REPORT

OF THE

CHIEF ENGINEER

UPON

RECENT SURVEYS, PROGRESS OF CONSTRUCTION,

AND AN

APPROXIMATE ESTIMATE OF COST

OF

FIRST DIVISION OF FIFTY MILES

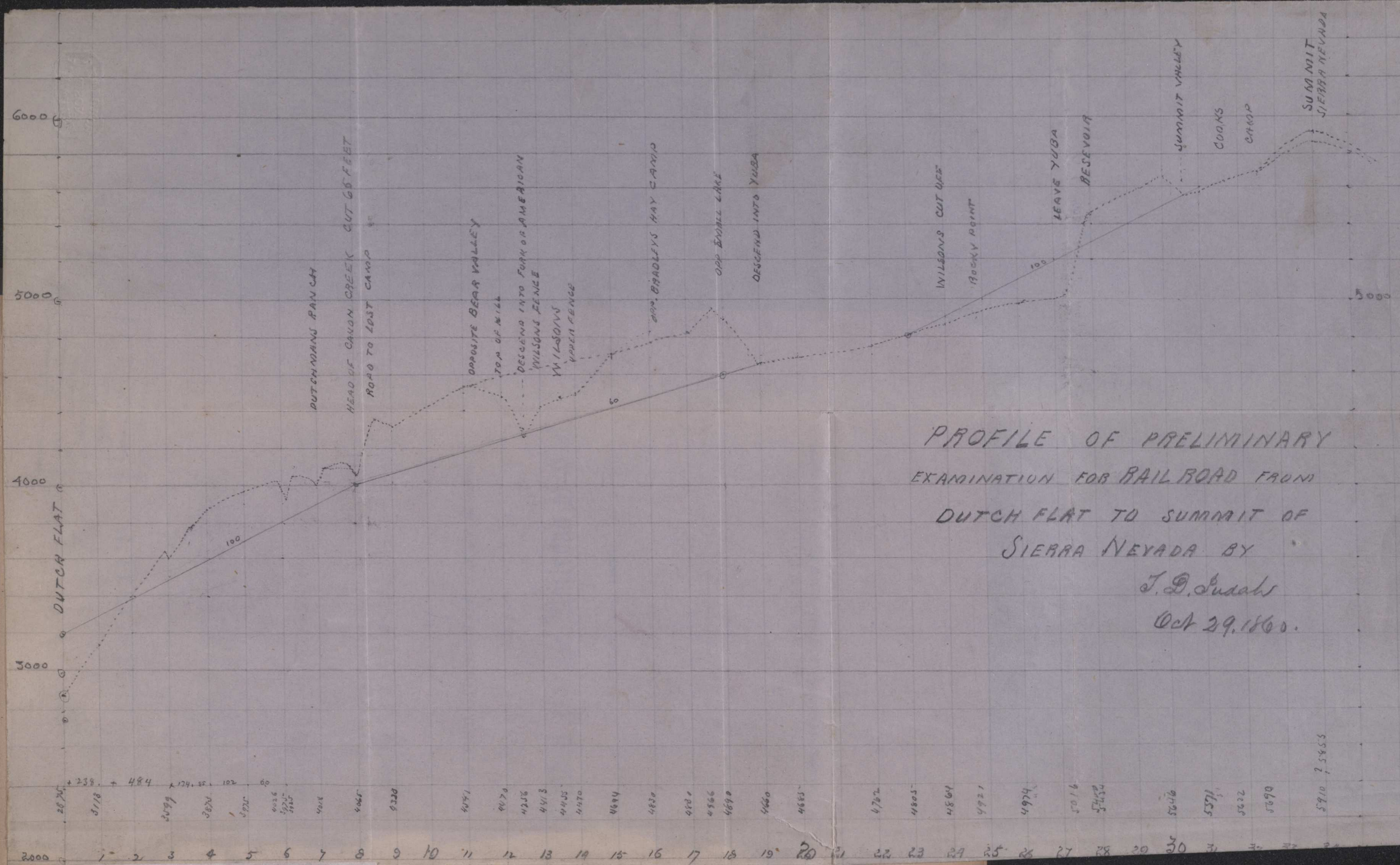
OF THE

Central Pacific Railroad of Cal.,

JULY 1st, 1863.

SACRAMENTO:
JAMES ANTHONY & CO., PRINTERS, UNION BOOK AND JOB OFFICE.
1863.

PROFILE OF PRELIMINARY EXAMINATION FOR RAILROAD FROM DUTCH FLAT TO SUMMIT OF SIERRA NEVADA BY T. D. Judah Oct 29. 1860.



REPORT OF THE CHIEF ENGINEER.

ENGINEER'S OFFICE,
JULY, 1863.

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

GENTLEMEN—Herewith I present a Report upon the recent surveys, progress of construction, and an approximate estimate of the cost of the 1st Division of 50 miles of your road.

It being determined to place a portion of the work upon the 1st Division under contract during the Fall and Winter of 1862, surveys for the purpose of determining upon the line were commenced in October, 1862.

The first question arising upon location of the road was to determine if the present Sacramento Valley Railroad and its extension to Auburn Station could be used and made available as a portion of the location of our road. The advantage to be gained by adopting these lines were, the saving of time in work of construction, and the removal of rivalry and competition in business.

Upon investigation many and serious objections presented themselves. 1st. From foot of K street to Auburn, via Sacramento Valley Railroad, 43 miles; from foot of K street to Auburn, via Antelope line, 35 miles; difference in distance against Sacramento Valley Railroad, 8 miles.

2d. A clause in the Pacific Railroad Bill expressly says that no part of the appropriations therein contained shall apply to that portion of any road now constructed, a prohibitory clause which nothing but further legislation would remove.

3d. Another clause in the Pacific Railroad Bill requires all iron used in construction of road to be American iron. The iron upon the Sacramento Valley Railroad, being English, while that upon the Sacramento, Placer and Nevada Railroad, although American, weighing only 52 pounds per yard (a weight too light

for our purpose), presented another objection requiring further legislation.

4th. Another clause in the Pacific Railroad Bill requires that the mortgage to the United States shall be a *first mortgage*, a provision which could not be complied with without retiring the present issue of Four Hundred Thousand ($400,000) Dollars First Mortgage Bonds of that road, having about twelve years to run, drawing 10 per cent. interest, many of which are in the hands of foreign holders.

5th. The nominal cost of the Sacramento Valley Railroad was about $1,500,000, represented as follows:

1st Mortgage	$400,000
2d "	367,000
Stock	800,000
	$1,567,000

Although not the actual cash cost of the road, yet it stands represented by securities to that amount, and it is not likely that the bond-holders would consent to give up their 10 per cent. bonds for anything less than par, if indeed they would consent to part with them at all. This, then, is the nominal cost of that road as it now stands; but in order to place it in the position of a first class road, according to the terms of the bill, it would be necessary to relay it with new iron (the old iron being defective and nearly worn out), also to partially relay it with new ties; also to replace the wooden culverts with stone, and the trestle work with piers and abutments of masonry, and bridges; also to purchase anew a portion of the locomotives and cars, and to place the balance in complete repair, and alter the present equipment to conform to the new guage of 4' 8½"; also to erect suitable and permanent depot and other buildings in Sacramento, as follows:

2,000 tons new iron, delivered at $90	$180,000
40,000 cross ties, delivered at 70c	28,000
Permanent culverts and bridges on line	35,000
Bridge across American river	40,000
New locomotives and cars	35,000
Altering over and repairing equipment	20,000
Buildings, etc., at Sacramento	25,000
	$363,000
Deduct 2000 tons iron sold at $40	80,000
	$283,500

Making an expenditure in cash, say $285,000, in order to render it a first class road.

When we consider that the total cost of grading, ties, and track laying from Sacramento to Grider's (a point 3 miles nearer Auburn than Folsom) is but $400,000 (including American river bridge), of which but $250,000 in cash is paid by the Company, there can be but little question as to the wisdom of the course adopted in building a new line.

6th. A location to Grider's will secure to this road, in connection with the California Central Railroad, the Marysville and northern business, and prevent the construction of a new line reaching from the Lincoln line to Sacramento.

These considerations, therefore, have governed this Company in adopting the direct route via Grider's, and settled the question of location so far as the Sacramento Valley Railroad is concerned.

DESCRIPTION OF LINES SURVEYED FOR CENTRAL PACIFIC RAILROAD OF CALIFORNIA.

Barometrical reconnoisances have been made upon five different routes across the Sierra Nevada mountains, as follows:

BAROMETRICAL RECONNOISANCES.

1st. A route via Folsom, Greenwood and Georgetown.

2d. A route via Auburn and Illinoistown, Dutch Flat and Donner Pass.

3d. A route via Nevada and Henness Pass.

4th. A route via Downieville and Yuba Gap.

5th. A route via Oroville, Bidwell's Bar, Middle Feather River and Beckwourth's Pass.

ROUTE VIA GEORGETOWN.

Commencing at the terminus of the Sacramento Valley Railroad at Folsom, the distances were taken by odometer, and elevations by aneroid barometer, to a point 78 miles from Sacramento; thence aneroid observations were extended to the summit of the Sierra Nevada mountains, near the head of the middle fork of the American river, following the ridge between the south fork of the American and its northern tributaries, and middle fork of the American—the barometrical observations indicating that a grade of 150 feet per mile would be necessary in order to overcome the summit upon that route.

Commencing at Folsom the line of observations were as follows: Sacramento Valley Railroad Depot, Spruance's, Shaw's

Bridge across south fork of American River, Negro Hill, Berry's, Atchinson's, Young's, Cooper's Ravine, Bailey's, Knickerbocker Ranch, Harris' Ranch, Penobscot House, Greenwood, Halfway House, Georgetown (54 miles from Sacramento), Clipper Mills, Castle Hill, top of hill, foot of hill, Creek, top of hill, Work's Ranch, Cabin, Richardson's, Volcano Mill, top of hill, Emigrant Road, top of hill, Log Shanty, Ballard's, Pilot Creek, Ice House, Stockton's Upper Store, head of Pilot Creek Ditch, top of ridge.

Leave Emigrant Road 78 miles from Sacramento; leave Waggons, point in ridge, do. do.; descend to bottom of Middle American river, foot of hill; point in river do.; leave river and ascend to top of ridge, camp, summit of Sierras, distant 97 miles from Sacramento.

2D.—ROUTE VIA AUBURN, ILLINOISTOWN AND DUTCH FLAT.

As the located line of road follows this route, and is more particularly described herein, a further description of this barometrical reconnoisance is deemed unnecessary.

3D.—ROUTE VIA NEVADA AND HENNESS PASS.

Commencing at Folsom the observations were taken at the following points: Sacramento Valley Railroad Depot, Rock Springs, Mountain House, Dutch Ravine, Auburn Forks, Illinoistown Road, Dry Creek, Foster's, English Bridge, Globe Ranch, Wolf Creek, Boston Ravine, Grass Valley, Nevada, Turner's Mill, Blue Tent, South Yuba, Bell's Ranch, Lake City, Junction House, Devil's Backbone, Humbug Road, Snow Tent, Cherry Hill, Magenta Flume, Eureka, Forks, top of divide, Bowman's Ranch, Canon Creek, Eureka Ditch, Canon Creek Summit, Jackson's, Downieville Road, Old Emigrant Road, Henness Pass, Webber's Lake, Truckee Falls, Maples, Tule Lake House, Hunter's Ranch, Sardine Valley, Dog Valley, Neil's Ranch, State Line—143 miles.

This line was 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 get from the Henness Pass to the plateau of the Truckee river, to avoid Dog Mountain, also from its moderately descending grade eastwardly, and consequently high elevation through the snow region.

4TH.—ROUTE VIA CAMPTONVILLE, DOWNIEVILLE, NORTH YUBA AND SIERRA VALLEY.

Commencing at the terminus of the California Central Railroad, at Lincoln, the line of observation was as follows: Lin-

coln, Kennebec Bar, Long Bar, Timbuctoo, Smartsville, Empire Ranch, Deer Creek, Keystone House, Ankeny's, Pleasant Valley House, Bridgeport, South Yuba, French Corral, Brickville, Sweetland's, San Juan, Freeman's Crossing, Middle Yuba, Camptonville, Sleighville House, Top of Ridge, Mountain House, Goodyear's Bar, North Yuba, Downieville, Mooney's, Charcoal Flat, Lima City, Howard's, Yuba Gap, Hale's, Sierra Valley.

From this point the railroad line would extend northeasterly through Sierra Valley, passing out through Beckwourth's Pass, and connect with the line of observations taken upon the Middle Feather river route; but in order to ascertain the hight of the divide between Sierra Valley and Little Truckee, or Maple's Creek, and the elevation of Dog Mountain route, the observations were extended on this line, continuing as follows: Arms Store, Summit of Divide, Forks Henness Road, Triplet's, Sardine Valley, Junction Truckee Emigrant Road, Perkins', Dog Valley, Top of Dog Hill, Neil's, Stout's, Junction Fuller's Road—145 miles.

The objection to this route was found in the rugged nature of the country through which it passed, the expensive crossing of Deer creek, south fork of Yuba, and the numerous deep ravines of their tributaries, and the necessity, as in the Henness route, of making a detour north through Sierra Valley and Beckwourth's Pass, in order to reach the valley of Truckee river.

5TH.—ROUTE VIA OROVILLE, BIDWELL'S BAR, MIDDLE FEATHER AND BECKWOURTH'S PASS.

Commencing at Oroville the line of observations were taken as follows: Oroville, North Fork, Bidwell's Bar, South Fork of Feather, Union Bar, Kanaka Bar, Bald Rock Canon, Indian Crossing, American Bar, Long Riffle, South branch of Middle Feather, Millsop Bar, Rinehart's Bar, Marble Cone No. 1, Marble Cone No. 2, China Wing Dam, French Cabin, Saw-Mill, Hartman's Bar, Delap's Wing Dam, Pyramid Rock, Scrubby Jacks, Rich's Point, Butte Bar, Onion Valley Creek, China Bar, Last Chance Ravine, Railroad Ravine, Gap Point, Webb's Bar, Colby's, Minerva Bar, Washington Bar, Rich Bar, Winters' Creek, Sailors' Bar, Nelson's Point.

From Nelson's Point in bed of Middle Feather river, 80 miles from Oroville, for next 17 miles (the river rising at an uniform grade, without obstruction), the line of observations were carried to the North across the divide between Middle Feather and Spring Valley Creek, a tributary of the north fork of Feather, as

follows: Nelson's Point, Flume, top of divide, foot of divide, Spring Garden Ranch, Bear Trap, Misenhamer's, top of hill, Cunningham's House, Jackson's, top of hill, foot of hill, Middle Feather River, 97 miles from Oroville, at which point the line of observations again touch the bed of the river, and are continued on as follows: Lower Ford, Upper Ford, Penman's. Leave river at 100 miles from Oroville. For next 10 miles, the observations were taken upon a line north of river as follows: Leave river top of Anthony's Hill, Anthony's House, Poplar Creek, point of river, 112 miles from Oroville, thence via river as follows: Point of river, north branch middle fork Feather, Beckwourth's House, foot of Sierra Valley, Butte Cabin in Sierra Valley, Bingham's Ranch, Marsh's Summit House, Beckwourth's Pass (131½ miles from Oroville); thence the line turns to the south and follows down through Long Valley and Pea Vine Valley to Truckee River at Fuller's Crossing, as follows: Beckworth's Pass, foot of pass, Long Valley, Road and Ranch, Pond Ranch, Antelope Springs, Alkali Summit, Alkali Lake, Pea Vine Summit, Pea Vine Hotel, Pea Vine Valley, Truckee Summit, Junction Stone's Road, Fuller's Crossing of the Truckee River, 160 miles from Oroville, and 283 miles from Sacramento.

The advantages of this route consist in its low grades and a lower altitude of summit than upon the other routes. But it also presents disadvantages, which render it next to impossible for us to avail ourselves of its advantages in this respect. It is 80 miles further from Sacramento to Fuller's Crossing of Truckee, by this route, than by our present location.

Bald Rock Canon, about 20 miles above Bidwell's Bar, is a rocky gorge in the Feather river, rising with smooth granite sides, almost perpendicular, being 3,000 feet high upon the north side, and 2,500 on the South side, the length of the canon being about 1½ miles.

In order to avail ourselves of the lower grades, it is necessary to run near the river, or at an elevation sufficiently high to be above high water; this renders necessary the crossing of all the ravines and tributaries, many of which run in gorges of great depth near their mouths, and also involves the necessity of curving up into them and running down again, in order to procure a suitable crossing.

From Nelson's Point to Bald Rock Canon, about 50 miles, the river runs in a gorge varying from 2,000 to 2,600 feet in hight, at a pretty steep slope, which near the river where our line runs, in many places. is perpendicular and generally rocky. The course of the river between these points is

extremely tortuous and winding, the spurs of the mountains upon either side putting out sharply and running by each other like the fingers of two hands thrust together, this involves the necessity of many tunnels upon this 50 miles. The work of construction would therefore be vastly expensive and slow.

In view of our relations with the United States Government and the Union Pacific Railroad Company, who are to build about 1,700 miles in the interior, and who cannot commence until we reach the State line; in view of the increased cost of the line by this route, and the increased cost to Government of appropriation for 80 miles of additional road to the same point; in view of the additional time necessary to construct the additional length of 80 miles, and the physical impossibility of constructing the division from Bald Rock Canon to Nelson's Point in one year, the time required in Pacific Railroad Bill, this route is reluctantly placed among the list of those denominated unavailable for Pacific Railroad purposes, in the present position of railroad affairs.

A barometrical reconnoisance was also extended from the end of instrumental survey on Truckee river, down the same, to Stout's Crossing of the Truckee, thence up Steamboat Valley, and by the present traveled road across the Washoe mountains via Virginia City, down 6 mile Canon and Flowery District to Carson river, and down the same to Fort Churchill, as follows:

Terminus of Survey, Neil's, supposed State Line, Stout's Crossing, Truckee Meadows, Truckee City, Steamboat Springs, foot of Washoe mountains, Toll Road, top of hill, junction with Henness Road, Virginia City, Gould & Curry Mill, foot of 6 Mile Canon, Carson River, Reed's, Fort Churchill.

Returning: Fort Churchill, Virginia City, Gold Hill, Devil's Gate, Silver City, American Flat, top of Washoe mountains, foot of Washoe mountains, Washoe Lake, Washoe City, Galena, Stout's.

A barometrical reconnoisance was also made from Donner Lake, via the old Truckee emigrant trail, to the Henness Road at Sardine Valley, 16 miles.

A barometrical reconnoisance was also made, and observations taken, from Donner Lake up the Truckee river to Lake Bigler, 13 miles.

A barometrical reconnoisance was also made from the head of Donner Lake, via Castle Peak, to the line of our location at foot of Summit Valley, 8 miles.

A further reconnoisance was made from the terminus of our instrumental survey up the Twin Valley creek, into Twin Valley

and across by Castle Peak, into Lower end of Summit Valley, 15 miles.

Particular description of the Location adopted for First Division of Fifty Miles, via Antelope Route, to near the New England Mills; thence via Preliminary Survey to Eastern Boundary of California.

Commencing at the foot of K street in the city and county of Sacramento, where it intersects the water front of the Sacramento river, the line passes northerly and west of the City Water Works building, through what is known as Slater's Addition, for about fifteen hundred feet, thence crossing to the east it strikes the main North Levee at the intersection of Sixth with E street; thence it follows the line of North Levee for about three miles to a point near the old Muldrow House; thence curving to the left it passes across the space of low land lying between the levee and the American river, about half a mile in width, upon trestle bents averaging about fifteen feet in hight, and crosses the American river with two 192 feet spans of Howe's Truss Bridge; thence running straight over about one thousand feet of low land upon trestle bents, the line curves to the right into a direction of North 24° 30′ East, magnetic, and pursues its course in a straight line to about sixteen miles from Sacramento, across the Rancho del Paso, passing about one mile easterly from the Arcade House, crossing the north line of said ranch about one-half mile westerly from its northeast corner, and striking near the southwest corner of section 21, township 10, north Range 6, East, and crossing a corner of sections 16 and 15 to a point on the aforesaid section 15, distant about sixteen miles from the foot of K street in the City of Sacramento, at which point the line enters the county of Placer. Thence curving gently to the left, and reversing to the right again, it crosses Dry Creek with four 55 feet spans of bridge, and passes about 300 feet westerly of Dudley's house; thence curving gently to the right, it follows for about two miles along the foot of a light ridge in a direction parallel with Dry Creek and Secret Ravine, to the California Central Railroad, at a point known as Grider's, in section 2, Township 1, north Range 6, East. Thence running northerly for about one mile, the line curves to the right and crosses Antelope Creek with a 50 feet span, about 500 feet from its intersection with Secret Ravine, and attaining the top of the divide or ridge between Antelope and Secret Ravine, it follows the same, passing through sections 35, 36, 25 and 24 of Township 11, north Range 6, East, and sections 19, 18, 17, 8, 9 and 4

of Township 11, north Range 7, East, to what is known as the Big Reservoir, at the head of Red Ravine, a point distant about twenty-six miles from Sacramento, at which point commences the maximum grade of 105 feet per mile. Thence pursuing a northeasterly course, it continues along the top of said ridge or divide, crossing the main Antelope road at the flume known as Antelope divide, passing through sections 34, 27 and 26, of Township 12, north Range 7, East. Thence curving sharply to the right and reversing to the left, in about half a mile further it reaches the summit of the divide between Dutch Ravine and Secret Ravine, at a point known as the Caperton Flume, distant about three miles southeast from Gold Hill, in Placer county, and about four miles westerly from the Auburn Station—the terminus of the Sacramento, Placer and Nevada Railroad. Thence running a little north of east the line follows up said divide, crossing the main Auburn and Sacramento road to what is known as Newcastle Gap, in said ridge between Dutch Ravine and Secret Ravine, crossing said gap with an embankment 62 feet high, and passing through sections 26, 23 and 24 of Township 12, north Range 7, East, and section 19, Township 12, north Range 8, East—said point being distant 31 miles from Sacramento. Thence pursuing a general course of nearly due East, the line follows the south side of the hill of Dutch Ravine for about two miles, passing through sections 19, 20 and 21, of Township 12, north Range 8, East. Thence curving to the left the line crosses Dutch Ravine near its head, about $\frac{1}{4}$ mile below the Bloomer Ranch House, and crosses the divide between Dutch Ravine and Baltimore Ravine, passing along and near the Bear River Ditch to the main stage road between Auburn and Sacramento—being at said point distant about $\frac{1}{2}$ mile south of the town of Auburn, on section 15, Township 12, north Range 7, East—distant $34\frac{1}{2}$ miles from Sacramento. Thence curving to the left into a general northerly direction, the line follows near the top of the divide between the American river and Auburn Ravine, and near the Bear River Ditch, $\frac{1}{4}$ mile west from the Junction House, and through sections 15, 10, 3 and 2, of Township 12, north Range 7, East, and sections 34 and 35 of Township 13, north Range 7, East, to the head of Rock Creek, at which point the line reaches the summit of the divide between Dry Creek and the American river—distant about 39 miles from Sacramento. Thence pursuing a north-easterly course along the top of said ridge or divide, passing about $\frac{1}{8}$ mile south of Lovell's house and near the Cataract Mill, crossing through sections 35 and 25, of Township 13, north Range 8, East, and sections 19, 17 and 8, of Town-

ship 13, north Range 9, East, the line reaches the Clipper Gap, in section 19, at a point distant about 44 miles from Sacramento. Here, instead of following the top of the ridge further, it rising too rapidly for our grades, we curve to the right and run up the north side hill of Clipper Ravine (a tributary of the North Fork of the American), crossing several short, steep-side ravines to Wild Cat Summit. Passing through Wild Cat Summit (about $\frac{1}{4}$ mile south of Widow Hawes' house), we pass around Hawes' Hill, and curving to the left, cross the main road and pass up a smooth ravine to the top of the ridge at a point called Applegate Summit. A short distance further on, the line passes through Evergreen Gap, crossing the divide again at Baney's Gap, from which point it curves around in the side hill (on North Fork side) to Star House Gap, near the Star House. Here the line crosses the Star House Gap (and the traveled road) about 50 feet high, passing up very nearly on top of the divide to the head of Applegate Ravine, which runs into Bear river, this point being called New England Gap—distant about 50 miles from Sacramento. From New England Gap the line passes out upon the north side hill of North Fork; crossing the traveled or stage road, it runs along above the same, and about 500 feet above New England Mills; thence through the peach orchard of Murphy to Station 2,640, which point is about one mile north of the New England Mills, and the terminus of the 1st Division of 50 miles.

For a further description of the general line of road from this point to the Eastern boundary of the State, reference is had to a previous report of the Chief Engineer upon the preliminary survey, cost of construction, and estimated revenue of the Central Pacific Railroad of California, published October 1st, 1861, and subsequently re-published October 22d, 1862.

DESCRIPTION OF OTHER SURVEYS.

Clipper Gap, upon the top of ridge between the American river and Dry Creek, about 44 miles from Sacramento, being a point common to all the proposed lines from Sacramento, upon the Dutch Flat route, several lines have been surveyed and located for the purpose of determining the best, which are denominated as follows:

1st. Route via Auburn Station.
2d. Secret Ravine Route.
3d. Antelope Ravine Route.
4th. Doty's Ravine Route.
5th. Dry Creek Route.

The 1st, 2d, 3d, and 4th, of the above enumerated lines, have a common point at or near Auburn, the 5th at Clipper Gap.

1ST.—ROUTE VIA AUBURN STATION.

This line pursues the direction already indicated from Sacramento to Dry Creek, about 16 miles; thence curving southerly it follows up the divide between Miner's Ravine and Strap Ravine; thence via Miner's Ravine it strikes the Sacramento, Placer and Nevada Raliroad at Wildwood, and continues upon south side of same to Auburn Station; from this point to Bloomer Divide near Auburn, two lines have been run and located, one upon an 80 feet grade to Newcastle Gap, and thence a 90 feet grade to Bloomer Divide, the other upon a 105 feet grade from Auburn Station to Bloomer Divide. Preliminary and location lines have been run upon both routes.

A line was also run and located from Dry Creek, via Grider's and Miner's Ravine, to Wildwood, but abandoned.

2D.—SECRET RAVINE ROUTE.

A line has been run upon this route, from Grider's to Auburn, but it was found impossible to attain the required elevation without using a higher grade than the maximum allowed by the Pacific Railroad Bill.

3D.—ANTELOPE RAVINE ROUTE.

This route has been fully described in the *particular* description of line, it saves $3\frac{1}{4}$ miles in distance over the Auburn Station line, and about $8\frac{1}{2}$ miles over the Dry Creek line.

4TH.—DOTY'S RAVINE LINE.

A line was run from McBowen's Ranch, on Dry Creek line, near Gold Hill, via Doty's Ravine, Doty's Flat, Ophir and Millertown, to Auburn, but it was found that it would be necessary to attain a higher elevation than the town of Auburn, which would require a grade higher than our maximum, and this line was therefore abandoned.

5TH.—DRY CREEK LINE.

This line follows the present line of road to Grider's; thence runs near the present line of California Central Railroad to Lincoln; thence via Gold Hill and Virginia; thence via McBowen's Ranch, Sailors' Ravine, Moore's Bar, Sedgerst Summit, Taylor's Ravine, it reaches the south side hill of Dry Creek; thence following the same, it encounters and runs up Deadman's Ravine; thence crossing and running down the same, it continues up the

same via Page's, Redum's, Hawes' Store, Cook's, Watson's, Neilsburgh, Gassoway's and Predmoer's, to Clipper Gap.

Three lines of location, contingent upon this line, were run from Sacramento across to the line of the California Central Railroad.

"A"—Line striking at Leets.
"Ex"—Line striking at Pleasant Grove.
"B"—Line striking at Lincoln.

This line being 9 miles longer, and requiring the maximum grades with increased curvature, was finally abandoned. Experimental and location lines were run upon the Dry Creek lines.

MILES OF LINE RUN AND ESTIMATED BY THE ENGINEERING DEPARTMENT, FROM OCTOBER 1ST, 1860, TO OCTOBER 1ST, 1861.

Barometrical Reconnoisance.	*Miles.*
Barometrical Reconnoisance via Georgetown to Summit...	97
" " " Duch Flat to Fort Churchill	190
" " " Nevada and Henness Pass..	143
" " " Miscellaneous.....	50
Total Barometrical Reconnoisance.....	480

Preliminary Lines.	*Miles.*
Preliminary Line from Lincoln to Truckee River..... ..	102
" " " Gold Hill to Auburn.....	11
" " " Miscellaneous.....	5
Total Preliminary Lines.....	118

MILES OF LINE RUN AND ESTIMATED FROM OCTOBER 1ST, 1862, TO JULY 1ST, 1863.

Barometrical Reconnoisance.	*Miles.*
Via Yuba Gap.....	145
" Middle Feather River.....	160
Total Barometrical Reconnoisance.....	305

PRELIMINARY AND LOCATION LINES RUN.

			Preliminary.		*Location.*
1st.	Sacramento to	Grider's.....	18	.....	18
2d.	"	" Leet's.....	18	.....	18
3d.	"	" Pleasant Grove.....	21	.....	21
4th.	"	" Lincoln.....	25	.....	25

	Preliminary.	*Location.*
5th. Leet's to Grider's	3	3
6th. Lincoln to Clipper Gap	27	27
7th. Grider's to Bloomer Ranch	16	
8th. " " " "	16	16
9th. Grider's to Mildwood via Miner's Bar	7	7
10th. Grider's to Bloomer Divide	22	22
11th. Auburn Station to Bloomer Divide	21	21
12th. Auburn Station to Kelley's	2	2
13th. Sundry Preliminary—Auburn to Auburn Station	20	
14th. Wildwood to Auburn Station	6	6
15th. Auburn to Illinoistown	20	20
16th. Sundry Preliminary Lines	5	
17th. In Sacramento	6	3
Total	253	209

SUMMARY.

Or a Total of	Barometrical Line	785 miles.
" " "	Preliminary "	371 "
" " "	Location	209 "
	In all	1365 "

GRADES.

The following table shows the number of miles of each grade, upon the several routes, on the 1st Division of 50 miles.

TABLE OF GRADES

ON LOCATED LINES OF CENTRAL PACIFIC RAILROAD OF CALIFORNIA, FROM SACRAMENTO TO STATION 2,640.

Grade per Mile.	Antelope Line. MILES.	Auburn Line 80′ Gr. MILES.	Auburn Line 105′ Gr. MILES.	Dry Creek Line MILES.
0.5	.....	.....	.....	0.95
2.5	3.58	3.58	3.58	3.65
5	0.38	0.38	0.38	0.57
10	1.05	1.13	1.13	1.47
16	2.60	1.51	2.51	2.80
21	3.87	2.43	1.45	3.15
26	4.75	6.56	6.56	5.75
31	.....	1.05	1.05	0.75
35	.....	.....	.....	0.90
37	0.58	0.09	0.09	1.25
40	0.38	0.38	0.38	0.57
42	0.38	1.33	1.33	2.35
45	0.38	.....	.....	0.75
47	0.38	0.38	0.38	0.41
52	4.05	4.75	4.35	3.55
58	0.58	0.19	0.19	0.19
60	.....	.....	.....	0.35
63	1.04	3.50	3.30	0.19
68	0.20	0.19	0.38	0.66
74	0.20	0.85	0.85	0.25
78	0.98	.....	.....	.....
80	0.68	2.70	1.15	0.48
84	.....	2.84	.....	.....
88	0.17	0.17	0.17	0.17
90	2.60	5.07	2.58	8.18
105	11.89	6.11	10.45	7.85
∠	9.28	9.76	9.81	10.86
Total..	50.00	53.35	52.07	59.05

From the above table of grades it will be seen that while the adopted line has more miles of maximum grade, yet, taking the grades from 80 to 105 inclusive and it stands 15.35, 16.89, 14.35 and 16.68, while the distance to the same point by the different lines are 50 miles, 53.35, 52.07 and 59.05.

ALIGNMENT.

The following table shows the number of feet in length of the different curves and tangents, also the total number of miles of curved and straight line. Also the total amount of curvature in degrees, and also in circles of 360 degrees each, upon the first division of fifty miles of the Central Pacific Railroad:

TABLE OF CURVES

ON LOCATED LINES OF CENTRAL PACIFIC RAILROAD OF CALIFORNA, FROM SACRAMENTO TO STATION 2,640.

Radius of Curvature.	ANTELOPE LINE.		AUBURN LINE. 80′ Grade.		AUBURN LINE. 105′ Grade.		DRY CREEK LINE.	
Feet.	Distance. Feet.	Curvature. Degrees.	Distance. Feet.	Curvature. Degrees.	Distance. Feet.	Curvature. Degrees.	Distance. Feet.	Curvature. Degrees.
5,730	3,053	31	5,224	55	5,524	55	1,759	18
3,820	2,320	35	600	9	600	9	1,160	17
2,865	8,221	164	10,900	202	11,085	221	5,836	117
2,292	4,250	106						
1,910	3,016	90	8,367	251	8,397	252	6,866	206
1,637	2,102	74	2,102	74	2,102	74	2,102	74
1,432	12,398	496	12,097	484	14,655	586	19,547	782
1,146	4,032	202	7,172	359	4,002	200	10,842	542
1,075	83	4			83	4		
955	22,734	1,364	25,716	1,543	23,502	1,410	26,341	1,580
819	1,740	122	980	69	700	49	6,190	433
800	910	67	910	67	910	67	910	67
764	730	55	730	55	730	55	730	55
716	23,524	1,882	16,680	1,334	17,049	1,364	18,505	1,480
638	600	55	2,475	241	600	55	3,175	286
573	3,800	380	6,651	665	5,200	520	8,680	868
Straight Line.	170,486		181,583		179,800		199,140	
Total number of feet and degree of curv're	264,000	5,127	281,687	5,008	274,929	4,921	311,783	6,525

	ANTELOPE LINE. Number of Miles.	AUBURN LINE. 80′ Grade. Number of Miles.	AUBURN LINE. 105′ Grade. Number of Miles.	DRY CREEK LINE. Number of Miles.
Curved Line.	17.71	18.96	18.02	21.34
Straight Line.	32.29	34.39	34.05	37.71
Total number of Miles	50.00	53.35	52.07	59.05
Number of Circles.	14.2	15.0	13.7	18.1

ESTIMATES.

APPROXIMATE ESTIMATE OF THE TOTAL COST OF 1ST DIVISION OF 50 MILES OF CENTRAL PACIFIC RAILROAD OF CALIFORNIA.

Total cost of grading, masonry, bridging, ties, and track laying of Sections 1 to 18 inclusive, as per existing contracts.....	$400,000
Total cost of grading, masonry, bridging, ties, and track laying of Sections 19 to 50 inclusive, as per proposals received from contractors.....	1,835,896
Total cost of iron rails, locomotive engines, passenger, baggage and freight cars, turntables, switches and frogs, and machinery for machine shop....	721,000
Total cost of buildings, machinery, right of way and engineering.....	175,000
Contingencies.....	89,600
Total cost of 1st. Division of 50 miles.....	$3,221,496

For detailed estimates of the above, as also the actual cost of grading, masonry, etc., already performed, you are respectfully referred to accompanying schedules, marked D, E and F.

SECOND DIVISION OF FIFTY MILES

Reaches to within 6 miles of the summit of the Sierra Nevadas.

A party, under the charge of S. S. Montague, Esq., are in the field making permanent location of the 2nd division. Ten miles, or to Long Ravine, are already located, and the balance will be completed during this fall, so that the 2nd division can be placed under contract by the 1st of December, 1863.

PROGRESS OF WORK OF CONSTRUCTION.

The work of construction was commenced by placing the grading, masonry, bridging, ties, and track laying of that portion of the work between the foot of K street, Sacramento, and the line of the California Central Railroad at Grider's (comprising sections 1 to 18 inclusive), under contract to C. Crocker & Co., December 27th, 1863.

This work was afterwards let by C. Crocker & Co., as follows:

From 6th Levee to end of Levee work (about 3 miles), to S. D. Smith.

From thence, the piling, trestling and bridging across the American river, to Baker & Hubbard.

From thence, sections 5 to 10 inclusive (about 6 miles), to S. D. Smith & Co.

From thence, sections 11 to 18 inclusive (about 8 miles), to Messrs. White & Gay.

Sections 7, 8, 9 and 10 were subsequently let by S. D. Smith & Co. to Charles Bates.

Sections 11 and 12 were let by White & Gay to John Coffee.

Part of section 15, section 16, and part of section 17, were let by White & Gay to Boyle & Mahon.

Part of section 17 and section 18 were let by White & Gay to Collins.

At present date, the levee is completed from the intersection of E and 6th streets to the point of leaving the levee near Tivoli, and ready for laying track.

The lumber for the American River Bridge has been delivered, the bridge framed, and the foundation of north pier completed, ready for raising the pier.

The coffer dam around center pier is driven, and only the capping of piles remains to complete the foundation.

The foundation of south pier is completed, and the timber pier is in process of construction.

The lumber for piers has partly arrived, and the balance is on its way.

Nearly all the lumber for the trestling has arrived, and about two-thirds of the same is framed.

Sections 5 to 10 inclusive, are completed, and ready for laying track.

Sections 11 to 16 inclusive, will be completed by the latter part of August.

Sections 17 and 18 having been delayed until the line of per-

manent road eastwardly was adopted, they will not be completed as soon as the others, but will be finished so as to cause no delay to the track laying.

CHARACTER OF MATERIAL.

The cost of grading the first 18 miles has been somewhat enhanced, in consequence of encountering a larger proportion of hard material than was at first anticipated; over one-third of the whole quantity of material excavated up to the present time being cement, costing more than double the price paid for excavating earth.

Also, from the fact that this hard material underlies the earth, on most of the line from the American river eastwardly, at from 1 to 2 feet only, below the surface, rendering it difficult to find borrowing material for embankments without excavating over a considerable area of surface.

Also, from the fact that the experience of this season in high water at the bridge across the American river, has demonstrated that it is necessary, in order to render the piers secure beyond a contingency, that they should be filled around pretty extensively with cobble stone which is now being done.

CULVERTS

Were originally intended to be built of stone, but in consequence of the distance which the stone had to be hauled, and therefore their increased cost, culverts of brick were substituted.

The total number of culverts on sections 1 to 18 inclusive, is 36, of which 26 are completed, there are three in process of construction, and 7 remaining to be completed.

These culverts are barrel and arch culverts—the largest being 8 feet span.

They are built of hard burned brick, in a substantial and workmanlike manner, the parapet walls will be coped with cut granite, of 8 inches in thickness, securely fastened to the walls with iron anchors.

TRESTLING.

There are two heavy pieces of trestling on the first division, requiring 283,000 feet, board measure, of timber, and about 800 redwood piles from 12 to 30 feet in length. This trestling has been planned with a view to strength, safety and durability; the ties, stringers, corbels and caps being of best quality of Puget Sound pine, and the posts, braces, sills and piles of coast or black redwood, from Santa Cruz.

THE PLAN OF TRESTLING

Is simple in its details, consisting of two perpendicular main posts twelve inches square let into a 12 by 12 inch sill, with mortise and tenon directly under the bearing of the track stringers. Two brace posts, 10 by 12 inches, extend down on either side of the main posts (with a run of one foot in three) into the sill, to which they are also secured, and are bolted at the top to the main posts with inch iron bolts and heavy cast iron washers, the sills resting on four piles of redwood timber, which are let into the sill with mortise and tenon. The piles are driven so as to come directly under each post and also under the lower end of the main post braces. The posts are capped with a timber 12 inches square and 9 feet long, into which the posts are tenoned and pinned. Upon the caps rest the corbels, 12 inches square and 9 feet long. Upon these corbels are laid the stringers, 12 by 15 inches and 15 feet long, which are secured by two-inch iron bolts at each end, passing down through either ends of stringers and corbels. The caps are notched one inch to receive the corbels.

Upon the stringers rest the cross-ties, 3 by 8 inches and 8 feet long, securely spiked down to the stringers. Upon these cross-ties the rail is laid and secured in the usual manner. The bents are placed at intervals of 15 feet from center to center.

THE TRESTLING AT SOUTH SIDE OF AMERICAN RIVER BRIDGE

Is 2,200 feet in length, commencing at the levee a short distance above the Tivoli House, and consists of 151 bents, from 8 to 17 feet in hight. Short bents at the end of trestling join it to the levee embankment, making a thorough connection with the same. Most of these bents are framed and upwards of 100 piles already driven.

THE TRESTLING AT NORTH END OF AMERICAN RIVER BRIDGE

Is 615 feet long, and composed of 42 bents from 9 to 18 feet in hight. It is similar in character to that on the south side of the river. The foundations of trestling are all of piles.

AMERICAN RIVER BRIDGE

Is planned upon the principle of the Howe Bridge, crossing the American river in two spans of 192 feet each in the clear, with an elevation above the highest water of 6 feet in the clear.

The piers, for present purposes, will be built of timber, and so constructed as to allow stone piers to be built within them. The details and dimensions of its parts have been planned to correspond with its importance, and no considerations of economy have been allowed to interfere with a perfect and thorough combination of strength and durability. It contains 183,000 feet, board measure, of timber; 44 tons of iron bolts and washers, and weighs about 400 tons, which, with 375 tons (the greatest load to which it can ever be subjected), gives 775 tons as the whole weight of structure and load, one-half of which, or 388 tons, is supported by each span. The total length is 397 feet; hight of truss, 24 feet; width of truss from out to out, 18 feet 8 inches; width of truss in clear, 13 feet. It has two bottom chords, consisting of six pieces each, two of which are 5½ by 16 inches, and four are 4½ by 16 inches, with an intermediate space of 1 inch, admitting the main tension bolts, giving an aggregate cross section of lower chord of 896 square inches. There are also corbels at either end of each span, with a cross-section of 792 square inches, the corbels extending 22 feet from either end of chords and resting on four wall plates, 10 by 12 inches. The upper chords also consist of six pieces of the same width as the lower chords, 12 inches deep, with a center rib of 6 inches in depth extending over six panels and firmly bolted to the upper chord, giving an aggregate cross-section of 1,008 square inches. All the chords are framed. The dimensions of the main braces at the ends of each span are 10 by 12 inches, diminishing in size towards the center. The counter braces at the ends of the bridge are 8 by 12, which also diminish towards the center. The largest main tension bolt is 2 inches in diameter, diminishing to 1½ inches at the center. The angle blocks, of cast iron, are all cast to a length corresponding to the total width of chords, with a face equal to the size of the ends of the braces, which are secured in their places by flanges. There are also three iron tubes or boxes, of the same length as the depth of the chords, through which the tension rods pass.

All the iron for this bridge is now delivered.

THE FOUNDATIONS OF PIERS AND ABUTMENTS OF AMERICAN RIVER BRIDGE

Are of redwood piling, driven at intervals of 2 feet from center to center. It was necessary, in the middle pier, to use iron shoes, to drive the piles to the required depth, the hard bottom being composed of boulders. The piles are tenoned and capped with timbers 12 inches square, upon which are laid longitudinal timbers of the same dimensions as the caps, one foot apart, and

secured by drift bolts. On these timbers a solid flooring of 10 by 12 inch timbers is laid, projecting one foot beyond the footing course of the intended masonry. There are 370 piles in the foundations, of about 30 feet in length.

THE MASONRY IN PIERS AND ABUTMENTS OF AMERICAN RIVER BRIDGE

Will be of the best description of hammer-dressed masonry, with rock face, laid in regular courses, with stone of uniform thickness, of the best quality. The stone will conform to a plan so arranged as to break joints as well in the center as the face of the wall. The stone will be dressed to their proper dimensions before being brought on the wall, and no work will be allowed on the wall to the injury of the stone already laid. The coping will be laid with broad stone, dressed down to an even surface, to receive the wall plates. The cement will be of the best hydraulic cement, in the proportion of one of cement to two of clear, sharp sand.

BRIDGE AT DRY CREEK

Is planned upon the principle of the Burr bridge, which experience has proved to be well adapted for short spans.

This bridge is built in 4 spans, of 54½ feet each, from center to center of pier, making a total length of 218 feet. It is connected with the embankment at each end by shore bents, the stringers extending to the bank in the same manner as described in the trestle work at Arcade Creek.

This will be a *deck* bridge, the cars running upon the top of the same.

Each of the *chords* of each span are composed of two lengths of timber reaching from center to center of pier, 54½ feet long, 8 inches thick, and 12 inches high, placed five inches apart, between which are placed the posts 10 feet long, 12 by 12 inches, notched so as to pass between the *chords*, at intervals of 6½ feet. Main braces, 6 by 12 inches, extend from bottom to top of posts.

Upon the upper chords rest floor beams, 10½ feet in length, 6 by 12 inches, at intervals of about 2 feet from center to center.

Upon the floor beams are placed track stringers, 10 by 12 inches.

Upon the track stringers rest sawed cross ties, 8 feet long, 3 by 8 inches, at intervals of two feet from center to center.

The iron rail is firmly spiked on to these cross ties.

The chords are securely bolted together by 288 five-eighth bolts in each span, with 576 cast washers.

The lower chords rest upon corbels or bolsters, over each pier, 13 feet long, 20 inches wide, and 12 inches high, securely bolted on to the chords with $\frac{3}{4}$ inch bolts.

Length of span from center to center	$54\frac{1}{2}$ feet.	
Cross section of upper chords at Center	384	square inches.
" " " " " " Ends	384	" "
" " " lower chords " Center	384	" "
" " " " " " Ends	384	" "
" " " corbels	240	" "
Hight of truss from top of upper to bottom of lower chord	11	feet
Hight of truss inside of chords	9	"
Width of truss from out to out of chords	10 "	6 inches.
Width of truss inside of chords	6 "	6 "

There will be 306 cubic yards of rubble bridge masonry in the 5 piers, laid in cement.

STONE PIERS

Will be of rubble masonry, the stone to be of good quality. The corner stones and coping will be dimension stone, with dressed beds and joints, and rock face, an arras of one inch to be cut on the angles or corners, true to the batter marked on the plan.

The body of the work will be laid of stone of large size and regular courses, the whole thoroughly bonded with the proper proportion of headers and stretchers, and will in all cases be so scabble pointed, or otherwise dressed, with joints not exceeding an inch in width, as to have a good general bearing upon each other without the aid of chips, pinners or anything that may be removed or cracked; and no chips or pinners will be put into the face of the work. The tops of the walls to be dressed with coping stone of even thickness, so leveled and dressed as to give a uniform and substantial bearing to the wall plates.

FOUNDATIONS.

The pits for foundations will be excavated to hard bottom, leveled off and the footing course laid, thereby doing away with timber in the foundations; the line of hard bottom is from six to twelve feet below the surface of the ground.

ARCADE CREEK TRESTLING

Is 220 feet in length, and consists of 14 bents, placed at intervals of 15 feet. The bents are placed at an angle of 45 de-

grees with the line of road, that being the general course of the creek at the point which we cross.

PLAN OF TRESTLING AT ARCADE CREEK

Is similar to that of the American river, excepting the foundations, which are of plank 3 inches in thickness, and 5 feet in length, laid at right angels to the bents. The foundations are excavated down to solid material, upon which plank are laid as above described. The end bents are connected with the bank by stringers, extending 13 feet beyond the end of same, resting on the bank sills firmly embedded in the embankment.

The timber is framed and will be ready for raising in a few days, making a completed road-bed from the American river to section 12.

In this structure there is 20,000 feet, board measure, of timber, and 800 lbs. of iron.

CROSS TIES

Are of redwood, the joint ties being 6 by 10 inches, and 8 feet long; the intermediate ties being 6 by 8 inches, and 8 feet long; 68,000 ties are under contract, 4,000 are delivered at Sacramento, and the balance to be delivered so that the work of track laying may progress uninterruptedly.

IRON.

Six thousand tons, or over 60 miles, have been purchased, contracted to be delivered at the rate of 500 tons per month. A considerable portion of this iron has been shipped, and is on its way to California.

The spikes and chairs necessary to complete 60 miles, have been purchased, and are being sent forward.

LOCOMOTIVES.

The following locomotives have been purchased in the Atlantic States, for the 1st Division of 50 miles:

Of William Mason & Co., Taunton, Massachusetts.

1 locomotive, 15 by 22 inch cylinders.
1 locomotive, 16 by 24 inch cylinders.
1 locomotive, 17 by 25 inch cylinders.

Of Norris & Co., Philadelphia.

1 locomotive, 15 by 22 inch cylinders.

Of Danforth, Cook & Co., Patterson, New Jersey.

2 tank locomotives. In all 6 locomotives.

PASSENGER CARS.

Six first class passenger cars have been purchased of Mason & Co., of Springfield; also, 2 baggage cars; also, 25 platform freight cars; also, 15 box freight cars; also, frogs, switches, turn-tables, etc., necessary for the first 50 miles.

Proposals have been invited and received for the grading and masonry, etc., of the remaining portion of the 1st Division.

Twenty-three bids were received, a number of which, from responsible parties, will range within my approximate estimate of the cost of grading, masonry, bridging, etc., for this portion of the work.

Sections 19 to 31 inclusive, or from the line of the California Central Railroad to Newcastle Gap, have been let to responsible contractors, and will be commenced immediately.

I would advise, that for present purposes, we follow the line of 6th and I street to Front, leaving the heavy work between 6th and E streets and the Water Works Building, to be performed next Summer.

I would also remind the Board, that in order to preserve the charter granted us by the Territory of Nevada, it will be necessary to make a survey of the line in Nevada this year. I respectfully ask action upon it.

I also invite your attention to a previous report, giving the dates at which it will be necessary to place the 2d and 3d Divisions under contract, in order to complete the same within the time required by Act of Congress.

Accompanying this Report will be found in document "A," a printed form of general contract for grading, masonry, bridging, etc., containing the stipulations required by San Francisco, Sacramento and Placer counties; also, by the By-Laws of this Company in regard to liabilities of the counties and stockholders; also, printed document "B"—general specifications of the manner of executing the work of grading, etc.; also, printed document "C"—a form of release for right of way, etc.

I would also invite your attention to 48 specimens of rock from different localities, upon sections 22 to 50, showing the character of the material in cuts upon the work to be put under contract upon 1st Division; also, *seven specimens of gold, silver and copper ore*, from the vicinity of the line; also to two specimens of iron ore, one of asbestos, and one of soap-stone from the vicinity of the line.

Respectfully submitted,

THEODORE D. JUDAH,

Chief Engineer Central Pacific Railroad.