M.R.O. 1—77,006—8-6-37.

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MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.

G.O. No. 1742 & 1743 Press Mis.

Dated 11-6- 1907

Not to be folded or roughly handled

Proceedings of the Madras Government, Public Works Department, 11th June 1867.

Read the following papers :—

No. 220. From the Officiating Superintending Engineer, 8th Division, to the Secretary to Government, Department Public Works, dated Madura, 16th January 1867, No. 1,742.

1. With reference to G. O. No. 96, of the 11th instant, I have the honour to state that no metalled roads have been constructed in the hilly parts of the Madura and Tinnevelly districts and we have therefore no data on which to give answers to the questions referred by the Ceylon Government.

2. The roads that have been under construction in the past three years are—

The main southern road from Trichinopoly, through Madura and Palamcottah.

From Tirumungalam, through Pulney, to the Coimbatore boundary.

The Cotton road, through Sateor to Tuticorin.

From Palamcottah to Tuticorin.

These roads lie entirely on the plains, and as information regarding them can be of but little use, when the cost of hill roads is the subject of inquiry, it appears to me unnecessary to furnish answers to the questions from this division. If however you consider that there will be any value in giving answers, as for roads in the low country, I will take up the paper at once.

No. 221. From the Superintending Engineer, 6th Division, to the Secretary to Government, Public Works Department, dated Tanjore, 20th February 1867, No. 1,388.

Ref. " 1,796 of 11th January.
" 297 of 30th "

1. With reference to the G. O. noted in the margin, I have the honour to inform you that as the questions in No. 96, refer to roads in hilly districts, and to a system of labour, supervision, &c., &c., which does not prevail in this division, and as there are no roads of the nature referred to in this division, I am unable to afford information on the points adverted to.

2. There are a few questions of a general nature under "earth-work," "metaling," "culverts," &c., to which I could reply, but that only by taking up some one road, and that of a nature entirely different to that of the roads regarding which information is required.

No. 222. From the Acting Superintending Engineer, 1st Division, to the Secretary to Government, Department Public Works, dated Camp, Dowlaishweram, 9th March 1867, No. 276.

In reply to G. O. No. 96, 11th January 1867, I have the honour to observe that the only hill roads in this division are as yet tracks, made by local labour, of the poorest description, and paid by daily hire. I imagine that information on such points as these is not required by the Ceylon Government, and that a report on the low country roads would be of no service, and merely burden the record.

No. 223. From the Superintending Engineer, 7th Division, to the Secretary to Government, Department Public Works, dated Coonoor, 11th May 1867, No. 34.

I have the honour, with reference to your reminders No. 77 of 8th April, and No. 99 of 8th May, to state, with regret, that I see no chance of my ever having

time to spare to do justice to the questions propounded in the paper which accompanied G. O. No. 96 of 11th January. It is a subject which interests me, and regarding which I would gladly give the benefit of my experience; but I cannot do so to any purpose without neglect of my current work.

No. 224. From the Superintending Engineer, 5th Division, to the Secretary to Government, Department Public Works, dated Cuddalore, 6th March 1867, No. 184.

With reference to G. O. No. 96, of the 11th January 1867, I have the honour to forward a list of answers to the several questions proposed by the Committee appointed to inquire into the cost of the construction of roads in Ceylon.

1 List.
1 Estimate.

ANSWERS TO QUESTIONS BY THE ROAD COMMITTEE IN CEYLON.

General character of Roads.

1. ———
2. ———
3. The road surface has a rise in the middle of one inch for every yard of width.
4. On clayey soil from six to twelve inches of sand is spread before metaling. Metal should be spread on road during rain.
5. Only on ghaut-roads there is a mud bank eighteen inches by eighteen inches on the outer side, and sometimes on road raised more than one yard.
6. As follows:—
   a. Rupees 2,000, on heavy cuttings; often double this cost.
   b. Included with earth-work.
   c. Rupees 500.
   d. Rupees 1,500.
   e. Collecting stone 410, cartage one mile 275, spreading 110, gravel 25, total Rs. 850.
   f. Five per cent. on cost of road.
9. Open drainage for sides of road, and both open and covered for cross drainage.
10. ———
11. One yard on each side of the metalled portion. There are no foot-paths.

Earth-work.

12. One Anna per cubic yard, if not conveyed beyond a distance of more than 25 yards.
15. One Rupee per cubic yard.
16. Many. Cost for removal 4 Annas per cubic yard. Not estimated as so much rock.
17. Frequently. Cost for removal from 4 to 8 Annas per cubic yard, according to nature of material.
18. Always.
19. Only when the slopes are spread to the action of running water.
20. Brick or rough stone in chunam, top thickness two feet. Thickness at base one-third the height of the wall.
21. Not known. Retaining walls not used except there is water. Earth-work cheaper.

Metaling.

22. The hardest stone to be got within a distance of three miles, broken into cubes of not more than one inch.
23. Six inches.
24. Two Annas.
25. Piled at the site of the road for measurement, blinded with gravel, watered (if no rain falls) and rolled.

Proceedings of the Madras Government, Public Works Department,
11*th June* 1867.

26. Breaking 4 Annas per cubic yard. Cartage and piling 2½ Annas per cubic yard per mile. Spreading and rolling 1 Anna per cubic yard. If water has to be carried 1 Anna per cubic yard extra.
27. Often found close to road. Sometimes carted ten miles, average distance about three miles.
28. Two and a half Annas per cubic yard per mile.
29. No. A measure of one yard square, and half a yard in depth. (Half a cubic yard.)
30. Not heaped.
31. 23,328 cubic inches.
32. Not heaped.
33. ———

Culverts.

34. On ghaut road 8 to 10. Other roads about fo ur permile.
35. Laterite stone and brick plastered over. On ghaut roads ashlar work is applied to the piers, &c.
36. Never used unless within three miles of the road. Brick-work is cheaper.
37. Blasted for large works, but not for small works. Break up both with regular and irregular fracture.
38. Undressed quarried stone Rupee 1 per cubic yard. Rubble stone can be had for the cost of carting.
39. Four Annas per parah a measure of 20 inches by 20 inches by 10 inches, 4,000 cubic inches.
40. Two and a half parahs per cubic yard.
41. One of lime, two of sand.
42. Coral, stone, and shell all very good.
43. Lime found in several places is moderately hydraulic.
44. Easily obtained, size 9 inches by 4½ inches by 2½ inches. Cost Rupees 2-8-0 to 3 Rupees per 1,000.
45. Rupees 2-12-0 to 3 Rupees per cubic yard.
46. Rubble masonry Rupees 1-8-0 to 2 per cubic yard, according to cost of cartage.
47. Rubble masonry 1½ to 2 cubic yards per diem.
48. Formerly in much use, not so at present.
49. Rupees 10 per lineal yard for small culvert of 1 yard span.
50. Eight Annas per diem.

Bridges.

51. The bridge across the Pooniar at Cuddalore, 21 arches of 45 feet span, 21 feet roadway, built on sand, cost 56,000 Rupees, a 12 feet tunnel has been built for 400 Rupees.
52. One, besides tunnels of sizes up to 5 yards span.
53. Mason 8, Bricklayer 6, Carpenter 6, Blacksmith 5 Annas per diem.

Labour.

54. From the nearest villages on a simple promise to pay them so much per diem.
55. None.
56. No agreement except with contractors who give security.
57. No importation.
58. Yes. A pygust on Rupees 10 or 15 per month for every 24 miles of roads, &c., a head cooly on Rupees 5 per month for every 6 miles, with regular working parties under them.
59. Yes. 2 to 4 Annas daily, extra pay, charge to the work.
60. From 1 to 2 Annas per day.
61. Yes. Men 2 Annas, Women 1½ Annas, and children 1 Anna.
62. Yes, and are very useful.
63. A man, and a woman or child can do from 3 to 6 cubic yards of earth-work daily according to the soil.

64. None beyond the pygust or head cooly. If the daily task is not performed, a portion of the pay is stopped.
65. Sometimes they receive an advance of money when engaged, which they gradually refund.
66. When accidently injured on the work. Not often in other cases. No pay given if there is no work.
67. Not unless very large numbers are employed in feverish places. Cost Rupees 60 per mensem, charge to the work.
68. Rice seldom used. When used it is at the prevailing rates.
69. Merely the cost of carriage.
70. Petty superintendence and tools of all kinds.
71. Not much.
72. ———
73. Yes.
74. Often.
75. Not, if they are regularly paid.
76. The men are hutted, supplied with rice, and sometimes with clothing.
77. Yes.
78. About 2 per cent. on large works.
79. Blasting, earth-work, and felling trees are on contract, but not the bridges.
80. According to estimate.

Supervision.

81. One Engineer, two Overseers, and two Maistries on every 60 miles of new road.
84. Commonly employed as Overseers, and Maistries, and on the whole with satisfactory results.

Transport.

87. Very seldom used of late years. Cost not known.
88. In common use.
89. Eight Annas per diem.
90. Do. per do.
91. Yes, on main lines of road.
92. For distances short of one-fourth of a mile metal is carried to road by men, at 2 Annas per diem.

Character of traffic.

93. Merely carts and pack-bullocks.
94. A very primitive, but useful affair on two wheels, no springs.
95. Two inches.
96. One thousand lbs. is called a load, but on good road 1,500 lbs. can be taken.
97. On main lines about 400 or 500. On cross roads 100 to 200.
98. All roads are kept in good order by an annual grant after construction.
99. The annual grant varies from 100 to 500 Rupees a mile.

Miscellaneous.

102. Lines are only built where there are no villages near, and then at a cost of 8 Annas per head.
103. Mud walls 6 feet high with bamboo roof covered with straw or leaves.
104. On large works by ticket. On small works by cash, one hour per diem for payment on large works.

(Signed) E. A. FOORD, Lieut.-Colonel, R. E.,
Superintending Engineer, 5th Division.

CUDDALORE,
6th March 1867.

Proceedings of the Madras Government, Public Works Department,
11th June 1867.

Detailed Estimate for making a Road from Pondicherry to Mercanum.

Length 19 *miles.*

Nature of soil.	Miles.	Yards.	Measurements. Length.	Breadth.	Height or depth.	Earth-work.	Metaling.	Contents. No. of Tunnels.	Particulars of work.
Sand	...	100	100	6¾	½	337½	...	1 Tunnel of 3 feet.	Raising.
Do.	...	377	277	2	1	554	...	...	Cutting channels.
Do.	...	477	100	2	1	200	...	...	Do.
Do.	...	509	32	6½	½	52	...	...	Raising.
Do.	...	649	140	6½	¼	227½	...	...	Do.
Do.	...	706	57	6½	¼	92⅝	...	...	Do.
Do.	...	818	112	2	1	224	...	...	Digging channels.
Do.	...	1,164	346	2	1	692	...	...	Do.
Do.	...	1,234	70	2	1	140	...	...	Do.
Do.	...	1,318	84	6¾	⅓	283½	...	...	Raising.
Do.	...	1,585	267	2	1	534	...	...	Digging channels.
Do.	...	1,670	85	6¾	⅓	286⅝	...	...	Raising.
Red soil	...	121	211	6½	¼	342⅜	...	1 Tunnel of 3 feet.	Raising.
Do.	...	188	67	2	1	134	1,760	...	Digging channels.
Do.	...	478	290	2	1	580	...	1 Dam of 25 yards.	Do.
Do.	...	578	100	2	1	200	...	...	Do.
Do.	...	994	416	2	1	832	...	1 Dam of 30 yards.	Do.
Sand	...	965	1,031	2	1	2,062	1,760	1 Do. of 30 yards.	Do.
Do.	1	661	396	2	1	792	...	...	Raising.
Red soil	...	728	67	6¾	⅓	226⅓	...	1 Tunnel of 6 feet.	Do.
Do.	...	928	200	6¾	⅓	675	...	...	Do.
Sand	...	1,124	196	2	1	392	...	...	Do.
Do.	...	1,311	187	2	1	374	...	...	Do.
Do.	...	1,393	82	2	1	164	...	...	Do.
Do.	...	1,525	132	2	1	264	...	...	Digging channels.
Do.	...	1,702	177	2	1	354	...	...	Raising.
Do.	3	109	167	7⅛	¾	892⅜	1,000	1 Bridge of 18 feet.	Do.

Nature of soil.	Measurements.					Contents.			Particulars of work.
	Miles.	Yards.	Length.	Breadth.	Height or depth.	Earth-work.	Metaling.	No. of Tunnels.	
Sand	...	178	69	$7\frac{1}{2}$	1	$517\frac{1}{2}$	...	.....	Digging channels.
Do.	...	321	143	$7\frac{1}{2}$	1	$1,072\frac{1}{2}$	...	.....	Do.
Do.	...	361	40	$6\frac{3}{4}$	$\frac{1}{2}$	135	...	1 Bridge of 12 feet.	Do.
Do.	...	549	188	$6\frac{3}{4}$	$\frac{1}{2}$	$634\frac{1}{2}$	...	.....	Raising.
Do.	...	682	133	2	1	266	...	.....	Do.
Do.	...	779	97	$6\frac{1}{2}$	$\frac{1}{4}$	$157\frac{5}{8}$	...	.....	Digging channels.
Do.	...	1,063	284	$6\frac{3}{4}$	$\frac{1}{2}$	$958\frac{1}{2}$	...	1 Tunnel of 6 feet.	Do.
Do.	...	1,397	334	2	1	668	...	.....	Do.
Do.	...	1,553	156	2	1	312	...	.....	Do.
Do.	...	1,759	206	2	1	412	...	.....	Do.
Do.	4	199	209	$6\frac{3}{4}$	$\frac{1}{2}$	675	1,000	1 Tunnel of 3 feet.	Do.
Do.	...	299	100	$6\frac{3}{4}$	$\frac{1}{2}$	$337\frac{1}{2}$	...	.....	Raising.
Red soil	...	571	272	2	1	544	...	.....	Do.
Do.	...	764	193	2	1	386	...	.....	Digging channels.
Sand	...	907	143	2	1	286	...	.....	Do.
Do.	...	982	75	2	1	150	...	.....	Do.
Do.	...	1,075	93	2	1	186	...	.....	Do.
Do.	...	1,099	24	2	1	48	...	1 Tunnel of 6 feet.	Do.
Do.	...	1,151	52	$7\frac{1}{8}$	$\frac{3}{4}$	$277\frac{7}{8}$	...	.....	Raising.
Do.	...	1,227	76	$6\frac{1}{2}$	$\frac{1}{4}$	$123\frac{1}{2}$	...	.....	Do.
Do.	...	1,368	141	2	1	282	...	....	Digging channels.
Red soil	...	1,504	136	2	1	272	...	.....	Do.
Do.	...	1,576	72	$6\frac{3}{4}$	$\frac{1}{2}$	243	...	1 Tunnel of 3 feet.	Raising.
Do.	...	1,644	68	$6\frac{3}{4}$	$\frac{1}{2}$	$229\frac{1}{2}$	...	1 Dam of 20 yards.	Do.
Do.	5	707	823	2	1	1,646	1,000	....	Digging channels.
Do.	...	1,094	387	2	1	774	...	.....	Do.
Sand	...	1,261	167	$7\frac{1}{2}$	1	$1,252\frac{1}{2}$	...	1 Tunnel of 6 feet.	Raising.
Do.	...	1,286	25	2	1	50	...	....	Digging channels.
Do.	...	1,657	371	2	1	742	...	.....	Do.
Do.	6	435	538	2	1	1,076	1,000	1 Tunnel of 3 feet.	Do.
Do.	...	609	174	$7\frac{1}{2}$	1	1,305	...	.....	Raising.
Do.	...	676	67	$6\frac{3}{4}$	$\frac{1}{2}$	$226\frac{1}{2}$	...	1 Tunnel of 3 feet.	Do.
Do.	...	862	186	2	1	372	...	... .	Digging channels.
Do.	7	701	1,599	2	1	3,198	1,000	... .	Do.
Sand	...	1,128	427	2	1	854	...	... .	Do.
Do.	...	1,696	568	2	1	1,136	...	.....	Do.
Do.	8	580	644	2	1	1,288	1,000	.....	Do.
Do.	...	720	140	$7\frac{1}{2}$	1	1,050	...	1 Tunnel of 3 feet.	Raising.
Nunjah	...	1,580	860	$7\frac{1}{2}$	1	6,450	...	4 Tunnels of 3 feet.	Do.
Sand	...	1,638	58	2	1	116	...	.....	Digging channels.
Do.	9	108	230	2	1	460	1,760	.....	Digging channels.
Do.	...	154	46	2	1	92	...	.....	Do.
Nunjah	...	678	524	$7\frac{1}{2}$	1	3,930	...	2 Tunnels of 3 feet.	Raising.
Poonjah	...	785	107	2	1	214	...	... .	Digging channels.
Nunjah	...	1,015	230	$7\frac{1}{2}$	1	1,725	...	1 Tunnel of 3 feet.	Raising.
Sand	...	1,158	143	2	1	286	...	.....	Digging channels.
Do.	...	1,305	147	2	1	294	...	.....	Do.
Do.	...	1,502	197	2	1	394	...	.....	Do.
Do.	...	1,752	250	2	1	500	...	.....	Do.
Do.	10	144	152	2	1	304	1,760	.....	Do.
Do.	...	563	419	2	1	838	...	.....	Do.
Do.	...	727	164	2	1	328	...	.....	Do.
Nunjah	...	1,030	303	$7\frac{1}{8}$	$\frac{3}{4}$	1,619	...	1 Tunnel of 3 feet.	Raising.
Do.	...	1,140	110	$7\frac{1}{2}$	1	825	...	.....	Do.
Do.	...	1,388	248	$7\frac{1}{8}$	$\frac{3}{4}$	$1,325\frac{1}{4}$	...	1 Tunnel of 3 feet.	Do.
Do.	...	1,597	209	$7\frac{1}{8}$	$\frac{3}{4}$	$1,116\frac{1}{2}$	...	3 Tunnels of 3 do.	Do.
Do.	11	41	204	$7\frac{1}{8}$	$\frac{3}{4}$	$1,090\frac{1}{8}$	1,760	1 Tunnel of 3 do.	Do.
Do.	...	343	302	$7\frac{1}{8}$	$\frac{1}{2}$	$1,613\frac{1}{4}$	...	1 Do. of 3 do.	Do.
Do.	...	470	127	$6\frac{3}{4}$	$\frac{1}{4}$	$428\frac{5}{8}$	...	1 Do. of 3 do.	Do.
Do.	...	636	166	$6\frac{1}{2}$	1	$269\frac{3}{4}$	...	.....	Do.
Do.	...	875	239	2	$\frac{1}{2}$	478	...	.....	Digging channels.
Cotton soil	12	438	1,323	$6\frac{3}{4}$	1	$4,465\frac{1}{2}$	1,760	.....	Raising.
Do.	...	771	333	$7\frac{1}{2}$	1	$2,497\frac{1}{2}$	...	.....	Do.
Sand	13	1,292	521	2	1	1,042	...	.....	Digging channels.
Do.	...	399	777	2	1	1,554	1,760	.....	Do.
Do.	...	1,575	1,266	2	1	2,532	...	1 Tunnel of 3 feet.	Do.
Nunjah	14	716	901	$7\frac{1}{2}$	$\frac{1}{2}$	$6,757\frac{1}{2}$	1,760	2 Tunnels of 3 do.	Raising.
Do.	...	831	115	$6\frac{3}{4}$	$\frac{1}{2}$	$388\frac{1}{8}$	...	.....	Do.
Sand	...	1,401	570	2	1	1,140	...	.. ..	Digging channels.
Do.	...	1,428	27	$7\frac{1}{2}$	1	$202\frac{1}{2}$	...	.....	Widening bank.
Do.	...	1,554	126	4	2	1,008	...	.....	Do.
Do.	...	1,754	200	$7\frac{1}{2}$	1	1,500	...	1 Tunnel of 6 feet.	Raising.
Do.	15	86	92	$7\frac{1}{8}$	$\frac{3}{4}$	$491\frac{5}{8}$	1,760	.....	Do.
Do.	...	137	51	$6\frac{3}{4}$	$\frac{1}{4}$	$172\frac{1}{2}$	...	.....	Do.

Contents.	Measurements.					Nature of soil.	Earth-work.	Metaling.	No. of Tunnels.	Particulars of work.
	Miles.	Yards.	Length.	Breadth.	Height or depth.					
	...	...				...		...	.....	
1	...	225	188	2	1	Sand ...	376	...	1 Tunnel of 3 feet.	Digging channels.
2	...	555	230	2	1	Cotton soil...	466	...	.....	Do.
3	...	862	307	2	1	Do. ...	614	...	1 Tunnel of 3 feet.	Raising.
4	...	1,344	482	2¼	1	Do. ...	3,615	...	.....	Digging channels.
5	...	40	456	2	1	Sand ...	912	1,760	.....	Do.
6	...	306	266	2	1	Do. ...	532	...	.....	Do.
7	16	825	2,289	2	1	Do. ...	4,578	1,760	.....	Do.
8	17	1,639	504	2	1	Do. ...	1,008	...	.....	Do.
9	...	720	1,147	2	1	Do. ...	2,294	1,760	.....	Do.
10	18	1,257	331	2	1	Do. ...	1,062	...	.....	Do.
11	...	1,477	220	2	1	Do. ...	440	...	.....	Do.
12	...	1,658	181	2	1	Do. ...	362	...	.....	Do.
13	19	1,760	102	2	1	Do. ...	204	1,760	.....	Do.
							1,00,956¾	28,880		

Abstract of Estimate.

		Rs.	A.	P.		Rs.	A.	P.	Rs.	A.	P.
1,760	Cubic yards of metal carting for 1st mile	0	15	0	Per C. yard.	1,650	0	0			
1,760	Do. do. for 2nd mile ...	0	12	6	Do. ...	1,375	0	0			
2,000	Do. do. for 3rd & 8th do.	0	10	0	Do. ...	1,250	0	0			
2,000	Do. do. for 4th & 7th do.	0	7	6	Do. ...	937	8	0			
2,000	Do. do. for 5th & 6th do.	0	5	0	Do. ...	625	0	0			
1,760	Do. do. for 11th do	1	4	0	Do. ...	2,200	0	0			
1,760	Do. do. for 1 th do.	1	15	3	Do. ...	3,437	8	0			
1,760	Do. do. for 13th do.	1	12	9	Do. ...	3, 62	8	0			
1,760	Do. do. for 14th do.	1	10	3	Do. ...	2,887	8	0			
1,7 0	Do. do. for 15th do.	1	7	9	Do. ...	2,612	8	0			
1,760	Do. do. for 16th do.	1	5	3	Do. ...	2,337	8	0			
1,760	Do. do. for 17th do.	1	2	9	Do. ...	2,062	8	0			
1,7 0	Do. do. for 18th do.	1	0	3	Do. ...	1,787	8	0			
1,760	Do do. for 19th do.	0	13	9	Do. ...	1,512	8	0			
1,760	Do. do. for 9th do.	0	15	0	Do. ...	1,650	0	0			
1,760	Do. do. for 10th do.	1	1	6	Do. ...	1,925	0	0			
									31,412	3	6
28,880	Do. of metal collecting...	0	1	0	Do. ...	.....			1,835	0	0
28,880	Do. of do. spreading ...	0	0	6	Do. ...	.....			902	8	6
1,00,956¾	Do. of earth-work ...	0	1	0	Do. ...	.....			6,309	12	9
5	Tunnels of 6 feet span ...	130	0	0	each ...	650	0	0			
26	Do. of 3 do. do. ...	80	0	0	Do. ...	2,080	0	0			
1	Bridge of 18 do. do. ...	900	0	0	Do. ...	900	0	0			
1	Do. of 12 do. do. ...	550	0	0	Do. ...	550	0	0			
1	Dam of 30 yards in length.	90	0	0	Do. ...	90	0	0			
1	Do. of 25 do. do.	75	0	0	Do. ...	75	0	0			
2	Do. of 20 do. do.	60	0	0	Do. ...	120	0	0			
									4,465	0	0
19	Miles clearing jungle ...	70	0	0	Do. ...	.....			1,330	0	0
	Planting avenue trees 19 miles	60	0	0	Do. ...	.....			1,140	0	0
20	Mile stones	4	0	0	Do. ...	.....			80	0	0
	Compensation for lands ...	.....			.....	.....			500	0	0
	Sundries	.....			.....	.....			1,035	3	3
					Total Estimates ...				49,000	0	0

CUDDALORE,
6th March 1867.

(Signed) E. A. FOORD, Lieut.-Colonel, R. E.,
Superintending Engineer, 5th Division.

No. 225. From the Superintending Engineer, 2nd Division, to the Secretary to Government, Department Public Works, dated Masulipatam, 8th March 1867, No. 116.

1. Adverting to G. O. No. 96, dated 11th January last, I have the honour to forward answers to the questions proposed by the Ceylon Road Committee, received from five Ranges in this division. Some of the answers are, I regret to say, not quite so explicit as I should have desired, but I have thought it advisable to forward them as they are, rather than delay in replying to the order.

Nellore.	*Kistna.*
1st Range.	5th do.
3rd do.	7th do.
4th do.	

2. As the rates and the peculiarities of each Range greatly vary, I considered it desirable to obtain the information needed from those which may be considered as having a marked typical character.

3. In the 1st Range, Nellore, the roads generally traverse a laterite formation, and pass over level ground. They run also near the coast, where the traffic is considerable.

4. In the 3rd Range they generally pass over black soil with an under-lying stratum of nodules of limes-stone, and lie in land where the cultivation is scanty and traffic small.

5. In the 4th Range the soil is black cotton chiefly, as in No. 3, but of a worse nature, and they run near the coast. Metal is procurable with difficulty.

6. The 5th Range, Kistna, is in the non-deltaic portion of that district, where the soil is generally stony and material abundant. It is an inland range and contrasts with

7. The 7th Range, which is deltaic in its formation, and where no material is procurable excepting sandy nodules, dry out of the swamps close to the sea.

NELLORE DISTRICT.

No. 1 or Nellore Range.

Answers to the questions forwarded with the Superintending Engineer's Memorandum No. 552 of 21st ultimo.

General Character of Roads.

Q. A.

1—1. None in this Range.

2—2. First class roads are metalled to a breath of 6 yards, and second class to a breadth of 4.

3—3. Surface is put into section, with reference to the transverse slope of the proposed road.

4—4. No.

5—5. No.

6—6. 6 yards breadth of metaling. 4 yards breadth of metaling.

			Rs.
a.	Cost not known; Trunk Road made by Road Department.	... ...	170
b.			
c.		... ...	659
d.		Cost not known, built by Road Department.	
e.		... ...	1,007
f.		... ...	198

7—7. Already replied to by the Government of India.

8—8. Do. do. do.

9—9. Side drains are cut parallel to the road; these are connected, as often as possible, with the natural drainage streams of the country traversed by the road.

10—10. Average quantity of earth-work cubic yards 2,816 per mile; no rocky cutting in this range.

11—11. One yard. No. foot paths.

Earth Work.

12—12. Depends on the distance the soil has to be carried. Varies from 9 Pies to 1 Anna 4 Pies per cubic yard.

13—13. Already replied to by the Government of India.

14—14. Do. do. do.

15—15. No rocky cutting in this range.

16—16. No.

17—17. No.

Q. A.

18—18. Does not apply to this range.

19—19. None in this Range.

20—20. } See answer to question 19.
21—21. }

Metaling.

22—22. From one to three inches diameter; hard laterite; when this is not procurable within a reasonable distance quartzy and broken up boulders.

23—23. Varies considerably; six inches may be taken.

24—24. Rupee 0-4-9.

25—25. Metal is deposited at the side of the road; after being spread it is watered and tamped, and covered with a coat of gravel generally about three inches in thickness.

26—26. The metal is supplied by contractors at the following rates:—
Collecting and breaking up, per cubic yard 4 Annas.
Tamping, per cubic yard 1 Anna.

27—27. Six miles.

28—28. 3 Annas 9 Pies, per cubic yard per mile.

29—29. The parah is the measure in use.

30—30. The measure is not heaped.

31—31. 4,000 cubic inches.

32—32. Measures are never heaped in this range.

33—33. Does not apply to this range.

Culverts.

34—34. 2·61.

35—35. Brick and laterite.

36—36. No.

37—37. No.

38—38. Quarrying from Rupee 1 to Rupees 1-8-0 per cubic yard.

39—39. 8 Annas per parah.

40—40. Two Parahs.

41—41. One part of lime to two of sand.

42—42. Nodular of very fair quality in part of the range; and shell in others.

43—43 Have not seen any approach to good hydraulic lime.

44—44. Really good bricks are not to be had, unless prepared specially by the department; dimensions 9 inches × 4½ inches × 2¾ inches.

45—45. Rupees 3-8-10 per cubic yard.

46—46. Ordinary rubble Rupees 2-6-0 and laterite Rupees 5-0-2 per cubic yard.

47—47. Three-quarters of a cubic yard.

48—48. No.

49—49. Culverts, 9 feet span cost Rupees 18-8-0 per lineal yard, 6 feet span Rupees 10, 3 feet span Rupees 3; the faces Rupees 219, 83, and 27-8-0 respectively.

50—50. Rupees 0-6-0 and 0-6-6.

Bridges.

51—51. The bridges are all of ordinary span, the maximum being about 40; breadth between parapets does not exceed 18; built by the Road Department; cost not known.

52—52. ·83 per mile.

53—53. Carpenters Annas 7, Blacksmiths Annas 8, Bricklayers Annas 6, Painters Annas 7 per day.

Labour.

54—54. From the surrounding country, on fair wages.

55—55. No.

56—56. No.

57—57. Does not apply to this range.

A. Q.

58—58. One head labourer is allowed for every two miles of road.
59—59. No.
60—60. Annas 2.
61—61. General rate Annas 2; Annas 2 Pies 3, and Annas 2 Pies 6 are paid occasionally for particular work.
62—62. Yes.
63—63. The earth-work, spreading and tamping metal is generally done by contract.
64—64. Payment is made for the work done only.
65—65. Does not apply to this range.
66—66. No.
67—67. No.
68—68. No.
69—69. Does not apply to this range.
70—70. The cost of the road and building materials; also miscellaneous expenditure.
71. 71. Does not apply to this range.
72—72. Do. do.
73—73. Do. do.
74—74. Do. do.
75—75. Do. do.
76—76. Do. do.
77—77. Do. do.
78—78. Unknown.
79—79. Earth-work, quarrying, and cartage of materials are done by contract; spreading and tamping of road metal also (generally).
80—80. Earth-work Pies 9 per cubic yard; gravel quarrying Annas 2 per cubic yard, sifting Pies 6 per cubic yard; cartage Annas 3 Pies 9 per cubic yard per mile.

Supervision.

81—81. Inspections of, by the Range Officer, the road being under the immediate charge of an Overseer who has subordinates to superintend the details of construction and repair; these men have generally eighteen miles of road to attend to.
82—82. Already replied to by the Government of India.
83—83. Do. do.
84—84. Largely and on the whole satisfactory.

Transport.

85—85. Already replied to by the Government of India.
86—86. Do. do.
87—87. No.
88—88. Yes.
89—89. Carts are not hired on daily or monthly wages.
90—90. Does not apply to this range; the quantity of materials carted is paid for without reference to the number of carts engaged.
91—91. No.
92—92. No.

Traffic.

93—93. Principally merchandise conveyed by bandies or on pack-bullocks.
94—94. Two-wheeled drawn by bullocks.
95—95. Two and a quarter inches.
96—96. Lbs. 1,000.
97—97. No traffic returns kept.
98—98. A maintenance grant is allowed for each road after construction.
99—99. See answer to question 97.

Proceedings of the Madras Government, Public Works Department,
11th June 1867.

Miscellaneous.

Q. A.

100—100. Already replied to by the Government of India.
101—101. Do. do.
102—102. None are provided.
103—103. See answer to 102.
104—104. With few exceptions all payments are made to contractors.
105—105. Already replied to by the Government of India.

(Signed) R. SMITH,
Executive. Engr., 1st or Nellore Range.

Camp, Nellore.
23*rd February* 1867.

Answers to questions put forth by the Committee appointed to enquire into the cost of construction of roads in Ceylon, communicated in G. O. No. 96, dated the 11th January 1867.

Roads.

Q. 1. Does not apply to works in this range.

2. The type of roads of different widths is laid down in Extract Minutes of Consultation, No. 92, dated 2nd February 1857.

3. The system followed in preparing the road for the reception of metal is as follows:—The earth taken from the side-drains is thrown up, covering a surface varying from one to three yards in excess of the width to be covered with metal, and in depth from six inches to one yard, according to the nature of the country traversed. The embankment thus formed is then allowed to settle, and is afterwards levelled preparatory to laying down the metal.

4. No.

5. No.

6.

Width of road.	Earth-work.	Side-drains.	Cross-drains.	Bridges.	Metaling.	Miscellaneous.
Metal, 6 yards width ...	312	165	600	...	990	200
Metal, 5 yards width ...	288	110	430	...	825	160

7. * *

8. * *

9. The system of drainage usual is as follows:—shallow surface drains one foot six inches in width are formed parallel to the road and along its edge, on both sides from which at distances averaging twenty yards, oblique drains are led to an outer surface drain one and a half yard in breadth by half a yard in depth, which discharge into the natural water-courses.

10. Rock is rarely met with in this range.

11. The width varies with the description of road and nature of country—*vide* Proceedings quoted in answer to question 2.—Foot-paths are not formed.

Earth-work.

12. The excavation of earth-work averages 1 Anna per cubic yard.

13. * *

14. * *

Q. 15. Cost of cutting averages 4 Annas per cubic yard.
16. Not applicable.
17. No.
18. No. All materials other than the earths and gravel and of a compact nature is defined as rock.
19. No.
20. Not applicable.
21. Do.

Metaling.

22. Metal has not been used, the surface being formed with either laterite gravel or disintegrated granite. The character of the latter if carefully selected gives a firm unyielding surface during rains; but becomes dusty during the dry weather, and wears quickly; the laterite wears well, and forms a hard unyielding surface.
23. Four and a half inches.
24. One and a half annas.
25. The surface material is deposited in half yard heaps on the side of road till spread, and after spreading it is watered and tamped with flat wooden rammers 12 × 8 × 3 inches.
26. The tamping of material costs on an average 2 Annas per cubic yard, other items not applicable.
27. Two miles.
28. Four annas per mile.
29. The parah (as measure 20 inches × 20 inches × 10 inches) is the measure used, and 15 parahs are reckoned to the cubic yard.
30. The measure is struck.
31. Four thousand cubic inches.
32. Not applicable.
33. Do.

Culverts.

34. The dimensions and character of the various minor masonry work in this range varying constantly with the requirements of the drainage, no average can be struck.
35. Masonry work are built of either brick or roughstone-in-chunam.
36. Stone is generally procurable within a distance of five miles, when such is not the case brick is substituted.
37. No; stone is obtained by quarrying with the pick or crowbar; when not found on the surface, it is obtained in irregular masses and with an irregular fracture.
38. Average cost of stone at work Rupees 1-8-0 per cubic yard.
39. Cost of lime delivered at work Rupees 9 per candy of twenty parahs.
40. Quantity of lime per cubic yard of masonry two and a half parahs.
41. The proportion of lime to sand is one part of the former to two parts of the latter.
42. Lime used is produced from a nodular lime stone; it is of fair quality.
43. No.
44. There is a difficulty in procuring fuel for burning bricks, which causes stone to be preferred were procurable. The size of the bricks used are 9 × 4½ × 3¼, and their cost per thousand averages Rupees 4-8-0.
45. The cost of brick-work averages Rupees 3-8-0 per cubic yard.
46. The cost of masonry per cubic yard averages Rupees 2-8-0.
47. A mason builds one cubic yard per day.
48. No.

Q. 49. Average cost of a culvert of 3 feet span per lineal yard, Rupees 25-4-0.
Do. do. of 6 ,, do. ,, 28-12-0.
Do. do. of 9 ,, do. ,, 39-8-0.
Do. do. of 12 ,, do. ,, 70.
50. Rates paid to masons, from 6 to 8 Annas per day.

Bridges.

51. No large streams in this range have been bridged.
52. Not applicable.
53. Same as stated in answer to question No. 50.

Labour.

54. Labour is procured from resident population.
55. No.
56. No regular agreement for ordinary labour.
57. Not applicable.
58. No.
59. No.
60. The daily rate for ordinary labour is 2 Annas.
61. Labour is divided into two classes, boys and women, and men; and the daily rate of pay is 2 Annas for men and 1 Anna 4 Pies for women and boys; heavy work such as lifting large stones commands an increased rate, viz., 2 Annas 8 Pies per day.
62. Women and boys are employed on roads.
63. When the spreading and tamping of metal is performed by daily labour, each gang is tasked at so many squares, which varies with the depth of metal laid.
64. All work is measured by the disbursing agent before making payment, and fines are inflicted for short work.
65. Not applicable.
66. No.
67. No.
68. No.
69. No.
70. No charges other than the price of labour and materials are incurred in road-making, except when the road passes through cultivated land, when compensation for the same is incurred.
71. Labour is difficult to procure, while cultivation is in progress and during harvest.
72. Coolies prefer working in the fields when such work is procurable.
73. The wages paid by cultivators are higher than that paid by Government.
74. Not applicable.
75. Do.
76. Do.
77. Do.
78. Not definable.
79. All materials are supplied on contract, or purchased at rates previously agreed upon; and, as a rule, no work but petty repairs is performed by daily labour.
80. The rates paid for contract work are as follow:—
For the excavation of gravel for metal 1 Anna per cubic yard.
For carting the same 3 Annas 9 Pies per cubic yard for spreading and tamping.
Do. 2 Annas 6 Pies per cubic yard.

Supervision.

Q. 81. With the exception of the Talook Overseer and the Range Officer, both of whose supervision is more or less general, there is a lack of Superintendents with any special training; for their workmen are retained or dismissed as they evince aptitude for the work on which they are engaged, and the consequence of a want of previous training is that much additional work is thrown on the officers of the permanent establishment, in order to secure the proper out-turn of work.

82.———

83.———

84. Native supervision is very largely employed, and much of it necessarily so; but the result is not so satisfactory as would be the case were better class of men obtainable.

85.———

86.———

87. No.

88. The country cart drawn by a pair of bullocks is used, and also the Waddah cart, which runs upon low roughly-sloped solid wheels, drawn usually by a pair of buffalos. The latter is useful in a rough country where there are no roads, as it is not liable to upset, and, if damaged, is at once repaired on the spot by its owner; its capacity, however, is small, not more than one-third of a cubic yard of rough stone.

89. The cost of a pair of bullocks and driver per day ranges from 8 to 14 Annas.

90. Carts are never hired without bullocks and driver; the price of which ranges from 12 Annas to 1 Rupee per day.

91. No.

92. No.

Character of Traffic.

93. The traffic on all roads is light.

94. The cart used is the common cart of the country, mounted on two wheels, about 4½ feet in diameter, and 4 feet width of track.

95. The breadth of the tire is 2½ inches.

96. The weight carried is about 700 lbs.

97. The average traffic on the main line of road is 200 carts per day; that on the subsidiary road about 70 carts.

98. Average duration of road about 3 years.

99. Unable to answer this question, as it depends on other conditions of traffic than that of carts alone, there being much cattle traffic on some lines as compared with others.

Miscellaneous.

100.———

101.———

102. Lines for the use of labourers are not used.

103. Not applicable.

104. The system of pay, if for contract work, is by cheque on the local treasuries, and for daily labour, by weekly cash payments by disbursing agents. The time of payment is generally after the close of the working day, and the time taken about 2 hours.

105.———

(Signed) R. HASLER,
27*th February* 1867. *Supervisor in charge 4th or No. 1 Range, N. D. C.,*

(Signed) G. V. WINSCOM, Lieut.-Colonel, R. E.,
Superintending Engineer, 2nd Division.

Proceedings of the Madras Government, Public Works Department,
11*th June* 1867.

REPLIES TO QUESTIONS ON ROAD-MAKING.

General character of roads.

1. Describe the general character of the roads in hilly districts, and the materials of which they are composed?
   No roads in hilly parts have yet been thoroughly formed in this Range.
2. What is the usual size for roads of different widths?
   5, 6, 8, 10, 12 yards.
3. What system is followed in forming road-surface, before laying on the metaling?
   In the first instance it is usual, after the centre line of proposed road is decided upon, and its breadth, height, &c., known, to erect sections denoting the height and side-slopes required, the latter is invariably made 1½ or 2 to 1; the side-drains is then marked out, and if they are covered with good grass, it is carefully removed and preserved; the side-drains are then dug, and thrown for forming the road, which is generally sufficient, but if not so, extra earth is taken from pits; when the road is sufficiently raised, it is well rammed, the transverse and side-slopes are then formed, the latter turfed from the turf removed from side-drains, the road is then ready for metaling.
4. Is it usual to adopt any substratum differing in character or material, from the surface metaling? If so, describe it.
   Instances have occurred when a layer of sand have been put over a road formed of black soil under the metaling, but is very seldom done.
5. Are the roads fenced in? If so, what description of fencing is used, and what is its cost?
   No.
6. What is total cost per mile of roads, with different widths of metaling, sub-divided under the following heads, viz.:—
   a. Earth-works (including retaining walls and rocks.)
   b. Side-drains.
   c. Cross-drains or culverts.
   d. Bridges.
   e. Metaling.
   f. Miscellaneous.

   The following was the cost of completing the 34th mile of the Dornal road during this official year
   Earth-work, no retaining wall or rock in the mile.
   Side and check drains.
   Cross-drains or road.
   Dams.
   Bridges—none.
   Metaling.
   Miscellaneous.
   The total cost of Rupees was 925-3-5.
7. How are the estimates for roads framed?
   Already replied to by the Government of India.
8. What check is there for ascertaining whether the quantities actually executed agree with the estimated quantities.
   Do. do. do.
9. What system of drainage is adopted?
   All nullahs or rivers are bridged or dammed over as the necessity of them may require, side-drains are cut at certain distances along the road to carry off the water from the high to the low lands.
10. What is the average per-centage of rock to earth, and what are the average quantities of rock and earth per mile.
    Rock is but very rarely met with.
11. What is the usual width allowed beyond the metalled portion, and are there foot-paths?
    In first class road 1 yard is usually allowed, which is used by passengers as a foot-path.

Earth-work.

12. What is the cost of earth-work per cubic yard?
    8 Pies, Light easy soil.
    9 ,, Black soil.
    10 ,, Slightly gravelly.
    12 ,, Gravelly soil.

13.	Does this cost include carrying to embankment, or is the cost of embankment formed from cuttings, estimated as a separate item ?	Already replied to by the Government of India.
14.	How is soil estimated ?	Do. do. do.
15.	What is the cost of rock cutting per cubic yard ?	No work of this description here.
16.	Are there any boulders ? If so, what is the cost of removing them ? Are they estimated as so much rock ?	Do.
17	Is there much material difficult to be removed by spade or mamotie, but too soft for blasting ? If so, what is the cost of such material per cubic yard ?	Do.
18.	Is rock defined as material which requires blasting ?	Do.
19.	Are retaining walls used extensively as a substitute for earth slopes ?	Retaining walls as a substitute for ear this not used.
20.	If so, what is the character of masonry in such walls ? What is the thickness for different heights of wall, and the cost per cubic yard.	Not answerable.
21.	What is the average number of cubic yards of retaining wall per mile of road.	Do.

Metaling.

22.	Describe the general character of the metaling, and the materials of which it is composed ?	Metaling is composed chiefly of quart, boulders, and black basalt ; the latter is but rarely obtained, but in red soil and the foot of hills the two former is plentiful, each is hard substantial material, but quartz is used with preference.
23.	What is the average thickness of metaling ?	6 inches.
24.	What is the average cost per superficial yard of metaling ?	9 Pies when obtained within a distance not exceeding half mile.
25.	How is metaling laid ? Is it piled at the side of the road, and, after being laid, is it watered, stamped, rolled, or blinded with gravel ?	Metaling is first piled on the berms of the road in heaps of 6 parahs, half cubic yard each ; it is afterwards spread and well packed together, the crevices filled with small stone and gravel ; a layer of gravel is then spread over it, which is wetted, and well rammed.
26.	What is the cost of each of the following items in metaling, viz., blasting, sledging, breaking, piling, stamping, or rolling.	Metal in this range goes through only the following processes :—quarrying or excavating, 2 Annas per cubic yard (piling is included in *carriage*) ; *breaking*, 3 *Annas per cubic yard* ; stamping or rolling included in graveling.
27.	What is the average distance to which metal is conveyed from the quarry.	Two miles.
28.	What is the cost of transport of metal for different distances ?	For one-third mile, 1¾ Annas per cubic yard ; two-thirds of a mile, 2$\frac{15}{16}$ Annas per cubic yard ; *one mile*, 3¾ *Annas per cubic yard.*
29.	Is the bushel in use as a measure ? If not, what measure is used for metal ?	No. The Parah measure.
30.	Is the measure heaped or not ?	No.
31.	How many cubic inches does the measure contain ?	4,000 cubic inches.
32.	How many cubic inches should be allowed on the average, if the measure be heaped ?	*Measure not heaped.*

33.	How many cubic yards of solid rock are required to make up a given number of measures, say 100 bushes ?	Not experimented upon here.

Culverts.

34.	What is the average number of culverts of different dimensions per mile ?	On the Dornal road there is not more than 3 in 1 mile.
35.	What is the general description of masonry, of which they are constructed ?	Rubble stone and brick in chunam.
36.	Is the stone for masonry generally near at hand ?	Generally within 2 miles distance.
37.	Is the stone blasted ? If so, does it laminate with an even bed, or break up with an irregular fracture ?	It is quarried, not blasted with powder ; some laminate with an even bed, others break up with irregular fracture.
38.	What is the cost of procuring stone per cubic yard ?	At quarry, 4 Annas per cubic yard.
39.	What is the cost of lime delivered on the work ?	4, 6, 8, 10 Rupees per candy.
40.	What is the average quantity of lime per cubic yard of masonry ?	2 or 2½ parahs according to quality.
41.	What is the proportion of lime to sand used ?	Generally from 1 to 2.
42.	What description of lime is chiefly used ? Is it of good quality ?	Stone lime. Yes.
43.	Is there hydraulic lime in the district ?	None found.
44.	Are bricks easily obtained ? What are their dimensions and cost per thousand ?	No difficulty is obtained on account of fire-wood. Brick 9 inches by 4½ inches by 2¾ inches would cost from 6 to 8 Rupees per 1,000.
45.	What is the cost of brick-work per cubic yard ?	Rupees 4 per cubic yard of brick in chunam.
46.	What is the cost of masonry per cubic yard ?	Rupees 2½ per cubic yard, when stone is quarried within a mile from building site.
47.	What quantity of masonry does each mason complete per diem ?	Three-fourths of a cubic yard.
48.	Are elephants employed to assist in building ?	No.
49.	What is the average cost per lineal yard of different dimensions of culverts, and what is the cost of their faces ?	Culverts or tunnels and road dams cost per lineal foot Rupees 17-3-2.
50.	What are the rates paid for masons ?	6, 7, 8 Annas per diem.

Bridges.

51.	Give a general description of different bridges, with their cost.	Bridges with segmental arches only have been constructed here as yet ; the latest built was one of 1 vent 15 feet span ; its foundation was 6 feet deep, abutments 3 feet high from the spring of arch, and average breadth 5¼ feet, the wings from foundation 16 feet high, average breadth 4 feet, arch 1½ feet thick, retaining walls and flooring was put, the parapet 1¼ feet

high; the whole was plastered with 2 coats of chunam. The cost of construction altogether was Rupees 1,122.

52. What is the average number of bridges per mile?

No. 1 in 11 miles.

53. What rates are paid to skilled artisans of different kinds?

The skilfullest workman receives no more than 8 Annas per diem.

LABOUR.

54. Whence is labour obtained, and on what terms?

By free agency, either as contractors or daily labourers.

55. Is any of the labour imported? If so, at what cost?

No.

56. Is there any system of agreement? If so, what is the character of such agreement?

Not answerable.

57. Is the cost of importation charged to the cost of the road?

Do.

58. Is there any organized body of road labourers or artisans?

None with the exception of a few mile-men or labourers on monthly hire, whose duty is to keep the road in good order, by making slight repairs, and to see that passengers, bandies, &c., do no injury to masonry buildings.

59. Is any labour on the roads performed by Pioneers or Military? If so, at what rates, and to what charged?

No.

60. What is the average daily rate of pay for labourers?

2 Annas per diem, men coolies; 1½ Annas women; 1¼ Annas boys; 1 Anna girls.

61. Are there different grades? If so, how are they distinguished and paid?

Not particularly. Young, active, able-bodied men receive the highest rate, viz., 2 Annas per diem, but old men incapable of performing a full day's work, receive women's rate 1¼ Annas.

62. Are women and children employed on the roads?

Yes.

63. How are the labourers and others tasked?

Daily labourers are not tasked, neither are they frequently used; for all work possible is done by contract; the few employed would seldom appear if strict task work was enforced.

64. What system is adopted to enforce discipline, or to ensure the completion of the task?

Merely unremitted attention to work during working hours, which is superintended by a Gumastah.

65. Are the labourers paid when on the march, changing from one place of work to another?

Labourers, such as tank-diggers, frequently work at a distance of 10 miles from their village; they get nothing for marching. Daily labourers are found generally in villages in the vicinity of the work.

66. Are they paid when sick in Hospital? or when prevented from working by stress of weather?

Yes, if they had received an injury, while working. No allowance is made for the stress of weather, without an important bridge was under construction and labourers scarce, batta at so much per diem would then be given.

67. Is medical aid given to the labourers? If so, how is it charged, and what is the cost of it?

Until latterly medicine chest was furnished on application by Government free of charge.

68. Is rice issued at a fixed rate? If so, in what quantities?

No grain is issued whatever.

69. Is there any loss on the rice thus issued?

Do. do.

70. What other charges beyond the regular pay of the labourer are included in the cost of a road?

Materials, sundries, such as tools and plant.

71. How far is labour affected by the proximity to estates?

To a considerable extent at certain seasons of the year.

72. Does coolies prefer working on estates to being employed on roads?

They do prefer working for cultivators.

73. Are the wages paid to road-coolies higher than those paid to estate-coolies?

No less; and this is the reason that it is different in harvesting season to get labourers.

74. Are coolies enticed from the roads by crimps employed on the estates?

No.

75. Are there many desertions?

They desert the work for better pay as forestated.

76. What is the general system pursued with regard to labour on estates?

Coolies employed by cultivators are generally on daily pay, during requirements they receive one meal of food for breakfast and 2½ Seers of grain, the whole valued at 3½ Annas.

77. Do the highest rates prevail in these districts in which estates are most numerous?

The highest rates usually prevail in parts where there are most wet crops.

78. What is the proportion of non-effectual labour?

According to supervision when work-people are well looked after, there is no non-effectual labour.

79. How far is the contract system pursued in road-making?

To the fullest extent available, but at present no thorough contract have been entered into, although ¼¾ths of expenditure have been executed by petty contract system.

80. What are the rates paid for contract work?

Rupees 2¼, 2½, 2¾ by 3 and upwards according to the distance of obtaining material.

SUPERVISION.

81. What is the general character of supervision and establishment?

Supervision consists in having a Talook Overseer for each talook to superintend all works in it; three or more talooks generally comprise a range, in which an Upper Subordinate or Executive or Assistant Engineer, according to the class of the range is in charge of. Talook Overseer is responsible to, and immediately under, the order of the Range Officer.

82. What proportion of the supervision is borne on the fixed or provisional establishment, and what is charged to the roads under construction?

Already replied to by the Government of India.

83. Is any portion supervised by Military Engineers or other Officers. If so, to what are their pay and allowances charged?

Do. do. do.

84.	To what extent is Native supervision employed, and is such supervision attended with satisfactory results?	To a considerable extent Native supervision is employed both as upper and lower subordinates *if well overlooked. Their supervision is* generally attended with satisfactory results.
	TRANSPORT.	
85.	How is the cost of transport borne ?	Already replied to by the Government of India.
86.	Is there a special vote for transport, or is the cost of transport in each case charged to the construction of the road ?	Do. do. do.
87.	Are elephants, camels, or donkeys extensively used in transport ? If so, what do they cost per mensem or per annum ?	No.
88.	Are carts employed ?	Yes.
89.	What is the cost of a pair of bullocks and a driver per diem.	12 Annas per diem.
90.	What is the contract price of carts per diem ?	Not contracted for, when used are generally furnished under the contract or on daily hire.
91.	Are barrows or hand-carts in general use ?	Not in frequent use.
92.	Is any transport performed by men ? If so, at what cost ?	Now and again at 4 Pies per mile.
	CHARACTER OF TRAFFIC.	
93.	What is the character of the traffic on different roads ?	Chiefly exporting grain, salt-fish, salt, tobacco, cotton, &c., from district to district.
94.	What description of carts are used ?	Common country carts formed of teak or tumma wood, generally prepared in the roughest manner.
95.	What is the breadth of the wheels in ordinary use ?	Breadth is 2 inches.
96.	What weight is carried on a pair of wheels ?	1,000 lbs.
97.	How many wheels pass over the roads in the course of a day ?	Traffic fluctuates in season with favourable weather 150 per diem.
98.	What is the average duration of each road ?	Not answerable. Roads are only now being formed here.
99.	Has any relation been observed between the duration of the roads, and the number of carts which have passed over them ?	Do. do.
	MISCELLANEOUS.	
100.	How are the supplies from the Workshops charged ?	Already replied to by the Government of India.
101.	Is there a separate votee for tools, or are the tools charged to the roads on which they are used ?	Do. do. do.
102.	What is the cost of lines or buildings for accommodation of those employed on the roads.	No buildings are constructed.
103.	What is the character of such buildings, and how many are erected for a given length of road ?	No buildings are constructed.
104.*	What is the system of pay, and what time is lost in paying ?	* All contractors and work-people, for amounts from Rupees 10 and upwards, are paid by cheques by the Overseers in charge of talooks, who receive a certain quantity according to requirements, and as indented for once in 15 days the Range Officer frequently himself issues cheques for contract work, he examines daily, labourers are paid by coin, settlements are made as frequent as possible, not generally later than once in 8 days.
105.	Are there any general votes bearing upon the construction of roads, the amounts of which are not charged directly to the cost of roads ?	Already replied to by the Government of India.

(Signed) S. C. PLUMMER,
Supervisor in charge of No. 3 Range, Western District.

CAMP SANGAM,
8th February 1867.

(Signed) G. W. WINSCOM, Lieut.-Colonel, R. E,
Superintending Engineer, 2nd Division.

From the Assistant Engineer in charge No. 7, or Masulipatam Range, to the Superintending Engineer, 2nd Division, dated Masulipatam, 20th February 1867, No. 375.

In reply to your Memorandum No. 1,071, accompanying Government Order No. 96, I have the honour to forward the following Answers to the Questions therein asked.—

N. B.—Where a question is omitted, it is to be understood that it does not apply to the work done in this Range, and the rates given in all cases are those in practice in the Bunder Talook.

3. Before metaling, the surface of the road is made perfectly even, the centre being 3 inches or four inches higher than the sides.
4. No.
5. No.
6. Metaling with swamp kunker, 5 yards in width and 3 inches thick, Rupees 1,300 per mile.
   Do. 6 yards wide do. 1,550 ,, ,,
7. Already replied to by the Government of India.
8. Do. do. do.
9. Side drains are excavated along the roads to conduct the drainage into the nearest low ground, where it crosses the road by means of bridges, tunnels, or road dams, and falls into swamps, from which in most cases it finds its way into the sea.
11. A berm of one yard is left on each side of the metaling.

Earth-works.

		RS.	A.	P.
12.	Sand, per cubic yard	0	0	8
	Common delta black soil	0	1	0
	Gravel (hard)	0	1	3

With lead not exceeding 20 yards or depth of excavation of *one* yard, or height of lift, (as over a spoil bank), of 2 yards. For every additional 20 yards lead 1 Pie extra per cubic yard ; for each additional yard depth of excavation or height of lift 1 Pie extra per cubic yard.

13. Already replied to by the Government of India.
14. Do. do. do.

Metaling.

22. Lumps of kunker of about 200 cubic inches each are obtainable in swampy ground from half to three-quarter yard below the surface. These are broken into small pieces and mixed with one-sxth of clay to make them conglomerate.
23. From 3 to 4 inches in each layer, and from 1 to 4 layers according to the quantity and nature of traffic.
24. Rupees 0-2-6 per square yard of 3 inches in thickness completed.
25. The kunker is heaped at the side of the road, spread according to the estimated width and thickness, and mixed with a proportion of clay. It is then well watered, rammed, and rolled, a small quantity of sand being spread over the surface to prevent the adherence of the clay to the rammers.
26. Spreading and seeting of 1 cubic yard of kunker (3 inches thick) ... Rupees 0 1 0
Ramming ... ... ,, 0 2 1
Rolling ... ... ,, 0 0 5
Breaking ... ... ,, 0 3 3
Digging ... ... ,, 0 6 6
Rupees... 0 13 3
27. From 1 to 3 miles.
28. Cartage hire at 5 Annas per cubic yard per mile.
29. Parra.
30. Not heaped.
31. 4,000 cubic inches, viz., 20 inches × 20 inches × 10 inches.
34. The number of culverts depends on the area, the drainage of which is to be passed under the road.
35. Brick in stone or chunam plastered with concrete foundations.
36. Stone has to be brought from Bezoarah, a distance of 47 miles.
38. Rupees 2 per cubic yard delivered at the canal bank.
39. Rupees 10 for stone lime, and Rupees 10-8-0 for shell lime per candy of 20 parras.
40. Two and a half parras for brick-work and three for rough stone.
41. Two parts of sand to one of lime for masonry works; and 1½ to 1 for plaster and arch work.
42. Stone lime is chiefly used and has to be brought 62 miles by canal; shell lime is obtained in small quantities along the coast.
44. Good bricks are obtainable within 12 miles of Masulipatam. Bricks measuring 9 inches × 4½ inches × 2½ inches cost Rupees 6 per thousand, delivered at Masulipatam.
45. Rupees 5-6-0 per cubic yard.
46. Stone in chunam Rupees 5-6-0 per cubic yard, plastering with *one* coat Rupees 2 per square of 100 feet; with *two* coats Rupees 3 per square.
47. From 18 to 27 cubic feet.
49. Road tunnels of 3 feet span, 18 feet 6 inches long, pier 1 foot 3 inches high, and arch semicircular, costs altogether including wing-walls about Rupees 260.
Of 6 feet span, 18 feet 6 inches long, piers 1 foot high, and arch semicircular about Rupees 380, inclusive of every thing.
50. 1st class bricklayer ... ... 0 6 0 per day.
2nd do. ... ... 0 5 0 do.
3rd do. ... ... 0 4 0 do.
51. Bridges are built of stone where the latter can be brought by canal, but where water carriage is not available, they are constructed of brick. The dimensions of the piers, abutments, thickness of arches, &c., are those laid down in "Foord's Notes on Building and Road Making."

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A bridge of 1 arch of 9 feet span costs about ... ... Rupees 620
Do. 12 arches do. ... ... ,, 740
Do. 3 arches, making a total span of 45 feet with piers 8 feet high, costs about Rupees 3,500.
A bridge of 6 arches of 8 feet span, with piers 9 feet high, costs about Rupees 6,300.
52. This depends on the volume of drainage water which is required to cross the road; also whether the road crosses irrigation channels or not.
53. Carpenters, 1st Class ... ... 0 7 0 per day.
Do. 2nd do. ... ... 0 6 0 do.
Painters ... ... 0 5 0 do.
Borers ... ... 0 7 0 do.
Smiths ... ... 0 8 0 do.
Hammermen ... ... 0 4 0 do.
54. Skilled labour is obtainable at Masulipatam only. Ordinary labourers are procurable at most places in the district. They are paid either by daily hire or contract.
55. No.
56. No.
59. No.
60. Coolies } 0 2 6 to 0 2 9.
61. Women } 0 1 9.
Boys 0 1 6.
62. Women and boys are employed for breaking, conveying, and spreading kunker.
63. The task work performed by labourers is as follows:—
Digging kunker at so much per candy of 20 parras.
Breaking kunker at do. do.
Spreading do. per 100 square yards.
Raising road at so much per cubic yard of earth-work.
64. When a considerable quantity of task work is required to be executed by labourers, agreements on stamped paper are taken from them, and a Penal Clause inserted in the same.
65. Not except in special cases.
66. No.
67. Medical aid is usually given, but they are not paid when under medical treatment.
70. Compensation for lands taken up is also paid at so much per acre according to the nature of the land.
79. The materials for masonry works, viz., bricks, lime, sand, &c., are generally contracted for at the sites of the works. Breaking and spreading kunker and earth-work are also performed by contract.
80. The supervision is generally by the fixed Establishment, attached to each Range or district; but in some contracts the contractors provide supervision, and the work done is merely checked by some one of the fixed Establishment before payments are made.
82. Already replied to by the Government of India.
84. The whole of the direct supervision is performed by natives: one Officer of the Department Public Works being attached to each range to exercise a general supervision.
88. Carts are employed where procurable.
89. Annas 12 per day.
90. From Annas 14 to 1 Rupee.
91. Not in this range.
92. No.
93. Carts, bullocks, or donkeys.
94. Two-wheeled country carts with wheels 5 feet diameter.
95. 2½ inches.

96. 1,000 lbs. besides the weight of the cart itself.
97. From 200 to 300 in the course of 24 hours.
98. A road metalled with kunker requires repair after about four months if country carts are allowed to travel on it, but a maintenance grant of Rupees 150 per annum per mile will keep it in good order.
99. No.
100. Already replied to by the Government of India.
101. Do. do. do.
104. When daily labour is employed, weekly payments are made. When work is done by contract, measurements are taken when any portion of the work is completed.

Answers to Questions required by the Committee appointed to inquire into the cost of the construction of Roads in Ceylon, compared with other Countries.

Roads.

1. ———
2. Ten yards width; 8 yards metalled, 3 yards width, 6 yards metalled, with side drains.
3. Surface sectioned to allotted width from centre to sides with a slope of 3 inches.
4. No.
5. No.
6. *a.* Cost must be regulated by the quantity of earth required.
   b. Do. by the dimensions and length of drains required.
   c. Do. by the number required.
   d. Do. do.
   e. From Rupees 380 to Rupees 1,760 for a breadth of 6 yards and 6 inches depth.
   f. Sundries at 5 per cent.
7. ———
8. Already replied to by the Government of India.
9. Side drains, &c.
10. ———
11. From half to one yard which forms a foot-path.

Earth-work.

12. One Anna per cubic yard.
13. Already replied to by the Government of India.
14. ———
15. ———
16. Yes. 2 Annas per square yard.
17. Yes. From 2 to 4 Annas per cubic yard.
18. Yes.
19. No.
20. ———
21. ———

Metaling.

22. Composed of stones from 3 to 6 inch cubes of granite and quartz.
23. From 3 to 6 inches.
24. 8 Annas.
25. Packed by hand, blinded with gravel.
26. Not known.
27. From half to four miles.
28. 4 Annas per cubic yard per mile.
29. No. Parra and half cubic yard measure.
30. Not.
31. 4,000 cubic inches, and 23,328 do.
32. ———
33. ———

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Culverts.

34. No. Average number, but merely built where necessary.
35. Rough stone in chunam.
36. From half to four miles.
37. Yes. No, breaks up with an irregular fracture.
38. From 8 Annas to 1 Rupee per cubic yard.
39. ,, 5 to 6 Rupees per candy of 20 Parras.
40. Two parras.
41. One of lime to two of sand.
42. Hydraulic. Yes.
43. Yes.
44. No.
45. From 4 to 5 Rupees.
46. ,, 3 to 4 ,,
47. ,, ½ to ¾ cubic yard. Rubble masonry one yard.
48. No.
49. ———
50. 6 Annas, 8 Annas, and for Maistries 10 Annas per diem.
51. ———
52. ———
53. As stated in answer 50 for Bricklayers, Carpenters, and Smiths.
54. From neighbouring villages, on daily pay.
55. No.
56. Yes, for contract work, but not for simple labour.
57. ———
58. One man to every two miles of road.
59. No.
60. 2 Annas and 6 Pies.
61. Yes. According to the quantity of work they perform.
62. Yes.
63. A certain quantity of work given to each gang.
64. Fines.
65. No. Unless it is a very long distance, *i.e.*, more than a day's march.
66. No.
67. ———
68. No.
69. ———
70. Cost of construction including materials, &c.
71. Very much, as they are in general bound to give their services to the estates during certain portions of the year.
72. No.
73. About the same at ordinary times, but at harvest time the farmers offer higher rates than those prevailing in the Government works which of course the coolies take advantage of.
74. No.
75. Sometimes they remain away for days and weeks, and return at their pleasure.
76. Not known.
77. Do.
78. Do.
79. As far as possible.
80. The same as when executed by ordinary labour.

Supervision.

81. Range Officer, Overseer, Maistries, and Store Peons.
82. Already replied to by the Government of India.
83. Do. do. do.
84. All, except the Range Officer. Yes, in general.

Transport.

85. Already replied to by the Government of India.
86. Do. do. do.
87. No.
88. Yes.
89. From 10 to 12 Annas per diem.
90. Same as above.
91. No.
92. Yes, by baskets at 2 Annas 6 Pies and 2 Annas 9 Pies per diem.
93. Rice, Cholum, Tobacco, Salt, and other products.
94. Two-wheeled carts without prings.
95. Breadth of tire, two inches.
96. 1,000 lbs.
97. 600 average.
98. ———
99. No.

Miscellaneous.

100. ———
101. Already replied to by the Government of India.
102. None.
103. ———
104. As convenient to Range Officer, and Overseer.
105. ———

(Signed) W. H. BUTLER, Conductor,
Supervisor in charge No. 5 Range, Kistna.

CAMP, JUGGIAPETT,
31*st January* 1867.

No. 226. From the Acting Superintending Engineer, 4th Division, to the Secretary to Government, Public Works Department, dated Madras, 23rd May 1867, No. 927.

1. I have the honour to reply to the questions sent with G. O. No. 96, dated 11th January last, regarding the cost of the construction of roads, and which were set by a Committee appointed to report on the subject in Ceylon.

2. Many of these questions are of a very general nature, and others would require more time and attention in answering them fully, than we are enabled to give to them.

3. Colonel Boileau has hitherto delayed his reply, pending answers from Mr. O'Shaughnessey, Assistant Engineer, who has had experience of road-making in Wynaad; but this Officer still delays answering this requisition, and I do not deem it advisable to wait any longer, especially as I can speak from my own experience of roads on the Western Coast and elsewhere.

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1. The materials of which the sub-soil of roads in hilly districts are composed, are generally obtained on the spot, and formed of the same soil from which the cutting is made; this material being generally of a harder, more rocky, and more gravelly nature on the hills than on the plains. Rock which is worked with a crowbar, or of a harder nature requiring blasting, is frequently met,

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with and makes excellent macadam. Where the soil is soft, or of a clay nature, and subject to the action of springs, as often happens in a cutting, gravel must be laid over. In a side cutting the road is made of the excavated portion of soil, and is half formed out of the solid, and half formed of the loose earth. Roads in this situation are generally good, and being exposed to free currents of air, are generally dry and much more so than those in cuttings which require more attention paid to them. In roads excavated on the side of a hill, great care is required to revet the slopes, and to allow for unequal settlements.

2. When roads are cut out of a face of a hill the slope is generally reversed, the fall being inwards, the drainage running into a channel on the inner side of the cutting. In cuttings through hills, the centre should be raised from 4½ inches to 6 inches according to the breadth of road, and deep side channels, according to the length of scour and depth of cutting should be excavated.

3. The surface is well levelled, and the section to be permanently maintained first given to the road. As to the nature of the substratum much will depend upon the character of the natural soil, no definite rule can be laid down.

4. The substratum is different at times from the surface metal. If much clay is found on the road, sand is mixed with it, and *vice versa* before the metal is laid, friable soils, and those of a chalky formation require peculiar treatment, frequently old broken brick when available and refuse of this nature is laid down and forms a good substratum. In roads of laterite gravel, the laterite itself in lumps of from 2 to 2½ inches form an excellent foundation.

5. The roads, as a rule, are not fenced in.

6. The cost of roads I am unable to give with any great accuracy; they may according to number of masonry works, soil, &c., cost from 2,000 to 10,000 Rupees per mile without bridges, earth-work 12 Annas to 3 Rupees per cubic yard, side drains 6 to 9 Pies per running yard of road. Cross drains, according to description, from 20 to 250 Rupees each.

Bridges used to cost of brick or chunam, as follows:—

Five Arches from 35 to 25 feet Rupees 6,500 }
,, ,, ,, 35 ... ... ,, 8,500 } But they are now 20per cent. dearer.
Three ,, ,, 25 ... ... ,, 4,000 } Estimates had better be sent.

Metaling 6 yards wide ... ... Rupees 1,320 per mile.
,, 4 ,, ,, ,, ... ,, 880 ,,

Miscellaneous 5 per cent. on estimate.

9. The drainage is generally surface on both sides. Open drains led off at the low ground varying in section according to climate and local situation. On hills where cuttings are made, under drains are required at intervals to cross the road, and catch drains on the upper side, leading into the side drains, are made to take off the hill drainage; occasionally open paved drains or Irish bridges are resorted to. On ghauts these cross-drains are built at every 100 or 200 yards according to circumstances.

10. It is difficult to say what is the per-centage of rock to earth. It varies for every locality, as a rule on the plains very little rock-cutting is met with. On the hills one or two ghauts have been constructed when the road is cut out of solid rock for a quarter of a mile intervals.

11. The metaling may be from 4 to 6 yards wide, or even on rare occasions 8 yards; the road formation should be from 2 to 6 yards wider at surface.

12. Earth-work per cubic yard varies from 6 Pies to 3 Annas per yard according to distance hardness of soil.

15. Rock cutting varies according to hardness, when it can be split by fire, by chisels or by jumpers; it costs from 12 Annas to Rupees 1-4-0, and when blasted from 1 to 4 Rupees per yard.

16. There are often boulders on hills. If large and cannot be rolled, they must be blasted. When they can be removed without blasting, they are often charged separately for.

17. No, there is not, but if too soft for blasting, the above method may be resorted to, and cost from 8 to 12 Annas per yard.

18. Yes, generally.

19. On ghauts they are not otherwise. On steep inclines of hills such as the Malabar and Wynaad Ghauts, it is often impossible to do without them.

46. We do not use masonry in Madras; its cost varies according to the description of the work, whether rubble faced or two or three line dressed.

47. No data to go on, if the stone is dressed the work is very slow as a rule.

48. Elephants are not employed. In the Districts in which jungles are found, elephants are occasionally employed dragging timber, and I have so employed them on bridge works.

49. Culverts vary per lineal yard. Standard plans and estimates, and some already sanctioned should be sent.

50. Masons receive from 7, 7½ to 8 Annas per diem.

51. This can better be done by sending a few spare copies of plans and estimates.

52. Depends entirely upon the locality.

53. Carpenters draw from 6 to 8 Annas; stone masons from 7 to 12 Annas; bricklayers from 7 to 8 Annas; and blacksmiths from 8 to 12 Annas per diem.

54. The market is well stocked, and the labourers are willing to be paid once a fortnight, or month.

55. The labour in this Division is not imported.

56. If Artificers were engaged there would or ought to be an agreement in the first instance.

57. The cost of importation would be eventually charged.

58. None, unless we except the tank diggers or wudders, who are so far organized as to be trained to their work; we have no road Corps of Sappers.

59. No, not by Military or Pioneers.

60. About 3 Annas.

61. Boys are paid less than men. Rates vary according to class of men; for instance, tank-diggers if employed on daily labour, which is seldom, would get higher wages.

62. Yes, they are.

63. They are not generally.

64. If individual contracts are given, they can only be sued at great trouble and risk.

65. They are not marched when at work.

66. If on monthly hire, they are paid in hospital, unless the sickness is of any duration.

67. When there are large gangs of labourers, Government generally furnish a Dresser or Apothecary.

68. Yes, generally in *the season when scarce at, or a little below the, bazaar rate.*

69. I have known considerable loss in this way in Wynaad, but there was no other way of retaining labour, but by supplying moderately priced food.

70. Labour, material, and contingencies form the items of estimates.

71. The estate owners often outbid Government servants in their wages to coolies; but Government have authorized the payment of higher wages if found absolutely necessary.

72. They do as a rule.

73. The above question No. 71 refers to this.

74. Sometimes they are.

75. Very frequntly if the locality is unhealthy.

76. The estate owners must be asked this.

77. Yes, I believe so.

78. Not known—varies.

79. It is generally pursued, when trustworthy men are found willing to take contracts; but much difficulty is experienced in working out contracts.

80. According to distance and nature of soil.

81. Executive Officer, with an Overseer, and Conocopilly under him to keep accounts.

84. Generally native supervision.

87. Elephants in the jungles are used for dragging timber. They cost much. I have paid 2 and 3 Rupees per diem.

88. If roads are favourable for traffic.

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92. In the plains rain hinders not them.
93. A little below the three.
94. Not in any great use.
95. No rail beyond excavation of earth.
96. Various in hilly country with the exception of rock, where carts are not practicable, pack bullocks are employed.
97. Wallaz carts and common bullock.
98. Wallaz carts have broad wheels. Common carts narrow.
99. Various up to half a ton.
100. Not known, as they vary.
101. Not known, varying according to traffic.
102. I suppose so. I have no data.
103. Already replied to by the Government of India.
104. Do. do. do.
105. Varies according to material at hand. In the jungles where bamboos abound, they are inexpensive.

Where gangs are located for any time, they are built of bamboo mats and thatched, but coolies can walk out and work for some miles each day from these lines.

Daily or weekly pay, generally the latter.

Already replied to by the Government of India.

MADRAS,
23rd May 1867.

(Signed) J. DEAN, Lieut.-Colonel, R. E.,
Acting Superintending Engineer, 4th Division.

No. 227.

CIVIL WORKS, No. 30.

ORDER THEREON, 11th June 1867, No. 1,742.

Ordered that these papers be communicated to the Government of Ceylon.

(Here enter No. 1,743, dated 11th June 1867.)

(True Extract.)

(Signed) CHARLES A. ORR, Colonel, R. E.,
Secretary to Government.

To the Superintending Engineers.

Exd. S. T. Augustin.

PUBLIC WORKS DEPARTMENT,
FORT SAINT GEORGE,
11th June 1867.

No. 1,743.

No. 228.
To

THE COLONIAL SECRETARY, COLOMBO.

SIR,

CIVIL WORKS, No. 31.

With reference to your letter of the 6th December 1866, No. 46, I have the honour, under the orders of His Excellency the Governor in Council, to forward for the information of the Government of Ceylon the enclosed collection of papers relating to the construction of roads in some of the districts of this Presidency.

I have the honour to be,
Sir,
Your most obedient servant,

(Signed) CHARLES A. ORR, Colonel, R. E.,
Secretary to Government.

Exd. S. T. Augustin.

Supd. Engr. Office 8th Jan.

No. 1742 Kadiwa 16th January 1861

From

Captain H. L. Prendergast R.E.

Offg. Superintending Engineer 8th Dn.

To

Colonel C. A. Orr R.E.

Secretary to Government P.W.D.

Sir

With reference to G.O. No 98 of the 11th Instant, I have the honor to state, that no metalled roads have been constructed in the Hilly parts of the Kadiwa & Simonwelly Districts: and we have therefore no data, on which to give answers to the questions referred by the Ceylon Government.

2 The roads that have been under Construction in the past 3 years, are

The main Southern road from Trichinopoly thro' Madura & Palamcotah.

From Sirumungalam this Colony, to the Coimbatore boundary.

The Cotton road, thro' Salem to Tuticorin.

From Palamcotah to Tuticorin.

6

These roads lie entirely on the plains and as information regarding them can be of but little use, unless the cost of Hill roads is the subject of enquiry: it appears to me unnecessary to furnish answers to the questions from this Division. If however you consider that there will be any value in giving answers, as for roads in the low country: I will take up the paper at once.

Yours &c.

Thos. L. Saunders Captain R.E.

Officg. Superintending Engineer

8th Division

No 1588

Supt Duff's Office &c &c
Sanford 20th October 1863

Sir,

Captain R. F. Oakes R.E.
Supt Engineer 6th Div.

Sir,

Col C. C. M. Ord R.E.
Secretary to Government

With reference to the P.O.
note in the Margin, I have the
honor to inform You, that on the
first Tuesday in November, & to be regular
in Labor, Supervision &c in which
I am not personally in this Division
& as there are no Roads of the
nature referred to in this Division,
I am unable to afford the
information on the points adverted to.

There are a few questions
of a similar nature under the
work "Embanking" "Culverts" &c
to which I could refer, but that
only by taking up some one Road
& that of a nature entirely different
to

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to which I could refer, but that
only by taking up some one Road
& that of a nature entirely different
to

I have the honor to be
Sir,
Your most obedient
humble Servant
Robt Duff
Capt R.E.

Supt Engineer
6th Division

Sanford
20th October 1863

Referred to Capt Oakes R.E.
Supt Engineer 6th Division
for report

By Order
C. C. M. Ord
Col R.E.
Secretary to Government

Quarantine
20th October 1863

1588

Answered 24th October 1863

to that of the Road repairing which
information is required
Please the honorable
Court
Fort Scott Kas
Sept 8th 1858

No 375

From

Lieut H. H. Cowper R.E.
Assistant Engineer in charge No 7 of
Or Mian Upatan Ranges

To

Lieut Colonel J. T. Wilcox R.E.
Superintending Engineer
2 D. Div

Sir

In reply to your Memo No 1071 accompanying Government Order No 95. I have the honor to forward the following answers to the questions therein asked;

N.B. Where a question is omitted it is to be understood that it does not apply to the work done in this Range, and the rates given in all cases are those in practice in the Bunder Taluq.

3 Before metalling, the surface of the road is made perfectly even the centre being 3" or 4" higher than the sides.

4 Do.

5. Do.

6. In metalling with swamp Kunkur 5 yds in width & 3" thick — Rs 1300 per mile
— Do 6 yds wide — Rs 1550 — " —

7. The Estimates are generally drawn under the following heads.

Already applied by the Govt of India

Raising Roads with Earth & digging side drains. } This work is always estimated at so much per Cft. The heights of the Embankment for different sections depends

No 218

Dated 26th February
Received 28th February
No 1388

Subject

Reply to G.O.
dated 96 & 297
11th & 30th January
on the subject
of Roads in
Hilly Districts.

1762-1763-11 Images

depends on the nature and levels of the Country through which it passes.

Metalling. This is estimated at so much per Cubic Yard of Broken Stone inclusive of all charges for digging, Carting, spreading, ramming &c.

Turfing. This is estimated for at from 3 to 6 Rs per 100 Yard which includes watering for a few days.

Masonry Works. Road Tunnels, Bridges & Road Dams are estimated at so much per Cubic Yard of brick or stone in Chunam Concrete, arch work &c and Plastering at so much per 100 ft. This rate includes all charges for labour & Material.

Compensations for land at so much per acre.

8. The Earth Work is checked by Section measurement. Kunkur is checked by being spread by measuring the heaps collected along the road; Turf Work by measurements; & Masonry Works by comparing the dimensions with those given in the Plan & Estimate.

9. Side drains, are excavated along the roads to conduct the drainage into the nearest low ground, where it crosses the road by means of Bridges, Tunnels, or Road Dams, and falls into swamps from which in most cases it finds its way into the sea.

11. A berm of 1 Yard is left on each side

Already replied to by the Forest Officer in charge of Bridges

side of the Metalling.

Earth Work.

		R.	a.	P.
12.	Land ——— per Cyd ———	—	—	8
	Common delta black soil ———	—	1	—
	Sand (Hard) ———	—	1	3.

Where lead not exceeding 20 yards or depth of excavation of one yard, or height of lift, (as one a spoil bank), of 2 yds. For every additional 20 yds lead or lift extra per Cyd; for each additional yd or ft of excavation or height of lift, 1/6 extra per Cubic yard.

13. ~~The rates include digging carting~~ Already replied to by the Forest Officer in charge of Bridges.

14. ~~Do explanation.~~

Metalling.

22. Lumps of Kunkur of about 200 Cubic inches. Each are obtainable in swampy ground from 1/2 to 3/4 yd below the surface. These are broken into small pieces and mixed with 1/5 of clay to make them Conglomerate.

23. From 3 to 4 inches in each layer, and from 1 to 4 layers according to the quantity and nature of traffic.

24. Rs 2-0 per Cyd Yard of 3" in thickness Complete.

25. The Kunkur is thrown at the side of the road, spread according to the estimated width & thickness, & mixed with a proportion of clay. It is then well watered rammed and

and rolled, a small quantity of sand being spread over the surface to prevent the adherence of the clay to the rammer.

26. Spreading & setting of 1 Cft. of Kunker (3" thick) ——— Rs. " — 1 — "

Ramming	"	2	1
Rolling	"	"	5
Breaking	"	3	3
Digging	"	6	6
	"	13	3

27. From 1 to 3 Miles.

28. Cartage Lime also 2½ per Cft. per Mile.

29. Parra.

30. Not Leased.

31. 4000 (Three inches by 20" x 20" x 10")

34. The Number of Culverts depends on the area the drainage of which is to be taped under the road.

35. Brick in stone or chunam plastered with Concrete foundations.

36. Stone has to be brought from Bezwara a distance of 47 Miles.

38. Rs 2 per Cft. delivered at the Canal bank.

39. Rs 10 for stone lime & 14½ for shell lime per Candy of 20 Parahs.

40. 2½ parahs for brick work & 3 for rough stone.

41 Two parts of sand to one of lime for masonry work; & 1½ to 1 for plaster & arch work.

42 Stone lime is chiefly used & has to be brought 62 Miles by Canal; shell lime is obtained in small quantities along the Coast.

44. Good bricks are obtainable within 12 Miles of Masulipatam. Bricks measuring 9" x 4½" x 2¼" Cost Rs 6 per Thousand delivered at Masulipatam.

45 Rs 5-6-0 per Cft.

46 Stone in Chunam Rs 5-6-0 per Cft. Plastering with one Coat Rs 2-0-0 per Cft. of 100 Sft. with two Coats Rs 3 per Cft.

47 From 18 to 27 Cft.

49. Road tunnels of 3 ft. span 18' 6" long piers 1' 3" ft. high & arch semicircular Cost altogether including wing walls about Rs 260-0-0.

of 6 ft. span 18' 6" long piers 1 ft. high and arch semicircular about Rs 380 inclusive of every thing.

50. 1st Class Bricklayer 0-6-0 per day
2d ——— Do. ——— 0-5-0 Do.
3d ——— Do. ——— 0-4-0 Do.

51 Bridges are built of stone where the latter can be brought by canal but where water carriage is not available they are constructed of brick. The dimensions of the piers, abutments & thickness of arches &c are those laid down in "Foord's rules on Building and Road making."

A bridge of one arch of 3 ft. span Costs
about Rs. ——— 120 ——
——" ——— 12 ——— " ——— 400 ——
——" ——— 3 arches making a total span
of 45 ft. with piers 8 ft high. Costs about
Rs 3500 ——.
A bridge of 6 arches of 8 ft span with
piers 9 ft high Costs about Rs 6800 ——

52. This depends on the volume of drainage water which is required to cross the road: also whether the road crosses irrigation channels or not.

53. Carpenters 1st Class ——— 7 ——— per day
——" ——— 2nd Do. ——— 6 ——— Do
Painters ——— " ——— 5 ——— "
Borers ——— " ——— 7 ——— "
Smiths ——— " ——— 8 ——— "
Hammermen ——— " ——— 6 ——— "

54. Skilled labor is obtainable at Mangalatan only. Ordinary Laborers are procurable at most places in the district - They are paid either by daily hire or contract.

55 —Do.

56 —Do.

59 —Do

60 } Coolies 0—2—6 to 0—2—9.
61 } Women 0—1—9.
Boys 0—1—6.

62 Women & boys are employed for breaking Conveying & spreading Kunkur

63. The task work performed by laborers is as follows.
Digging Kunkur at so much for Cuby of 20 Parrahs.
Breaking Kunkur at Do. Do.
Spreading Do. per 100 Sqr. Ft.
Raising road at so much per Cft. of Earth Work.

64. When a Considerable quantity of task work is required to be executed by laborers, agreements on stamped paper are taken from them & a penal Clause inserted in the same.

65. Not except in special cases.

66. Do.

67. Medical aid is usually given but they are not paid when under Medical treatment.

70. Compensation for lands taken up ~~are~~ also paid at so much per acre according to the nature of the land.

79. The Materials for Masonry Works, viz. bricks lime sand &c. are generally Contracted for at the sites of the Works. Breaking & spreading Kunkur and Earth Work are also performed by Contract.

80. The Supervision is generally by the Fixed Establishment attached to each range or district; but in some Contracts the Contractor

Exercise

provide supervision and the work done is nearly checked by some one of the Fixed Establishment before payments are made. Already supplied by the Govt of India

82. ~~In all Estimates 7½ per cent on the~~ amount of the same is charged for supervision.

84. The whole of the direct supervision is performed by Natives; one officer of the Dept being attached to each Range to exercise a general supervision.

88. Carts are employed where procurable

89. Rs 12 per day.

90. Four as 14 to one Rupee.

91 Not in this Range.

92 Do.

93 Carts, bullocks, or Donkeys

94 Two wheeled Country Carts with wheels 5½ diameter.

95. 2½ inches.

96 1000 lbs besides the weight of the Cart itself.

97 From 200 to 300 in the Course of 24 hours.

98. A Road metalled with Kunkur requires repair after about 4 months if Country carts are allowed to travel on it but a Manufacturer Contract of Rs 100-0-0 per annum per mile will keep it in good order.

99 Do.

100 ~~Subsidies from the Municipality are charged to~~ Already supplied to by the Govt of India

101. ~~Cartage~~ Already supplied by the Govt of India are on a separate scale for roads

104. When daily labor is employed, weekly payments are made. When work is done by Contract, measurements are taken when any portion of the work is completed.

I have the honor to be
Sir
Your most obedt servt
W. Foster Lieut R.E.
Asstant Engineer in Charge
Trichinopoly Range

To the Chief Engineer & Secretary
Madras

20th February 1867

To Thomas Colvin Esqr
Supt Engineer &c &c

Yellow Ochre

Color Yellow Orange

Annexed to the Specification forwarded with the Superintending Engineers Memo No 5552 of 9th Oct.

General character of Sections and Arrangements

Yards

1 — 1 — One in Chain Orange

2 — 2 — Five Clear Roads are installed to a breadth of 6 Yards, and seven Clear to a breadth of 4.

3 — 3 — Surface in fuel with section, with reference to the transverse slope of the proposed Road

4 — 4 — do

5 — 5 — do

6 — 6 — 6 yards breadth of Metalling — 4 yards breadth of Metalling

Index of Drawings

a — Plan and Section of Bridge No 170

b — Plan and Section of Bridge No 609

c — Plan and Section of Culvert, Brick Arch & Stone Dis[illegible] No 1097

d — Plan and Section of Bridge No 198.

e — Plan and Section of Culvert

f — Plan and Section of Bridge No [illegible]

7 — 7 — Abstract supplied to Engr the Est of Bridges & Culverts

8 — 8 — do do do

9—9 Rock Measure are ascertained to the Road, there are Connected, as often as possible, with the natural Drainage of the Country traversed by the Roads

10—10 Average Quantity of Earthwork per Yard 2816 per Mile, in Rocky Cutting on the Slopes

11—11 Five Yards to the Station

Earth work 12—12 Deficiency in the Estimate has not been the Cubic Yards. Cutting. Varies from 0 to 5 per Cyd.

13—13 Already replied to by the Cubic Yards of Rock

14—14 Do Do

15—15 In Rocky Cutting in Thin Beds

16—16 Do

17—17 Do

18—18 Does not apply to Thin Beds

19—19 None in Thin Beds

20—20 See Answer to Question 9.

21—21 See Answer to Question 9.

Masonry 22—22 Varies from 6 Cubic Inches to 1 Yard Cubic; when Thin is not procurable, Random Rubble, Dressed as Ordered.

23—23 Varies Considerably; 6" may be taken

24—24 Rates R. & D. 0—4—9

25—25 Metal is deposited at the Side of the Road; after being spread it is watered and stamped, and Covered with a Coating generally, about 3" in Thickness

26—26 The Metal is supplied by Contractors at the following Rates:

Collecting and breaking 0—4—0 per Yard 11—4—0

Stamping per Yard 1 Penny

27—27 6 Miles

28—28 R. & D. 0—3—9 per Yard per Mile,

29—29 The Rate in the measure in use

30—30 The measure is not shaped

31—31 4,000 Cubic inches

32—32 Measures are never heaped in Thin Beds

33—33 Does not apply to thin Beds

Quarry 34—34 2.61

35—35 Brick and Laterite

36—36 Do

37—37 Do

38—38 Quarrying from Rs 1 to Rs 1½ per Yard

37—37— a. 8 " " Same as for Length ———

40—40— 2 Panels ———

41—41— One Yard of Line to 2 yd of Road ———

42—42— Sodding of new Slope generally in Yard of the Slope Road, Ditto in Ditch ———

43—43— Have not seen any Approved Yard Hydraulic Lime ———

44—44— Really good Bricks are not to be had, unless Prepared Specially by the Yard = mean Dimensions 9" × 4½ × 2¾ ———

45—45— Ditto 3—8—10 per Yard ———

46—46 Ordinary Rubble Ditto 2 6 " and Cubic Ditto 5" " 2 per Yard ———

47—47— 3/4 Yard ———

48—48— Ditto ———

49—49— Waterfall Coal Ditto 18/2 per Long Yard of Superficies 10 " " 23 Ditto Ditto 3/ " " the Places Nos 219, 88 and 27-8 " respectively

50—50— Ditto 0—6—0 40—6 6. ———

Bridges 51—51— The Bridges are all Ordinary Span, the maximum being about 40; Exceeds the Between Parapets does not exceed 18; Fixed by the Road Department; Cost not known ———

52—52— 183 per Mile.

53—53— Carpenters 0—7 " Blacksmiths 0—8 " Bricklayers 0—6 " Painters 0 7 " Sawyers

Labour 54—54— From the surrounding Country on fair wages.

55—55— Ditto ———

56—56— Ditto ———

57—57— Does not apply to this Bridge ———

58—58— One Hand Labourer is allowed for every 2 Miles of road. ———

59—59— Ditto ———

60—60— Ditto 0—2—0 ———

61—61— Guinea Grade " 2 " 0—2—3 and " 2 6 are paid occasionally for particular work ———

62—62— Ditto ———

63—63— The Earthwork, spreading and tamping Metal is generally done by Contract ———

64—64— Payments is made for the work done only ———

65—65— Does not apply to this Bridge ———

66—66— Ditto ———

67—67— Ditto ———

68—68— Ditto ———

69—69— Does not apply to this Bridge ———

70—70— The Cost of the road and building Materials, also Minor Charges expended since ———

71–71 Does not apply to this Stage

72–72 " " "

73–73 " " "

74–74 " " "

75–75 " " "

76–76 " "

77–77 " "

78–78 Unknown

79–79 Earthwork, excavating exceeds Earthwork of
Materials are done by Contract, Ephesus Road
and Carrying of Road Materials Credited generally

80–80 Earthwork 0 to 4 for Slopes & Drains

excavating 2 to 3 for Cuttings & Embankments

for Side Cuttings & Side Drains

81–81 Inspections of by the Stage Officer, the road
being under the immediate Charge of the Person
who has undertaken to superintend the
details of Construction exceeds expiring three
miles hence generally 18 Perches of Road to a Mile

82–82 ~~Always applied to by the Govt of India~~
~~Cancelled Mile & Chains of Office Inventory 1857~~

83–83 " "

84–84 Largely and on the whole inspection

85–85 ~~Always applied to by the Govt of India~~
~~Cancelled Office Check Copy of Office Inventory 1857~~

86–86 ~~Always applied to by the Govt of India~~
~~Cancelled Office Check Copy of Office Inventory 1857~~

87–87 " "

88–88 Yes

89–89 Officers are obtained on daily or Monthly wages

90–90 Does not apply to this Stage: the Quantity of
Materials carted is fixed from without reference
to the Number of Carts engaged

91–91 " "

92–92 " "

93–93 Principally Merchandise conveyed by Carriers
or Country Carts

94–94 Two wheeled drawn by Bullocks

95–95 2½ inches

96–96 Not 1000.

97–97 Not Traffic returned

98–98 & Maintenance granted & allowed for each
Road after Construction

99–99 See answer to Question 97

100–100 ~~Always applied to by the Govt of India~~
~~Cancelled Office Check Copy of Office Inventory 1857~~

Divi- 101–101 Two
sions
cut

102–102 None are provided

103–103 See answer to 102.

104–104 With two exceptions all Ferry made use
made by Boat Bridges

1865 Aug 9 Replied to by the Govt Agent Kandy

Executive Engineer's Office
Camp at Colombo
23rd February 1865.

Executive Engineer
Colombo Range

Commissioner of Roads
Central Range

Answers to Questions put forth by the Commissioners appointed to enquire into the cost of construction of Roads in Ceylon Communicated in G. O. No. 96 dated the 11th January 1865.

Roads.

Question 1 Does not apply to works in this Range.

" 2 The Sytem of Roads of different widths is laid down in E. in C. No. 92 dated 2nd February 1857.

3 The system followed in preparing the road for the reception of metal is as follows. The earth taken from the side drains is thrown up, covering a surface varying from one to three yards in excess of the width to be covered with metal, and in depth from 6 inches to 1 yards, according to the nature of the country traversed. The embankment thus formed is then allowed to settle and is afterwards levelled preparatory to laying down the metal.

4 No

5 No

6

Width of road.	Earth work.	Side drains	Cross drains	Bridges	Metal slips	Rock Cuttings.
Metal'd 6 yds wide	312	165	600	"	990	200
Metal'd 5 yds wide	288	110	430	"	825	165

7 × ×

8 × ×

9 The system of drainage usual, is as follows. Shallow surface drains one foot five inches in width are formed parallel to the road and along its edge on both sides from which at distances averaging twenty yards, oblique drains are led to an outer surface drain one and a half yd. in breadth by half yard in depth, which

discharge into the natural water courses

10 Rock is rarely met with in this range

11 The width varies with the description of ground and nature of country vide proceedings guide to assessment Question

2 Foot paths are not formed.

Earthwork

12 The excavation of Earthwork averages one annas per C.yd.

13 X X

14 X X

15 Cost of Cutting averages four annas per Cubic yard

16 Not applicable

17 Ns

18 No, all materials other than the earth excavated and of a compact nature is deposited on road

19 No

20 Not applicable

21 do

Metalling

22 Metal has not been used the surface being formed with either laterite gravel or decomposed granite. The Character of the latter is carefully selected gravel from upper drying surface during rains, but becomes hard during the dry weather, and wears quickly, the latter if mixed well, and forms a bond on yielding surface

23 4 1/2 inches

24 1/2 annas

25 The surface material is deposited in heaps of yard heaps on the side of road till spread, and after spreading it is watered and tamped with flat wooden Rammers 9/12x8x8 inches

26 The Supply of Material costs on an average two annas per Cubic yard other items not applicable.

27 Two Coolies

28 Four annas per Mile

29 The para (as measure 20x8x6) is the measure used and fifteen paras are reckoned to the Cubic yard.

30 The measure is struck

31 4000 Cubic inches

32 Not applicable

33 Do

Culverts.

34 The dimensions and character of the various Masonry work in this range varying Constantly with the requirements of the drainage no average can be struck.

35 Masonry work are built of either Brick or Rough Stone in Chunam.

36 Stone is generally procurable within a distance of 5 Miles when such is not the case Brick is substituted

37 No, Stone is obtained by quarrying with the pick or Crowbar when not found on the surface, it is obtained in irregular masses and with an irregular fracture.

38 Average cost of stone at work Rs. 1-8 as per C.yd.

39 Cost of lime delivered at work Rs. 9-0 per Candy of 20 Paras

40 Quantity of lime per Cubic yd. of Masonry 2 1/2 paras.

41 The proportion of lime to sand is one part of the former to two parts of the latter.

42 Lime used is produced from a nodular kunkur stone it is of fair quality.

43 No

44 There is a difficulty in procuring fuel for burning Bricks which causes stone to be preferred where procurable. The size of the Bricks used are 9x4 1/2x2 1/4 and their cost per thousand averages Rs. 4-8-0

45 The cost of Brick work averages Rs. 3-8-0 per Cubic yd.

46 The cost of Masonry per Cubic yard averages Rs 2-8-0

47 A Mason Builds 1 Cubic yard per day.

48 No.

49 Average cost of a culvert of 3ft Span per lineal yd Rs 25-4-0

" Do Do of 6 ft do 28-12-0

Do Do of 9 ft do 34-8-0

Do Do of 12 ft do 70-0-0

50 Rates paid to Masons from 6 to 8 annas per day

Bridges

51 No large streams in this range have been bridged

52 Not applicable

53 Same as stated in answer to question No 51

Labour

54 Labour is procured from resident population

55 No

56 No regular agreement for ordinary labour

57 Not applicable

58 No

59 No

60 The daily rate for ordinary labour is 2 as

61 Labour is divided in to two Classes beyond women, and Imen, and the daily rate of pay is 2 as per man and 1. 4 a p for Women and boys. Heavy work such as lifting large stones commands an increased rate viz 2-8 a p per day.

62 Women and Boys are employed on roads.

63 When the spreading and tamping of metal is performed by daily labour each person is tasked at so many Squares which varies with the depth of metal laid.

64 All work is measured by the disbursing agent before making payment, and fines are inflicted for short work.

65 Not applicable

66 No

67 No

68 No

69 "

70 No charges other than the price of labour and Materials are incurred in road making except when the road passes thro Cultivated land when compensation for the same is incurred.

71 Labour is difficult to procure while cultivation is in progress and during harvest.

72 Coolies prefer working in the Fields when such work is procurable.

73 The wages paid by Cultivators are higher than that paid by Government

74 Not applicable

75 do

76 do

77 do

78 Not definable

79 All Materials are supplied on contract or purchased at rates previously agreed upon, and as a rule no work but petty repairs is performed by daily labour

80 The rates paid for Contract work are as follows.

For the excavation of Grand for metal 1 anna per C. yd.

For carting the same 3. 9 a p per C. yd for Spreading and tamping

do. 2. 8 a p per cubic yards.

Supervision

81 With the exception of the Sabeq Overseer and the Ranger Office death of whose Supervision is more or less General, there is a Cadre of Superintendents with any Special training for their work men are retained or dismissed as they evince aptitude for the work on which they are engaged, and the Consequence of a want of previous training is that much additional work is thrown on the officers of the permanent Establishment in order to secure the proper out turn of work.

82 × ×

83 × ×

84 Native supervision is very largely employed and much of it necessarily so but the result is not as satisfactory as would be the case were better class of men obtainable

85 + +

86 + +

87 No

88 The country cart drawn by a pair of Bullocks is used and also the Wasdah cart, which runs upon low roughly sloped solid wheels drawn usually by a pair of Buffaloes. The latter is useful in a rough country where there are no roads as it is not liable to upset and if damaged is at once repaired on the spot by its owner its capacity however is small, not more than 1/3 of a Cubic yard of rough stone.

89 the cost of a pair of Bullocks and driver per day ranges from 8 to 14 annas

90 Carts are never hired without bullocks and drivers, the price of which ranges from 12 annas to Rs 1 per day.

91 No

92 No

Character of Traffic

93 The Traffic on all Roads is light

94 The cart used is the common cart of the Country, mounted on two wheels about 4½ feet in diameter and 6 ft. width of track

95 The breadth of the tire is 2½ inches

96 The weight carried is about 700 lbs.

97 The (average) Traffic on the Main line of Road is 200 Carts per day that on the subsidiary roads about 70 Carts

98 Average duration of road about 3 years

99 Unable to answer this Question, as it depends on other conditions of traffic than that of carts alone, Liberlacing much cattle, traffic on some lines as compared with others.

Miscellaneous

100 + +

101 + +

102 Lines for the use of labourers are not used

103 Not applicable

104 The System of pay if for Contract work is by Cheque on the local Treasuries, and for daily labour, by weekly cash payments by disbursing agents; The time of payment is generally after the close of the working day and the time taken about 2 hours

105 + +

Note — Northern Range Office
7th February 1884

E. Stubbs
Superintendent

Commissioner
Central Provinces
2nd Circle

Prov.ll Surveyor's Letters 225

Surveyor's Instructions with Roads in Hilly Districts

Copy

For the Superintendent
of the Survey of
Roads

Respecto

Directions on Roads in Hilly Districts

General
Character of
Roads

1 Directs the general character of the roads in Hilly districts, and the manner of executing them.

Of Roads in Hilly & Mountainous Districts

2 Directions in the event of disagreement between Surveyors

5, 6, 8, 10, 12 yards.

3 Directs system to be followed in first marking out new roads

On the first instance it is usual after the centre line of proposed road is decided upon and its breadth, height, &c. known to erect sections denoting the height and rise & fall required, the latter is invariably made 1 in 2 to 1, the cross drains is then marked out and if they are carried with good & safe it is ever after preserved and preserved and the side drains are then

and thrown for forming the road which is generally sufficient but if not so extra earth is taken from pits, when the road is sufficiently raised it is well rammed, the transverse and side slopes are then formed, the latter turfed from the turf removed from side drains the road is then ready for metaling

4 Is it usual to adopt any substratum differing in character, or material, from the surface metaling? If so describe it.

Instances have occurred when a layer of sand have been put over a road formed of black soil, under the metaling but is very seldom done

5 Are the roads fenced in? If so what description of fencing is used, and what is its cost.

No

6 What is total cost per mile of roads, with different widths of metaling subdivided under the following heads viz:—

The following was the cost of completing the 34th mile of the Dorwal road during this Official year

Earthwork, no retaining wall or rock in the mile

a Earthwork including retaining walls and rock
b Side drains
c Cross drains or culverts
d Bridges
e Metaling
f Miscellaneous

Side and Catch drains
Cross drains or Road Dams.
Bridges none
Metalling
Miscellaneous
The total Cost of Repairs was 925-3-5

7 How are the Estimates for roads framed?

Already applied for by the Govt of India ~~Estimates framed by the officers of the Range~~

8 What check is there for ascertaining whether the quantities actually executed agree with the Estimated quantities

Do In the first instance measurements of all works is entered in a station book, the accuracy of which is checked by the Range Officer, for works over Rs 2500 the details of Expenditure are entered in the Progress report of the Range, a copy of which is forwarded to the Controller of Public Works Accounts who can any moment test the quantity done and compare them with the sanctioned Estimate. Again when a work is done a completion certificate

certificate is sent to the Controller by the Range Officer who certifies to the work being accomplished according to the sanctioned Estimate or otherwise.

Q. What system of drainage is adopted?

All Culverts or Rivers are bridged or arched over as the nature of them may require. Side drains are cut at certain distances along the road to carry off the water from the high to the low lands

Rock is but very rarely met with.

10 What is the average percentage of rock to earth? And what are the average prices of rock and earth per cubic yard

11 What is the usual width allowed beyond the metalled portion, and are there footpaths?

In 1st Class roads 1 yard is usually allowed which is used by foot passengers as a footpath

Earthwork

12 What is the cost of earthwork per cubic yard.

8	Feet	Light easy soil
9	"	Clay Road
10	"	Slightly stony
12	"	Stony, soil

Already replied to by the foot path

Spoil is distributed not exceeding 15 yards for every 5 extra 15 yards in length & more distant the 60 yard would be taxed, for ordinary light soil carried a distance of 45 yds it 11 pence per cubic yard would be the rate, the embankment is formed & formed from earth taken from side drains when this is found to be insufficient for the purpose it is taken from

[illegible] to the work of this description

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

16 Are there any boulders for which in the contract receiving them are they disposed of and to whom?

D 2

17 Is there much material difficult to be removed by spade or mandrie, but too soft for blasting? If so, what is the cost per cubic yard?

D 2

18 Q. Are roc. to be figured as material to be hauled separately?

Do

19 Are retaining walls used frequently as a substitute for earth slopes?

Retaining walls are a substitute for earth in good used

20 If so what is the character of masonry in such walls? What is the thickness for different heights of wall, and the cost per cubic yard

Not answered to date.

21 What is the average mean lead of cubic yards of retaining wall per mile of road

Do

Metalling

22 Describe the general character of the metalling and the materials of which it is composed?

Metalling is composed chiefly of gravel, boulders, and blue clay rock, the latter is rarely obtained, but is used both and the poor of the other two former is plentiful, each in hard substantial material but gravel is used with preference to stone

23 What is the average thickness of metalling?

9 Inches

24 What is the average cost per superficial yard of metalling?

when obtained within a distance not exceeding ½ mile

25 How is metalling laid? is it laid at the side of the road, and after being

Metalling in gravel fields on the borrow of the road in shape of 6 Ridges to ½ cubic yard

26 What is the cost of each of the following items in the following order: Blasting, digging, filling, stone breaking, stone laying

Gravel in the Gangs through or the following proportions: Gravel or ballast 2 cubic yards Filling in metalling in carriage of Blasting 3 cubic yards, stone filling in metalling in Gravelling

27 What is the average distance to which material is conveyed from the quarry

2 Miles

28 What is the cost of transport of metal for different distances?

For ½ Mile 1/3 Annas per cubic yard, ¾ Mile 2 15/16 As. per cubic yard. 1 Mile 3 3/4 Annas per cubic yard

29 Are the buckets in use one a measure? if not what measure is used for metal

etc. The Panchayat Gra= =dars

30 Is the measure- ditto
sheafed as not?

31 How many cubic 4000 Cubic feet
inches does the measure
contain?

32 How many cubic Measure not sheafed
inches should be allow
ed on the average, if
the measure be sheafed?

33 How many cubic yards Not Experimented
of solid rock are required upon here
to raise the usual
minimum of measured, say
100 cubic?

Cubic

34 What is the average On the Dorset Road
number of cubic yds there is not more than
of different stones 3 in 1 Miles
raised per mile?

35 What is the general Rubble stone and
description of masonry Brick in mechanical
of which they are
constructed?

36 Is the stone for Generally within 2
masonry generally Miles distance
near at hand?

37 Is the stone blasted, If it is quarried, not
if so, does it examined blasted with powder,
with Stone

38 What is the cost of Some labourers are
sheafed measured at 1/6 per cubic yard
cubic yard?

39 What is the cost Generally 4, 6, 8, 10 Pence
of raising and per cubic
delivering?

40 What is the average 2 or 2½ Parishes accord-
number of cubic ing to quality
yards of masonry
executed by a
mason in a day?

41 What is the proportion Grave 1/3, stone 2/3
of lime to sand used?

42 What is the average Stone Lime Gas.
price of each
of these in the
neighbourhood?

43 Are there hydraulic Stone found
limes in the district?

44 Are they to be easily Not, obtained on account of Pierced
obtained? and are Brick 9" × 4½" × 2¾"
there deficiencies, and would cost from 6 to 8
how supplied? Pence per 1000
Rubble per Cubic yard
Pence 4 per Cubic yard
of three ft in thickness
Rubble 2½ per Cubic yard
when stone is quarried
within a mile from
the Cubic yds

45 What is the cost 3/4 Cubic yard
of brick work per
cubic yard?

46 What is the cost of
scaffolding per
yd?

47 What quantity of
masonry does each
mason complete per
day?

48 Are the Roads Covered with Gravel or Stone Ballast?

Ballast in Cuttings & Gravel on Embankments

49 What is the average cost per Lineal Yard of different dimensions of Culverts? and what is the cost of their Jacks?

Culverts in Cuttings 2 Feet wide 20 inches deep per Lineal Foot Stg. 17-3-2

50 What are the Rates paid for Labour?

6/, 7/ & 8/ per day

Bridges

51 Give a General description of different Bridges with their Costs

Bridges with segmental arches or by Iron Girders constructed there are at the Central Circuit one of 1 Span 15 Ft. span do Foundations were 6 Ft. deep, Abutments 3 Ft. high from the Springs of Arch, and average breadth 5½ Ft, the wings from Foundation 16 Ft. high, average breadth 4 Ft. and 1½ Ft. thick, retaining walls and floors were 1 Ft. thick, the parapets 1½ Ft. high, the whole Plastered with 2 Coats of Chunam the Costs of Construction all together were Rs 1122-0-0

No 1 in 11 Miles

The Abutments were from an Inspection no more than 8 Inches out of Plumb

52 What is the Average Number of Bridges per Mile?

53 What Rates are paid to Skilled Artizans of different Kinds?

Labour

54 Are Men to be had obtained? and on what terms?

By Free Agency, either as Contractors or Daily Labourers

55 What may the Labour contracted? Stg. do at what Cost

Do

56 Are there any System of Agreement? Specify in the Character of the Agreement

Not Answerable to

of the Cost of Conveyance to the Road Officers?

Do

57 Are any Labourers employed by Contract?

58 Are they engaged by Days, or Month Labourers or Artizans?

Some with the Exception of a few Men who are employed by Month to keep the Roads in good order by making slight Repairs and to see that Passengers Baggage &c. do no injury to Masonry Buildings

59 Are any Labour on the Roads performed by Prisoners or Military? Stg. do, at what Rates and to what Charges?

No

60 What is the average daily Rate of Pay for Labourers

2 Annas per diem Coolies 1½ Annas Women 1⅓ do Boys for Girls

61 Are there different grades, if so, how are they distinguished and paid?

Not particularly, Gangs are taken from the highest rate they can be induced to work at, but there is a fixed charge for piecework, and a fixed charge for breaking stones

62 Are Women and Children employed on the roads?

Yes.

63 How are the labourers and others taxed?

Daily labourers are not taxed, nor the are they frequently used for as the work is done by contract, the few ratepayers would seldom appear if that was the case

Hereby incurred attention to work during wet days, which is superintended by a foreman

The labourers duties are digging frequently at a distance of 10 miles from their village they get nothing for lunching. Daily labourers are found sometimes in villages in the vicinity of the works.

64 What system is adopted to enforce discipline or to ensure the completion of the task?

65 Are the labourers paid when on the march, changing from one place of work to another?

66 Are the ratepayers liable or compellable to keep horses for the purpose of the roads

Yes if they had received an injury while working, no allowance is made for the stoppage in weather, without an important bridge was under construction and the labourers scarce, 6d a day per diem would then be given

67 Are medicine chest kept for the labourers? Supplied to the labourers? If so, how is it charged? and do the Jury visit the said chest?

Adult labourers medicine chest was provided on application by Government free of charge

68 Are Piece jurors at a fixed rate? If so, in what proportion?

To grain in specie 1/2 Labour

69 Is there any toll on the river this juror?

" "

70 What other charges beyond the regular pay of the labourer are included in the cost of a road?

Materials, sundries such as tools & plant 1/2

71 How far is labour affected by the price of potatoes?

To a considerable extent at certain seasons of the year

72 Does cooliee prefer working on Estates to being employed on roads

Yes, by larger wages for cultivators

73 • Are the wages paid to road Coolies higher than those paid to estate coolies

• No Coolies employed on the roads

• No, and this is the reason that it is difficult in harvesting season to get Coolies

• Do

74 • Are Coolies entered from the roads by Overseers on the Estates?

75 • Are there many deserters

Very few except Coolies employed by Contractors who labour only on daily pay during harvesting and those receive one Pound of food & Wages, the whole valued at 3½ Annas

76 What is the general System pursued with regard to labour on Estates?

77 Are the highest rates given in those Districts in which Estates are most numerous

• The highest rates usually given are paid in and near Colombo

78 What is the proportion of non-Effective labour?

• According to Superintendents when two People are well looked after, there is no non-Effective labour

79 How far is the Contract System pursued in road making?

The largest extent available, but at present no thorough Contracts have been entered into although 15/16 of expenditure have been executed by petty contract system

80 What are the rates paid for Contract work

Rs 2¼, 2½, 2¾ x 3 and upwards according to the distance of obtaining Materials

Superintendence

81 In what manner are the Coolies employed distributed

Superintendence consists in having a Tasks given for each Task to include all work in it, 3 or more Tasks generally comprises Range in which one inspector undertakes or Assistant Inspectors according to the Range in one Range are two Overseers responsible to and immediately under the Range officer

82 What proportion of the Superintendence is borne on the fixed or permanent Establishment & what proportion is charged to the under Construction

Already replied to by the 2nd & 3rd proportion of Superintendence that is borne on the fixed Establishment is 32 Percent on the Expenditure that may be incurred during this year. The amount of Superintendence (for all the Establishment) charged to Roads under Construction is 3 Percent on the Expenditure

83 Are any portion Superintended by Military Officers or other Officers Who, & what are their pay and Allowances Charged

Yes, by a Military Non Commissioned Officer whose pay is charged to Civil Department

84 To what extent is Native Superintendence employed

To a considerable extent mostly Superintendence

Such Lapels; and in that
Instance will be attended
with the same Factory
Penalties.

Frankfort

85 What is the Port
of Frankfort bound?

86 Do they a Specie
Port for Frankfort
or in the Port of Frank-
fort in each Case
Charged to the Conside-
ration of the Head

87 Are Elephants,
Camels, or Dromedaries
Exclusively used in
Frankfort? If so
what do they Contribute
or Encumber per Annum

88 Are Cattle Particular

89 What is the Cost of a
Pair of Bullocks and
a Driver per Diem

90 What is the Contract
Price of Carts per Diem

Already applied to by the Board of Inland Revenue

Such Lapels

Do Do Do

Let all in each
Case Charged to the Con-
sideration of the Head

10

Such Lapels; and in that
Instance will be attended
with the same Factory
Penalties.

Frankfort

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of Frankfort bound?

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Such Lapels

Do Do Do

Let all in each
Case Charged to the Con-
sideration of the Head

10

Not Exclusively Employed
in Frankfort

12 Annum per Head

Not Contracted For,
in Each Case are generally
Furnished when the Con-
tract is entered into

91 What is the Number of
Such Carts in general
use?

92 What is their Form &
Construction by which
they are distinguished
from Carts in other Parts?

Chaise for Hire

93 What is the Charge
of the Chaise on
Hire per Diem?

94 What is the Number
of Chaises let out
for Hire?

95 What is the Breadth
of the Wheels of Chaises
used?

96 What is the Weight
Carried on a Pair
of the Chaises?

97 How many Miles
may one Horse
in the Course of a day?

98 What is the Average
Duration of one Wheel?

99 Have any Regulations
been established between

Chiefly Exported
Stone, Salt Fish, Salt
Tobacco, Cotton &c. from
Portugal to Prussia

Common Country Carts
Some of Oak or Common
Wood, Generally Prepared
in the Roughest manner

Breadth in Inches

10 00 Lbs.

Traffic fluctuates in
Season with favourable
weather 150 Kreutzers

Not Commonly used
are only here & there.

0 0

91 What is the Number of
Such Carts in general
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used?

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Carried on a Pair
of the Chaises?

97 How many Miles
may one Horse
in the Course of a day?

98 What is the Average
Duration of one Wheel?

99 Have any Regulations
been established between

the duration of the Road
and the number of carts
which have passed over
them?

Miscellaneous

100 Have any of the Supplies
from the works stopped
Charges?

101 Are there a separate
votes for Tools, or are
the tools charged to the
Road on which they
are used?

102 Is Land in the Cost of
Lines, or Clearings for
Accommodation of
those employed on the
Roads?

103 Is Land in the Channels
of such Lines, and
how many are erected
for a given length of
Road?

104 * Is Land in the Expen-
diture of Prey? and
is Land given in Cost
in Paying?

105 Are there any
Special Votes bear-
ing upon the Construction

Already replied to by the foot of Page
of the Return, for
which such Lists are
obtained

Do Do Do

The purchase of Tools
Entirely forms a separate
Charge and are not Charged
to any works particularly

No Clearings are
Constructed

Do

* All Contractors and
work People for sums over
from £10 upwards are paid
by Cheques by the Overseers
in Charge of Ranges, who are
Given a certain quantity
according to requirements and
as indented for once in 15 days
the Range Officer frequently
himself issues Cheques for
contract work the Examinations
made by the Overseers are paid
by Coin, all sums are made
as frequent as possible, not
Generally later than once a day

~~from the Hire~~
Already replied to by the foot of
this Page

of Roads the Amounts
Expended for, are not charged
Separately to the cost of
Roads?

Camp Langara
5th February 1867

L. Gl Clemmow
Superviser in charge
of No 3 or Western
Range Queen Ch.

Examined & Checked
Assistant Engineer

No. 184.

Superintending Engineer's Office,
Cuddalore the 5th March 1867.

From

The Superintending Engineer,
5th Division,

To

The Secretary to Government,
P. W. Works.

Sir,

With reference to G. O. No. 96 of the 11th
Instant I have the honor to forward
herewith a list of Answers to the several Questions
contained in the Letter from the Committee appointed
to enquire into the cost of the construction
of Roads in Ceylon.

I have the honor to be,
Sir,
Your most obedient Servant
Lieut Col R. E.
Superintg. Engineer 5th Division

Copy of Letter from the Superintending Engineer 5th Division, dated 5th March 1867, forwarding Answers to Questions contained in Letter from the Committee appointed to enquire into the cost of the construction of Roads in Ceylon.

Copy of Letter from the Superintending Engineer 5th Division, dated 5th March 1867, forwarding Answers to Questions contained in Letter from the Committee appointed to enquire into the cost of the construction of Roads in Ceylon.

To

The Secretary to Government,
P. W. Works.

Sir,

I have the honor to forward herewith a list of Answers to the several Questions contained in the Letter from the Committee appointed to enquire into the cost of the construction of Roads in Ceylon.

I have the honor to be,
Sir,
Your most obedient Servant
Lieut Col R. E.
Superintg. Engineer 5th Division

5th Division D. P. W.

Answers to Questions by the Road Committee in Ceylon. ——

General character of Roads.

1. ——
2. ——
3. The road surface has a rise in the middle of one inch for every yard of width.
4. On clayey soil from 6 to 12 inches of sand is spread before metalling. Metal should be spread on road during rain.
5. Only on Ghaut roads, there is a mud bank 18 x 18 on the outer side, and sometimes in road raised more than 1 Yard.
6. As follows.
   a. Rs 2000, on heavy cuttings, often double this cost.
   b. Included with earthwork.
   c. Rs 500 —
   d. Rs 1500.
   e. Collecting stone 440, Cartage 1 Mile 275, Spreading 110. Gravel 25. Total Rs 850 —
8. 5 p Cent on cost of road.
9. Open drainage for sides of road, and both open and covered for cross drainage.
10. ——
11. One Yard on each side of the metalled portion. There are no foot paths.

Earthwork.

12. One Anna per Cubic Yard, if not conveyed beyond a distance of more than 25 Yards.
13. One Rupee per Cubic Yard.

---

8 7th 1867. D. P. W.
5th Division
Pro. of Govt for June
No 840

From
The Superintg Engineer
5th Division.

To
The Secretary to Govmt
D. P. W.

Dated 6th March /67
Received 28 March /67
No 184.

Enclosure 2
No 1742 & 1743, 11th June 1867.

Submitting a list of Answers to the several Questions proposed by the Road Committee in Ceylon.

No 224

16. Many. Cost for removal 4 Annas p Cubic Yard. Not estimated as so much rock.
17. Frequently. Cost for removal from 4 to 8 Annas p Yd according to nature of material.
18. Always.
19. Only when the slopes are exposed to the action of running water.
20. Brick or rough Stone in chunam, 1½ thick in 2 feet. Thickness at base one third the height of the wall.
21. Not known. Retaining walls not used except where is water. Earthwork cheaper.

Metalling.

22. The hardest stone to be got within a distance of 3 Miles, broken into cubes of not more than 1 inch.
23. Six inches.
24. Two Annas.
25. Piled at the side of the road for measurement & Rolled with gravel, watered if no rain fully rolled.
26. Breaking 4 Annas per Cub yd. Carriage & piling 2½ Annas p Cyd. per Mile. Spreading and rolling 1 Anna p Cyd. Gravel hay to be carried 1 Anna p Cyd extra.
27. Often found close to road. Sometimes carried 10 Miles, average distance about 3 Miles.
28. 2½ Annas per Cubic Yard per Mile.
29. No. A measure one Yard square and half a Yard in depth. Half a Cubic Yard.
30. Not heaped.
31. 25328 Cubic inches.
32. Not heaped.
33. ———

Culverts.

34. On Trunk road 8 to 10. Other road, about 4 per mile.
35. Laterite Stone and brick plastered over. On Trunk road, Ashlar work is applied to the piers &c.
36. Never used unless within 3 Miles of the road. Brickwork is cheaper.
37. Blasted for large works, but not for small works.
38. Rock is both with regular and irregular fracture. Undressed quarried Stone R 1, p Cub Yard. Rubble stone can be had for the cost of cutting.
39. 4 Annas per perch a measure of 20"×20"×10", 4000 Cub inches.
40. 2½ Annas per Cub Yard.
41. 1 of lime, 2 of Sand.
42. Coral, Stone, and Shell all very good.
43. Stone found in several places is moderately hydraulic.
44. Easily obtained, size 9"×4½"×2¼". Cost R 2½ to 3 p 1000.
45. R 1½ to 3 p Cub Yard.
46. Rubble masonry R 1½ to 2 p Cub Yard, according to cost of carriage.
47. Rubble masonry 1½ to 2 Cub Yard per diem.
48. Formerly in mud eyes; not so at present.
49. R 10 per lineal Yard for small culvert of 1 Yard span.
50. Eight annas per diem.

Bridges.

51. The bridge across the Coonoor at Cuddalore, 21 Arches of 45 feet span, 21 feet roadway, built on sand, cost 3 lacs of rupees. A 12 feet tunnel has been built for 500 rupees.
52. One, besides tunnels of sizes up to 5 Yards span.
53. Mason 8, Brick layer 6, Carpenter 6, Blacksmiths 8 Annas p diem.

Labour.

54. From the nearest villages on a simple promise to pay them so much p diem.
55. None.
56. No agreement except with contractors who give security.
57. No importation.
58. Yes. A puggul on R 10 or 15 per Month for every 24 Miles of roads. A road cooly on R 5 per Month for every 6 Miles, with regular working parties under them.
59. Yes. 2 to 4 Annas daily, extra pay, charge to the work.
60. From 1 to 2 Annas per day.

61. Yes, Men 2 Annas, Women 1½ Annas and Children 1 Anna.
62. Yes, and are very useful.
63. Aman, and accounts or a bill can be given to 6 Cyds of earthwork daily according to the soil.
64. None beyond the Tyndal or Head Coolie. If the daily task is not performed, a portion of the pay is stopped.
65. Sometimes they receive an advance of money when engaged, which they gradually expend.
66. When accidentally injured on the work. Not often in other cases. No pay given if there is no work.
67. Not unless very large numbers are employed on Jewish feasts. Cost to be per contra charge to the work.
68. Rice seldom used. Often used in the travelling lads.
69. Merely the cost of carriage.
70. Petty Superintendence and hire of all kinds.
71. Not much.
72. —
73. Yes.
74. Often.
75. Not, if they are regularly fed.
76. The men are fed, supplied with rice, and sometimes with clothing.
77. Yes.
78. About 2 per cent on large works.
79. Blasting, Earthwork, and felling trees are on contract, but not the bridges.
80. According to Estimate.

Supervision

81. One Engineer, two Overseers and two Maistries on every 50 Miles of New Road.
84. Commonly employed as Overseers, and Maistries and on the whole with satisfactory results.

Transport.

87. Very seldom used of late years. Cost not known.
88. In common use.

Character of Coolie.

89. Merely early and good bullocks.
90. A very primitive, but useful affair on two wheels, the spokes.
91. Slow.

Miscellaneous.

92. Is called a road, but in good road 1500 men to do it.
93. For common lines about 400 or 500. An cross roads 100 to 200.
94. All roads are kept in good order by an annual contract or per centage.
95. The annual grant varies from 100 to 5000 rupees annually. Some are only built where there are advantages over that of a cost of 8 Annas per head.
96. Small wells 6 feet high with bamboo roof covered with a large of leaves.
97. On large works by ticket. On small works by each one hour per diem for payment on large works.

E A Ford Lieut Col R.E
Superintendg Engineer & Division

Superintendg Engineers Office
Cuddalore 6th March 1867.

p M 24/9/57.
Mov 11th June/57 L. 2224.

List of Answers to the several Questions pro= posed by the Road Committee in Ceylon,

No 116

Supt Gen Office 2nd Dr
Maradankatoe
2nd March 1867.

From

Lieut Colonel J. T. Dunsford R.E.
Supt Engineer 2nd Dr

To

Colonel C. A. Orr R.E.
Secretary to Government
P.W.D.

Sir

Adverting to G.O. No 96
Dated 11th January last, I have the honor
to forward an answer to the questions
forwarded by the Ceylon Road Committee
received from 5 Ranges in this Province
some of the answers are, I regret to say,
not quite so explicit as I could have
desired - but I have thought it advisable
to forward them as they are, rather than
delay in replying to the order -

2nd As to rates and the peculiarities
of each Range greatly to enhance the
desirable to obtain the information
needed from those which may be
considered as having rather typical
Characters -

3rd In the 1st Range below, the roads
generally traverse a laterite formation

Ayr Dist
1st Province
3d do
4th do
Central
5th do
2nd do

2nd March 1867
Dept of Public Works
Colombo
To
The Superintending
Engineer
2nd Division
Kandy
Sir
I am directed by
the Ceylon Road
Committee to
forward for your
information
Extract
No 1943
dated 17th May 1867.

No 225

And pass over land gradually to the Kay from
also Near the East. where the Coffee is
Considerable -

4. In the 3d Range the Kay generally pass
over Black soil with an underlying
stratum of Rounded lime stone and lie
in land where the Cultivation is scanty
and the Coffee small -

5 In the 4th Range. the soil is also black
Cotton chiefly - as in No 3 - but of a worse
nature and the Kay run Near the Coast. Metal
is procurable with difficulty -

6. The 5th Range Nicotra is in the Main
Deltaic portion of Rat District
where the soil is generally stony and
Material abundant - This an inland
Range and Contracts with the
7 The 7th Range, what is Deltaic
in its formation and where no Material
is procurable except Kunjy and Modaly
drift of the Swamps close to the Sea -

I have the honor to be
Sir
Your most Obt Servt

Capt Innes
Supt Engineer 2 Dn R.E.

No 276.

Camp Courtallum
9th January 1867.

From

Lieut Col T.A. Cloberly R.E
Dy Supt Engineer 1st Dn

To,

Colonel C. J. Orr R.E
Secretary to Government Genl M.

Sir,

In reply to G.O. No 96. 11th Jan.
1867, I have the honor to observe
that the only hill roads in this Dn
are as yet tracks made by coarse
labour of the poorest description
and paid by daily hire - Imagine
that information on such points
as there is not required by the Ceylon
Government; and that a report on
the low country roads would be of
no service, & merely burden the record

I have &c &c

T.A. Cloberly Lieut Col R.E
Dy Supt Engineer 1st Dn

No 34

Supp. Engineers Office J. Div.
Conoor, 11th May 1867.

From,
Colonel Gld. Walker R.E.
Supg Engineer J. Division

To,
Colonel C. A. Orr R.E.
Dep. to Government D.W.W. Madras

Sir,

I have the honor, with reference to your reminders N.o 77 of 8th April, and N.o 99 of 8th May, to state with regret that I see no chance of my ever having time to spare to do justice to the questions propounded in the paper which accompanied G.O. N.o 96 of 11th January. It is a subject which interests me and regarding which I would gladly give the benefit of my experience; but I cannot do so to any purpose without neglect of my Current work.

I have the hon to be
Sir,
Your most obedient Servant

Gld Walker Colonel R.E.
Supp. Engr. J. Div.

A.S.

Copy of letter from Supg Engr J. Div. No 34 dated 11th May 1867.
To Dep. to Govt D.W.W. Madras
Subject Questions propounded in G.O. N.o 96 of 11th January.
Replying to D.O. No 1742, dated 13th May 1867.

No. 927. Supg Engineer's Office 4th Divn
Madras 23rd May 1867.

From

Lieutt Colonel J. Bean R.E.
Ag. Supg. Engineer 4th Division

To

Colonel C. A. Orr R.E.
Secretary to Government P.W.D.

Sir,

I have the honor to reply to the questions sent with G.O. No. 96 dated 11th January last, regarding the cost of the construction of roads, and which were set by a Committee appointed to report on the subject in Ceylon.

1 Enclo:

2. Many of these questions are of a very general nature and others would require more time and attention in answering them fully, than we are enabled to give to them.

3. Colonel Boileau has hitherto delayed his reply, pending answers from Mr. O'Shaughnessy Assistant Engineer, who has had experience of road making in Wynaad; but this officer still delays answering this requisition

---

Pro. of Govt. Fort St. George
1762

From
The Supg Engr
7th Divn

To
The Secretary to
Govt. P.W.D.

No. 34
Dated 11th May 1867
Recd 13th May 67

Nos. 1742 & 1743 - 11th June 67

Reports that for want of time he is unable to furnish answers to the questions communicated in G.O. No. 96 of 11th Jany 1867.

No. 223

requisition, and do not deem it
advisable to wait any longer, espe-
cially as I can speak from my
own experience of roads on the
Western Coast and elsewhere —

I have the honor to be
Sir,
Your most obed.t servant

J. Reeve Lieut Corps
Asstt Engineer & Del.

1. The materials of which the sub-soil of roads in hilly districts are composed, are generally obtained on the spot, and formed of the same soil from which the cutting is made; this material being generally of a harder, more rocky, and more gravelly nature on the hills than on the plains - Rock which is worked with a Crow-bar or of a harder nature requiring blasting is frequently met with and makes excellent mac-adam. Where the soil is softer of a clay nature, and subject to the action of Springs, as often happens in a Cutting, gravel must be laid over - In a Side cutting the road is made of the excavated portion of soil and is half formed out of the solid, and half formed of the loose earth - Roads in this situation are generally good, and being exposed to free currents of air, are generally dry and much more so than those in cuttings - which require more attention paid to them - In roads excavated on the side of a hill, great care is required

to

Public Works Office
Ceylon
The 18th July 1870

Sir,

By the Secretary
to Government
dated 23-5 May 1865
Rec'd 25-5 May 1865
Ans: one
No 923.

Referring to the question
sent for my opinion on the 15th ult.
1st - As January last requiring
the construction of the Cart Road
of Pundaluoya and which was
to be a Communication between
Kandy & Dimbula on the
one hand & Nuwara Eliya on the
other.

I have the honor to be
Sir
Your most obedient
humble servant
[illegible]
Engineer

Chief Secretary
to Government

to reveit the slopes, and to allow for unequal settlements -

2. When roads are cut out of a face of a hill the slope is generally reversed, the fall being inwards, the drainage running into a channel on the hinner side of the cutting - In cuttings through hills, - the centre should be raised from 6" to 6' according to the breadth of road, and deep side channels according to the length of scour and depth of cutting should be excavated. -

3. The surface is well levelled, and the section to be permanently maintained just given to the road. As to the nature of the substratum much will depend upon the character of the natural soil - no definite rule can be laid down.

4. The substratum is different at times from the surface metal. If much clay is found on the road, sand is mixed with it and vice versa before the metal is laid - friable soils, and those of a chalky formation

formation require peculiar treatment - frequently old broken buck when available and, reprise of this nature is laid down and forms a good substratum. In roads of laterite gravel, the laterite itself in lumps of from 2 to 2½ inches form an excellent foundation -

5. The roads as a rule are not fenced in -

6. The Cost of roads I am unable to give with any great accuracy, they may according to number of culverts work &c cost from 2000 to 10000 Rupees per mile without Bridges - earthwork 12 Annas to 3 Rupees per Cubic Yard, side drains 6 to 9 pie per running Yard of road - Cross drains, according to description, from 20 to 250 Rupees each.

Bridges used to Cost of Brick & Chunam — as follows

5 Arches from	35 to 25 feet	Rs. 6500	but they are now 20 per cent dearer & Granite instead of Laterite
5 Arches	35	8500	
3 Arches	25	4000	
Metalling 6 Yards wide		Rs 1320 per mile	
4 Yards do		880 do	
Miscellaneous		5 per Cent on Estimate	

9. The drainage is generally on surface on both sides - open drains en-

led

led off at the low ground & varying in
section according to climate and
local situation - On hills where cuttings
are made, under drains are required
at intervals to cross the road, and catch
drains on the upper side, leading into
the side drains, are made to take off
the hill drainage - occasionally open
paved drains or rush bridges are re-
sorted to - On Ghauts these cross drains
are built at every 100 or 200 yards ac-
cording to circumstances -

10. It is difficult to say what
is the per centage of rock to Earth - It
varies for every locality, as on the
on the plains very little rock cutting
is met with - On the Hills once or
two Ghauts have been constructed when
the road is cut out of solid rock for a
quarter of a mile intervals -

11. The metalling may be
from 4 to 6 yards wide or even on
rare occasions 8 yards, the road for-
mation should be from 2 to 6 yards
wider at surface -

12. Earthwork per Cubic Yard
varies from 6 pice to 3 Annas per
Yard according to distance and

Yardage of soil.

15. (Rock cutting) varies according
to hardness, when it can be split by
fire, by Chisels or by pumpers it costs from
12 Annas to 1½ Rupees and where blasted
from 1 to 3 Rupees per Yard.

16. (There are often boulders on hills -
if large and cannot be rolled, they must
be blasted - when they can be removed
without blasting, they are often charged
separately for -

17. (If there is not, but if too soft
in blasting) the above method may be
resorted to and cost from 8 to 12 Annas
per Yard -

18. Yes, generally.

19. On Ghauts they are not other-
wise - On steep inclines of hills such
as the Malabar boy road Ghauts it is
often impossible to do without them -

20. The masonry may be packed
without Chunam - The costly materials is
only used where the walls is so steep —
that no proper base can be got for the
stone - The thickness vary - in loose
stone, the breadth at base is from ½ to 2½
Yards and ½ Yard to a Yard at top -
The cost per yard of plain rubble packed
without chunam from 8 Annas to 1 Rupee
per

per Yard - but if brought from a distance it is often more -

21. I cannot say the average number of Cubic Yards of retaining Wall per Mile -

22. Metalling is generally composed of broken granite in Cubes of 1½ or 2 inches in size -

23. The thickness varies from 3 to 4½ to 6 inches in thickness -

24. If laid 18" Yards in thickness it would vary in price from 2 Annas to 6 Annas per Square Yard -

25. Where strict and constant Supervision is available it is laid at once, but more generally it is heaped at intervals on the side of the road and the metal is measured in portable pans being laid - it is spread, and occasionally rolled but not generally on account of the Expense - Sometimes gravel is put on at top and generally do not keep in Repair -

26. The cost of the metal varies as above - there is no data for stamping or rolling - Men are generally employed breaking the metal at Rs nine a day On the Coorg Roads they used to break from 8 to 9 Cubic feet per diem and

practised

practised men will do more -

27. This is impossible to answer - If brought at all distances, but beyond half a mile the Expence increases very much -

28. A Cart can carry with first rate bullocks half a ton, but this weight is seldom loaded, 6 Cubic feet of stone may be put in a Cart and one Yard is Equivalent to two tons - this is rather less than ½ a ton and the cost of Cart and bullocks Rs per day is 1 Rupee - a Cart will hardly make more than four trips of 1½ Miles in distance a day - and not even this distance -

29. The bushel is not used generally a parah of 1000 Cubic inches or 21.56 x 21.56 or 31,56 inches -

30. The measure is not generally heaped -

31. Answered in question 29

32. Do Do

33. The above second measure is 2 Cubic feet or $\frac{2}{27}$ th of a yard -

34. This depends entirely upon the drainage crossed or irrigation Sluices of Country under wet cultivation -

35 Brick in Mud and in Lime in procurable - Chunam rubble -

36. It depends upon the locality -

37. In

37. In some localities it laminates the stones are split by fire, or by chisel or by simple Crowbar -.

38. This question has been already answered -

39. This varies according to locality - In Madras we pay a Pagoda or 3½ Rupees for 13½ parahs.

40. There are generally 3 parahs of lime in a Cubic Yard of masonry each parah containing two maties

41. The proportion is generally one of lime to two of sand. -

42. In Madras shell chunam is used, but for hydraulic works - we use stone chunam - The former is of excellent quality. -

43. The lime is made hydraulic, The stone lime by itself in Madras has not very strong hydraulic properties. -

44. The bricks are easily made they are 9" × 4½" × 2½. Large size but of late years they have been reduced to 9" 4½" × 1¾" - they Cost about 3½ Rupees per 1000 but are not of very good quality -

45. Brickwork Costs, 2. Annas 5 pie per foot or Rs 4-1-3 per Cubic yard - Rock would rather more -

46. We do not use masonry in Madras, its cost varies according to the description of the work, whether rubble faced or three line dressed -

47. No data to go on - if the stone is dressed the work is very slow - as a rule -

48. Elephants are not employed in the Districts in which jungles are found, Elephants are occasionally employed during Timber, and I have so employed them on Bridge works. -

49. Culverts vary per lineal yard - Standard plans and Estimates and some already sanctioned should be sent -

50. Masons receive from 7, 7½, to 8 Annas per diem. -

51. This can better be done by sending a few spare Copies of plans and Estimates

52. Depends entirely upon the locality -

53. Carpenters draw from 6 Annas to 8 Annas, Stone masons from 7 Annas to 12 Annas, and Bricklayers from 7 to 8 Annas and Blacksmiths from 8 to 12 Annas per diem -

54. The market is well stocked and the labourers are willing to be paid once a fortnight or month -

55. The labour in this District cannot be imported -

56. If Artificers were engaged there would or ought to be an agreement in the first instance -

57. The cost of importation would be eventually charged.

58. None, unless we except the Tank Diggers & Bridders, who are so far organized as to be trained to their work - We have no road Corps of Sappers.

59. (No, not by Militia) or Pioneers

60 About 8 Annas

61. Boys are paid less than men - Rates vary according to class of work, for instance Tank Diggers if employed on daily labour which is seldom, would get higher wages.

62. Yes they are.

63. They are not generally

64. If Individual Contracts are given, they can only be sub-contracted at a great loss - to be avoided

65. They are not marched when at work.

66. If on (monthly) hire, they are paid in hospital & unless the sickness is of any duration. -

67. When there are large gangs of labourers, Government generally furnish with a dresser or Apothecary. -

68. Yes generally in the season - when scarce at or a little below the

Bazaar

69. I have known considerable loss in this way in Wynaad, but there was no other way of retaining labour but by supplying (moderately) priced food -

70. Labour, material and Contingencies form the items of Estimates -

71. The Estate owners often outbid Government Servants in their wages & Coolies, but Government have authorized the payment of higher wages if found absolutely necessary. -

72. They do as a rule

73. The above question (my) refers to this.

74. Sometimes they are

75. Very frequently if the locality is unhealthy).

76. The Estate owners must be attended this

77. Yes, I believe so.

78. Not known - varies -

79. It is generally pursued, when trustworthy men are found willing to take Contracts - but much difficulty is experienced in working Contracts -

80. According to distance and nature of soil

81. Executive officer with an Overseer, and

Conveyed by

Conceptly) under him to keep accounts.

84. Generally native supervision

87. Elephants in the jungles are used for dragging timber - they cost much - I have paid 2 & 3 Rupees per diem.

88. If roads are favourable for traffic.

89. In the plains one rupee per diem

90. A little below the above

91. Not in very great use.

92. No, not beyond excavation of soil

93. Varies in hilly country with the description of road, where Carts are not practicable, pack bullocks are employed.

94. Mudder Carts, and common bandies

95. Mudder Carts have broad wheels. Common Carts narrow.

96. Varies up to half a ton.

97. Not known, as this varies

98. Not known, varies according to traffic.

99. I suppose so - I have no data.

100. ~~Either to stock or the Estimates~~ Already replied to by the former of Index

101. ~~Tools and plant separate head~~ in the Budget, but Estimates frequently include items for tools

102. Varies according to material at hand - In the jungles where bamboos abound, they are inexpensive.

103. Where Sangs are located for any time, they are built of Bamboo. Mats and thatched, but coolies can build out and work for some miles each day from their lines.

104. Daily & Weekly pay generally the latter

105. ~~Already replied to by the former of Index~~ ~~Not that I know of. Enquiry of these questions apply to Ceylon Engrs. Colonies~~

Supg. Engr's office
Madras 23 May 1867

Lieut R.E.
Ag. Supg. Engineer & Dep

Public Department.

No 1742.

PROCEEDINGS of the MADRAS GOVERNMENT.

Under date the 11th June 1867

From the Secretary N. E. 16th January/67. No 1742 Read the following
do — G. — " — 20th Feby — " — 1388.
do — 1st — " — 9th March — " — 276.
do — 7th — " — 11th May — " — 34
do — 5th — " — 6th March — " — 184
do — 2nd — " — 23rd Inst — " — No. 927 116
" — 4th — " — 23rd May — " — 927

(Here enter No. dated)

Ordered that these papers be communicated to the Government of Ceylon

No 1743

To The Colonial Secretary Colombo.

Sir With reference to your letter of the 6th Dec 1866, No 46, I have the honor under the orders of His Excellency the Governor in Council to forward for the information of the Govt of Ceylon the enclosed collection of papers relating to the Construction

Enclosure in a letter from the Acting Chief Secretary to Government, Public Department, No 927, dated 23rd May 1867.

Recd 13/6/67

Capt Rumsey

Recd 11th June 1867 No 226.

of Roads in Scotland of the Board of Commissioners for



Frontispiece
Illustration

P. W. 186 . D.

No.

PROCEEDINGS OF GOVERNMENT. Judicial

Dated 11th February

Pending orders on
enclosed papers relative to
the construction of Roads
in some of the Districts
of the Madras Presidency.

The Govt. of Ceylon
furnished with the above
papers.

vol 220-227@228