Carolina Conductor

Volume 13 Number 09 Monthly Newsletter of the Carolina Railroad Heritage Association, Inc. © September 2026

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Blue Ridge RR

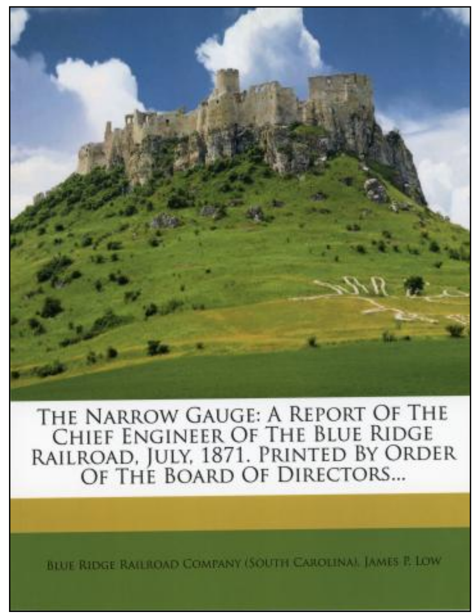
A REPORT OF THE CHIEF ENGINEER OF THE BLUE RIDGE RAILROAD 1871

To the President and Board of Directors of the Blue Ridge Railroad :

GENTLEMEN—A conviction that, in our present condition, and with our present prospects, it would be wise to make ourselves ac-quainted with the real merits of the "narrow gauge" system, has led me to prepare and submit to you the following paper.

The subject has been approached with special reference to its practical bearings upon the work which you have in charge—the completion of the Blue Ridge Railroad ; and the matter of this communication is not the plea of an advocate of the new system, but rather the result of the search of an inquirer.

To present to you all the information on this subject which can readily be collected, sufficient, at least, to enable you to form a sound and well considered opinion on the question of changing the gauge of our road, is the object of the writer.



The "narrow gauges," so called, vary from two to four feet. For almost any width between these two extremes may be found advo-cates among the professional men who are well qualified judges. Three feet, however, is the measure toward which opinion seems to gather, and that gauge will answer the purpose of this inquiry.

We desire to know, then:

First—Will a railroad of a three feet gauge answer all the requirements of the traffic for the accommodation of which this road is to be built? To be satisfied on

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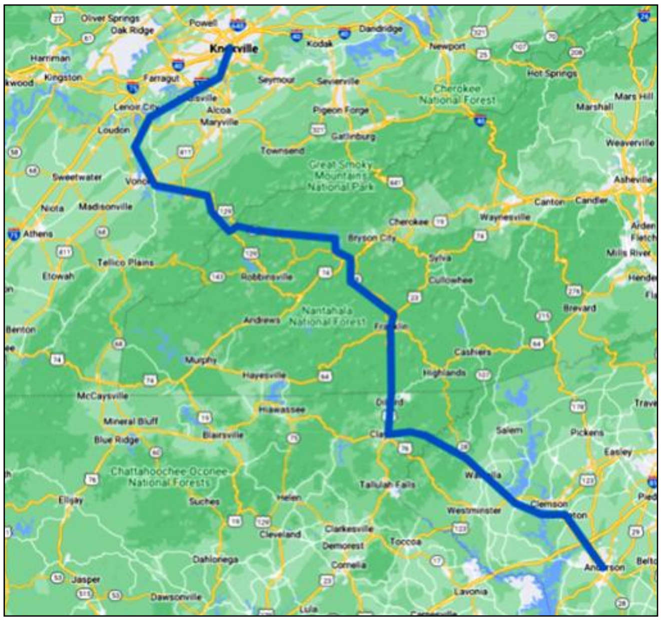

this point, we must have answers to the following questions: Can locomotives be constructed for this gauge of sufficient power and speed? Will the passenger cars be safe, comfortable, and attractive to the public?

Can freight cars be built of a size convenient for the stowing and transportation of cotton, livestock, and miscellaneous freight?

And finally: can all the probable traffic be accommodated with-out overcrowding the single track with trains?

MOTIVE POWER

We consider the question of locomotive power first, because it is obvious that, if a favorable result is not obtained here, it is useless to go further with the investigation. Indeed, the gauge controversy has been, from the days of Stephenson and Brunel, fought over the locomotive. The latter advocated the seven feet gauge on the ground that the additional width gave greater stability to the locomotive, and, with greater convenience in the arrangement of parts, increased power, and speed.

Mr. Stephenson did, indeed, at first meet with difficulties in construction ; but, by persistent ingenuity, he overcame them with-out resorting to an increase of gauge. Forty years' experience has proved the soundness of his judgment, for his gauge (4 feet 8 inches) has been demonstrated to be ample in dimensions, both for the construction of locomotives and for the requirements of traffic. All the excess of capital involved in the building of wider roads has been wasted on works disproportioned to the duty to be required from them.

Although, theoretically, the wider gauge should at least have de-veloped greater speed in return for increased cost, this has not prac-tically been the case. From the published statistics of the English roads, it appears, that the average speed including stoppages, the average full speed when running, and the maximum speed, are almost exactly the same for the two gauges. A maximum speed of 65 miles per hour has been attained on the Great Western, (7 feet gauge,) and 62 mph is a rate frequently reached on the Great Northern, (4 feet 8 inch gauge.)

The London and Birmingham (7 feet gauge) makes an average speed, including stoppages, of	37	miles per hour
An average full speed, running, of	45	" " "
A maximum speed of	60	" " "
The London and Brighton (4 feet 8½ inch gauge) makes an average speed, including stoppages, of	38½	miles per hour
An average full speed, running, of	45	" " "
A maximum speed of	60	" " "

Notice, also, the comparative speed attained on American

Name of Railroad.	*Gauge.*	*From.*	*To.*	*Distance in Miles.*	*Speed in Miles per Hour.*
New York and Erie.	6	Jersey City	Dunkirk	460	28.2
New York and Erie	6	Jersey City	Corning	291	31 3
New York Central	4.8½	Buffalo	Albany	297	33 0
Ohio and Mississippi	6	St. Louis	Cincinnati	340	25.2
Louisville and Cincinnati Short Line	4 8½	Louisville	Cincinnati	107	26.7

Whence it appears that the principal six feet gauge roads in the United States actually attain a less maximum speed for express travel than the rival lines of a narrower gauge.

That Mr. Brunel felt that his system could be sustained against the superior economy of the common gauge only by developing greater speed, and by fostering the public demand for rapidity of travel, is forcibly illustrated by an incident which was narrated to me by one of Mr. Brunel's pupils. This gentleman, traveling over the Great Western Railway, was surprised to find the train, usually so true to the schedule, lagging behind time. Curious as to the cause of delay, at the last stopping place, before reaching the ter-minus at London, he left his seat and walked forward to the en-gine, to find that the locomotive was run by Mr. Brunel himself, clad in the usual driver's costume. To my informant's inquiry about the delay, Mr. Brunel replied that he knew he was fifteen minutes behind time, but that the train would be in London on time. The truth was, that he had purposely delayed the train, and was thus showing the public that the

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time of the express trains on the Great Western Railway might be greatly shortened ; and he thus endeavored to stimulate the public desire for a higher rate of speed. This was probably but one of many occasions upon which he, in a similar way, demonstrated the power and speed of his engines.

However, as before stated, the four feet eight and a half inch gauge has successfully competed for the public favor with the seven feet ; and, with this brief retrospect, we are now to inquire into the capacity of the locomotive when built for still narrower gauges.

Thanks to the zeal and skill of those who have gone before us in this direction, our inquiry will be not theoretical, but rather a record of their experience. The first narrow gauge engines were built for the now famous " Festiniog Railway," in Wales. Origi-nally constructed as a tram road, thirteen miles in length, the gauge being twenty-three and a half inches, until 1863 the loaded trains descended the line by gravity, the average descent being fifty-seven feet per mile, and the return trains were drawn up the line by horses. The demands of an increasing traffic led to frequent discussions as to the practicability of employing locomotives on so narrow a gauge. Often discussed, the project was often abandoned, on account of the seeming difficulties, and the adverse opinions of professional men. The Secretary and Engineer, Mr. C. E. Spooner, however, was not to be diverted from his purpose, and, finally, in 1863, found, in Mr. George England, the only locomotive-builder who would undertake to build the engines, and guarantee their performance. Two locomotives were put on the line in 1863, and being found to work successfully, others of similar patterns were added. The dimensions of these engines are generally as follows: The wheels are two feet in diameter, four in number, coupled; cylin-ders, eight inches in diameter ; stroke, twelve inches ; weight, seven and a half tons ; carrying water in a tank surrounding the boiler. The average load taken by these machines over grades of sixty-six feet per mile, and curves of one hundred and fifty feet radius, is fifty tons gross, at a speed of ten miles per hour. I have before me an account of a trial of the locomotives in use on the Festiniog Railway, which took place in the presence of the Commissioners for the India railways, Mr. Pihl, Chief Engineer of the Norwegian railways, and Captain Tyler, the Government Inspector of Railways for Great Britain. Following, are some of the results obtained :

The " Welsh Pony," is a tank engine, of the common type, hav-ing four wheels, two feet in diameter, cylinders eight and a half inches, with twelve inch stroke, and a gross weight of ten tons. The limit of this machine's power was 73 tons 16 cwt., on a grade of 1 in 85, (62 feet per mile,) at five miles per hour. The average pressure of steam was 150 pounds. With this load the engine would stop and start on the grade of 1 in 85.

The " Little Wonder " is a double bogie engine, built by Mr. Fairlie, having 4 cylinders 8 and 3-16 inches in diame-ter; stroke 13 inches. The wheels are 2 feet 4 inches in diameter, and they weigh 19 tons, the length being 27 feet. The total wheel base is 19 feet ; the rigid wheel base, 5 feet. This engine took a mixed train of 90 slate wagons, 7 passenger cars, 57 passengers, a gross weight, exclusive of engine, of 75 tons, up the road at an average speed of 14f miles per hour, and a maximum speed of 26 1/2 miles per hour. The length of this train was 854 feet, and it occupied, at several points, two or three reverse curves at once, some of them as sharp as 115 feet radius. The maximum grade, as before stated, being 62 feet per mile.

The same engine was, then tried with a train weighing 1861 tons, exclusive of weight of engine. With this load it not only passed up the grade of 62 feet per mile with ease, but, being stopped on the grade, the train standing on two curves, one a curve of 297 feet radius, the other a reverse curve a little easier, the engine was able to start the train and complete the trip.

The following passage occurs in the official report of these trials of the *Little Wonder*:

"It was observed that, even on curves of 115 feet radius, and at a maximum speed, there was very little perceptible oscillation or movement on the engine, or in the carriages, and by no means such as is usually felt, even on comparatively easy curves on ordinary railways, and less at high speed than at low speed."

The locomotives built in Sweden for the 3 feet 7 inch gauge have also been entirely successful. They weigh about 13 tons each, with 9 inch cylinders and four coupled wheels, 3 feet 6 inches in diameter. The State Engineer says of them in a recent report:

"I had doubts of the ability of these light engines to keep the road open during winter, but the experience of several severe winters has shown that no such fears need be entertained."

There is a railway near Cologne, connecting the Valley of the Brol with the Sieg. The gauge of the road is 2 feet 7 inches, the length of the main line 12 1/4- miles; there are curves of 125 feet radius, and grades of 66 feet to the mile. This line is worked by tank locomotives built at Carlsruhe. Following are the dimen-sions of these engines : Diameter of cylin-

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ders, 10 13/16 inches; stroke, 10 inches; diameter of wheels, of which there are 6 connected, 2 feet 31-inches. The weight, in working order, is 121 tons. The usual gross load drawn by these machines is 210 tons, exclusive of engine, at a speed of 9 miles per hour; but the engines are able to draw with ease 270 tons gross.

But it is not in Europe alone that efficient locomotives are built for the "narrow gauges." There have been, for some time, in use at the "Thomas Iron Works," at Hoquendaqua, Pa., tank engines, built by M. Baird & Co., of Philadelphia.

These engines weigh, with tank full, 8 tons 4 cwt.; the cylinders are 9 by 12 inches; the driving wheels 30 inches in diameter. One of them will readily haul up a grade of 211 feet per mile 26 gross tons, with a boiler pressure of 120 to 125 pounds.

These manufacturers, wisely anticipating the demand, which is now so rapidly increasing, for narrow gauge locomotives, have pre-pared drawings, and built several styles of small engines, both with and without the tender. I had, recently, the pleasure of visiting their works, and examining one of these locomotives, then nearly finished. So far as could be judged, without an actual trial under steam, there could be no reason to doubt that the engine would do all that its builders claimed for it. In proportion, and general ap-pearance and finish, nothing was wanting; and, indeed, without some larger engine standing near, as a standard of comparison, a casual observer would not be likely to know but that he was look-ing at an engine for the usual gauge, so perfectly was the general type of American locomotives preserved. Engines from these works, of two feet six inch, two feet nine inch, three feet, and three feet six inch gauges, are now in use in the United States and in South America, and are, in all respects, satisfactory in performance.

I give here the dimensions of several styles of these machines, from information obtained at the works, together with the duty which they are guaranteed to perform. I confine myself to those having a tender, as better adapted to our general wants:

Kind of Locomotives.	Cylinders. Diameter.	Cylinders. Stroke.	Diam. of Drivers	Weight, in Working Order. Total.	On Drivers	On each pr. of Drivers.	Load, in Gross Tons, Cars and Lading. On Level.	40 Feet Grade.	80 Feet Grade.	100 Feet Grade	125 Feet Grade.	150 Feet Grade.
CLASS 4.												
6 wheels connected.	12	16	36	33,000	33,000	11,666	850	255	140	115	92	71
CLASS 5.												
4 wheels con'ect'd &	9	16	36 to 40	25,000	20,000	10,000	480	140	75	60	48	38
1 pr. leading wheels	10	16	36 to 40	30,000	25,000	12,500	605	175	95	75	60	48
CLASS 6.												
6 wheels con'ect'd &	10	16	36	30,000	25,000	8,333	605	175	95	75	60	48
1 pr. leading wheels	11	16	33 to 40	35,000	30,000	10,000	730	220	120	100	80	65

I have extended the above table to show the power of the locomo-tives on 125 and 150 feet grades. The makers say of them: " Class 4 and 6 are intended for freight service; class 5 for pas-senger trains. All these machines are designed to pass curves of short radius with ease. Any of the engines described may be run around curves of 100 ft. radius, or even shorter."

SPEED

"A narrow gauge locomotive, with driving wheels 36 inches in diameter, and cylinders with 16 inches stroke, at a speed of 36 miles per hour, develops the same speed of piston as a full gauge locomotive with 5 feet driving wheels and cylinders with 24 inches stroke, at a speed of 40 miles per hour. With driving wheels 40 inches in diameter and 16 inches stroke of piston, the narrow gauge locomotive develops the same total travel of piston, in going one mile, as does the full gauge locomotive, with driving wheels 60 inches in diameter and 24 inches stroke of piston. It evident that speeds are attainable on the narrow gauge as great as the system will require either for freight or passenger traffic. The angle of stability of the narrow gauge locomotive, with the 3 feet driving wheel, is somewhat greater than that of the 4 feet 81 inches gauge locomotive, with 5 feet driving wheel."

To make a practical application of the information above de-tailed to the road with which we are connected, let us suppose that the road is built on the narrow gauge (3 feet) adopting grades of say 150 feet per mile going west, and of 100 feet per mile going east, in the direction of our heaviest traffic. We now try the powers of one of these engines

100 passengers, at 150 pounds, including baggage...	15,000	pounds.
3 passenger cars, at 12,000 pounds..................	36,000	"
1 smoking car..	8,000	"
1 baggage car..	8,000	"
	67,000	"

on a train of 100 passengers:

Or, say 30 tons of cars and load. Now, referring to the table just given, we find that the lightest of the passenger engines of class 5 would be equal to moving a train of 38 tons under the conditions assumed. We might add another passenger car, and give our pas-sengers a little more room, making a train of 36

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tons, which the second engine of class 5 would take, and still work 12 tons under its power.

But, to be a little more exact: Instead of taking the builders' statement of the power of the locomotive, we will find out the re-sistance of the train and the power of the engine by the common method:

Weight of train, as before	67,000	pounds.
Weight of tender	14,000	"
Weight of engine, No. 2, Class 5	30,000	"
	111,000	"

It is seen that the power of the engine exceeds the resistance of the train by nearly 30 percent, and that the effective adhesion exceeds the tractive power. The proportion of weight on the drivers, assumed as effective for adhesion, would hold good under any ordinary conditions, either in very dry or very wet

Resistance due to gravity, grade 150 feet per mile, (1 in 35.2)	3,153	pounds.
Friction of engine, 13.4 tons, at 18 lbs	241	"
Friction of train, including tender, speed 20 miles per hour, 36.1 tons, at 10.25 lbs	370	"
Total resistance	3,764	"
Tractive power of locomotive, Class 5, No. 2, 3 feet wheel, pressure of steam 110 pounds, $\frac{10^2 \times 110 \times 16}{36}$	4,888	"
Effective adhesion, $\frac{25,000}{5}$	5,000	"

weather. In case of an icy or frosty rail, it would sometimes be necessary to have the aid of the helping engines, which must, under any circum-stances, be kept at the foot of the mountain grade for the freight trains. But I am confident that the cases in which the passenger trains required aid would be rare; as rare, perhaps, as the presence of one hundred passengers on one train.

PASSENGER CARS

Leaving the subject of motive power, keeping in mind the facts noted for reference hereafter, let us pass on to consider the other rolling stock. I do not stop to describe the passenger cars of the Festiniog or other European lines. They are admirably adapted to the respective gauges, of varying proportions and capacity; they agree, however, in one most important point, which we shall also see conspicuous in American narrow gauge cars, namely, that the proportion of dead weight hauled for each passenger is very greatly less than in the broad gauge cars.

Having had an opportunity to examine narrow gauge rolling stock within a few weeks, at the Jackson and Sharp Company's works, at Wilmington, DE, I can describe to you the cars, as I saw them, nearly completed, designed and finished in the style to which we are accustomed here, and more pleasing to our eyes, and, to our notions, more comfortable than any of European fashion. The first-class passenger car is thirty-five feet long by seven feet wide, outside, and ten feet six inches in height; runs upon two four-wheel trucks; has wheels twenty-four inches in diameter; weighs 12,000 pounds and carries thirty-four passengers. The sills are but twenty-seven inches from the rails, and the center of gravity low. The seats are arranged double on one side, and single on the other; one-half the length of the car having the double seats on the right, and the other half having them on the left ; an arrangement for distributing the weight equally. The single seats are nineteen inches wide ; the double, thirty-six inches ; the aisle, seventeen inches. This car was finished, in every particular, in the best style; the woodwork, the upholstery, decorations, and the whole arrangement being unexceptionable. To enter that car was to be convinced that there need be no apprehension that travelers would not be comfortable on the narrow gauges. Improvements will un-doubtedly be suggested by experience ; it may be that other arrangements may be adopted for the seats, but the car, as it is, is, to all appearance, perfectly adapted to our needs. I received from the Harlan and Hollingsworth Company copies of their designs for rolling stock, but they had no cars in process of construction. That which has been described will answer as a type of what our narrow gauge passenger car will be and will serve our present purpose. Such a car will vary in price, according to the finish. About $2,500 will buy the best, and $2,000 to $2,300 would be a fair price for a car, every way good, but not so elegant. Cheaper styles of passenger cars may be built for second-class passengers, with slatted seats running lengthways, either in the center or at the sides. Such cars would not cost more than $1,600 to $1,800.

The weight of the first class passenger car was given to me at the shops as 10,000 pounds, but this seemed to me an under-estimate, and I have taken it in my calculations at 12,000 pounds, and very likely it may weigh a little more. Notice, for comparison, as we pass, that the car assumed to weigh 12,000

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pounds would, when full, carry 34 passengers, with a dead weight of 353 pounds per passenger, while the largest car for the common gauge would carry 60 passengers, and weigh at least 15 tons, giving a dead weight of 560 pounds per passenger. Sixty passenger cars on Northern roads will weigh much more than this, say 17 to 20 tons. The narrow gauge baggage and smoking cars, as now built, are 25 feet long by 6 feet 6 inches wide ; are said, by the makers, to weigh 8,000 pounds, and cost about $1,200. They are placed on 4 wheels, fixed to a rigid frame under the center ; but I think it will be found an improvement to arrange the running gear in such a way as to admit of more flexibility for passing curves, and of bringing the wheels nearer the ends of the cars.

FREIGHT CARS

We now have to enquire into the dimensions of the freight cars and their fitness for our traffic.

The box car for the three feet gauge is 6 feet wide, 14 feet long, and 7 feet high, running on four wheels; having a floor area of 84 square feet, and weighing 5,500 pounds, or 2½ tons.

The flat car has a little more area of floor, and weighs about 4,500 pounds, or 2 tons. The flat cars will cost about $350, and the box cars $450, at the manufacturer's, but they can be built much cheaper at our own shops, and the expense of transportation be saved. The capacity of the box car, loaded with miscellaneous goods to a height, say, of five feet from the floor, will be 14x6x5= 420 cubic feet; giving, at 75 cubic feet per ton, more than 5 tons of load ; being two tons of paying load to one of dead weight. There will be no doubt that the area of the car is sufficiently con-venient for stowing miscellaneous goods, but the question may be asked here: How will they answer for carrying cotton or cattle?

TRANSPORTATION OF COTTON AND CATTLE

The average common gauge box car in present use has a floor area, say, of 27x8=216 square feet, weighs 16,000 pounds, and carries thirty bales of cotton, of the average size from the country presses, say, 5x2x3 feet, 30 cubic feet each, weighing 425 pounds per bare. This gives a bale of cotton to each seven square feet of floor area. The weight carried is 425x30=12,750 pounds, and the dead weight 16,000 pounds. Or, for each bale of cotton 533 pounds non-paying load is hauled. Now, upon a narrow gauge box car, 6x14=84 square feet of floor area, can be hauled 12 bales of cotton, weighing 5,100 pounds, and the dead weight per bale is 458 pounds. The advantage, then, in stowing load, is on the side of the narrow gauge; and the same proportionate loads can be stowed on the flat cars of each gauge. I desire here to note one point in passing, namely, this: That the cotton bales may be compressed to half their present size ; and that this will be done for convenience in transportation in future is certain. But, in the transportation of compressed bales, the narrow gauge has the advantage, for this reason: that double the number of bales now carried by the common gauge cars would be an excessive weight for the car, while the narrow gauge cars can safely take double the weight allowed them in the fore-going estimate. For double the weight of thirty bales, 12750x2= 25,500 pounds, an excessive load for the ordinary box car, while double the weight of twelve bales, 5100x2=10,200 pounds, is within the safe carrying capacity of the narrow gauge car. It will be readily understood how the narrow gauge box car is relatively stronger, for carrying weight, than the common gauge, when it is considered how rapidly the strain upon the axles diminishes with the reduction of their length from five to three feet. In fixing the gauge and designing the rolling stock for the India railways, special reference was had to the carriage of cot-ton ; the development of the production of that article being a prime object in view in the extension of the India railway system.

From the plans and descriptions published by Mr. Fairlie, I ob-tain the following description of their cotton cars. The flat are pre-ferred to box cars, and are of dimensions as follows: 10 feet 6 inches long, 6 feet wide, with 6 upright posts, having two round iron hinge rods between each, which keep the bales in place, and stay the posts. The car weighs 3,000 pounds, and carries 24 bales of cotton, of 420 pounds each, a total paying load of 10,080 pounds, or more than three paying to one pound of dead weight. The weight of the India cotton bales is about the same as of the Ameri-can, but the cubic contents of each bale average 12 feet, indicating that the India bale is compressed to half the size of the Ameri-can. The floors of these wagons are 2 feet 6 inches above the rail; the angle of stability is 38°.

What is the capacity of narrow gauge cars for cat-

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tle?

As carried by the car load over the Southern roads, from 18 to 26 cattle are stowed in the car of 27 feet by 8 feet, an average of, say, 22 head, with a floor area of 10 feet per head. Such a car will weigh, say, 16,000 pounds, which gives a dead weight of 727 pounds per head. The narrow gauge car, 14x6, floor area 84, will carry, say, 8 head, and the dead weight is 687 pounds per head.

Although the superior capacity of the narrow over the wide car is not so marked in carrying cattle as in the transport of other freight, it still shows a sav-ing, in dead weight hauled, of six per cent., when compared with cars of the 5 feet gauge.

It seems unnecessary to extend remarks upon this point. Suffi-cient has been learned, in answer to our inquiry, to assure us that freight of all classes can be stowed in narrow gauge cars without difficulty; and not only this, but the proportion of non-paying load hauled is far less than in cars of the common gauge. We may add that there has been ample experience in Europe bearing upon this particular point, and for all classes of freight the small cars have been proven to be perfectly well adapted.

STABILITY

One question, however, arises that should receive attention. What is the stability of this rolling stock ? Or, to put it less technically, is there any danger that the cars will topple or upset, either from wind pressure or from passing over irregularities in the track at speed? Probably this is the first objec-tion to the narrow gauge which arises in the mind of one for the first time contem-plating the possibili-ties of traveling over such a road.

The diagrams herewith presented will illustrate to the eye, more clearly than can be presented in the text of this paper, the relative stability of cars of the two gauges. From them it appears that there is, theoret-ically, a slight difference in favor of the wider gauge, say, of from 2° to 8° in the angle of stability in dif-ferent styles of cars. Such an amount would entail no practical disadvantage in daily service.

Referring to the experience gained on the Festin-iog Railway on this point, Mr. C. E. Spooner says of the cars: "They have, how-ever, stood the severest storms known in this country without being blown off the rails, at a time when large trees were root-ed up, and the carriages and trucks run very steady at a speed of 20 miles an hour, and proved to have lateral stability when going over old and rough track."

According to Mr. Spooner's calculations, these cars, which were safe from overturn by wind during severe storms, were capable of withstanding a wind pressure of 12.6 pounds per square foot. Our box cars for narrow gauge weigh 5,500 pounds, empty, have a side area of 14x7=98 feet, and the center of wind pressure would be 4i feet above the rails. To overturn one would require, then, 18.7 pounds pressure per square foot. This calculation exhibits a stability exceeding 50 percent, that of the Festiniog cars, which have proved practically safe. A storm which exerted a pressure exceeding 18.7 pounds per square foot perpendicularly to the exposed surface would overturn the car; but this pressure would be that of a storm of unusual severity. Against such hurricanes, fortunately of most rare occur-rence, even wide gauge rolling stock is not safe, as witness accidents from this cause, within the last few months, at East St. Louis, and on the plains.

This possibility of being blown off the track, alt-hough a popular bugbear, would be by a person of experience in handling rolling stock, considered of but little importance. Such a person would include it with the chances of being struck by lightning—a possi -bility, but a very remote one. He would, however, not so regard the possibility that this light rolling stock might run with a swaying, oscillating motion, very destructive both to the cars and to the track. On this point, we can only say that the diagrams shown indicate that there should be, theoretically, no marked difference in this particular between the two gauges ; and Mr. Spooner's expe-rience, as quoted above, sub-stantiates the theory.

You will also remember the remark, in the official report of the Commissioners who tested the rolling stock on the Festiniog rail-way, hereinbefore quoted. For future reference, a table is here inserted, showing proportions of paying and dead load in cars of the two gauges. The columns in this table, showing the propor-tions of dead and paying load, when the cars are *full,* make the comparison under the most favorable conditions for the' wide gauge. The actual results, in practice, are shown in the column, made up from the statistics of the Massachusetts and New York roads. The agreement in the dead load carried with freight is marked. The difference in the dead load carried with passengers is accounted for by the comparatively larg-er number of commutation passengers for short dis-tances on the Massachusetts roads:

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Kind of Car.	Weight of car in pounds.	Number of passengers or tons to full load.	Pounds dead load to pass'r or ton freight when full.	Pounds actual dead load to passenger or ton freight carried.	
				Mass.	New York.
5 ft. gauge pass. car	33,600	60	560	1,250	2,748
3 ft. gauge pass. car	12,000	34	353		
5 ft. gauge box car.....	16,000	8	2,000	3,186	3,091
3 ft. gauge box car.....	5,500	5	1,100		

CAPACITY OF LINE FOR TRAFFIC

The fourth question to which it is necessary for us to find an an-swer has been thus stated : Can all the probable traffic over our road be accommodated in these smaller cars without over-crowding or choking the line ? What we have learned of the power of the loco-motives, and the capacity of the cars, has prepared us to expect a favorable answer to this question. We know, also, that none of our existing Southern lines are worked anywhere near the limits of their capacity, four to six trains each way, daily, being all that is required of them ; and we are prepared to learn that these roads are of unnecessary dimensions, and that a few addi-tional daily trains, at the most, would enable a small gauge line to move as much tonnage as do they. However, let us apply the test of a simple calcula-tion, and a familiar illustration, by a comparison with the business of a road well known to you all. Calculations of the probable traffic of a new line of railroad are most uncertain at the best, and, in this case, no data seem accessible. We have no tables of population or production of the Counties in the four States through which our line passes. But, for our pre-sent purpose—which is to learn whether we can han-dle a traffic, if we get it—let us as-sume that we wish to do a business sufficient to pay, say, 7 per cent. interest on $6,000,000 of capital. We must have, then, a net income of $420,000. The net earnings may be estimated at 50 per cent. of the gross receipts, which must then be, say, $850,000, or $4,722 per mile of road—assuming that the nar-row gauge line will be but 180 miles in length. Now, referring to their report for 1870, the South Carolina Railroad did a business that year of $1,468,000, or $5,477 per mile of track. Assuming, then, that the Blue Ridge Railroad transports freight and passengers at the same rates, it would be necessary to handle a tonnage bearing a proportion to the South Carolina Railroad tonnage of 4,722 to 5,477, or, say, 86 per cent.; that is, 86 percent of 239,000 tons freight equals 205,540 tons, and 86 percent of 187,000 pas-sengers equals 162,820 pas-sengers, a daily tonnage of 563 tons, and a daily passenger list of 446.

To be continued next month! Ed.

Wanted—Articles for the Carolina Conductor

Submit an article of 200 words or more with some photos and captions and see them in print. Every one of us has some unique railroad experience that would make interesting reading for our membership. Your editor always needs more contributions of railway history and news.

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