**OFFICERS OF THE CENTRAL PACIFIC RAILROAD COMPANY OF CALIFORNIA.**

President, LELAND STANFORD, SACRAMENTO.
Vice President, C.P. HUNTINGTON, SACRAMENTO.
Treasurer, MARK HOPKINS, SACRAMENTO.
Chief Engineer, THEO. D. JUDAH, SACRAMENTO.

**DIRECTORS.**
LELAND STANFORD OF SACRAMENTO.
CHARLES CROCKER OF SACRAMENTO.
JAMES BAILEY OF SACRAMENTO.
THEODORE D. JUDAH OF SACRAMENTO.
L. A. BOOTH OF SACRAMENTO.
C. P. HUNTINGTON OF SACRAMENTO.
MARK HOPKINS OF SACRAMENTO.
D. W. STRONG OF DUTCH FLAT.
CHARLES MARSH or NEVADA. REPORT.

**ENGINEER'S OFFICE, CENTRAL PACIFIC R. R. of CALIFORNIA.**

**SACRAMENTO, October 1, 1861.**

To the PRESIDENT AND Directors OF THE CENTRAL PACIFIC RAILROAD COMPANY OF CALIFORNIA:

GENTLEMEN—Agreeably to your instructions, I have completed the preliminary survey of a Railroad across the Sierra Nevada Mountains, from the city of Sacramento to a point on the Truckee River, at the eastern base of the mountains; the result of which confirm the facts established by the barometrical reconnoisance made last fall.

A preliminary examination was made, and barometrical observations taken last fall upon three routes—one through El Dorado county via Georgetown, another via the present route (Illinoistown and Dutch Flat), and the third via Nevada and Henness Pass.

These observations demonstrated the existence of a route from Sacramento across the Sierra Nevadas, by which the summit could be attained with grades of 105 feet per mile; accordingly field parties were organized early in the spring, and a thorough Railroad Survey made, the results of which are embodied in the following Report, developing a line with lighter grades, less distance, and encountering fewer obstacles than found upon any other route or line hitherto examined across the Sierra Nevada Mountains; and proving, by actual survey that, the difficulties and formidable features of this range can be successfully overcome for Railroad purposes.

Among the objectionable features which render the Sierra Nevada Mountains formidable for Railroad operations, are found—

**FIRST. THE GREAT ELEVATION TO BE OVERCOME IN CROSSING ITS SUMMIT, AND THE WANT OF UNIFORMITY IN ITS WESTERN SLOPES.**

It will be observed that in crossing a summit of 7,000 feet in height, an average grade of 100 feet per mile, can only be attained, with a distance or base of 70 miles. Should any irregularity of surface occur in this distance, the grade would be correspondingly lessened or increased, in conformity with such irregularity of surface.

When it is considered that the average length of the western slope of the Sierra Nevada Mountains, from summit to base, is only about 70 miles, and the general height of its lowest passes about 7,000 feet, the difficulty of locating a Railroad line with 100-feet grades is correspondingly increased, as it becomes absolutely necessary to find ground upon which to preserve a general uniformity of grade.

In the present instance, the elevation of summit 7,000 feet above Sacramento, is reached by a maximum grade of 105 feet per mile; showing a remarkable regularity of surface, without which the ascent could not have been accomplished with this grade.

**SECONDLY. FROM THE IMPRACTICABILITY OF RIVER CROSSINGS IN THE MOUNTAINS.**

To those unacquainted with the mountain topography of the western slope of the Sierra Nevadas, and accustomed to the lesser elevations and gentler slopes of the Atlantic States, it would be difficult to convey an adequate idea of the extensive proportions of the irregularities of surface which attach to these mountains.

The general course of the Sierras is north-westerly, and parallel to the line of the Pacific coast.

This western slope being at right angles, extends, therefore, in a southwesterly direction, which is the general course or direction of the rivers and streams upon its western slopes.

Between a point opposite the city of Sacramento (about latitude 38 1/2) and Shasta (about 41 degrees), this western slope is intersected by numerous rivers, having their sources near the summit of the Sierras. They are as follows: The South Fork of American, Middle Fork and North Fork, Bear River, Deer Creek, South Fork of Yuba, Middle Fork, North Fork, the South, Middle and North Forks of Feather River.

These rivers run through gorges or canons, in many places from 1.000 to 2,000 in depth, with side slopes varying from perpendicular to an angle of forty-five degrees.

The ridges formed by these rivers are sharp, well defined, and in many places so narrow on top, as to leave barely room for a wagon road to be made without excavating surface of ridge.

The branches, also, of many of these rivers have worn out gorges as deep as those of the rivers, and present physical barriers to a line of communication either crossing them, or extending in a northerly and southerly direction.

These rivers are generally made the dividing lines between mountain counties, which are of oblong shape, long and narrow; the counties of El Dorado, Placer and Nevada, extending from base to summit of Sierra. The thoroughfares of travel extend into these counties along these ridges; the focus of travel for the large counties of El Dorado, Placer, Nevada and Sierra, being Sacramento (a portion of this travel, however, concentrating at Marysville ).

No wagon road exists across the middle Fork of the American. The inhabitants of El Dorado county, in order to reach the divide between Middle and North Fork of the American, by wagon, are obliged to proceed down to within eight or ten miles of the Sacramento valley, in order to obtain a crossing.

The towns of Forest Hill, Yankee Jim's, Todd's Valley, Michigan Bluffs, Bird's Flat, Sarahsville, etc., lying in the divide between the North and Middle Forks of the American, are reached by crossing the North Fork, about four miles above Auburn, at which point the road is excavated on the face of a steep side-hill above the river canon, which is about 1,000 feet high, closely following its bends and sinuosities; the hill upon each side being about four miles in length, or a total of eight miles in length; the grade for wagon road varying from 250 to 300 feet per mile.

Iowa Hill and Wisconsin Hill, although upon this same divide are separated from the above mentioned towns by two or three canons, or branches of the North Fork, running nearly parallel.

One of these canons is deeper and more precipitous than the crossing of North Fork, above Auburn; the descent into the canon being about one thousand five hundred perpendicular feet. A wagon road wide enough for a single team, with occasional turning-out places, has been built across, but a distance of ten miles of road is rendered necessary in order to reach across a direct line of about three miles, the grades being between three hundred and four hundred feet per mile.

From Iowa Hill to Illinoistown and Nevada, the canons of Bear River, of Steep Hollow, Greenhorn, Wolf Creek, and Deer Creek intervene.

Above Nevada, the South, Middle, and Main Yuba also intervene.

The present traveled stage road from Nevada to Eureka, etc., crosses South Yuba about eight miles from Nevada, the road descending in about two miles one thousand feet, and in the next five miles ascending two thousand feet, to the top of ridge.

Thus it will be seen that in order to reach the summit of Sierra Nevada, a Railroad line must avoid the crossings of any of the canons; for were it even practicable to follow down into them with a grade of one hundred feet per mile, it would still be necessary to retrace the line upon the opposite side, which would involve (in a canon of, say, one thousand feet in depth) the additional length and cost of twenty miles of line of maximum grade, with the crossings of side ravines and tributaries.

The *present line* pursues its course along an *unbroken ridge from base to summit of Sierras*, the only river crossing in the mountains being Little Bear River (a tributary of Main Bear River, about three miles above Dutch Flat), which is crossed at an elevation of fifty feet, and will require only about fifty feet span of bridge.

**THIRDLY. IN ITS ENTIRELY AVOIDING THE SECOND SUMMIT OF THE SIERRA NEVADA MOUNTAINS.**

A cross section of the main range of Sierra Nevada presents a profile showing two summits, with a range of elevated table-land lying between; thus, upon the profile of Lieutenant Beckwith's survey across the Sierra Nevada *via* Madelin Pass, are shown two distinct summits, thirty-five miles apart, with a range of elevated table-land between them.

The present Placerville wagon road to Washoe also crosses these two summits; passing the first range *via* Johnson's Pass, it descends into Bigler Lake Valley, and ascending again, crosses the second summit *via* Daggertt's Pass, into Carson Valley.

Lake Bigler lies in this valley between the two summits—is about 35 miles long, and from 12 to 15 miles in width; is entirety surrounded by mountains and lofty peaks, excepting at one point on its western shore, where the Truckee River forms its outlet.

Running at first north-westerly about eight miles, then northerly about ten, thence north-easterly about twelve miles, the Truckee passes down between these two summits with a nearly uniform fall of about thirty-five feet per mile; thence sweeping round to the eastward, it passes through the second range or summit, at a depression where it seems to be entirely worn away down to the level of the river, thence pursuing its way through an extensive plain known as the Truckee Meadows; thence through the Washoe Mountains to the Big Bend; thence northerly about twenty miles, finds its way into Pyramid Lake.

At the Donner Lake Pass where our line crosses the first summit of Sierra Nevada, the altitude of line is about 1,200 feet above the Truckee River. Donner Lake lies immediately beneath, at a depth of 1,000 feet.

Two long side ranges or spurs inclose the lake and its valley, declining in height gradually to the Truckee River, about eight miles below.

Our line is carried down along the side-hill of the spur or range immediately above the lake, and upon its south side to the Truckee River, which point it reaches in a distance of eleven and a half miles of line, with an uniformly descending grade of 105 feet per mile from the summit.

The Truckee thus reached, all further difficulty of location ceases, as it pierces its way through all obstructions with an uniform descent not exceeding forty feet per mile, to the Humboldt Desert, which forms the sink of the Humboldt and Carson Rivers.

Thus, the second summit of Sierra Nevada and the crossing of the Washoe Mountains are entirely avoided; and from the western base to the summit of Sierra Nevada, the grade is uniformly ascending or level, there being no descending grade going eastward; while from the summit to Big Bend of Truckee or Humboldt Desert, a uniform grade is likewise maintained.

**THE PROMINENT FEATURES OF THIS LINE MAY BE BRIEFLY ENUMERATED AS FOLLOWS:**

1st. It crosses the Sierra Nevada Mountains, and reaches the Truckee River, in 123, and State line in 145 miles from Sacramento.

2d. Big Bend of Truckee, or Humboldt Desert, is reached in 178 miles.

3d. It crosses the State at nearly its narrowest width.

4th. It pursues nearly a direct course from Sacramento to the Big Bend of Truckee.

5th. It forms a local road for the counties of Sacramento, Placer and Nevada.

6th. It commands and will perform the entire business of Nevada Territory, Washoe, and the Silver mineral region.

7th. It will also command the business of the newly discovered Humboldt mineral district, Pyramid Lake, Esmeralda, and Mono mineral districts.

8th. It crosses the Truckee Meadows at the head of Steamboat Valley, which, with Washoe Valley and Eagle Valley, connects with Carson Valley, enabling a branch road, with light grades, to be built to any point on Carson River.

9th. It reaches eastern base of Sierra Nevada in 11 1/2 miles from Summit.

10th. It follows the valley of Truckee River, without obstacle, to Big Bend, or Humboldt Desert.

11th. It entirely avoids the second summit of Sierra Nevada.

12th. Its maximum grades are 105 feet per mile, or less than those of the Baltimore and Ohio Railroads.

13th. The grades down the Truckee will not exceed 40 feet per mile.

14th. The elevation of line is maintained, continuously to the summit—there being no down grade running easterly to Summit.

15th. An uniformly descending grade is maintained from the summit easterly to the Truckee, or eastern base.

16th. Encounters no elevated plateau of table-land at Summit.

17th. Running to and from summit with maximum grades, cannot have an extensive snow-line.

18th. Runs through extensive forests of Pitch and Sugar Pine, Fir, Cedar, and Tamarac, which latter two species of timber are abundant, and will furnish excellent cross-ties.

19th. Crosses no deep river canons or gorges.

20th. Its longest tunnel will not exceed 1,350 feet in length, and no shafting will be required.

21st Shortest radius of curvature, 573 feet.

22d. Navigable waters of the Sacramento River at all seasons of the year its western terminus; Washoe and the Great Basin its eastern terminus.

23d. At Big Bend of Truckee, the line is in position to proceed *via* the Humboldt to Salt Lake, or follow the Simpson route to some point.

24th. Saving in distance over route *via* Medlin Pass and headwaters of Sacramento, as surveyed by Lieut. BECKWITH, from Lasseaur's Meadows, or Hummboldt crossing, 184 miles.

25th. Saving in cost of Pacific Railroad line, taking Lieut. BECKWITH'S estimate from Lasseur's Meadows, or Humboldt crossing, as compared with cost of present proposed line, in thirteen and one half millions of dollars.

26th. Reduces the time of passenger transit to and from Washoe to 8 1/2 hours. Passengers leaving Virginia station at 5 A.M. will reach San Francisco the same evening.

27th. Saving in cost of transportation of freight to citizens of Washoe or Nevada Territory, one million of dollars per year.

28th. Affords a market for low-class silver ores (now thrown aside), for shipment to Europe, from over 3,000 mining claims.

29th. Is advantageously located for an extension to Oregon.

30th. Completes first western link of Pacific Railroad, overcoming its greatest difficulties.

**GENERAL REMARKS CONCERNING LOCATION AND DESCRIPTION OF RIDGE OR DIVIDE.**

This divide is the strip of land lying between the American River and its North Fork (on the south), and Bear River and the South Yuba (on the north).

The American River unites with the Sacramento River at the city of Sacramento; Bear River unites with Feather River (a tributary of the Sacramento) about 30 miles north of the city of Sacramento.

The direction of divide is north-easterly and south-westerly. Its width opposite Sacramento is about 30 miles.

The foot-hills of Sierra Nevada begin at Folsom, on the American, and at Johnson's Ranch on Bear River; the line of foot-hills running through or near Lincoln (about 15 miles northerly, from Folsom, and 10 miles, southerly, from Johnson's Ranch), forming a piece of land in Sacramento Valley, between the foot-hills and Sacramento River, of about 30 miles in length and 20 in width. The ravine of Bear River, from Johnson's Ranch to English Bridge (a distance of about 15 miles), pursues nearly an easterly course, while the course of the ravine of American River, from Folsom, is nearly north, to a point within about 8 miles (south-easterly), from English Bridge. Here the American River branches, and the ravine of its north fork, as well as that of Bear River, pursue a north-easterly course, but gradually approach each other to a point about four miles above Illinoistown, called Long Ravine, where the two rivers are less than three miles apart.

At this point occurs the greatest depression on the ridge, and the greatest difficulties in location were found. From Long Ravine, the ravines of these rivers diverge somewhat, but are scarcely further than six miles apart at any point — the ravine of North Fork and its tributaries and branches continuing up to the summit.

Numerous branches and ravines extend northerly from the North Fork, rendering a location on that side extremely difficult, if indeed practicable, our line at Long Ravine being about 1,200 feet above the bed of North Fork. The ravine of Bear River extends up about fourteen miles above Dutch Flat, widening out near the source of Bear River into a beautiful valley, called Bear Valley, about two miles long and one mile wide. Diminished in size to a small creek, Bear River passes through this valley, and a mile above, is lost among the benches to the right. The ridge between Bear Valley and North Fork of American is about 800 feet high.

Here occurs a singular freak of nature. The South Yuba, augmented by numerous large branches along its course, is seen emerging from impassable rocky canons, and sweeping down through the head of Bear Valley, it turns suddenly to the north and pierces the ridge or divide lying north of Bear Valley, forcing its way out to the northward, between rocky walls, surmounted by peaks from 2,000 to the 3,000 feet high.

There is little doubt, that at some former period, the waters of South Yuba flowed through Bear Valley, and down the ravine of Bear River; and, indeed, it would be no difficult matter, to turn the whole volume of South Yuba into Bear River at the present time.

The South Yuba Canal Company, who supply the Nevada divide with water for mining purposes, take their water from the South Yuba, at the head of Bear Valley, bringing it down through Bear Valley by the side of Bear River, with a grade of about ten feet per mile, being, at points, as near as 200 feet to Bear River, and not over fifteen or twenty feet above it. Thus, it will be seen, that the canon of Bear River becomes, and is the same as that of the South Yuba, which latter river now takes its place, the divide or ridge being now bounded by North Fork of American on the south, and South Yuba on the north.

The ravine or valley of South Yuba continues on to the summit of Sierra Nevada, and in Summit Valley, within two miles of Summit, the river is a larger stream than is Bear River in Bear Valley.

A barometrical examination of this route indicated that the top of ridge or divide could be reached at Clipper Gap, near the head of Dry Creek, 48 1/2 miles from Sacramento. From this point to Reservoir Gap (about 1 1/2 miles above Dutch Flat, and 25 miles from Clipper Gap), it was found that the line must be carried on the top of ridge.

The line of top or crest of ridge being far from uniform, of course the lowest points or gaps in ridge become commanding points, and it was found necessary to carry the line from gap to gap, passing around the intervening hills, upon their side slopes.

It was also found, upon reaching New England Gap (near the New England Mills, about six miles from Clipper Gap), that to Long Ravine, a distance of eight miles, the ridge was nearly level, the elevation of a grade at Long Ravine being only about 100 feet higher than at New England Gap.

Also that the ridge rose rapidly from Long Ravine, eastward to the next gap (called Secret Ravine Gap).

It was also found that from Reservoir Gap (1 1/2 miles above Dutch Flat) the ridge rose too rapidly for one maximum grade, and that for the next 20 miles, to the bottom or valley of Yuba, the line must be carried on the main slope of Bear and Yuba Rivers. It was thought, however, that the line could be carried up Canon Creek (a tributary of North Fork) with tolerably smooth side slopes), to Dutchman's Gap, about eight miles above, and there cutting through the gaps, brought out on to Bear River side-hill.

Subsequent examination proved this to be impracticable. Canon Creek rising too rapidly for our grades, we were therefore compelled to carry the line immediately on to Bear River side-hill, and were fortunate enough to be able to avail ourselves of the side-hill of Little Bear River for that purpose.

Being on the top of ridge at Reservoir Gap, we were enabled to cross Little Bear River near its head, and to use its side-hill for an approach to Main Bear River.

The barometrical elevations also indicated that the Yuba could be reached about twenty miles above Dutch Flat, at the head of its canons, and the line carried along up its smooth, uniform bottoms for some distance; then, by taking to its south side-hill, Summit Valley and summit reached with maximum grades.

The South Yuba, from this point (twenty miles above Dutch Flat), called Yuba Bottom, extends to the summit, a distance of sixteen miles, most of the way through a valley, in some places 500 to 600 feet wide. The old Truckee emigrant trail follows down through the valley a portion of this distance, generally over a smooth natural road.

Were the fall of this river evenly distributed, it would afford a uniform grade of a little less than 100 feet per mile to the summit. Rising, however, from Yuba Bottom (say half a mile at a grade of fifty feet per mile), the river canons for half a mile at a steeper grade; thence for four miles its grade is about sixty feet per mile; it then canons, rising about 250 feet in a mile, at a point called Slippery Rock Canon.

The river then rises gently for about three miles, and again rapidly for three miles, to Summit valley.

Through Summit Valley (a distance of two and a half miles) its grade is scarcely twenty-five feet per mile, then rises rapidly again to the summit.

Inasmuch as the indications of altitude of the aneroid barometer proved lower than those of the true level, after continuing our line for six miles along the Yuba bottom, we were obliged to retrace our steps and commence again near Yuba Bottom, running up on south side-hill of Yuba, with maximum grade, into Summit Valley, in order to attain a sufficient elevation to reach the summit.

Summit Valley is a beautiful valley, near the source of the Yuba, about two and a half miles long and three-quarters of a mile wide, yielding excellent pasturage for cattle, hundreds of which are driven there each summer.

From the summit looking easterly, you appear standing upon a nearly perpendicular rocky wall, of 1,000 feet in height.

Immediately below is seen a valley, from one to two miles wide, extending up from the Truckee River, to nearly beneath your feet. Donner Lake, (about three and a half miles long, by one mile in width) occupies the upper portion of this valley, and its outlet is seen pursuing its course down to a junction with the Truckee. Two long ranges or spurs are seen, on either side, parallel with and inclosing the lake, reaching from the summit to Truckee River. Immediately beyond the river is seen the second summit of Sierra Nevada, while still further in the distance the Washoe Mountains are plainly visible.

Passing the summit, our line is carried down upon the side-hill of the range, on the south side of Donner Lake, descending with the maximum grade for about eleven miles.

The distance, in a direct line, from Summit to Truckee River, does not exceed eight miles: but we fortunately encountered two long ravines, with smooth side-slopes, which, with the sinuosities of side-hill, gave about three additional miles of distance, enabling us to reach the Truckee with maximum descending grades.

**PARTICULAR DESCRIPTION OF LINE.**

Commencing at the city of Sacramento, the line will cross the American River about half it mile above Lisle's Bridge; thence pursuing a north-easterly course, for twenty-five miles, across the Sacramento Valley, it reaches the town of Lincoln, or intersection with the California Central Railroad, which point is at an elevation of 140 feet above the top of the levee at Sacramento.

From Lincoln the line follows up an indentation or bay, in the foot-hills, with grades not exceeding 50 feet per mile (passing half a mile north of Virginia), to Barmore's, thirty-one miles from Sacramento (elevation, 340 feet above Sacramento), from which point grades of 84 feet per mile are first used.

Continuing on up the southerly bank of Doty's Ravine (passing about one mile north of Gold Hill), the line crosses Doty's Ravine, running down the north side of same for about one-quarter of a mile with ascending grades; thence, turning to the right, it crosses the traveled road, near Dutch Colonel's House, and passes up the upper portion of what is known as Shipley Ravine.

Thence crossing north-easterly corner of the old Boyen Ranch, it follows northerly (near the line of what is known as Sailor's Ravine Ditch), at the base of the foot-hills, to Sailor's Ravine.

Running up Sailor's Ravine, about one-third of a mile, the line crosses the same, and, turning to the left, it passes about 300 feet east of Moore's House; continuing on, up a branch of Sailor's Ravine, to a point called "Bar Summit, having attained an elevation of 660 feet above Sacramento.

Thence winding about between the beads of small ravines, it crosses near the head of Taylor's and Sedergest Ravines, and passing about two-thirds of a mile north of Taylor's House, reaches the side-hill of Dry Creek.

Passing up the south-side-hill of Dry Creek, the line follows up two tributary ravines a short distance, to a favorable crossing, and in a short distance further strikes another tributary, called Deadman's Ravine.

This ravine, presenting a smooth side-hill, the line continues up the same about half a mile, to a favorable point, where it crosses, at a height of about 45 feet.

Pursuing its course down the east side-hill of Deadman's Ravine, it strikes again the main side-hill of Dry Creek following the same to the point where it breaks from its smooth, uniform valley, into rocky canons; thence up Dry Creek about two and a half miles, to the Auburn and Nevada Stage Road.

From the Nevada Stage Road to Clipper Gap (a distance of six miles), the line follows up the valley of Dry Creek, with grades varying from 50 feet to 105 feet per mile. (At one point on the profile, a grade of 116 feet per mile will be observed. This is the grade upon the line, as run; but a slight alteration of line will reduce it to 105 feet.

From point where Dry Creek canons to Clipper Gap, the line passes up and near to Oert's House, Page's, Redwines, passing under the flume of Bear River Ditch, and crossing Wyman's Turnpike and Auburn and Nevada Stage Road at Hawes' Store.

Thence passing over lands and near the dwellings of Wells, Gilbert, Cook, Kingsley, Cogswell, Watson, Buckley, and Neil, it reaches Gasorway's, or Golden Gate Hotel (passing about 25 feet in front of Gasorway's house).

Here the stage road forks, one branch following up a side ravine to the left, over Tunnel Hill, and via Empire Mills to Illinoistown, while our line continues to the right, up Dry Creek, about a mile further, passing about 200 feet in front of Predmore's house.

Here, instead of following Dry Creek further (it rising too rapidly for our grades), we cross a gap to the right, called Clipper Gap, and run up the north side-hill of Clipper Ravine, (a tributary of North Fork of American), to Wild Cat Summit, crossing several short, steep side ravines.

Passing through Wild Cat Summit (about one-quarter of a mile south of Widow Hawes' house), we pass around Hawes' Hill, and curving to the left, cross the main road, and pass up a smooth ravine to the top of the ridge, at a point called Applegate Summit.

A short distance further on, the line passes through Evergreen Gap, crossing the divide again at Baney's Gap, from which point it curves round on side-hill (on North Fork side) to Star House Gap, near the Star House.

Here the line crosses Star House Gap (and the traveled road) about 50 feet high, passing up very nearly on top of divide, to the head of Applegate Ravine, which runs into Bear River, this point being called New England Gap.

From New England Gap the line passes out upon north side-hill of North Fork.

Crossing the traveled or Stage Road, it runs along above the same, and about 500 feet above New England Mills, through peach orchard of Murphy; through Manzanita and Chaparral Gaps, and over Sugar Loaf Summit to Lower Illinoistown Gap, at the point where upper stage road crosses the gap (about one and a quarter miles below Illinoistown.)

Crossing this gap, about 30 feet high, the line continues on about half a mile further, over a broken country, to a point called Bear River Gap, where it turns abruptly to the left, with maximum curve, and crosses the ridge with a tunnel of 500 feet in length, emerging on the south side-hill of Bear River, along which it pursues its course to Storm's Gap and Long Ravine Gap, leaving Illinoistown about one mile to the right.

Here was found the greatest difficulty in location; Long Ravine Gap being an unusually low depression, the ridge beyond rising quite rapidly to attain its average elevation.

Here the line crosses gap, about 70 feet high, and curving to the right, follows the side-hill of Rice's Ravine (leading to North Fork) for about one mile, encountering a succession of short, steep, abrupt side ravines, to Cape Horn, which is a bold, rocky bluff nearly perpendicular, and 1,200 feet high, above the North Fork of American.

Passing round the face of this bluff, about 200 feet below the table above, we strike the side-hill of Robber's Ravine, which runs parallel to Rice's Ravine, and continues up along the side-hill of same for about one and a half miles, crossing Oak Summit, and passing about three-quarters south of Madden's Toll House, through Trail Summit.

From this point the line follows along the face of side-hill above North Fork, striking Secret Ravine, along which it runs for about one mile, when, turning to the left, it passes up a tributary side ravine to its head, the line striking a point about two hundred feet south of stage road, one mile south of Secret-town.

Running thence, along side of road nearly a mile, it crosses the same, and passing between Everhart's house and barn, at Secret-town, it reaches the head of Secret ravine, or Secret-town Gap, crossing it with trestling, about 50 feet in height.

Turning to the left the line now passes north of Cold Spring Mountain (on Bear River side), and for two miles encounters a succession of steep side ravines, where some of the heaviest work on the line will be found. Two tunnels will be necessary on this piece of line, each about 600 feet in length.

Leaving the side-hill again, the line strikes a long and nearly level bench, about two miles in length, extending up nearly to Dutch Flat.

This bench is the well known gravel ridge which extends along the slopes of the Sierras at about this elevation, and on which are situated the mines worked by the hydraulic mining process.

Extending up this ridge to within about one mile of Dutch Flat, the line again takes to side-hill to left, running near to Strong's Cabin, Brickell's Steam Saw Mill, Dutch Flat Steam Saw Mill, to the Dutch Flat Water Company's large reservoir (about one and a half miles above Dutch Flat).

The town of Dutch Flat lies on Bear River side-hill, about half way down to Bear River, the line passing about half a mile in the rear, and about 300 feet higher than the town.

At this last named reservoir, which is upon the top of ridge (called Reservoir Gap), we leave the crest of ridge for the last time, it rising too rapidly to be available for a railroad line at our maximum grades.

Turning to the left, the line now runs at nearly a level grade, about one and a half miles further to Little Bear River, which stream it crosses just above the Saw Mill, near Widow Homer's Ranch.

Pursuing its course down the north side-hill of Little Bear River, it departs at Ellmore Hill, passing round the same, and enters upon the side-hill of Bear River.

The river gorge at this point is about 1,500 feet deep ~ our line being about 500 feet below the top of ridge, and from 1,000 to 1,200 feet above the river. Its side-hill is steep, rocky, and marked by many abrupt indentations and corresponding salient points. The line was carried round most of these points; but upon a final location, it will probably be found advisable to run through the sharp points with short tunnels ~ the longest of which will be 1,350 feet — none of them, however, requiring shafting.

The line passes up this side-hill of Bear River (the grade line being nearly parallel with the crest or top of the ridge, and from 500 to 700 feet below the same), crossing through Zerr's Ranch (about 600 feet north of his buildings), striking the lower end of Bear Valley, about 200 feet high, on its south side-hill. Continuing on for two miles, it leaves the head of Bear Valley, at an elevation of about 350 feet on side-hill above the same, crossing the head of Bear River (which is here but a small creek), following it up to its source, which is in a marshy lake, about one and a half miles above Bear Valley.

It will be observed on the profile, that from Zerr's Ranch to head of Bear River a grade line is indicated, running about 100 feet higher on the side-hill.

In locating the line as run, the intention was to cross Bear River, and continue on the side-hill of the main gorge to Yuba River (near head of South Yuba Water Company's Canal), keeping up on main side-hill of South Yuba to Yuba Bottom; but upon examination, this proved to be impracticable, the Yuba above Bear Valley running in deep rocky canons, with perpendicular rocky walls of granite, too rugged in their character to admit of the location of a line over them.

It therefore became necessary to carry the line on to a bench above and south of the Yuba River, and nearly at the base of main Ridge — a line from Zerr's Ranch to this point being practicable at our maximum grade, the only change necessary being to make the location a little higher on side-hill.

Our present line passes about 100 feet to the left of Jew Davids' Cabin. On the location as changed, it will pass a short distance in the rear of same.

Continuing on, the line pursues the general course of Yuba River, about six miles further, to the point where old Truckee emigrant trail leaves Yuba Bottom to ascend on the main ridge to the south (which point is 19 miles above Dutch Flat by trail, and about 22 1/2 miles by our line), called Yuba Bottom.

This point is at the head of the lower canons and falls, between Yuba Bottom and Bear Valley.

In subsequent location, it will be necessary to run the line between these two points, (viz., head of Bear River to Yuba Bottom) a little lower down on side-hill, as indicated on profile, for the following reasons: Fearing that the elevation of Yuba Bottom might prove too high, the line was run from head of Bear River, at our maximum grade, in order to gain as much elevation as possible. But on reaching Yuba Bottom, it was found that this gave more elevation than was necessary; therefore the last half mile of line was run down on to Yuba Bottom. The last elevations show, that a grade of 80 feet per mile can be obtained from the head of Bear River to Yuba Bottom.

From this point (Yuba Bottom), the line follows the river for about one mile, passing through a short canon, and emerging at very near the level of water surface in river (called Hall's Canon). From this point the line was first run for about six miles up the river valley, taking to side-hill at the two upper canons, the line being carried up to the upper ford, at head of Wilson's Cut-Off; but finding that the summit could not be reached without increasing grade on the remaining distance, our parties proceeded to summit, from which a line was run down on south side-hill of Yuba, at maximum grade, striking into the valley line, at head of first small canon (about one mile above Yuba Bottom), called Hall's Canon.

The location, therefore is carried from Hall's Canon, on South, side-hill of Yuba, at maximum grades, into lower end of Summit, Valley (about 3 1/2 miles below summit of Sierras), crossing the old Truckee Emigrant Trail, near Kidd's Reservoir, about half way up to the top of ridge, the line striking the lower end of Summit Valley, about the level of Yuba River; running thence straight across Summit Valley, about two miles, at a grade of about 25 feet per mile, to a point on the south side of Summit Valley, near Cook's old cabin, the line takes to side-hill on the right, and in 1 1/2 mile further reaches the summit of Sierras, with a cutting of about fifty feet.

By commencing the last named ascent a little further back in Summit Valley, the summit can be reached with maximum grades without any excavation. The elevation of surface at summit is 7,027 feet above top of levee at Sacramento.

**DESCENT ON EASTERN SIDE OF SIERRA NEVADA.**

Pursuing its course from the summit easterly, the line commences its descent with maximum grade, and, passing to the right, is carried for next two miles over a steep, rocky side-hill, on which will be found quite heavy rock cutting: thence turning abruptly to the right, it enters upon side-hill of Strong's Ravine, and, running up the same, about one mile, crosses over, and is carried down over a smooth side-hill, to a point 600 feet higher than the south-west corner of Donner Lake, thence pursuing its course along the side-hill for about three miles, it encounters Coldstream Ravine, and runs up the same a little over a mile.

Crossing Coldstream, the line follows along down its south side-hill to within about a quarter of a mile of the Main Truckee, where turning to left, it crosses the valley of Donner Creek, accomplishing the descent in about 11 1/2 miles of downward maximum grade. Thence the line was carried about five miles down the valley of Truckee River, and the survey terminated at a point 128 miles from Sacramento.

The object of this survey being to accomplish the crossing of the Sierras with a Railroad line, it was considered unnecessary, at this time, to extend the survey any further down the Truckee River; barometrical elevations were taken from our line up the Truckee River to Lake Bigler, and also down the same to the lower end of Truckee Meadows, showing its average fall to be only about 35 feet per mile.

I also carried a series of observations down Steamboat Valley to Steamboat Springs, thence across the Washoe Mountains (via Virginia, Flowery and Six Mile Canon) to the Carson River, thence down the same to Fort Churchill - a profile of which is shown on the small, general profile of grades.

A continuation of our line down the Truckee to Big Bend follows the same, from terminus of survey, 13 miles, to Neil's Ranch, or Henness Road; thence 7 miles to Stout's crossing of Truckee; thence through the Truckee Meadows and across head of Steamboat Valley eight miles to Stone's crossing or Western base of Washoe Mountains; thence 23 miles, through Washoe Mountains, to Big Bend of Truckee, or edge of Humboldt Desert, making the total distance about 178 miles.

No obstacle exists, and a line, with light grades over exceedingly smooth surface, can be carried from Stout's crossing of Truckee, up Steamboat Valley, to its head; thence through Washoe Valley into Eagle Valley, which opens into Carson Valley; thence down the Carson River to Fort Churchill, or edge of Desert, making, however, a longer line than that down Truckee.

**GRADES.**

The following table of grades extends from Lincoln (a point 25 miles from Sacramento,) to terminus of survey, on Truckee River, a point about 16 miles easterly from summit of Sierra Nevadas.

TABLE OF GRADES. [Table Omitted]

While upon the eastern side, or descent, there are 11.41 miles of grade, of 105 ft. per mile.

The total elevation of grade overcome at Summit is 7,000 feet.

That the elevation overcome in crossing the summit of Sierra Nevada is greater than that upon any other line of road in the United States, is true. But it is no less true that the grades employed in reaching the summit, are less than the maximum grade employed on important roads in the United States; the Pennsylvania Central having ten miles of grade of 95 feet per mile, while the Baltimore and Ohio Railroad has one plane, 15 miles in length, on which are 11 1/2 continuous miles of grade of 116 feet per mile, and 3 1/2 of 100 feet per mile. A portion of the Virginia Central Railroad was operated successfully a period of five years over two miles of grades of 300 feet per mile, with curves of 300, and one as small as 238 feet radius — with a 30-ton locomotive engine.

By referring to the above table of grades, it will be seen that the longest piece of continuously ascending maximum grade of 105 feet per mile, is about 10 miles; all of these heavy grades being relieved at frequent intervals by lesser grades or levels. So that on no portion of the road will there be so long a piece of continuously ascending grade of 105 feet per mile, as upon the 116 feet grades of the Baltimore and Ohio Railroad.

It is deemed unnecessary, here, to enter upon a calculation of the effective power of locomotive engines upon different gradients, General MCCLELLAN having given very full notes of the results of his investigations upon the subject, in his memoranda on P. R. R., published in the Report of the Secretary of War upon

P. R. R. Surveys. The following extracts from his Report are given here: <BLOCKQUOTE

"On the Pennsylvania Central Road, are gradients of 95 feet per mile, for 9 3/4 miles. Passenger trains ascend this grade with a velocity of 24 miles per hour, and descend at 20 per hour.

"The working load of the heavy freight engines (weighing 65,000 lbs., on eight drivers), on the 95 feet gradient, is 125 tons net, or about 208 tons, including tender and cars."

Of the Baltimore and Ohio Railroad, he says:

"The most interesting and analogous case, however, to which I can refer, is that of the Baltimore and Ohio Railroad, one of the great lines in the United States, alluded to in a previous part of this article, as connecting the seaboard with the valley of the Mississippi across the Allegheny Mountains. In the year 1850, 447,000 tons of merchandise and 180,000 passengers were transported on this Road, the receipts amounting to $1,343,000, the road being only about half completed. When finished to the Ohio river, the receipts are expected to amount to $3,000,000. On this road are heavy gradients, with several curves of 600 feet radius, and some of four hundred feet. It is to the mountain district of the road just opened, that I wish particularly to invite attention, and for this purpose an extract is made from the official report of the Chief Engineer, Mr. Latrobe, one of the most distinguished engineers of North America, in which he describes the route and grades over the Allegheny Mountains."

"At about a mile below this point, the high grade of 116 feet per mile begins and continues about 11 1/2 miles, crossing the Potomac from Virginia into Maryland near the beginning of the grade, and thence ascending the steep side slopes of Savage river and Crab Tree Creek, to the summit, at the head of the latter, a total distance of about 15 miles. Upon the last three and a half miles of which, the grade is reduced to about 100 feet per mile. From the summit, the line passes for about 19 miles through the level and beautiful tract of country, so well known as the Glades, and near their western border the route crosses the Maryland boundary, at a point about sixty miles from Cumberland, and passes into the State of Virginia, in whose territory it continues thence to the terminus on the Ohio. From the Glades, the line descends by a grade of 116 feet per mile, for eight and-a half miles, and over very rugged ground, and thence three and a half miles further to Cheat River, which it crosses at the mouth of Salt Lick Creek. The route, immediately after crossing this river, ascends along the broken slopes of the Laurel Hill, by a grade of 105 feet per mile for five miles, to the next summit passing the dividing ridge by a tunnel of 4,100 feet in length; and whence, after three miles of light grade, a descent by the grade of 105 feet per mile for five miles is made to the Valley of Raccoon Creek, by which and the Valley of the Three Forks Creek, the Tygarts Valley River is reached in fourteen miles more, at the Turnpike Bridge above described, and 103 1/2 miles from Cumberland."

Upon the Virginia Central Railroad, the Allegheny Mountains were crossed with grades of 296 feet per mile, and the road operated successfully a period of over five years.

Reference is had to a pamphlet published by CHAS. ELLET, Esq., the Engineer of the road, who says:

**EASTERN SIDE.**

"The length of descent, from summit to foot of grade, on eastern side, is 2 37-100 miles.

"The road descends in this distance 610 feet, "The average grade is, therefore, 257 feet per mile. "The maximum grade is 296 feet per mile.

**WESTERN SIDE.**

"Length of descent 2 2-100 miles.

"Road descent in this distance 450 feet.

"Average grade is 223 feet per mile,

"Maximum grade is 280 feet per mile.

"On both sides of mountains, the ruling curves are described with a radius of 300 feet, on which the grade is 237 feet per mile."

"The admirable engines relied on to perform the extraordinary duties imposed upon them in the passage of this summit have failed but once in this period - 2 1/2 years - to make their regular trips. The mountain has been covered with deep snow for many weeks in succession, and the cuts have been filled, for long periods, many feet in depth, with drifted snow; the ground has been covered with sleet and ice, and every impediment due to bad weather and 32 inclement seasons has been encountered, and successfully surmounted in working the tracks.

"The total weight of engines is 55,000 lbs., or 27 1/2 tons, when the boiler and tank are supplied with fuel and water enough for a trip of eight miles."

"Ascending engines stop daily on a grade of 280 feet per mile, and are there held by the brakes, while the tanks are being filled, and are started again, at the signal, without difficulty."

With the practical experience afforded by the workings of these roads, it may be safely assumed, that a thirty-ton engine, with eight drivers, will ascend the maximum grades of this road with an ordinary passenger train at a speed of twenty miles per hour.

That an engine of the same class will ascend these grades, with a freight train weighing 150 tons, at a speed of 13 miles per hour.

The following is taken from memoranda of Gen. MCCLELLAN on subject of Pacific Railroad:

Calculations for a 30-ton Engine on 6 drivers, total adhesive weight ..67,200 pounds.
By formula 1, maximum load on a level is 1,680 tons.
By formula 2, maximum grade up which this engine can draw a load of 76 tons is 401 feet.
By formula 4, the maximum grade for same load 281 feet.
By formula 1 the maximum load for grade of 150 feet is....186 tons.
By formula 3, the maximum load for same grade is 133 1/2 tons.
By formula 1, the maximum load for grade of 200 feet is ..146 tons.
By formula 3, the maximum load for same grade is 104 1/2 tons.

COMPARISON OF ELEVATIONS OVERCOME. [Table Omitted]

It will thus be seen, that the sum of ascents and descents upon this line are but 1,800 feet more than upon the Baltimore and Ohio Railroad, our line crossing a summit of 7,000 feet, the elevation of summit on that road being only 2,700 feet,

The small per centage of total rise and fall upon this line, as compared with the altitude of summit, is due to the fact that there are no undulatory grades — the rise and fall is constant, no elevation being lost.

**GRADES ON LIEUT. BECKWITH'S ROUTE FROM LASSENS TO SALT LAKE, 451 MILES.**

The following in a statement of grades from Lassens to Salt Lake, taken from Lieut. Beckwith's Profile, assuming his projected improvements in location:

[Table Omitted]

The highest grade shown being 8 miles of 89 feet grade, which can probably be reduced to 50 or 60 feet per mile.

**ALIGNMENT.**

The first 25 miles of line from Sacramento to Lincoln will be generally straight. From Lincoln to Barmore's, or six miles further, the least radius of curvature will be 1,432 feet.

From Barmore's (or western base) to the Truckee River, or eastern base of Sierra Nevada, the line is mostly on side hill; there is, consequently, a preponderance of curved line rendered necessary by the sinuosities of side hill and projecting points.

The least radius of curvature, however, upon the line is 573 feet or a ten-degree curve.

The Baltimore and Ohio Railroad has several curves of 600 and some of 400 feet radius. (See Report of General MCCLELLAN.)

The Virginia Central Railroad had curves of 300 feet radius, on which the grade was 237 feet per mile. One curve upon that Road had a radius of 238 feet. (See Report of CHAS. ELLETT, Esq.)

Curves of 500 feet radius are common upon many of our Eastern roads, and are safely traversed at a speed of 30 miles per hour.

For a particular description of the alignment of this road, attention is invited to the large map of location (scale 400 feet per inch) exhibiting each curve and tangent, with the length and radius marked upon it.

Also, to the tabular arrangement of the same, in which each curve and tangent is laid down, from which it will be seen that between Barmore's and Truckee River, a distance of 92 miles, there is of straight line:

No. of Curves of 573 feet radius 157
No. of Curves of 716 feet radius 65
No. of Curves of 955 feet radius 140
No. of Curves of 1,432 feet radius 65
No. of Curves of 1,910 feet radius 62
No. of Curves of 2,865 feet radius 23

From the eastern base of mountains to Big Bend of Truckee, the length of curved line will not exceed thirty per cent, of the whole distance, the curves being generally of over 1,500 feet radius.

Thus, it will be seen that the alignment of this road compares favorably with that of many of the most important roads of the Atlantic States.

**SNOWS.**

The argument of obstruction from snow having been frequently urged against the Central route for Pacific Railroad, I have taken much pains to arrive at correct conclusions upon this subject, and feel warranted in the statement, that a Railroad Line, upon this route, can be kept open during the entire year for the transaction of its business.

It is true that snow falls to a greater depth upon the elevated portions of this line than upon the lines of Railroads in the Atlantic States.

The depth at which snow lies upon this route is plainly distinguishable at any season.

The trees are generally covered with moss down to the level of the snow, and thousands of them can be seen entirely free from moss up to a certain height, and almost entirely covered with moss from that height.

Frequent marks have also been made by persons who have traversed the route on snow shoes, during the winter, by axe marks chopped in the tree at the level of the snow.

The limbs of the small trees also afford indications of the height of snow; those limbs lying beneath the snow maintaining their original or natural position, while those above the snow-line are almost universally bent downwards, and not unfrequently broken by the weight of snow.

These observations lead to the conclusion that the greatest depth of undisturbed snow is 13 feet at the summit. In places where drifts occur, the depth is of course greater, and at corresponding points, less than the average level.

This may, at first, seem to be a serious obstacle to the passage of Railroad Trains. But this depth of 13 feet is not the result of a single storm, but the accumulation of a number of successive storms, occurring during the winter.

Snow does not melt very rapidly at this elevation, during the winter.

A storm will occur, and snow fall to the depth, perhaps, of three or four feet.

Another storm will, perhaps, add two or three, or four feet to this depth.

Successive storms add to its depth; but it is believed that its highest level is not over 13 feet.

The town of Dutch Flat, 72 miles from Sacramento, and 40 miles from summit may be considered the foot or snow line on western side - snow seldom falling more than two feet there, and melting off in a day or two.

The average depth of snow at lower end of Donner Lake is about six feet.

At Neil's Ranch, on the Truckee River, 28 miles easterly from the summit, I am assured by Mr. Neil, that the greatest depth of snow last winter was 18 inches, and that during the five years he has lived there, it has not exceeded three feet in depth.

It may be safely concluded that the line of deep snows terminates where our line strike the Truckee River, or, say, 12 miles from the summit, making 52 miles of snow line.

It will also be remembered that our line is almost exclusively a side-hill line, from which the snow can be more easily removed than from a level surface.

It is only necessary, then, to start an engine with snow-plows, from the summit each way, at the commencement of a storm, clearing the snow as it falls. A similar course of procedure at each successive storm, will keep the track open during the entire winter.

It is also stated that a crust soon forms upon the snow, which prevents its drifting badly.

The only point where we shall encounter a level surface of snow, is in Summit Valley, for about two miles.

By elevating the track at this point, no trouble need be anticipated.

The great dread, and real danger of a storm in the mountains, does not arise from the depth of snow, but from the entire absence of shelter and relief in the mountains, there being no houses or accommodations, excepting upon the wagon roads across to Washoe.

The Placerville wagon road is kept open for travel during the entire winter, hotels being established every few miles along the route. With a railroad built upon this route, this objection would also be entirely obviated.

**TUNNELS.**

Upon the line, as located, but four tunnels appear upon the profile, but upon further examination, it has been deemed expedient to cut through several sharp projecting points, instead of carrying the line around them.

It is estimated that the cost of these tunnels will not exceed the cost of the increased length of line around these points.

It will be observed that the tunnels are comparatively short, the longest being 1,370 feet in length; they can all be worked from either end, reducing the greatest consecutive length of tunneling to 685 feet.

They are in rock, generally granite, and require no shafting.

The cost of shafting in long tunnels is usually one-third the whole cost of tunnel.

Their lengths are as follows:

[Table Omitted]

Making 18 tunnels, with an aggregate length of 17,410 feet, costing, at $50 per linear foot, $870,500.

The longest tunnel can be excavated in thirteen months, at the rate of two feet per day.

The following statistics were given in report of Gen. MCCLELLLAN to the Secretary of War, on Pacific Railroad:

Nerthe Tunnel, France — 15,153 feet long; 24 shafts; aggregate length of which was 7,589 feet; deepest of which was 610 feet; in very hard limestone; dimensions, 29 1/2 by 26 1/4 feet. Its cost was, as follows:

For mining body of tunnel $705,982
For mining shafts 109,081
Masonry for shafts 49,069
Lining for body of tunnel 423,711
Cost of aqueduct ....10.607
Total cost of tunnel $1,298,450

Cost of mining main body of tunnel, $46.58 per linear foot.

Woodhead Tunnel, England— 3 1/2 miles long 5 shafts; 400 to 600 feet deep; rock, granite, or mill-stone rock; entire cost, $1,026,705; cost of tunnel, including shafting, $55 per linear foot. Excavated at the rate of eight feet per day.

Uppingharn Tunnel— 1,320 feet long; cost $40 per linear foot.

Black Rock, Tunnel, Pennsylvania— 1,932 feet long; rock, greywacke; six shafts; cost $77 per linear foot.

The cost per cubic yard of excavating tunnels in the United States, has been:

Lehigh, very hard granite $4 36 per linear foot.
Schuylkill State 2 00
Union State 2 09
Blue Ridge Tunnel 4 00

A section of tunnel, averaging 20+17 feet, contains, 12 2/3 cubic yards per linear foot.

TIME CONSUMED IN MAKING THE TRIP WITH PASSENGER TRAINS FROM SACRAMENTO TO VIRGINIA STATION. [Table Omitted]

A train leaving Sacramento at 6 A.M., would arrive at Virginia Station (13 miles north of Virginia) at 2.30 P.M., passengers reaching Virginia City at 4.30 P.M..; Gold Hill, 4.50 P.M.; Silver City, 5.15; Chinatown, 6.10, and Carson City, 7.15 P.M.

Freight trains leaving Sacramento at 6 A. M., would reach Virginia Station at 7 P. M., including all stoppages.

Returning, the passengers leaving Virginia depot at 5 P.M., would arrive in Sacramento in time to take the 2 o'clock boat, and arrive in San Francisco the same evening.

**ESTIMATE OF COST.**

The estimated cost of this road will be found to exceed the average cost of railroads in the Atlantic States, but is nevertheless a cheaper line than has been heretofore estimated for the crossing of the Sierra Nevada Mountains.

The rugged nature of the country over which the line passes, the character of the excavations (which for 90 miles are almost exclusively rock cuttings), the high cost of labor in California, the extra weight of rail (estimated at 75 lbs. per yard), with its cost of transportation to California, all tend to swell the cost of road beyond the average cost of railroads in the Atlantic States,

But when it is considered that this line accomplishes the crossing of Sierra Nevadas (by far the most difficult and expensive portion of the great line across our continent), is carried over an elevation of 7.000 feet in height, entirely avoids the second summit of Sierra Nevada, saves 184 miles in distance, and $13,500,000 in cost to the Pacific railroad, its cost of $88,000 per mile can scarcely be deemed high.

The Boston and Providence Railroad cost.. .$81,273 00 per mile.
The Boston and Lowell Railroad cost 78,636 00
The New York and Erie Railroad, about 80,000 00
The Hudson River Railroad, about 80,000 00

COST OF ROAD FROM SACRAMENTO TO STATE LINE, OR NEIL'S [Table Omitted]

ADDITIONAL COST TO STONE'S CROSSING OF TRUCKEE OR VIRGINIA STATION - 15 MILES. [Table Omitted]

ADDITIONAL COST TO BIG BEND OF TRUCKEE OR HUMBOLDT DESERT -- 23 MILES. [Table Omitted]

ADDITIONAL COST OF A RAILROAD LINE FROM BIG BEND OF TRUCKEE TO LASSEN'S MEADOWS, OR TO A CONNECTION WITH LIEUT. BECKWITHS LINE ON HUMBOLDT RIVER -- 104 MILES. [Table Omitted]

ADDITIONAL COST OF LINE FROM LASSEN'S MEADOWS TO SALT LAKE, TAKEN FROM ESTIMATES OF LIEUT. BECKWITH, P. R. R. REPORTS--451 MILES. [Table Omitted]

ESTIMATED COST OF LINE FROM SALT LAKE TO COUNCIL BLUFFS, BY LIEUT. BECKWITH, P. R. R. REPORTS --1,125 MILES. [Table Omitted]

RECAPITULATION AND ESTIMATE OF ENTIRE COST OF PACIFIC RAILROAD LINE, TAKING LIEUT. BECKWITH ESTIMATES, FROM COUNCIL, BLUFFS TO LASSEN'S MEADOWS, AND THENCE VIA THIS ROUTE TO SACRAMENTO -- DISTANCE, 1,858 MILES. [Table Omitted]

The importance of this route to the great enterprise of which it is destined to form a link, cannot be more clearly manifested than in the reduction of cost in constructing the Pacific Railroad.

In all the previous comparisons of cost and distance, the Central Route has labored under great disadvantage, and has not taken the rank among routes, to which, by its merits, it was entitled.

A reduction in cost of $13,500,000, and a saving in distance of 184 miles of line, present features which may well invite consideration from the friends of that project.

**GENERAL REMARKS.**

It will be observed that the estimates of cost and distances from Big Bend of Truckee to Salt Lake are made upon the Beckwith or Humboldt route, a distance of 733 miles.

While it is possible that a more southerly line can be found along or near the Simpson route, in the absence of surveys, or data for estimate, no reliable opinion can be formed of its feasibility or probable cost.

Our line, at Big Bend of Truckee, is in position to join an extension on either route.

According to the itinerary of Captain Simpson, it does not appear that the more southerly route presents any advantage in distance to Salt Lake City.

The distance given by Captain Simpson from Carson City to Camp Floyd is 554 miles. Adding to this the distance from Sacramento to Carson City, 142 miles, and the distance from Camp Floyd to Salt Lake City ~ say 35 miles — it gives the total distance from Sacramento to Salt Lake City as 731 miles.

From our line at Big Bend of Truckee, via Simpson route to Salt Lake, the distance would be about the same as to Salt Lake City, on the Humboldt route, but should the main line of lower road he carried round the head of Utah Lake, and up the Timpanogos, it would make the lower line about 50 miles the shortest.

If a line can be found from the Sink of Humboldt across to Gravelly Ford (on that river,) it will shorten the Humboldt route about fifty miles.

There are three important considerations, however, which give the route up the Humboldt River a manifest advantage over any other route for a railroad line.

First — Its availability for a connection with Oregon and Washington.

Lassen's Meadows are only about eighty miles south of the forty-second parallel of latitude, which parallel is the southern boundary of Oregon, there being a good emigrant road from that point to Jacksonville and Fort Lane, in Oregon, the line following around the northerly end of Mud Lake, up Black Rock Creek, southerly end of Goose Lake, and between the Klamath Lakes to Jacksonville, from which point a good railroad line, with light grades, was found (see reports of Lieutenants WILLIAMSON and ABBOTT) to Portland on the Columbia River, the distance from Lassen's Meadows to Jacksonville being about 280 miles.

Second — The recent discoveries of silver on the Humboldt River in the vicinity of Lassen's Meadows.

The well known discoveries of silver ore in the Washoe Mountains has drawn thither, in the last two years, a population of about 17,000 souls, most of whom are hardy, able-bodied miners. Numerous flourishing towns and villages have sprung into existence, permanent improvements have been made, and but a few years will elapse before a new State will be formed out of that portion of Nevada Territory.

Within the last few months, discoveries of silver have been made on the Humboldt, which are said to rival those of Washoe. Already a new city is in existence, and hundreds of miners have gone there.

There will of course be but a small emigration there this winter; but next spring and summer will undoubtedly witness an influx of population hardly second to that of Washoe.

The mines are stated to be of great extent and richness, many of the out-croppings assaying over $1,000 per ton. A number of tons of ore have been sent to Sacramento and San Francisco for trial, the results of which have proved them to be of extraordinary richness.

Cinnabar and coal have also been discovered in this locality.

Several mills are in the course of erection, and permanent improvements are being rapidly made.

Being on the main emigrant route to California, and accessible from both Oregon and California, the accessions to its population cannot fail to be large; and it will not be many years before the new State of Humboldt will apply for admission into the Union.

Thirdly — From the feasibility of this as a Railroad route, and the character of soil etc., along its route.

After striking the Humboldt at Lassen's, there are 190 miles of unobstructed valley, on which the grade for 145 miles is only four feet per mile; 36 miles are level; 24 miles has a grade of half a foot per mile; 160 miles has a grade of four feet; 50 miles has a grade of seven and eight feet; 53 miles a grade of eight and ten feet; 43 miles a grade of eighteen to twenty-one feet; 40 miles of from twenty-five to thirty-one feet: 18 miles of grade of fifty-eight feet; there being only eight miles of a higher grade, in eighty-nine feet, which can undoubtedly be reduced.

The elevation at Lassen's is only about 250 feet lower than the Big Bend of Truckee, the distance 104 miles.

There will be then 539 miles of light grades, not exceeding 31 feet per mile, on a line of 555 miles long — a feature of no little importance in determining the location of the Pacific Railroad.

The valley of the Humboldt has been traversed by many thousands of Emigrants to Oregon and California, and is well known to embrace many valleys of alluvial and fertile soil.

The general character of the soil in the great basin is barren and sterile, except where intersected by rivers. The valley of the Humboldt has received the largest share of the emigrant travel, for the reason that it afforded good grass, and water in abundance.

Being more inviting to emigrants, it will settle up more rapidly, and thereby greatly facilitate the construction of a railroad line on this route.

Accompanying this report, will be found the following Maps, Profiles, etc.:

A. Large map on a scale of 400 feet per inch (90 feet long), showing the curves and tangents, from Dutch Flat to Truckee River, for filing in Secretary of State's office.

B. Seventeen sheets of location, numbered 1 to 17, inclusive, scale 400 feet per inch, showing curves and tangents, from Barmore's (or western base), to Dutch Flat,for filing, as above. (Also copies of same.

C. Five large maps (20 feet long), scale 400 feet per inch, showing curves and tangents, as follows: Nol Barmore's to Clipper Gap. No.2. Clipper Gap to Dutch Flat. No.3. Dutch Flat to Rattlesnake Bluffs. No.4. Rattlesnake Bluffs to Summit. No.5. Summit to eastern terminus of survey.

D. Thirty-two sheets, numbered 1 to 32, scale 400 feet per inch, exhibiting the angular line as run with projected curves and tangents thereon.

E. Map (16 feet long) scale 5,000 feet per inch, exhibiting the country from San Francisco to terminus of survey, showing our line, with adjoining towns and rivers, for ten miles on either side, and connecting railroads,

F. Traced copy of the same.

G. Smaller map prepared for lithographing, showing whole country, from San Francisco to Big Bend of Truckee.

H. Britton and Rey's map of California.

I. United States Surveyor General's map of State.

J. Elliott's map of a portion of the State.

K. Ransom's map of San Francisco, and 40 miles round.

L. Map of Sacramento Valley Railroad, Sacramento to Folsom, scale 5,000.

M. Map of California Central Railroad, location, Folsom to Marysville.

N. Map of California Northern Railroad, Marysville to Oroville.

O. Map of survey, Sacramento to Benicia.

P. Map of survey, Marysville to Benicia.

Q. Map of survey, Folsom to Placerville.

R. Smith's map of survey for Canal up North Fork of American River to Lake Bigler.

S. Connected map of Lieutenant Beckwith's surveys, showing the topography, etc. from Benicia to Salt Lake.

T. Map of Captain Simpson's route to Camp Floyd.

U. Large map compiled in office of Secretary of War, showing the country west of the Mississippi River, with all the surveys for Pacific Railroad laid down thereon.

V. Smaller map of routes, as above.

W. Map of Rancho del Paso, through which our line passes.

X. Map of City of Sacramento.

Y. Map of survey across Sacramento Valley.

Z. Degroot's map of Washoe mines, also Pierce's map of Washoe.

**PROFILES.**

a. Sheets, 1 to 34 inclusive, working profile of line as run (horizontal scale, 400 feet; vertical scale, 30 feet per inch).

b. Profile of line to Dutch Flat (horizontal scale, 500 feet per inch; vertical scale, 50 feet per inch).

c. Two profiles of line reaching from Lincoln to Truckee River (horizontal scale, 1,000 feet; vertical scale, 100 feet per inch).

d. One profile, extending from Sacramento to Big Bend of Truckee, also showing a section of Washoe Mountains, on a line from Stout's to Fort Churchill (horizontal scale, 11,000 feet; vertical scale 600 feet per inch).

e. Copy of same for filing in Secretary of State's office. / Profile of Lieutenant Beckwith's line, Salt Lake to Fort Reading, containing profile of Noble's Pass. g. Two sheets of profiles of various southern passes across Sierra Nevada (published in Secretary of War's office).

f. Barometric profile of reconnoisances in Sierra Nevada Mountains, viz.: Georgetown route; Dutch Flat Route; Henness Pass route via Nevada.

Also, a set of Pacific Railroad Reports, and all the maps, profiles, etc., relating thereto — published by United States Government.

Our levels indicate that many of the passes in the Sierra Nevada Mountains will be found, upon actual survey, much higher than they have been represented.

The estimates of business, and revenue of Road, will be deferred to another time in consequence of delay in procuring the statistics of the Washoe trade and business.

In conclusion, I take this opportunity of expressing my obligations to Messrs. Edward Judah, Assistant in charge of Party; John R. Brown, in charge of levels; H. T. Hall, Topographer; for the able and satisfactory manner in which they performed the arduous duties assigned them; also to Wm. S. Watson, Esq., Chief Engineer of California Northern Railroad, for valuable assistance in office; to Dr. D. W. Strong, of Dutch Flat, who accompanied me in my reconnoisance last fall, who was with me during the entire survey, and whose experience in and knowledge of the mountains was of the greatest assistance, and contributed to the success of the survey; also, to S. B. Wyman, Esq., of Virginia; Mr. Neil, of Neilsburgh ; Mr. Applegate, of Empire Mills; Messrs. Egbert and Brickell, of Illinoistown - who were with me on portions of the route; to Chas. Marsh, Esq., of Nevada, who accompanied me on the reconnoissance via Nevada and Henness Pass; also to Messrs. John Shaw, of Mormon Island, D. W. McKinney and Mr. Shankland, of Georgetown — who accompanied me on the Georgetown reconnoissance; also, to Mr. Stout, of Stout's Crossing, Nevada Territory; F. Moore, Esq., of Dutch Flat; and J. P. Robinson, Esq., of Sacramento, for courtesies extended.

Very respectfully,

THEODORE D. JUDAH,

Chief Engineer Central Pacific Railroad of California.

**ENGINEERS OFFICE, CENTRAL PACIFIC R. R. OF CALIFORNIA.**

SACRAMENTO, October 22, 1861.

TO THE PRESIDENT AND DIRECTORS OF THE CENTRAL PACIFIC RAILROAD COMPANY OF CALIFORNIA:

GENTLEMEN:

In accordance with a resolution of your board, passed October 9th, 1861, as follows:

"Resolved, That Mr. T. D. Judah, the Chief Engineer of this Company, proceed to Washington on the steamer of the 11th Oct. inst., as the accredited agent of the Central Pacific Railroad 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."

I beg leave to report my return to California after an absence of about ten months, having fully accomplished the objects of my mission, a detailed and full account of which is herewith appended, marked document "A."

A brief statement of some of the advantages accruing to your Road through its connection with the Pacific Railroad bill, recently passed, seems necessary, in order to realize its advantages, and secure the benefits and public consideration to which it is justly entitled.

The theory of the Pacific Railroad bill recognizes existing Companies at either end of the Road; while the central division, or portion between the States of Kanzas and California, is committed to the supervision of a company created by Act of Congress, deriving its existing powers and authority from the bill itself.

Upon the eastern side, the right to construct the road, from the junction of the Missouri and Kanzas Rivers, through Kanzas, to the 100th meridian of longitude west from Greenwich, with all the grants, donations, etc., for about 350 miles, is given to the Leavenworth, Pawnee, and Western Railroad Company of Kanzas.

The central division, or portion through the Territories of Nebraska, Utah and Nevada, to the eastern boundary of California, a distance of about 1300 miles, is given to the Union Pacific Railroad Company, a Corporation created by Act of Congress; while the construction of the western division, reaching from the eastern boundary of California, to the navigable waters of the Sacramento River, or to the City of San Francisco, is assigned to the Central Pacific Railroad Company of California, to whom are made the grants of lands, bonds, etc., for that purpose.

The aid granted by the United States Government, to your Road, is liberal, and will materially assist in constructing and completing it.

**ENUMERATION OF ADVANTAGES.**

The first important advantage derived by your Road, consists in the grant of the free right of way to a strip of land 400 feet in width across all Government lands.

This is a liberal width, and preludes the possibility of building a parallel road over your route, at any points, without occupying a portion of your lands.

Secondly. The United States Government is obliged to extinguish the Indian title to all lands donated to the Company, either for right of way, or to the land granted on either side of your road.

Thirdly. In order to prevent speculation by individuals, who may enter upon and take up these lands, after the passage of the Railroad bill, and before the Company has time to locate its line with accuracy, it is provided "that within two years after the passage of this act, said Company shall designate the general route of its road, as near as may be, and file a map of the same in the Department of the Interior, whereupon the Secretary of the Interior shall cause the lands within fifteen miles of said designated route, or routes, to be withdrawn from pre-emption, private entry and sale; and when any portion of said route shall be finally located, the Secretary of the Interior shall cause the lands hereinbefore granted, to be surveyed, and set off, as fast as may be necessary, for the purposes herein named."

Before leaving Washington, I made a proper map, showing the general route of our road, in accordance with the provision of the bill, which map, accompanied by a written designation of the route, I filed with the Secretary of the Interior, who assured me that he would give the necessary instruction to have the same withdrawn from market. This has been done. Such lands are now secured to us, and cannot be pre-empted or purchased, until after our final location, and until a survey by the United States authorities of these lands.

The Department of the Interior also expressed a desire to cooperate with our Company in preventing the cutting of timber on these lands. It becomes, therefore, important for your board to decide, if they will take any steps to prevent depredations upon these timbered lands, until a final location is made of the whole, or a part of their road.

Fourth. A grant of United States Bonds, to the amount of about $6,000,000 is made to this Company. These bonds run for 30 years, draw interest at the rate of six per cent, payable semi-annually, by United States Government, who cannot redeem them until their expiration, or, for, say, 30 years, as is the case with their issue of 20 year bonds, which are redeemable, after five years, at the option of the Government.

They are, therefore, the best class of Government bonds in market, and will lead all others of her securities, now issued.

These bonds enure to your Company, as each section of40 miles is completed, west of the western base of the Sierra Nevada mountains, at the rate of $16,000 per mile, — while for 150 miles from such western base easterly, the amount is increased to $48,000 per mile, and the same are paid over as each section of 20 miles is completed

Your road exhibits a remarkably favorable peculiarity in this respect.

While most of the Railroads constructed in the United States, are encumbered with issues of mortgage bonds, on which the yearly interest must be paid, as well as the bond itself at maturity, usually taking, for that purpose, the earnings of the road, which otherwise would be applied to the payment of dividends to stockholders.

Your Road, instead of issuing her own bonds, for the payment of which, and the interest, she would have to provide, receives all the benefits of nearly $50,000 per mile, or an aggregate of $6,000,000, of United States bonds, the interest on which is regularly paid by the Government, until their maturity. It is true that Government contemplates the repayment of this loan at that time, but it is obvious that Government will furnish very nearly business enough to the road, to repay them before the bonds become due. Therefore, instead of appropriating the net earnings of your road yearly, to the payment of interest on bonds, there is no reason why such earnings should not go to the stockholders in the shape of dividends.

This feature, peculiar to your road, is deserving of especial consideration. These bonds will, probably, command a premium in market, and, whenever our present difficulties are settled, will be sought after in preference to all other issues, for foreign investment.

Fifth. The right to extend the road from Sacramento to San Francisco, is given to your company, with all rights, grants, donations, etc., given to that portion of the line, west of the western base of the Sierra Nevada.

Sixth Perhaps the most important feature in the grant, made to this Company, exists in authorization, or right given it to continue on from the easterly line of the State of California eastwardly, and construct the line of Pacific Railroad and Telegraph, until it meets and connects with the line of the Union Pacific Railroad and Telegraph, coming from the east.

This virtually concedes to your Company the right to construct at least one half of the line of the Pacific Railroad, and to receive all the grants, donations, etc., therefor, without absolutely compelling them so to do.

It becomes important, therefore, that a Railroad survey be made from the eastern boundary of the State eastwardly, to, say, Salt Lake, for the purpose of determining the cost of a Railroad line, and to ascertain if sufficient inducement exists for your Company to construct said road. I am positive in the opinion, that it will be found advisable to undertake the construction of about 300 miles next easterly from the State line of California.

**VALUE OF LAND GRANTS.**

The United States Government donates to your Company every section of land (not sold, pre-empted, or otherwise disposed of), for a distance of ten miles upon either side of the road. Mineral lands are excepted from the operation of the Act, but wherever the same contains timber, the timber thereon is granted to the Railroad Company.

The quantity of land, (if it were all available to the Company), would be 6,400 acres per mile, or about 960,000 acres between Sacramento and the eastern boundary of the State. From the western base of the Sierra Nevada to State line, nearly all of these lands are covered with timber, which becomes valuable as soon as a railroad is built, on which it can be transported to market.

It is always difficult to estimate the worth of timber lands, their value being dependent upon their quality, the density of the timber, the demand for, and facilities for conveying it to market.

The Saratoga and Sackett's Harbor Railroad Company, of the State of New York, who have 500,000 acres of timber land in that State, in a report published by them, estimate the avails of its yield as follows:

ESTIMATED TIMBER VALUE OF LANDS BELONGING TO THE SARATOGA AND SACKETTS HARBOR RAILROAD [Table Omitted]

Thus it will be seen that they estimate their spar timber at 1 128/1000 spars per acre, as yielding a net profit to them of $162 per acre or a total of $81,000,000.

The whole net proceeds of the production of their lands, they estimate at $341 per acre, or an aggregate in round numbers of $157,000,000. Their lands they assume to be worth $15 per acre, afterwards, or $7,500,000.

They estimate the freights derived from one acre of timber land and accruing to the Railroad Company, to be $161.17, which on their 500,000 acres amounts to $80,585,000. They also make the statement, based upon the production of a good farm on the Illinois Central Railroad as a guide, that there is more freight on their landed estate now ready for the cars, than can be produced from the original and entire estate of the Illinois Central Railroad Company in more than one half a century.

They also state, that a committee of capitalists, proposing to become interested in this work, personally traversed the route of their Road, and made a report thereon, from which the following extracts were, taken. They say: "The Engineer states, and your Committee confirm his statements, from personal observation, that this Road for more than seventy-five miles, passes directly through a wilderness, as remarkable for its density and extent, as any other in this country.

"The land for ten miles on each side of the road, and for ten miles from the margin of the lakes, is groaning under the weight of an immense amount of most valuable freight, all of which is wanted at tide-water as speedily as it will be in the power of the Road to transport it. There is more freight on the surface now ready for use, than could be grown upon a cultivated country in more than half a century. The weight of lumber, etc., is about seventy tons per acre. The average weight of products of an agricultural country does not much exceed one ton per annum per acre."

Thus are the products of a timber domain estimated, when railroad facilities are afforded with which to carry its products to market.

It is not expected that the timber land belonging to your Company will prove as profitable as that estimated by the New York Company, nor is this estimate here introduced to promulgate such an idea, but for the purpose of illustrating the difference in value between a timber estate without, and one with facilities for conveying the same to market. While this is the case, the fact cannot be controverted that your Company possesses about 500,000 acres of timber land, which will, by the construction of your road through it, become immediately available and largely enhanced in value; and if we allow that 300,000 acres, or one-third of this land, contains only ten trees per acre, from which can be cut six logs twelve feet long per tree, averaging twenty-four inches square, this gives 3,400 feet, b. m., per tree, and the total quantity amounts to ten thousand millions feet of lumber, which delivered at Sacramento at, say $15 per thousand, amounts to one hundred and fifty millions of dollars; or calling this lumber worth, standing, one dollar per thousand, it would be worth $10,000,000 to the Company.

It is well known that the sugar pine of these lands often runs 125 feet high without a limb, and often measures eight feet through at base-while a tree is seldom found measuring less than three and one-half feet at base. Cut but one tree per acre per year, and it gives an annual yield of 1,000 million feet of lumber - three million feet per day, equal to 5,000 tons per day, or, say, 1,750,000 tons per year.

Allowing the 500,000 acres instead, to yield fifty cords of wood per acre (a very low estimate) and it amounts to twenty-five million cords of wood, which, if delivered at Sacramento at $6 per cord, would amount to 150 millions of dollars, and pay the road about 100 millions of dollars freight.

It is well known that the supply of wood is becoming more scanty, and is rising in value yearly.

What then may we estimate the value of this domain in years to come, not only to the Company, as owners, but to the railroad as a source of revenue in its transportation, and to the community, who are obliged to use it.

Wood is now worth $18 per cord in Washoe, and in the winter commands $40 per cord. In fact, the cost of hauling is so great that not a few mills have been compelled to stop work, and are now idle in consequence.

How difficult it is then to realize the immense value of this estate, which belongs to your Company, by absolute grant from the United States Government, and to which you hold as title, which cannot be disputed or disturbed.

**REVENUE.**

In estimating the revenue of your road, it is gratifying to be able to arrive so correctly at its probable business from statistics of actual business, now performed over the same route, exclusively by freight teams and stages.

It may be truly said, that no road was ever constructed or contemplated in the United States, or elsewhere, that promised as large and speedy a return upon investment, as the one proposed to be constructed by you between the city of Sacramento and the Washoe silver mining district.

The extent of the existing trade now performed over this route by teams and stages, can be scarcely realized, except upon careful inquiry and investigation. It is difficult to credit the statement that over five millions of dollars per year is paid out for freight alone to Washoe, but rigid scrutiny and investigation bears out the assertion, which seems to be entirely within bounds - and this trade is increasing and growing every day.

Your road, when completed, from Sacramento to Washoe, will perform—

1st. The local business of Placer, Nevada, Sierra, Plumas, and a portion of that of El Dorado county.

2d. Over its first 25 miles, the northern, business, now performed by stages and steamboats.

3d. The entire freighting and passenger business Washoe, Esmeralda, Carson Valley, Pyramid Lake and Humboldt, and a portion of the Salt Lake business.

It is to be observed that the freighting business to the mountains and to Washoe is now performed entirely by teams; there is no other way of forwarding goods to the interior.

The lowest price paid for freighting to Washoe is four cents per pound, or $80 per ton, and that only when the roads are in good condition.

When the roads are not in good condition, or when there is a large amount of freight offering, this price is increased to six, eight and ten cents per pound.

A peculiarity of Washoe is, that it is situated in a section of country so barren and sterile that nothing but a scanty supply of vegetables can be raised there. Every thing used there to eat or wear, all necessaries of life, as well as all manufactured goods, have to be transported by wagons or mules. The inhabitants, therefore, are absolutely compelled to draw their supplies of all kinds from the western side of the Sierra Nevada Mountains, and in paying for their supplies, to pay the additional cost of freighting by wagons, at from four to ten cents per pound.

This is the business proposed to be performed by your Railroad, when constructed, and it is obvious that it will be entirely commanded by your Road without competition. With a Railroad built to Washoe, this business cannot be performed by any other means, or in any other manner.

In addition to this large and increasing business, may be reckoned that of supplying lumber, timber, and logs for consumption and for timbering the mines; also, fuel for consumption in the cities of Nevada Territory, and to supply the mills, a majority of which are run by steam.

As has been previously observed, wood is worth at the present time $18 per cord, and in the winter will be worth $40 to $50 per cord, and many of the mills are obliged to cease running in consequence.

Your railroad will supply this fuel from the timber on its own lands, and at such a reduction in price as will enable these mills to run through the entire year. It is a fact worthy of observation that the construction of this road will save to the residents of Washoe and Nevada Territory, over $2,500,000 yearly.

In order to obtain accurate information with regard to the business now performed over what is known as the Placerville road to Washoe, I have stationed a trustworthy and reliable agent at Strawberry Valley, (J. R Atkins, Esq.,) who has taken a careful and correct account of the travel passing that point for eight weeks, commencing August 16, 1862, and terminating October 10,1862, or for a period of fifty-six days.

Every team going and returning was counted each day, and Mr. Atkins' returns present a complete statement of the weight and nature of each load, the number of horses, mules or oxen, of stages and stage passengers, buggies and occupants, riders, footmen and loose stock.

It is to be borne in mind that these are the returns on only one road to Washoe; the different roads are enumerated as follows:

Big Tree Road.
Amador Road (new road).
Placerville Road.
Henness Pass Road.

Which comprises the Nevada road, the Marysville, San Juan and Downieville roads, and the Sierra Valley and Beckworth's Pass road.

A compilation of these returns is herewith presented:

ACTUAL COUNT OF TRAVEL ON THE PLACERVILLE WAGON ROAD TO WASHOE AND NEVADA TERRITORY FOR EIGHT WEEKS, ENDING OCTOBER 10, 1862. [Table Omitted]

Allowing 18 days as the average time of a trip, and the number of teams and teamsters employed, amounts to 2,772, and of animals, 14,052.

At the present date, Oct. 22, 1862, the price of freight is seven to eight cents per pound.

Estimating the yearly average of freight over the Placerville road to be 120 tons per day, at an average price of six cents per pound, and the total amount paid for freight alone, amounts to $5,256,000 upon this one road.

A four horse or mule team, which makes the trip in about sixteen days, pays for tolls $22.75; a six horse or mule team pays $30 tolls. Averaging the time at eighteen days, the tolls at $25 per trip, and we find that the enormous sum of $693,000 per year year is paid for tolls by freight teams.

The returns show that the stages average 37 passengers per day, which, at $30 per passenger, amounts to $405,150. It is believed, however, that the total receipts of the stage line exceeds this sum.

It will be observed that 68 additional travelers per day, or nearly double the number carried by stage, pass over this road, at least one half of whom would probably take the cars, were a Railroad completed.

From an entirely reliable source, I have ascertained that the total amount of silver bullion brought down by Wells, Fargo's Express, for the ten months of 1862, is over 150,000 pounds, and may be safely stated at 200,000 pounds for the entire year.

Its value is not, of course, known, gold being mixed with it, but it is safe to estimate it at $30 per pound, or a total value of $6,000,000.

This is only what comes by Express, and does not indicate the amount actually taken out, and retained there, or sent down by private conveyance.

It is estimated by Wells, Fargo & Co., that this amount will be doubled for the year 1863, and in 1866, reach twenty-five millions of dollars.

It would, perhaps, be proper, therefore, to assume that, upon the completion of your road, at a charge of one per cent., an additional revenue of at least $200,000 per year would be derived from this source.

ESTIMATED ANNUAL RECEIPTS OF ROAD IN CALIFORNIA. [Table Omitted]

ESTIMATE OF ANNUAL RECEIPTS FROM WASHOE BUSINESS. [Table Omitted]

Which is equivalent to an annual net profit of 25 per cent, upon a cost of fifteen millions of dollars, or monthly returns of two per cent, per month.

Upon completing the first division of fifty miles, your road will perform, in addition to the local business of Placer, Nevada, Sierra and Plumas counties, and the Marysville and northern business, a greater portion of the present Washoe business over such division of fifty miles.

In addition, therefore, to the estimated receipts from California business, it will be proper to add as follows:

WASHOE BUSINESS ON FIRST FIFTY MILES. [Table Omitted]

Or an annual net profit of twenty-four per cent., or monthly return of two per cent, per month.

That these results appear large is true, but it is no less true that the conditions which produce these results are extraordinary, and unlike those which govern the business conditions of any other Railroad ever built, with one exception, viz: the Panama road.

The charge for transporting a ton of freight over a Railroad 160 miles long in the Atlantic States, would be from four to five dollars — say five dollars.

As has been previously observed, the lowest rates for freight over the line of your road by wagons, are $80 per ton; while the average cost by wagon is over $100 per ton.

A reduction in price to $40 per ton by Railroad, and a saving in time from nine days to one day, would give satisfaction to both merchants and consumers, and secure every pound of Washoe freight over your road. The receipts being at least eight times those of a Railroad in the Atlantic States performing the same business — while the expenses of operating your road will not be in the same proportion.

Statistics of Railroad operations, show the cost of fuel to be a prominent item in the cost of operating Railroads, and this feature is nowhere more clearly shown than in a comparison of the difference in cost of operating the Baltimore and Ohio Railroad, and the New York Central Railroad, to roads of about equal length. The first named road using coal procured from the line of their road at cheap cost, while the latter is compelled to supply itself with fuel at what may be considered a high price.

The cost of fuel upon the line of your road will be simply the cost of cutting it, which can be contracted for to any extent at not over one dollar per cord-and the supply may be considered, for all practicable purposes of your road, as inexhaustible. It is to be remembered, however, that the supply of fuel for operating the Pacific Railroad as far east as Salt Lake, will have to come from the Sierra Nevadas, and in all probability from your lands. It is a source of congratulation, therefore, that you are so liberally provided with that article most needed in the future, and in fact absolutely essential in conducting the future operations of the road with economy.

It has been stated that the cost of operating roads, having heavy grades and high summits, is greater than upon valley roads, and that this argument applies to your road. This is, in a measure, true; but an analysis which resolves the elements of this increased cost, will prove that it is mainly owing to the necessity or employing greater locomotive power with which to overcome these grades and summits, equivalent to the use of more steam, or, in other words, more fuel. Therefore, it may be fairly stated, and can scarcely be denied, that this objection does not apply with its usual force to your road.

**RETURN FREIGHTS OF SILVER ORE.**

Without entering into the details of this subject, it may perhaps be sufficient to say that the business of carrying return freights of low grades of silver ore for foreign shipment at San Francisco can be made a profitable business to the road.

The following extract is taken from the communication of a firm in San Francisco (date of November 4, 1860, or a year ago,) who were conversant with that branch of business, and who were at the time supplied with foreign capital for this very purpose. They say:

"There are now, probably, forty to fifty mining claims being worked, from which not less than two hundred tons of ore are being taken out daily, that would warrant shipment at a low rate. There are four first class mines, viz: the Ophir, Mexican, Central, and Gould and Curry, that alone are capable of turning out that quantity of ore, of sufficient value to warrant transportation by Railroad to this place for shipment.

It is only necessary to furnish facilities for cheap transportation, to insure the opening and working of hundreds of rich claims, capable of turning out an almost incredible quantity of ore, every ton of which would meet with ready sale on its delivery at either terminus of the road. It is a safe calculation to estimate that five hundred tons of ore daily, would be sent over such a road, at a rate of freight not exceeding say $25 per ton. In fact, the only limit to the quantity would, perhaps, be the inability of the road to do the business offered.

There are, at the present time, a number of agencies of eastern and foreign capital, armed with authority and means to purchase, at remunerative prices to the producer, ores of any grade, from $100 per ton and upward; but, owing to the limited quantity arriving, have not been able to purchase a fraction of the orders in hand. It is difficult to say what would be the limit to the amount of capital seeking investment in this channel. It is safe to say that five thousand tons of ore could be sold for cash, at this moment, if it could be had.

In regard to the benefit to the State and cities of California, that would arise from the enterprise proposed by you, it is almost impossible to calculate its extent. That it would make it the richest and most prosperous State in the Union, there is not a doubt. This new resource of wealth is unbounded, and the only obstacle to its realization, is that which your project will most certainly remove."

The capacity of your road for the performance of a business of this kind, may be estimated by a comparison with that of similar roads.

The Mine Hill and Schuylkill Haven Railroad of Pennsylvania, possesses grades of two hundred and fifty feet per mile. The tonnage of coal over this road, which (it is to be borne in mind) is one way, was as follows:

For 1855 1,534,876
For 1856 1,614,887
For 1857 ..1,564,119
For 1858 1,452,083
Or an average of about five hundred tons per day.

**DESCENDING GRADES FOR RETURN FREIGHT.**

It will be remembered upon your road the up grades are principally ascending eastwardly, while the return loads are carried mostly on down grades. Its capacity, then, for return business, is not to be judged by the character of its ascending grades.

Trusting that the above report may serve to explain the permanent features of this enterprise, and soliciting your indulgence towards any imperfections or omissions it may contain, arising from want of time and unavoidable interruptions,

I am, very respectfully,

THEODORE D. JUDAH; Chief Engineer C. P. R. R. Co. of California