REPORT

OF THE

CHIEF ENGINEER

UPON

RECENT SURVEYS,

PROGRESS OF CONSTRUCTION,

AND AN

APPROXIMATE ESTIMATE

OF

RECEIPTS

OF THE

Central Pacific Railroad

OF CALIFORNIA,

OCTOBER 8th, 1864.

ENGINEER'S OFFICE, C. P. R. R. OF CAL.,
SACRAMENTO, OCTOBER 8th, 1864.

To the President and Directors of the
Central Pacific Railroad Company of California:

GENTLEMEN—I present herewith a report upon the progress of the surveys, work of construction, and equipment of your Road to the present date; and also an estimate of the business and Revenue of the Road when completed to Stout's Crossing of Truckee River—a distance of one hundred and fifty-five miles from Sacramento.

As the Report of your Chief Engineer, the late T. D. Judah, Esq., made in July, 1863, contained a detailed description of the several lines surveyed up to that time, I have deemed it unnecessary to embody a similar description in this Report.

I append, however, a few notes of the general topographical features of the country over which the line passes, and also notes of such surveys as have been made since the date referred to.

The practicability of a railroad route across the Sierras, was for many years a question of serious doubt, even among the warmest advocates of a Pacific Railroad; and previous to the surveys made by Mr. Judah, in 1861, under the auspices of your Company, but little reliable information on the subject had been placed before the public.

The result of this survey was the development of a feasible line for a railroad, with maximum grades of one hundred and five (105) feet per mile.

Before commencing the survey, careful and extended examinations were made of five of the most prominent routes across the mountains, distances measured, and the altitudes of the different "Passes" ascertained by barometrical observations. The conclusions based upon these examinations were fully confirmed by the subsequent instrumental survey, made, as before stated, in 1861.

Before the final adoption of this route for the location of your road, still further explorations and examinations were made, but without satisfactory results, save the evidence afforded that the route selected for the experimental survey was beyond question the best, if not indeed the only practicable route for a rail-

road across the mountains; and it is gratifying to be able to state, that as far as the location survey has been extended, its entire practicability has been fully proven.

The Pass selected is believed to be the lowest of any across the Sierras, which are attainable by a practicable railroad line. In fact, I think that upon no other route (with perhaps one exception,) has a continuous line of levels been carried from tide water to the Summit, and I am not aware of the result of that survey having been placed before the public.

The route selected for your Road is the most direct in its general course of any proposed across the mountains—the distance from the city of Sacramento to the foot of the maximum grade upon the Eastern Slope being but 118 miles, which is much less than a corresponding point can be reached by any other route.

A careful examination of the map of Central California, will convince any one of the many important advantages of location which your Road possesses. Following one of the main spurs of the Sierras, which forms the Divide between the waters of Bear river and the Yubas on the north, and the American river on the south, the crossing of the deep cañons formed by those streams is entirely avoided, and you are enabled to make the ascent of the Western Slope of the mountains, attaining an altitude of 7,000 feet *without any loss of grade*, beyond the first eighteen miles.

Another important feature of your route is, that the *Second Summit* of the Sierras is avoided. As can be seen by reference to the map, that portion of the Sierras lying between latitude 38° 30′ and 41° north, consists of two parallel ranges of nearly equal altitude, enclosing an immense basin from ten to thirty miles in width. Lake Tahoe, which is the great reservoir for the waters of the upper or southern end of this basin, finds its outlet through the Truckee river, to which Mr. Judah, in his Report of 1862, refers as follows:

"Running at first northeasterly about eight miles, thence northerly about ten, and thence northeasterly 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, sometimes called the 'Truckee Pass,' where our line crosses the first Summit of the Sierra

Nevada, the altitude of the line is about 1,200 feet above the Truckee river.

"Donner Lake lies immediately beneath at a depth of 1,100 feet. Two long ranges or spurs enclose the lake and its valley, declining in hight 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 a 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 a uniform descent of not over forty feet per mile, to the Humboldt Desert, which forms the Sink of the Humboldt and Carson rivers.

"*Thus the Second Summit of the Sierras, and the crossing of the Washoe mountains, are entirely avoided*, and from the western base to the Summit of the Sierra Nevada, the grade is uniformly ascending or level (there being no descending grade going eastward); while from the Summit to the Big Bend of Truckee, or Humboldt Desert, a continuous descending grade is maintained."

These important advantages of location will not be underrated by those who are conversant with the difficulties attending the construction and working of mountain roads.

By avoiding the Second Summit of the Sierras and Washoe mountains, you are not only enabled to save the grades required to overcome those ranges, but also encounter a much narrower snow-belt—the eastern limit of deep snow upon this line being the Truckee river, at a distance of but twelve miles from the Summit.

GRADIENTS.

The objection which has been so often urged against the successful operation of a railroad across the Sierras, viz: the heavy gradients to be overcome, has been so fully answered in the previous reports of your Chief Engineer, that it is unnecessary to discuss the matter at length here.

With the practical examples furnished by the Baltimore and Ohio, the Virginia Central, and other important roads in the Eastern States and Europe which might be cited, the question of the successful working of a railroad with gradients of 105 feet per mile, is neither doubtful or problematical. Upon that portion of your Road which is already completed, there occur four and one-half consecutive miles of maximum grade of 105 feet per mile, over which for more than four months, six trains have passed daily without accident or detention—the passenger trains

making a speed fully equal to the average speed of express trains on Eastern roads. The operating of a road of this character is of course more expensive than where lighter gradients can be obtained.

Besides requiring a superior class of machinery, an additional item of expense will be found in the increased consumption of fuel; yet the abundant supply of this article in the immediate vicinity of your Road, and the low price at which the same can be delivered, viz: from $2 50 to $3 00 per cord, renders this a less important item than would otherwise appear.

The maximum grade, which according to the Act of Congress, passed July 1st, 1862, you are allowed to use in the construction of your road, is one hundred and sixteen (116) feet per mile; the adopted maximum is, however, one hundred and five (105) feet, and at no point will it be necessary to exceed this grade. The location of the only portion of the line upon which the preliminary surveys indicated the necessity of using a higher grade than 105 feet, has already been accomplished with a grade of less than eighty feet per mile, and as *the levels have been carefully tested from tide water to the Summit*, the practicability of constructing your road upon the adopted maximum, is fully demonstrated.

A table of grades from Sacramento to the end of the located line, is appended, by which it will be seen that the location thus far has been made with a less distance of maximum grade than was contemplated by the original survey.

ALIGNMENT.

Although by the Act of Congress already referred to, you are allowed to use the maximum curves used on the Baltimore and Ohio Railroad, the adopted maximum is 10°, or a radius of 573 feet. But two curves of this radius, (with the exception of the curves used on temporary tracks in the City of Sacramento,) occur on the first division, and at those points the grade is comparatively light. It has been necessary in but few instances to introduce maximum curves upon maximum grades, and the alignment will be found to be more favorable than was originally anticipated.

By reference to the appended tabular statement of the alignment, it will be seen that more than sixty per cent. of the first division is *tangent* or straight line, while of the eight succeeding miles, in the very "heart of the mountains," more than twenty per cent. is *tangent* line.

This will, I think, bear a favorable comparison with the alignment of other roads constructed through mountainous regions.

FIRST DIVISION OF FIFTY MILES.

For a general description of the located line of this division I would respectfully refer you to the report of your Chief Engineer, made July, 1863.

No changes were made in the line between Sacramento and Newcastle, but from the thirty-first to the forty-eighth section almost an entire relocation has been made, resulting in a material reduction in the cost of the work, and several important improvements in the alignment on Sections 35 and 43; the changes being made (with the exception of a single instance) without any increase of grade.

The most important changes were upon the line through Dutch Ravine (Sections 32—3—4—5), from Lime Point to the head of Rock Creek (Sections 38 to 40, inclusive), through Clipper Ravine to Wild Cat (Sections 44 and 45), and at Baney's Ranch, by which the contemplated tunnel at that point is avoided, reducing the cost of a single section (47) more than $70,000.

By the present location no tunneling will be required on the first division.

WORK OF CONSTRUCTION.

As no portion of your Road was fully completed at the date of the last report of your Chief Engineer, it may not be inappropriate to refer here to the progress and manner of construction of the first division.

That portion of your Road lying between the foot of K street, in the City of Sacramento, and the California Central Railroad, comprising Sections 1 to 18, inclusive, was placed under contract to Charles Crocker & Co., December 27, 1862, but active operations were not commenced until the month of February following, from which time the work steadily and rapidly progressed, and on the 29th day of February, 1864, their contract was fully completed, and the road ready for business from Sacramento to the junction with the California Central Railroad.

The second subdivision of the first division, comprising Sections 19 to 31, inclusive, was let in July, 1863, as follows:

Sections 19 and 20 to Cyrus Collins & Bro.; Sections 21, 22, 23 and 24 to Messrs. Turton, Knox & Ryan; Sections 25, 26 and 27 to Charles D. Bates & Co.; Sections 28 and 29 to S. D. Smith; and Sections 30 and 31 to Charles Crocker. The work on this portion of the line was fully completed, the track laid and the Road opened to Newcastle on the 6th day of June last.

The Road has been constructed in the most permanent and

durable manner, and the general character of the work will compare favorably with first-class railroad work in the Eastern States.

The bridge across the American river is the largest and most substantial structure of the kind in the State, comprising two spans of Howe's truss, of 192 feet each in the clear, with approaches of trestling, resting on pile foundations, of 2,400 feet in length on the south, and 600 feet on the north side of the river, making a total length of bridging of 3,400 feet.

The foundations of the piers are of piles, which are tenoned and capped with timbers twelve inches square, upon which are laid longitudinal timbers of the same dimensions as the caps, one foot apart and secured by bolts.

On these timbers a solid flooring of ten by twelve inches is laid, projecting one foot beyond the footing course of the intended masonry.

One hundred and twenty-three piles, from 25 to 35 feet in length, were used in the foundation of each pier.

As a security against the action of floods, several hundred yards of cobbles were placed around the foundations of each pier, filling the space between and around the piles, inside the coffer dam, up to low water mark. In addition to this, about sixty car loads of granite have recently been placed around the piers, in such a manner as is believed will render them perfectly secure from all action of high water.

The trestling at Arcade creek, is 200 feet in length, and similar in plan to that at the American river.

THE BRIDGE AT DRY CREEK

Consists of four spans of Burr's truss, of 54½ feet each, resting on stone piers, and connected with the embankment at each end by shore bents of trestling.

THE ANTELOPE CREEK BRIDGE

Consists of one span of Burr's truss, resting upon substantial granite piers.

The above are all the wooden structures that occur upon the first thirty-one miles of your road, and for full details respecting them, reference is made to the above mentioned Report of your Chief Engineer for 1863.

THE CULVERTS

On Sections 1 to 18, inclusive, thirty-six in number, are built in a thorough and substantial manner, of hard-burned brick, laid in

hydraulic cement, with parapet walls, coped with granite six inches in thickness, securely fastened to the walls with iron anchors.

On Sections 19 to 31 inclusive, the culverts are built exclusively of granite, with paving of the same material.

THE TIES

Furnished by the contractors are of the best quality of *Coast* or *black* redwood, and there are now delivered, in addition to those already used, a sufficient number to lay twenty-two miles of track.

THE TRACK

Has been laid in a thorough and workmanlike manner, and is ballasted with such material as could be obtained in the vicinity of the Road. The material composing the road bed on Sections 19 to 31, forms of itself an excellent ballast, being for the most part a decomposed granite, which, while forming an excellent support for the superstructure, is sufficiently porous to prevent the collection of water on the road bed.

Portions of the track, especially through the cement and clay cuts on the plains, will probably require a better quality of ballast than has yet been provided. Excellent material for this purpose can be obtained near the confluence of Secret and Miner's ravines, and within one-half mile of the road.

The cost of grading a track to the point named will be but trifling, and I would recommend its construction at an early day.

Good ballasting is found at various points on the line, and besides the inexhaustible quantities of decomposed granite already alluded to, extensive deposits of gravel, and various kinds of disintegrated rock are met with at convenient intervals, so that an adequate supply of ballasting can always be obtained.

BUILDINGS.

Commodious freight and passenger depots have been erected at Sacramento and Newcastle, and at the former place an Engine house, with stalls for five engines has also been built.

Turn-tables have been built at both named places, and a Y track constructed at the Junction. Suitable watering places have also been provided at Sacramento, Junction and Pino.

A Fairbank's track scale of a capacity of sixty tons, has been landed from the ship, and will soon be erected at the Junction.

A TELEGRAPH LINE

Has also been constructed along the line of your Road, from Sacramento to Newcastle, and offices established at both named places.

It may not be improper to state in this connection, that the Commissioners appointed by the President of the United States in accordance with the provisions of Section 4, of the Pacific Railroad Act, have made a careful and thorough examination of your Road and the Telegraph Line connected therewith, and their favorable report has already been transmitted to the proper authorities at Washington.

ROLLING STOCK.

There have been purchased for use upon the first division, and are now in daily use upon the Road, 5 Locomotives; 6 First-Class Passenger cars; 2 Baggage cars; 25 Box Freight cars; and 25 Platform cars.

In addition to which there have been received one heavy Freight Locomotive, and 20 Freight cars not yet put together.

There have been purchased and shipped—4 First-Class Passenger cars; 2 Mail and Express cars; 24 Freight cars; 20 Dump (or Gravel) cars.

Two more heavy Freight Locomotives have been contracted for with Messrs. Danforth, Cook & Co., of Patterson, N. J., and are now in course of construction. Extra axles, car wheels, locomotive tires, etc., have been purchased and shipped.

The following table shows the size, weight, etc., of the engines now in use upon the road:

NAMES OF ENGINES.	Wg't of Engines, Tender with wood and water—Tons.	No. of Drivers.	Diam. of Drivers—feet.	Diam. of Cylinders—Inches.	Length of Stroke.	NAMES OF BUILDERS.	REMARKS.
Gov. Stanford.	46	4	4½	15	22	Norris & Son.....	
Pacific.....	47½	4	5	16	24	Wm. Mason & Co.....	
Atlantic.....	47	4	5	15	22	Wm. Mason & Co.....	
John Conness..	50	6	4	17	25	Wm. Mason & Co.....	Just received.
T. D. Judah.....	18	2	4½	11	15	Danforth, Cook & Co...	Tank Engine.
C.P.Huntington	18	2	4½	11	15	Danforth, Cook & Co...	Tank Engine.
———	—	6	4	—	—	Danforth, Cook & Co...	Now being
———	—	6	4	—	—	Danforth, Cook & Co...	constructed.

The rolling stock is all of the best class used on eastern roads. The locomotives, with one exception, were built to order, and have thus far given perfect satisfaction. Those now under construction are designed particularly for service on heavy grades.

CONSTRUCTION OF THIRD SUB-DIVISION.

The work of grading above Newcastle was commenced in April last, and has been steadily progressing since that time.

The cut through Bloomer Divide, which is the heaviest cut on the First Division, being 63 feet in depth, and 800 feet in length, through a hard indurated gravel, is now fully completed, and the grading on other portions of the line is in a favorable state of progress.

The culverts are built of the very best quality of granite, which is found in great abundance in convenient proximity to the work.

All of the unfinished work between Newcastle and Clipper Gap, a distance of twelve miles, is of such a character as to admit of its rapid prosecution, and the work upon this portion of the line can easily be completed within four months.

TRESTLING.

As much of the heavy work on your Road (as has been noticed in former reports), occurs in crossing the depressions or gaps in the Divide along which the line runs, it has been deemed expedient in some instances to substitute trestling for embankments.

Trestling, properly constructed of Puget Sound pine and redwood, will last from eight to ten years, and can then be replaced with embankments, by transporting the material on the cars, at much less than the present cost.

At Newcastle Gap, Lovell's Gap, and at two points near Clipper Gap, trestling has been designed, and timber for the structure at the former place, is now arriving.

SECOND DIVISION.

The work of location on this Division was commenced in July, 1863, but owing to the extremely rugged character of the country, the progress of the survey was necessarily slow, and but about eighteen and a half miles of permanent location were made. New experimental lines were run some eight miles further, and the preliminary location had been commenced, when owing to the lateness of the season, the party was withdrawn from the field.

The greatest difficulty encountered in the work of location, is that of maintaining a continuous ascending grade, which, were it possible to accomplish, the maximum grade from the foot hills to the Summit of the Sierras, could be reduced below 80 feet per mile; but as the frequent depressions or gaps in the Divide, along which the line passes, render a continuous grade impracticable,

they necessarily become commanding points in the problem of location.

Thus, in order to pass the Illinoistown and Long Ravine Gaps, we are compelled to maintain, for nearly eight miles, a very light average, and in many places a level grade, making in that distance an altitude of but 115 feet, while immediately following is a section of three and a half miles of maximum grade.

From the commencement of the second division, the line passes along near, and frequently upon, the summit of the Divide, about two miles, to the Lower Illinoistown Gap; thence along the American River slope for about one-half mile, when it recrosses the Divide through Bear River Gap, (where a tunnel 500 feet in length will be required,) and thence follows the Bear River slope of the Divide three and a half miles to Long Ravine. Some heavy work occurs on this portion of the line, but with the exception of the tunnel referred to, will not exceed the average of the work on the last five miles of the first division. The succeeding nine miles from Long Ravine to Gold Run, comprises some of the most formidable work encountered upon the Western slope of the mountains. Crossing Long Ravine at a hight of one hundred and fifteen feet, the line curves sharply to the right, and passes with a maximum grade along the steep, and in many places precipitous side hill of Rice's Ravine, crossing a sucession of short, steep side ravines and gulches, and intervening spurs, to Cape Horn; which is a precipitous, rocky bluff, about twelve hundred feet in hight above the American river.

The construction of the Road around this point will involve much heavy work, though the material encountered is not of a very formidable character, being a soft friable slate, which yields readily to the pick or bar.

The dip of the ledge is about seventy-five degrees, or nearly perpendicular; but as our line at this point crosses the line of stratification nearly at right angles, the cuttings will admit of a much steeper slope than can be generally adopted for that class of material.

The road around this bluff will necessarily be mostly in excavation, as the construction of an embankment, even with a heavy retaining wall, would in many places be unsafe if not impracticable. Passing around the face of this bluff, with an aggregate curvature, in one direction, of one hundred and eighty-six degrees, the line enters Robbers' Ravine, the western slope of which it follows for about one and a half miles to Oak Summit, at the point where the old pack trail crosses the same.

Passing thence via Trail Summit, and along the side-hill above the North Fork of the American river, encountering a number of abrupt, deep ravines (some of which it will probably be ne-

cessary to cross temporarily on trestling), the line enters Secret Ravine, which it follows for about three-fourths of a mile, and thence follows a tributary of the same to its source, near the Illinoistown and Dutch Flat stage road, about one and a half miles east of Madden's toll house. Thence the line runs near the stage road to Secret-town Gap, which it crosses at the hight of fifty-five feet. The crest of the ridge, or divide (between the American and Bear rivers), is here so narrow as to barely admit of the construction of trestle work, and the sinuous course of the line precludes the possibility of using any other kind of wooden structure.

Trestling, strongly and substantially built of the best mountain timber, red fir, sugar pine, or tamarack, can safely be depended upon for five or six years, and in the meantime, with the facilities for transportation of material which your road will afford, such structures can be replaced either with embankments or stone viaducts, as may be deemed most advisable.

From Secret-town Gap to Gold Run, a distance of two and a half miles, the line passes around the northern or Bear river slope of Cold Spring mountain, encountering a succession of deep, abrupt ravines, where some of the heaviest work on this division occurs.

One tunnel of about three hundred feet in length will be required on this portion of the line.

At Gold Run the line attains and thence follows the summit of the divide, which presents a very uniform surface for nearly two miles, and the work will be comparatively light.

Leaving the summit of the ridge near Bradley's reservoir, the line bears to the left, and, following the Bear river slope of the hill, passes one half mile south of, and three hundred feet above, the town of Dutch Flat, to Toll's Mills, a distance of 67 miles from Sacramento, at which point the location survey was suspended. As before stated, the experimental and preliminary location surveys were extended several miles further, and I would suggest the propriety of resuming the surveys at an early day, as the labor required to prepare this division for the contractors will necessarily occupy several months.

As the line beyond this point cannot deviate materially from the line of Mr. Judah's preliminary survey, I would refer you for a general description of the same to his report, made October, 1862, pages 18 to 22.

The location surveys so far made have demonstrated the accuracy of the preliminary survey made by Mr. Judah, and from my own knowledge of the country east of the point to which the location has been completed, I am satisfied that there will not be any material deviation from the line established by him.

The peculiar location of your Road, passing as it necessarily does near the Summit of the Divide, and consequently crossing

the ravines and cañons near their sources, precludes the necessity for large and expensive culverts, or other structures for the passage of water, but few places occurring where more than forty or fifty feet area of water-way will be required.

It will, however, probably be found advisable, as before suggested, to adopt, as a matter of expediency, trestle or other bridging, for many of the deeper ravines or gulches.

Rock for culverts, foundations, etc., can be obtained within a reasonable distance, and frequently in the immediate vicinity of the work, and timber suitable for bridging, etc., is everywhere abundant.

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

GRADES.

The following table shows the distance (in miles) of the different grades used upon the First Division, and eighteen miles of the Second Division:

TABLE OF GRADES.

ON LOCATED LINE OF CENTRAL PACIFIC RAILROAD OF CALIFORNIA, FROM SACRAMENTO.

FIRST DIVISION.		FIRST DIVISION.		SECOND DIVISION.	
GR. PR. MILE.	NO. OF MIL'S.	GR. PR. MILE.	NO. OF MIL'S.	GR. PR. MILE.	NO. OF MILES
Level.....	9.33	42 ft.	.52	Level.....	4.32
3 ft.	3.32	45	.38	5 ft.	.95
5	.38	47	.38	13	.70
11	1.32	53	2.55	19	.21
13	.57	58	1.40	26	.26
14	.57	61	.32	40	.38
16	1.48	63	.57	42	.19
21	4.78	74	.19	61	.07
26	3.28	75	.24	65	.40
28	.51	79	1.34	66	.23
30	.21	82	.38	79	.57
32	.57	90	1.16	95	.38
37	.76	97	.31	100	.38
40	.19	105	12.99	105	9.33
			50.00		18.37

TABLE OF ALIGNMENT,

SHOWING THE AGGREGATE LENGTH OF TANGENTS AND CURVES OF DIFFERENT RADII IN LOCATED LINES OF C. P. R. R. FROM SACRAMENTO TO STATION 3,610.

FIRST DIVISION.		FIRST DIVISION.		SECOND DIVISION.	
RADII IN FEET.	DISTANCE IN MILES.	RADII IN FEET.	DISTANCE IN MILES.	RADII IN FEET.	DISTANCE IN MILES.
15,000	.10	1,042	.09	5.730	.23
5,730	.62	955	4.75	2,865	.32
3,820	.44	882	.54	1,910	.21
2,865	1.39	819	.48	1,433	.85
2,292	.55	800	.17	1,146	1.67
1,910	.55	764	.14	955	1.98
1,637	.46	717	4.25	819	1.74
1,482	.08	714	.03	717	2.19
1,433	2.79	637	.36	637	1.94
1,338	.04	573	.21	573	2.19
1,146	1.28	Tangent.....	30.68	Tangent.....	5.05
			50.00		18.37.

REVENUE.

In estimating the probable business of your Road, when completed across the mountains, the calculations are based upon actual statistics of the freight and passenger business between this city and Nevada Territory, during the last three years. Though during the present season there has been a marked depression of business in that direction, as compared with the two preceding ones, it is not considered that any apprehensions of a permanent decrease of the former business with that region need be entertained. On the contrary, those best acquainted with the resources of Nevada Territory, and the Great Basin towards Salt Lake, are confident in the opinion that another season will witness an animated revival of business in that direction, and that within two, or three years at the farthest, it will largely exceed the business of 1863.

The extent and character of the resources of the Territory occupying the Eastern slope of the Sierra Nevada and the Great Basin, are too well known to require an extended notice here. The evidence afforded by the daily shipments of bullion, is sufficient to convince the most skeptical of the richness and permanent value of the mineral deposits of that region.

Hardly second in importance to the famous Washoe district, are the Esmeralda, Silver Mountain, Humboldt and Reese River

districts, many portions of which are already yielding rich returns for the capital and labor expended in the development of their mines.

As the Eastern slope of the Sierras is but sparsely timbered, and together with the Great Basin is almost wholly unsuitable for agricultural purposes, it is evident that the principal supplies of lumber and fuel, as well as general merchandise and breadstuffs, must be furnished by California. As illustrative of the immense consumption of lumber and fuel in the mining districts, the following extract from the Report of John F. Kidder, Esq., Chief Engineer of the Virginia and Truckee River Railroad Company, made in April, 1863, furnishes some valuable information.

Stating that the average price of fuel in Virginia City, is "$15 per cord," he says, "At Virginia, Gold Hill and Silver City, there are at present two thousand houses, consuming daily forty cords of wood; forty-six steam quartz mills consuming daily two hundred and thirty cords; and nine hoisting engines with a daily consumption of twenty-seven cords, making an aggregate consumption of two hundred and ninety-seven cords.

There are daily used for mining and building purposes, one hundred and twenty-five thousand feet, BM., of lumber and square timber, the cost of transporting which costs twenty dollars per thousand, making an annual consumption of *one hundred and eight thousand cords* of wood, and *forty million feet of lumber*," which is more than three times the amount estimated by Mr. Judah, in his report of 1862, as a legitimate item of Washoe freight. Upon the above estimate of Mr. Kidder, the *Territorial Enterprise* makes the following remarks:

"In the report of Mr. Kidder, the Engineer of the Washoe Valley and Virginia City Railroad, that gentleman makes an estimate, which is altogether too low, of the consumption of firewood in this city, Gold Hill and Silver City, but which foots up one hundred and eight thousand cords. We think the quantity approaches much nearer two hundred thousand cords.

"Now where can this enormous quantity of firewood be obtained in a year or two from this time? At its present value here, which at a very low figure may be set down at $16 to $20 per cord, it makes a sum approaching $350,000 for firewood actually paid out in cash, by but three towns, in a Territory but three years old. There is no denying the proposition that we will have to look beyond the limits of this Territory before many years shall have elapsed for fuel with which to keep in motion the countless number of mills that will eventually be in operation within our border.

"The importance of where our fuel is to come from cannot be overrated."

That this vast trade must be supplied from the inexhaustible forests of California, and pass over your Road, is too evident to require any argument for its demonstration. The road upon which Mr. Kidder reports, is designed to connect with your Road at the most eligible point on the Truckee, and will form a most important auxiliary to the business accruing thereto.

THROUGH FREIGHT FROM CALIFORNIA.

The statement made by Mr. Judah, in his report for 1862, of the amount paid for freight over one route alone, to Nevada Territory, viz: $5,256,000, was received with incredulity by many who were unacquainted with the immense demands of the Washoe trade.

Yet reliable statistics show that the freight paid on shipments from California, across the mountains in the year 1863, amounted to fully two and a half times that sum, or $13,000,000; which is twice the amount paid for freight received at San Francisco from domestic and foreign ports during the same year.

Estimating the average price of freight from California to Nevada, during the year (1863), at five cents per pound, we have 130,000 tons of freight transported by teams across the mountains, in one year, exclusive of westward bound freight, such as minerals, lumber, etc.

Full statistics of the business of 1864, to date, have not been obtained, but from the data at hand, it is fair to assume that freights for the years 1862–3 and 4, will average 72,500 tons.

It is also safe to assume that within three years this average will be more than doubled, which amount, it will be seen, will but slightly exceed the business of 1863, and that your road will, when completed, command fully four-fifths of the Nevada freight and travel, as competition by teams and stages will be entirely out of the question.

This gives as a perfectly safe basis for an estimate, 116,000 tons of freight per annum.

PASSENGERS.

The following extracts from published statistics are given to show the data upon which the estimates of revenue from this source are based:

"During the months of August, September, and October, 1862, the average number of passengers over one route across the mountains was—

Stage passengers	37
In carriages and on foot	68
Total per diem	105

"In the months of February, March, and April, 1863, the number of persons who crossed the mountains on one route, is estimated as follows:

Footmen	6,607
Horsemen	833
Stage passengers	3,154
Total	10,594

Or an average amount of 119 per diem.

"For the six months ending January 1, 1864, the stages on one route alone carried 10,500 through passengers," or an average of 58 per day.

Allowing one-half this number for other routes, and we have 87 through passengers per day. Add for those traveling by private conveyances, 87, and we have a total of 174 passengers per day This is believed to be a low estimate, and not exceeding the average for the last three years.

It is a well established fact that travel is everywhere proportionate to the facilities afforded for its accommodation, and were a railroad completed across the mountains to-day, the travel between California and Nevada Territory would (with the present amount of business) be increased at least fifty per cent. It is, then, safe to assume that with the prospective increase of business, there will, at the end of three years, be fully double the present amount of travel, or 350 passengers per day.

Allowing one-fourth of this number to go by other routes, there still remains an average of 263 passengers per day, or a total of 95,995 per annum.

ESTIMATED ANNUAL RECEIPTS IN GOLD COIN FROM PASSENGERS IN CALIFORNIA.

Junction and other way passengers per day, both ways	40
Auburn passengers—including those from the lower portion of Nevada county, per day, both ways	25
Illinoistown passengers, including those from Nevada Grass Valley and Sierra county, per day	40
Dutch Flat, including upper portion of Placer and Nevada counties, per day	30

SUMMARY.

14,600	Junction and way passengers	average	$1 50...	$21,900 00
9,125	Auburn	"	3 50...	31,937 50
14,600	Illinoistown	"	5 50...	80,300 00
10,950	Dutch Flat	"	6 75...	73,912 50
	Total, in gold coin			$208,050 00

ESTIMATED ANNUAL RECEIPTS FOR FREIGHT IN CALIFORNIA—IN GOLD COIN.

10,000	Tons	Auburn and way average	$4 00...	$40,000 00
27,000	"	Ill'town {including Nevada, Grass Valley, Sierra Co., Iowa Hill, Forest Hill, etc., etc.,}	$8.....	216,000 00
10,000	"	Dutch Flat and vicinity.....	10 00..	100,000 00
20,000	"	Return freight, including stone.....	1 50...	30,000 00
20,000	Cords	wood.....	2 50...	50,000 00
10,000,000	Feet	B.M. lumber	6 00...	60,000 00
		Total receipts for freight.....		$496,000 00
		Add passengers.....		208,050 00
		Total annual receipts from Cal. business		$704,050 00

ESTIMATED ANNUAL RECEIPTS FROM THROUGH BUSINESS TO AND FROM NEVADA TERRITORY.

116,000 Tons	merchandise.....	$22 50...	$2,610,000 00
100,000 Cords	of wood.....	5 00...	500,000 00
30,000,000 Feet	B. M. lumber.....	10 00...	300,000 00
16,000 Tons	return freight.....	10 00...	160,000 00
96,000	Passengers both ways.....	12 00...	1,152,000 00
	Express and mails.....		30,000 00
	Total.....		$4,752,000 00
	Add for business in California.....		704,050 00
	Total annual receipts in gold coin.....		$5,456,050 00
	Deduct for expenses for operating, etc.....		1,636,800 00
	Leaves net revenue of.....		$3,819,250 00
	Or 25 per cent per annum on a capital of.....		$15,200,000 00

ESTIMATED RECEIPTS TO DUTCH FLAT.

Your road will, when completed to Dutch Flat, command all the local business of Placer, Nevada, Sierra, and a portion of El Dorado counties, as well as the greater portion of the Nevada freight and passenger business, which is estimated as follows:

Annual receipts from passenger business in California (see foregoing estimate)	$208,050 00
Annual receipts from freight in California (see foregoing estimate)	496,000 00
77,500 tons Nevada freight, $10	775,000 00
48,000 Nevada passengers (both ways), $6 75	324,000 00
Express and mails	20,000 00
Total annual receipts in gold coin	$1,823,050 00
Deduct expenses of operating, etc	546,000 00
Leaves net revenue per annum	$1,277,050 00
Or 25 per cent. upon a capital of	$5,100,000 00

LOCAL RESOURCES OF PLACER AND ADJOINING COUNTIES.

The development of the mineral resources of Placer and the adjoining counties, which embrace the richest mining district of the State, will add largely to the local business of your Road.

Besides the placer diggings of the foothills, and the heavier gravel deposits through the central and upper portions of the counties referred to, which have heretofore occupied almost exclusively the attention of the gold miner, the large and valuable veins of quartz which traverse the whole western slope of the mountains, are being prospected and worked with success. Recent discoveries of quartz of unusual richness have been made in the vicinity of Illinoistown, and also on Diamond Creek, Nevada county, within five miles of Bear Valley. Mills have been erected and extensive preparations made for the reduction of the rock. The development of the vein at the latter places indicates that it will prove one of the richest yet discovered in that county. At numerous other points in the vicinity of the line, important and promising veins of quartz have been discovered, and with the fine water privileges in the vicinity of these ledges, it only needs capital and enterprise to develop a source of immense wealth to the country. The opening of your road is already calling public attention to these facts.

At Gold Run, and Dutch Flat, the railroad line crosses the rich vein of auriferous gravel which stretches from Quincy and Pilot Peak on the north, through Downieville, Forest City, Moore's Flat, Alpha, Dutch Flat, Iowa Hill, Forest Hill, Georgetown, and so on to the southern mines, and in which the richest deposits of gold are found. At those places, and at Red Dog, Waloupa, Little York, You Bet, Yankee Jim's, Michigan Bluffs, and other important mining towns in the vicinity of the railroad, the

mines are worked by the hydraulic process, and are yielding rich returns.

Copper ore is also found in the immediate vicinity of Auburn, and between that place and Grass Valley. Some of these mines afford evidence of great richness, and will undoubtedly, in time, be a source of revenue to the Road.

Soapstone of an excellent quality, and in inexhaustible quantities, is also found near Rattlesnake Bar, but a few miles from Newcastle. This rock is an excellent substitute for fire-brick.

Limestone of a superior quality is also found at numerous points in the vicinity of the Road. A large portion of the lime brought to this market is from the kilns at Alabaster Cave, Lime Point (two miles from Auburn) and the American river quarries, about one mile from Neilsburg.

IRON.

Extensive beds of iron ore are found in the vicinity of Neilsburg, and about one mile from the line of your Road. This ore is of a superior quality, and will yield from seventy to ninety per cent. of metal.

The high price of labor in this State, has hitherto precluded the working of these ores with economy, and as yet no efforts have been made to develop these mines, or even to bring them into public notice.

With the facilities afforded for the reduction of this ore, viz.: the cheap production of charcoal in the forests of the Sierras, and of stone coal from the Truckee river mines, and cheap and abundant water power, it is believed that within a few years, capitalists will find this a profitable field for investment, and that the transportation of this ore and its products will form an important item in the business of your Road.

COAL.

The recent discovery and working of the coal mines at Crystal Peak, near the Truckee river, and in the immediate vicinity of your Road, is an important fact for consideration in connection with your future business. From accounts received, it is believed that coal of a superior quality, and in inexhaustible quantity, has been discovered at the eastern base of the mountains at the point named.

The lack of fuel between the Sierras and Salt Lake, has always been considered one of the greatest difficulties attending the working of that division of the Pacific Railroad. These discoveries will remove that obstacle, and will also furnish a large amount of return freight to California.

GRANITE.

I wish to invite your particular attention to the extensive granite quarries in the immediate vicinity of your road. These quarries are found at numerous points between Rocklin and Auburn, a distance of thirteen miles, and for quality of rock are unsurpassed by any in the State.

All varieties of color are found, from the darkest to the lightest, and of every degree of hardness desirable for different classes of work.

The most important quarries yet opened are at Rocklin, within twenty-two miles of Sacramento, which is a less distance than similar quarries can be reached by any other road. The unusual cheapness with which this rock can be quarried—the ledges being everywhere accessible by spur tracks—thus avoiding the cost of intermediate transportation—will, with the low rates of freight at which it can be delivered here, place it in market at a figure that will defy competition.

The quality of the stone alone, would give it pre-eminence in the market at even the present ruling rates. It is of a close, even texture, of a light bluish color, and entirely free from the hard knots and discolorations, which render so much of the granite heretofore brought to this market, unfit for the best class of work.

It has received the unqualified approbation of the State Capitol Commissioners, and they have already contracted for the delivery of all the granite required for the completion of the capitol building, from these quarries. The following is an extract from the report of Reuben Clark, Esq., the able and experienced architect of the building, to the Board of Capitol Commissioners:

"On the Pacific Railroad line there has been discovered a most excellent quality of granite. I visited the quarries, and found it in quantity inexhaustable, and in quality free from all black knots and stains, and of excellent rift."

These and other quarries upon the line of the road are now being opened on an extensive scale, and preparations are made for bringing large quantities of the stone into market at an early day, and it is believed that within a few months you will be able to secure, and thenceforth command the entire granite trade of the State.

WATER POWER.

The value of the unlimited motive power afforded by the waters of the Truckee, Yuba and Bear rivers, and the facility and cheapness with which it can be applied to manufacturing purposes, are facts worthy the attention of capitalists. The rapid

declination of these streams renders them available at almost any point; and the dense forests of pine, fir and tamarack growing upon their slopes, suggest a ready means of securing the advantages which they offer. Abundant power can also be obtained by using the water of the mining ditches, which, until transit by rail is supplied, are in some localities more convenient of access than the natural streams.

This water can be used without wastage, and consequently at but trifling cost, as it will in no case be necessary to divert it from its present channel, except for the short distance required to gain the desired elevation.

Thus the Bear River ditch, which in the Winter season carries 3,500 inches of water, (miner's measure) and at its lowest Summer stage never has less than 500 inches, can at numerous points be used for the purposes mentioned.

Near Clipper Gap the water of this ditch runs for about three-fourths of a mile in the natural bed of a ravine, falling in that distance nearly three hundred feet. At the head of Auburn Ravine, and within three miles of the town of Auburn, it has in about a mile, a fall of 200 feet, and again about one mile above Newcastle, it crosses the line of the road and runs into Dutch Ravine, falling 200 feet in one-fourth of a mile.

There are other points also convenient to the line of your Road, where the same water can be used, with a fall of from 20 to 40 feet.

Other ditches in the vicinity of Gold Run and Dutch Flat, with a larger supply of water, also present similar advantages.

The abundant power thus afforded may be considered permanent, as the mining and agricultural interests will always demand a supply of water fully equal to the present capacity of these ditches.

WOOD, LUMBER, ETC.

The importance of the wood and lumber trade that must eventually accrue to your Company, can hardly be over-estimated.

The completion of the first fifty miles of your Road, will render available a large amount of the timber lands adjacent to the line, which are now comparatively valueless; and besides the importance of the carrying trade already alluded to, an important item in the construction of the road will be saved by procuring the timber and ties needed, in the immediate vicinity of the line.

For general use, the red fir is probably the best timber that can be obtained until the Road reaches the Yuba, where tamarack is found in abundance. The latter is, in my opinion, the

best timber produced in this State for ties and other railroad purposes. It will resist decay as well as redwood, and in point of strength and elasticity, is probably equal to the Puget Sound pine. The completion of the Road to Newcastle has placed within reach of the Sacramento market, large quantities of the live oak, white oak, etc., growing upon the foot hills, which, for lack of facilities for transportation, has hitherto borne but a nominal value.

LANDS.

The lands granted to your Company by the National Government, viz. twenty sections, or 12,800 acres for each mile of road, is an important source of revenue for its construction. You are now entitled to these lands for thirty-one miles, or a total of 396,800 acres, which, at the minimum Government price, may be estimated as worth $496,000.

Many of these lands bordering on the Sacramento, American and Bear rivers are among the most fertile in the State. The value of the timber products of the foothill lands, has already been alluded to. Many of the latter are also susceptible of a high state of cultivation. From their peculiarity of soil, they are particularly adapted to the cultivation of fruit, and in ordinary seasons, the cereals are grown with success. With a proper system of irrigation, these lands may be made highly productive. For the production of the vine, they are considered as far superior to the low lands of the valley, and this fact is already attested by the successful cultivation of numerous and extensive vineyards. That the wine-producing districts of this coast will in future be confined almost exclusively to the foothills, there can be no doubt.

FACILITIES FOR TRAVEL.

The present facilities afforded by your Road, and the connecting Stage Lines for the accommodation of travel across the mountains, are unequaled upon any other route.

Persons traveling via the Central Pacific Railroad, and the Dutch Flat and Donner Lake Wagon Road, reach Virginia City in from four to six hours less time than by any other line. Since the California Stage Company placed their coaches upon this line in July last, the average time for the trips from Sacramento to Virginia has been but seventeen hours.

This road, which was commenced in 1863, and completed in June last, is by far the best road yet constructed across the mountains. It accomplishes the ascent of the Western slope of the Sierras with a much lighter maximum grade than has here-

tofore been deemed possible to attain within the limits of expense which such an enterprise would justify.

The maximum ascending grade, (eastward) is but ten inches to the rod, or less than one-half the maximum grade on the other most important roads crossing the mountains.

It is constructed in the best possible manner, and is everywhere wide enough for teams to pass each other without difficulty.

Commodious hotels have been erected along the route, and preparations are being made to keep the road open during the Winter.

No difficulty is apprehended in doing this, as the snow-fall is believed to be much lighter upon this, than upon the other routes, via the Henness and Johnson Passes.

This comparative immunity from heavy snows, which frequently form a serious obstruction to travel across the mountains during the Winter months, is chiefly due to the *difference in altitude* between this and the other routes named, there being several hundred feet in favor of this route.

The question of the obstruction of a railroad by snow, and the practicability of keeping the line open for business during the Winter months, is a very interesting and important one, and cannot be better answered than has already been done by Mr. Judah in his report for 1862, from which the following extract is taken:

"The argument of obstruction from snow being frequently urged against the Central route for the 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 hight, and almost entirely covered with moss from that hight.

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 trees at the level of the snow.

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

These observations lead to the conclusion that the greatest depth of undisturbed snow is thirteen 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 thirteen 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 thirteen feet.

The town of Dutch Flat, 67 miles from Sacramento, and 35 miles from the summit, may be considered the foot of 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 eighteen 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 strikes the Truckee River, or say 12 miles from the summit, making 47 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 "deep snow-line" does not extend more than twenty miles westerly from the summit, so that the distance will not exceed thirty-two miles where any greater difficulties need be apprehended than are ordinarily encountered upon Eastern roads during the winter months. In further illustration of this subject, reference is made to the above mentioned report, pages 25 to 27.

SURVEYS IN NEVADA TERRITORY.

An experimental survey was made in November and December last, from the terminus of Mr. Judah's line, near the eastern boundary of California, to a point five miles east of the Big Bend of the Truckee, a distance of fifty-three miles. The result of this survey was highly satisfactory, developing a line with easy grades and curves, and for the greater portion of the distance, with very light work. At three points on the experimental line, grades of seventy-nine feet per mile were introduced, for short distances, but a careful location will reduce the maximum to fifty feet per mile. The maximum curves will probably not exceed six degrees, or a radius of 955 feet. The only heavy work occurring on the line, will be through the Cañon below the Big Meadows, and for a distance of about five miles, and even there a large portion of the heavy cutting shown upon the profile, may be avoided by crossing the river two or three times at its narrowest points. From the lower end of this cañon to the Big Bend, the slightly undulating surface of the country, will admit of a rapid and easy construction of the road.

At the Big Bend the line leaves the river, and bears eastward across what is known as the Truckee Desert, towards the Sink of the Humboldt. Beyond the terminal point of the line, no explorations were made, as from the well known character of the country to the eastward, no doubts exist as to the practicability of the route to the Sink of the Humboldt, and from that point to Salt Lake, the choice of routes must be hereafter determined by proper explorations and surveys.

The present Engineer force in the field consists of one party on construction of First Division, in charge of Mr. Chas. Cadwalader, and one party employed on location of Second Division, in charge of Mr. L. M. Clement.

Respectfully submitted,

SAM. S. MONTAGUE,

Acting Chief Engineer C. P. R. R. of Cal.

SECRETARY'S REPORT.

OFFICE OF THE CENTRAL PACIFIC R. R. Co.,
December 1st, 1864.

The total amount of the capital stock of the Company issued and subscribed, is 14,987 shares.....$1,498,700 00

The total indebtedness of the Company is as follows, viz:

First mortgage bonds issued.....	1,394,000 00
Individual accounts.....	159,226 14
Unadjusted accounts, and November pay-rolls.....	20,000 00
Bills payable.....	20,859 79
	$1,594,085 93

The assets of the Company are:

Amount due from stockholders.....	$138,596 68
Placer county bonds.....	75,000 00
Sacramento County bonds.....	163,500 00
Amount due from the City and County of San Francisco in 7 per cent. bonds, principal and interest payable in gold.....	400,000 00
Amount due from the Government of the United States, in 30 year 6 per cent. bonds, (on the 30 miles of road completed and accepted by the Government.).....	1,264,000 00

Every alternate section of public land, (except mineral land,) for twenty miles on each side of the road, granted to the Company by the United States.

Under authority of an Act of the Legislature of the State of California, the Company has executed and holds one million and a half of bonds, on which the State pays interest at 7 per cent. in gold coin, for twenty years, from the 1st of July, 1864.

Thirty-one miles of railroad and telegraph line completed, with all necessary depot buildings, etc.

Grading beyond Newcastle has been done to an amount exceeding one hundred thousand dollars.

Eight locomotives, ten passenger cars, four mail and express cars, one hundred and twenty-four freight cars, five hand cars and three construction cars, extra axles, wheels, tires, etc.

Six thousand tons of iron, about three thousand tons of which are laid, the greater part of the balance has arrived; there is

also purchased, but not yet shipped, two thousand tons additional.

Chairs and spikes sufficient to lay all the iron, and ties enough for twenty-two miles of road beyond Newcastle, are on hand.

BUSINESS OF THE ROAD.

On the 26th of April, 1864, the track was completed from Sacramento to Junction, a distance of 18½ miles, and trains were run daily over the road to that point. Little freight, however, passed over the road until the 10th of the following June, when it was opened to Newcastle, 31 miles from Sacramento, and regular freight and passenger trains commenced running to that point.

The following is a statement of the number of passengers transported each month, and the amount received therefor:

	PASSENGERS.	AM'T REC'D.
April 26 to 30	298	$ 354 25
May	8,906	4,291 25
June	7,329	9,364 30
July	7,687	11,047 35
August	6,508	10,107 14
September	4,726	8,801 22
October	7,615	10,089 90
November	6,870	9,347 74
Total	48,941	$63,408 15

The following statement shows the amount received for transportation of freight each month:

April 26th to 30th	$ 188 25
May	160 50
June	3,993 86
July	5,002 70
August	6,393 72
September	7,668 04
October	8,110 82
November	7,154 00
Total	$38,666 89

There has been received for transportation of Express matter and Messengers $ 1,487 50

The expenses of operating the Road from April 25th to December 1st have been as follows, viz.:

For repairs of Locomotives	$ 3,089 95
For repairs of Cars	3,234 47
For repairs of Track	9,520 41
For repairs of Buildings	251 95

For repairs of Bridges	1,343 64
For Locomotive service	3,666 73
For Train service	3,634 49
For Station service	6,953 54
For Fuel and Water	5,746 12
For Oil, Waste, etc	842 38
For Stationery and Printing	565 00
For Advertising	836 75
For Office expenses	75 95
For Damage to freight	141 67
For Miscellaneous damage	137 00
For Taxes	10,051 61
For United States Revenue Tax	1,060 14
For Incidentals (fixtures for trains, depots, etc.)	449 18
For Telegraph Expenses	8 00
Total	$51,608 98
November Pay Rolls not yet distributed	4,680 19
Total operating expenses	$56,289 17

RECAPITULATION.

Passengers	$ 63,403 15
Freight	38,666 89
Express	1,487 50
Gross receipts	$103,557 54
Operating expenses	$56,289 17
Net earnings in gold coin	$47,268 37

Miles run by passenger trains, 14,016; miles run by freight trains, 19,468.

Average rate of speed of passenger trains, including stoppages, has been 22 miles an hour. Average rate of speed of freight trains, including stoppages, has been 15½ miles an hour.

There has been but one accident to persons on the road during seven months running. Frank Brady, an employee of the Company, in attempting to get on a construction train in motion, was injured so as to cause his death in a few days.

The earnings will be increased fully 50 per cent. by the further extension of the road, soon to be completed to Rock Creek or Neilsburg station, 42 miles from Sacramento, while the expenses for operating the road to that point will not be materially increased.

E. H. MILLER, Jr., Secretary.

REPORT

OF THE

CHIEF ENGINEER

UPON

RECENT SURVEYS AND PROGRESS OF CONSTRUCTION

OF THE

CENTRAL PACIFIC RAILROAD

OF CALIFORNIA.

DECEMBER, 1865.

REPORTS

OF THE

PRESIDENT AND CHIEF ENGINEER,

UPON

RECENT SURVEYS, PROGRESS OF CONSTRUCTION,

AND

ESTIMATED REVENUE

OF THE

CENTRAL PACIFIC RAILROAD

OF CALIFORNIA.

DECEMBER, 1865.

OFFICERS

OF THE

CENTRAL PACIFIC RAILROAD COMPANY OF CALIFORNIA.

PRESIDENT,
LELAND STANFORD.

VICE PRESIDENT,
C. P. HUNTINGTON.

TREASURER,
MARK HOPKINS.

SECRETARY,
E. H. MILLER, JR.,

GENERAL SUPERINTENDENT,
CHARLES CROCKER.

ACTING CHIEF ENGINEER,
S. S. MONTAGUE.

ATTORNEY,
E. B. CROCKER.

DIRECTORS,

LELAND STANFORD, Sacramento.
C. P. HUNTINGTON, Sacramento.
MARK HOPKINS, Sacramento.
E. B. CROCKER, Sacramento.
E. H. MILLER, JR., Sacramento.
A. P. STANFORD, San Francisco.
CHARLES MARSH, Nevada.

Engineer's Office, C. P. R. R. of California,
SACRAMENTO, November 25th, 1865.

To the President and Directors of the Central Pacific Railroad of California:

GENTLEMEN:—The location surveys for the Second Division of your road, which, at the date of my last Report, (October, 1864,) had been extended to Dutch Flat, were subsequently revised, and changes made, wherever any improvements were found practicable.

From Lower Illinoistown Gap a survey was made, following the American River slope of the divide, avoiding the tunnel at Bear River Gap, and connecting with the original line at Long Ravine, developing a very favorable line, but involving a loss of altitude of twenty-six feet in reaching the latter point. This loss, however, did not affect the maximum grades above that point, and the compensating advantages of better alignment and reduced cost of construction were largely in favor of the new line. After a careful location between the points named—giving the following results—this line was adopted:

Distance by old line	22,800 feet.
" " new line	20,600 "
Difference in favor of new line	2,200 "
Difference in aggregate curvature in favor of new line	420°
Difference in cost in favor of new line	$50,000 00
Difference in total rise of grade in favor of old line	26 feet.

Between Long Ravine and Dutch Flat, the original location has been generally adhered to. Some modifications of the line were made, improving the alignment, without materially increasing the cost of construction.

From Secrettown Gap a line was surveyed, following the American River slope of Coldspring Mountain to Gold Run, but without satisfactory results, and the original location upon the northern slope of the mountain was adhered to.

At Tunnel Hill the line was so changed as to admit of an open

cut instead of a tunnel, as at first proposed. This change was made without any increase of grade or curvature, but at an additional cost of construction, as it was believed that the difference in the time required for the completion of the work, would, by permitting an earlier use of the road, more than compensate for the increased cost.

Other changes will be referred to hereafter under the head of construction.

During the Winter of 1864–5, but one small locating party was employed, and the field operations were confined to the line below Dutch Flat. Above that point, but one survey, extending to the summit of the Sierras, had yet been made—viz: Mr. Judah's Survey of 1861. His line, as described in his reports, followed the Bear River slope of the divide to the source of that stream, and thence, the valley of the South Yuba to the Summit.

A re-survey of the Bear River route, for a distance of nine miles above Dutch Flat, in the Fall of 1863, had developed a very heavy line, and a re-examination of the route, made in the spring of the present year, together with a careful study of the maps and profiles of the original experimental survey, led to the conclusion, that by the best location that could be made, the line would be extremely sinuous, involving ruling curves of the minimum radius allowed by Act of Congress, and would also be so much shortened that grades of one hundred and sixteen feet per mile, for a distance of nearly twenty miles, would be required, in order to attain the necessary altitude at the head of Bear Valley. The character of the work required to construct a road upon this line, though by no means impracticable, nor indeed, heavier than was originally anticipated, was certainly formidable, and rendered it desirable, if possible, to find a more available route. With this view, examinations of the American River slope were commenced early in the Spring of the present year.

From my own observations of the general topography of the country forming the southern water-shed of the South Yuba and Bear rivers, and the northern water-shed of the main North Fork of the American, and from such information as I could gather from others, I had been led to believe, that by following the latter stream and its tributarie , the Summit might be reached with a lighter grade, and with the additional advantage of a southern exposure for nearly the whole distance, and, possibly, a reduction in the cost of construction.

The results of these examinations and surveys, though not fully confirming my preconceived opinions respecting the practicability of the American River route, have nevertheless, been very satisfactory, leading to the discovery of a new route from Dutch Flat to Emigrant Gap, near the head of Bear River,

avoiding the heavy work on the Bear River line, and entering the valley of the South Yuba at an elevation that enables us to carry our line to the Summit with comparatively light grades, and avoid much expensive work which a lower line would have encountered.

I am indebted to the Report of Mr. L. M. Clement, Engineer in charge of location of Second Division, for the facts embodied in the following account of explorations and surveys that were made before the route for a location above Dutch Flat was determined upon:

"The examinations, commenced April 17th, 1865, were first directed to Cañon Creek, with the view of following up that stream for a distance of seven or eight miles, and regaining the Bear River slope by crossing the divide at or near Dutchman's Gap. Two lines were surveyed, one crossing the divide at the above named point, and the other following a tributary of Cañon Creek, and crossing the divide about one-half mile farther west. Both were found impracticable, requiring respectively, tunnels of two and a half, and two miles in length.

"Returning to Towle's mill, near Dutch Flat, and using a grade of one hundred and five feet per mile, we followed our former line to a point about one-half mile below Herbert's ranch, where we crossed Cañon Creek, and with a very good line, were enabled to reach a low depression in the divide between Cañon Creek and the North Fork of the American River, known as the Hog's Back. The line here passes near Bradley & Co.'s large reservoir, and turning sharply to the left, attains a comparatively uniform bench upon the American River slope. Continuing our line with the grade above stated, no serious obstacles were encountered until we reached Prospect Hill, a sharp spur forming the eastern slope of Little Blue Cañon, and distant about eight miles from Dutch Flat.

"The summit of this spur was two hundred and fourteen feet above our grade, and required a tunnel of over one-half mile in length. Carrying our line forward to Blue Cañon, about four miles farther, we found the grade at that point was too low to admit of a practicable crossing, the cañon being so narrow that we were unable to make the necessary curvature to gain the opposite slope.

"A reconnoissance of the country for a few miles beyond Blue Cañon gave very satisfactory results, and with an additional altitude at that point of about one hundred feet, the most serious obstacles could be overcome. Being unable to make a sufficient increase of distance to gain the desired altitude, a new survey, based upon a grade of one hundred and sixteen feet per mile, was commenced near Towle's mill and carried along the general route above described, attaining a sufficient altitude at Prospect Hill to enable us to pierce that spur with a tunnel of

four hundred feet in length, and giving a very satisfactory crossing of Blue Cañon.

"Subsequent surveys enabled us to reduce the grade for a portion of this distance, and still maintain a desirable location at Blue Cañon.

"Running down the left bank of this cañon for nearly a mile, our line turns abruptly to the left, and cutting Lost Camp spur, strikes the slope of one of the main tributaries of the North Fork of the American, known as Wilson's Ravine. Following the same, and crossing its tributaries, viz: Sailors' Ravine, Owl Cañon and Heath's Ravine, we reach the summit of the divide between Wilson's Ravine and Bear River, at a point called Emigrant Gap, distant about seventeen miles from Dutch Flat. For about four miles below this point we have been able to maintain an average grade of eighty-five, with a maximum of ninety feet per mile.

"There being no further question regarding the practicability of regaining the Yuba Valley via the North Fork of the American and Wilson's Ravine, it was thought best to continue the examination of the American River route towards the Summit. Diverging from the Emigrant Gap line about four miles below that point, we crossed Wilson's Ravine and made instrumental examinations of Six Mile Cañon and Lake Valley, following the latter to its head, and crossing the divide to the Yuba through Lake Valley Pass.

"The country passed over between Wilson's Ravine and the head of Lake Valley was very rugged in its character, being mostly a granitic formation, much broken, and presenting many formidable obstacles to the construction of a road.

"Though ascending this valley with a grade of one hundred and sixteen feet per mile, we found it impossible to reach the main North Fork of the American River by crossing the crest of the ridge, as we had hoped, and could only reach the Yuba by tunneling thirty-five hundred feet. This line was accordingly abandoned. Still desiring to test the practicability of the main North Fork route, we returned to the foot of Lake Valley, and thence made a reconnoissance along the southern slope of Bear Mountain for a distance of six miles, to Monumental Cañon, which we crossed and continued our line in a southerly direction until we reached the (so called) East Fork. The country over which we had passed, after leaving Lake Valley, as well as that before us at this point, was of the most rugged and formidable character, and as our line for nearly ten miles had been carrying us from instead of towards the Summit, and that too without enabling us to avail ourselves of the increase of distance by reducing the grades, it was determined to abandon this route above Wilson's Ravine, and return to the Yuba River line."

Subsequent examinations of the American River slope in the

vicinity of the Devil's Peak proved still more conclusively the impracticability of reaching the Summit by following that stream. For had the slope of the main North Fork, above Monumental Cañon been gained, it would only have been to reach, about midway of its hight, a sheer perpendicular wall of rock, rising three thousand feet above the bed of the stream, along which the construction of a road would have been impracticable, within the limits of cost which such an enterprise will warrant. Above this cliff, which extends for two miles or more, the country in the vicinity of the Devil's Peak is scarcely less forbidding in its character, being deeply furrowed by narrow rocky cañons, and presenting otherwise many serious obstacles to a favorable location.

"Returning to Emigrant Gap, we ran an experimental line up Wilson's Valley to Bear Trap Summit, but though using a grade of one hundred and sixteen feet per mile, the grade line was two hundred and forty-seven feet below the surface of the ground at the above named summit, which could only be passed by a tunnel, thirty-five hundred feet in length."

Having thus become fully satisfied that our best route for location above Emigrant Gap lay through the South Yuba Valley, we entered upon a careful survey of that route. Not feeling confident of the practicability of maintaining an uniform grade from this point to the Summit, or even of making the distance indicated by the experimental surveys, our first surveys were based upon a grade of one hundred and five feet per mile; but encountering a very rugged country above Crystal Lake and finding that the maintainance of so high a grade was unnecessary to attain the desired elevation at the Summit, we dropped our line at a point opposite the New Hampshire Rocks, a distance of two hundred and fifty-four feet, vertical, and thence to the Summit, continued the survey upon a grade of eighty-five feet per mile. This lower line was subsequently extended back from the offset point to Emigrant Gap, upon the same grade, which by the later location has been in many places still further reduced.

"So much time had already been consumed in the experimental surveys, thus briefly alluded to, it was found that the location of the line to the Summit, now a matter of urgent necessity, in consequence of the rapid advance of the work of construction, could not be accomplished by one party before the commencement of winter. Accordingly on the 18th of July another party was organized and placed in the field to assist in the location of this portion of the line."

Mr. Robert L. Harris, to whom was assigned the work of location upon the eastern slope of the mountains, entered the field with a full party, July 12th. A fourth party, in charge of Mr. W. F. Boardman, placed in the field to assist in making

necessary experimental surveys between the Summit and the Truckee River, was disbanded after a service of sixty days. Before commencing the location from the Summit eastward, the following experimental lines were run :

First—From mouth of Donner Creek (continuation of Judah's Line) via Truckee River to Hunter's Crossing. Second—From Summit to Truckee River via Coomb's Ravine and north side of Donner Lake, joining first line about one and a half miles below Coburn's. Third—From Summit to mouth of Donner Creek (initial point of first line) following the general course of Judah's Line, via Strong's Cañon south side of Donner Lake and Coldstream, but increasing the distance sufficiently, by running farther up the valley of Coldstream, to permit the use of a maximum grade of ninety feet per mile, instead of one hundred and five as at first contemplated.

Examinations were made of a route from Donner Lake to Crystal Peak, via Prosser Creek, Russell's Valley, Little Truckee and Dog Valley, and also via Prosser Creek, west side of Little Dog Mountain and the Little Truckee to its mouth, connecting at that point with the first line via Truckee river.

These examinations demonstrated conclusively the superiority of the Truckee River line in every respect, and it only remained to decide upon the most eligible route from the Summit to the valley of the Truckee. The choice lay between the two lines already mentioned. The one bearing to the left from the Summit Pass, and running north of Donner Lake, the other bearing to the right, and running south of Donner Lake. They are designated respectively as the North and South Lines.

The principal difficulties to be encountered in the work of construction upon either of these lines, occur within a distance of two and a half miles from the Summit; the descent for the remaining portion of the distance being accomplished with uniform grades, good alignment and easy work.

After a thorough survey of all the approaches to the Summit Pass, a careful location and estimate of the most difficult portions of the North and South lines, resulted in the choice of the latter. The reasons governing this choice were, first, lighter maximum grades, and secondly, less cost of construction on the adopted line.

The survey of the North line was based upon a grade of one hundred and five feet, and the South line upon a grade of ninety feet per mile. These grades can be reduced respectively to ninety-eight and eighty-five feet. Besides the consideration of grades, alignment, and cost of construction, the question of possible obstruction by snow, formed an important element in the comparison of the merits of the two lines. In this respect, the North line doubtless possesses some advantages, though upon a

careful consideration they are of much less importance than would at first appear.

The heavy snowfall in the immediate vicinity of the Summit, amounting in the aggregate to ten, and sometimes even twelve feet in depth, and a much heavier accumulation at some points by drifting, will render it necessary to provide a substantial protection, either of timber or masonry, to ensure the successful and uninterrupted operation of the road during the winter months.

The principal points requiring such protection occur upon the eastern slope, and within two miles of the Summit; and though the liability to a heavy accumulation of snow is apparently much greater on the South, than on the North line, there is but little difference in the cost of an adequate protection for either.

In consequence of the North line having a southern exposure for a portion of its length, the snows will melt more rapidly than upon the shaded hillside of the corresponding portion of the South Line. Yet during the prevalence of the storms, when the real difficulty of operating occurs, the necessity of a protection against snow, or the labor of removing it from the track, will be as great in the one case as the other

The objection at first urged against the South line, from the apprehension of danger from 'snow slides' along the northern face of Donner Mountain has been entirely obviated by the location surveys. At the only point where any real danger of obstruction from this cause existed, the line has been thrown so far into the hill that the entire road-bed will be cut in the solid granite, and so protected by masonry and timber work, that any 'slides' that may occur will pass harmlessly over the track without interfering in the least with the passage of trains.

That portion of the line requiring this rather unusual protection, does not exceed one hundred yards, and with the road properly constructed, I do not entertain the slightest apprehension of any stoppage or disturbance of trains from the causes alluded to.

The engineering difficulties here encountered are far less than have been met upon many portions of your road already constructed, and I allude to this particular point thus in detail, only for the reason that much doubt has been expressed regarding the practicability of operating a road along this mountain side during the winter months.

Before leaving this subject, I will remark, that our location has developed a line much more favorable for overcoming the difficulties incident to the snow-belt than was formerly anticipated. Lighter grades and better alignment are secured, as we approach the Summit, and for the greater portion of the distance through the snow-belt, the road-bed will be formed by

light side-cutting or embankments, thus greatly facilitating the removal of snow from the track.

The most important features of the North line having been noticed in a former Report (dated September 30th, 1865), a repetition here is unnecessary. The South line will be more fully described in its proper place, under the head of Location Surveys.

Mr. Harris commenced the work of final location of the Third Division early in October, and at the present date has carried his line as far as the Truckee Cañon, and by the 20th proximo will have reached Crystal Peak, Nevada, about six miles from the point of crossing the State line.

LOCATION OF SECOND DIVISION.

The limits of the first and second divisions (heretofore alluded to as comprising fifty miles each) have been changed as follows: The first division to extend from Sacramento to Colfax, fifty-four miles; the second division, from Colfax to the Summit, fifty-one and one-half miles; and the third division, from the Summit to the State line, thirty-two and a half miles.

A detailed description of the located line below Dutch Flat has been given in a former Report, and the late changes in the line have already been referred to in the preceding pages.

The terminal point of the location survey of 1863, was at Station 3610, nearly opposite Dutch Flat. In consequence of the change of line, already noted, from the Bear River to the American River slope, a slight modification of about one mile of the old line became necessary. From Dutch Flat to Emigrant Gap the route of the new location, as already briefly noticed in the account of preliminary surveys, lies via Reservoir Gap and Cañon Creek, to the Hog's Back—thence along the slope of the North Fork of the American River via Blue Bluffs, Little Blue Cañon, China Ranch, Horse Ravine, Blue Cañon and Lost Camp Spur to Wilson's Ravine, and following the latter and crossing Sailors' Ravine, Owl Cañon and Heath's Ravine, reaches Emigrant Gap, in a distance of seventeen miles from Dutch Flat. Crossing the divide at Emigrant Gap, with a cut but ten feet in depth, and passing along its northern slope, which for about two miles forms the southern water-shed of Bear River, the line enters the valley of the South Yuba, which it follows to the Summit, a distance of twenty miles.

The general character of the work between Dutch Flat and Owl Gap, a distance of thirteen miles, does not differ materially from, and will not exceed in cost of construction, the work for an equal distance below Dutch Flat, the construction of which,

commenced in August last, will be nearly or quite completed during the present year

Five tunnels, of an aggregate length of eighteen hundred feet (the longest being six hundred feet), occur on this portion of the line. The material through which they will be excavated, is soft slate, cement, and conglomerate. These tunnels, with perhaps one exception, will require a lining of masonry.

The water courses, which with the exception of Cañon creek and Blue Cañon, are all small, will be provided with substantial stone culverts, and no trestling or other bridging will be required between Dutch Flat and Crystal Lake.

From Owl Gap to the Summit, a distance of twenty-four and one-half miles, the work is of a much less expensive character, and a good location has been made upon a grade of eighty-five feet per mile. From Owl Gap to Emigrant Gap, a distance of three miles, and thence for four miles along the northern slope of the divide to the Yuba Pass, the work will be light. From the Yuba Pass to Holt's Ravine, the cuttings, though generally light, are mostly in granite or gneiss, and for a short distance in the vicinity of Butte Cañon, in trap. For nearly three fourths of the distance between the Yuba Pass and Holt's Ravine, the work will consist of light side cutting and embankment, and between Holt's Ravine and the Summit, almost wholly of the latter. Two tunnels opposite Coolbroth's and Jones' of three hundred, and two hundred feet, respectively, will be required. Trestling will probably be required at Butte Cañon and Holt's Ravine. Both those crossings will be at a hight of seventy feet, and five hundred feet in length. These, with truss bridges in single spans of one hundred and fifty, and two hundred feet, at the upper and lower outlets of Kidd's Lakes, and a single span of one hundred feet across the South Yuba at the foot of Summit Valley, are the only wooden structures required on this division.

The line through the valley of the Yuba is in every respect much more favorable than was originally anticipated. Light grades, good alignment, and work admitting of rapid and economical construction constitute its most salient features.

THIRD DIVISION.

Before commencing the location of this division the determination of the line at the Summit was a question of the utmost importance. Although the grades upon either slope admitted of a location with a very light cutting at the Summit Pass, the surveys eastward, pointed to a lower summit grade, as calculated to greatly reduce the cost of construction, and afford better alignment over the most rugged portion of the line. After a

careful consideration of the matter, a tunnel of seventeen hundred feet in length was determined upon.

I will here state, that in addition to the lines heretofore noted in this connection, a line was run cutting the crest of the mountain one-third of a mile south of the Pass, and joining the present line about one mile from the Summit. This line requiring a tunnel of four thousand two hundred feet in length, and affording no advantages in regard to grade, was abandoned.

By the final location, the summit of the grade is made at the western end of the tunnel, and thence descends uniformly at the rate of ninety feet per mile for a distance of six and a quarter miles. Leaving the tunnel, the line bears to the right, and skirting the terraced slope of Donner Mountain and its main spur, for a distance of two and a half miles, enters Strong's Cañon. This portion of the line, heretofore alluded to, comprises all the formidable work on the eastern slope; two tunnels, through cement and granite, of four hundred and two hundred feet in length, respectively, occur within this distance. Running up the west side of Strong's Cañon, crossing the same, and thence along its eastern slope, the work for a distance of three miles will be extremely light, and the material of the most favorable character. Emerging from Strong's Cañon, the line passes along the hill-side south of, and about four hundred feet above Donner Lake, for two and a half miles, when curving sharply to the right, it pierces the hill with a tunnel nine hundred feet in length and enters Coldstream Valley. Thence to the valley of the Truckee, a distance of seven and three-quarter miles, with the single exception of Donner Creek crossing, the work is very light, and will compare favorably with the same length of line in the Sacramento Valley. The crossing of Donner Creek will be at a hight of eighty feet above the bed of the stream, and a length of seven hundred feet at grade. The general characteristics of the line from Donner Creek to Hunter's Crossing are succinctly stated in the following items from the Report of Mr. Harris:

"The line follows the Truckee River at an elevation varying from thirty to one hundred and fifty feet above its bed—and the surveys have demonstrated the fact, indicated by a previous reconnoissance, that a line, very favorable for the construction of a railroad, can be obtained; the grades averaging less than forty, and none exceeding eighty feet per mile, with but three miles of heavy work, twelve miles of ordinary railroad work, and nineteen miles of very light construction."

The line, in this distance, crosses the river five times, requiring truss bridges at three points of single spans of two hundred feet each, and at each of the other points, probably, two spans of one hundred and fifty feet.

"Of the above river crossings, there is but one place where

the work will be expensive, which is at Devil's Grip—corresponding to the *Easterly Summit* of some other routes, as here the river cuts through the easterly chain of mountains."

The increased expense at the latter point will be incurred in the extra strength required for abutments and protection walls, to guard the embankments from the encroachments of the river, which is here confined to a narrow channel, and when swollen by rains or melting snows, acquires a velocity, which nothing short of the most substantial masonry will withstand.

The difficulties of the Truckee Cañon, heretofore so much dreaded, because so little known, have dwindled to three miles of heavy work, which can be built at less cost than the three miles next below Gold Run—on the Second Division—upon which, ninety days since, not a day's work had been done, and which half as many more working days will fully complete.

For full details, respecting the lines and work thus briefly alluded to, reference is made to the accompanying maps and profiles:

LIST OF TUNNELS ON SECOND AND THIRD DIVISIONS.

LOCALITY.	Length in feet.	Material.	Probable time required for construction	REMARKS.
Boulder Hill.....	200	Cement and Conglomerate	60 days..	
Prospect Hill.....	400	Clay, Slate & Cement.....	100 days .	Will require lining.
Fort Point.....	300	"	75 days..	" " "
Grizzly Hill.....	600	Conglomerate....	150 days..	A portion "
Lost Camp Spur.....	300	Slate & Sandstone..	100 days..	
Red Hill, above Crystal Lake.....	300	Schist	120 days..	
Opp. Jones' Station...	200	Granite.....	100 days..	
Summit of Sierras.....	1,700	"	18 months	Will be constructed for double track.
Cement Hill.	400	Cement.....	120 days..	
Mouth Strong's Cañon	180	Granite.....	90 days..	" " " "
Coldstream.....	900	Cement.....	1 year.....	" " " "
Devil's Grip.	175	"	80 days...	
Total feet.....	5,655			

Being less than one-third the aggregate length of tunneling contemplated by the original surveys.

The above tunnels can all be worked from both ends, and with the exception of the Summit Tunnel, will require no shafting.

GRADIENTS AND ALIGNMENT.

In a former Report a table was given presenting the grades upon the located line from Sacramento to Dutch Flat. No material changes in grades upon that portion of the line have since been made. Above Dutch Flat, as before stated, the maximum grade of one hundred and sixteen feet per mile, for an aggregate distance of ten and a half miles, has been resorted to; the longest plane being 3 18-100 miles. The ruling curves upon this grade do not exceed eight degrees, or a radius of 716 feet, and upon all the long curves of this radius, the grade has been reduced from ten to twenty feet below the maximum.

But five curves of a less radius than seven hundred and sixteen feet occur between Dutch Flat and Emigrant Gap, viz: one at the Hogsback having a radius of six hundred and eighty-eight feet; one at Little Blue Cañon with radius of six hundred and thirty-seven feet; one at Stony Gulch, and one at crossing of Blue Cañon of the same radius, and one at Lost Camp Spur, having a radius of six hundred and seventy-five feet.

From Owl Gap to the Summit, a distance of twenty-four and one-half miles, the average grade is eighty-one, and the maximum eighty-five feet per mile. From the Summit to the Truckee River, the average grade is eighty-four, and the maximum ninety feet per mile, and down the Truckee, as before stated, the grades average less than forty and at no point exceed eighty feet per mile. The location upon the higher slopes of the Sierras has generally admitted of a very favorable alignment. Curves of 573 feet radius have in but a few instances been resorted to, and only at points where the grade could be sufficiently reduced to compensate for the increased curvature; and as before stated, the curves are generally lighter, and the per centage of tangent line much greater than upon the lower portion of the Second Division.

WORK OF CONSTRUCTION.

The most satisfactory progress has been made in this department during the past year. Up to the first of January last, but little work had been completed above Newcastle, with the exception of the heavy cut at Bloomer Divide. The force employed, which in December, 1864, had been raised to about three hundred men, was still further increased in January and February, and the work prosecuted as rapidly as the inclemency of the season would permit. Steady additions were made to the working force as the season advanced, until in April it numbered about twelve hundred, in June two thousand, and the

latter part of July four thousand men. It became apparent early in the season, that the amount of labor likely to be required during the summer could only be supplied by the employment of the Chinese element of our population. Some distrust was at first felt regarding the capacity of this class for the service required, but the experiment has proved eminently successful. They are faithful and industrious, and under proper supervision, soon become skillful in the performance of their duties. Many of them are becoming very expert in drilling, blasting, and other departments of rock work.

The road was completed from Newcastle to Auburn—five miles—and the cars commenced running to the latter place May 13th, and on the 10th of June to Clipper Gap, seven miles further. Eighty days later, September 1st, the road was completed and trains ran to Colfax (near Illinoistown), distant eleven miles from Clipper Gap, and fifty-four from Sacramento.

August first, the work of grading above Colfax was commenced, but the full force employed below that point was not removed to the new work until September first. Considerable loss of time necessarily occurred in the removal of so large a force, and its proper distribution upon the line, yet the heaviest portions of the work were all well under way early in September, and at the present date, the grading upon the thirteen miles between Colfax and Dutch Flat—comprising some of the most expensive work on the line—is two-thirds completed, and with ordinarily favorable weather will be ready for the track in the month of January, 1866. The work at Cape Horn has proved less difficult and expensive than was first anticipated.

The line was thrown into the hill sufficiently to form the road-bed in solid cutting, with the exception of two points, where for a distance of one hundred and two hundred feet respectively, heavy retaining walls have been built, and the road made as secure as if upon the solid ledge.

The work of construction between Dutch Flat and Blue Cañon has already been commenced with a force of six hundred men, which number will be increased as the work below is completed.

Camps have been established at all the tunnels and heavy points on the section named, and it is confidently expected that by the opening of spring the grading will be so far advanced as to admit of its completion to Emigrant Gap early in July, and to Crystal Lake in the month of August. Work has been commenced on both ends of the Summit Tunnel, and will be prosecuted vigorously during the winter, and the heavy work upon the eastern slope will be opened as early as the season will permit.

I will here remark, that although a portion of the line on the Second and Third Divisions will require a longer time for its

construction, the cost of grading the thirteen miles next above Long Ravine is fully equal to the cost of the same number of consecutive miles upon any portion of the line. The rapid accomplishment of this heavy work can only be attained through the medium of that class of labor heretofore alluded to. Indeed had it not been for this element, it would have been impossible to have completed your road to Clipper Gap at this date.

With this force at your command, and with the assurance of its large augmentation the coming year, the work of construction, which by some has been deemed the labor of years, will be reduced to months, and judging from what has been accomplished during the past season, I confidently predict that within the year 1866 your trains will run to the summit of the Sierras, and by the fourth of July, 1867, to Hunter's Crossing of the Truckee, fifteen miles beyond the eastern boundary of the State.

Geo. E. Gray, Esq. (late Chief Engineer of the N. Y. Central Railroad), who examined the line of your road from Sacramento to Crystal Peak (Nevada), in July last, expresses the following opinion regarding the character of the work upon the completed portion:

"That portion of the Railroad constructed and in operation from the city of Sacramento to Clipper Gap, a distance of forty-three miles, and which attains an elevation of 1,785 feet above the sea, will compare most favorably in every respect with any railroad in the United States. The road bed and mechanical structures are well constructed, ample provision being made for drainage, the cross ties are of redwood, and the whole laid with a rail of 60-lb. weight per yard, and set in wrought iron chairs. The locomotives, cars and machinery, are all of the first quality and of the best material, and are maintained in good order."

Of the line upon the Eastern slope, he says:

"The recent surveys down the Truckee River, from the mouth of Donner Creek, through the cañon where the river pierces the eastern range of the Sierra Nevadas, have developed an excellent line, with light grades, all descending eastwardly, and comparatively easy of construction.

"The ease with which this eastern range is passed by your route is one of its most important features. In addition to its other advantages, it enables you to pass rapidly out of the snow belt, and with a shorter snow line than could otherwise be attained. That portion of the line along the Truckee River will be comparatively free from snow, and by properly constructing your road over the mountains the snow will not form any insuperable difficulty in operating it."

BRIDGING.

But few timber structures have been found necessary. Those originally designed for crossing the deeper ravines and gaps, between Newcastle and Colfax, have mostly been discarded, and embankments built instead. The Newcastle trestling, sixty feet in hight and five hundred feet long, one similar structure near Auburn, thirty-eight feet in hight and four hundred feet in length; two of the same hight at Lovell's Gap; one near Clipper Gap station fifty feet high and four hundred feet in length; two in Clipper Ravine fifty and ninety-three feet in hight and three hundred and fifty, and five hundred feet in length, respectively, and one trestling of four bents at Lower Illinoistown Gap (introduced for the convenience of a road crossing), are the only wooden structures between Newcastle and Colfax.

Long Ravine bridge, consisting of five hundred feet of trestling in spans of sixteen feet, and extreme hight of sixty feet, and three spans of Howe truss, two of one hundred and fifty feet each, and one of one hundred and twenty feet, crossing the main ravine at a hight of one hundred and fifteen feet; and the Secrettown trestling, one thousand feet in length, nine hundred feet of which is fifty, and the remainder ninety feet in hight, are the only wooden structures between Colfax and Dutch Flat. Beyond the latter place the structures required upon the second and third divisions have already been noticed.

The American River bridge has recently been covered and painted, and a similar protection will be provided for all truss bridges hereafter constructed.

ROLLING STOCK.

The rolling stock upon the road consists of six locomotives, six first-class passenger cars, two caboose, one baggage and express, thirty-nine box-freight, and sixty-five platform cars. The materials for twenty dump cars have arrived and they are now being put together. A new locomotive, 16 by 24 inch cylinders and 5 feet drivers, built by Booth & Co., San Francisco, is expected to arrive in a few days.

Seven heavy freight locomotives, cylinders 18 by 22 inches, with six drivers each, four feet diameter, and one passenger locomotive, 15 by 22 inch cylinders, 5 feet drivers, have been purchased.

Advices have been received of the shipment of four of the above, and the others were to be shipped during the present month.

Orders have been given for four others of a similar class, cyl-

inders to be 18 by 24 inches, six drivers, four feet diameter Materials for one hundred freight cars have been purchased and were to have been shipped the present month; and orders have been given for as many more, all of which are expected to arrive in season for next spring's business.

GENERAL REMARKS.

The prospect of the speedy completion of your road to the eastern boundary of the State is most flattering. The financial difficulties incident to the initiation of all public enterprises of great magnitude, have been successfully overcome, and, as will be seen by the report of the Secretary, the future prospects of the company are highly encouraging.

The character of the line developed by the recent location surveys is remarkably favorable for rapid construction, and the comparatively low grades attained through the snow belt, divest it of its objectionable features.

The success attending the running of freight trains on the high grades upon the completed portion of your road is very gratifying, and fully sustains the opinions heretofore expressed that no apprehension of serious difficulties need be entertained in regard to the practicability of working a road constructed upon these grades.

The completion of the road to Dutch Flat will enable you to command the freight and passenger traffic with Nevada, Utah and Idaho, and its further advance into the mountains will add materially to the dispatch of business with those localities. The business of the past season as shown by the Secretary's Report, has been very satisfactory, and the discovery of the new mines in the Excelsior District, Nevada County, will tend to largely increase the business over your road the coming season.

These mines are situated within ten miles of the road at Crystal Lake, and though at present but partially developed, they bid fair to rival in extent and richness the famous Comstock mines in Nevada. Other developments of mineral wealth in various portions of Placer and Nevada counties are constantly being made, creating an active demand for labor and capital.

I omitted to mention in connection with the subject of experimental surveys, that a reconnoissance was made of the Henness Pass route from Bear Valley to the Little Truckee. The observations taken fully confirmed the opinion expressed by Mr. Judah in his report of 1863, in which he says:

"This line we found impracticable on account of the crossing of the South Yuba, and objectionable from the absolute necessity of making a long detour either to the north or south, in order to avoid Dog Mountain and reach the valley of the Truckee;

also from its moderately descending grade eastward and consequent high elevation through the snow region."

The altitude of this pass was ascertained by level and found to be 7,031 feet, or sixty feet lower than the Donner Pass. A railroad line carried through this pass would, from the necessity of constructing sufficiently above the natural surface to avoid obstruction by snow, attain a greater altitude than the summit grade of your road. These and other measurements were taken for the purpose of correcting the false impressions that have obtained, relative to the comparative altitudes of the most prominent passes across the Sierras. I will here state that these altitudes all date from low tide at San Francisco.

The altitude at Sacramento is taken from the barometrical calculations of Major Williamson and Thos. Logan, M. D., by which the new grade of Front street, Sacramento, (28 feet above low water mark), is made 56 35-100 feet above low tide at San Francisco.

The apparent discrepancy between the altitudes here given and those given by Mr. Judah, are due to the different bases from which the levels were taken—the latter being run from the old Front street levee as a base, and our present lines from tide water.

The following altitudes of prominent points upon the line of your road, also of Lake Tahoe and the Summit Passes of other routes, may be of interest:

Sacramento (Front street grade)	56 feet.
Junction	189 "
Auburn (Railroad station)	1,185 "
Clipper Gap	1,785 "
Colfax	2,448 "
Jones' Mill, near Dutch Flat	3,416 "
Emigrant Gap	5,286 "
Grade opposite Crystal Lake	5,775 "
Surface of Water in Crystal Lake	5,907 "
Summit of Grade, west end of Summit Tunnel	7,042 "
Donner Lake	5,964 "
Lake Tahoe	6,247 "
Webber Lake, near Henness Pass	6,904 "
Summit at Henness Pass	7,031 "
Summit at Donner Pass	7,091 "
Summit at Georgetown Pass (levels run from Summit to Lake Tahoe in 1863)	7,154 "
Summit at Johnson's Pass (Bishop's Report)	7,374 "

But one location party will be kept in the field during the winter. The location now completed to Crystal Peak, will be extended to the Big Bend of the Truckee, a distance of fifty miles, beyond which point the route of your road is not yet de-

termined upon, and in the absence of reliable data, any discussion of the relative merits of the various proposed routes thence to Salt Lake, must be entirely speculative and unsatisfactory.

I need not, however, urge the importance of commencing the explorations and surveys necessary to an intelligent choice of route, at the earliest practicable moment.

The labor of several well organized engineer parties, will be required to make the necessary surveys during the coming year, and I would recommend that a force, adequate to ensure the early completion of the work, be placed in the field as soon as the season will permit.

I wish here to express my obligations to Messrs. L. M. Clement and Robt. L. Harris, and to those employed under their direction, for the faithful and efficient manner in which they have discharged the duties assigned them. My acknowledgments are also due to Messrs. Chas. Cadwalader and S. M. Buck, assistants in charge of construction, for valuable assistance in their department.

Very respectfully,

SAM. S. MONTAGUE.