

**HOUSE; NO.30; ANNUAL REPORT  
OF THE COMMISSIONERS  
ON THE TROY AND GREENFIELD  
R.R. AND HOOSAC TUNNEL**

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Hoosac Tunnel by Various

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**VARIOUS**

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R.R. AND HOOSAC TUNNEL**



HOUSE.....

.....No. 30.

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# ANNUAL REPORT

OF THE

## COMMISSIONERS

ON THE

### Croy & Greenfield R.R. and Hoosac Tunnel,

TOGETHER WITH THE

REPORTS OF CHIEF AND CONSULTING ENGINEERS.

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BOSTON:

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1867.

# Commonwealth of Massachusetts.

## COMMISSIONERS' REPORT.

*To His Excellency the Governor, and the Honorable the Executive Council of the Commonwealth of Massachusetts.*

The Commissioners on the Troy and Greenfield Railroad and Hoosac Tunnel respectfully submit herewith a statement on the condition of that work, December 1st, 1866.

The money on hand at the date of the last report was, . . . . .	\$12,491 44
Received since, to December 1, 1866, . . . . .	590,000 00
For materials and supplies beyond the sum deducted from pay-rolls, . . . . .	30,603 18
For salaries of Commissioners, 15 months, to September 1, 1866, . . . . .	7,216 71
	<hr/>
	\$640,311 28
They have furnished vouchers for payments amounting to, . . . . .	\$626,815 80
And for their salaries, . . . . .	7,216 71
	<hr/>
	634,032 51
Leaving a balance in their hands of, . . . . .	\$6,278 77
They are chargeable with the following amounts:—	
Cash on hand, December 1, 1865, . . . . .	\$12,491 44
Supplies and materials stated to be on hand at that date, . . . . .	35,447 59
Money received from the State treasurer, . . . . .	590,000 00
	<hr/>
	\$637,939 08

This is accounted for as follows :—

Amount expended on buildings, machinery, and fixtures, . . . . .	\$179,569 59
On the work of construction, . . . . .	411,334 51
Cash on hand, . . . . .	6,278 77
Leaving, as supplies unsold, and materials not charged to the work, the sum of . . . . .	40,756 16
	<hr/>
	\$637,939 03

Of the items composing the last amount, an inventory is being taken, with a view to the disposal of all stock in the stores, as well as of the business of store-keeping.

For information relating to the cost, progress, and condition of work upon the tunnel, we refer to the accompanying report of Thomas Doane, the present chief engineer, appointed by the Commissioners in 1863.

The selection by you, in August, of Benjamin H. Latrobe, Esq., of Baltimore, as consulting engineer, is likely to prove useful to those intrusted with the conduct of the work. He is a gentleman of large experience, of excellent judgment, and eminently practical in the treatment of subjects presented for his consideration. His suggestions regarding the methods to be adopted hereafter, commend themselves alike to men of the same profession and to the skilful miner, and his desire to render available whatever has been provided as auxiliary to the plans of the Commissioners will tend to avoid the waste which might otherwise arise from the proposal of important changes.

In July last, proposals were made by the Fitchburg and the Vermont and Massachusetts Railroad Companies to lease the railroad from Greenfield to its terminus in the town of Rowe, near the eastern entrance to the tunnel, at an annual rental of \$30,000; this lease to continue in force until the completion of the tunnel, unless that work should be suspended by competent authority. Such lease was subsequently executed, under the direction of the attorney-general.

After amending the line in many of its details, lessening the curvature, and improving the location of some of the bridges,

the construction of the road was, on the 8th of October, with your approval, and under the advice of Mr. Latrobe, put under contract, to be completed for the sum of \$545,000. This does not include depot buildings, turn-tables, nor engineering expenses, which are estimated at an additional sum of \$45,000, and it is believed that the entire cost will not exceed \$600,000.

The contract provides for the opening of the road to Shelburne Falls by the 15th of November next, and throughout its remaining distance by the 15th of the following July.

About the middle of June, the automatic drills, referred to in previous reports, were introduced into the heading at the East End. For a few weeks, their operations were attended with reasonably satisfactory results, and they gave promise of complete success whenever the workmen should become familiar with this new system of drilling. Gradually they began to fail in strength; the incessant and rapid blows—counted by millions—to which they were subjected, appearing to granulate or disintegrate portions of the metals composing them, so that, in consequence of frequent changes for repairs which were found to be necessary, it became evident that these machines would prove of little practical value.

Having been produced by years of the combined ingenuity and toil of skillful men, at large expense to the State, after costly preparations in the river and on the mountain, and endorsed as they had been to some extent by the legislature of the Commonwealth, it was decided to employ them long enough at least to furnish the most satisfactory test of their capability for this service.

For these reasons, they were kept in use for six months, the expenses of operating being greater than those required by hand labor, and the progress during that period smaller than could have been made by the ordinary method of manual drilling.

At the time the conclusion was reached that these machines would not be able to meet the requirements needed for work upon the tunnel, the attention of the Commissioners was called to a new power-drill, which appeared to be free from the objections which had disclosed themselves in the one then in use.



As this drill could readily be adjusted to a carriage which had been prepared at great cost, and as its trial would involve no further expensive outlay for other necessary appliances, these having been already provided, it was though advisable to continue the organization for working by machinery for a few weeks longer, until the value of this system could be thoroughly ascertained.

Four drills of the new pattern have recently been brought into use, with flattering indications of success; but until eight or ten can be kept steadily at work in one of the headings, it will be unwise to promise ourselves that every difficulty in this direction has been surmounted.

The adoption of machinery necessarily leads to the employment of a more skilful class of labor, and the saving is likely to be in time only, which may lessen the accumulation of interest on the great outlay required for the prosecution of the work.

The value and economy of nitro-glycerin as an explosive seems to have been fully demonstrated, and the method of using it with safety to the employees appears to be the only question now undetermined. Its early introduction is very desirable, and preparations are making to bring this about whenever it shall appear to be prudent to do so, since it is believed, on the strength of numerous experiments made in the tunnel at the West End, that by the use of this agent alone, as compared with gunpowder, the time required for completing the work may be greatly reduced.

Inquiries regarding the value of other substances used in blasting have been made, and it is not improbable that something may be provided as effective as glycerin, without its attendant dangers.

The system of exploding simultaneously by the agency of electricity appears to possess many advantages, and provision has recently been made for its early adoption upon every section of the work.

In order to produce rapid progress we are not necessarily dependent upon the use of power-drills, which, while they may give great promise of usefulness, are also liable to bring disappointment by the development of some hidden difficulty.

Various opinions are entertained regarding the expense to be incurred and the time consumed in completing the tunnel, and it may not be unwise to estimate these matters in what seems to us their most discouraging aspect.

It appears to be quite certain that, with the usual instrumentalities which have been furnished during the last three years, and without any aid from the Central Shaft, at headings from the two ends alone, 125 feet per month, or 1,500 feet per year, can be gained. This rate has been accomplished during several months of the present year. The distance between the two points is 18,000 feet, and to overcome that would, at the above rate, require just twelve years. The western section can be completed many years earlier, and this when done will effectually provide for the troublesome influx of water which is likely at times to retard operations from the West Shaft. The use of power-drills and newly invented explosives may very much reduce this period, or compensate at least for such occasional delays as will occur; while persons of practical and intelligent minds believe that, by the employment of nitro-glycerin, simply as an auxiliary to hand labor, this estimated time may be shortened one-half.

Of the cost, it can be stated that, in the decomposed formation at the West End, a brick and stone tunnel is now being built, for a portion of the distance by contract, at \$400 per lineal foot. It is known that this formation does not extend beyond 1,900 feet, and there is good evidence tending to prove that it will hardly reach one-half this distance. The outlay for the whole of this section, then, need not exceed \$760,000. The distance between the heading at the East End and the heading at the West End is 18,000 feet. This heading comprises 60,000 cubic yards, which it is confidently believed can be taken out for less than \$15.00 per yard, or \$900,000. There would then remain of enlargement, on the present plan, and this may be somewhat reduced, 800,000 cubic yards, which could be let out at the present time at \$6.00 per yard, or \$1,800,000. From the West End to a connection at North Adams with that part of the railway now in operation, the construction of the road, land damages, and enlargement of the small tunnel at that point, should not exceed the sum of \$150,000. This shows that the entire amount necessary to be expended hereafter, without

interest, might reach the sum of \$3,610,000, in the present currency of the country, with a strong probability that the amount would be greatly lessened by an improved condition of the finances, and its consequent effect upon the prices of labor and materials. The present section of the tunnel, containing  $18\frac{4}{10}$  cubic yards for each lineal foot, is one of very convenient form; but its usefulness could not be seriously impaired should it be made to contain but 17 yards, the difference being, at \$6.00 per yard, nearly \$200,000.

These estimates are not based upon any prices heretofore paid for work upon the tunnel.

From the best information to be obtained, the cost of taking out the heading, under the system pursued for three years past, cannot have been less than \$30 per cubic yard; and yet we have become satisfied that individual enterprise can accomplish better results than those indicated by the above calculations. Other work of a character quite as difficult has been performed at even lower rates.

Of the amount expended since the appointment of Commissioners in 1862 to Nov. 1, 1866, \$957,899.75 have been disposed of in the erection of a dam, wheel-house, and other buildings; in the purchase of land and machinery; in payments to engineers and for excavations at the west approach; leaving, for operations upon the rock in the tunnel and shaft, \$525,073.45. For this latter sum, 21,000 cubic yards have been removed, at an average cost of \$25 per yard.

For the first-named objects, large appropriations will not be requisite hereafter; and in the future management of the enterprise expenditures may be confined to the most expeditious and economical means of reducing the distance yet remaining to overcome.

The Sand Patch Tunnel, on the Pittsburg and Connelville Railroad, through one of the Alleghany Mountains, 18 by 16 feet, about a mile in length, a large portion built during the present year, the heading nearly complete, composed of very hard sandstone, lying more unfavorably for blasting and quite as hard to drill, as the rock of the Hoosac, has thus far cost but \$4.16 per cubic yard, including heading. Other tunnels, of