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SIXTEENTH LEGISLATURE.

No. 9. **SENATE.**

To the Senate and House of Representatives:

I lay before the two branches of the Legislature for their consideration, the Report of Lt. Col. Long, of the Topographical Engineers of the United States, on a Reconnoissance for a Rail Road from the coast of Maine to Quebec; together with a sketch of the country traversed by the routes treated of in the Report, and which is intended as an accompanyment to the document.

ROBERT P. DUNLAP.

COUNCIL CHAMBER,
January 18, 1836.

[Copy.]

REPORT

ON A

RECONNOISSANCE FOR A RAIL ROAD

FROM THE

COAST OF MAINE TO QUEBEC.

RESPECTFULLY INSCRIBED TO
His Excellency, ROBERT P. DUNLAP, Gov. of Maine,
BY
S. H. LONG, Lt. Col. U. S. Eng'rs.

HOPKINTON, N. H. December 20, 1835.

SIR,

In accordance with Instructions from the Topographical Bureau, predicated on a memorial from the Legislature of Maine, and in conformity to stipulated arrangements, mentioned by your Excellency, I engaged early in the month of July last, in a reconnoissance of the country situated between the sea-coast of Maine, and the river St. Lawrence, with the view of discovering the most favorable route for a Rail Road leading "from Portland or some "other point on the sea-board, or connected with the sea-"board by navigable waters in this State, (of Maine,) to "some point on the borders of Lower Canada, the best "situated for a Rail Road from Portland, or other con-"venient point, to Quebec."

Having completed the several examinations that were deemed necessary and practicable with the means placed at my disposal, and the aids generously contributed by numerous public spirited individuals, and associations, who have been prompted by a lively interest in the success of the enterprise, it becomes my duty to submit the results that have been obtained, which I shall endeavor to do, as briefly and perspicuously, as the intricacy of the subject and the indefinite nature of the information obtained will permit. The extent and diversified aspect of the country in which my examinations have been made, the devious tendencies of the routes explored, many portions of which were unfrequented and almost untractable, owing to the unreclaimed state of the country, the cursory and hasty manner in which the examinations were unavoidably made, and the impracticability of making any other observations than such as might be made with a mere glance of the eye, preclude any claim to accuracy or precision in the statements or opinions that may be advanced.

Although the reconnoissance of the country between the Canada line and the St. Lawrence, has been confided by the authorities of Lower Canada, to a distinguished officer, Capt. Yule of the Royal Engineers, and although my researches have been confined more particularly to the State of Maine, yet in the absence of that gentleman's report, and in view of the importance of connected statements relating to the entire routes from the coast of Maine to Quebec, I deem it incumbent on me, without further apology, to treat briefly of the country northwardly of the Canada line, as well as of that southwardly of the line, with the fullest assurance, however, that the representations of Capt. Yule, will supply numerous deficiencies, and rectify many inaccuracies, in the limited and

cursory remarks I have to offer, in relation to the routes within the limits of Lower Canada.

In submitting my views in reference to the contemplated Rail Road, I purpose to adopt the order I have heretofore chosen on similar occasions, agreeably to which, the topics for consideration are as follows: viz.

1st. The system of gradations and curvatures applicable to the several routes explored, with a view to economy of construction, and facility of transportation.

2d. The mode of construction deemed most economical, efficient and durable.

3d. A few general remarks on the coast of Maine, and the country traversed by the routes.

4th. A description of the several routes that have been examined, setting forth the more remarkable and prominent features of the country on their respective vicinities, and the circumstances under which a Rail Road is deemed practicable on each route.

1*st. The system of Gradations and Curvatures applicable to the routes explored, with a view to economy of construction, and facility of transportation.*

To all who are conversant with the nature and objects of Rail Roads, it is obvious that the principal advantage upon which their utility in all other respects depends, consists in the facilities afforded by them for reducing the friction, and thereby obviating the resistance to which loaded carriages are liable in their transitions from place to place. It is also obvious that this advantage can only be realized to its fullest extent, on roads that are perfectly level, and the transitions reciprocal, or alternately equal in both directions. It is moreover equally obvious that where the transition is to be made from a lower to a higher level, the resistance to ascending carriages is increased

by a part of their gravity equal to the proportion subsisting between the height and length of the road or plane, or in other words, the additional resistance thus imparted, is equal to the tendency of the carriages downward upon the road. The difficulty of overcoming this additional resistance, or downward tendency, increases as the acclivity becomes more abrupt, till at length the resistance from friction, bears so small a proportion to the resistance from gravity, that the advantage obtained in counteracting the former, is comparatively annihilated by the increased difficulty of overcoming the latter. In this extremity, Rail Roads yield to common roads the preference to which they are otherwise entitled, and cannot be recommended as substitutes in providing the means of ordinary transportation.

The resistance from friction upon Rail Roads may be assumed as equivalent to one two hundred and twentieth part of the weight of the carriage and its load, in all cases where the road is level, and the curvatures limited to a radius of one thousand feet. Hence the resistance from friction becomes equal to the resistance from gravity, on an acclivity rising at the rate of twenty four feet in the distance of one mile. It follows, that on a Rail Road thus inclined, (at the rate of twenty four feet per mile, or $15\frac{3}{8}$ minutes of a degree,) a carriage will descend spontaneously, being impelled by its own gravity or downward tendency, and consequently that the power of force required to propel it upward on a road of the same inclination, (24 feet per mile) must be double that required for locomotion on a road perfectly level.

Hence it may be inferred that on a Rail Road ascending at the rate of 460 feet per mile, or five degrees, the resistance from gravity will be nineteen times greater than

that resulting from friction. Also that a given power, that of a horse for example, is sufficient to drag upward on such an acclivity, a gross load, the weight of the carriage, &c. included, of only 1,447 pounds, whilst on a smooth common road of the same inclination, a horse will be able by exerting an equal force, to drag upward a gross load of 1,433 pounds, giving for the comparative efficiency of a given power on a common road, and on a Rail Road, both inclined on an angle of five degrees, only about one point in favor of the latter. By comparing the relative efficiency of a given power on these two descriptions of roads, both being level, the advantage will prove at least eight times, or eight hundred per cent. greater in favor of the Rail Road, than of the smooth common road.

From these considerations, as also from various others, that might be adduced, it is manifest, that the more level the route of a Rail Road, the greater is its advantages over a common road, and *vice versa*, the more it is inclined, whether by frequent undulations of moderate extent, or by occasional changes in the gradations, of great extent, the less considerable will be its inferiority in comparison with common roads. The requisite data from which to compute with any degree of certainty, the extent, frequency, and abruptness of the undulations, that are admissible upon a Rail Road, without reducing its advantages to an equality with those of common roads, have never been furnished; yet, without attempting to explain the reasons, upon which our conclusions are grounded, we venture to advance the opinion, that whenever the inequalities or undulations of the country traversed by a route, are so frequent and abrupt as to require a succession of ascending and descending graduations, equivalent to a constant inclination of one degree or 90 feet per mile, the expedien-

cy of a Rail Road, as a means of reciprocal transportation, is exceedingly questionable, and its inferiority over a common road, all things considered, extremely doubtful. Straightness, levelness and entire freedom from undulations, are undoubtedly essential to the perfection of a Rail Road on which the trade and travel are equal in both directions. A slight declivity in the direction of the heavier transportation, when the trade and travel are unequal, is no less compatible with the perfectibility of such a work. It is no less obvious, that those very desirable qualities are not attainable to any considerable extent, in the selection of routes for Rail Roads, in any country. The aspect of every country is more or less variegated with mountains, hills, plains and vallies, none of which admit of a compliance with either of the conditions above mentioned, through any considerable distance.

Obstacles of the nature just explained, are either to be overcome by means of ascents and descents, on the line of the road, or avoided by means of curvatures in the route at the expense in the first instance, of an increased motive power, without materially effecting the distance or cost of construction; and in the second at the expense not only of an increased distance, but of a corresponding enhancement of the cost of construction.

In reference to ascents and descents, the system of gradations, regarded as most conducive to the convenience, and best adapted to the exigencies of transportation, embraces the following orders; viz.

1st. A gradation varying from a level to an ascent or descent of thirty feet per mile. The experience already had in numberless instances on Rail Roads, authorizes the conclusion, that locomotive engines, can operate to great advantage on roads thus inclined, both with respect

to the load a single engine is able to convey upward, and to the speed with which it can ascend, with a load corresponding to half its utmost power at a moderate speed, on a level road. It is moreover believed that an occasional acclivity of thirty six or even forty feet per mile, for short distances, will not materially impair its useful effect.

2d. A gradation varying from forty to sixty feet per mile, is occasionally admissible, especially where a very considerable elevation is to be overcome, and a route presented by which the ascent may be effected without materially affecting the length of the road. On portions of the road thus inclined, two locomotive engines may be employed for the conveyance of a train of loaded cars upward; in which case one of the engines will preceed and the other follow the train, pushing the hindmost car. Examples of this nature are afforded on the Manchester and Liverpool Rail Road at the Rain Hill and Sutton Inclines. It is scarcely pertinent to add, that gradations of this character should occur as rarely as possible, and that whenever they become necessary, they should occupy as great an extent, as the nature of the ground will permit, with the view of reducing the gradations on other adjoining portions of the route.

3d. Gradations varying from sixty to ninety or one hundred feet per mile are occasionally advisable and proper, in consequence of the impracticability of finding a route sufficiently direct, for the adoption and use of inclined planes on which the transition may be effected by means of a stationary engine.

The employment of inclined planes with stationary engines, as just intimated, is not only attended with great expense, and difficulty, but involves the necessity of adopting, for each plane, a route very nearly straight, in order to

insure the most direct, safe, and efficient operation of the ropes, or chains, by means of which, the transitions upon the planes, must be effected. The latter of these considerations is some times unavailable, in the passage of hills, or mountains, on account of the windings, and sinuosities of every route leading from its base to its summit, no localities being presented for the reception of straight planes, of suitable length and inclination. Under these circumstances, it as often happens, that a serpentine route, with curvatures sufficiently gentle, is to be found by which the road may be conducted to the top of the hill or mountain, rising continually by gradations not exceeding the limits prescribed by this order (90 or 100 feet per mile) and may be substituted at far less expense, and probably with equal advantage, instead of a route, adapted to the application and use of inclined planes, and stationary power. On gradations of the character here recommended, the employment of two or three, perhaps four locomotive engines, is contemplated by means of which the train of loaded carriages may be conveyed upward, either entire or divided into parts of a train, as may be found most convenient; or the ascent may be effected by the aid of horses or mules, stationed at the foot of the mountain, and kept in readiness to aid ascending trains. In this case stable cars should be prepared, and should ascend with the train, receive the horses or mules at the summit, and descend by their own gravity to the foot of the plane, where the animals would be ready to aid again, in the ascent of the next train. This mode of employing animal power, has been necessarily practised on the Mauch Chunk, and other rail roads.

4th. This order embraces inclined planes varying in their gradations, from three to six or eight degrees, or from 276 to 736 feet per mile.

The operations on planes of this description, are effected by means of stationary power, either steam or animal, communicated to the loads by means of stationary steam engines, gins, &c. Each plane should have an inclination, as nearly uniform as circumstances will permit, and as already intimated, should be straight, or very nearly so from its head to its foot. Its length should be from a quarter to a half, or if convenient three fourths of a mile, and its vertical rise or lift, from one hundred and fifty to three hundred feet. The Rail Road whether single or double on other parts should be furnished with two tracks, on all inclined planes of this description. By this means the inclined planes, may readily be endued with the properties of self acting planes on which the gravity of descending trains, may be applied in a manner to overcome in part, the resistance of trains that are ascending.

Curvatures in Rail Roads are objectionable on account of prolonging their extent, as also on account of increasing the friction, and of course the resistance to locomotion, but are nevertheless admissible when regarded in connexion with two important considerations, viz. the facility afforded for selecting the most suitable or most favorable route for the road, whereby the cost of construction may be greatly reduced; and the means of avoiding ascents and descents, and thereby diminishing the cost of transportation, both of which are leading advantages, resulting from their use.

With respect to the abruptness of curvatures, the ample and diversified experience already had upon Rail Roads, affords the best criterion for judging, agreeably to which the curves found admissible, without materially impairing the usefulness of Rail Roads, are such as are limited to a radius of not less than one thousand feet. Exceptions to

this rule are sometimes, though as rarely as possible allowable, especially when the project of a Rail Road must be abandoned unless a more abrupt curvature is adopted; in which case, a curve of even half that radius may be admitted.

A full and adequate discussion of the subject of curvatures, would comprehend a variety of topics, relating both to the cost of construction, and to that of transportation, and should exhibit conclusions, agreeably to which a definitive choice of a route may be judiciously made. But the performance of such a task, in a manner to embrace all the details relating to this subject, would require more time, and occupy more space than we have to bestow, yet in order to arrive at certain practicable results deemed essential to a proper acquaintance with the condition by which curvatures ought to be regulated, we shall offer a few summary statements, predicated upon a careful and laborious computation heretofore made, and embracing all the items of expenditure incident not only to the construction of a Rail Road under ordinary circumstances, but to the continued transportation thereon.

The computations alluded to, give for the average prime cost of a good double track Rail Road, all the expenses of construction being included, as also the investment of funds sufficient to keep the road in repair forever, twenty-five thousand dollars, for each mile of the road.

The computations relating to transportation were predicated on the employment of animal power, for the conveyance on a level road of such an amount of transports at five cents per ton, per mile, for the conveyance of freight, and four cents per mile for each passenger, as would yield twelve and a half per cent. on the capital invested in the work at the time of its completion. These

premises being duly considered, and all items of expense for the purchase of horses, harness, cars, hire and subsistence of attendants, horse keeping, &c. &c. being taken into the estimate, the cost or present worth of transportation forever on each mile of level road, amounted to fifty thousand dollars; or more plainly the interest of fifty thousand dollars, at six per cent. annually, would be sufficient to defray all expenses incident to a transportation extensive enough to yield a nett profit of twelve and a half per cent. on the entire capital invested for each mile of level road.

Steam being substituted for animals as a motive power, the computations give a decided superiority to the former, the useful effect being increased about one half. Hence we shall assume twenty-five thousand dollars as the present worth of perpetual transportation, by means of steam power, on each mile of level road, making the aggregate cost of construction and transportation by steam power, fifty thousand dollars per mile. In comparing the efficiency of motive power on a level road, with that on a road alternately ascending and descending, it is proper to regard the ascents as causes of increased resistance to the passage of carriages, while the descents afford no advantage worth mentioning, that cannot be had upon a level road; for the power, whether animal or steam, adequate to overcome the ascents must accompany the load through the descents, upon which last there is very little or no occasion for its employment. Hence in all cases relating to the application of motive power, upon undulating roads, ascents are to be regarded as obstacles or hindrances, and descents merely as levels, especially where a uniformity of speed is required.

The connexion between the several topics just consid-

ered, and the subject of curvatures remains to be explained. From what has been advanced in relation to the comparative cost of construction and transportation, and the comparative difficulty of locomotion, on level and ascending roads, (it being understood that descending roads are to be regarded as equivalent merely to those that are level,) we are prepared to take a view of some of the circumstances that justify the substitution of a curved, for a straight road.

We have seen that the construction and subsequent repairs, or renewals of a Rail Road, call for an expenditure of $25,000 per mile, and that the present value of perpetual transportation by steam power, on every mile of level road, is also $25,000 per mile, the road being level, and the curvatures so gentle as not to augment the resistance to locomotion. Hence the propriety of adopting the shortest practicable route, even at the expense of paying at the rate of $50,000 per mile, for every reduction of distance that can be effected at such a rate of expenditure.

We have also seen that the power required to overcome a vertical ascent or elevation of twenty-four feet, is equal to that required for locomotion through a distance of one mile on a level road ; consequently the cost of the two items above considered, will amount to $75,000 when the length of the road is one mile, and the ascent in that distance twenty-four feet. Hence it is obvious that a curved level route one and a half miles long, is equally as favorable as an ascending route whose length is one mile, and ascent twenty-four feet, provided the curvatures in the former are so gentle as not to increase the resistance from friction. Hence it is also apparent, that if the ascent can be avoided by substituting a curved level route, twenty-five per cent. longer, instead of the more direct route on

which the ascent must be encountered, there will result in favor of the route thus prolonged, an eventual saving of $12,500.

By similar computation, it may be shown whether a hill or mountain of any given height can be more economically passed by means of an inclined plane, of a tunnel, or of a curved road. For example, let us suppose the distance across the hill one mile, and the elevation to be overcome 240 feet; the equated distance for transportation will be eleven miles, and the present worth of this item for that distance will be $275,000, to which must be added $25,000 on account of construction, giving for the aggregate cost of the two items, $300,000, which is adequate to the construction and transportation, on a level route, extending through a distance of six miles; or in case a tunnel should be preferred, would allow for its construction, provided a level route could be obtained by its adoption, $275,000. Any general rules intended to embrace the conditions above considered, ought to be based on the prime cost of construction, at an average rate, added to that of renewals and repairs forever; the present worth or valuation of perpetual transportation on a level road, and the acclivity or inclination on which carriages can descend spontaneously, (all of which respectively are to be regarded as constant quantities,) and may be of the following import, viz:

1st. Determine the equated length of the road in each direction, by adding to its actual length, in miles, the quotient arising from a division of the sum of all its ascents in feet, by the declivity in feet per mile, corresponding to the gradation at which spontaneous descent is produced, and the sum will be the equated distance or length of the road.

2d. To the cost of construction computed for the actual length of the road, add the cost of transportation, corresponding to its equated length, and their sums will show the aggregate cost of construction, and transportation.

3d. From the cost of transportation computed for the equated distance, deduct the cost of construction for the actual distance, and the remainder will exhibit the amount applicable to the construction of a more costly and expensive road, which may be desirable for the sake of avoiding ascents or elevations.

4th. In order to determine whether another route may be advantageously substituted, as above intimated; to the prime cost of construction, including renewals and repairs, add the extra cost of a tunnel, or that of an increased length of road, required in order to avoid the ascents either in whole or in part, due allowance being made agreeably to rule 2d, for such portions of the ascents as cannot be avoided, and if the amount thus produced, is less than the difference or remainder obtained, agreeably to rule 2d, the contemplated substitute is preferable to the route in question.

The views and deductions above advanced, in relation to ascents, curvatures, &c. are no doubt imperfect, and may be erroneous in many respects, yet they are believed to be approximately correct, and have been given for the purpose of explaining some of the more prominent considerations that have been regarded as governing principles in all the examinations that have been made, as well as for the purpose of leading to a full exposition and clear understanding of the nature and character of the routes to be treated of in the subsequent part of this paper.

2d. The mode of construction deemed most economical, efficient and durable.

Under this head we shall endeavor to explain, the various modes of grading or road formation which the nature of the surface seems to indicate in different localities, as well as the manner of railing, deemed most appropriate and serviceable.

The country traversed by the several routes exhibites all the diversities of aspect, from the most rugged and broken, to the most uniform and level; and all the varieties of structure, and consistency, from the most inveterate and unyielding primevals, to the softest and most recent alluvion. Of course all the varieties of road formation hitherto successfully adopted, are likely to occur on different portions of the routes. The vast amount of business likely to be done, on the contemplated rail road, will no doubt require a double track, viz. one track for outward and the other for return transportation, we shall accordingly assume such dimensions and exhibit such statements, as relate to a double track.

The surface width of a double track rail road should be twenty five feet, with the addition of fifteen feet more, for the accommodation of sidelings, whenever they occur. The distance in the clear, between the rails of each track, should be four feet, eight and a half inches, while the distance in the clear between the two tracks, should be about four feet, perhaps four and a half feet. Hencc the transverse extent of the graded surface beyond the rails on each side of the road, will be about five feet. The road surface should be transversly horizontal, or level longitudinally, coincident with the line of gradation adopted for the road. The bed of the road must be formed by means of excavating, wherever the line of gradation passes be-

low the natural surface, and by means of embankments, causeways, or bridges where the surface of the road is to be elevated above the natural surface.

Excavations in earth should have their side slopes inclined at an angle of forty five degress except in a sandy soil, where the slope should be less abrupt. Those in rock may have their sides perpendicular, or nearly so.

On steep hill sides the road bed should be constructed by means of side walls, at least two feet thick at top, and having an exterior slope, of one horizontal to five vertical, the thickness at the bottom being increased, in that ratio, when the height is less than eight feet; and by one or more back grades, in addition to the thickness given, by the slope when the height exceeds eight feet. In case quick sands occur at the bottoms or sides of the excavations, they should be counteracted by inserted arches of mason work, heavily loaded on each side of the way with weight walls, or abutments of heavy masonry.

The exterior slopes of embankments, should be as the hypothenuse of a triangle whose base is three, and perpendicular two. Their foundations should be firm and unyielding, or rendered so by means of piles driven into their substratum, or by a broad and substantial grillage prepared by logs, bushes, &c. whenever the ground is marshy or miry.

Causeways may be constructed in the manner just mentioned, or by means of frame work surmounted by a platform, &c. The trestles employed for their support, should be substantially braced, and the timber used in their construction, of the most durable kind. The sills upon which they are sustained, should be firmly imbedded and secured against subsidences, or other derangements, by underlaying timbers, or by piles, especially in situations where the

soil partakes of the character of a quagmire, or quicksand. The distance between the trestles lengthwise of the road may vary from eight to ten, or even twelve feet, increasing in this respect with their height, for all elevations not exceeding eighteen feet. When the height of the causeway exceeds eighteen feet, a bridge with inflexible truss frames, resting on trestle piers, with appropriate foundations, forty or fifty feet asunder, will be found more economical and durable.

Bridges with spans wide enough to admit the free passage of the most copious floods, as also that of the logs, and other drift that float upon them, will be required, at the crossing of all considerable streams. They should be substantially braced and counterbraced, in order to give efficient support to the heaviest loads, even to the amount of one hundred tons, and to be entirely exempt from yielding, springing, and even trembling; for all defects of this character contribute to retard the progress of carriages upon them.

Abundance of excellent building stone is to be had in all parts of the country, and may be advantageously employed, in the construction of the abutments and piers of bridges, in the formation of side walls—for the support of embankments, and in the construction of culverts and bridges, wherever structures of this sort are required to be built of mason work.

In the location and construction of wooden causeways, and bridges, care should be taken to fix them in such a position, and prepare their foundations in such a manner, that their abutments, piers, or trestles may be prolonged downward, in the direction of the water current, in a manner to afford space enough for the erection of a new bridge or causeway near, and parallel to the old one,

whenever the latter should begin to exhibit symptoms of decay, or inefficiency. On the completion of the new structure, the rail tracks may be diverted from the old to the new road way, without impairing or molesting the business of the rail road.

At all ravines and water courses, culverts or cross-drains, with vents or waterways of sufficient size to admit the free passage of the largest volume of water, likely ever to pass through them, will be required. These ought to be made of stone, which is the material best adapted to that purpose. The use of timber in their construction is probably more objectionable than on any other appendage of a rail road, on account of the speedy decay likely to be induced from the peculiarly exposed situation the timber must unavoidably occupy, when thus employed.

The kinds of railing deemed most economical, efficient and durable, though not least expensive, at first, is of the following description:—

The edge rail, of wrought iron, is believed to be preferable to any other rail hitherto in use. Among the variety of forms given to this rail, that best adapted to its efficient strength, and most conducive to the advantageous exercise and employment of all the powers of the material of which it is composed, is the form of the Pennsylvania edge rail, which is composed of a cap and rib incorporated together; the dimensions of the cap, which is rounded at the corners, being two and a quarter inches wide, and three fourths of an inch deep, and the rib which is united to the cap being three fourths of an inch thick at its junction with the cap, five eighths of an inch thick at its base, and two and three fourth inches deep, making the entire depth of the rail from its crown to its base, three and a half inches. The weight of this rail is about thirty-ty six pounds per lineal yard of each rail.

The chair adapted to its reception is of cast iron and weighs eight pounds. Hence the weight of the rails and chairs required for one mile of road, with two tracks, is nearly one hundred and thirty eight tons; or if we include the keys required to fasten the rail in the chairs, and the nails by which the chairs are fastened to their supports, the aggregate weight of metal required for a double track rail road, is about one hundred and forty ton per mile.

An Edge Rail of very different form, denominated the Y Rail, from its fancied resemblance to that letter, is preferred by many highly respectable engineers, and has been necessarily adopted on the New Orleans and Lake Ponchartrain rail road, the Camden and Amboy, the Boston and Providence, and several other rail roads. This rail may be applied to its supports, without the intervention of chairs. Its weight per lineal yard varies from forty five to fifty pounds, the latter being preferred. Consequently the quantity of metal required per mile, for two sets of rail tracks of this description, nails, splicing plates, &c. included, amounts to at least, one hundred and sixty tons.

The rails and their chairs are to be applied to the road, by means of transverse timbers called sleepers, firmly laid and compacted in the road bed, at the distance of three feet asunder, from centre to centre, and two and a half or three inches below the surface of the road. The sleepers should be of the most imperishable timber that can be procured, such as cedar, hemlock, heart pine, chesnut, or white oak, in pieces about seven feet long and seven inches in diameter, or equivalent thereto, at their smaller ends. They should be fitted for laying in the road, by hewing, or dressing one side of each piece in a manner to form a flat and straight surface for the reception of the chairs. The surfaces thus prepared, should be so adjusted to the

grade line surface, or plane of the road, as to be in exact parallelism with it, and two and a half or three inches below it. In soft, miry or yielding ground it will be proper to place string pieces or sills of undressed timber, beneath the sleepers, and directly under the rails, in which case the sleepers should be so adjusted to the sills, as to produce the parallelism above mentioned. This mode of supporting the sleepers is frequently advisable, upon embankments, especially where sufficient time cannot be allowed for their settlement and consolidation. In the construction of bridges and causeways, the rail sleepers should be applied to string pieces of square timber, by means of notches of moderate depth in the former, embracing the upper side of each string piece. Or it may be more expedient to dispense with sleepers, altogether, on bridges and causeways, and apply the chairs immediately to the string pieces, which in this case should be firmly connected with the transverse timbers of the structure.

In the selection of timber for the construction of a rail road, special regard should be had, not only to the quality of the timber, with respect to its soundness, freedom from splits, shakes, and defects of all kinds, but to the season of the year proper for felling it. Timber of all kinds is found to be more durable if cut in the winter, *when the sap is down*, than in any other portion of the year. The months of December and January are accordingly regarded as the most suitable time for felling timber. Timber that is to be laid in contact with the ground, should be well seasoned before it is applied to the work. All the varieties of oak timber especially, should be thoroughly seasoned in order to secure them from the destructive effects of the dry rot. It will not be amiss to observe further, that not only the seasoning of timber, but its exemption from decay, are

most effectually achieved by the use of timbers of the least possible size; and consequently that the smaller the timbers, provided they possess the requisite strength, and the more perfectly they are seasoned, the more durable will be the structure.

Although the foregoing observations may be accounted desultory, and in many respects irrelevant, and perhaps gratuitous, when regarded as preliminary to the description of routes examined, merely in a cursory and hasty manner, yet they will serve to explain the nature of the objects constantly had in remembrance, and the various methods that may be resorted to, in order to render facilities available, and counteract or surmount difficulties.

Having advanced all we deem pertinent, under such a view, we next proceed to a description of the routes, and the country traversed by them.

3d. *General Remarks on the coast of Maine, and on the aspect, and passes of the country traversed by the routes.*

No coast in the world, probably, presents a more irregular and diversified outline than that of the marine coast of the State of Maine.

The margin of the Atlantic ocean is here studded with a profusion of Islands, of every variety of size, shape and aspect. The shores are deeply indented with bays, inlets, estuaries and coves, alternately with rugged capes, promontories, peninsulas and points protruding in all possible directions. Harbors more or less safe and commodious, and accessible to shipping of the largest class, are frequent. The tide ranges within them from twelve to fifteen feet. They are all more or less incommoded with ice during the winter season, some of them are effectually closed by this means, against the entrance or departure of shipping for many weeks.

Among the harbors most capacious and commodious, and most exempt from the inconvenience last mentioned, and at the same time most accessible both from the ocean and from the interior of the country, and of course most worthy of consideration in connexion with our subject, are the harbors of Portland, Wiscasset, and Belfast, neither of which has been known to be blocked up with ice, more than a day or two at a time, while either of them and especially those first and last mentioned is large enough to accommodate the largest navy in the world, with safe and commodious anchorage. These harbors have been selected however, not merely on account of their size and commodiousness, but on account also of the relations subsisting between them and the route deemed most practicable and advisable for the contemplated rail road. Numerous other harbors equally accessible to shipping are to be found along the coast, but none are so conveniently situated with respect to their connexions with the interior of the State, and their proximity to Quebec.

The country along the coast from the estuary of the Kennebec, to that of the Penobscot river, and extending inland several miles from the sea-shore, exhibits an aspect very much diversified and broken. The hills are numerous, abrupt, and in places rugged, while the vallies and basins interspersed among them, are exceedingly multiform and irregular, with respect to their sizes, shapes and directions. Many of the latter have been long since rescued from the dominion of the ocean, either by a subsidence of its waters, or by an uplifting of its shores, and have thus been reclaimed, and subsequently converted by the labor of man, into fertile meadows, while others still remain subject to the invasion of the tide, and are occupied as estuaries, salt marshes, or muddy flats of various dimensions.

The country south-westward of Kennebec river embracing Freeport, Portland, Saco, Kennebunk, &c. presents an aspect far less variegated. The shores of the Atlantic, if we except that part of the coast situated between Bath and Portland, are less deeply indented with bays and inlets: extensive salt marshes alternately with upland plains and flats, more or less spacious, frequently occur, while the latter are here and there surmounted by ridges and swells of greater or less extent, with rounded summits and gentle declivities. Rocks are less abundant upon the surface, and the soil of the uplands more sandy and tractable.

As we retire inland from the coast, and advance northwardly towards the Canada frontier, the diversifications of the surface assume a different character, and impart to the country a bolder and more rugged aspect. Mountains, hills, valleys, glades, lakes and ponds are here scattered in wild profusion throughout the country. Rivers, rivulets and brooks are numerous, and copious, running in all directions.

The confusion evinced in the disposition and distribution of the hills and mountains, is not less remarkable than the complicated eccentricities, windings and deviousness of the innumerable channels, through which the copious fountains of Maine, discharge their waters. Hence it may be inferred that all passes leading through the country, must be more or less devious and winding, conforming in these respects to the flexures, and meanderings of the valleys and water courses.

In Waldo county a range of elevated hills occurs, commencing near the head of Penobscot Bay, stretching south westwardly about thirty miles, and terminating in the northerly part of Lincoln county. Owing to this hilly tract, the country between the Penobscot and Kennebec presents but two low passes favorable to the transit of a

rail road, viz. one traversing the hilly range at the source of Wescott stream, tributary to Belfast river, and the other passing its south-west extremity in the valley of Sheepscot river.

Another range of hilly country equally as elevated, occurs in the county of Kennebec, stretching from Gardiner, northwardly, and intervening between the tributaries of the Kennebec river, on the north-east, and those of the Androscoggin on the south-west side of the range. Agreeably to information derived from creditable sources, no doubt is entertained of the existence of several passes comparatively low, leading across this range. The most important of these in reference to the contemplated rail road, is a pass leading from the Androscoggin by a small stream and continuing thence through a series of ponds, in a direction towards the most southwardly tributary of Sandy river, and thence down the valleys of these streams to Kennebec river. This pass is entitled to particular notice on account of its being a part of the most favorable route from Portland to the valley of the Kennebec river. The hilly range last mentioned, after passing the source of Sandy river, enters Oxford county and traverses this county westward to the line of New Hampshire, giving rise to the following streams, which run southwardly into the Androscoggin, viz: Webbs, Swift, Ellis, and Bear rivers, at the sources of which the country is very mountainous and broken. The only passes to be had across this part of the range, are those afforded by the valleys of the streams above mentioned, all of which as we approach the more elevated parts of the range become narrow, winding, rugged and abrupt. The route by the valley of Ellis river, Black brook, &c. is undoubtedly more favorable than by either of the other valleys, by reason of its crossing the range, at a less elevation than at either of the three passes.

That portion of Oxford county situated to the south and west of the Androscoggin, and the northerly part of Cumberland county presents a surface agreeably diversified with hills, valleys, flats, upland plains, swells, ridges, ponds and stagnant pools. This part of the country is watered by numerous small streams, the most considerable of which are the Presumpscot, Crooked, Little Androscoggin, Sumner and Concord rivers, the valleys of which and of other smaller streams, present easy passes in almost every direction, some of which might be regarded of importance in connexion with our project, but for want of favorable opportunities of extending them northward across the range just before considered, and thence to the source of the Chaudiere river. It is believed that a favorable pass may be found leading from Portland northwestwardly to the Androscoggin, through which and the pass before mentioned, as existing between the valleys of the Androscoggin and Sandy rivers, a favorable route may be found connecting Portland with the valley of the Kennebec. With respect to this route, however, no particular information can be given. Its examination was pretermitted for want of facilities requisite to that purpose.

Somerset county exhibits all the variety of aspects from the most uniform and unbroken, to the most varied, rugged and mountainous. Here are to be found in the valley of the Kennebec, as also in those of other streams, spacious alluvial marshes, and meadows, extensive upland plains, broad and gentle swells, rugged and precipitous hills and mountains, covered with rocks and faced with precipices. No part of Maine, probably, possesses a soil more tractable and productive, than the southerly part of this county, in which the great bend of the Kennebec is situated. An extensive landscape of basin like appearance, surrounded by

an ampitheatre of hills and mountains, is here presented. The spacious area constituting the bottom of this basin is beautifully variegated with flats, plains, and lowly ridges, and adorned by the winding valleys of the Kennebec and Wesrunset rivers.

This interesting tract of country is accessible from the southward by several comparatively easy passes, which are as follows, viz: one by the valley of Sandy river before noticed, which may be continued through the tract by pursuing the valley of the Kennebec; another from the head of a branch of Sheepscot river, crossing the Sebasticook at Winslow, and proceeding northwardly to Milburn, whence it may be continued by Madison Pond, and reenter the valley of the Kennebec at Solon; a third from the head of Wescott stream, crossing Marsh creek in the township of Brooks, pursuing the valley of Sandy river, and of the outlet of twenty-five mile pond to the Sebasticook, thence by a broad ravine to Libby's Pond, thence through an extensive flat to Hights' Pond, and thence by the valley of Wesrunset, Wentworth Pond, and Fall brook, to the Kennebec river, where it becomes coincident with the routes before mentioned.

Should a route from Bangor be desirable, the most favorable pass for it is likely to be found leading in a direction, for Chandlerville, and thence by the valley of the north branch of the Sebasticook and by Moose poud, to Height's pond, where it becomes coincident with the route last mentioned.

The southerly part of Penobscot county in which Bangor is situated, presents a very rolling surface, divided by numerous water courses, most of which decline towards the southeast, and unite with the Penobscot river. Easy passes for rail roads may readily be found, leading in a direction coincident with the ravines above mentioned.

Agreeably to the representations of many, intelligent and creditable individuals, who have carefully explored this part of the country and the country between it and Moosehead lake, no serious obstacles exist in the way of a rail road till we arrive at the southerly margin of the lake. But any further extension of a feasible route, in this direction is rendered very doubtful, if it be not effectually precluded on both sides of the lake, not only by the rugged aspect, and deep indentations of its shores, but by the difficulty of crossing 'the height of land' northward of the lake, through any pass connecting favorably,with the most feasible route, thence to Quebec. Nor have I been able to learn, either from observation or enquiry, the existence of any favorable pass between Bangor and the valley of Kennebec river, connecting with the latter at any point above the mouth of Austin stream, which enters the Kennebec in the upper part of the township of Bingham.

The northerly portions of the three counties above mentioned, viz. Penobscot, Somerset and Oxford, are yet in a wilderness state—a few widely scattered, and as yet half formed settlements are here to be met with. The surface is exceedingly diversified by hills, mountains, ponds, lakes,valleys, swamps, quags, &c. The mountains exhibit a great variety in their forms and sizes, and are not less remarkable for their insulated positions, with respect to each other and to the neighboring hills. Some of them rise into conical peaks of great height, others into sturdy knobs of equal altitude, others again spread into broad misshapen swells, or ridges variously truncated; all of them are clad in forests, here and there interrupted by naked cliffs and precipices, others contributing to render the general aspect wild, majestic and imposing in the highest degree.

Many of the mountains, it is believed, rise to the height

of four or five thousand feet above tide, or two to three thousand feet above the flats or swamps in their vicinity; some of them probably attain even a greater altitude.

The mountains being isolated in the manner already stated, present numerous broad and deep vistas between them, through which easy passes are to be found, on a level or nearly so, with their bases. The passes of this character leading across the Canada line, are frequent although very few of them are coincident with any direct and practicable route from the Atlantic coast to Quebec.

The gaps or depressions in the height of land dividing between the waters of the Atlantic and those of the St. Lawrence, and of course at the boundary line, between the United States and Lower Canada, may be passed at elevations varying from fifteen hundred to three thousand feet above tide, thus requiring summits of a corresponding altitude, some one of which must be surmounted by the contemplated rail road.

The summits or passes proper to be noted at this time are the following, viz. The summit near the point where the Canada road crosses the boundary line, and in the vicinity of the monument designating a point in that line. This summit is probably much lower than any other point in the line, within the distance of thirty, perhaps forty miles, to the northeastward, and the whole extent of the northern boundary of Maine, to the southwest of the monument, while at same time it is more nearly coincident, with the shortest practicable route between the coast of Maine and the city of Quebec, than any other pass leading across the 'height of land.'

The summit next in order with respect to its elevation, is probably at a gap or depression of the line situated between a source of Portage stream tributary to the river

Du Loup and the source of one of the tributaries of Penobscot river, but the descent from this pass northward, which is to be made, only in the narrow ravine of Portage stream, is abrupt, rugged and very crooked.

A third summit of about the same elevation, as that last mentioned, perhaps somewhat lower, is said to exist between the most southerly source of the Etchemin river, and that of a branch of St. Johns river.

A fourth summit is found westward of the monument, situated between a source of Sandy stream and the main source of the river Du Loup. Its elevation is greater than that of either of the summits before mentioned.

A fifth of still greater elevation across between one of the sources of Sandy stream and that of a branch of the Chaudiere river, called Sampson's river.

A sixth, probably of about the same elevation, is to be found between a branch of Dead river and a small tributary of a small stream called Arnold's river. Through this pass the expedition of that ill fated General, against Quebec, was conducted.

A seventh occurs between the source of Cupsuctuc stream and Arnold's river; and an eighth between the valley of the stream last mentioned, and the source of a small tributary of the Megalloway river. Of these two passes we shall have occasion to treat in the sequel, in as much as they are coincident with one of the main routes examined. Other passes no doubt exist in connection with the boundary line, but it is believed, that none elsewhere present facilities for the passage of a rail road, comparable with some of those above mentioned.

Moosehead lake is the largest body of fresh water within the State of Maine. It is situated in the northerly part of Somerset County, and covers an area of about one

hundred square miles, or upwards of six thousand acres. In shape it is very irregular, being ramified into a multiplicity of arms, bays and coves. Its greatest length is about thirty five miles, while its breadth varies from one to eight or ten miles. Its shores of course are very deeply indented, and in places are exceedingly rugged and broken. This lake is supplied by many copious streams of which Moose river is the most considerable. It serves as the main reservoir from which the Kennebec river derives its waters.

The lake next in order in point of size and situated within the country explored, is Mooselumaguntie, in the northerly part of Oxford County. Its length, including an arm called the Cupsuctuc lake, is about fourteen miles, its breadth from half a mile to three or four miles, and its surface, about thirty square miles or two thousand acres. Its shores are irregular, but less multiform and rugged than those of Moosehead lake. It is one of a series or chain of lakes and ponds connected by water courses, and occuring in the following order, from the Androscoggin, to which they are all tributary, upward to 'the height of land,' viz. Umbagog, twelve miles long, one to three wide. Allagundebagog, one and a half to two miles across; Welokimbacook, five miles long, and one to three wide; Malachunkamaunk or Richardson's lake, six miles long, and one to two broad; Mooselumaguntie of the dimensions already given; Aquosak and Rangelry's lake six miles long, and one to two wide, besides many lagoons, ponds, &c. scattered in various directions.

The Lakes, &c. above enumerated are a very limited number even of those connected with the Androscoggin river, while those connected with the Kennebec and Penobscot rivers are far more numerous, and more profusely

scattered over the country, drained by these noble streams.

The largest and most important rivers of Maine, are—the Penobscot, Kennebec, and Androscoggin. The Penobscot enters a large and commodious Bay of the same name, and is a tide water stream to Bangor, about twenty miles inland from the head of the Bay. Above Bangor its navigation is obstructed by occasional rapids, between which however are extensive reaches of still, and deep river way, well adapted to light navigation.

The Kennebec also receives the tide to Augusta, more than fifty miles from the ocean. Its banks through this distance are rugged and broken; and like all other estuaries connected with the coast of Maine, its shores are deeply indented with inlets, coves, &c. The lines of coincidence between the flats, and river hills, both of this and the Penobscot rivers, are very irregular, crooked and zigzag, especially in the vicinities of the tide.

Rapids and water-falls of great power occur at intervals of a few miles on the Kennebec above tide water, between which are extensive reaches of slack water, easy of navigation. In the neighborhood of the Great Bend, the river hills are apparently lower than on any other part of the river, but as we proceed farther up, they become more elevated, till at length in the vicinity of the Forks, or at the mouth of Dead River, they attain the altitude and size of mountains.

For a distance of twenty miles below the Forks, the river is shoal in many places, and the current generally rapid; and from the same point upward to Moosehead Lake, embracing a distance of twenty-three miles, the river presents a continued rapid, impracticable even for the descent of boats, in any stage of the water.

In many places its valley is limited to a very narrow

width, by steep and rugged hills of great height, and presents the appearance of a chasm cleft in the mountain, through which the river is hurried with the speed of a torrent. The tributary streams also, that enter this part of the Kennebec, especially from the east, are precipitated in foaming cataracts from the mountains, on that side of the river. Dead River, which enters from the southwest, is but little inferior in size to the main stream, above their confluence, nor does it differ much from its compeer, in the rapidity of its current, the ruggedness of its channel, and the wildness of its scenery, in the distance of ten or twelve miles above the Forks.

From these remarks it may readily be inferred, that a pass within the valleys of either of these streams, for any considerable distance, above their junction, would be exceedingly difficult, if not utterly impracticable; and in consequence no extension of a route by either of them, except for the distance of a mile in the valley of Dead River, has been sought for.

The Androscoggin differs in its character materially from the Kennebec, and Penobscot. It unites with the Kennebec in merry-meeting Bay, at the head of which is the inlet of the Androscoggin, and beyond which, the tide ceases to penetrate, being shut out by a bold cascade of many feet, which occurs at that place. From its mouth upward, even to Kennebago Lake, by the main stream, and to Pavmakenney Lake, by the Magalloway, its main tributary, it presents a series of stagnant pools, in the shape of lakes, ponds, and sluggish streams, alternately with cascades and cataracts, accompanied by rapids of greater or less extent, and declivity. Among the most formidable of them are the falls of Brunswick, at Lewiston, and at Rumford, down the last of which the river is

precipitated over rocks and cliffs, at least two hundred feet, in the distance of about a mile.

The valley of this river, in accordance with the character of the stream itself, presents a succession of broad and spacious basins, enclosing extensive meadows of rich appearance, separated from each other by narrows formed at the several waterfalls, by the hills and highlands, which in these places protrude quite to the margin of the river. Hence, it may be presumed, that the valley of the Androscoggin, is quite as favorable for the passage of a rail road, as those of the Kennebec and the Penobscot, except, perhaps, at the narrows just mentioned.

With respect to the valleys of the streams generally, as also to the flats on the shores of the lakes and ponds, within the State of Maine, it should be observed, that they are very variable in their width, alternately expanding into areas of considerable extent, and contracting into narrows of very limited width; of course their boundaries, or the lines of the bases of the hills, which divide the flats from the uplands, are very serpentine and crooked. The hills are faced with slopes more or less abrupt, often rising in the manner of bluffs and promontories, separated from each other by deep recesses, or cave-like cavities. The hill sides are often steep, rugged, and rocky, but cliffs and precipices of great magnitude seldom occur. Hence it may be inferred that the most feasible routes for rail roads are to be found upon the flats, and that routes passing for any considerable distance upon hill sides, are highly objectionable, if not impracticable, on account of the excessive curvatures and the enormous expense that are unavoidable in such localities. The timber growth of Maine, consist principally of the following trees, viz: White, Pitch and Norway Pines, Hemlock, Spruce, Fir, White

Cedar, Hackmitack,* Juniper, Rock and White Maple, Yellow and White Birch, Black, red, and some White Oak, Chesnut, Black, Red, White and Mountain Ash, Red and White Elm, Oil Nut or White Walnut, &c. &c. Of these the timber best adapted to the construction of bridges, &c. above ground, consists of the Pine, Spruce and Hemlock: that best suited for rail road sleepers, and other work contiguous to or beneath the ground, embraces the Cedar, Hemlock, Pitch Pine, Chesnut and Oak, a sufficiency of some one or more of which may be found in every part of the State.

Having premised thus much in reference to the geography of Maine, we next proceed to a very brief description of that part of Lower Canada traversed by the routes under consideration.

As we advance northward from 'the height of land,' dividing between the waters of the Atlantic, and those that fall into the St. Lawrence; having previously passed the boundary line between the United States and Lower Canada, we soon leave the mountains and enter upon a region far less diversified, and of very different character, with respect to its rocks, hills and water courses. On the American side of the line the rocks are decidedly primiative, but as we enter the great basin of the St. Lawrence, the geological formations though distinctly and manifestly transition or secondary, exhibit more clearly and generally a stratified arrangement. Organic remains if ever found in connexion with them, are of very rare occurrence. Gold and copper have been found in the valley of the

*This tree is deciduous, and is distinguished by a variety of appellations, by which it is known in different parts of the country; for example, Bald Spruce, Epinette, Larch, Juniper, Hackmitack, &c.

Chaudiere river. The northwesterly slope of the mountains embraces a very rough and rugged portion of the country situated between the boundary line and the upper Chaudiere river, extending southwestward to the sources of the St. Francis river, and northeastward to the elevated table lands, northward to the sources of the St. Johns river. The elevation, as well as the abruptness of this slope obviously becomes less, as we proceed from the southwest, towards the northwest, till we arrive at the gap near the monument, of which mention has already been made; but a farther progression in that direction, agreeably to the best information that could be obtained, as also to the fairest inferences deducible from the hydography of the country is not likely to lead us across any lower depression, within the region above designated.

As we approach nearer to the St. Lawrence, the country becomes less mountainous, till at length none but far distant mountains are to be seen. The uplands run into extensive swells, and gently sloped ridges, gradually decreasing in altitude as we advance. Rocks are less abundant upon the surface, and the soil of the uplands become deeper and of a better quality.

The valleys of the streams are generally more uniform, broader, and more regularly defined by river hills; while the latter, though occasionally precipitous and sometimes rugged, are generally accessible, on all sides, and present rounded summits, and gentle declivities quite to their bases.

The most favorable route from the boundary line to Quebec, agreeably to the best information I could obtain, both from personal observations and from the testimony of others well acquainted with the country, is to be found in

the valleys of the Du Loup and Chaudiere rivers. Of this route we shall treat more particularly in the sequel.

Another route supposed to be practicable and by some thought to be quite as favorable as that just before mentioned, is said to exist, leading from the source of one of the head branches of the St. John's river across the 'height of land' to a remote source of Etchemin river, and thence downward in the valley of this stream to that of the St. Lawrence near Quebec. But in reference to this route its most zealous advocates admit that the valley of the Etchemin is less favorably adapted to the reception of a rail road, than that of the Chaudiere, while its extention southward from the line which must in all probability be made in the valley of the Penobscot river, or perhaps in that of the St. Johns would no doubt greatly enhance the length of the contemplated road, and at the same time render its position with respect to Maine, less commodious to the population, and less conducive to the interests of the State, than a route by the valleys of the Kennebec and Chaudiere rivers.

A third route crossing the boundary line near the sources of the Androscoggin and proceeding thence to Quebec through the valleys of Arnold's river, lake Megantic, and Chaudiere river, has also received due attention. Of this route we shall also treat more particularly hereafter.

It is believed that either of the routes above designated, is practicable for a rail road at gradations no where exceeding one degree, or ninety two feet per mile, from the main summit at the 'height of land' to the brow of the river hills of the St. Lawrence opposite to the city of Quebec.

But in descending from these heights to the shores of the river, an inclined plane with a lift of about one hun-

dred and fifty feet in a distance not exceeding half a mile, will probably be required, and that the transit upon the plain may be most readily effected by means of stationary machinery.

Having reached the shore of the river, in the way above indicated, an extensive range embracing a distance of many miles is presented along the immediate margin of the river, for the commodious adjustment and construction of quays, warehouses, &c. on the most extensive scale, for the reception and discharge of freight, for the landing and embarkation of passengers, and other purposes connected with the future operations of the rail road.

The St. Lawrence at Quebec affords a most ample, safe and commodious haven for shipping of all classes. The width of the river at this place, and its vicinity varies from one to two miles; the extreme range of the tide within it is about twenty two feet.

A more particular designation of the routes deemed most favorable and of the circumstances attending them, will be exhibited under the following head.

4th. *A description of the several routes that have been examined, setting forth the more remarkable, and prominent features of the country in their immediate vicinities, and the circumstances under which a rail road is deemed practicable on each route.*

My personal attention which has invariably been regulated by information obtained from numerous individuals well acquainted with the aspects and character of the country in which the reconnoissance was to be made, has been directed more particularly to the following routes, which from subsequent observation, as well as from preliminary enquiry, appear to possess stronger claims to consideration, in view of the contemplated rail road, than any others that can be found, viz.

No. 1. A route commencing at Portland proceeding northwardly, and near the centres of the following townships, viz. Falmouth, Gray, Poland, Paris, Rumford, Andover, Township C, Townships No. 4, in ranges 1st, 3d, 4th, and 5th, to the height of land, and thence downward in the valleys of Arnold's river, lake Megantic, Chaudiere and Etchemin river to the southerly shore of the St. Lawrence opposite to Quebec.

No. 2. A route from Wiscasset ascending in the valley of Sheepscot river, passing thence by upper Webber Pond and its outlet from which it approaches the outlet of twelve mile pond, and pursues its valley to the Sebasticook river. It then enters the valley of the Kennebec river, and pursues a course more or less distant from the river till it arrives at the Carritunk Falls; it then ascends in the immediate valley of the river to the Forks or mouth of Dead river, and passing thence by Wilson's and Cold Streams, Parlin Pond and its outlet to Moose river, near Holden's, and thence in the vicinity of the Canada road, to the boundary summit near the monument, whence it descends in the ravine of a stream tributary to the Du Loup, and in the valley of this river, to that of the Chaudiere, where it unites and becomes coincident with the route first mentioned.

No. 3. A route beginning at Belfast, and proceeding northwardly through the valleys of Wescott marsh, Half moon, and Sandy streams to the flats adjacent to Twenty-five mile Pond, and thence on the flats of its outlet to the Sebasticook river, whence it proceeds, either in valleys or on flats, by Libby Pond, Hight's Pond, a branch of the Wesrunset and Wentworth Pond to the valley of Kennebec river, where it becomes united with routes No. 2, and No. 3, either in the township of Solon, or in that of Bingham.

In regard to the numerous localities traversed by the routes above designated, it is not to be supposed that an ocular inspection has been passed upon all of them, but that a careful examination has been made, of all places, where from the representations of those best acquainted with the country difficulties of any kind that would operate as obstructions to the passage of a rail road, were likely to be found.

In treating of these several routes we shall regard them as respectively divisable into two parts, one of which is situated within the limits of Maine, and the other within the limits of Lower Canada, the posts being designated the Maine Division and the Canada Division, both of which we shall consider as divisable into smaller portions, to be called sub-divisions, which will respectively embrace such portions of the route, as may be conveniently described under a separate head.

Route No. 1, from Portland to Quebec.

Length of the Maine Division 133 *miles. Length of the Canada Division* 144 *miles. Aggregate distance from Portland to Quebec* 277 *miles. Sub-division No.* 1. *From Portland to Gray corner, distance sixteen miles.* On leaving the peninsula of Portland, the route crosses a mere tide water arm of the harbor, about a thousand yards wide, and requiring a bridge of that length, and ten to fifteen feet above high water, in order to pass it. Thence to Presumpscut river, four and a half miles, the ground is favorable and the route pretty direct, crossing a low summit by means of a cut of fifteen or twenty feet deep. The Presumpscut and its valley will require a bridge and causeway about four hundred yards long, and fifty feet high. The route then proceeds on uneven and broken ground, connected with the easterly slope of Blackstrap hill, and in the ravine of the

Piscataquis river, seven miles to a summit, near the Methodist meeting house, whence it proceeds two miles further by Goose Pond, crossing its outlet by means of a bridge and embankment, one hundred and fifty yards long, and fifteen or twenty feet high, and ascends to a third summit, which must be crossed by a deep cut of considerable extent. Thence to Gray corner two miles, the ground is favorable being most of the way on an extensive low land flat; and on the residue of the distance, on an upland plain which may be attained by a very gradual ascent from the low ground.

The gradations on this sub-division will not exceed thirty-five feet per mile, the curvatures may be limited to a radius of one thousand feet, numerous excavations and embankments will be required, which together with the bridges, the aggregate length of which, will be nearly a mile, will render the construction on this part of the route very difficult and expensive.

Sub-division No. 2, extending from Gray corner to Andover, and embracing a distance of sixty-two miles.

From Gray corner, the route, after crossing a ravine, three hundred yards wide and fifty feet deep, which occurs in the distance of half a mile from the village, passes on favorable ground about eight miles, to the outlet of Sabbath day Pond, most of the distance being on a pine plain. A summit occurs on this part of the route, between Snow's or Crockett's hill, and the upper village of New Gloucester, which must be crossed by a cut of moderate depth and extent. The outlet must be crossed about half a mile below the Pond. The route then passes between Shaker's and Allen's hills, where it encounters another summit of similar character, dividing the waters of a stream that enters Casco Bay, at North Yarmouth, from those of

the little Androscoggin; whence it proceeds through a swamp, and on the west side of Worthly pond to Dunn's mills, on the outlet of the lower range pond, the distance between which, and the outlet of Sabbath Day pond, is six miles, and the ground the most of the way favorable.

From Dunn's mills, the route proceeds about five miles in a direction for the little Androscoggin, passing eastward of the Hogan ponds, and entering the valley of that stream near its confluence with the outlet, from the ponds just mentioned. It then pursues its course upward in the valley of the little Androscoggin, about twenty-four miles to Bryant's pond.

The principal difficulties to be overcome on this part of the route, in addition to several crossings of the stream, and occasional cuttings and fillings on the slopes of the river hills, are to be met with at Snow's and Bacon's falls, at the former of which a heavy embankment of considerable extent, and much excavation in rocky hill sides, as also a bridge across the stream, will be required, in order to keep the gradations within thirty-five feet per mile; and at the latter an ascent of fifty or sixty feet must be overcome, in the distance of about a mile, at the expense of much deep cutting and filling throughout that distance. In other places the route for the most part traverses flats of greater or less extent, its gradations seldom exceeding thirty feet per mile.

From Bryant's pond the route descends on favorable ground, in the valley of a small stream, tributary to Concord river, and then along the flats of this river, and those of the Androscoggin, about nine miles to the river first mentioned at Rumford village, which is at the confluence of the Androscoggin and Ellis' rivers.

The Androscoggin must be crossed by a bridge about

one hundred and fifty yards long, the appropriate locality for which will probably be found a little above the mouth of Ellis' river.

The route then pursues the valley of Ellis' river upward about ten miles to Andover, occasionally crossing the stream in order to shorten the distance, or to avoid uneven ground. The ascent on this part of the route is very inconsiderable, not exceeding two or three feet per mile.

The bridging on this subdivision across the more considerable valleys and ravines, may embrace in the aggregate, a length of about one thousand yards; the heavy embankments or causeways about one mile. The gradations with the exceptions already made, will nowhere exceed thirty-five feet per mile, while on far the greater portion, they may be limited to a very few feet per mile.

The curvatures may readily be limited to a radius of one thousand feet. Materials suitable for construction, consisting of Pine, Hemlock, Spruce, White Cedar, Juniper, White Oak, Elm, &c. also granite of an excellent quality, Brick, Clay, &c., are sufficiently abundant and convenient.

Subdivision No. 3, from Andover to the main summit, between the Maine and Canada divisions, embracing a distance of fifty five miles.

From the spacious valley or glade in which Andover is situated, the route passes upward along the west side of the main west branch of Ellis' river, crossing two considerable tributaries, and proceeding upward on the westerly slopes of the ravines, of a third called Boggy brook, to the easterly slope of Round hill, and thence on the slope of this hill, till it enters the ravine of Black brook, another tributary of Ellis' river, along which the route pursues its course quite to the source of the stream, in the immedia te

vicinity of lake Welokennebacook, the distance from Andover to the lake being computed at ten miles. Of this distance the first two miles are on uneven ground, requiring much cutting and filling, together with two considerable bridges, accompanied by causeways, the gradations rising to forty or fifty feet per mile. The next five miles are on ragged and steep side hills, requiring much deep cutting, and heavy side walling; the gradations on this distance being not less than sixty feet per mile. The remaining distance of three miles, is on a flat, swampy tract of land extending quite to the lake shore, with very little change of elevation. It is very remarkable, that the route by the ravine of Black brook, may be continued to the very margin of the lake, without crossing a summit, from which it must descend in order to arrive at the lake shore, while the lake discharges its waters by an outlet, in a very different direction.

Having reached lake Welokennebacook, the route passes along its northerly shore either upon flats or hill sides, more or less steep, to the outlet of Molechunckamaunk or Richardson's lake, seven miles through which the course is serpentine, with gentle curvatures.

From this outlet, commonly called the narrows, the route proceeds northwardly three and a half miles, passing the east end of Richardson's lake and traversing a neck of land situated between the lake first mentioned and an arm of Lake Mooselamaguntic, called Trout cove, to the outlet of the Lake last mentioned, at the lower extremity of the cove, the ground through this distance being somewhat rough in places, and especially across the neck, which is low and rocky. The outlet must be crossed at its head, or perhaps within the cove by a bridge six or eight hundred yards long, the water being shoal and the bottom rocky throughout this distance.

From Trout cove the route pursues a very serpentine course along the west side of Lake Mooselamaguntic, passing alternately on flats and side hill slopes, and of course requiring much cutting and embanking for a distance of fourteen miles, which carries us to the head of the Lake, or to the mouth of the Cupsuctuc stream which enters from the north.

From the Narrows before mentioned, to a point in the valley of the Cupsuctuc stream, a mile above the head of the Lake, a different route may be substituted, passing over ground quite as favorable, but through a distance three or four miles greater, by pursuing the following track, viz: from the head of the Narrows, proceed north-eastwardly, perhaps two miles, then eastwardly eight miles further to the southeast extremity of Lake Mooselamaguntic, and thence north-westwardly, along the east side of the Lake, and in a direction for the point above designated, about thirteen miles, crossing the Kennebago stream a little below its confluence with the outlet, from Agnosak or Rangeley's Lake.

From the mouth of the Cupsuctuc, the route proceeds upward in the valley of this stream, quite to its source at the Canada Boundary ; the distance from the head of Mooselamaguntic to the line being computed at twenty miles.

The valley of this stream exhibits a series of basins, separated from each other by Narrows of greater or less extent. The former embrace large tracts of flat land, many of them low and marshy ; while the latter are limited to a very inconsiderable width, by abrupt, steep, and rocky hills and mountains. There are three considerable reaches of this character, which I shall denominate the Lower, Middle and upper Narrows, the length and vertical ascent, of which are estimated as follows, viz : the Lower three

fourths of a mile long, ascending forty-five feet, or at a gradation of sixty feet per mile ; the Middle two miles long, gradation ninety feet per mile, two considerable cascades occur on this part of the stream ; the Upper four miles long, gradation sixty feet per mile. The gradation in other parts of the valley need not exceed thirty-five feet per mile.

It may readily be inferred that the route on this entire subdivision, will be sepentine, but it is believed, that the curvatures may be limited in extreme cases to a radius of six hundred feet; and in general to a radius of one thousand feet. Excavation and embankments will be frequent and in many places very heavy: numerous bridges from fifty feet, to six or eight hundred yards long will be required. Many swamps are to be traversed upon which the road must be sustained upon piles, or a very broad grillage of timber; all of which will contribute to render this part of the route very expensive.

Subdivison No. 4, *from the Canada line to the outlet of lake Megantic, or head of Chaudiere river, embracing a distance of twenty seven miles.*

From the 'height of land' between the sources of the Cupsuctuc stream, and Arnold's river, which is here a portion of an extensive flat drained by both of those streams, the route proceeds downward, in the narrow and abrupt valley of the stream last mentioned, at gradations varying from sixty to ninety feet per mile, for a distance of nine or ten miles from the summit. Through the distance just mentioned, with the exception of half a mile from the line, the ravine presents very few flats, is bounded on both sides by hills of great height, but gradually sloped at their bases, and it is remarkably free from curvatures. The road formation will no doubt prove difficult and expensive on

this part of the route, on account of heavy excavations, embankments, walling and bridging, in the more rugged portions of the valley.

It is proper to remark in this place, that a route by the valley of the Magalloway river may connect with this sub-division, at the distance of about two miles northwardly of the summit, where another summit is to be found at least one hundred feet lower, than that just before mentioned.

The connexion may be formed at this point, either by means of an inclined plane of one hundred and fifty or two hundred feet lift, or by means of a tunnel eight hundred, perhaps one thousand yards long, and perhaps one hundred feet below the summit; at this place passing from the ravine of Arnold's river, in a direction to enter a branch of the Magalloway. From the summit here contemplated the route in view leads downward in the ravine of the branch, and enters the valley of the Magalloway about three miles above Parmachena Lake, through which the Magalloway flows. It proceeds thence downwards, in the valley of the river, to a point about two miles above Axiscoois Falls where it turns from the river, and pursues a course leading over an extensive swamp, &c. situated between the Axiscoois, and observatory mountains, to the head of Richardson's Lake, and then southwardly of the Lake to the narrows between it and Lake Welokennebacook, where it unites with the route designated under sub-division, No. 3. The substitute here contemplated will be somewhat longer than the route already described, between the same points. But it is believed that it will pass on ground quite as favorable, if not more so, and will be attended by gradations more easy and less abrupt. The principal difficulties to be apprehended on this route, are the passage of numerous extensive swamps and quags, some of which are subject to

occasional overflows from the river. The final adoption of a general route, in this direction, ought to be predicated on a survey of both these routes.

Having descended below the Narrows of Arnold's river in the distances already stated, the valley of the stream becomes broader, embracing extensive natural meadows of beautiful appearance, through which the stream meanders in serpentine folds, and with a very sluggish current, for a distance of five miles till it enters the extensive marshy and miry flats at the head of Lake Megantic. The route leads across these flats, upon which the road formation, for a distance of about two miles, must be effected by means of embankments supported on piles or broad grillage. The route then proceeds about nine miles on the south side of the Lake, along the slopes of hills, more or less abrupt, and in a direction nearly parallel to the Lake shore, and of course considerably serpentine, quite to the outlet of the Lake.

The gradations on this sub-division, with the exception already stated, need not exceed thirty feet per mile. The curvatures may be limited to a radius of eight hundred feet. The road formation is not likely to prove very troublesome or expensive, except across the swamp at the head of Lake Megantic.

In reference to this, as also to the preceding subdivision it should be remarked, that timber suitable for the work, consisting of White Cedar, Pine, Hemlock, Spruce, Juniper, Rock Maple, Yellow Birch, Elm, &c. are to be had with convenience, and in sufficient abundance.

Sub-division No. 5, extending from the outlet of Lake Megantic, downward in the valley of the Chaudiere to the mouth of the Du Loup river, and embracing a distance of fifty-three miles.

As already intimated, the route under this head pursues the valley of the Chaudiere river, but whether on the right or left shore, or occasionally on either, and at what points the transitions from one side to the other may be not conveniently effected, can only be determined by an instrumental survey.

The Chaudiere throughout this sub-division may be regarded as a continued rapid, presenting at two places only falls too abrupt for the safe ascent of canoes, in an elevated stage of the water. In its declivities it varies from three or four, to thirty feet per mile.

The width of its valley is very variable, the uplands seldom presenting themselves on both sides of the river, except in the last four miles of the sub-division, where only precipices or cliffs occur at or near the margin of the river. The course of the stream is somewhat serpentine, but its flexures are neither abrupt or circuitous, except at two or three points, where there are bends of moderate extent, the gorges of which are believed to be practicable for a rail road. The greatest difficulties in this part of the route are to be encountered on the last four miles above mentioned. These impediments are occasioned by the irregularity and ruggedness of the shores in the vicinity of Jersey Falls, three and a half miles above the mouth of the Du Loup, and by the abruptness, and height of the river hills, between the points just designated. Within this distance, also, the river must probably be crossed by a bridge one hundred and fifty, or two hundred yards long, and forty or fifty feet high.

The route on this sub-division must of course be serpentine, with curvatures that may be limited to a radius of one thousand feet, the gradations need not exceed thirty-five feet per mile. The road formation will no doubt prove expensive, on account of the frequent bridges, that may be deemed advisable, in order to avoid several circuits made by the river, which must otherwise be traversed.

In reference to this and the two preceding sub-divisions, it should be remarked, that the cost of constructing a rail road, will be very materially affected, by a total absence of the means of subsistence at present afforded by the country in which they are situated. As yet no settlements have been made within a considerable distance of the track pointed out, except in two or three instances, nor are there any roads or other facilities presented by the country, for the conveyance thither of the necessary supplies.

Sub-division No. 6. This sub-division extends from the mouth of the Du Loup, to Point Levi, on the shore of the St. Lawrence opposite to Quebec, and embraces a distance of sixty-four miles.

The residue of the route to Quebec is comprised in this sub-division, and traverses a region of the most cheering and beautiful aspect, inhabited by a dense population of French origin, not more remarkable for their cheerfulness and good humor, than for their contentment, with the limited comforts that fall to their lot. The country on both sides of the Chaudiere and Etchemin through almost the entire distance above mentioned, is occupied by villages, cultivated fields or other enclosures, a very small proportion of the surface, remaining uncleared of its natural growth.

The valley of the Chaudiere is generally broad, and bounded by hills of very gentle acclivity. The river is most of the way sluggish, and of course liable to overflow its banks, and inundate portions of its valley, in times of freshet. From this valley the route passes to that of the Etchemin leaving the former at a point about six miles below the village of St. Mary, and entering the latter at or near the village of St. Henry. From this place flats or plains are remarkably continuous, quite to the brow of the river hills, binding upon the valley of the St. Lawrence.

The most favorable locality for the contemplated road, appears to be on the west side of the river from the mouth of the Du Loup, downward about forty miles to a point six miles below St. Mary's where it may cross the river, on a bridge about two hundred yards long, and twenty-five or thirty feet high, and proceed thence over a summit of moderate height, in a direction for a tributary branch of the Etchemin, and thence downward near the branch to the flats before mentioned, and thence on favorable ground to the valley of the St. Lawrence, which must be entered as heretofore intimated, by an inclined plane. The gradations on the route may be limited to thirty feet per mile, or even less, except at the crossing of the summit above mentioned, where it may be advisable to adopt a gradation of thirty feet per mile, for a distance of one mile on each side of the summit. Although the route is slightly serpentine, conforming in this respect to the courses of the valleys, yet its curvatures may probably be limited to a radius of two thousand feet. The only considerable difficulty in the way of constructing a rail road on this portion of the route will probably be found in elevating the road surface on many parts of the route, six or eight feet above the

river flats, in order to place the rail tracks above the reach of the highest freshets.

We shall conclude our description of this and the routes hereafter to be considered, with a brief synopsis, or general view setting forth in a tabular form, certain localities traversed by the route, the probable distances between those localities, the distances corresponding to different gradations, the length of each division, and subdivision, the aggregate distances on each grand division, and the assumed probable cost of road formation, the expense of bridges, causeways, excavations and embankments being included, except in particular cases, in relation to which extra allowances are deemed more appropriate.

Synopsis of Route No. 1, or the Portland and Quebec Route.

Grand Division.	Subdivisions. No.	LOCALITIES. Beginning at Portland, and including the places designated.	Supposed distances under different gradations. 0 to 35 feet per mile	35 to 60 feet per mile.	60 to 90 feet per mile.	Distances on each Subdivision.	Length of each Subdivision.	Distances and Lengths of Grand Divisions.	Probable cost of road formation. Average cost per mile	Probable aggregate cost.
			Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Dolls.	Dolls.
Maine Division.	1	Extra for Bridge at Portland,								45,000
	—	Presumpscut River,	5			5			6,000	30,000
	—	Extra for a Bridge, &c.								7,000
	—	Gray Corner, or village,	11			11	16	16	13,000	143,000
	2	Outlet of Sabbath-day Pond,	8			8			6,000	48,000
	—	Extra for Bridges, &c.								15,000
	—	Little Androscoggin,	11			11			8,000	88,000
	—	Bryant's Pond,	23	1		24			6,000	138,000
	—	Extra for Embankments, &c.								30,000
	—	Androscoggin River,	9			9			6,000	48,000
	—	Andover village,	10			10	62	78	8,000	80,000
	3	Head of Black Brook,	3	7		10			10,000	100,000
	—	Trout Cove,	11			11			10,000	100,000
	—	Extra for Bridge, &c.								30,000
	—	Mouth of Cupsuctuc stream,	14			14			13,000	182,000
	—	Canada Boundary,	13	7		20	55	133	11,000	220,000
	—	Extra for Bridges,								10,000
		AGGREGATES,	118	15		133	133	133	10,000	1,330,000
Canada Division.	4	Shore of Lake Megantic,	7	2	9	18			9,500	171,000
	—	Head of Chaudiere River,	9			9	27	27	8,000	72,000
	5	Mouth of River du Loup,	53			53	53	80	7,500	397,500
	—	Extra for Bridges, Embankments, &c.								50,000
	6	Crossing of Chaudiere River,	40			40			7,000	280,000
	—	Extra for a Bridge, &c.								9,000
	—	St. Henry's,	11			11			4,500	49,500
	—	Extra for a Bridge, &c.								7,000
	—	Head of inclined plane,	10			10			4,000	40,000
	—	Point Levy,	1	1	1	3	64	144	10,000	30,000
	—	Extra for inclined plane,								10,000
		AGGREGATES,	131	3	10	144	144	144	7,750	1,116,000
		Aggregates for the entire Route.	249	18	10	277	277	277	8,830	2,446,000

The statements exhibited, and the conclusions drawn in the foregoing synopsis, are sufficiently clear and obvious to be understood without farther explanation.

From them it appears that the probable average cost of road formation on the Maine division, will be ten thousand dollars per mile, all things included, and on the Canada division, seven thousand seven hundred and fifty dollars per mile. If to the former we add, seven thousand dollars per mile, for railing, &c. of a single track, or thirteen thousand dollars per mile for the railing of a double track, all things included, which is probably a fair allowance for this part of the work, executed in the best and most substantial manner, we shall have for the average cost of a single track rail road on the Maine division, seventeen thousand dollars per mile, or for a double track rail road twenty three thousand dollars, per mile; or for the entire division from Portland to the Canada line with a double track, three millions fifty nine thousand dollars.

By a similar calculation for the Canada division, we shall have for the average cost of a single track rail road from the Canada line to Point Levy, fourteen thousand seven hundred and fifty dollars per mile, or for a double track road, twenty thousand seven hundred and fifty dollars per mile; or the aggregate cost of a double track rail road on the entire division, two millions nine hundred and eighty eight thousand dollars.

Hence the aggregate cost of a double track rail road on route No. 1, from Portland to Quebec, is computed at six millions and forty seven thousand dollars which is equivalent to an average cost of eight thousand eight hundred and thirty dollars per mile.

Route No. 2. from Wiscasset to Quebec.

Length of the Maine Division one hundred and fifty four miles, length of the Canada Division ninety four miles. Aggregate distance from Wiscasset to Quebec two hundred and forty six miles.

Subdivision No. 1, *extending from Wiscasset to the Sebasticook, and embracing a distance of forty two miles.*

At Wiscasset the conveniences presented for a connexion between the shores of the bay, and a rail road terminating at this place, though somewhat limited in their extent, are probably not surpassed by those of any other place on the coast of Maine. Sites commodious for the location of two branches are here afforded, viz. one leading along the shore, and presenting facilities for numerous connexions with quays, &c. and the other entering immediately in the rear of the present village, and affording ample accommodations for the business likely to be done on the road, in the way of personal and light transportation, without interruption from commercial business.

From the northeasterly part of the village, the route enters a valley separated from the main valley of Sheepscot river, by an elevated ridge, and pursues its way by this inland pass, about ten miles to the village of Alna, a little below which it enters the valley of the Sheepscot river.

The ground traversed by this part of the route is somewhat broken in places and will require much cutting and filling. It then ascends in the valley of the river, encountering numerous inequalities of surface, crossings of the stream, curvatures, &c. through a distance of eight miles to Turner's mills. The rugged aspect presented on this part of the Sheepscot, will be likely to render the road formation very expensive. The curvatures however, may be

limited to a radius of one thousand feet, and the gradations to thirty five feet per mile.

From Turner's mills the route ascends in the valley of the Sheepscot, and in that of its western branch on favorable ground, quite to upper Webber pond, the distance being about nine miles. The gradations may be limited to thirty five feet per mile, perhaps less, and the curvatures to a radius of one thousand feet.

The route then passes a little to the eastward of the pond on ground less favorable, to the flats traversed by its outlet, the descent to which from the shore of the pond must be made over uneven ground, and at a gradation of thirty five feet per mile, for a considerable distance. These flats must be pursued for the distance of half a mile from the pond, when the route takes a new direction leading to the outlet of twelve mile pond, which it reaches at a point near the village called North Vassalborough, and about one mile below the pond, and at the distance of about ten miles from the summit at the southerly extremity of upper Webber pond.

The route through the distance last mentioned will be serpentine, and even circuitous in places. Its gradations may be limited to thirty five feet per mile, at the expense of much cutting and filling especially in its passage by Taylor's tavern, near the outlet of upper Webber, or three mile pond.

From North Vassalborough the route proceeds downward upon the flats of the outlet from twelve mile pond, on ground very favorable for its passage about five miles to Sebasticook river, which it reaches at a point, about two and a half miles above its mouth, when this subdivision terminates.

The materials suitable for construction, on this subdi-

vision, are convenient, and of good quality. The timber growth consists of maple, beach, birch, hemlock, white cedar, fir, spruce, white pine, oak, ash, elm, &c. Woodlands however, occupy but a small proportion of the country.

The gradations on this part of the route may be limited, as already remarked, to thirty five feet per mile, and the curvatures to a radius of one thousand feet.

Subdivision, No. 2, extending from the Sebasticook to Currituuk Falls in Solon, and embracing a distance of thirty four miles.

From the crossing of the Sebasticook at the point already designated, a tract of flat or valley country, occasionally coincident with the immediate valley of the Kennebec, but more generally separated from it by hills, ridges, and planes of greater or less elevation, extends northwardly in a pretty straight direction, quite to the outlet of Madison pond: according to creditable representations of numerous individuals, well acquainted with this part of the country, this tract is of considerable width, of an aspect remarkably even and presents no obstacles in the way of an easy and nearly direct passage of a rail road, through the distance above indicated, which is about twenty two miles. The route traverses this track, approaching the Kennebec opposite to the village of Fairfield, crossing the Wesrunset river, near the mouth of Madison pond stream, and ascending in the valley of this stream, nearly to the pond. It proceeds thence northwardly, through the same valley tract to a summit dividing between the waters of Wesrunset, and the flats of Michael's stream, which last are coincident with a spacious upland plain, extending quite to the Currituuk Falls, where this subdivision terminates.

The passage of the summit just mentioned will require a deep cut in ground very easy of excavation, attended by gradations of thirty five, perhaps forty feet per mile, for a distance of a mile probably on either side of the summit; with these exceptions it is believed that no difficulties exist on the subdivision that cannot be easily surmounted, and at a very moderate expense. The distance from the outlet of Madison pond to the Falls of Currítunk is computed at twelve miles.

A substitute for the route above indicated on this subdivision, is to be found in the following localities; beginning at a point on the Sebasticook river most favorable for the termination of the preceding subdivision, and pursuing its valley upward to the mouth of twelve mile stream, thence by the valley of this stream to Sibly pond, thence over an extensive flat, to Hight's pond, and thence by Athens village, Wentworth pond, &c. either to Solon or Bingham. The shades of difference between this route and that above described, are so slight with respect both to comparative distance, and facilities of passage, that in case a route leading either from Wiscasset or from Augusta, should be adopted, both routes ought to be actually surveyed, in order to determine to which the preference should be given.

In reference to a route from Augusta as above intimated, or rather from a point on the east side of the Kennebec opposite to the town of Gardiner, where a much more favorable connexion with tide water is presented; it is proper to remark in this place, that such a route may proceed upward on the east side of the river, and within its immediate valley to the mouth of the Sebasticook where it may connect with the route already described, as leading from Wiscasset. The route here contemplated, will pass most

of the way on favorable ground, but in places must encounter, much heavy cutting, side walling and embankment, especially through the distance from the lower part of Vassalboro,' downward to Gardiner. Its further extension downward on the east side of the river, would be attended with a very heavy expense, and is deemed inadvisable, if not utterly impracticable, in view of any means that can be brought to bear upon it, further than to the entrance of the Kennebec river into Merry Meeting Bay. While any attempt to cross the river below Augusta, and pursue a course downward, either to Bath or to some point on Casco Bay, would prove altogether inadmissable on account of the interruption it would occasion, both to the navigation of the river, and to the transit upon the Rail road.

The distance from Gardiner to the Sebasticook by the route above intimated, or to the point of connexion, between this and the route from Wiscasset, is twenty-five miles; the distance from Wiscasset to the same point, being seventeen miles further.

Sub-division No. 3. Extending from Currituuk Falls to the mouth of Wilson's stream, in the valley of Dead river, one mile above its confluence with the Kennebec, and embracing a distance of thirty-two miles.

At Currituuk Falls is a site remarkably favorable for a bridge, on which the rail road may be conducted across the river. The length of the bridge need not exceed one hundred yards, exclusive of abutments.

Having crossed the river, the route ascends along its westerly margin, occasionally passing in rear of insulated sand ridges, called horse backs, of greater or less extent, and here and there encountering steep-hill sides. Opposite to the village of Bingham, is a high bluff rock, pre-

senting a front nearly perpendicular, at the water's edge for the distance of about one hundred yards. This is the only instance of a rocky precipice jutting to the margin of the river, on this entire sub-division. Some distance below this precipice, is a bluff bank of clay, sand, and gravel, occupying a distance of about two hundred yards, which will be difficult to pass, on account of its liabilty to slopes or avalanches. These difficult passes may be avoided by ascending to Bingham, on the east side of the river, and there crossing by a bridge about two hundred yards long to the other side.

On entering the valley of Dead River, and for a considerable distance below, the route must be conducted along side hills, more or less abrupt, in order to attain a plain elevated fifty or sixty feet above the surface of this river, upon which the road may be deflected in a manner to cross the river, and enter the ravine of Wilson's stream, to the best advantage, which requires a bridge about two hundred and fifty yards long, and sixty, perhaps seventy feet high, in order to avoid the adoption of an inclined plane, on which stationary power must be employed. The curvatures on this sub-division may be limited to a radius of one thousand feet, except at the crossing of Dead river, where the radius will not probably exceed six hundred feet. The gradations need not exceed thirty-five feet per mile, on any portion of the route, and may be limited to ten feet per mile, or even less through the greater part of the distance. Materials for construction are abundant, and convenient, supplies being attainable by water conveyance. The road formation on about three miles of the upper part of the sub-division, will of course be very expensive.

Sub-division No. 4. Extending from Dead river to the Boundary Line summit, and embracing a distance of forty-four miles.

Having entered the ravine of Wilson's stream, at an elevation of sixty or seventy feet, above the surface of Dead river, the route ascends in the valley of this stream, by gradations varying from sixty to ninety feet per mile, about four miles, when it approaches the valley of Cold Stream. Here is an extensive tract of flat and swampy land, in which Salmon stream, has several of its sources, and through which also Cold stream winds its way. The route ascends in the valley of the latter, at a moderate rate, not exceeding thirty feet per mile, for two or three miles, when it rises more abruptly for four or five miles to a summit situated between a source of Cold stream, and a spring branch running northwardly into Parlin Pond. The ascent to the summit just mentioned may be effected at gradations limited to one degree, or about ninety feet per mile, on the distance last mentioned. From the summit the route descends in the ravine of Parlin Pond stream, about two miles to the head of the pond just mentioned, the gradations on this part of the route being limited to ninety feet per mile.

The distance from the mouth of Wilson's stream on Dead river to the head of Parlin Pond, is computed at fourteen miles. The surface traversed by the route is occasionally flat and swampy, but for the most part uneven, and in places, very rugged and rocky. Through the distance here contemplated, the route is approximately the same as that suggested by Major Bache, in his late report on a route, for a national road to the Canada Line.

From the head of Parlin Pond, the route proceeds northwardly on its west shore about three miles, over ground

somewhat uneven, and thence pursues its course downward on an extensive flat, through which the outlet of the pond has its course, and which are coincident with the flats of Moose River, upon which last the route which must cross the river, on a bridge about one hundred yards long, is continued to Holden's, sixteen miles from the head of the pond, or thirteen miles from its outlet. Throughout this distance, the ground though low, flat and in places swampy, is generally elevated,above the reach of freshets, and is very favorable for a rail road. The gradations need not exceed fifteen or twenty feet per mile, on the roughest ground.

From Holden's the route ascends in the valley of Sandy stream, and that of one of its branches on favorable ground about eight miles, to a low summit situated between Ball mountain,on the right, and Sandy mountain on the left, and dividing between the waters of Kennebec and Penobscot rivers.

This summit may be reached by gradations not exceeding thirty five feet per mile; the route leading to it being generally on flats; or in a valley sufficiently spacious for its accommodation, though very rocky at the summit.

The route proceeds thence on sidling ground of a gentle slope, and even surface about two miles, descending at a moderate rate till it enters the flats of three head branches of Penobscot river, whence after traversing the flats about a mile, it ascends in the ravine of the most northerly branch of gradations, varying from sixty to ninety feet per mile, for a distance of three miles, which carries us to the boundary summit, or 'height of land,' dividing between the waters of the Atlantic and St. Lawrence, where this subdivision terminates.

The route throughout the subdivision is remarkably

direct, notwithstanding the rugged, broken and mountainous character of the country traversed by it, and in its general course is very nearly coincident with the cardinal bearing of Quebec.

Between Parlin pond and Moose rivers, a considerable circuit is made by it, in order to avoid Hurricane mountain, which presents itself in the way of a direct route.

The curvatures on the route are every where gentle, and may probably be limited to a radius of two thousand feet, especially on the more abrupt inclinations; while its gradations with the exceptions already stated, will be very inconsiderable. The materials for construction are abundant, the country as yet remaining uncleared.

The circuit above mentioned may probably be avoided by crossing a low summit, situated between Hurricane and Owleshead mountains, but it is believed that the saving in distance will not be sufficient to compensate for its elevation above the other route, and the additional cost of road formation.

A substitute has been proposed on a part of this subdivision, calculated to increase its distance very considerably, while it is represented as more level and generally on more favorable ground than the route above described. Its locality is as follows, viz. leaving the valley of Coldstream, about five miles from the commencement, of this subdivision, and proceeding thence on flats, on which the headwaters of Salmon stream, Enchanted stream, &c. are to be crossed, thence in a direction for the east side of Attain pond, thence by the east side of Wood pond, and thence crossing its outlet, which constitutes Moose river, to Holden's, where it again becomes coincident with the route described.

Subdivision, No. 5. Extending from the boundary summit to a point on the Chaudiere river, opposite to the mouth of the Du Loup, and embracing a distance of thirty miles.

The boundary summit is situated in the lowest part of the pass heretofore represented, as the lowest depression to be found in the boundary line, within the scope or reach of the contemplated rail road. At this place is a tract of flat and swampy land of very considerable area; from which the water flows southwardly towards the Atlantic, and northwardly towards the St. Lawrence, and in which the summit is situated.

From the summit, the route descends in the valley of Monument stream on favorable ground about five miles, at gradations not exceeding sixty feet per mile, and continuous thence in the same ravine and in that part of the Du Loup river, about twenty five miles further, descending at gradations not exceeding thirty five feet per mile to the valley of the Chaudiere river. Through the last two miles of this descent, the ravine of the Du Loup is very narrow, crooked and abrupt; but by frequent crossings of the stream, on bridges, the curvatures may be probably limited to a radius of one thousand feet, and by crossing the Chaudiere river on a bridge forty or fifty feet high, and probably about two hundred yards long, the gradations may be limited to forty or perhaps thirty five feet per mile on this part of the route.

The road formation on this subdivision, will prove expensive, on account of the frequent bridges and embankments, that will be required, especially on the lower part of the Du Loup, where also the expense will be much enhanced, by the amount of side walling required for the support of the road bed on the steep declivities of the ravine. Stone of a good quality for this and other purpo-

ses is to be found in abundance near the sites where it will be required; and timber abounds every where in the vicinity of the route.

Subdivision, No. 6. *From the mouth of the Du Loup to point Levy, sixty four miles.*

This sub-division is identical with sub-division *No.* 6, *of Route No.* 1, which see.

We shall conclude our description of this route also, with a brief synopsis, setting forth certain localities traversed by the route, the distances between them respectively, the supposed distances, under different gradations; the extent of each sub-division, the distance on each grand division, the probable average cost per mile, and the aggregate cost of road formation on the several portions of the route separately considered, the extra allowances deemed proper on account of Bridges, &c., the average cost per mile, and aggregate cost of each grand division, and of the entire Route, &c.

Synopsis of Route No. 2, or the Wiscasset and Quebec Route.

Grand Division.	Subdivisions. No.	LOCALITIES. Beginning at Wiscasset, and including the places designated.	Supposed distances under different gradations. 0 to 35 feet per mile.	35 to 60 feet per mile.	60 to 90 feet per mile.	Distances on each Subdivision.	Length of each Subdivision.	Distances and Lengths of Grand Divisions.	Probable cost of road formation. Average cost per Mile	Probable aggregate cost.
			Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Dolls.	Dolls.
Maine Division.	1	Turner's Mills,	18			18			14,000	252,000
	—	Upper Webber Pond,	9			9			7,000	63,000
	—	North Vassalborough,	10			10			7,500	75,000
	—	Sebasticook River,	5			5	42	42	6,000	30,000
	2	Outlet of Madison Pond,	22			22			6,000	132,000
	—	Carritunk Falls,	10	2		12	34	76	8,000	96,000
	—	Extra for a Bridge, &c.								5,000
	3	Point opposite Bingham,	8			8			8,000	64,000
	—	Mouth of Wilson stream,	24			24	32	108	7,500	180,000
	—	Extra for a Bridge, &c.								12,000
	4	Head of Parkin Pond,	4	3	7	14			9,000	126,000
	—	Holden's on Moose River,	16			16			6,000	96,000
	—	Extra for a Bridge, &c.								5,000
	—	Boundary summit,	11	1	2	14	44	152	8,000	112,000
		AGGREGATES,	137	6	9	152	152	152	8,210	1,248,000
Canada Division.	5	Mouth of the du Loup,	25	5		30	30	30	9,000	270,000
	—	Extra for a Bridge, &c.								20,000
	6	St. Mary's,	40			40			7,000	280,000
	—	Extra for a Bridge, &c.								9,000
	—	St. Henry's,	11			11			4,500	49,500
	—	Extra for a Bridge, &c.								7,000
	—	Head of inclined plane,	10			10			4,000	40,000
	—	Point Levy,	1	1	1	3	64	94	10,000	30,000
	—	Extra for inclined plane,								10,000
		AGGREGATES,	87	6	1	94	94	94	7,612	715,500
		Aggregates for the entire Route.	224	12	10	246	246	246	7,982	1,963,500

From the foregoing Synopsis, it appears that the distance on the entire route from Wiscasset to Quebec, is two hundred and forty-six miles, of which two hundred and twenty-four miles are attended by gradations not exceeding thirty-five feet per mile; twelve miles by gradations not exceeding sixty feet per mile, and ten miles by gradations not exceeding ninety feet per mile, or one degree. It also appears that the probable average cost of road formation, per mile, will be seven thousand nine hundred and eighty-two dollars, and that the aggregate cost of this item on the entire route, bridges, embankments, &c. included, is one million nine hundred and sixty-three thousand, five hundred dollars.

To this amount if we add seven thousand dollars per mile for a single track, or thirteen thousand dollars per mile for a double track, as we did in reference to Route No. 1, we shall have for the aggregate cost of a double track rail road from Wiscasset to Quebec, five million, one hundred and sixty-one thousand, five hundred dollars.

On the supposition that this grand route is to commence at a point opposite to Gardiner, and extend upward in the valley of the Kennebec, on the east side of the river, instead of commencing at Wiscasset, the entire length of the route, will be two hundred and twenty-nine miles, and the average cost per mile, will probably somewhat exceed that above stated, and may be assumed at eight thousand dollars; hence the aggregate cost of a rail road from Gardiner to Quebec, is computed at four million eight hundred and nine thousand dollars.

Route No. 3. from Belfast to Quebec.

Length of the Maine Division, one hundred and thirty-three miles. Length of the Canada Division, ninety-four miles. Aggregate distance from Belfast to Quebec, two hundred and twenty-seven miles.

Sub-division No. 1. Extending from Belfast to Sebasticook river, and embracing a distance of thirty-one miles.

The facilities afforded at Belfast, for a connexion between the rail road, and the commercial and other business, likely to be done at the depot, where it terminates, are equally commodious with those presented at Wiscasset, while they are to be had on a much more extensive scale.

The estuary of Belfast or Pasagasawakeag river, extends inland about two miles from the head of Penobscot Bay, of which it is an arm, and is navigable for heavy shipping, about two thirds of a mile, for sloops as much farther, and for smaller craft nearly to the head of tide. This arm of the Bay varies in its width from one hundred and fifty yards to a mile or more. At the upper bridge which is about a mile above the site of the present town of Belfast, it is contracted to the width of about one hundred yards, below which, it gradually widens, till we arrive at the principal landing of the town, where it is more than a mile wide.

The mode of connexion had in view contemplates a branch of the rail road, extending downward from the upper bridge, on each side of the arm or estuary above described; both of which branches may be extended to the distance of two or three miles each, and as much farther as may be desirable both sides of the estuary, and the shores of the Penobscot bay, being favorable for such an extension.

The elevation at which the town of Belfast can be most conveniently approached, by the rail road, can only be determined by actual survey; which will probably show that an elevation between thirty and fifty feet above tide, will be most appropriate. At the narrows above mentioned, or at the site of the upper bridge, both having the same locality, the ground and shores are favorable for assuming the desired elevation, and the estuary may here be crossed by a bridge of the requisite height, and about one hundred and fifty yards long.

At the site just mentioned we shall commence the description of the route which proceeds thence northwardly as follows, viz. From the upper bridge it passes along the eastern shore of the estuary, about half a mile, on rough and broken ground, crossing several ravines, and perhaps the point of a cove, to the mouth of Wescott stream, whence it ascends in the valley of this stream nearly a mile on rough ground. It thence pursues the same valley, nearly to the source of Wescott stream, where it encounters a summit, elevated about thirty feet above the flats of the stream, and dividing between the waters of Belfast river, and Marsh stream,which enters the Penobscot river at Frankfort. This summit is situated in an extensive tract of swampy ground, through which the route passes, and afterwards enters the valley of marsh creek at the distance of twelve or thirteen miles from its mouth.

The distance from the upper bridge at Belfast to the valley of Marsh creek, is computed at ten miles, through which the route is somewhat serpentine, and near its entrance into the valley just mentioned, quite circuitous. Its curvatures however, may be limited to a radius of one thousand feet; and its gradations to thirty five feet per

mile. On ascending from the flats of Wescott stream to the summit a rise of thirty feet is incurred, in less than a quarter of a mile, the passage of which will require much embankment, and considerable cutting in rock. The flats at the summit present an extensive quag, upon which the road bed must be supported on piles or broad grillage, for the distance of half a mile or more. Materials of the best quality for construction are abundant and convenient.

From the point of entrance into the valley of Marsh Creek, the route proceeds upwards in this valley, and on broken ground, about a mile to Brooks village, and ascends thence two miles, in the same valley, and on favorable ground to Sawyer's mills, whence it ascends for about a mile at a gradation of sixty feet per mile, to flats situated near the head of the stream, where it passes a very low summit. The flats just mentioned embraces the sources of Haskell's and Half Moon stream, and present a favorable passage for the route leading through an extensive cedar swamp, to the valley of the latter, down which it proceeds to the junction of this stream with Sandy river. From this point the route pursues the valley of Sandy river, downward to the plains connected with the basin of Twenty-five Mile Pond, whence it traverses an extensive flat, in places low and marshy, but generally of a uniform and even aspect, quite to the Sebasticook, which it reaches at or near the place called the Pug Hole, about two miles below the mouth of Twenty-five Mile Creek, which flows from the Twenty-five Mile Pond.

The distance from the point of entrance into the valley of Marsh creek to the Sebasticook, is computed at twenty one miles, viz : from that point to the summit, five and one half miles, thence to Unity village, three and one half miles, and thence to the Sebasticook seven miles.

With the exceptions already made, the gradations on this part of the route, will be easy, no where exceeding thirty-five feet per mile. The curvatures will be gentle, being limited to a radius of one thousand feet, in one instance only, viz: at Sawyer's mills. The road formation will be generally easy, except where bridges and embankments are wanted, several of which will probably be required on the streams along which the route passes, and a bridge of large size, at the crossing of the Sebasticook, probably one hundred and fifty yards long, and forty feet high.

The abrupt gradation of sixty feet per mile, included in this sub-division, may be avoided, and forty-feet per mile substituted, at the expense of considerable excavation, and embankment, at the place where it occurs. With this exception, the gradations in very few instances, will amount to thirty-five feet per mile, while the route on much of the way will vary from a level but a very few feet in the mile.

Sub-division No. 2. Extending from the Sebasticook to Bingham, and embracing a distance of thirty-four miles.

From the crossing of Sebasticook river, the route traverses a level or slightly rolling surface, to the valley of Twelve Mile stream, and then ascends in this valley on favorable ground, quite to its source, when it crosses a lower summit, at the distance of five miles from the Sebasticook. At this summit the route enters an extensive flat stretching northwardly ten or twelve miles, and embracing Sibly's, Height's and Moose Ponds, the elevation of the flat above Kennebec river, being about one hundred feet. The route traverses this extensive swamp, passing in the vicinity of Sibly's and Height's Ponds, from the last of which the route passes over a very low summit, and en-

ters the valley of Wesrunset near Athens village. The distance from the Sebasticook to Sibly Pond by the route above indicated, is computed at ten miles—a route quite as favorable and somewhat shorter, between the points just mentioned, is said to exist a little to the eastward of the route described. From Sibly pond to the summit near Height's pond, the distance is computed at nine miles.

After passing this summit and entering the valley of Wesrunset, the route passes on uneven ground about one and a half miles, in the vicinity of Athens village and ascends in the valley to Wentworth pond, and after crossing a low summit, may descend by either of three routes to the immediate valley of the Kennebec, the distances being about equal on each. The routes from the summit downward are as follows, viz. one by the valley of Michael's stream; one by that of Fall Brook, both of which terminate at Currituk Falls; and the third by the valley of a stream entering the Kennebec river, a little below the village of Bingham, near which this route approaches, and must cross the river, on a bridge about two hundred yards long. Although these several routes are about equal in respect to the facilities they afford for arriving at the river, yet inasmuch as that last mentioned strikes the river about eight miles above the point at which the others reach it, the route leading through Bingham, and crossing the river at some point near the village, is regarded as fairly entitled to a preference. We shall accordingly consider the crossing of the river, at this place, as the end of this subdivision.

The distance from the summit near Height's Pond, to Bingham, is computed at fifteen miles. The road formations on this part of the route will require much cutting and filling, in order to pass numerous ravines, and other inequalities, which it must encounter.

The curvatures on this entire subdivision, may readily be limited to a radius of one thousand feet, and the gradations to thirty-five feet per mile. Extensive portions of the route may be kept free from curvatures, and nearly level. The country abounds in timber, and other materials well adapted to the purposes of construction.

In reference to this, and the preceding subdivision, it should be remembered, that instead of the route, leading from the confluence of Half Moon and Sandy streams, to the summit near Height's Pond, a different route may be substituted which may prove quite as favorable in all respects as that before described, and which ought to be carefully surveyed, before a decisive preference is given to either. The route alluded to leaves the valley of Sandy river, near the point above indicated, passes near Twenfive Mile Pond, probably on the east side of it, and proceeds thence to Peottoma Point, in the township of Chandlerville. From this point it ascends in the valley of the Sebasticook, passes Moose and Height's Ponds, and unites with the other route at the summit, in its vicinity.

Subdivision No. 3, extending from Bingham to the mouth of Wilson's stream and embracing a distance of twenty-four miles.

This subdivision from a point opposite to Bingham, in the valley of the Kennebec, eight miles above Currituk Falls,is coincident with the 2d subdivision of Route No. 2, or the Wiscasset and Quebec Route, from the same point to the mouth of Wilson's stream, in the valley of Dead River, one mile above its mouth. *Subdivisions No. 4, No. 5 and No. 6, of this Route*, viz:—the Belfast and Quebec Route—are also coincident and identical with the same subdvisions of Route No. 2, to which reference is respectfully made.

We shall conclude our description of this grand Route with a brief Synopsis as before, exhibiting items of information, similar to those contained in the synopsis of Route No. 1, or in that of Route No. 2.

Synopsis of Route No. 3, or the Belfast and Quebec Route.

Grand Division.	Subdivisions. No.	LOCALITIES Beginning at Belfast, and including the places designated.	Supposed distances under different gradations. 0 to 35 feet per mile.	35 to 60 feet per mile.	60 to 90 feet per mile.	Distances on each Subdivision.	Length of each Subdivision.	Distances and Lengths of Grand Divisions.	Probable cost of road formation. Average cost per Mile	Probable aggregate cost.
			Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Dolls.	Dolls.
Maine Division.	1	Bridge, &c. at Belfast,								10,000
	—	Marsh Creek,	10			10			8,000	80,000
	—	Unity village,	13	1		14			7,000	98,000
	—	Sebasticook River,	7			7	31	31	6,000	42,000
	—	Extra for a Bridge, &c.								8,500
	2	Height's Pond summit,	19			19			6,000	114,000
	—	Bingham,	15			15	34	65	7,500	112,500
	—	Extra for a Bridge, &c.								10,000
	—	Mouth of Wilson stream,	24			24	24	89	7,500	180,000
	—	Extra for a Bridge, &c.								12,000
	4	Head of Parlin Pond,	4	3	7	14			9,000	126,000
	—	Holden's on Moose River,	16			16			6,000	96,000
	—	Extra for a Bridge, &c.								5,000
	—	Boundary summit,	11	1	2	14	44	133	8,000	118,000
		AGGREGATES,	119	5	9	133	133	133	7,564	1,006,000
Canada Division.	5	Mouth of the du Loup,	25	5		30	30	30	9,000	270,000
	—	Extra for Bridge, &c.								20,000
	6	St. Mary's,	40			40			7,000	280,000
	—	Extra for a Bridge, &c.								9,000
	—	St. Henry's,	11			11			4,500	49,500
	—	Extra for a Bridge, &c.								7,000
	—	Head of inclined plane,	10			10			4,000	40,000
	—	Point Levy,	1	1	1	3	64	94	10,000	30,000
	—	Extra for inclined plane,								10,000
		AGGREGATES,	87	6	1	94	94	94	7,612	715,500
		Aggregates for the entire Route.	206	11	10	227	227	227	7,584	1,721,500

The foregoing exhibit shows, that the entire length of Route No. 3, from Belfast to Quebec, is two hundred and twenty-seven miles; which is shorter by nineteen miles, than Route No. 2, from Wiscasset to Quebec, and fifty miles shorter than Route No. 1, from Portland to Quebec. Of the distance above stated (227 miles) two hundred and six miles are attended by gradations not exceeding thirty-five feet per mile; eleven miles by gradations varying from thirty-five to sixty feet per mile; and ten miles by gradations not exceeding ninety feet per mile. It also appears from the Synopsis, that the average cost per mile, for road formation, bridges, &c. included, is seven thousand five hundred and eighty-four dollars, and that the aggreg ate cost of this item, on the entire route from Belfast to Quebec, with a road surface twenty-five feet wide, is one million seven hundred and twenty-one thousand five hundred dollars.

To this amount, if we add as before, seven thousand dollars per mile for a single track, or thirteen thousand dollars per mile for a double track, we shall have for the aggregate cost of a double track Rail Road from Belfast to Quebec, four millions six hundred and seventy-two thousand five hundred dollars.

It will be perceived that in the several tabular views, comprehended in this Report, no allowances have been made for surveys, superintendance or contingencies of any kind; we shall accordingly subjoin a brief general Synopsis of the Grand Routes, in which the allowances of this character, deemed requisite and proper, will be included, and with which we shall conclude our description of the several routes.

This Synopsis is intended to exhibit the extent of each grand route; the distances under different gradations, for each route; the average cost per mile for road formation, as derived from the foregoing tables; and for this item in-

cluding the cost of railing for a double track; the average cost per mile of this last item, (grading and railing combined,) including an allowance of five per cent. for contingencies, &c. right of way excepted; and the aggregate cost of each entire route, with the exception just mentioned, all other expenses being included.

Synopsis of Grand Routes from the coast of Maine to Quebec.

GRAND ROUTES.	Localities at the commencement and termination of each Route.	Length of each Grand Route.	Distances under different gradations.			Probable cost of a Rail Road on each Grand Route, all things included except the right of way.			
			0 to 35 feet per mile.	45 to 60 feet per mile	60 to 90 feet per mile	Cost of grading per mile.	Cost of grading and railing per mile.	Cost per mile including 5 per cent for contingencies.	Aggregate cost of each Grand Route.
		Miles.	Miles.	Miles.	Miles.	Dolls.	Dolls.	Dolls.	Dolls.
No. 1.	Portland to Quebec.....	277	249	18	10	8,831	21,831	22,923	6,349,671
No. 2.	Wiscasset to Quebec...	246	224	12	10	7,982	20,982	22,031	5,419,626
No. 3.	Belfast to Quebec.....	227	206	11	10	7,584	20,584	21,613	4,906,151

From this Synopsis it appears that the cost of a rail road from Portland to Quebec, all things included except the right of way, amounts to about six millions three hundred and fifty thousand dollars, which gives for the average cost per mile, twenty two thousand nine hundred and twenty-three dollars. That the cost of a rail road from Wiscasset to Quebec, amounts to about five millions four hundred and twenty thousand dollars, or to an average cost per mile of twenty-two thousand and thirty-one dollars. And

That the cost of a rail road from Belfast to Quebec amounts to a little more than four millions nine hundred and six thousand dollars, which is equivalent to an average cost of twenty-one thousand six hundred and thirteen dollars per mile.

Hence it appears also, that the aggregate cost of Route No. 3, is less than that of Route No. 2, by five hundred and thirteen thousand four hundred and seventy-five dollars; and that the average cost per mile of the former, is four hundred and eighteen dollars less than that of the latter. Moreover,

By a similar comparison with Route No. 1, the difference in favor of Route No. 3, amounts to one million four hundred and forty-three thousand five hundred and twenty dollars, in their aggregate cost, and to one thousand three hundred and ten dollars in their average cost per mile.

In view of what has been advanced in this paper, no doubt can remain as to the route entitled to the preference, not only on account of their relative distances, and the probable cost of a rail road on each, but on account of the comparative facilities for travel and transportation presented by them respectively. These and a variety of other considerations, relating to the accommodation, welfare, and future prosperity of the State of Maine, as well as to those of Lower Canada, combine to render the route from Belfast to Quebec, more eligible and advisable than either of the other routes herein described.

With respect to the contemplated rail road, as herein computed, I am aware that it is far less per mile, than has been incurred on the rail road from Baltimore to Washington, from Philadelphia to Columbia, from Hollidaysburg to Johnstown across the Alleghany mountains, from Camden to Amboy, from Boston to Providence, Lowell and Worcester, and on various other rail roads of the United States, now in successful operation; yet from a careful comparison of the facilities presented on the routes herein described, with those of the routes pursued by the

rail roads just alluded to, it is confidently believed that the prices annexed and the allowances made in the preceding tables, will prove adequate to the construction of the road in question, agreeably to the manner proposed.

In connexion with the views herein exhibited, it was my intention to accompany them with a variety of statistical matter, derived from experience on other rail roads, and exhibited in numerous reports relating to the same. But having been for several months severely afflicted with ophthalmy, I have been prevented from preparing any compilation of such an import and character.

A sketch of the country embracing the several routes that have been examined and exhibiting the positions of the routes herein described, has been prepared, and is herewith submitted. The sketch however, is far less complete than I could wish, and presents fewer of the topographical features of the country, than such a document ought to comprise. My apology for these deficiencies, is the infirmity mentioned in the preceding paragraph, which prevented the execution of a more comprehensive delineation.

In conclusion, I take leave to add that the Reconnoissance that constitutes the main subject of this essay, was intended merely as a step preliminary to an instrumental survey, and has been regarded as such in the instructions I have received from the War Department, which moreover authorize the prosecution of such a survey, provided the requisite funds for that purpose are supplied by those concerned. Accordingly I hold myself in readiness to comply with your wishes in this respect, and to enter upon the survey at an early date of the ensuing spring,

should such a step be desired, and the means of accomplishing it be furnished.

I have the honor to be, sir,

very respectfully, your most obt. servt.

S. H. LONG, *Lt. Col. Top. Eng.*

To his Excellency,

ROBERT P. DUNLAP,

Governor of Maine, Augusta, Me.

STATE OF MAINE.

In SENATE, January 20, 1836.

ORDERED, That 3000 copies of the foregoing Report be printed for the use of the Legislature.

(Extract from the Journal.)

Attest, WILLIAM TRAFTON, *Secretary*