

# UNION PACIFIC RAILROAD.

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## REPORT OF JAS. A. EVANS

OF EXPLORATION FROM

## CAMP WALBACH TO GREEN RIVER.

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Montrose, Penna., Jan. 3, 1865.

SIR,—I have the pleasure of submitting the following report of explorations and surveys, extending from the eastern slope of the Black Hills, to Green River :

On reporting for instructions, at Omaha, Nebraska, early in April last, it was found, in consequence of the non-acceptance of one of the appointments made by the company, that the work originally designed for two distinct parties would have to be done by one. By giving that single corps additional strength, the supposition was entertained that it could cover the ground. Subsequent events fully justified the arrangement; hence the portion of line first assigned to the undersigned for examination, formed but a part of the country covered by this communication.

Preparations for our journey up the Platte river having been completed, I left Omaha on the 16th day of April, looking to Old Camp Walbach, at the eastern slope of the Black Hills, and on Lodge-pole creek, as our point of commencement.

In consequence of Indian difficulties on the border, I made application to Brigadier-General Mitchell for authority to procure escort, which was very cheerfully granted by him, and very promptly complied with by Colonel Collins, then in command at Fort Laramie.

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Travel was on the north side of the Platte river as Kearney, where we crossed, thence on the south side on the south fork, distant from Omaha 400 miles. In consequence of the hostility shown by the Indians, I telegraphed to the commander at (Col. W. O. Collins) for escort. With promptitude highly commendable, he immediately sent a detachment, composed of a lieutenant and twenty men of the Eleventh Ohio Volunteer Cavalry.

At Julesburg we crossed the south fork of the Platte river, a short distance below the mouth of Lodge-pole creek, up the valley of which we continued our journey. Some 40 miles up this tributary we met our escort, they having crossed the country from Fort Laramie for the purpose of intercepting, or rather meeting the party; they remained with us until the completion of our field work in September.

We reached the deserted ruins of Camp Walbach, situated in latitude  $41^{\circ} 21' N.$ , longitude  $105^{\circ} 15' W.$ , distant by travelled road from Omaha, 575 miles, on the 16th May. The instructions given me contemplated my noting the country along the line of travel.

As far as Fort Kearney, the country is favorable for the construction of a railroad; and the same is true of the entire route until we approach to within fifty miles of the Black Hills. For that entire distance, the uniformity of surface, the superior character of the material, and the small amount of mechanical work required, as bridge superstructure, masonry, &c., combine to make this portion of the line everything that can be desired. When we consider that such is the topography of the country extending over nearly ten degrees of longitude, we can safely come to the conclusion that a region more favorable for railroad purposes does not exist in this or any other country.

As we approach to within fifty miles of the mountains, the valley of Lodge-pole creek gradually changes; the distinctive smoothness of surface ceases, giving place to a more broken topography—by no means making necessary heavy or expensive grading, yet in marked contrast to the extreme uniformity of the lower part of its course, and of the valley of the Platte.

The only difficulty in the way of the engineer on the portion

of line above referred to, is the scarcity of timber. Confining my observations to the Platte valley, it may be stated that as far west as a point 80 miles above Fort Kearney, all the timber that seems to be available occurs on the Loup fork of the Platte, and on the Platte itself; principally cottonwood, with some cedar interspersed.

At and near Cottonwood Springs, distant from Omaha 285 miles, from Fort Kearney 90, the bluffs on the south side of the valley tend towards the river, approaching to within half a mile of the stream, and continuing parallel with it for some distance above and below. Here, in a district very broken, and somewhat difficult of access, a considerable growth of cedar is found, of excellent quality for cross-ties and kindred purposes. From this point to the mountains no timber is found, neither on the streams nor contiguous to them. The manner of supplying this portion of the line will be hereafter indicated.

#### BLACK HILLS.

On reaching the base of this chain of mountains, after a reconnaissance of the country in the vicinity of old Camp Walbach, I fixed the starting point of my survey directly south of the ruins, at a point distant 1,200 feet, and on the opposite bank of Lodge Pole creek. The line follows that tributary of the South Platte to its source at the summit of the range, overcoming, in a distance of  $14\frac{1}{8}$  miles, an elevation of 1,612 feet, giving an average grade of  $114\frac{2}{3}$  per mile. It was found necessary to undulate this grade, not however to an extent seriously to interfere with any traffic this part of the road may be called upon to do.

The accompanying map and profile will show the direction and arrangement of grades.

A sufficient supply of timber (yellow pine and spruce pine) can be obtained in this mountain chain, and contiguous to the line, to supply all the wants of construction, besides furnishing a large surplus for the line to the eastward, and for fuel.

The character of the material in excavation is indicated on the profile; specimens have been furnished. On the eastern slope it will prove to be granite, of different degrees of hardness and coarseness; on the western slope, sandstone exclusively. A tunnel 1,500 feet long is found necessary at the summit.

The gradient used from the summit of this range to the Laramie Plains is 2.5 per 100 feet, 132 feet per mile. A lighter grade cannot be used over this ground without a large sacrifice of profile and direction. A reference to the accompany profile will show this grade to be continuous for  $8\frac{1}{10}$  miles. Should this, or any other line crossing the Black Hills be the one finally adopted, additional or extra power will be required to make the ascent; knowing this to be the case, and knowing too, that any attempt to use a lighter gradient over the ground would result in giving a very expensive line, I came to the conclusion that a sufficient saving in grades could not be made, to compensate for the additional material it would be necessary to move.

Efforts were subsequently made by me and the party under my charge, to obtain a more favorable crossing of this range of mountains, but without success, the details of which will be submitted in their proper place.

By reference to the profile, it will be seen that on the western slope of the Black Hills depression amounting to 1,080 feet is overcome by means of a gradient of 2.5 per 100 feet. To reduce this to our maximum grade would require additional distance as follows:

43,200 feet at 2.5 per station = 1,080 feet.

49,091 " at 2.2 per " = 1,080 "

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5,891 " additional distance required.

By using a 2.2 grade, 116 feet per mile from the mouth of the tunnel, say station 780 to station 881, there inserting a switch, and running back half the distance, or 2,945½ feet, then switching again, we would be placed 99 feet lower at station 881 than we are now, and could reach the foot of the slope from that point with a grade of 116 feet per mile, striking the table at the foot, as we do now, which I consider important.

My reason for fixing upon station 881 as a point from which to switch back, is, that the requisite distance can be obtained there on a smoother slope, less cut up by ravines than elsewhere.

## LARAMIE PLAINS.

Soon after leaving the base of the Black Hills, our line crosses the main fork of the Laramie river.

From thence to the Rattlesnake Pass, at a point where the Medicine Bow range of mountains drop off into low ranges of hills of comparatively slight elevation, our line crosses the drainage of that mountain chain, and of the plains at nearly right angles. Some bridging will be necessary on this part of the route. For amount see item of "Bridging." The principal streams crossed are—

Main Fork of Laramie river.

Right hand Fork " "

Cooper's Creek.

Rock or Frappe's Creek.

Medicine Bow river.

The amount of grading necessary for the distance is light, the alignment excellent, the material good.

The Medicine Bow Mountains, distant from our crossing of the Laramie river 16 miles, are in good part covered with timber suitable for all kinds of construction. As our line proceeds westerly we gradually approach them, at Cooper's Creek we are distant but  $2\frac{1}{2}$  miles; from thence we run nearly parallel with the range until we flank or turn it by the Rattlesnake Pass.

The large amount of timber found here renders easy the solution of a problem that would otherwise be extremely difficult to solve, viz., the supply of timber for that part of the line west of the North Platte river, a country desert in character, destitute of vegetation, and impossible to avoid by any line following the valley of the Platte. This consideration alone should, and doubtless will, have great weight in the comparison of routes—when we consider, further, that the timber of this region is indispensable for the purpose of developing and making available the coal of Bitter Creek, too much importance cannot be attached to its fortunate proximity to the line.

Distance from the main fork of Laramie to the head of Rattlesnake Pass  $69\frac{1}{2}$  miles. The only difficult point for that distance

is the dividing ridge between Rock Creek and the Medicine Bow river.

Should it be considered desirable to lessen the gradients and obtain a smoother profile, by a sacrifice of distance at that point, a detour of four or five miles to the northward will accomplish it, as indicated by the dotted line on the map.

The fixed points on this section of line are, in my opinion, Station 1,520, near the crossing of the main Laramie.—the crossing of the Medicine Bow river—the head of Rattlesnake Pass.

Should explorations already, or hereafter to be made, demonstrate the practicability of a line *via* the south fork of the Platte and the Cache-la-Poudre Creek, the first point mentioned above would have to be made for the purpose of avoiding the broken ground at the base of the Medicine Bow range of mountains.

Our descent from the head of Rattlesnake Pass is made by a gradient of 116 feet per mile for five miles nearly.

This Rattlesnake Pass is a marked depression in the spurs forming the termination of the Medicine Bow range, which here loses the distinctive character of a mountain chain dropping off into ridges of slight elevation, stretching far to the northward, and forming the eastern boundary of the

#### VALLEY OF THE NORTH PLATTE.

The line here offers nothing remarkable, aside from the crossing of the North Platte river, which proves to be extremely favorable, being rectangular, and affording reliable foundations for piers and abutments. The amount of bridging required is 600 feet. It will be seen that our line makes considerable southing to reach this point. A short distance below our crossing the river enters a canon extremely crooked, bounded by perpendicular escarpments of sandstone rock, which feature it continues to have so far as the mouth of Pass Creek, some fifteen miles below.

Any line *via* Bridger's Pass will, from necessity, make this crossing of the river a fixed point, there is no means of avoiding it; hence I look upon the favorable character of the crossing as fortunate.

After passing the Rattlesnake Pass, the country changes sensi-

bly—everything indicating the approach to a barren region. The abundant pasturage of the Laramie Plains being here replaced by a stunted growth of sage brush. Grass is only found on the water courses, the more elevated points being almost entirely destitute of vegetation. This feature of extreme barrenness increases in intensity until the western terminus of the division is reached at Green river.

The topography of the valley of the North Platte river immediately bordering on the stream, and in the vicinity of our line, has been already referred to. The perpendicular walls of sandstone commence a very short distance below our crossing on the *eastern* or right bank. On the *western* side, the slopes are gentle for nearly four miles, from thence the vertical rock borders closely both sides of the river, continuing, as stated before, to the mouth of Pass Creek.

After crossing this river, our line continues down it to nearly the commencement of the cañon. We then leave the valley, and by easy grades reach Sage creek, striking the latter stream about two miles above its mouth.

No information can be given in a report of this part of the line other than what may be conveyed by the accompanying map and profile. The grades are light, the amount of excavation necessary small; building stone for what light structures may be needed, abundant.

Thirty-one and one half miles from the crossing of the North Platte river, brings our line to the summit of

#### BRIDGER'S PASS.

Although this is a point of some geographical importance, as forming the water-shed of two oceans, nothing formidable is encountered either in approaching or leaving it. The maximum grade on the eastern side is 2.05 per 100 feet. On the western, 2.18 per 100, and only for short distances.

The approaches to this and the Rattlesnake Pass are the points where the greatest obstructions from snow may be looked for. The location of the line in the vicinity of both has been made with reference to such contingency. In every instance where the nature of the ground admitted, without sacrificing

profile, the line has been thrown to the right, by that means placing valleys and depressions between it and the prevailing northwesterly winds.

Soon after crossing the divide or head of Bridger's Pass, we reach a branch of Muddy creek, down which our line runs to its junction with the main stream, which we follow a distance of fifteen miles to a point where it bends strongly to the southward, to form its junction with Little Snake river, of which it is a tributary.

The valley of Muddy Creek, as far as followed by our line, is extremely narrow, having but little flat or bottom land on its margin—much of the distance being what is termed in the phraseology of the mountains a cañon. Our line, in consequence, comes in frequent contact with the stream, and several changes of channel will be necessary.

By a judicious arrangement of grades, the work is rendered light in character. Where changes of channel are necessary, the embankment will require protection on the exposed side, by a lining of loose rock (rip-rap), the material for which purpose is convenient, abundant, and easily quarried. This stream (Muddy creek), it may be stated, is comparatively small and insignificant,—in June last it was nearly dry. During the melting of the snow its section is much increased.

From what observation I was able to make, I estimate its flood section to be 180 square feet.

After leaving the elbow of Muddy creek, the line passes over a country of long, flat slopes, crossing Bridger's Fork of Muddy. By means of a tributary and easy grades, we reach the broad table-land at the head of

#### BITTER CREEK.

The distance from the broad dividing ridge at the head of this stream to its junction with Green river, is 79 miles by our line, which keeps the valley for the entire distance with one exception, where we cut off a bend the stream makes to the northward, saving a distance of four miles at a very slight sacrifice of grade and profile.

The extreme scarcity of herbage for our stock made it neces-



sary to push over this part of the line with great rapidity. Extraordinary exertions were made by the party to reach Green river at the earliest possible time compatible with the interests of the survey. When I state that runs of 12 miles per day were made over this portion of the line, engineers will understand the anxiety manifested by those engaged in the work. The favorable nature of the surface (affording no choice of ground but that could be readily detected by the eye) enabled us to reach our terminus at Green river, in nine working days from the time we first touched the drainage of Bitter creek. The profile shows very light work until we approach to within six miles of Green river. It seems to be a characteristic feature of this region that streams form their intersection by means of narrow gorges, Bitter creek is no exception; the last six miles of its course is through a crooked cañon, the sides of which are composed of friable sandstone and shale.

Having understood that Mr. Reed, in charge of the party west of Green river, made his connection near Rock Springs, some 18 miles above the mouth of Bitter creek; it does not seem necessary to be minute in description of that part of the line.

#### TIMBER—FUEL—COAL.

From what has been already said in the first part of this report in reference to the supply of timber for the line east of the Black Hills, viz: the valley of Lodge-pole creek and the South Platte, it is evident that the surplus in the Black Hills and along the Medicine Bow Mountains, will have to be made available to supply the almost entire want of so important an item of construction on that part of the route. From Julesburg, on the South Platte, to Camp Walbach, at the foot of the mountains, is 175 miles. This distance will require 394,000 cross-ties alone. As the building of the road will probably be from east to west, this material will have to be furnished in advance of construction, by teams.

The superior direction, and consequent saving of distance from the Missouri river to Salt Lake City, via Lodge-pole creek, Cheyenne Pass, Fort Halleck, and Bitter Creek, over the much

longer road, via, the north fork of the Platte, and the South Pass, is fast diverting the travel to the former.

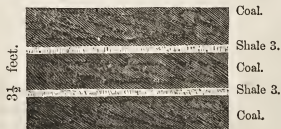
During the past season a large proportion of the emigration has travelled it in preference to the latter and older route. It is believed the Lodge-pole road will continue to grow in favor. By establishing proper and convenient places of deposit for ties along the Lodge-pole creek, much, and perhaps all this hauling could be done by empty return trains from Salt Lake. The mode of supplying the desert country on this division west of Rattlesnake pass with fuel (wood), ties, timber for bridges, &c., is obvious.

#### COAL.

The first indication of this mineral in place on the line occurs on Rock or Frappe's creek, in Latitude  $41^{\circ} 43'$ .

On the other side of the divide, near the Medicine Bow river, at station 3640 of our line, a seam of coal can be seen two feet thick, dipping south south-east, at an angle of 20 degrees. The coal is inferior in quality, being extremely dry and brittle.

East of Fort Halleck, coal is again found, probably of the same formation. At both of the places mentioned, some mining has been done, the coal from each having been used for blacksmith purposes with success. As to the extent of the deposit east of the North Platte river, the undersigned has no means of basing an intelligent opinion. It may be stated, however, that the places mentioned are not the only ones where coal is found east and north of the Medicine Bow mountains. The next coal found is near Sulphur Springs stage station of the Overland Stage Co., on Muddy creek, 14 miles west of the summit of Bridger's Pass. It is seen at the mouth of the Cañon, at a considerable elevation above the stream, and gives the following section :



This opening has been worked systematically, and is carried in a distance of 40 feet, with but little appreciation in the quality of the coal, it being like that found to the eastward, brittle and imperfectly mineralized. The station of the Overland Stage Company, at Sulphur Springs, is the headquarters of one of the divisions of their line; their blacksmith and repair shops are here. The object in making the coal opening, of which a section is given on the other side, was to save the hauling of coal from Bitter creek, whence they procure their supply.

At the shop I found some good specimens from that locality. I afterwards visited the opening from which they were obtained, and a specimen is now in your possession; an analysis of it will probably be made. At Black Buttes, 30 miles from the summit of Bitter creek, and on our line, where this coal occurs, several seams have been opened, one 5 feet, and one  $3\frac{1}{2}$  feet of clean coal. Frequent propping is required, in consequence of the broken, fragmentary nature of the roof. This is the hardest and best quality of coal found on the line. It may be stated that these are merely surface openings—other seams may occur at a greater depth; if so, they will be found of a superior quality, having a better roof. Some expenditure in sinking shafts will probably be necessary to determine fully the extent and value of this coal basin. As far as my examination and observation went, from this point (Black Buttes) to near Green river, the coal crops out of the bluffs frequently, and seems abundant.

*Approximate Estimate of Quantities.*

MASONRY.

| Reference to Profiles.         | From Station. | To Station.  | Miles. | Cubic yards<br>earth<br>excavation. | Cubic yards<br>solid rock. | Cubic yards<br>tunneling. | Cubic yards<br>ree culvert. | Cubic yards<br>arch culvert. | Cubic yards<br>and piers. | Timber in<br>sluces and<br>foundations. | Lineal feet<br>truss bridging. |
|--------------------------------|---------------|--------------|--------|-------------------------------------|----------------------------|---------------------------|-----------------------------|------------------------------|---------------------------|---|--------------------------------|
| Black Hills.....               | 0             | 1230         | 23.29  | 12,100                              | 804,700                    | 14,000                    | 1,171                       | 3,012                        | 1,167                     | 2,800 ft. B.M.                          | 600 feet.                      |
| Laramie Plains, No. 1.....     | 1230          | 2770         | 29.11  | 356,466                             | 24,000                     |                           | 163                         |                              | 225                       | 1,700 "                                 | 300 "                          |
| " " 2.....                     | 2770          | 3660         | 16.86  | 375,312                             | 120,274                    |                           | 365                         | 528                          | 225                       | 5,000 "                                 | 300 "                          |
| Laramie P. & Rattlesnake Pass  | 3660          | 5520         | 35.21  | 478,150                             | 205,462                    |                           | 478                         | 586                          | 178                       | 5,000 "                                 | 280 "                          |
| Platte Valley & Saige Creek... | 5520          | 7370         | 33.04  | 433,330                             |                            |                           | 423                         | 134                          | 992                       | 8,000 "                                 | 600 "                          |
| Bridger's Pass & Muddy Creek.  | 7370          | 9350         | 37.50  | 510,230                             | 20,000                     |                           | 94                          | 254                          | 1,088                     | 4,000 "                                 |                                |
| Bitter Creek, No. 1.....       | 9350          | 10970        | 30.70  | 209,580                             |                            |                           |                             |                              | 930                       | 12,800 "                                |                                |
| " " 2.....                     | 10970         | 12950        | 37.50  | 366,730                             |                            |                           |                             |                              | 1,280                     | 13,400 "                                | 400 "                          |
| " " 3.....                     | 12950         | Green River. | 24.48  | 267,820                             | 96,280                     |                           |                             |                              | 1,840                     | 14,400 "                                | 800 "                          |
| Total.....                     |               |              | 269.69 | 3,008,778                           | 1,270,716                  | 14,000                    | 2,694                       | 4,464                        | 7,640                     | 67,100 "                                | 2,980 ft.                      |

Average for 1 mile..... 11.156 4,712 51  $\frac{1}{2}$  9  $\frac{1}{2}$  16  $\frac{5}{16}$  28  $\frac{3}{16}$  248 ft. 11,156 ft.

It may be proper to state here, that no temporary structures are contemplated in the foregoing estimate. In all cases, even when there is a want of material, and where no located line would balance the excavation and embankment, the estimate has been made under the supposition that material would be borrowed for the purpose of making the fills. This has been done for the purpose of simplifying the estimate, and affording a basis to work from, in arriving at the cost of construction. The Black Hills are peculiar, in that the principal ravines on either slope are deep and narrow, with no ridges between, making it difficult obtaining the material necessary to fill them from the adjacent cuttings. On this part of the line the material is all rock. It is a question to what extent truss bridges or short viaducts may be used with advantage and economy. The crossing of Lodge Pole Creek on the eastern slope, a type of all of them, would compare in quantities, as follows:

|   |        |
|---|--------|
| 1st. Estimate for full embankment, cubic yds..... | 60,920 |
| Arch culvert masonry, " .....                     | 810    |

|   |        |
|---|--------|
| 2d. Estimate for truss bridge:          |        |
| Embankment, " .....                     | 12,360 |
| Masonry in piers and abutments, " ..... | 1,856  |
| Truss bridging, lin. feet.....          | 300    |

## BRIDGING.

|                                  | Lin. Feet. |
|----------------------------------|------------|
| Main Fork, Laramie River.....    | 350        |
| Lefthand " " .....               | 250        |
| Cooper Creek.....                | 50         |
| Rock, or Frappe's Creek.....     | 250        |
| Bear Creek.....                  | 50         |
| Medicine Bow River.....          | 150        |
| Pass Creek .....                 | 80         |
| North Platte River .....         | 600        |
| Bitter Creek, 17 crossings ..... | 850        |
| Green River.....                 | 350        |
| Total.....                       | 2,980      |

TABLE OF GRADES.—ASCENDING.

| DISTANCE. |                   | Grade         | Grade     |
|-----------|-------------------|---------------|-----------|
| Feet.     | Miles.            | per 100 feet. | per mile. |
| 7,000     | 1.325             | 2.8           | 147.84    |
| 43,700    | 8.276             | 2.2           | 116.16    |
| 44,400    | 8.409             | 2.0           | 105.6     |
| 7,600     | 1.439             | 1.9           | 100.32    |
| 16,600    | 3.143             | 1.8           | 95.04     |
| 22,500    | 4.240             | 1.6           | 84.48     |
| 42,500    | 8.049             | 1.5           | 79.20     |
| 37,700    | 7.140             | 1.2           | 63.36     |
| 30,700    | 5.814             | 1.0           | 52.80     |
| 83,000    | 15.719            | 0.8           | 42.24     |
| 94,400    | 17.878            | 0.5           | 26.40     |
| 34,400    | 6.515             | 0.3           | 15.84     |
| 32,400    | 6.136             | 0.2           | 10.56     |
| 46,900    | 8.880             | 0.1           | 5.28      |
| Total.... | 102,963....Miles. |               |           |

TABLE OF GRADES.—DECENDING.

| DISTANCE. |                   | Grade         | Grade     |
|-----------|-------------------|---------------|-----------|
| Feet.     | Miles.            | per 100 feet. | per mile. |
| 56,000    | 10.606            | 2.5           | 132.09    |
| 48,100    | 9.110             | 2.2           | 116.16    |
| 34,600    | 6.553             | 2.0           | 105.6     |
| 8,600     | 1.628             | 1.9           | 100.32    |
| 4,800     | 0.909             | 1.8           | 95.04     |
| 14,200    | 2.689             | 1.6           | 84.48     |
| 39,600    | 7.5               | 1.5           | 79.20     |
| 46,300    | 8.768             | 1.2           | 63.36     |
| 22,900    | 4.335             | 1.0           | 52.8      |
| 62,500    | 11.837            | 0.8           | 42.24     |
| 94,200    | 17.84             | 0.5           | 26.4      |
| 58,900    | 11.155            | 0.3           | 15.84     |
| 59,900    | 11.344            | 0.2           | 10.56     |
| 161,800   | 30.643            | 0.1           | 5.28      |
| Total.... | 134,917....Miles. |               |           |

|                         |         |
|-------------------------|---------|
| Distance ascending..... | 102,963 |
| “ decending.....        | 134,917 |
| “ level.....            | 31.81   |
| Total distance.....     | 269.69  |

TABLE OF ALIGNMENT.

| $\frac{1}{2}^\circ$ | $1^\circ$ | $1\frac{1}{4}^\circ$ | $2^\circ$ | $2\frac{1}{2}^\circ$ | $3^\circ$ | $3\frac{1}{2}^\circ$ | $4^\circ$ | $5^\circ$ | $5\frac{1}{2}^\circ$ | $6^\circ$ | $8^\circ$                |
|---------------------|-----------|----------------------|-----------|----------------------|-----------|----------------------|-----------|-----------|----------------------|-----------|--------------------------|
| Rad.                | Rad.      | Rad.                 | Rad.      | Rad.                 | Rad.      | Rad.                 | Rad.      | Rad.      | Rad.                 | Rad.      | Rad.                     |
| 11,459 feet.        | 5,730 ft. | 3,820 ft.            | 3,820 ft. | 2,292 ft.            | 1,910 ft. | 1,537 ft.            | 1,432 ft. | 1,146 ft. | 1,042 ft.            | 955 ft.   | 716 ft.                  |
| 1.05 miles.         | 24 89 m.  | 1.06 m.              | 6.12 m.   | 1.17 m.              | 22.23 m.  | 1.42 m.              | 6.13 m.   | 5.45 m.   | 0.28 m.              | 3.38 m.   | 1.49 m.                  |
|                     |           |                      |           |                      |           |                      |           |           |                      |           | Tangent<br>195.02 miles. |

Tangent ..... 72.31 per cent.  
 Curve..... 27.69 " "

Length of Tangent line..... 195.02 miles.  
 " " Curve " ..... 74.67 "

Total length of Division..... 269.69 "

TABLE.

|                                      | Latitude.   | Longitude.   | Altitude,<br>Feet. |
|--------------------------------------|-------------|--------------|--------------------|
| Camp Walbach.....                    | 41° 18'     | 103° 15'     | 7,000              |
| Summit of Black Hills.....           | 41° 16'     | 105° 29' 48" | 8,656              |
| Crossing of Main Fork of Laramie.... | 41° 18' 17" | 105° 34' 18" | 7,175              |
| Rattlesnake Pass.....                | 41° 45'     | 106° 39' 12" | 7,560              |
| Crossing of North Platte River..     | 41° 42' 20" | 106° 59' 45" | 6,695              |
| Bridger's Pass.....                  | 41° 41' 09" | 107° 30' 48" | 7,534              |
| Head of Bitter Creek.....            | 41° 31' 56" | 108° 16' 48" | 7,090              |
| Green River.....                     | 41° 32' 51" | 109° 30' 20" | 6,092              |

## REMARKS.

Soon after crossing the Black Hills with my line, I was impressed with the necessity of making a further examination of that range of mountains, both to the northward and likewise to the southward of the ground covered by my instructions; I should have done so then but for the following consideration: As stated before, my work was largely increased and extended in consequence of the non-acceptance of one of the appointments. I looked upon the necessity of having a line through as of the first importance. In accordance with that supposition I resolved to push my line to Green river, for the purpose of making my connection there, then, if time permitted, to return to the Black Hills for further examination.

The country west of the North Platte river proving much more favorable than was anticipated, enabled the party to reach the terminus on the 26th July. On the following day (27th) we started on our return journey.

I expected, if time permitted, on my return, to examine the country south of our main line over the Black Hills (the range being considerably less in elevation there), if possible avoiding the drainage of Crow Creek, and finally reaching Lodge-pole Creek by means of a tributary of that stream (south of the main branch which we followed on the eastern slope), and designated on the maps as Muddy Creek. After that was done, it was my purpose to examine the Cañon of the Laramie river, supposing that if



the latter afforded but ordinary obstacles to construction, the question of grades there would be an easy one, running, as this river does, completely through the range.

On reaching Fort Halleck, on my way back to this work, I found instructions requiring me, if possible, and if the state of my supplies warranted me in so doing, to return by way of the South Pass.

To make this part of my report intelligible, it becomes necessary to state here, that Fort Halleck was fixed upon as our base of supplies, and for obvious reasons, among which may be stated its central position with reference to the division, and the superior facilities it afforded for storage.

In pushing our line west, we left Fort Halleck with rations sufficient to take us to Green River and back to the fort. When we reached there on our return our stock of provisions required replenishing.

Had my instructions, therefore, found me at Green River instead of Fort Halleck, it would not have been possible to have complied with them.

I regard it as unfortunate that the possibility of our being able to return by way of the South Pass was not foreseen and provided for, and a different arrangement of supplies made to meet the emergency, as it would have enabled me to have based upon actual observation, what is now but conjecture and the observation of others.

When we left Omaha, the impression prevailed that the extent of the division would prove to be all one corps could accomplish during the season.

As stated before, the favorable nature of the ground, the fortunate proximity of the travelled road to our line, enabling us to move our transportation readily, and with despatch, combined with the strength and efficiency of the party, brought us to our terminus at least six weeks earlier than I anticipated.

The geographical position of Fort Halleck with reference to the South Pass will show the difficulty in reaching the latter.

Had our supplies been in shape it is very questionable if the integrity of the party could have been preserved. The ordeal our stock had passed through west of the North Platte River, made our teamsters extremely reluctant to traverse a similar

region still more extensive. That reluctance (had the order been given to retrace our journey) would have resulted in insubordination, and other and different arrangements for transportation would have become necessary. This I should not have hesitated about, however, had it been the only difficulty in the way.

Here Mr. Finney, first assistant, left the party and returned to the States.

I concluded, however, that I would carry out the programme I had already marked out, with reference to the head of Crow Creek and the Laramie Cañon; then, if rapid transportation and escort were provided me through the military authorities at Fort Laramie, I would go to the South Pass, taking with me a few men, for the purpose of examining the salient points on that line, the party returning to the Missouri meanwhile.

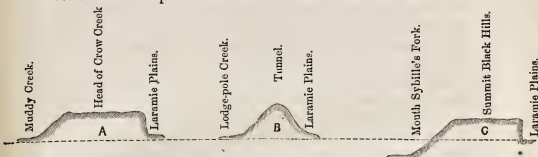
The result of our labors in the Black Hills, south of our main line, may be summed up thus: The starting point (running back) of the branch line is a little west of our crossing of the main fork of Laramie River. Distance from the point of divergence to the foot of the range by main line  $5\frac{1}{2}$  miles, by branch line 9 miles, caused by the latter striking the range more diagonally. The broken nature of the surface after touching the Black Hills, had the effect of keeping us constantly at the foot of the slope. When it became necessary to turn to the left for the purpose of preserving our direction and to prevent our being thrown into the tributaries of Crow Creek, the elevation was found to be greater than we could surmount.

Explorations have been made since on the Cache-la-Poudre Creek; in the country to which this line would have carried us, had we continued it, and is probably the line with which Mr. Case connected his survey.

It must be understood here, that our labors were done with a view of still making the valley of Lodge-pole Creek our eastern continuation.

Our journey to the Laramie Cañon was by way of Camp Walbaeh and the valley of the Chugwater to near its mouth, where we crossed a low divide between it and the Laramie River; thence up the latter to near the mouth of Sibylle's Fork,

where we established a camp, intending to devote some time to an exploration of the hills in that vicinity, the Cañon of the Laramie and the valley of Sibylle's Fork. On producing a line 25 miles up the latter, we found it did not penetrate the range with anything like a distinct valley, besides carrying us far to the southward. My explorations and observation now enable me to form an idea of the several crossings of the Black Hills. The sections will compare as follows :



Section A.—From Muddy Creek to Laramie Plains.

B.—Section on main line.

C.—Sybille's Fork to Laramie Plains.

It will be seen that both the sections A and C are lower than the crossing of our main line. What constitutes their inferiority is the great rapidity of the descent where it does occur. The Laramie Cañon remains to be noticed.

I approached this part of my labor in the mountains with no little interest and solicitude. As our main line progressed across the North Platte River, over Bridger's Pass, and over the country between Muddy Creek and Bitter Creek, a sufficient knowledge of the country north was obtained to show the feasibility of a line, striking the Medicine Bow River at its elbow, the North Platte below the mouth of Pass Creek, then north of Bridger's Pass, and by means of some one of the valleys leading into Bitter Creek from the northeast, forming a junction with our line in the valley of that stream.

The Laramie Cañon seemed to be the key to this route.

It will be understood, then, that the importance of this gorge was not underestimated by me—no information could be obtained as to its character, even from mountain men, supposed to

be familiar with all the nooks and gorges of a country in which they had spent the whole of their manhood, and no small portion of their declining years. While camped within a mile of its terrible chasm, projecting points obscured it so entirely from view, that had it not been for the river rushing by our tents and the previous knowledge of its existence, it might have been passed unnoticed.

Taking with me Messrs. Dutton, Sladden, O'Neil, and Booze, of the party, I started from camp 74 on the morning of August 30, with the intention of tracing the river through the gorge. It is unnecessary to detail the difficulties we encountered in proceeding up it on merely a prospecting tour.

The river has evidently cut its way through the range, composed principally of granite and gneiss; its channel is extremely crooked, hemmed in closely by (for the greater part of the distance) vertical walls of rock, ranging in height from 500 to 1,500 feet—what room there is is occupied solely and exclusively by the bed of the torrent. Where it cuts through the cone of the range it forms a succession of rapids for miles, descending, it is estimated, from 3 to 5 feet in 100; these rapids would form a great obstacle, were the sides of the gorge otherwise favorable and the curvature such as could be overcome. From the necessity of keeping close to the water, (as where the walls are not vertical, the talus, at the foot is insignificant, and by no means continuous), it will be seen that the grade would have to undulate with the descent of the stream, and no advantage could be taken of distance to overcome *extraordinary* elevation at any one point. In overcoming a distance of 12 miles in a direct line, this river must run through 22 miles at least of cañon. For a portion of the distance it more than doubles itself. Two cases were noticed particularly where the stream is only prevented from forming a perfect ellipse, by a vertical wall of gneiss 1,000 feet high and 700 feet through from water to water. The cases above were noticed as extraordinary, but the whole distance is a succession of short bends, many of them forming greater obstacles still to the construction of a line. A succession of tunnels and bridges would be required for almost the entire distance. Taking this view of it, I did not think it necessary to run any line up it. It seemed now that we had, either by actual trial or observation,

examined everything within accessible distance that promised an opening.

On the 1st September, I started for the eastward with the party, expecting, when I reached Fort Laramie, to learn by telegraph, something to govern my future operations.

At Fort Laramie I telegraphed for instructions. The reply was, in effect, a permission to send the party back, and a request to go to the South Pass myself for the purpose of observation.

In accordance with, and from a strong desire to comply with the request, as well as a wish on my own part to be in possession of facts necessary to institute a comparison between routes that seemed likely to come into competition, I started the party from Fort Laramie for the Missouri river, on the 5th September, remaining myself, with the intention of going up the North Platte, for the purpose mentioned.

My only reliance for transportation, rations, &c., being on the ability and courtesy of the commanders of the different military posts, no arrangements having been made through the commander of the district.

The Indian difficulties having their origin in the spring, had increased in intensity, until during the summer, the whole frontier (including the valley of the North and South Platte) was rendered insecure. At the time of my arrival at Fort Laramie, the several posts along the North Platte river, from Fort Laramie to the South Pass, were considered in danger. It is certain they were but feebly garrisoned, and incapable of offering anything like a protracted defence. This feeling of insecurity, coupled with the difficulty of procuring transportation and the consciousness of being so entirely subject to the movements of others, forced me reluctantly to the conclusion that I could not do what I desired with the requisite despatch, if at all. I, therefore, left the post with the purpose of overtaking my party, which was done on the following day.

Our return was along the telegraph road, striking our outward line of travel on the Lodge-pole Creek, 40 miles above its mouth.

By the exercise of constant vigilance, through a country from which the inhabitants had been forced to flee, and where the savages were decidedly hostile, we safely reached Omaha, with but slight interruption, on the 25th day of September.

It may be deemed a subject of congratulation that we returned without the loss of a single member of the party, with our stock entire, and everything in good order.

#### CONCLUSION.

By using the accompanying table of latitude and longitude in connection with a map of the country, it will be seen that in point of direction, the line of which this report is descriptive, stands pre-eminent. Taking the junction of the North and South forks of the Platte River, as a common starting point, the distance by way of Fort Laramie, through Valley of the Sweet-water, and through South Pass, would, under the most favorable circumstances, be increased 70 miles over this line.

In addition to the above, the Bridger's Pass route affords a much larger amount of valuable timber contiguous to it, than the line by the South Pass. A very important consideration, and one by no means to be overlooked.

Coal is said to occur on the North Platte, above Fort Laramie, as well as on Bitter Creek; both of these coal deposits should receive the closest scrutiny before any route is finally decided upon. My opinion is, and I give it with diffidence, that the result of such investigation will be to entitle the route *via* Bridger's Pass to still greater consideration. From some little observation of the valley of the North Platte, near Fort Laramie, from hearsay, and from the profiles of military engineers, I am led to believe that the upper route is by no means one of continuously ascending and easy grades, as far as South Pass even. In some instances it will be found necessary to leave the valley of the stream on account of cañons and narrows.

Some distance below Fort Laramie the North Platte ceases to be a river of the plains.

Twenty-five miles above that military post, it runs through what is called Horseshoe Cañon. Here spurs of the Black Hills extend some distance to the eastward and across the river. Major Bridger, in a conversation I had with him at Laramie, was very emphatic in stating that no line could pass up it. The alternative, in his opinion, was to leave the valley of the river below the Fort, follow up the Rawhide Creek, striking

the Platte again at or nearly opposite the mouth of La Bonté Creek. This would be leaving the valley of the Platte for a distance of 45 miles.

I do not mean to be understood that there is anything insurmountable here; only to show some of the obstacles that may be expected on this route, not only at the Horseshoe Cañon, but at Red Buttes, still further up, at the mouth of the Sweetwater, and at Devil's Gate, on the latter stream.

As the South Pass route will probably be examined, it does not seem necessary for me to follow the comparison further. I have merely given what information I was able to obtain.

I cannot close this communication without making one or two suggestions for the benefit of the Company in future explorations, as conducing to the efficiency of parties in the field, as well as the comfort mentally of those who may have charge in conducting the surveys.

There is no probability that the Indians will be more peaceable during the coming season than they have been during the one just past. Parties of engineers going there, unless protected by escort, will be subject to interruption and delay, if nothing more. The efficiency of the escort depends in a great degree upon the ability and attention to duty of the officers temporarily in command. My suggestion is, that the engineer in charge of the party should, by means of some arrangement with the War Department, be able for the time being, to outrank the commander of the escort. By no other means can unity be preserved and a conflict of authority prevented.

The other suggestion is, that either the Company, or head of the party should *absolutely own* the means of transportation. We suffered no inconvenience in consequence of this defect in our organization, but I can now see, how easily contingencies might have arisen, making it necessary to remodel this part of the organization of the party, a thing difficult of accomplishment in the Rocky Mountains.

In conclusion, I wish to acknowledge my obligations to the members of my party.

To F. N. Finney, 1st Assistant, I am particularly obliged for his valuable assistance so cheerfully rendered while he remained with the party.

From Messrs. Dutton, O'Neil, Furguson, and the remaining members of the corps, I received valuable assistance, for which they are not only entitled to my thanks, but to the consideration of the Company.

Praise is due Colonel W. O. Collins for his promptitude in furnishing escort.

To —— Jones, Esq., now of Salt Lake City, then in charge of the sutler's establishment, at Fort Halleck, I am obliged for several acts of kindness, among which may be mentioned his liberality in furnishing us with room for storage without charge.

Respectfully submitted,

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