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MADRAS RECORD OFFICE

Government of Madras

Public Works DEPARTMENT

G.O. No.	3379	Press
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Dated	26. 11.	195
		1875

Not to be folded or roughly handled

*Proceedings of the Madras Government, Public Works Department,
26th November 1875.*

No. 591. Read the following Circular from the Government of India, Public Works Department (Railway), dated Fort William, 11th November 1875, No. 23 R. :—

Inspection of State Railway Works prior to opening.

RESOLUTION.—The Honorable the President in Council is pleased to issue the following instructions in regard to the inspection of State Railway works under construction, and in regard to their final inspection prior to opening the Railway for public traffic.

2. The usual detailed inspections will be made by the Engineer-in-Chief or other officer in charge of the line who, under the orders of the Director of State Railways, will be responsible for the efficiency of the works.

3. General inspections will be made by the Consulting Engineer to the Government of India for State Railways. These inspections will necessarily not be in such detail as to secure that all work is properly done. For that the Government of India rely on the Engineers-in-Chief and Superintending Engineers. The Consulting Engineer's inspections must be directed chiefly to informing himself so as to enable him to advise the Government on the engineering questions which may arise in connection with the works, and besides this to satisfy himself in a general way that the system of construction is sound and well administered.

4. Lastly, when a railway or section of a railway is reported ready to be opened for public traffic, a final inspection of it will be made by an officer of the Government Consulting Engineer's Department for Guaranteed Railways, under rules which have been drawn up for the information and guidance of all concerned.

5. It is essential to the complete information of the Government that the final inspection of a railway about to be opened for traffic shall be entrusted to an experienced officer who has not been connected with its construction. This is also an additional guarantee that nothing has been overlooked which is necessary to the due security of the public and the welfare and safety of passengers and railway servants.

ORDER.—Ordered, that this Resolution and the Rules alluded to in paragraph 4, be forwarded to all Governments and Administrations for information, and to the officers named in the margin for information and guidance.

Director of State Railways.
Consulting Engineers at Calcutta, Lahore and
Lucknow.

(Signed) C. H. DICKENS, Colonel, R.A.,
Secretary to the Government of India.

*Proceedings of the Madras Government, Public Works Department,
26th November 1875.*

Rules for the Inspection of Railways by an independent Officer prior to the opening of any section or sections for Passenger Traffic.

- | | |
|-----------------------------------|----------------|
| I. Rules for Inspecting Officer. | V. Desiderata. |
| II. " " Manager. | VI. Tests. |
| III. Information to be furnished. | VII. Forms. |
| IV. Certificates of Manager. | |

The object of inspection is to ensure safety and proper accommodation to the travelling public and railway servants; it is desirable, therefore, that such inspection should be confined to points directly bearing upon this object.

The Government of India requires, however, from the Manager of each Railway certain information for office record, and this information may embrace points outside the proper limits of inspection.

Section I.—Duties of Inspecting Officer.

As these inspections are made for the particular object of assuring the Government of the condition of the line, it is desirable that the Inspecting Officer should confine his report to points directly affecting the safety and welfare of the travelling public and of the railway servants, and should not introduce into his report any irrelevant matter.

He should be as concise as possible in his recommendations, stating briefly but clearly the grounds on which they are made. It will be assumed that any points on which he has made no remark do not, in his opinion, affect the safety or welfare of the travelling public.

He may recommend the railway to be opened either unconditionally, or subject to certain restrictions, or he may recommend a postponement of the opening.

The Inspecting Officer is to turn his attention to all questions affecting the safety of the public, but his attention is particularly directed to the following points:—

1. To the general formation of the line, and the necessity for increasing widths, flattening slopes, or preventing slips.
2. To the existence of sharp curves or gradients in dangerous positions.
3. To the general character and condition of the rails and fastenings, sleepers, and ballast.
4. To the strength and quality of all structures above ground.
5. To the waterways of the bridges and culverts, so far as to ascertain that they have been fully investigated by the proper officers.
6. To the provision of parapets or hand-rails where necessary on bridges and viaducts.
7. To the means of escape of railway servants in long viaducts or tunnels.
8. To any infringement of the standard dimensions of fixed structures.
9. To the protection of bridge platforms from fire.
10. To the character and condition of the fencing.
11. To the proper arrangements for level-crossings.
12. To the provision of proper gradient posts and mile marks.
13. To the character and condition of the points and crossings.
14. To arrangements for preventing the escape of vehicles from sidings in stations, either by gravity on an incline, or by force of the wind.
15. To the character, condition, and position of the signals.
16. To the width of the platforms, and their proper ramping at the ends.
17. To the sufficiency of accommodation for passengers at stations, especially with regard to latrine arrangements.
18. To the weight and dimensions of the rolling-stock and their limitation to the standards prescribed.
19. To the provision of cow-catchers on an unfenced line.

*Proceedings of the Madras Government, Public Works Department,
26th November 1875.*

20. To the sufficiency of space and ventilation in the passenger carriages.
21. To the establishment of a proper and sufficient block system or other approved mode of working the traffic.

The character of the tests of iron bridges is given in Section No. VI.

The Inspecting Officer should furnish to the Government a record of the deflection and oscillation of all girder bridges of large span, and one of each type of small spans under the test loads. All bridges of about 40 feet span and over are to be considered "large span."

The Inspecting Officer should during his inspection intimate, as far as practicable, to the Manager, the general tenor of the recommendations he intends to make, in order to afford that officer the opportunity of discussing the points with him.

The report of the Inspecting Officer, with his recommendations, is to be sent to the Government of India who will issue such instructions thereon as may appear to be desirable.

Section II.—Rules for the "Manager."

The term "Manager" of any Railway is intended to mean the responsible officer in charge of the Railway at the time of the inspection, whether Engineer-in-Chief, General Manager, or Agent. If not an Engineer, he should be accompanied during the inspection by the Engineer-in-Chief or by any other officer of the Railway who can afford to the Inspecting Officer such technical information as he may require.

As soon as the "Manager" can fix approximately the date for opening the railway, he will give notice to the Government of the intention to open; six weeks' notice will be required.

At the time of giving notice the Manager should send to the Government of India (through the Public Works Department Secretariat) the information required in Section No. III. in the case of State and Provincial Railways, either through the Local Governments and Administrations, or the Director of State Railways as the case may be; and in the case of Guaranteed Railways through the Consulting Engineer.

The Government, after receiving this notice and information, will fix a date for the inspection of the line, and name the officer appointed for the duty.

The Manager of the line will enter into direct communication with the officer so appointed, and arrange with him the details of the inspection and the character of the tests.

The information sent by the "Manager" will be forwarded to the Inspecting Officer (to be returned by him to the Government of India after inspection) to enable him to study the subject before he makes his visit of inspection.

The Manager of the Railway, or such officer as he may delegate for that purpose, must accompany the Inspecting Officer in his inspections, afford him all information and assistance, and provide all instruments and arrangements necessary for applying such tests as he may require.

In order to save time, the Inspecting Officer will advise the Manager of the Railway beforehand of the character of the tests he will require, so that all arrangements may be made, as far as practicable, in anticipation of the visit of the Inspector.

The Manager will give to the Inspecting Officer in writing certificates that he will carry out any conditions he may have undertaken to perform previous to the opening of the railway for traffic, or of any restriction he may consent to adopt in the working. The responsibility of any infringement of the certified conditions will rest on the Manager.

If the Local Government or Administration or the Director of State Railways, as the case may be, considers the restrictions or conditions recommended by the Inspecting Officer to be unnecessary, impracticable, or undesirable, the matter may be referred to the Government of India for decision.

Section III.—*Information to be furnished.*

The information to be supplied to the Government of India together with the plans by opening will be as follows:—

1. A small index plan and section of the line, on which must be shown all curves, gradients, cuttings, and embankments, the position of large bridges, level crossings, stations, and sidings, &c.

The scale of the plan and section must not be less than 1 inch = 1 mile horizontal and 1 inch = 100 feet vertical, with enlargement of detail wherever the scale is too small to afford the prescribed information.

2.	A table of curves.	See Form A, Section VII.
3.	" gradients.	"
4.	" ballast.	"
5.	" important waterways.	"
6.	" abstract of waterways.	"
7.	" large bridges.	"
8.	" stations.	"
10.	" station machinery.	"
11.	" station buildings.	"
12.	" staff quarters.	"
13.	" table of level crossings.	"
14.	" cost of railway under special headings of account, Form I.	"

Drawings.—*Note.*—If Government lithographed types have been adopted in any case it will be sufficient to refer to the type, giving the date of the lithography, and it will be unnecessary to submit drawings of them.

15. Diagram of standard dimensions of fixed structures.
16. Type section of formation and ballast.
17. Type drawing of permanent-way and fastenings, sleepers, and their arrangement.
18. Types of small bridges and culverts with detailed drawings of each type of girder.
19. Detailed drawings of all large bridges or girders.
20. Sections of tunnels.
21. Drawings of fencing.
22. Types of different classes of level crossings.
23. Drawings of the points and crossings.
24. Plans of each type of stations.
25. Special plans of stations of which there are no types.
26. Diagrams of each type of locomotive showing length over buffers, position of wheels, and weight on each pair of wheels when the engine is in working trim.
27. Diagrams of each type of vehicle, showing the length over buffers, position of wheels, and the maximum load on each pair of wheels.
28. Cross-sections and plans of each kind of passenger vehicle, showing the arrangement, width and breadth of seats, the position of the lamps, the number of passengers for whom accommodation is provided, the cubic space per passenger and the general dimensions.
29. Diagram of the maximum moving dimensions approved by Government.

Section IV.—*Certificates.*

The following certificates duly signed by the Manager are to be handed to the Inspecting Officer before he commences his inspection. These certificates must subsequently be sent to the Government of India and placed on record:—

- (1.) Certificate that no structure projects within the limits of the standard dimensions given in No. 15, Section III.

(2.) Certificate that no engine or other vehicle exceeds the maximum moving dimensions as given in paragraph 29, Section III.

(3.) Certificate that no infringement of the standard dimensions either in structures or moving bodies will be made without the consent of the Government of India in writing to each case of infringement.

(4.) Certificate that no engine in working order exceeds the wheel weight given in diagram 26, section III.

(5.) Certificate that no carriage or wagon shall be loaded in such a manner as to give greater wheel weights than those shown in diagram 27, section III.

(6.) Certificate that no engines or vehicles shall hereafter be used on the railway differing from the types submitted (26 and 27, section III), without the express permission in writing from the Government of India.

(7.) Certificate that not more than three engines (two in the case of the light 5 feet 6 gauge) shall ever be allowed at one and the same time on any one span of a bridge with a single track.

(8.) That the structures have been executed in strict accordance with the drawings furnished to the Government of India.

Section V.—*Desiderata.*

The attention of Managers is particularly requested to the following points which the Government of India recommend for adoption:—

1. The provisional list of dimensions be followed as far as practicable; this list will be subject to alteration from time to time as found necessary.

2. Rails should be fished at the joints.

3. With flat-bottomed rails the rails on both sides of the joints should be secured either with fang bolts or else with coach-screws and keepers.

4. Gates capable of closing across the line should be furnished with signal boards and lamps that can be clearly seen by those on the approaching train, and should have gate-keepers provided with huts.

5. Mile and quarter-mile marks should be provided, and gradient posts for all gradients exceeding 300 yards in length.

6. Stations and Junctions should be properly protected by main and distant signals.

7. Arrangements should be made to avoid, if possible, shunting over a junction. And when two lines meet the junction should in ordinary cases be formed as a double line junction.

Tunnels, level crossings if not visible at a reasonable distance, difficult places, and steep inclines should be protected by means of telegraph or some other satisfactory plan of signal.

8. All signals worked by wire should be weighted so as to fly to 'Danger' on the fracture of the wire.

9. Tunnels and long viaducts should be provided with facilities which will enable workmen to escape from an approaching train without difficulty.

10. The descent at the end of platforms should be by ramps, not steps. Platforms not to be less than 6 feet wide, and to be more when the traffic is large. No structure on passenger platforms should be nearer than 6 feet to the edge of the platform.

Facing points should be kept locked as far as practicable.

Carriages should not contain less than 20 cubic feet of space per passenger. All seats should be provided with backs, and should not be less than 15 inches broad and afford 16 inches width per passenger.

Proper parapets should be provided in all places used by passengers.

Stations should not be on gradients steeper than 1 in 250. When they are unavoidably on steeper gradients, proper catch sidings should be provided to prevent runaway wagons from descending the gradient.

Clocks at stations should be placed where they can be seen by the drivers and signal-men.

*Proceedings of the Madras Government, Public Works Department,
20th November 1873.*

The book system, or some other system approved by Government, will be adopted for the working of the traffic.

Street wheels should be issued to all Managers of Railways and be allowed more than three engines to be on any span of a narrow gauge and more than two of narrow gauge railway, or more than two of a light 3-foot 6 inches gauge railway.

Figure 1. The effect of the concentration of the *Agaricus bisporus* spores on the growth of *Agaricus bisporus* on the substrate.

System of Family Law in England and Wales

The Government of India do not approve of the extension of existing credit facilities to an extent far in excess of the maximum loans they will have to carry in principle.

If tested heavily, a faulty portion is likely to be stressed and to cause failure elsewhere, and the extreme test is no more guarantee against failure than the lightest test.

The rolling loads assumed for the calculation of the strains in girders of railways should give nearly an equivalent to a maximum of three engines of the heavy class, two in the case of the light 3 feet 6 inches gauge with their full complement of water and fuel, and there is room for them on the spans, and the remainder of the span covered with a train of wagons of the heaviest type, fully loaded. If this load be adopted in designing bridges after war-time, it will suffice.

In long spans the loaded engine should be kept before and behind the engine, so that the engine may stand as near as possible to the center of the span. Officers who construct viaduct bridges should ascertain and report whether the load, together with the dead load, including the rails, planks, ballasting, a gravelly surface or cross-girders, does not produce a stress exceeding 5 tons per square inch (or 4 tons in compression) in any part of the material, whether in the main-girders, in the cross-girders, or in the rail beams.

When material is exposed to a tensile strain, deduction must be made to allow for the diminution of area caused by rust holes or otherwise. When subject to a compressive strain, deduction should be made to allow for diminution of area caused by imperfectly filled rust holes, and by holes for pins or bolts whether filled or not.

The materials in some of the bridges sent from England will probably be strained to more than 4 tons per square inch in compression, but though this may in some cases be allowed, it must be, with the special sanction of the Government of India.

The testing load should pass over the bridge three times, and the deflection and oscillation (when practicable) should be noted at each time of passing.

At the first passage, the testing train should proceed slowly, and should be brought to a stand with its heaviest portion as near as possible to the centre of the span. It should remain in this position for at least ten minutes.

At the second passage also the train should proceed slowly, and be brought to a stand, but need not remain in that position longer than is necessary to observe the deflection. The object of this test is to ascertain the deflection after the girder has recovered from the first test.

At the third, the train should pass over the bridge at the speed of twenty miles an hour. It is desirable that this should be done at the same time as the first test.

It is desirable that strict orders should be issued to all Managers of Railways not to allow more than three engines to be on any span at one and the same time.

For structures of cast-iron the breaking load shall be determined as follows:—
 $B =$ Total breaking load

L = Total permanent load, structure, platform, &c.

l = Maximum moving load = three of the heaviest engines (two in the case of the light 5-6 gauge) as near as possible to the centre of the span, and the rest of the span covered with goods wagons of the heaviest type fully loaded.

$$E = 3L + 6L$$

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26th November 1875.*

Section VII.—Forms.

FORMS A AND B.

List of Curves and Gradients. It is not necessary to give a "complete" list of Curves and Gradients, but simply an abstract under different classes. For the sake of uniformity, the classes given below should be adopted on all Railways.

No.	Form A.			Length, Miles.
	Radius of Curves, &c.			
	Above 300 feet	...	...	
	300 " to 400 feet inclusive.	...	...	
	" 400 " to 500 "	" "	...	
	" 500 " to 600 "	" "	...	
	" 600 " to 1,000 "	" "	...	
	" 1,000 "	...	...	
	Straight line	...	...	
	Total ...			

No.	Form B.			Length, Miles.
	Gradients.			
	1 in 30.			
	Above 1 in	30 to 1 in	50 inclusive	
	" 1 in	50 to 1 in	80 "	...
	" 1 in	80 to 1 in	100 "	...
	" 1 in	100 to 1 in	150 "	...
	" 1 in	150 to 1 in	200 "	...
	" 1 in	300 to 1 in	1,000 "	...
	" 1 in	1,000		...
	Level	...	...	...
	Total ...			

All curves below the minimum of 300 feet radius, and all gradients below the minimum of 1 in 30, must be specially noted in addition to the above forms.

FORM C.

List of Ballast.

Position.	Length, Miles.	Character of Ballast.	Average load, Miles.	Cost per cube (100 cubic feet.)	Cost per Mile.
Between M 1 and M 28	29	Gravel	1	4	2,560
" 29 " 32	4	Broken-stone	1	5	3,000
" 32 " 45	13	Burnt Clay and Sand ...	3	7	4,200
" 45 " 81	36	Kauker	4	4½	2,700
" 81 " 110	29	Burnt Clay	2	6½	3,900
Total ...	110		Average ...	5½	3,125

FORM D.

List of Important Waterways.

[illegible]

* Value of K in the formula $\text{Log. K} = \text{Log. D} - \frac{1}{4} \text{Log. M.}$

Where D = Total discharge of the river in extreme flood in feet per second.

M = Drainage area in square miles.

K = Co-efficient for Colonel Dickens' formula.

Proceedings of the Madras Legislative Council
20th November 1933.

[illegible]

Figure 1. The effect of the concentration of the *Agaricus bisporus* spores on the growth of *Agaricus bisporus* on the substrate.

[illegible]

Table 6.
List of Species

[illegible]

*Proceedings of the Madras Government, Public Works Department,
26th November 1875.*

FORM H.
List of Station Machinery, &c.

[illegible]

FORM I.
List of Station Buildings.

[illegible]

FORM J.
List of Staff Quarters.

[illegible]

*Proceedings of the Madras Government, Public Works Department,
26th November 1875.*

FORM K.
List of Level Crossings.

	Description of Level Crossing.	Number.	Average No. per 100 Miles.	Remarks.
A.	With gates closing across the Railway, and with huts			
B.	With gates not closing across the Rail- way, but with huts			
C.	Level crossings without huts			

FORM L.
*Railway.
Cost of Railway.*

Head or Sub-head of Account.	Estimated amount.	Expenditure to date.	To be expended.	Remarks.
Preliminary Expenses	RS.	RS.	RS.	
Land				
Earthwork, &c.				
Minor Bridges and Culverts				
Large Bridges				
Tunnels				
Level Crossings, &c.				
Fencing				
Ballast				
Sleepers				
Rails and Fastenings, &c....				
Stations				
Workshops				
Staff Quarters				
Station Machinery				
Telegraph				
Plant				
Rolling Stock				
Maintenance				
Establishment				
Contingencies				
Suspense Accounts				
Total ...				

*Proceedings of the Madras Government, Public Works Department,
26th November 1875.*

No. 592. ORDER THEREON, 26th November 1875, No. 3,379.

RAILWAY, No. 67.

COMMUNICATED to the Consulting Engi-
neer for Railways for information.

(True Extract.)

Major-General, R.E.,
Secretary to Government.

To the Consulting Engineer for Railways.

Exd. E. C. Shunkor.
Spare Copies

12

Rules for the Inspection of Railways by an independent Officer prior to the opening of any section or sections for passenger traffic.

- | | |
|-----------------------------------|----------------|
| I. Rules for Inspecting Officer. | V. Desiderata. |
| II. „ „ Manager. | VI. Tests. |
| III. Information to be furnished. | VII. Forms. |
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6. To the provision of parapets or hand-rails where necessary on bridges and viaducts.
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1. A small index plan and section of the line, on which must be shown all curves, gradients, cuttings, and embankments, the position of large bridges, level crossings, stations, and mileage, slopes, &c.

The scale of the plan and section must not be less than 1 inch = 1 mile horizontal, and 1 inch = 100 feet vertical, with enlargement of detail, wherever the scale is too small to afford the prescribed information.

- | | | |
|-----|--|--------------------------|
| 2. | A table of curves, | see Form A, Section VII. |
| 3. | " gradients | " B " |
| 4. | " ballast | " C " |
| 5. | " important waterways | " D. " |
| 6. | " abstract of waterways | " E. " |
| 7. | " large bridges | " F. " |
| 8. | " stations | " G. " |
| 10. | " station machinery | " H. " |
| 11. | " station buildings | " I. " |
| 12. | " staff quarters | " J. " |
| 13. | " table of level-crossings | " K. " |
| 14. | " Cost of railway under specified headings of account, Form L. | |

DRAWINGS.—*Note.*—If Government lithographed types have been adopted in any case, it will be sufficient to refer to the type, giving the date of the lithographs, and it will be unnecessary to submit drawings of them.

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16. Type section of formation and ballast.
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29. Diagram of the maximum moving dimensions approved by Government.

Section IV.—Certificates.

The following certificates; duly signed by the Manager, are to be handed to the Inspecting Officer before he commences his inspection. These certificates must subsequently be sent to the Government of India and placed on record:—

- (1). Certificate that no structure projects within the limits of the standard dimensions as given in No. 15, section III.
- (2). Certificate that no engine or other vehicle exceeds the maximum moving dimensions as given in para. 29, section III.
- (3). Certificate that no infringement of the standard dimensions either in structures or moving bodies will be made without the consent of the Government of India in writing to each case of infringement.

(4). Certificate that no engine in working order exceeds the wheel weight given in diagram 26, section III.

(5). Certificate that no carriage or wagon shall be loaded in such a manner as to give greater wheel weights than those shown in diagram 27, section III.

(6). Certificate that no engines or vehicles shall hereafter be used on the railway differing from the types submitted (26 and 27, section III), without the express permission in writing from the Government of India.

(7). Certificate that not more than 3 engines (2 in the case of the light 5 feet 6 gauge) shall ever be allowed at one and the same time on any one span of a bridge with a single track.

(8). That the structures have been executed in strict accordance with the drawings furnished to the Government of India.

Section V.—Desiderata.

The attention of Managers is particularly requested to the following points which the Government of India recommend for adoption:—

1. The provisional list of dimensions be followed as far as practicable: this list will be subject to alteration from time to time as found necessary.

2. Rails should be fished at the joints.

3. With flat-bottomed rails the rails on both sides of the joints should be secured either with fang bolts or else with coach-screws and keepers.

4. Gates capable of closing across the line should be furnished with signal boards and lamps that can be clearly seen by those on the approaching train, and should have gate-keepers provided with huts.

5. Mile and quarter-mile marks should be provided, and gradient posts for all gradients exceeding 300 yards in length.

6. Stations and Junctions should be properly protected by main and distant signals.

7. Arrangements should be made to avoid, if possible, shunting over a junction. And when two lines meet the junction should in ordinary cases be formed as a double line junction.

Tunnels, level crossings if not visible at a reasonable distance, difficult places, and steep inclines should be protected by means of telegraph or some other satisfactory plan of signal.

8. All signals worked by wire should be weighted so as to fly to 'Danger' on the fracture of the wire.

9. Tunnels and long viaducts should be provided with facilities which will enable workmen to escape from an approaching train without difficulty.

10. The descent at the end of platforms should be by ramps, not steps. Platforms not to be less than 6 feet wide, and to be more when the traffic is large. No structure on passenger platforms should be nearer than 6 feet to the edge of the platform.

Facing points should be kept locked as far as practicable.

Carriages should not contain less than 20 cubic feet of space per passenger. All seats should be provided with backs, and should not be less than 15 inches broad and afford 16 inches width per passenger.

Proper parapets should be provided in all places used by passengers.

Stations should not be on gradients steeper than 1 in 250. When they are unavoidably on steeper gradients, proper catch sidings should be provided to prevent runaway wagons from descending the gradient.

Clocks at stations should be placed where they can be seen by the drivers and signal-men.

The block system, or some other system approved by Government, will be adopted for the working of the traffic.

Strict orders should be issued to all Managers of Railways not to allow more than three engines to be on any span of a metre gauge and heavy 5 feet 6 inches gauge railway, or more than two of a light 5 feet 6 inches gauge railway.

Section VI.—Tests.

System of testing iron-bridges on Railways in India.

The Government of India do not approve of the system of testing iron-bridges to an extent far in excess of the maximum loads they will have to carry in practice.

If tested heavily, a faulty portion is likely to be strained and to cause failure afterwards, and the extreme test is no more guarantee against failure than the lighter test.

The rolling loads assumed for the calculation of the strains in girders of railways should give nearly an equivalent to a maximum of three engines of the heavy class, two in the case of the light 5 feet 6 inches gauge with their full complement of water and fuel (if there is room for them on the span), and the remainder of the span covered with a train of wagons of the heaviest type, fully loaded. If this load be adopted in testing bridges after erection, it will suffice.

In long spans the loaded wagons should be both before and behind the engines, so that the engines may stand as near as possible to the centre of the span. Officers who test wrought-iron bridges should ascertain and report whether this load, together with the dead load (including the rails, platform, ballasting, asphalt, girders or cross girders, &c., &c.) produces a strain exceeding 5 tons per square inch (or 4 tons in compression) in any part of the material whether in the main girders, in the cross-girders, or in the rail bearers.

When material is exposed to a tensile strain, deduction must be made to allow for the diminution of area caused by rivet holes or otherwise. When subject to a compressive strain, deduction should be made to allow for diminution of area caused by imperfectly filled rivet holes, and by holes for pins or bolts whether filled or not.

The materials in some of the bridges sent from England will probably be strained to more than 4 tons per square inch in compression, but though this may in some cases be allowed, it must be, with the special sanction of the Government of India.

The testing load should pass over the bridge three times, and the deflection and oscillation (when practicable) should be noted at each time of passing.

At the first passage, the testing train should proceed slowly, and should be brought to a stand with its heaviest portion as near as possible to the centre of the span. It should remain in this position for at least 10 minutes.

At the second passage also the train should proceed slowly, and be brought to a stand, but need not remain in that position longer than is necessary to observe the deflection. The object of this test is to ascertain the deflection after the girder has recovered from the first test.

At the third the train should pass over the bridge at the speed of 20 miles an hour.

It is desirable that strict orders should be issued to all managers of Railways not to allow more than three engines to be on any span at one and the same time.

For structures of cast-iron the breaking load shall be determined as follows:—

B=Total breaking load.

L=Total permanent load, structure, platform, &c.

l =Maximum moving load = 3 of the heaviest engines (2 in the case of the light 5-6 gauge) as near as possible to the centre of the span, and the rest of the span covered with goods wagons of the heaviest type fully loaded.

$B=3L + 6l$.

Section VII.—*Forms*

FORMS A, AND B

List of Curves and Gradients. It is not necessary to give a "complete" list of Curves and Gradients, but simply an abstract under different classes. For the sake of uniformity, the classes given below should be adopted on all Railways.

Form A.		
No.	Radius of curves, &c.	Length, miles.
	300 feet.	
	Above 300 " to 400 feet inclusive.	
	" 400 " to 500 " "	
	" 500 " to 600 " "	
	" 600 " to 1,000 " "	
	" 1,000 " "	
	Straight line	
	Total	

All curves below the minimum of 300 feet radius, and all gradients below the minimum of 1 in 33, must be specially noted in addition to the above forms.

FORM C

List of Ballads

Position.		Length, miles.	Character of Ballast.	Average Tons, loaded.	Cost per cubic yard loaded and spread.	Cost per cubic yard.
M 1	M 28	28	Gravel			Rg.
Between 28	and 32	4	Broken stone	1	4	2,400
" 32	" 45	13	Burnt clay and sand	1	5	3,000
" 45	" 81	36	Kankar	3	7	4,200
" 81	" 110	29	Burnt clay	4	11	2,700
				2	6	3,000
Total		110				
				Average...	5 1/2	3,128

FORM D

List of Important Water-ways.

List of Important Water-ways.												
Name of River.	Position, Mile.	Drainage area, square miles.	Rise of flood water above low-water level.	Declivity of bed, feet per mile.	Maximum velocity in flood, feet per second.	OPENINGS.					Character of foundations.	REMARKS.
						No.	Clear span.	Flood area, feet.	Flood discharge, feet per second.	Value of K*.		
	1	2	3	4	5	6	7	8	9	10	11	

* Value of K in the formula $V = \sqrt{K \frac{H}{L}}$.

* Value of K in the formula $\log R = \log D - \frac{1}{2} \log M$.
Where D = Total discharge of the river in extreme flood in feet per second
M = Drainage area in square miles.
K = Co-efficient for Coland Dickson's formula.

FORM E

Abstract of Waterway.

Clear spans.	Total area of waterway.	Area per mile of railway.	REMARKS.
In culverts and bridges not exceeding 10 feet clear span			
In ditto exceeding 10 feet but not exceeding 20			
In ditto .. 20 40			
In ditto .. 40 60			
In bridges exceeding 60 feet clear span			
Total			

FORM E

Abstract cost of Lacine Bridges.

[illegible]

FORM G.

List of Stations.

<i>Name.</i>	<i>Class.</i>	<i>Position, Mile.</i>	<i>DISTANCE APART,</i>		<i>On what gradient.</i>	<i>On what curve.</i>	<i>Total cost.</i>	<i>REMARKS.</i>
			<i>Station to station.</i>	<i>Of Engine Stations.</i>				
		Average ..				Total ..		

List of Station Machinery, &c.

List of Station Buildings.

List of Staff Quarters.

[illegible]

List of Level Crossings.

	DESCRIPTION OF LEVEL CROSSING.	NUMBER.	Average No. per 100 miles.	REMARKS.
A	With gates closing across the Railway, and with huts			
B	With gates not closing across the Railway, but with huts			
C	Level crossings without huts			

Cost of Railway.

Head or Sub-head of Account.	Estimated amount.	Expenditure to date.	To be expended.	REMARKS.
	Rs.	Rs.	Rs.	
Preliminary Expenses	...			
Land	...			
Earthwork, &c.	...			
Minor Bridges and Culverts ...	...			
Large Bridges	...			
Tunnels	...			
Level Crossings, &c.	...			
Fencing	...			
Ballast	...			
Sleepers	...			
Rails and Fastenings, &c. ...	...			
Stations	...			
Workshops	...			
Staff Quarters	...			
Station Machinery	...			
Telegraph	...			
Plant	...			
Rolling Stock	...			
Maintenance	...			
Establishment	...			
Contingencies	...			
Suspense Accounts	...			
TOTAL				

*All communications
should be addressed
to the Secretary.*

CIRCULAR No. 23 RAILWAY.
GOVERNMENT OF INDIA.
PUBLIC WORKS DEPARTMENT.
RAILWAY.

Fort William, November 11, 1875.

Inspection of State Railway works prior to opening.

RESOLUTION.—The Hon'ble the President in Council is pleased to issue the following instructions in regard to the inspection of State Railway works under construction, and in regard to their final inspection prior to opening the railway for public traffic.

2. The usual detailed inspections will be made by the Engineer-in-Chief or other Officer in charge of the line who, under the orders of the Director of State Railways, will be responsible for the efficiency of the works.

3. General inspections will be made by the Consulting Engineer to the Government of India for State Railways. These inspections will necessarily not be in such detail as to secure that all work is properly done. For that the Government of India rely on the Engineers-in-Chief and Superintending Engineers. The Consulting Engineer's inspections must be directed chiefly to informing himself so as to enable him to advise the Government on the engineering questions which may arise in connection with the works, and besides this to satisfy himself in a general way that the system of construction is sound and well administered.

4. Lastly, when a railway or section of a railway is reported ready to be opened for public traffic, a final inspection of it will be made by an Officer of the Government Consulting Engineer's Department for Guaranteed Railways, under rules which have been drawn up for the information and guidance of all concerned.

5. It is essential to the complete information of the Government that the final inspection of a railway about to be opened for traffic shall be entrusted to an experienced Officer who has not been connected with its construction. This is also an additional guarantee that nothing has been overlooked which is necessary to the due security of the public and the welfare and safety of passengers and railway servants.

ORDER.—Ordered, that this Resolution and the Rules alluded to in para. 4, be forwarded to all Governments and Administrations for information, and to the Officers named in the margin for information and guidance.

Director of State Railways.
Consulting Engineers at Calcutta, Lahore and Lucknow.

William Colonel, R. A.,
Secy. to the Govt. of India.

Mr. 7496/75

*To The Secy. to the Govt. of Madras
Public Works Dept. (Railway)*

P. W. 1875 Dept
No 7476

GOVERNMENT OF INDIA

PUBLIC WORKS DEPARTMENT
RAILWAY.

To

CIRCULAR No. 23 RAILWAY.

Dated November 11, 1875.

Received — 24th/11

No 3379

Commenced at the Commissioning
Engineers for the Railway for information

Inspection of State Railway works prior to opening.

No. 211, P. W. D. Press, — 15-11-75 — 230.

26 Nov 75

Engineering Dept. 21

Office 17

Recd - 6-12-75

No 591/72

92/10

UNITED STATES DEPARTMENT OF
PUBLIC WORKS

Comm. Aug. for
Phys.
27/1/12

26 Nov. 3379

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571-572

Inspection of State Railways
works prior to opening
Circular from the Govt of
India on the subject of the
— Communicated to the
Eng. Engineer for Phys —