

COPIED IN NY
To the Board of Directors of the
Penn. & Maryland Pipe Line Railroad Company
Huntington

The undersigned having been appointed by your Board to make an experimental survey, and estimate for a Railroad from Peru in Meigs County, through Kokomo the County seat of Howard County, to the County seat of St. John County; Northville the County seat of Hamilton County to Ludwigsburg, beg leave to submit the following Report

In the latter part of August last, I organized a party ^{Peru} and commenced operations by first and proceeded to ~~Peru~~, making the necessary examinations for the best crossing of the Mahesh river and the most eligible point ^{at which to pass} ~~at which to pass~~ summit of the

As a direct line from Peru to Kokomo would cross the Mahesh valley where the hills adjacent are almost perpendicular 120 feet, it was necessary to occupy some ~~valley~~ ^{disposition} having into the Mahesh ~~valley~~ ^{which} the high lands could be reached by a more gentle inclination

The three most practicable ~~valleys~~ are the Steady creek - Semestons branch and Maple creek valleys

In order to reach the mouth of the Steady creek valley, the line ~~occupies~~ the Mahesh valley about 1 1/2 miles above Peru ~~on Semestons branch~~ making an angle of near 90 degrees with the course to Kokomo ~~The valley at this point is 29 feet above low water of the River at Peru~~

From this point the general direction of the valley is South, but so many abrupt changes of direction occur and as to require curvature highly objectionable as the valley is too narrow to admit of proper curves without ~~great~~ expensive cutting into the high banks on either side - The rate of ascent is also too great - The mouth of the valley is only 29 feet above low water in the Mahesh at Peru, and this ~~head~~ ^{head} in a distance of 11 miles raised to an elevation of 125 feet

The valley of Simulone branch is entered, from the south
end of Cass street in Peru, on a course making an angle
of near 45 degrees with a direct line to Holcomb - although
a line up this valley would be more direct to Holcomb,
than the Treaty creek line, yet the same objections ^{occur} as to cur-
vature and rapidity of ascent ~~over the same~~ ~~as the~~ ~~same~~
~~fact~~ - The valley ~~now~~ is a distance of ~~feet~~
rate of ascent is about the same, yet the valley is not so
wide and the difficulty of following it ~~was~~ ^{correspondingly} ~~could~~
increased

Little Pipe creek empties into the Nabresh about $\frac{1}{2}$ miles below Plover - The Valley is much wider - than either of the others its course varies but little from the canyon to Kottomo is ~~not exposed~~ ~~sufficiently direct to~~ ~~a line of~~ ~~ascend~~ ~~overcome with gradients of~~ 40 ft to the mile, at a moderate cost, makes it by far the best route for a road from Plover to Kottomo - This line has another important advantage over the other two; in the rock bottom that here occurs in the Narrows where it crosses, allowing a bridge to be constructed more securely at a less expense than at any other point.

determining this valley the only practicable one for a road
 from Peru to MoRono, I commenced ^{the present century} in the town of
 Peru at the crossing of Cuzco & Main streets and ran
 down ^{the system of the Matruh on} the north side of the ^{about 1 1/2 miles} Matruh river, to a point, respects
 the proper entrance of the Pyrenean valley - As the
 town of Peru is situated in the valley of the Matruh on
 a plain gradually sloping towards the river, it is accessible
 with little variation in expense, by a Railroad at any point on its
 North Western boundary - The question therefore of the proper terminus
 of the road here, was not investigated, as its will
 ultimately be settled by circumstances independent of the character
 of the ground, which will be better developed and more
 perfectly understood, when the road is finally located.
 Then at this time - The line however now under

hills bordering it, rising generally to a height of nearly 70 feet above the surface of the stream. We however selected the best crossing that could be found in the vicinity, having the advantages of depressions ~~between~~ on both sides formed by the drainage of two small streams in the valley here. ~~It is not the case~~ less than its average width, and the stream runs upon a bed of solid limestone. The structure, estimated for, this stream is similar to that at the Naback, being a Bridge of 100 feet span, supported by stone abutments. Although the piers at this point have never yet been opened or the durability of the stone tested yet from ~~roads across~~ the inspection that ~~that structure~~ ^{being sufficient} ~~made~~ I made, I have no doubt of their durability ~~of the structure~~ for the structure contemplated —

for the structure contemplated —
From the crossing at Big Pipe and the line is straight to the
town of Holcomb a distance of 12 miles, passing with very
easy grades over the summits between Big Pipe &
the North Fork of Deer Creek that between the N &
S forks of Deer Creek, and that between the South
fork of Deer Creek and Wild Cat — The surface
of the country on this part of the route ~~is~~ ^{is} ~~very even and unbroken~~
^{between the streams of consequence} is very even and unbroken,
by any cross drainage, being formed of ^{regular} inclined planes from
each stream to the adjoining summit, offering every fa-
cility for the formation of a good road bed with very
little expense — The embankments at the crossing of
the valleys of these streams is light, being only suf-
ficient to protect the track and Bridges from the highest
floods — ~~North & South Deer creeks are crossed by substantial~~
^{North & South Deer creeks are crossed by substantial}
well built bridges of sufficient ~~height~~ ^{to pass the}
streams at their greatest height, and so protected as

to be safe secure from any ~~danger~~ ^{of} the increased ~~and~~
rapidly of their currents —
~~the East end of the~~
The line passes ~~the town of Holabon~~ ~~and~~

~~street~~ ~~by~~ ~~cracked~~ ~~wild~~ ~~cut~~ ~~at~~ ~~the~~ ~~terminations~~ ~~of~~
Market Street - The creek can be crossed at this point for
haps with less expense than at any other, near the town, yet
should other causes require a different location in the
town, the increased expense of crossing for ~~excursion~~ at
any point below this within the town limits, would not
offer ~~any~~ ^{material} obstacle
~~to~~ ~~the~~ ~~proposed~~ ~~project~~ ~~the~~ ~~project~~ - The final
location of the line here will consequently depend upon
other circumstances or ~~advantages~~ arising from the vicinity
or rivalry of the different ~~sections~~ portions of the
town - The estimates provided for crossing Wild
cat, on a permanent arched wooden superstructure
of 120 feet span, supported by stone abutments, founded on
a solid timber foundation placed below the lowest water
level of a gully sufficiently good, can be got a short
distance from the Reno site, and from the appearance
of the stone below this point there is every reason to be-
lieve ~~that~~ ^{it can be founded in} the bed of the creek at the crossing, yet
it is probable that its depth below the water will
be such as to under a timber foundation much more
economical.

After crossing the valley of Wild cat, a very ~~open~~ ^{very} curve
is made, comprehending an angle of ~~21~~ ²¹ degrees and
the tangent carried from that point to the town
of Lepton a distance of 15 miles - The line
in this distance crosses the dividing ridge between
Wild cat and Skokholm creek - that between Skokholm
creek and Mud creek and between Mud creek
and Turkey creek and that between Turkey
creek and Greene - But the slopes of these
ridges are so gentle in their inclination, and the
summits at such a small elevation above
the adjacent streams, ~~gradients~~ ^{gradients} varying
but little from a level, follow the surface of
the country so nearly, as to require but

little more than side drainage ~~to~~ ~~from~~ the road-bed -

Each of these streams is crossed upon substantial trestle bridges, well secured from the effects of high water & the foundations of the Bents so arranged as to be used hereafter when from decay it may be necessary to replace these ^{with} structures by means of a more permanent character - The embankment across the valley of these streams, which constitutes the only heavy work on this portion of the line is unusually light for streams of their dimensions -

The line passes through the western part of the town of Lipton, but as the town is situated upon an unbroken plain its final location may hereafter be made through any portion of the town, that the interest of the Company may demand -

Immediately after passing Lipton, another curve is introduced, varying the direction of the line 9 degrees to the West, and a straight line maintained from this point to the crossing of White river a distance of 14 miles - This tangent crosses the East-bank of Cicero and B near the town of Lipton and gaining the summit between the East Street Forts ~~by~~ by a very gentle acclivity, continues on the ridge dividing ridges for a distance of 8 miles where it again crosses the East Fork, near the town of Cicero - From thence it crosses the dividing ridge between Cicero and White river and descends into the valley of the river, ^{by means of} ~~occupying~~ a depression here found in the high ground adjacent to the river formed by a small branch emptying into the river at this point - The embankment at the first crossing of Cicero is light for a stream of

Elder the valley! It
of that age, being cradled very favorably, and
the adjacent high ground reached with an easy
grade ~~with~~ ^{and} little excavation - From this summit
to the second crossing of Cicer the ground is unusually
even and ~~uniform~~ gently descending with the stream
and but seldom broken by cross drainage - at the
second crossing however, the ground runs much higher above
the level of the stream, and necessarily requires both
Excavation & Embankment for a short distance
of a heavy character - While River is crossed
about 1 1/2 miles above Noblesville, at a point, better
^{I think} adapted, to a cheap and safe crossing than any
other in the vicinity - ^{to the north end of the} ~~On the~~ ^{gentle} ~~high~~ ^{valley of the} ~~road,~~ ^{stream} allows a, descent to the, ~~with~~ ^{with} but little excavation - On the south the
~~total~~ ^{total} ~~height~~ ^{height} elevation of the ground is just sufficient
to place the road ~~up~~ at a proper height to cross
the river, and the valley between is contracted at this
point to about one half its usual width -
The structures ~~envisaged~~ ^{envisaged} for both crossings of Cicer, cross
~~each other in a curve at both points by the~~
Bridges are upon the ~~same~~ ^{same} plan before noticed, the
foundations so arranged - as to be available when
it becomes necessary, advisable to replace these
structures ~~by~~ ^{with} permanent
~~structures~~ ^{with} ~~the~~ ^{the} ~~same~~ ^{same} ~~plan~~ ^{plan} ~~for~~ ^{for} ~~white~~ ^{white} ~~river~~ ^{river} ~~consequently~~ ^{consequently}
a Bridge of two spans each 150 feet the upper
structures being of the same character as that estab-
lished for the Wabash - In consequence of it
being impossible to procure stone here, at any reasonable
expense, the abutments, ^{spiers} are to be formed of wood
firmly tied together, and filled with gravel - the
foundations ^{are} so arranged as to be used when
by decay it becomes necessary to ^{rebuild} ~~rebuild~~ ^{the} ~~the~~ ^{abutments} ~~abutments~~
and ~~with~~ ^{with} ~~the~~ ^{the} ~~same~~ ^{same} ~~plan~~ ^{plan} ~~for~~ ^{for} ~~white~~ ^{white} ~~river~~ ^{river} ~~consequently~~ ^{consequently}
a small expense at the stone in the vicinity of the
northern terminations of the Road

After crossing White river the line curves to the West and traverses the eastern border of the town of Nobleville. For the same reasons before given with regard to the location of the line in Scotland and Dayton, the line may hereafter be placed in Nobleville, where the interests of the Company will then indicate. The only disadvantage arising from placing the line on different ground from that now occupied would be an increase of the curved part of the line - other advantages however may be offered in a change which would more than compensate for this.

At Nobleville another curve is rendered necessary in order to make the best crossing of Stony creek which is found one mile from the town and about $\frac{3}{4}$ of a mile above the mouth of the creek. It is here found necessary to occupy a depression in the high ground on the south side of the creek, as the hills rise to such a height on this side of the stream as to render a crossing otherwise very expensive. This stream is crossed by means of a brush bridge of the character before noticed. The embankment across the valley of the stream, and the excavation necessary to allow the summit on this south though less at this point than ^{they would be} ~~found~~ at any other crossing in the vicinity are still more than is usually encountered in crossing such streams.

After crossing Stony creek the line ascends to the summit of the dividing ridge between the Waters of Fall creek and White river and by the introduction of two slight curves, the continues on the ridge with very easy grades of ~~ridges~~ ^{ridges} followed for a distance of ~~11~~ ¹² miles - ~~to the foot~~

~~about for the crossing of Fall creek~~ passing about $\frac{1}{2}$ miles East of the town of Allisonville, on ground very favorable for the cheap construction of the road in the country.

and Indianapolis Railroad) - one passing the town on the East the other along the River bank of the Canal on the west. - As the best location of a Depot at this and the best ^{part of} ~~most~~ ^{of} going along with the main road ~~and~~ ^{and} ~~point~~ ^{can} ~~best~~ ^{be} made, after the matter is investigated and more fully understood by the Agents, it was considered preferable not to postpone the location in the town, until a final location of the road renders it necessary.

In our experimental survey of the character derived by your Board, it cannot be expected that the line would be placed at all points on the precise ground that it should occupy - and in the line we have surveyed there are doubtless many parts of it that a final and wise adjustment of the peculiarities of the ground, will change from the position it now occupies - All these changes will no doubt render it less expensive than the one ~~now~~ ^{estimated} - At the head of the Little Pipe creek valley it is very probable that the curved part of the line can be diminished and the cutting and filling not increased -

At the crossing of Big Pipe creek, a small deviation from the present line will diminish the earth work ^{considerably}. The embankment at Hollows creek can be lessened by a slight change of the line to the West.

The heavy embankment and deep cut at the second crossing of Cicero creek, ~~from~~ it is probable may be diminished by throwing the line farther down the creek ~~and the bridge~~ ^{and the bridge} would then ~~be made to~~ ^{approach} near the town of Cicero, but the length of it would be proportionally increased. The best location here can only be settled after a careful ^{examination of the} ~~comparison~~ ^{ground and a comparison of the different routes} -

It is ^{also} probable that the line after crossing Stony creek ^{if it cannot follow a direct line to Indianapolis as far as falls over the} ~~may~~ ^{may} be made more direct ~~to Indianapolis~~ ^{than it now is}, by crossing Big branch below the present crossing, without affecting the cost of construction.

The scenery from Pen to Enguapah is characterized throughout its whole extent by rich alluvial valleys of the streams exhibiting a soil unsurpassed anywhere for its adaptation to all the purposes of cultivation, and its flat unbroken table lands, which in many places are yet improved, owing to the obstructions offered by decayed timber and vegetation to its drainage appears to be too best for profitable cultivation. But this wet land is invariably found to occupy the highest level, and to afford every facility for complete and cheap drainage and indeed experience has shown that all such land needs but to be exposed to the sun and to have its natural drains opened, to become the most productive for the labor bestowed upon it.

With the exception of a few miles ^{of this large} in the vicinity of Pen and some 3 or 4 near Enguapah, Oak timber of the finest quality can be conveniently obtained in great abundance. So far as this material is used in the construction of the road, the cheapness and facility with which it can be procured, will render this item of construction much less than is usual upon works of this kind.

Stone of a desirable can be procured now, only in the northern part of the line extending as far South as Wild Cat Creek. Consequently for all structures south of this point timber has been estimated. These structures have always been so arranged however, as to make their renewal with stone, ~~when it came to be transported over the road without the aid of a horse or mule~~ ^{when it came to be transported over the road without the aid of a horse or mule} ~~without interfering with its transportation~~ ^{after the road is constructed} ~~the foundations are also~~ to be permanent, being made suitable for stone structures and placed below the low-water where they will not decay.

For convenience of calculation the estimate for the gradations of the line is divided into

4 divisions - The first cutting from Peru to No-Horn
the 2d from No-Horn to Lipton, the 3rd from Lipton
to Nohlesville and the 4th from Nohlesville
to Indianapolis - These divisions are again subdivided
into sections of convenient lengths to be entrusted in contracts
to individuals - The graduation has been estimated
for a single track - The embankments 14 ft wide at
the grade line, with side slopes of $1\frac{1}{2}$ to 1 - The
excavations 20 ft wide, with side slopes of $1\frac{1}{2}$ to 1 -

The bridges however designed as permanent structures
have been estimated of sufficient width for two tracks

The clearing of the way has been estimated \$800 per
mile, agreeably to the terms of ~~the~~ charter of the company

The estimated cost of the graduation of the first division
is shown in the following table

Estimate of Graduation from Peru to Rockwell

No of Section	Length in feet	Cost of Construction in \$		Length of Curves in feet	Radius of Curves in feet	Length of Tangents in feet	Ascend of grade line in feet	Descent of grade line in feet	Total elev. line above bottom of Canal at Peru	Distance from Peru in Miles & feet	Description of work
1	4200	1118 00				4200		2.57	16.10	0-4200	Earth work N. Side of Malash river
2	2400	1514 00		700	2560	1700	6.30	0.90	21.57	1-1320	do do
3	1200	23,983 00		600	"	600	3.50		28.11	"-2570	Bridge across Canal & Malash River and Embt
4	2100	4,493 00		2100	"		10.61		35.61	"-4620	Embt Malash & Ripe cutt valleys
5	4500	5,366 00		4200	1910	300	34.11		69.72	2-3840	Bridge over Little Ripe & Embt.
6	5100	9,515 00		4100	"	1000	35.66		108.38	3-3660	do " N. side do & do
7	5100	5,048 00				5100	38.66		147.04	4-3480	Earth work
8	6300	2052 00				6300	26.28	9.00	164.32	5-4500	do do
9	4200	15,135 00		600	1910	3600		31.53	132.49	6-3420	Bridge over Big Ripe & earth work
10	4800	8,892 00		900	"	3900	34.57		167.36	7-2940	Earth work
11	4800	1,027 00				4800	17.55	3.26	176.65	8-2460	do do
12	5400	710 00				5400	4.31	9.00	171.96	9-2580	do do
13	4200	804 00				4200		18.40	153.56	10-1500	do do
14	3600	1,708 00				3600	1.56		155.12	"-5100	Bridge N. side Bear creek
15	5100	972 00				5100	23.11		178.23	11-4920	Earth work
16	4800	804 00				4800	7.88		186.11	12-4440	do
17	5100	1,140 00				5100		2.21	183.90	13-4260	do
18	3600	4,502 00				3600	15.92	11.37	188.45	14-2380	Bridge S. side Bear creek
19	3600	1,103 00				3600	11.41		199.86	15-900	Earth work
20	5100	755 00				5100	5.64	7.23	198.27	16-720	do do
21	6300	1,293 00				6300	4.60	4.75	198.12	17-1740	do do
22	4800	693 00				4800		7.64	190.48	18-1260	do do
23	5100	542 00				5100		11.31	179.17	19-1080	do do to N. side of Rockwell
		97,199 00		13,200		88,200					

From an inspection of this table it will be seen that the total cost of the graduation of the first division embracing a distance of little more than 19.2 miles is \$92,199.00 - being an average of \$4,820.00 per mile. The ~~length~~ length of curved line $2\frac{1}{2}$ miles, with Radii varying from 2800 to 1900 feet -

The Grades on this division are as follows:

Level	—	—	—	1 mile - 2820 feet
Inclination from level to 5 ft per mile	—	—	—	2 " - 2940 "
do " 5' to 10 ft " "	—	—	—	2 " - 2340 "
do " 10 to 15 " "	—	—	—	2 " - 2640 "
do " 15 to 20 " "	—	—	—	1 " - 120 "
do " 20 to 30 " "	—	—	—	3 " - 3060 "
do " 30 to 35 " "	—	—	—	— 5700 "
do " 35 to 40 " "	—	—	—	4 " - 3180 "

Cost of Graduation of Second Division, from Kellome to Tipton

Station	Length in feet	Cost of Construction	Curved Line in feet	Radius of Curve	Length of Tangents in feet	Ascent in feet	Descent in feet	Total elevation above bottom of canal at station	Distance from Town in miles & feet -	Description of work
24	4200	9,336 00	2600	5730	2100	6.66		185.83	20-0000	Bridge over Wild Cat
25	6000	1,389 00			6000	16.90	10.25	192.48	21-720	Earth work
26	5400	4,727 00			5400	22.74	13.65	201.57	22-840	Bridge over Kelle creek
27	4800	1,143 00			4800	16.99		218.56	23-360	Earth work
28	5100	752 00			5100	6.07		224.63	24-180	do do
29	5400	799 00			5400	10.29		234.92	25-300	do do
30	3900	560 00			3900	4.56		239.48	25-600	do do
31	4800	763 00			4800	5.56		245.04	26-320	do do
32	4800	2,270 00			4800	3.20		248.21	27-320	Bridge over Mud creek
33	4200	699 00			4200		2.61	248.63	28-2160	Earth work
34	2700	537 00			2700	1.61		247.24	" - 4860	do do
35	5700	686 00			5700		1.08	246.16	29-4680	do do
36	5700	1,711 00			5700	2.45		248.61	30-5700	Bridge over Turkey creek
37	5700	833 00			5700		6.50	242.11	32-240	Earth work
38	5700	604 00			5700		4.45	237.66	33-60	do do
39	4800	631 00			4800		2.69	234.97	" - 4860	do do to North side of Tipton
	77,700	\$27,442 00								

Length of this division 14.71 miles
 Total cost — \$ 27,442.00
 Average cost per mile 1,865.53
 Length of curved line 2100 feet
 Radius of curve 5730 feet
 The Grades are as follows:

Level	—	—	2100 feet
from level to	5 feet inclination	—	6 miles 1920 "
"	5 feet to 10 "	"	— 2 " 2400 " +
"	10 " to 15 "	"	— " 4500 "
"	15 " to 20 "	"	— " 4500 " +
"	20 " to 25 "	"	— " 4200 "
"	25 " to 30 "	"	— " 3600 " +
"	30 " to 35 "	"	— 1 — 1620 " +
"	35 " to 40 "	"	— 1 — 2220 "

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Cost of graduation of Third Division, extending from Tipton to Noblesville

No of Section	Length in feet	Cost of Construction	Length of curved line in feet	Radius of curve in feet	Length of Tangent in feet	Angle in feet	Percent in feet	Station along bottom of channel as shown	Distance from P.M. in miles and feet	Description of work
40	4200	2,347.00	900	5730	3300	1.71	4.60	232.05	34-3780	Bridge at first crossing of Green creek
41	5100	672.00			5100	7.98	4.01	236.05	35-3600	Earth work
42	4200	590.00			4200	7.41	5.81	237.62	36-2520	do do
43	4500	847.00			4500	4.37	12.97	229.02	37-1740	do do
44	4500	851.00			4800	7.29	4.57	231.74	38-1260	do do
45	4500	754.00			4500	7.41	8.57	223.97	39-480	do do
46	5100	1,498.00			5100	4.35	4.65	223.64	40-300	do do
47	4800	870.00			4800	8.10	4.92	226.82	41-5100	do do
48	3900	482.00			3900	1.59	5.73	222.98	41-3720	do do
49	3300	1,273.00			3300	3.77	2.16	224.59	42-1740	do do
50	4200	564.00			4200	7.41	13.94	210.65	43-660	do do
51	4500	9,509.00			4500	12.89	18.93	204.59	44-5760	Bridge at second crossing of Green creek
52	4500	896.00			4500		10.11	194.45	44-4380	Earth work
53	5700	1,098.00			5700		10.67	150.03	45-4511	do do
54	3900	1,127.00			3900		14.09	165.94	46-3020	do do
55	4200	1,317.00			4200		7.45	158.69	47-2340	do do
56	3000	2,332.00			3000		15.03	143.46	48-60	do do
57	4200	16,718.00	1200	2865	3000	7.01	6.01	144.46	49-4260	Bridge over White river
58	5100	743.00	600	2865	4500	1.39	7.45	138.36	49-4080	Earth work
59	4800	576.00	1500	5730	3300	5.67	10.85	133.13	50-3600	do do to South side of Noblesville
	58500	44,464.00	4200							

Total ~~Length~~ of this division 16.76 miles
 Total Cost ————— \$44,464.00
 Average cost per mile \$2,653.00
 Length of Curved line 4,200 feet
 Radius of curves from 5730 to 2865 feet

The grades on this division are as follows:
 Sewer 900 feet

From level to an inclination of 5 ft per mile — 2 miles 1440 feet
 " 5 to " 10 " " — 3 " — 3060 " +
 " 10 to " 15 " " 4 " 1380 "
 " 15 to " 20 " " 2 " 2040 " +
 " 20 to " 25 " " 4200
 " 25 to " 30 " " 2 — 1440 " +
 " 30 to " 40 " " 1 — 120 "

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Cost of Graduation of South Division from Noblesville to Indianapolis

No of Station	Length in feet	Cost of construction	Curved line in feet	Radius of curve	Length of tangent in feet	Amount in feet	Percent in feet	Total eleva- tion above bottom canal in feet	Distance from Riv. in miles & feet	Description of work
60	3300	1,068 00	2100	5730	1200		6.43	126.70	51-1620	Earth work
61	5400	3,890 00	3600	"	1800	24.04		150.74	52-1740	Bridge over Stony creek
62	4500	1,362 00			4500	13.39		166.13	53-960	Earth work
63	4500	707 00			4500	16.37	0.50	182.00	54-180	do do
64	4800	514 00			4800	.86	7.21	175.65	54-4980	do do
65	4500	1,609 00	1200	5730	2300	13.37	3.23	185.79	55-4200	Bridge over Big branch
66	4200	764 00	900	"	3300	4.00	4.33	185.44	56-3120	Earth work
67	5400	691 00			5400		16.24	169.20	57-3240	do do
68	6000	1,513 00			6000	20.03	6.60	182.63	58-3960	do do
69	3900	701 00			3900	5.50	6.59	181.54	59-2580	do do
70	3900	748 00			3900	2.27	2.11	181.70	60-1200	do do
71	4200	758 00			4200	11.41	6.50	186.61	61-120	do do
72	6000	1,857 00	1800	5730	4200	2.47	7.56	181.52	62-840	do do
73	4800	768 00			4800		5.57	176.01	63-360	do do
74	3600	920 00			3600		11.69	164.52	63-3960	do do
75	4800	1,390 00			4800		17.89	146.63	64-3580	do do
76	5400	3,912 00	900	5730	4500		36.83	109.80	65-3700	do do
77	3600	1,156 00	1200	"	2400		12.27	97.53	66-2020	do do
78	3600	2,167 00			3600	6.23		103.76	67-340	do do
79	4500	7,731 00			4500	2.40	5.00	98.16	67-4840	Bridge over Fall creek
80	4200	402 00			4200		2.93	95.23	68-3760	Earth work
81	4800	379 00			4800	1.75	1.48	95.50	69-3280	do do
82	3900	569 00			3900	2.11	7.13	90.48	70-1900	do do
83	4500	393 00			4500		5.19	87.29	71-1020	do do

Total cost of this division ~~is~~ \$38,501.00
 Length — 20.57 miles
 Average cost per mile \$1877.88
 Length of curved line 2.21 miles
 Radius of curve 5730 feet

The grades on this division are as follows

Level		1 mile	2920 feet
from level to an inclination of 5 ft per mile	— 3 "	— 1260 "	
" 5 to "	10 "	— 5 "	— 600 " +
" 10 to "	15 "	— 1 "	— 3720 "
" 15 to "	20 "	— 3 "	— 960 " +
" 20 to "	25 "	—	— 4800 "
" 25 to "	30 "	—	— 3000 " +
" 30 to "	35 "	—	— 4800 "
" 35 to "	40 "	3 "	— 1760

Recapitulation

Total cost of graduation of entire line ~~is~~ \$202,606.00

Total length of line 71.2 miles

Average cost per mile \$2,843.58

Total length of curved line — 5.91 miles

Total level grade — 3 miles 3460 feet

Grades from a level to an inclination of 10 ft per mile = 27 miles 3240 feet

Do	"	10	"	10	"	= 16	"	— 4020	"
Do	"	20	"	20	"	= 9	"	— 3180	"
Do	"	30	"	30	"	= 3	"	— 960	"
Do	"	35	"	40	"	= 10	"	— 2000	"

To have reduced the inclination of the maximum grade materially, would have increased the cost of construction to an amount far beyond any equivalent that could be derived from the increased facility of doing the business of the road upon a lighter grade — the grade of

40 feet per mile, where it is used, conforms generally to the surface, and is not greater than that to be found on many of the best roads in the country.

Construction of Railway

The estimate for the superstructure of the road is based upon the following plan of construction —

Longitudinal mud sills 3 by 10 inches are placed upon the road-bed 5 feet from centre to centre, upon these are placed cross ties 6 by 6 inches square and 7½ feet long — 8 feet apart — In the space between the ties ~~string~~ blocks are placed so as to divide the space between the bearing points of the string-pieces — The cross ^{ties} are matched to secure string-pieces 6 by 10 inches square, ~~secured~~ secured in their places by wooden wedges — Upon the strings the iron rails are precast secured having a width of back of eight 8 inches — The whole of the timber to be sound white or Burr Oak.

In consequence of the great difficulty upon ^{or considerable} the greater portion of this line of procuring material for ballasting the track ^{material} - mate has been made for it — It may ~~however be procured~~ hereafter ^{however} be to the advantage of the Company to use it on that part of the road where it can be procured at a reasonable cost — In the immediate vicinity of the streams gravel can probably be had, and on the northern end of the line, ~~granite~~ stone may be

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procured at such a price as to justify the expenditure

The estimate for one mile of superstructure as above described is \$1750.00. The cost of the iron rail will of course depend upon its weight - I would recommend to your company to procure the edge rail either the 11 or 11^{1/2} pattern, not less weight than 45 lbs to the yard - If however, the means of the company ^{at this time} will not allow the use of a rail so ~~expensive~~ ^{costly}, a very ~~substantial~~ flat bar may be had at a cost of \$2000, per mile upon which all the business of the road ^{can be done} for several years ~~on the~~ ^{at an expense not} greater, probably, ~~than the interest on the~~ ^{than the} difference of ~~the two roads~~.

When the decay of the present superstructure renders its renewal necessary, the embankments will have settled, and the facility of procuring stone and gravel by the use of the road will be such as to insure at that time a permanent superstructure at an expense much less than it could now be made.

Estimating the flat-bar superstructure the average cost per mile will be \$3750.00
Average per mile of grading \$2845.50
Making the ~~total~~ cost of road ready for locomotive power \$6595.50 per mile.

Total cost from Peru to Indianapolis a distance of 71.2 miles \$469,599.60 -

Adding to this sum one mile of additional track for turnouts, and 5 per cent upon

