everyone was preoccupied with the war. California History - Theodore Judah, first Chief Engineer of the Central Pacific Railroad - 1862. Saved by Patricia Below. 9.Â Collis P. Huntington was likely the most famous member of the 'Big Four' which financed the Central Pacific and helped to create the Transcontinental Railroad. Kathy Simon Trains 3 of 25. Governor Of California California History Northern California Central Pacific Railroad Eadweard Muybridge American Frontier Stanford University Gold Rush Movies. The First Transcontinental Railroad in North America was built in the 1860s, linking the well developed railway network of the East coast with rapidly growing California. The main line was officially completed on May 10, 1869. The vast number of people who traveled the line, and the complex web of connecting routes that followed, set the USA on the path to economic abundance. It also ended the centuries old way of life of the Native Americans and greatly altered the environment. The rail line was an important goal of President Abraham Lincoln, fostered during the early portion of his term and