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*Proceedings of the Madras Government, Public Works Department,
29th January 1862.*

No. 161. Read the following Proceedings of the Government of India, in the Public Works Department, dated Fort William, 14th January 1862.

CIRCULAR No. 3 OF 1862.

PUBLIC WORKS DEPARTMENT, FORT WILLIAM, 14TH JANUARY 1862.

Improvement of unmetalled roads by the use of sand.

1. Portions of the unmetalled road between Prome and Pongday in Pegu were formerly impassable during the rainy season.

2. At Lieutenant Ingram's suggestion, the Government of India sanctioned his applying a layer of sand in lieu of metal over that road of which he had charge.

3. The experiment, as tested by the monsoon of 1859, was successful, and the result was communicated to the Department of Public Works generally,* further reports being called for, and the Government of Bengal being specially requested to try a portion of road laid in two tracks, one with sand for wet weather, one with clay for dry weather.

4. With reference to the Circular communicating these results to the Department generally, several replies have been received.

5. Colonel Ludlow, then Chief Engineer of the Saugor and Nerbudda Territories, stated that nearly all the roads in the Tanjore District, where no metal is procurable, are formed of an admixture of clay and sand, and are, he believed, found to answer the purposes of traffic remarkably well: the cost of repair being comparatively trifling.

6. Lieutenant H. H. Foord, Executive Engineer, Jaulnah Division, reports (see Appendix A) having used sand on several parts of the Nagpoor and Bombay Road lying in his Division.

The road in these places used to be almost impassable; but during the monsoon of 1860, was quite hard, and caused no hindrance to traffic.

He reports having traversed a portion of road thus treated after very heavy rain, and found it not in the slightest degree affected. The substratum was deep black cotton soil.

Lieutenant Foord spread the sand in layers of 2" at a time and rolled it well into the cotton soil. He deprecates much sand being applied at once.

He also states that some kinds of gravel which without sand fail to make a good road, with sand answer as well for light traffic as other roads costing treble the amount.

This paper of Lieutenant Foord's is valuable, and might be made generally known in the Bengal Presidency.†

7. The Chief Engineer, Madras, corroborates Colonel Ludlow's statement that the plan has been extensively tried in Tanjore and with success. Parallel roads of sand and clay have also been proposed there, but have never been tried.

8. Captain Oakes, District Engineer, Tanjore, reports (see Appendix B) that the method of using sand in that district is to deposit a layer 9" thick, and then, with that material thus deposited, fill the ruts which will result from traffic during the rains. By this means a well mixed upper stratum will be formed. Subsequently, if brought to a proper section and sanded with a 2½" or 3" layer, after a shower, the result will be a surface impervious to the rain of the next monsoon. Subsequent ruts are to be filled with sand deposited in heaps for the purpose at the side of the road.

Captain Oakes thinks that whilst clay predominates, a slope of 1 in 18 or 1 in 12 is proper for the section; but when sand predominates, the flatter the slope the better in his opinion. He would not give a slope greater than 1 in 36.

He considers that the only way to keep such roads in order is to retain a monthly Establishment of laborers for the purpose. The maximum charge admitted for maintenance of *trunk* roads of such construction is Rupees 100 per mile per annum. This Captain Oakes considers insufficient.

† A few Rules regarding such roads are found at page 106 of Lieutenant Foord's "Notes on building."

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9. Lieutenant Ingram's Reports, recently received, are highly satisfactory. The Prome and Pongday Road has stood well during the rains of the two last years. Repairs have cost Rupees 150 per mile. This he attributes to extraordinary floods, and hopes that one-third of that rate will hereafter suffice. But under any circumstances, looking to the high cost of labor in Pegu, the experiment seems successful.

10. In Bengal the experiment ordered, though apparently not strictly carried out, has been successful. Captain James, Executive Engineer, Berhampoor Division, states regarding it—"The portion of road covered with the sand, which in former years was quite impassable for wheeled carriages during the rains on account of the heavy clay, has remained in excellent order since the sand was laid down." He adds that he visited the road on two or three occasions, and was surprised to see how entirely the sand had corrected the ill effects of the clay.

11. The Officiating Chief Engineer, Bengal, remarks that the improvement of roads in Bengal by the use of sand has been long known and practised. He quotes Rules and Circular Orders by the Military Board, page 55, Section 744.

"Sand.—Clean sand when put upon and mixed with a soil of stiff clay, forms a species of metalling, the quality of which has been favorably reported on to the Board."

12. The chief question about these papers seems to be—"Is the fact they demonstrate sufficiently well known to render it worth while to publish extracts for the information of the Public Works Department and of Road Fund Committees at large in the Bengal Presidency?"

13. The Government of India believes that the fact is certainly not sufficiently known, at least among Bengal Officers, that the expedient is one particularly applicable to the improvement of many important district roads; and that these remarks with Captain Oakes's and Lieutenant Foord's valuable letters as Appendices, will repay publication.

(Signed) A. G. GOODWYN, Lieut.-Colonel,
Under Secy. to the Govt. of India.

PUBLIC WORKS DEPARTMENT, FORT WILLIAM, 14TH JANUARY 1862.

Copy of the foregoing forwarded to the Government of Madras in continuation of P. W. D. Circular No. 4,215, dated 18th August 1860.

(Signed) A. G. GOODWYN, Lieut.-Colonel,
Under Secy. to the Govt. of India.

APPENDIX A.

No. 388, dated 19th September 1860.

From Lieut. H. H. Foord, Ex. Engr., Jaulnah Division, to Chief Engr., Hyderabad.

I have the honor to acknowledge the receipt of the paper regarding "improvement to General No. 1,225, dated 6th September 1860. unmetalled roads by the use of sand."

1st. Having tried sand as a covering material on a portion of the road in the Jaulnah Division, and seen its effect, I beg to forward a Report of its result, thinking the same may be interesting to Government.

2nd. Sand was used on the portions of the Nagpore Road between Arungabad and Thesagum, between Checkultanah and Sendra, and between Budnapoor and Sailgaum; these portions were formerly almost impassable, but now and during the whole of the present monsoon were quite hard, and caused no hindrance to traffic. On the 5th, 6th, and 7th of September, the rain was unusually heavy, nearly seven inches having fallen during the first 48 hours. I traversed a portion of the road immediately afterwards, and found it had not been in the slightest way affected by the rains.

3rd. The portions of the road on which the sand was tried ran over deep black cotton soil.

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4th. One monsoon is hardly sufficient to test the advantage of sand as a covering material, more particularly as during the rains bandy traffic is insignificant; but as far as the tappal and transit have been concerned, it has answered remarkably well.

5th. In applying the sand I found it advisable to spread it only to a depth of 2" at a time and roll it well in, and not to apply more until the sand and black soil were thoroughly amalgamated; if too much sand is at once applied, the rain percolates quickly through it, and no amount of rolling will make it bind.

6th. Roads over deep black soil if first covered with sand and then metalled, will be found much more reasonable than those where metal is at once applied; the sand prevents the road sinking too far into the soil, and thus saves a vast amount of metal.

7th. Sand I have also found a valuable adjunct in road-making, where inferior moorum has had to be used as a covering material; moorum roads (unless very good moorum has been used) become muddy after the continuance of heavy rains, whereas if slightly covered with sand, they answer as well (for light traffic) as road costing treble the amount.

8th. The roads in the Cantonment at Aurungabad are constructed on this principle and answer remarkably well.

9th. The cost of repairing the portions of road where sand has been used as a covering material, will not exceed Rupees 10 per mile this year.

APPENDIX B.

A few remarks on clay and sand roads in the Tanjore District.

1. The soil in the Delta of the Kaveri consists chiefly of alluvial deposits, and of this material and sand the roads are formed. They pass through highly cultivated land of considerable value, so that even when side trenches have been dug to procure material for the embankment, of which the roads usually consist, the trenches are soon filled up by the Mirasidars and the cultivation is extended to the very foot of the slopes of the embankments.

2. The roads on the Delta are usually raised from 1½ to 5 feet above the level of the surrounding country. When the embankment has been raised for about two years, and has become consolidated by the traffic along it during the dry seasons, the sides of the embankment should be turfed, ridges of turf should be formed on both edges of the road, openings being left in them for the escape of rain at intervals of 25 or 30 yards; the surface should be brought to a proper section, and 9' of sharp river sand should be spread upon it after the fall of the first heavy shower of the N. E. monsoon, and as the surface becomes cut up by the bandies during the monsoon, the ruts should be filled up by bringing the surface of the road to a proper section with the material upon it; by the end of the monsoon the sand will have become thoroughly mixed with clay or alluvial deposit, and if then brought to a proper section and sanded with 2½" or 3" of good river sand, after a shower of rain, and while the surface is still moist, it will form an excellent road during the dry weather, and will probably be so thoroughly consolidated before the next monsoon as to offer a hard, smooth surface from which rain will run off without penetrating far; but should ruts be formed, they should be immediately filled up with river sand, stored at intervals on the road.

3. With regard to the section to be given to the surface of these roads, I am inclined to think that while the clay predominates, and the amalgamation between the clay and sand has not taken place, the section should be a high one, the slope being not less than 2" to 3" per yard; but when the surface of the road has become hard, and sand predominates, the flatter the road is the better; 1" per yard is ample.

4. It is very difficult to keep such roads in order, the turf dies during the dry weather, and if the surface of the road has become uneven, a heavy shower of rain may form a rut half across the road, and however carefully that rut may be filled, the road will be heavy at that point for some considerable period; the only way to preserve these roads is by an establishment

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of mile-men, whose duty it is constantly to fill up ruts or hollows as they are formed, and who spread the sand, which they should collect and store during the dry months;

Rupees 100 is the maximum charge allowed for this purpose for a mile of any road; it is far from being sufficient.

Trunk Road No. 9.

5. The following are the charges which I deem necessary for the proper conservation of these roads:—

1 man per mile, at Rupees $4\frac{1}{2}$ per mensem...	...	Rs.	54
2 women per mile, at Rupees $3\frac{1}{2}$ per mensem	...	„	84
$1,760 \times 6 \times \frac{1}{3} = 330$ cubic yards of sand, at			
8 Annas, including cartage	...	„	165
	Rs...		303

The cost of sanding depends entirely upon the distance the sand has to be conveyed; for the mile, coolies collect and store it.

6. In the eastern and parts of the southern portion of the District, the soil consists of but little else than sand; I am not aware of any successful attempt to improve the roads by mixing it with clay; where this has been tried on a small scale, the layers of clay have been so thin that the bandy-wheels removed the clay before it became mixed with the sand.

7. A very large sum indeed would be required to attempt to improve the sand roads by spreading clay upon them, for the clay would have to be brought from a considerable distance. The method I should propose to adopt would be to dig a trench in the sand 9" deep, and put 1 foot of clay in it, and to cover the clay with 9" of sand, thus raising the road 1 foot above the surface of the country. The road would then require the same attention as the sanded roads in the Delta.

(Signed) R. F. OAKES, Captain,
District Engineer, Tanjore.

No. 162.

ORDER THEREON, 29th January 1862, No. 82.

Communicated to the Deputy Chief Engineers Northern, Southern and Central Circles, for information.

(Signed) W. H. HORSLEY, Lieut.-Colonel,
Chief Engr. and Secy. to Govt., D.P.W.

CIRCULAR No. 3 of 1862.

PUBLIC WORKS DEPARTMENT,

FORT WILLIAM, 14TH JANUARY 1862.

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2. At Lieutenant Ingram's suggestion, the Government of India sanctioned his applying a layer of sand in lieu of metal over that road of which he had charge.

3. The experiment, as tested by the monsoon of 1859, was successful, and the result was communicated to the Department of Public Works generally,* further reports being called for, and the Government of Bengal being specially requested to try a portion of road laid in two tracks, one with sand for wet weather, one with clay for dry weather.

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6. Lieutenant H. H. Foord, Executive Engineer, Jaulnah Division, reports (see Appendix A) having used sand on several parts of the Nagpoor and Bombay Road lying in his Division.

The road in these places used to be almost impassable; but during the monsoon of 1860, was quite hard, and caused no hindrance to traffic.

He reports having traversed a portion of road thus treated after very heavy rain, and found it not in the slightest degree affected. The substratum was deep black cotton soil.

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A. G. GOODWYN, Lieut. Col.,
Under Secy. to the Govt. of India.

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Copy of the foregoing forwarded to the Government of Madras in continuation of P. W. D. Circular No. 4215 dated 18th August 1860.

A. G. Goodwyn, Lieut. Col.,
Under Secy. to the Govt. of India.

7th Oct 1862/60.5:71-72

Public Works 1862 Sept 1st
No. of Court for January
No 206.

From the Under Secretary
the Govt of India.

Dated 1st 3rd January 1862.
No 29

Attending Copy of a
Circular on the improve-
ment of agricultural
lands by the use of
manure.

No 114162.

With the order
of the Govt.

1/2

No 82.

Communicated to the
Sd. Secy. Govt. of India, Secretary and
Under Secy for information.

For the Secy
29th January 1862

No 1974.

To The Secy. Govt. of India.

B. C. C. C.

C. C. C. C.

No 84.