ORIGINAL REPORT by GEORGE STEPHENSON dated 18th January, 1822, of the Survey for the STOCKTON AND DARLINGTON RAILWAY.

350

S No. 181

To the Subscribers to the Intended Railway between the Port of Stockton and the Collieries situated in the Coal Field in the neighbourhood of West Auckland

Gentlemen

Agreeably to the Resolutions passed at your General Meeting held on the 23rd day of July 1825, I have minutely examined the Country over which your Railway is intended to pass, and I find that a practicable Line may be obtained within

within the limits granted by the Act of Parliament —

This Line would however be attended with many disadvantages — viz 1st Owing to various parts of the Line passing over very irregular ground which would be attended with considerable expence either by open excavations or Tunnels to procure a tolerable regular descent towards Stockton, and as there are many unseen difficulties to be met with in all such excavations or Tunnels they ought therefore to be estimated in proportion to the depth.

2nd On account of the many windings and circuitous routes which it possesses and which are very objectionable in a Railway, as the weight of the waggon and load are considerably augmented in going round Turns — For since the wheels of the Waggons are firmly fixed to the axles they must each make one revolution in the same time, and from their equality in size

must

must advance by their revolving motion equal spaces in equal times. And it being that it is evident, the exterior circle of a Turn is longer than the interior, therefore the exterior wheels of the Carriages, as they have the greater circle to describe, must necessarily slide along the surface of the Rails to keep pace with the interior, since their circumferences revolve with equal velocities. From this motion of the exterior wheels four disadvantages arise. 1st Great part of the weight actually becomes as moving on a sledge. 2nd An extra power is required to propel such weight. 3rd a considerable wear is caused on both the Railway and wheels of the Carriages. 4th The Railway will require more expence to keep it in order.

It may however be thought by having the wheels of the carriages loose on the axles they would not be liable to act as I have stated: This I grant but this advantage is far over balanced by the

difficulty

difficulty and expence incurred ~~by this kind of Wheels~~ in keeping ~~them~~ the rules of this kind in order; and it is only when they are so in order that the friction is reduced in moving round turns: which is the only situation where any benefit may be expected to be derived; for the friction is in nowise reduced when the Railway is ~~proper curvatures~~ straight or rectilinear.

It is quite evident both from "Theory" and "Practice" that the nearer Railways approach to straight lines the better: Keeping in view the expence of Cutting & Embankments so as not to exceed certain sums for avoiding certain Curves.

My first object therefore in improving your line of Railway was to reduce the Turnings as much as the limits prescribed by the act of Parliament would admit; but finding that no material improvement could be made without deviating therefrom, I then Surveyed another

another Line in pursuance of the instructions of your Committee, and now respectfully submit to your consideration the following remarks upon the two Lines -

1st. The old Line from Witton Park Colliery to the South side of Witton Park Dean does not seem to admit of any improvement - From the latter place I propose the new Line to proceed direct to St. Helen's Auckland avoiding the circuitous route taken by the old Line and saving one and a half mile in the distance, with very little more cutting - Indeed in this situation, the cutting is an advantage as it serves to make the embankments between No 1 and No 2 (see the plan) whereas in the old Line the Materials for the embankments would have to be led from some of the old Collieries, the cost of which from the nearest Colliery would be more than that

expence

~~expence~~ of Cutting through by Etherly Lane which is immediately adjacent to the main embankment and will be sufficient to form the same —

I would recommend a Steam Engine to be placed on the summit of the hill near Greenfield House at N° 2 to convey the Witton-park and Etherly Waggons from the large embankment where the Etherly waggons join the Main Line to St Helens Auckland, —

— And as no Horse Hackage would be needed on this part of the Line it would require little or no repair whereas on the old Line the increased length [owing to the circuitous route] which is all Horse Hackage [excepting from Norlees Lane to West Auckland the length occupied by the descending inclined Plane] would greatly increase the Tonage —

2ndly The old Line from near St Helens Auckland to the foot of the I think proceeds in the most desirable direction excepting the ascending plane but as this Plane which is made as short as possible and of a very steep ascent rendering

rendering the conveyance of goods very dangerous as is thereby rendered
accidents are very frequent on such steep ascents.
This inconvenience I would avoid by slanting the same ridge
and making the Ascendance this plane 3 times the length,
consequently only one third of the rate of ascent.
From the summit of this ridge, the intended
situation for the permanent Engine, the coals will
have to be conveyed by horses if the old Line be adopt-
ed. But from this place I propose the new
Line to diverge a little to the North of the old one
in order to obtain a quicker gradient descent from the
Engine, so that the loaded waggons will be able
to descend with the Rope for ½ a mile, and the Engine may
in return (be enabled to) bring the empty waggons back.
This will evidently be a saving in the Horse
Trackage and will require no more Machinery.
3rd From No 9 to No 11 near Redworth Abbas Lane Commence end of the Tunnel in the old Line is a distance
of nearly three miles the whole of which will be
expensive

* how many miles will from Potto Park to the point of
what have been should be taken for comparison?

expensive excavations and embankments viz at particularly
"Tedworth Lane". "The Hawthorn. "Middridge Grange"
and the "Tunnel at Aycliffe" vide ✱✱✱ ~~Page 24~~ Extended
will be attended with great expence in excavation & Embankment

In the new Line by ~~passing~~ keeping to the North of the
old Line from the Engine Bank Top, and proceeding
along the opposite side of the Vale avoiding all the
deep excavations and also the Tunnel at Aycliffe. will be avoided

When about a mile ~~from~~ west of "Sims Pasture"
the new Line ~~slants~~ 2 slopes gradually over the Vale and
curves a little to the East of "Sims Pasture" where
there will be a long excavation but of no great
depth - will be necessary

4th From Sims Pasture and the Tunnel at
Aycliffe the two Lines converge till they intersect
near Whiley Hills. where the new Line passes to
the West of the old one and continues to stretch
forward nearly straight passing Stand Alone
on the West and Myers Flat on the East and

again

again intersects the old Line near Whessoe from whence they nearly coincide to Little Whessoe Back Lane making a third intersection at the latter place. In this part of the two Lines the excavations seem to be nearly on a par but the new Line possesses the advantage of obtaining nearly a straight Line

5th From Little Whessoe Back Lane the old Line bears away a little to the East as far as Honey-pot Lane where it makes a very acute Turn and proceeds nearly South East until it crosses the Main Post Road between Durham & Darlington at Eben. changes its direction again to South and proceeds nearly on a straight Line to Haughton.

This part of the Line is very objectionable on account of its numerous Turnings and passing at such a distance from Darlington as to require a Branch of 1½ Mile in length over very unfavorable

unfavorable Ground -

The Main Line is also attended with another disadvantage arising from the great Excavations, the produce of which cannot be disposed of in any of the adjacent Embankments, and consequently will occasion additional expence in the removal, or occupy considerably more ground near the Railway -

The new Line from Little Whessoe Back Lane proceeds in a straight line towards Darlington as far as Honey Pot Lane leading to Cockerton, from thence it makes a gradual turning to within 400 yds of Northgate Bridge : This Line would be obtained without any surplus of Excavation -

6th At Haughton the old Line crosses the Skerne and Main post Road between Darlington & Stockton the Turnpike Road on a Level with the surface of the same Turnpike Branch and proceeds along the River on the opposite side as far as Haughton

as Haughton Mill and from thence to the Wheat Sheaf—

Here the Line becomes extremely unfavorable, this part of is as well by reason of its circuitous course as its ascent which will occasion a diminution of nearly one third in a Horse's Power being 25 feet in about 2 miles—

In pointing laying out the new Line from the Skerne at Darlington towards Yarm, Stockton &c. I endeavoured to avoid ascending the before named to the Wheat Sheaf I succeeded in getting a Line almost direct to the Fighting Cocks with a little descent towards Stockton.

The old Line may seem to possess an advantage by crossing the Skerne at a narrower part of the Vale than over the new one at Darlington but this advantage entirely disappears — considering the disadvantage above mentioned in that certainly vanishes when compared with that part of the Line from Haughton to the Wheat Sheaf which is considered

7 ½ From the Wheat Sheaf the old Line proceeds nearly direct to the Oak Tree in which distance there are

Two Bridges will be required with a great Length of
there are Heavy Cuttings and Embankments —

The new Line from the Fighting Cocks to the Oak
Tree is not at all a favorable Line but will con-
desirable
tain less cutting than the old Line and is therefore
require
preferable —

Near the Oak Tree the two Lines form a junction
from which place the surface of the Ground or Country
is remarkably regular so that little or no Cutting will
be necessary in the present Line which goes within
about 9 miles along the Turnpike Road
of the Main Post Road till very near Stockton —
to

This appears to be as beautiful a Line as could have
seems contiguous

been chosen —

The alteration made at Stockton was
by the desire of some Gentlemen at that place who
wished that the Line might be brought near to the Bridge
end for the convenience of Coals that might have to
pass to the other side of the River and from thence
proceed

proceed along the Streets as marked out in the old Line. To accomplish this I found it necessary to deviate from the said Post Road a little sooner than the old Line had done.

Darlington Branch

Darlington Branch

The advantage of bringing the Main Line near Darlington will be materially felt as the distance from the Collieries on the new Line is nearly three miles less than by the old one: consequently three miles of Tonage & Package will be saved to this place in communication with Yarm &c which will be considerable when the quantity of Traffick increases as may reasonably be expected.

Darlington Branch

The considerable Excavations and Embankments in the old Branch will be avoided by adopting the line 8 chains to the west of it: there will also be a saving in Rails, chains and Blocks which will materially lessen the first cost. I do not without in any manner impairing the Revenue, or increasing the cost of the Rail way I contemplate that considerable advantages will arise to the town of Darlington by having the Main line brought so near to it. The distance from Darlington to Stockton will be 11½ Miles which is [illegible] than by the Main line

as by the Main line

Yarm Branch

This Branch seems to pass in the most advantageous manner from the Main Line and terminate to land at a very convenient situation for the delivery of goods to the Town of Yarm. I have therefore made no alteration in it.

Evenwood Branch

In examining the proposed Branch from the old Main Line to Evenwood Lane I find it would be attended with considerable Excavations & Embankments: it is also an ascending line with the loaded waggons which if possible aught always to be avoided: another objection arises to this Branch viz that all the Coals moving thereon would have to descend the Inclined plane from near Norlees

Lane

Lane to West Auckland —

I propose the new Branch to proceed from Evenwood Lane down the margin of the River Gaunless which is a very favorable Line and is nearly direct to St Helens Auckland where it joins the main Line, avoiding the descending plane —

There will need very little Excavation or Embankment and a very desirable descent for the loaded waggons —

From Evenwood Lane the Line might be extended to the Western Collieries very conveniently over the late Lord Strathmores Grounds — If desirable to his Trustees these Grounds may be avoided by keeping a little to the North but this will not be so favorable a Line — The old Branch does not admit of this extension without considerable Excavations & Embankments —

Black Boy Branch.

I expected to have got this branch direct to where it joins the Main Line by leaving the old Line to the East : but after completing the Levels I found it was not so favorable as I expected as I had too much ascending Ground with the loaded Waggons I therefore abandoned the Idea of Keeping this Line considering the old Line preferable —

Not having time however to complete the Levels on the latter Line I cannot Estimate the cost but from what I saw of the country I think it may probably cost £300 ℔ Mile for Excavations and Embankments The Elton Branch will join the above on very favorable ground ———

Having thus briefly stated my reasons for recommending an alteration in the Line of way. I annex Estimates of the probable cost of each Line of Road, from which it appears that the
Old Line (subject to the Tunnel & Darlington Viaduct) would cost £77341 „18„ 8
and the new Line (with the same Tunnel) would cost 60987 „13„ 3
making a difference of 16354 „5 „5
on the original cost of the Way to which should be added a saving in the annual Repairs & Leading.

It is a principal part of the difference arises in the Cost of Forming the Road. I have also annexed a particular statement of the Measurements, Excavations and Embankments &c upon each Line.

Abstract Estimate of the Expense of the two proposed Lines of Railway

Works	Main Line Old	Main Line New	Darlington Branch Old	Darlington Branch New	Yarm Br.	Evenwood Branch Old	Evenwood Branch New
1 Forming the Road excavations and Embankments	£ 22160 1 8	£ 9453 17 9	£ 418 " "	£ 235 6	£ 100 " "	£ 932 6	£ 250 " "
2 Bridges and other Masonry	1138 " "	1218 " "	125 " "	100 " "	" " "	50 " "	20 " "
3 Blocks of Stones or Wood	5891 2 "	5371 5 "	275 " "	125 12 "	155 19 "	361 7 "	445 10 "
4 Chairs	2735 " "	2494 " "	127 10 "	58 " "	72 " "	167 3 "	207 0 "
5 Rails	20029 14 "	18226 " "	935 " "	423 4 "	519 13 "	1203 18 "	1483 " "
6 Laying the Rails and Ballasting the Road	4418 6 6	4028 8 "	206 5 "	94 4 "	116 18 6	270 18 "	333 15 "
7 Fencing the Road	3712 12 "	3413 17 "	172 14 "	83 1 "	108 18 "	252 9 "	310 15 "
One discending Inclined Plane wheel complete with Rope Rollers &c. &c. &c.	366 10 "	" " "	" " "	" " "	" " "	" " "	" " "
8 One 30 Horse Engine including House Boiler Rope Roll and every other material for completing the Engine at Etherly Bank top	" " "	1982 15 "	" " "	" " "	" " "	" " "	" " "
9 One 60 Horse Engine on Brusselton Ridge Including as p.r Last	3482 15 "	3482 15 "	" " "	" " "	" " "	" " "	" " "
10 Depots at Stockton Yarm & Darlington with one Weigh.g Machine for each place	2000 " "	2000 " "	" " "	" " "	" " "	" " "	" " "
11 Land occupied by the Railway & Branches	7500 " "	6750 " "	350 " "	150 " "	225 " "	500 " "	600 " "
	£ 73434 1 2	58419 17 9	2609 9	1269 7 -	1298 8 6	3738 1 -	3650 0 0

5465-10

Totals of Each Line =

Old Line	Lengths mls	fur	Ch	£	s	d
Main Line	20	7	-	£ 73434	1	2
Darlington Branch	"	7	"	2609	9	
Yarm Branch	"	6	3	1298	8	6
Evenwood Branch	2	3	0	3738	1	0
				£ 81079	19	8
Black Boy & Eldon Branch	3	6	4			
	34	5	7			

77341 18 8
5000
86079 19 8

brought forward

New Line	Lengths mls	fur	Ch	£	s	d
Main Line	24	5	5	£ 58419	17	9
Darlington Branch	-	4	5	1269	7	"
Yarm Branch	"	6	3	1298	8	6
				60986		
Evenwood Branch	2	7		3650	0	0
				£ 64637	13	3
Black Boy and Eldon Br.ch	3	6	4	5000		
	32	6	7	6000		
	3	6	4			
	29	0	3	£ 75636		

5000 - 0 - 0 both branches

58419 - 17 - 9
1269 - 7 -
1298 - 8 - 6
60986 - 13 - 3

Summary of the Excavations on each Line.

Old Line			Cubic Yards	P. Yd.	£	s.	d.	
From No 1	to No 2		3500	6				
			15857	12	880	7	"	N. Front to Etherley
" 2	" 3		2678	6	66	19	"	Etherley to Clearings Far Cover
" 3	" 4		13430	6	335	15	"	Thence to Norton Lane
" 4	" 5		10240	6	256	"	"	East of Sneilins Plain
" 5	" 6		4947	6	123	13	6	near Broom Moor
" 6	" 7		27562	6	1033	11	6	Top of Brafferton Sneilins
" 7	" 8		7392	6	184	16	"	
" 8	" 9		5000	6	125	"	"	to the Darlington & St Andrews Road near Skerton
" 9	" 10		44751	15	2796	19	9	* in Middridge Grange Estate
" 10	" 11		53412	24	5341	4	0	* completion of Mr Tunnell
" 11	" 12		11968	....	6000	"	"	* for the Tunnell
" 12	" 13		18156	8	605	4	"	Coatham Mondeville
" 13	" 14		28262	12	1413	2	"	Lane To Hilton Junior Post
" 14	" 15		12400	6	310	"	"	Durham & Darlington Turnpike
" 15	" 16		14792	6	369	16	"	Haughton
" 16	" 17		17364	6	434	2	"	Yarm Lane to Wheat Sheaf
" 17	" 18		33455	9	1254	11	3	Lane near Forster House
" 18	" 19		3542	4	59	"	8	to Darlington &
" 19	to Stockton		22800	....	570	"	"	
					£ 22160	1	8	
Darlington Branch			16720	6	418	"	"	
Yarm Branch			.....	....	100	"	"	
Evenwood Branch			37292	6	932	6	"	
					1450	6	0	
					£ 23610	7	8	

New Line			Cubic Yards	P. Yd.	£	s.	d.	
From No 1	to No 2		15962	6	399	1	"	Water Lot to Top of Rodyn Greenfield
" 2	" 6		32537	6	813	8	6	near Broom Moor
" 6	" 7		27562	9	1033	11	6	Top of Sneilins Brafferton
" 7	" 8		4046	6	101	3	"	end of Mr Musgrave's West Thickley
" 8	" 9		25680	6	642	"	"	Middridge Grange Cottages
" 9	" 10		28125	12	1406	5	"	Wood Lane C Harrison's
" 10	" 11		30987	9	1162	"	3	Myers Inlet
" 11	" 12		22640	6	566	"	"	Musgrave Gate East
" 12	" 13		18650	6	466	5	"	Stone Durham Turnpike
" 13	" 14		22663	6	566	11	6	Stone Stockton Etc
" 14	" 15		12957	6	323	18	6	Major Collings East Boundary
" 15	" 16		38119	6	952	19	6	Fighting Cocks
" 16	" 17		14646	6	366	3	"	Junction Thence Oak Tree
" 17	" 19		3342	6	83	11	"	
" 19	to Stockton		22800		570	"	"	Oak Tree to Stockton
			320716		£ 9452	17	9	
Darlington Bran.			9412	6	235	6	"	
Yarm Branch			.....	....	100	"	"	
Evenwood Branch			.....	....	250	"	"	
					£ 585	6	"	
					£ 10038	3	9	

Annual Revenue &c of

New Line

Not knowing the quantity of goods that probably would pass along your Line of Railway I have therefore taken the Revenue arising from the Tonage stated in a pamphlet handed to me by your Committee.

If the Tonage be as stated the Revenue appears correct viz ..... £ 23261. 3. 4

Allow £10 P Cent on the money sunk to Keep Railways, Engines, Ropes, Rollers, Agencies and every other expence that may annually be incurred by the Railway — will be 6763 11 4

Annual profit on the ..... £ 16497 9 —

each Line.

Old Line

Revenue as P other side ..... £ 23261 3 4

Allow £10 P Cent on the money sunk to Keep &c &c &c as P other side ..... 8408 " "

Annual Profit ..... £ 14853 3 4

In this Line I have not deducted any thing for the diminution of the Horses power arising from the irregularity of the Line which evidently must be the case as the descent is so much in one part with the loaded waggons consequently too much ascent with the empty ones and even in one part it ascends with the loaded waggons ..... On this Line a horse will not work with more than 7½ Tons — On the new Line a horse will convey with more ease 10 Tons —

G. Stephenson
Engineer

Killingworth Colly
Jany 18th 1822