

Gobt. of {1883} Madras.
REVENUE.

No 88 W. d. 17 March 83

Recorded in
Continuation of G. O.
3004, W d 13th November 1882

S 14/5

Issued

Recd.

Incl.

G.O., &c., 6th March 1883,
Nos. 340, 340A.

MARCH.

3004 W. 13. 11. 82

No 88 W. d. 17. 3. 83

Draft Famine Code

for the Madras Presidency, framed by a Special
Committee.— Amendment of Section 22 of the
—, approved.

A5

B5

A4

B4

A3

B5

A4

6TH MARCH 1883, Nos. 340, 340A, REVENUE.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

READ—the following letter from P. P. HUTCHINS, Esq., on behalf of the Members of the Famine Code Committee, to the Acting Secretary to Government, Revenue Department, dated Madras, 27th February 1883:—

Adverting to paragraph 3 of G.O., dated 5th October 1882, No. 1080-A, I am requested by those Members* of the Famine Code Committee who are now in Madras to explain that Colonel Sankey's protest, as now formulated, was not received until after the Code and their covering letter had been completed and agreed to.

2. I now submit copies of their several notes on the subject, seven in number, from which it will be seen that their opinions are equally divided as to the adoption of Colonel Sankey's proposals as now formulated, but that there would be a majority of votes in favor of paragraph 22 being amended, should the Government so desire, to the extent and in the words mentioned in paragraph 3 of the Order of Government, viz., that "where a Civil Agency work is of such importance as to require to be supervised by an officer of the Public Works Department, it should be transferred to the class of Works (a), which is under that department, the Executive Engineer of the division assuming charge of it."

ORDER—dated 6th March 1883, No. 340, Revenue.

Miscellaneous.

The Government consider that Section 22 should be amended in the words which find expression at the conclusion of the Committee's letter, viz., "where a Civil Agency work is of such importance as to require to be supervised by an officer of the Public Works Department, it shall be transferred to the class of Works (a) which is under that department, the Executive Engineer of the division assuming charge of it."

(True Extract.)

Ag. Secretary to Government.

No. 340-A.

Copy to the Secretary to the Government of India, Revenue and Agricultural Department, in continuation of this office letter, dated 5th October 1882, No. 1080-B.

(Signed) P. P. HUTCHINS,
Ag. Secretary to Government.

To the Board of Revenue.

- " Public Works Department.
- " Financial Department.
- " Members of the Famine Code Committee (i.e.)—
 - Hon. H. E. Sullivan.
 - " R. Davidson, C.S.I.
 - Surgeon-General Cornish, C.I.E.
 - Colonel Sankey, C.B.
 - " Hearn, C.I.E.
 - E. F. Webster, Esq.
 - Deputy Surgeon-General Furnell.
 - Major C. D. Baynes.
 - Mr. V. Jagannadha Row Pantulu.

Exd. A. Aubert.

150 Copies.

*the Gov. is now about to
pass orders, and
the question of the
union is quite under
the best possible way*

10-11-82

No. 2004 W. 7/3 Nov '82

*20.
No. 2004 W. 7-3-82*

*Draft Famine Code
Library 29.3.83
with C.I.E. 14.3.83*

14/6/83

Recd. in Receipt Regd.

No 3004 W

PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

Under date the 13th Nov/82

Read the following:—

Proceedings in the
Revenue Department } H. E. No. 1080 A dated
5th October 1882.

Recorded with the
remark that the subject
of para 9 of the Com-
mittee's report has already
in great measure
been dealt with in the
Public Works Department
vide letter to the Govern-
ment of India No. 2696 W

Dated 16th October 1882
and other previous communications
so far as relating to works other
than light railways and
tramways situated in the
famine zone of the Presidency
and a general scheme for
the maintenance of the
minor irrigation works
as regards the first

To The Rev. Secy with copy
of L.O. 2695-6 W of
16th Oct/82
14/11/82

Mc 7644
Govt. of 1882 Madras.
REVENUE.

Order, dated 5th October 1882, No. 1080A.

No 3004 W of 13th Nov/82

Rev. E.O. 1188-89-13. E. H.

Draft Famine Code — for the Madras Presi-
dency—framed by a Special Committee—Approved
with certain remarks, and ordered to be forwarded
to India Government with the Committee's
report.

9. Paragraph 92. The Government would omit the last two sentences of this paragraph. The question of remissions of Land Revenue is not a matter which strictly appertains to a Famine Code.

10. In the views expressed by the Committee in their covering letter, the Government generally concur. The question adverted to in paragraph 5, will be referred for the consideration of the Committee appointed to amend the Madras Rent Recovery Act VIII of 1865. The special attention of the Government of India will be invited to paragraph 9, and they will be separately addressed on the subject in the Public Works Department.

11. The Right Honorable the Governor in Council desires the Members of the Committee to accept his thanks for their valuable labors. The thanks of Government are also due to Mr. V. Jagannadharow for the assistance rendered by him to the Committee.

(True Extract.)

For the Secretary

Secretary to Government.

To the Board of Revenue.

„ Public Works Department.

„ Financial Department.

„ Hon. H. E. Sullivan.

„ „ R. Davidson, C.S.I.

To Surgeon-General Cornish, C.I.E.

„ Colonel Sankey, C.B.

„ „ Hearn, C.I.E.

„ E. F. Webster, Esq.

„ Deputy Surgeon-General Farnell.

„ Major C. D. Baynes.

To the Committee appointed under G.O., No. 437, 1882.

V. Jagannadharow

Exd. W. H. French.

200 Copies

be no change in this respect, and the first sentence of paragraph 9 will therefore be altered as follows:—

As altered.

The Government will also select an Officer, who, as Secretary in the Famine Department, will conduct the correspondence with the Government of India and with all officials in the Province, in matters relating to the administration of famine relief.

As at present.

"The Government will also select an Officer, who, as Secretary in the Famine Department, will be their representative in correspondence with the Government of India and the Home Government, and also with all officials in the Province, in matters relating to famine relief administration."

3. Paragraph 22 provides that "Civil Agency" relief works shall be entirely under the control of the Civil Department, whether supervised by Civil Officers or Public Works Officers. Colonel Sankey dissents for reasons recorded by him and considers that where a Civil Agency work is of such importance as to require to be supervised by an officer of the Public Works Department, it should be transferred to the class of works (a), which is to be under that Department, the Executive Engineer of the Division assuming charge of it. The Committee in their covering letter do not state their reasons for maintaining the provision in the Code in spite of Colonel Sankey's protest. The Government will be glad to know the Committee's reasons in detail, and the point will accordingly be referred to them for the purpose. The Draft Code, however, will not be detained on this account.

4. Paragraphs 31 and 93 relate to loans to agricultural classes, to save them from having recourse to relief works, and to enable them to prepare the lands for cultivation. As the Code stands at present, the grant is so fettered with conditions, that the intention to assist the ryots in tiding over the disasters incidental to an adverse season is likely to be neutralized. The Government are, therefore, of opinion that the concluding portion of paragraph 93, after the words "within the limits specified in the margin" may advantageously be omitted.

5. Paragraph 40. At the end of this paragraph the following should be added:—

"Further the utmost publicity should be given to the fullest information available regarding local prices for the guidance and encouragement of traders."

6. Paragraph 57. It does not seem necessary that the preparation of the village-relief registers should be undertaken when seasons are favorable, and there is no reason to apprehend abnormal distress. The advent of famine is always heralded by unmistakable premonitory signs, and it will be sufficient, if the provisions of this paragraph are given effect to, when there is reason to suppose, that the distress consequent on scarcity will be of such proportions as to require State relief. The section will accordingly be altered as follows:—

As at present.

57. "Collectors will accordingly at once direct the preparation of registers showing for each village in their districts, the names, sex, caste and age of all persons entitled to gratuitous relief in times of famine. These registers should be corrected annually by the Tahsildar of the taluk to which they relate, and should be carefully preserved for use when it has been determined to administer State relief in the District. Collectors will further at once divide all taluks," &c., &c.

As altered.

When the state of the season and the prices of food grains indicate an approaching scarcity of a nature likely to result in widespread distress requiring State relief, Collectors will direct the preparation of registers* showing for each village in their districts, the names, sex, caste and age of all persons entitled to gratuitous relief. Collectors will further proceed to divide all taluks," &c., &c.

7. To accord with the above alteration, the word "prepared" will be substituted for "retained" at the end of line 10, paragraph 58.

8. Paragraph 78. Compulsory retention of persons received into a relief house is doubtless, as observed by the Committee, an extreme measure, but the Right Honorable the Governor in Council recognizes it as an essential feature of relief administration, and in the interests of the famine-stricken wanderers themselves, supports the proposal that it should receive legislative sanction.

11. In proof of my contention I am now reluctantly obliged to advert to the following quotation from rules framed by a Collector during the last Madras Famine, a printed copy of which has been laid before the Committee.

Clause (b), Section II of these Rules runs as follows, viz.:—

"The Professional Establishment will, as a rule, consist of one Overseer on about 150 Rupees a month for every 30,000 to 40,000 coolies, and a Sub-Overseer on about Rupees 60 for every 10,000 coolies, or ten miles of road."

12. The duties of the Sub-Overseer are described as having to allot task-work, check measurements, and see that the work is executed in a proper manner.

13. Now in actual practice it may be said that when work is very concentrated, the staff of an Executive Division of Public Works, as per margin, would certainly be required for supervising the work of from 15,000 to 20,000 coolies, while not half these numbers could be worked by the same staff where the works are scattered in the usual manner.

14. To an Upper Subordinate should never be entrusted more than 1,200 or 1,500 coolies, or to a Sub-Overseer more than 500 or 600.

15. To all, therefore, in the least acquainted with the real requirements of work, the demand made by the rule above quoted will be recognized as nothing short of astounding, though there can be no question that it was framed with the best and fairest intentions. Honorable men will rather die than even appear to fall short of the demands made upon them, but it is nothing short of cruel wrong to such to expose them to risks of this character.

16. Lest it be urged that the above is an extreme case, I am compelled to draw attention to my remarks in the memorandum from Col. Sankey, R.E., Secretary to Government, P. W. D., 27th July 1881, No. 320, embodied in G.O., 13th August 1881, No. 1188-1,189. I instanced the utter confusion, if nothing worse, as resulting from non-professional direction on the Mysore Railway works in 1877.

17. By the amendment of Sections 22 and 50, which I have proposed, the Civil officers would be at once relieved of any amount of trouble, the works themselves would of necessity be better carried out, and, what is even of more importance, the Public Works staff would be much more effective in dealing with famine than could otherwise be the case. I am, therefore, I confess, unable to understand why a reasonable and simple amendment such as I have proposed should be rejected.

R. H. SANKEY, Col., R.E.,
Secretary to Government,
P. W. Department.

ORDER—dated 5th October 1882, No. 1080A, Revenue.

Miscellaneous.

The Right Honorable the Governor in Council has perused the report of the Committee and the Draft Famine Code accompanying it, with much interest.

They have his approval, and will be transmitted to the Government of India with the following remarks.

2. Paragraph 9. The Secretary to be newly appointed to the temporary Famine Department is proposed to be "the representative of Government" in their correspondence with the Government of India and the Home Government. It is presumed that all that is meant is, that he shall conduct the correspondence of the Department as the other Secretaries do in their respective branches. Correspondence with the Government of India is conducted by the Secretary, but with the Home Government, the Government correspond "by Despatch." There can

MINUTE OF DISSENT BY COLONEL SANKEY, R.E., C.B.

SECTIONS 22 and 50 of this Code read together provide that for the execution of Class (b) works, officers and subordinates of the Public Works Department may, at the request of the Collector, be entirely removed from departmental control and placed solely under his orders. The first-named section, it is true, employs the word "*assist*" in speaking of the services to be rendered by the members of the Department thus transferred, but read with paragraph 50 there can be no question that in practice the transfer from all departmental control would be absolute.

2. Under Section 47, Class (b) are all minor works costing less than Rupees 2,500 and repairs under 10,000 each. Although the majority of such work may, and probably will, be suitable for execution by non-professionals, much of it may, and most of it would be, all the better for being carried out under professional officers when they can be spared.

3. In some Districts where it may be difficult to maintain a sufficient programme of Class (a) works, those under Class (b) would in all probability assume large proportions. It might thus very easily come about that a large number of Officers and subordinates of the Public Works Department would be transferred under the sections quoted.

4. I am quite aware that the Committee have been very desirous to prevent all unnecessary dislocations in the ordinary working of the several Departments in famine, as evinced by their ruling that all Class (a) works are to be carried out entirely by Public Works agency, and I was anxious by a simple, and as I still think, reasonable addition to Section 22, to extend these principles to the execution of Class (b) works.

5. In this view I would omit the words "whether supervised by Civil officers or Public Works officers" and add the following words at end of the section, viz., "but in case any work, or group of such works, may be considered of sufficient importance to require to be executed under the immediate supervision of any of the Public Works staff, it should be transferred to Class (a), and be dealt with by the Executive Engineer of the Division in ordinary course."

6. As the new Public Works Divisions are under Section 14 to cover the whole area in each famine district, this would provide in the most efficient manner for the execution of the works in question, remove all causes of friction, and prevent the dislocation of the Department which must otherwise certainly ensue.

7. That officers of the Engineer Establishment would be extremely useful to Collectors, as general *advisers* and *inspectors* of all petty works during famine, appears to admit of no doubt, and if the section be modified as proposed the word "*assist*" would have its true meaning. In that case, however, it might be better if a specific definition of the duties of officers transferred with the object of assisting the Collector were inserted in Chapter III.

8. As regards Clause 8, Section 50, it might stand as now if at the end were added the words "*see Section 22*" to get rid of any misapprehension.

9. Having unfortunately failed to convince the members of the Committee as to the reasonableness of my amendment, I would willingly have ended my dissent here were it not for the conviction that very important principles underlie my contention, and such I cannot, in justice to the professional Department which I have the honor to represent, allow to pass by default.

10. It has been argued with much force and truth that, there would be no desire on the part of Civil officers particularly at such time, to do anything which would be construed into an interference with professional matters, &c., and I am quite willing to admit that, as a rule, very cordial relations do, and doubtless would exist, between the two Departments; still, from the evidence which has come before me, I am compelled to state, that even with the best intentions, errors arise from insufficient knowledge on the part of non-professional Officers, which might very easily lead to the establishment of the most undesirable relations, and give rise to serious embarrassment.

and about one-fifth of the land revenue are dependent, has been imposed on the already over-worked Revenue officers. In these circumstances, it needs no argument to show that, whatever capabilities may exist for developing the resources of the country, the professional agency in its present condition, is impotent to determine how far they can be utilized, and to maintain in advance the programme of works which the Code lays down as an essential measure of famine relief. As the recent reorganization does not meet the case, inasmuch as the strength of the Department was determined irrespective of the additional duty now imposed on it, we feel bound to urge the necessity of so strengthening the Engineering staff as to enable the Department to meet the requirements of the Code.

10. It will be observed, that at paragraph 122, we have made provision for the occasional employment of the services of contractors, and as strong opinions have been recorded against such a measure, we think it right to offer a few words in explanation of our having gone counter to them. The object of relief on works is to afford employment to the able-bodied labour thrown out of work in time of scarcity by the contraction of the ordinary demand for it, so that it may be preserved in its vigour, and be available for its normal occupation when the pressure has passed away. In previous famines this idea was not sufficiently recognized, and it was almost a cardinal maxim that the able-bodied labourer was not to be employed on a relief work until starvation had rendered him nearly incapable of labour, and in this view of the case, it was probably wise to dispense with the services of middlemen. But in the state of affairs contemplated by the Code, the position is altered materially:—work is to be provided for all comers, and the main difficulty will be to provide the supervision necessary to prevent an abuse of this form of relief, and here the services of a contractor offer an economical and efficient arrangement. As he is paid by results, he will certainly employ able-bodied labour, and it is his interest to maintain his working gangs in good condition, and as a fact contractors were found of great assistance in employing able-bodied labour on the Buckingham Canal and other works in Madras—as also in the earlier stages of the Mysore famine. On these grounds we have made the use of his services permissible, but at the same time we have taken the fullest powers for the protection of the labourers employed by him, who, if dissatisfied with his treatment, can at any time find employment on work conducted under Departmental supervision. In providing for the execution of work under contractors, we have acted on the principle that in time of famine it is inexpedient to disturb to a greater extent than can be avoided the systems to which the people are habituated. Labourers will often work more contentedly and more efficiently under a contractor whom they know than under an officer who is a stranger to them and who cannot understand their requirements so well as one of their own nationality.

11. We have thought it advisable not to lay down any instructions regarding the treatment of subjects of Native States, who may wander into British territory during a famine, leaving it to be inferred that no distinction is to be made between them and British subjects. The reciprocity to be established in regard to this between Her Majesty's Government and that of Native States is, as pointed out at page 61, Part I of the Report of the Famine Commissioners, a matter for the consideration of Government in the Political Department.

We have the honor to be,
Sir,
Your most obedient servants.

H. E. SULLIVAN.
R. DAVIDSON.
W. R. CORNISH.
R. H. SANKEY.
E. FORSTER WEBSTER.
M. C. FURNELL, M.D.
C. D. BAYNES, Lieut.-Col.

however, come to the conclusion that there is not at present sufficient information as to the extent to which State intervention in this direction would be necessary, nor as to how far it would be practicable, to enable us to lay down with any degree of precision the manner in which effect should be given to it. The measure is of a protective nature, the necessity for which must be determined by the enquiry into the economic condition of the people which it will be the duty of the Agricultural Department to institute, and if accepted, it will have to be carried out under ordinary administrative arrangements. It would, therefore, be out of place to lay down directions regarding it in a Code intended to meet the exigencies of an abnormal condition of affairs.

7. Nor do we consider it expedient to frame instructions in regard to the manner in which the Railways should be utilized in moving grain in time of famine.

Carriage of grain by Railways.

Arrangements of this nature must depend greatly on local circumstances and temporary exigencies, and to meet these, Government must issue instructions as they arise, based on the general principles which find expression at pages 172—174 of the Report of the Famine Commissioners regarding the control and management of the traffic.

8. In connection with the movement of grain in season of extreme drought, we have not lost sight of the fact that in past times this was much impeded by

Preservation of cattle in times of drought.

the mortality amongst the draught and ploughing cattle, which also operated seriously against the recovery of the people from the effects of unfavourable seasons after the extreme pressure had passed. We quite recognize the importance of taking every measure for the protection of animal life amongst an agricultural population, and at paragraphs 104 and 105 we have briefly indicated the course to be followed; but the object can be effectually attained only by systematic preparation being made beforehand. To afford facilities for the migration of cattle from the places where fodder is no longer procurable to localities where pasture is to be found is the only practicable method, and where this is obtainable within reasonable distance, the owners of cattle are not slow to take advantage of it. There are, however, extensive tracts of country liable to periodical droughts, which are so remote from perennial pastures that the cattle are at such seasons reduced to the last extremity. To devise means for meeting this difficulty is a measure of protection which should receive early attention at the hands of the Agricultural Department who alone, after careful local enquiry, will be in a position to deal effectually with it.

9. The employment on works of public utility of all able-bodied labour, which in a season of drought is deprived of its usual means of occupation, having been recognized as one of the main features of Famine relief administration, we have prescribed that a scheme of works, which in ordinary seasons would be spread over a period of four years or more, should be prepared and maintained, so that on an emergency arising, projects which investigation has shown to be of permanent utility, and sufficient to employ at least four times the amount of labour usually available, and as much more as may be possible, may be ready to be put in hand at once. In theory this would seem to answer all requirements, but we are not blind to the fact that in the existing position of affairs there are difficulties in the way of giving practical effect to the arrangement. We are given to understand, that in those parts of the Province most liable to periodical affections of drought, there is, according to present information, but a limited scope for the employment of the superabundant labour available in times of famine, on projects calculated to be of permanent benefit to the public. That reliable information on such an important subject should not be forthcoming is, it is believed, due to the numerical weakness of the Department of Public Works. It is a fact that for many years they have from this cause been unable to cope with the ordinary work of the Province. Whole districts have, until recently, been left without any professional supervision, and the duty of maintaining in repair the minor works of irrigation, on which the prosperity of a large proportion of the cultivating community

Preparation of programme of works for execution in time of famine.

class of persons to the poor-house to be there detained, as provided in Section 78, until the famine is at an end. The measure may at first sight seem harsh, but experience has shown it to be a necessity. Poor-houses are not, and are not intended to be, attractive. A sufficiency of food is provided, but no luxuries, and, of course, a certain amount of discipline has to be maintained. The starving man accepts this thankfully for a time, but when his stomach is full and his strength begins to return, the desire to go abroad comes upon him with irresistible force, and if not restrained, he either dies or is brought back in a moribund condition. Moreover, unless residence is enforced, this form of relief is liable to abuse. In the vicinity of towns paupers will come to the poor-house meals, but may in the intervals obtain by begging quite sufficient to maintain them, and of this facility for eating the bread of idleness the professional beggar, who cannot be made to work, is the first to avail himself. Individual liberty in these circumstances was in the late famine found to be so incompatible with an efficient administration of relief that officers took the law into their own hands and enforced residence within poor-house limits. We have, therefore, laid down the procedure which experience has shown to be necessary, and if this is accepted, it follows that those who have to give effect to it must be protected by law. In the evidence taken before the Famine Commission, the necessity for legislation to meet the case was strongly insisted on, and we are advised that in other Provinces, officers competent to form an opinion on the subject are in favour of it.

5. We have had under consideration how the tenants in Zemindari Estates might be enabled to tide over the difficulties caused by an adverse season and to avoid the necessity of coming on the State for relief. At such times, it is evident, that the first duty of a good land-lord is temporarily to forego his claim upon his tenants for rent, in the same manner as the suspension of the demand for land revenue on the part of Government is provided for in Section 92 of the Code. But as the law (Act VIII of 1865) stands at present, it appears to us that a Zemindar, unless he is prepared to forego his claim altogether, is powerless to grant any temporary relief to his tenants. An arrear of rent is defined at Section XIV of the Act to be "rent which shall remain unpaid at the time when according to written agreement or the custom of the country it ought to have been paid," and Section II which prescribes the mode of enforcing payment of arrears provides that "process against a tenant under this Act must be taken *within one year from the time when the rent became due.*" It is evident that the law itself operates against any temporary indulgence being shown by a land-lord to his tenants in time of distress, and until this is remedied it is impossible to impose any obligation on the former. We were at first disposed to submit draft sections in amendment of the Act, in view to meet this difficulty, but as it has long been admitted that the enactment is, in many respects, defective, that it operates injuriously as regards the interests of both land-lord and tenant and leaves the Curnam the master of the situation, we think it sufficient to indicate our view that, when its amendment comes under the consideration of the legislature, provision should be made for guarding the interests of tenants and imposing on land-lords an obligation to assist them in unfavourable seasons.

6. In regard to the storage of grain by the State, we have not thought it advisable to lay down any definite rules in the Code. The majority of the Famine

Storage of grain by the State.

Commissioners have recorded their opinion that it is unnecessary and inexpedient in all cases. The experience of the past precludes our accepting this view unreservedly, and we share the opinion of the minority that there are tracts, which, owing to their inaccessibility, the sparseness and poverty of their population, and other causes, are not at present reached by the ordinary operations of trade, and where in consequence the pressure of scarcity is felt in an extreme degree, when in time of famine the scanty reserves laid in by the people themselves are exhausted. In such places we are inclined to think that, as a temporary expedient, the supplementing of local stocks by the formation of State reserves, either in each village or at convenient centres, would afford facilities for the timely prevention of suffering, and on this ground we are of opinion that the suggestion, which is quite in consonance with oriental ideas on the subject, deserves careful consideration. We have,

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

READ—the following letter from the Members of the Famine Code Committee, appointed by G.O., dated 13th August 1881, Nos. 1188-1189, to the Secretary to Government, Revenue Department, Fort St. George, dated Madras, 1st April 1882 :—

We, the undersigned Members of the Committee, appointed by G.O., dated 13th August 1881, Nos. 1188-1189, have the honour to submit, herewith, draft of a Code containing Rules for the guidance of Officers of all Departments in times of great scarcity or famine.

2. We have endeavoured to arrange that measures of relief in time of famine should be given effect to by an expansion of the ordinary administrative machinery, and the Code has accordingly been framed so as to centre in Collectors, as representatives of Government, all responsibility for the efficient administration of relief measures in their respective Districts. Their position has been strengthened, by the subordination of all Departments to them in every respect except as regards executive detail requiring technical or professional knowledge; and provision has been made for expanding each Department to the extent necessary, to enable it to meet the requirements which may be made on it by the Collector.

3. The general arrangement of the Code is as follows :—

CHAPTER I refers generally to the duties devolving on Government and local officers in connection with the administration of relief—prescribes the special staff to be provided for administrative purposes, and indicates the nature of the measures of relief to be adopted, these being divided into (1) Relief on Works, (2) Gratuitous relief, and (3) other measures of relief.

CHAPTER II contains rules for the guidance of Civil Officers—prescribes the duties of Collectors and the ordinary Revenue staff, and the extent of assistance to be given them, deals with relief on works executed under the supervision of Civil Officers, with gratuitous relief in towns, villages, and poor-houses, and with other measures of relief not coming under either of the above heads.

CHAPTER III contains rules for accounting for famine expenditure by Civil Officers.

CHAPTER IV has reference to the duties of the Public Works Department in its administrative and executive branches, provides for the maintenance of a programme of works, the mode of execution, the system of work, rates of wages, and the nature of reports and returns to be rendered.

CHAPTER V deals with matters medical and sanitary—prescribes the administrative duties devolving on the Surgeon-General and the District Civil Surgeons; the duties of executive medical officers on works, and in charge of poor-houses, provides for measures of sanitation, and concludes with a carefully considered scale of rations suitable for all classes of persons in receipt of State relief.

APPENDIX A contains useful hints for the execution of relief works under Civil Supervision, and for the management of poor-houses and children's kitchens, with the necessary forms of account.

APPENDIX B contains the forms of account and returns required by the Code to which sectional reference is made, and

APPENDIX C the forms of account prescribed in the audit rules.

4. Relief in poor-houses is intended for homeless wanderers and for persons who can, but will not work. In Section 59 we have proposed to send this latter

ENCLOSURE.

STATEMENT showing the Receipts and Charges of the Road Fund of the Local Fund Circles for the Years 1881-82, 1882-83, and 1883-84.

Districts.	Circles.	ACTUALS, 1881-82.			ACTUALS, 1882-83.			ESTIMATE, 1883-84.		
		Receipts.	Expendi- ture.	Balance.	Receipts.	Expendi- ture.	Balance.	Receipts.	Expendi- ture.	Balance.
1. Arcot, North ..	{ Chittoor ..	2,84,292	1,33,274	1,51,018	3,06,666	2,31,349	75,317	2,19,759	1,58,710	61,049
2. Arcot, South ..	{ Vellore ..	2,19,688	89,363	1,30,325	2,21,370	1,36,157	85,213	1,36,960	70,680	66,280
3. Anantapur ..	{ South Arcot ..	3,13,486	2,65,060	48,426	2,64,118	1,99,603	64,515	2,17,900	2,01,940	15,960
4. Bellary ..	{ Anantapur ..	1,11,726	57,330	54,396	1,09,276	98,886	10,390	85,910	78,020	7,890
5. Bellary ..	{ Bellary ..	1,60,254	60,155	1,00,099	1,88,126	1,02,789	85,337	1,49,050	1,07,000	42,050
6. Canara, South ..	{ South Canara ..	1,45,393	1,09,689	35,704	1,63,227	1,36,206	27,021	1,14,790	1,12,800	1,990
7. Chingleput ..	{ Chingleput ..	1,79,127	96,797	82,330	2,43,966	1,72,690	71,276	2,13,700	2,09,120	4,580
8. Coimbatore ..	{ Coimbatore ..	2,92,782	1,73,382	29,350	2,48,987	1,90,755	58,232	1,82,370	1,69,660	12,710
9. Cuddapah ..	{ Cuddapah ..	1,78,060	1,09,292	68,768	1,84,837	1,54,769	30,068	98,410	88,000	10,410
10. Gajam ..	{ Madanapalle ..	70,378	32,638	37,740	96,401	59,705	36,696	43,960	43,130	830
11. Gajam ..	{ Chittoor ..	97,534	50,987	46,547	93,255	55,758	37,497	85,080	81,330	3,750
12. Godavari ..	{ Chittoor ..	1,04,375	90,667	13,708	1,03,722	1,09,995	5,727	95,430	92,880	2,550
13. Kistna ..	{ Godavari ..	3,75,162	1,88,293	1,86,869	3,14,938	1,21,609	1,93,329	2,12,870	1,67,330	45,540
14. Kistna ..	{ Ellore ..	2,01,253	1,16,311	84,942	1,91,058	1,53,861	37,197	1,73,940	1,91,990	41,000
15. Kistna ..	{ Masulipatam ..	3,07,717	2,50,306	57,411	1,05,569	1,58,779	53,210	1,65,770	1,65,030	740
16. Kistna ..	{ Guntur ..	2,53,518	1,08,330	1,45,188	2,34,304	1,47,188	87,116	1,88,970	1,57,780	31,190
17. Kistna ..	{ Guntur ..	96,586	85,499	11,087	1,08,417	86,159	22,258	1,06,340	95,270	11,070
18. Kistna ..	{ Kurnool ..	1,32,714	1,26,523	6,191	1,27,504	1,33,317	5,813	1,41,100	1,36,950	4,150
19. Madura ..	{ Madura ..	73,684	70,768	2,916	98,594	79,885	18,709	87,820	76,630	11,190
20. Madura ..	{ Dindigul ..	3,72,643	2,90,032	82,611	3,91,723	2,02,282	1,89,441	4,08,640	4,08,640	0
21. Madura ..	{ Madurai ..	2,71,397	1,65,189	1,06,208	3,11,058	2,33,809	77,249	2,25,840	2,24,980	860
22. Madura ..	{ Nellore ..	1,28,780	98,123	30,657	1,40,584	1,40,114	470	87,250	79,620	7,630
23. Madura ..	{ Salem ..	2,30,927	1,17,849	1,13,078	2,22,267	1,88,945	33,322	1,55,950	1,34,440	21,510
24. Madura ..	{ Hosur ..	55,204	49,356	5,848	58,747	43,829	14,918	45,210	45,210	0
25. Tanjore ..	{ Tanjore ..	2,93,377	96,836	1,96,541	3,76,185	1,62,272	2,13,913	2,43,410	1,94,230	49,180
26. Tanjore ..	{ Negapatam ..	3,75,695	1,43,132	2,32,563	4,12,643	1,62,031	2,50,612	3,05,130	2,27,500	77,630
27. Tanjore ..	{ Tinnevely ..	2,39,961	1,26,042	1,13,919	2,41,701	1,68,276	73,425	1,62,900	1,33,800	29,100
28. Tanjore ..	{ Shernadevi ..	71,244	65,973	5,271	60,445	50,785	9,660	59,800	59,470	330
29. Trichinopoly ..	{ Trichinopoly ..	1,79,747	1,44,160	35,587	1,50,480	1,13,865	36,615	1,44,120	1,17,680	26,440
30. Vizagapatam ..	{ Vizagapatam ..	3,02,706	1,78,089	1,24,617	2,84,650	1,85,953	98,697	2,28,500	1,71,740	56,760
Total ..		60,20,312	36,86,045	23,34,267	60,42,918	41,72,751	18,70,167	47,55,020	41,52,560	6,02,460

14. We enclose a statement showing the Road Fund assets of each district throughout the Presidency for the last two years, and the estimates for the current year. The last column

Districts.	Total District Road Fund Balance.	Circle Balances.	Circles.
	RS.	RS.	
Tanjore ...	1,26,810	{ 49,180	Tanjore.
		{ 77,630	Negapatam.
North Arcot ...	1,21,320	{ 61,940	Chittoor.
		{ 60,280	Vellore.
Godavari ...	86,540	{ 45,540	Cocanada.
		{ 41,000	Ellore.
Vizagapatam ...	56,760	...	...
Bellary ...	42,050	...	...
Tinnevelly ...	29,100	29,100	Tinnevelly.
Trichinopoly ...	26,440	...	...
	4,89,020	...	

also shows the estimated Road Fund balances of the various districts. From this it will be seen that there are now only seven districts where these balances are estimated to exceed Rs. 25,000 at the end of the current year. They are specified in the margin, with the balance which is estimated to be in hand in each at the end of the said period. These balances amount altogether to nearly five lakhs of rupees, while the whole of the Road Fund balances throughout the Presi-

deney are estimated to amount only to about six lakhs.* As the Local Fund law now

* *Vide* statement accompanying.

stands, these funds, being raised for local expenditure, cannot be expended outside

the limits of the circles in which they are raised. Apart from this law, however, there is nothing in the least inequitable in regarding Local Fund taxation, provided the cess on land is everywhere uniform, as taxation available for expenditure for the general benefit of the Presidency; and if the law were altered to admit of it being done, we think there could be no reasonable objection taken to a rateable deduction from all Local Road Fund incomes for the formation of a Railway Fund, from which to meet, to some extent, the cost of making the Provincial lines we propose. Such a deduction of 6 per cent. on the estimated incomes of all the Road Funds of the Presidency would give a sum of about 2·85 lakhs of rupees per annum; and if this was supplemented by an equal annual grant from Provincial funds, a sum of about 5·70 lakhs of rupees might be made available, which would suffice to pay 4 per cent. interest on 142·60 lakhs, a sum nearly equal to the total cost of all the lines we suggest; or (allowing 2 per cent. for earnings by the lines) 2 per cent. on 285·20 lakhs, a sum far more than sufficient to construct them and nearly enough to admit of the construction of twice that length of line. Or, to put the matter differently, when the proposed lines pay, on an average, 2 per cent. on the whole capital outlay on their construction, an annual contribution of 1½ lakhs from Provincial funds added to a 3 per cent. deduction from Local Road Funds, would more than suffice to pay the remainder of the guarantee.

15. We have laid great stress on the connection of all railway stations with the high-roads nearest to them, but we are aware that in one or more instances Local Fund Boards have objected to make such station-roads unless assisted with Provincial funds; while the Government in G.O., Financial Department, No. 1476 of 1883, have declared that it is opposed to their fixed policy to give grants-in-aid from such funds for such works. When the Local Fund Act first came into force, and for some years after, considerable grant-in-aid allotments used to be made to all districts from Provincial funds; and from these joint funds, in some instances, we believe station-roads were made. We trust we may be permitted to solicit a reconsideration of the order above quoted, for we consider there is no more legitimate way in which Provincial funds can be spent than in carrying out, or in aiding Local funds to carry out, such works, which are of a protective and provincial character as linking the district road-systems with the systems of railways throughout the Presidency.

(Signed) J. H. GARSTIN, C.S.I.
 (") H. L. PRENDERGAST, Colonel, R.E.
 (") C. BOWEN, Major, R.E.,
 (") C. J. SMITH, Lieut.-Colonel, R.E.

struction would involve a break of gauge, while for ordinary purposes of trade such a line would be but little used by native traders, who, for distances of about twenty miles, prefer to use their own, or hired, carts.

9. If the lines of railway above indicated are constructed, and if existing high-roads are maintained in an efficient state, then the improvement of village-roads and the connection of every railway station with the nearest high-road by a well bridged and metalled road, would go far towards placing the communications of the Presidency on a footing which would leave little room for apprehension, in time of famine, on the score of difficulty of distributing food throughout the country. We attach great importance to the extension of railway communication to such secondary commercial centres as most of those above named, mainly because in them already exists the machinery by which the produce of the land is ordinarily collected and stored, and from them already diverge the channels of communication by which the food supply of the country is generally distributed. Not only are these centres of great importance from a famine protection point of view, but in ordinary seasons the premium afforded by the substitution of rail for cart communication could not fail to prove a powerful stimulant to trade. This will be apparent if it be remembered that a spur line forty miles in length would enable goods to be put on to the main line at Rs. 6-0-8 per ton less than by ordinary road.

10. We lay special stress on the connection of railway stations with the high-roads nearest to them, because, unless the railway is thus connected with the high-road system, the construction of railway stations, even of the cheapest kind, is useless to trade; and it is in proportion to the number of stations on a line of railway that the facilities for passenger or goods traffic is great or small. In other words, the utility of railways, such as those in this Presidency, where there is comparatively little long distance traffic, depends greatly on the number of stations upon them.

11. As to the agency by which the works should be carried out, and the source from which the necessary funds should be drawn, we are of opinion that in all cases the works should, if possible, be undertaken by the companies with whose main lines the suggested light railways may be connected. These companies would be in a position to carry out the work more cheaply and quickly than any one else, the best professional supervision and local experience being ready at hand; and would have a direct interest in seeing that the work was well done. If these companies will not undertake the work (which we consider is unlikely) then we would suggest that they might be undertaken by other companies or by contractors, subject to the inspection of the Government engineers.

12. The question of the source whence the necessary funds should be derived, seems to us, under existing circumstances, to admit, generally, of but one answer. The Government of India having refused to carry out these works from Imperial funds the burden must necessarily be borne by Provincial or Local funds, and as, from the replies of the Local Fund Boards given above, it is clear that Local funds are not available, except, perhaps, in one or two instances, there is no alternative but that the burden should be principally thrown on Provincial funds, supplemented, where possible, by Local funds.

13. We estimate that a line of light railway such as we advocate would not cost more than Rs. 35,000 a mile, including rolling-stock and halting-sheds or stations of the simplest character. The total length of line we suggest for investigation is about 370 or 420 miles, according as the line from Pálghat to Dindigul, or that from Karúr to Dharapuram, is selected; which, at the above rate, would cost $129\frac{1}{2}$ or 147 lakhs of rupees, and if either sum were borrowed on a Provincial guarantee of 4 per cent., which we consider is the best plan to adopt, the interest on it would amount to 5.18 or 5.88 lakhs per annum. That the lines will pay something over and above their working expenses, we take for granted; and, assuming that this return will be 2 per cent. on the capital outlay, the whole annual charge to be provided for would probably not exceed 2.59 or 2.94 lakhs.

are other centres, though of less importance, which should be put in direct communication with the existing systems of railway, and that the best method of doing this is by making light metre-gauge railways, with steel rails of 35 lb. to the yard, capable of carrying the rolling-stock of any metre-gauge railway in India, but having engines of a lighter type than those generally used on such main lines. These railways could be laid on existing roads, where practicable, and elsewhere on independent embankments. The routes to be followed, or the lines to be constructed, as above suggested, should, we consider, be some or all of the following, subject, of course, to further detailed investigation:—

In Bellary.

- (1.) From Guntakal *via* Anantapur, Dharmavaram and Penukonda to Hindupur, about 100 miles.

In North Arcot.

- (2.) From Vellore *via* Arni and Pólúr to Tiruvannámalai, about 60 miles.

In South Arcot.

- (3.) From Villupuram to Tiruvannámalai, about 30 miles.
(4.) From Porto Novo *via* Vriddháchalam to Kallakurchi, about 60 miles.

In Coimbatore.

- (5.) From Karúr to Dhárápúram, about 50 miles, or,
From Pálghat to Dindigul, about 100 miles (of which about 60 would be within the Coimbatore district and the rest in Madura).

In Madura.

- (6.) From Madura to Ramnad and Kilakarai, about 70 miles.

As regards the Ganjam and Vizagapatam districts, we think the construction of no light lines of railways in them need be considered until the State line from Vizagapatam to Raipur has been opened and its effect on trade ascertained. As regards the Kurnool district, we consider that, when the railway from Bezváda through Nandyál to Guntakal is finished, there will be no need for any railway to Kurnool, seeing that that town is in direct communication by canal with Nandyál. We think it likely that the line we suggest from Porto Novo to Kallakurchi (No. 4) will be the one which will be recommended by the South Arcot Local Fund Board at their next meeting, when the question is to be discussed. We note that there is a large area of unprotected country in the eastern part of Madura regarding which we make no proposals, because it is chiefly foreign territory which has no claim on Local or Provincial funds. We refer to the Native State of Pudukóta. We think a line of rail to connect Tanjore with Pudukóta would be decidedly advantageous, but it is a line, the making of which, we think, may be deferred till the time referred to in paragraph 8 of the Government of India letter, of 28th April 1883, No. 364 R.C., when the further development of the system of constructing minor distributaries from Imperial Protective funds may be again considered. We have not suggested any line for the protection of the western taluks of the Bellary district, because when the lines from Bangalore *via* Tumkur and Tiptur to Hubli, and from Bellary to Hubli, now in progress, are finished, those taluks will be dominated by these two lines of regular railroads. Nor have we suggested any line in Tinnevely, because we understand the Madras and Travancore Governments contemplate constructing an extension of the South Indian Railway from Tinnevely to Quilon *via* Tenkási and Shencotta, and we do not consider a line from Tinnevely to the south-east coast needed as a protective work. As a rule we consider that it is useless to make any line, even as a famine protective work, that is not at least about thirty miles long, especially when its con-

seventy-six miles long is needed, but they do not say how it is to run. They are unwilling to borrow money to make it, but would borrow to make three short lines : (1) from Jangalapuram to Kistnagiri (18 miles) ; (2) from Mórappár to Dharmapuri (17 miles), and (3) from Kelamangalam, *via* Hosúr, to some point in Mysore territory (15 miles). The utmost they can guarantee is Rs. 8,000 a-year. They prefer to have the works carried out by a company.

The Salem Circle Board consider light railways are needed, the existing roads not being sufficient. They are ready to borrow and carry out the works which they would construct themselves. The largest guarantee they would afford to make is Rs. 25,000 a-year. The lines they propose are—

1. From Suramangalam (Salem railway station) *via* Salem to Námakal (35 miles).
2. From Tirupatúr to Kistnagiri (26 miles—10 in the Salem Circle and 16 in the Hosúr).
3. From Suramangalam to Ahtúr (35 miles).

They suggest trying a tramway, laid on the existing road to Námakal, as a first experiment, and consider it would pay 5 per cent.

Tinnevelly.—The Tinnevelly Circle Board are in favor of a steam tramway from Tinnevelly to Kayalpatnam and Kulasekharapatnam. They decline to borrow money to make the line, but will guarantee up to Rs. 20,000 a-year to a private company.

The Shermádevi Circle Board consider their circle is naturally protected from famine. A slight addition to existing roads would suffice for all purposes.

The Collector thinks that a railway should be made from Tinnevelly *via* Nagerecoil and Trivandrum to Quilon ; and that the line suggested by the Tinnevelly Local Fund Board is impracticable.

Vizagapatam.—The Circle Board say they cannot afford to pay for railways. Their circle wants more roads, to make which they are prepared to borrow money and repay it by annual instalments of Rs. 55,000, provided they are allowed to put tolls on them as recommended by Mr. Goodrich in his letter, of 21st September 1877, No. 762.

The Superintending Engineer of the First Circle (Ganjam and Vizagapatam) is in favor of a light railway, worked by mechanical power, from Gopálpúr nearly to Russellkondah on the existing road. Between Aska and Gopálpúr the traffic is very heavy and the line would, he thinks, probably pay between those points. He also suggests a tramway from Calingapatam up the valley of the Vamshadara to near Gunapúr.

The Superintending Engineer of the Second Circle has not answered the reference made to him.

The Superintending Engineer of the Third Circle (Bellary, Anantapur and Kurnool) is opposed to light railways or tramways except in towns and thickly populated districts. He thinks, however, the suggestion of the Kurnool Local Fund Board, that Kurnool should be connected by rail with the railway from Bezváda to Guntakal, is worthy of consideration.

The Superintending Engineer of the Fourth Circle (Coimbatore, Salem, North Arcot, Nilgiris, Malabar and Canara) is in favor of metre-gauge railways on independent embankments, worked by steam-power. He advocates a line to run from Satyamangalam down the valley of Bhaváni to Erode.

The Superintending Engineer of the Fifth Circle is a member of our Committee.

The Superintending Engineer of the Sixth Circle (Tinnevelly, Madura, &c.,) gives no opinion on the engineering question ; but considers that, if Government do not carry out the Madura-Ramnád railway, the Local Fund Board should not do the work unless the zemindars, through whose estates it would pass, give a considerable part of the guarantee.

8. We have given the matter submitted to us our most careful consideration and beg to answer the questions put to us by Government as follows :—

We are of opinion that, while the majority of the great centres of production and consumption in this Presidency, south of the Kistna river, are already either connected by rail or about to be so, or are so close to some existing line as to leave little room for anxiety regarding the supply of food to them in time of famine, there

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Railway.

Read the following paper :—

From the President and Members of the Railway Committee, to the Secretary to Government, Public Works Department, dated Madras, 24th October 1883.

We have the honor to submit the report called for in G.O., Public Works Department, No. 2062 W., dated 30th July 1883.

2. With their letter, No. 130 W., of the 18th December 1882, the Government of Madras submitted to the Government of India a scheme for the construction of light railways as protective works in the tracts of this Presidency liable to famine. The scheme involved the selection of 1,000 miles of existing roadway within the famine zone and their preparation to receive the permanent-way of any rail system that it might be decided to lay down on them, by widening, metalling, and otherwise improving them ; and, subsequently, the laying down of light rails, weighing 20 pounds to the yard and with a gauge of two feet, on such improved roads. It was estimated that it would take forty years to complete the whole of the works involved in the scheme, and it was pointed out in the Chief Engineer's note of the 11th November 1882 (on which the proposals were based) that every mile of such improved road would, even without the rails, be so much gained, and, were scarcity or famine to recur in the interval, the work would all be of a character well adapted for affording relief. The funds required for carrying the scheme into effect were proposed to be provided from the Imperial Protective grant, under a new sub-head in the budget of "Famine Roads."

3. The Government of India, in their letter of the 28th April 1883, No. 364 R.C., condemned the scheme, remarking that it would be a fatal mistake, until the main arterial protective lines were finished, to expend Imperial funds on detached tributary lines of the lightest types, which, however much they might benefit the tracts they immediately served, were incapable, from their very character, of coping with the exigencies of a severe famine affecting large areas of country and a vast population. At the same time they pointed out that light railways and metalled roads were unquestionably valuable auxiliaries for the mitigation of distress in times of scarcity, but that it was the duty of the Local Government to provide them.

4. Thereupon, the Madras Government appointed us as a Committee to report on two points—

1st.—The best method of connecting the great centres of production and consumption with the main arterial protective lines to which the Government of India refer as having the first claim on the Imperial exchequer, and the routes to be followed.

2nd.—The agency by which the work should be done, and the source whence the necessary funds should be drawn.

In connection with the first point we were directed to consider whether mechanical power should be substituted for animal draught ; and, if so, whether road-engines working on the high-roads or steam tramways or light railways would be preferable ; and, in the event of the railways being preferred, whether they should be of the metre or two-foot gauge.

5. We, accordingly, placed ourselves in communication with most of the Local Fund Boards throughout the Presidency, and invited an expression of their views on the following points, so far as their respective circles were concerned :—

- (a) Was it expedient or necessary for the better supply of food in times of famine, either from or to the circle, that light railways or tramways should be made to connect the centres of production and consumption within the circle with existing or proposed lines of railway, or would the existing high roads suffice if kept in good order.
- (b) If the Board were in favor of constructing light railways or tramways, were they prepared to borrow money to pay for them, even if they might not be shown to be remunerative.
- (c) If prepared to borrow, what was the largest sum they could guarantee to pay the interest on the amount borrowed.
- (d) Would the Board prefer to carry out the works themselves or leave it to a company working under a guarantee.

The replies to the circular letter containing the above queries were to be forwarded to us through the Superintending Engineers of the various circles, who were requested, in forwarding them, to favor us with their own views on the matter.

6. We have now received answers from all the Local Fund Boards and from most of the Superintending Engineers addressed, and subjoin a précis of them for the information of Government. We did not address the Nilgiri or South Canara Local Fund Board, because the physical character of the former district precludes the making of cheap railways, while from the position and never-failing rainfall of South Canara we considered that district might be looked on as not needing any means of communication as a protection against famine. Nor did we invite the opinions of the Local Fund Boards of the Cocanada, Ellore, Masulipatam, Cuddapah, Chingleput, Tanjore, Negapatam, or Trichinopoly circles, because in the five first-named circles there seemed to be little room or need for making railways, while each of the two last-named districts has three lines of railway radiating through it from its chief town, and because, owing to their fertility and relatively small areas, they are less likely to suffer from famine than other districts in the south of India. Moreover, the Tanjore Local Fund Boards have already given a very practical reply to the question now under consideration, by resolving, some months ago, to construct a metre-gauge railway, out of Local Funds, from Máyavaram *via* Tiruválúr to Mutupet. We may here remark that, when we drafted our circular letter to the Local Fund Boards we were not aware (owing to the absence on tour of Colonel Shaw-Stewart, the Consulting Engineer for Railways and a member of the Committee,) of the existence of the letter from the Government of India of the 28th April 1883, No. 363 R.C., which excludes from present consideration, as lines to be constructed from Imperial funds, the lines of

1. Párvatipur to Calingapatam.
2. Gopálpur to Sonpur.
3. Vellore to Chittoor and Madanapalle.
4. Vellore to Villupuram.
5. Tadpatri to Mysore frontier.

lines from Pálghat to Dindigul and from

* Letter from the Government of India, dated 28th April 1883, No. 363 R.C., printed in G.O., of 1st June 1883, No. 556 R., Public Works.

railway noted in the margin, which we had understood were likely to be so constructed, and to which we had referred in our letters to the various Local Fund Boards as lines likely to be made by Government. We also alluded to the Madura to Ramnad as being likely to be taken up by Government, but we now understand that this is not so.*

7. The following is the précis of replies above referred to :—

Anantapur.—The Local Fund Board consider that, if a railway is made by Government through the district to the Mysore frontier, the existing roads will suffice for some time to come.

Arcot (North).—If a railway is made by Government from Villupuram *via* Tiruvannámalai, Vellore, and Chittoor to Madanapalle, the two Boards of the district (Vellore and Chittoor) consider that no branches to that line are needed, as the existing roads will suffice; but if Government will not make the railway, then they are

willing to guarantee Rs. 50,000 a year between them towards the interest on the cost of making a line of light railway from Chittoor *via* Vellore to Arni.

Arcot (South).—The Local Fund Board think a light railway is needed to supply the western taluks of the district in time of famine, but do not say how it should run. They are not prepared to borrow money for the work, and will only guarantee Rs. 25,000 a year to a company approved by Government.

Bellary.—The Local Fund Board consider that the existing roads are not sufficient to protect the western taluks in famine time, and suggest two lines of railway or tramway—

- (1.) From Hospet *via* Harpanahalli to Daggavati on the Mysore frontier.
- (2.) From Bellary to Rayadrug.

They are unable to guarantee anything and decline to borrow money to carry out either work.

Coimbatore.—The Local Fund Board consider that, if Government will make a railway from Palghat to Dindigul, existing roads will suffice as feeders; but it would be an advantage if a tramway is laid down from Satyamangalam *via* Avanashi and Palladam to the said line. They do not think it would pay, however, and they would not attempt to borrow money to make it.

Cuddapah.—The Madanapalle Board are of opinion that light railways are needed between Tirupati and Rayachoti, and between Rayachoti, Kadiri and Madanapalle. They cannot, however, afford to incur any of the expense of making the lines.

Ganjam.—The Chatrapur Circle urge the necessity of making a light railway from Gopalpur *via* Aska to Russellkondah, to be prolonged to Sompur in the Central Provinces, a total distance of about 140 miles, of which seventy would lie within the limits of the circle. They believe the line would pay, but not having funds available they cannot guarantee anything.

The Chicacole Board recommend light railways being made from Parlakimedi to Calingapatam, a distance of thirty-five miles, and from Jalmur to a point on the proposed line from Parvatipur to Calingapatam, a distance of fifteen miles. They object to tramways and are unable to make any guarantee, not having funds.

Kistna.—The Guntur Board consider that neither railways nor tramways are needed, and they cannot afford to pay for them.

Kurnool.—The Board are in favor of a tramway from Kurnool to the nearest point on the line of railway from Bezvada to Guntakal, to be carried out by unguaranteed private enterprise.

Madura.—The Madura Circle Board think that, if the Government make a line of railway from Madura to Ramnad, the existing roads will suffice to bring centres of production and consumption into connection with it.

The Dindigul Circle Board are in favor of a light railway from Ammayanayakanur to Periyakulam, but cannot afford to undertake the work themselves.

Malabar.—The Local Fund Board, adopting generally the views of the President, consider the district is practically safe from famine, and that neither light railways nor tramways are needed to bring the centres of production into connection with the existing lines of railway; but, in order to facilitate the export of the surplus produce of the district, they advocate two lines of light railway—

- (1.) From Shoranur to Cochin, and
- (2.) From Tellicherry *via* Coorg to Mysore.

There are no Local Funds available, however, to pay for these lines.

Nellore.—The Local Fund Board declare their readiness to connect centres of production or consumption by good roads with any line of railway which may be made, but do not consider light railways or tramways suitable for the district except between Nellore and Kistnapatam, between which two places they are willing to make a tramway.

Salem.—The Hosur Circle Board consider existing roads insufficient in time of famine, owing to the then existing want of cattle. They consider a light railway

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1883) Madras.

PUBLIC WORKS.

Dated July, 30th.

Recd.

Encl.

G.O., 30th July 1883, No. 2062 W.

JULY.

Light Railways

Appointing a Committee to report on questions connected with the scheme for the construction of — as protective works in tracts of the Madras Presidency liable to famine.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—again G.O., dated 18th December 1882, No. 3346-7 W., Public Works.

READ—also the following papers :—

Proceedings of the Board of Revenue, dated 5th January 1883, No. 10.

Read—the following letter from J. G. HORSFALL, Esq., Collector of Kistna, to the Secretary to the Board of Revenue, dated Masulipatam, 6th November 1882, No. 2840 :—

In accordance with paragraph 17 of Board's Proceedings, No. 2230, dated 7th September 1882, I have the honor to bring to the recollection of the Board the project for a railway or tramway from Bezvada to Hyderabad.

2. This scheme has been discussed more than once as is known to the present Acting Third Member of the Board.

3. From Bezvada, connected by canal with Cocanada, Masulipatam and Madras, the line would pass on the left bank of the Kistna, crossing only two tributaries—the Muniru and Pálér—which would not present very great difficulties, and then would traverse the Nizam's territory. A glance at the map will show that no difficulty in the construction of this line need be apprehended there. No large river need be crossed, and a comparatively level trace can doubtless be made winding among the undulating hills of the Deccan.

4. The line would pass by the important trading town of Jaggayapet. Opium and other goods from Central India would find their way to the coast, and the salt and rice of the Kistna District would take this route inland. It seems strange that the line was not made long ago.

5. The Nizam's Government are, I understand, about to construct a line from Hyderabad to Chanda. This would considerably shorten the proposed line from Bezvada, which need only to be carried to the nearest point of the Chanda line.*

* Probably one hundred miles.

6. The Singareni coal-fields in the vicinity of Varangal would not be far to the north of this line.

7. The Famine Commissioners when here appeared to be favorably impressed with the proposal.

8. A recent paragraph in the newspapers stated that among the projects before the Government of India was one for a railway from Kurnool to Guntúr. That would be of little use except in famine years, but the line I suggest would be profitable in favorable as well as unfavorable years.

Resolution—dated 5th January 1883, No. 10.

Submitted to Government in continuation of Board's Proceedings, dated 7th September 1882, No. 2230.

2. The line from Bezváda to Hyderabad, now proposed by the Collector, was, with other lines, discussed in the papers printed with G.O., dated 20th September 1871, No. 2396, Public Works Department, and it was also reported upon by the Consulting Engineer for Railways in his letter printed in G.O., dated 19th September 1868, No. 2967, Public Works Department.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Secretary.

Proceedings of the Board of Revenue, dated 5th January 1883, No. 13.

Read—the following letter from J. LEE-WARNER, Esq., Acting Collector of Nellore, to the Secretary to the Board of Revenue, dated 15th December 1882, No. 6727 :—

With reference to the Board's reminder in memorandum, 7th December 1882, I have the honor to express regret that it had escaped my memory that a reply was expected to Board's Proceedings, dated 7th September 1882, No. 2230. Since I have joined the district my attention has been drawn to the advantages of a line of road connecting Nellore with the Madras Railway almost direct *via* Podalakur and Rápúr, and I would certainly propose to add this one to the lines suitable for a tramway suggested by my predecessor. It should be observed that the experience gained by this year shows that the East Coast Buckingham Canal cannot be depended upon at all in times of drought. The Canal Officers can say what they please as to water-level having been abnormally low in the Pulicat lake, and so on and so on; but the fact remains that during the most important months of this year, when the merchants wanted to export their goods to Madras, the Buckingham Canal failed. Again, as soon as heavy freshes came down the rivers in November, the canal became so silted in places that it became impassable for days together. Traffic between Kistnapatam and Kottapatam (Ongole), suspended since the 28th November, is only just re-opened. A great advantage of this route now proposed is that it encounters no cross drainage, if the Kandleru is excepted; and even where the Kandleru has to be crossed, that stream is only in its infancy, and therefore not a very formidable obstacle. The only difficulty of any magnitude is the last mile of the ghât over the Rápúr pass, and no doubt the Engineers will find an easy mode of surmounting that.

Resolution—dated 5th January 1883, No. 13.

Submitted to Government in continuation of Board's Proceedings, dated 7th September 1882, No. 2230.

2. The reminder was sent to the Collector by a clerical error, but the Board are glad to receive Mr. Lee-Warner's suggestions.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Secretary.

Proceedings of the Board of Revenue, dated 5th January 1883, No. 14.

Read—the following letter from H. W. BLISS, Esq., Commissioner of Salt Revenue, to the Secretary to the Board of Revenue, dated Madras, 11th December 1882, No. 13754 :—

I have the honor to furnish the report called for in the last paragraph of the Board's Proceedings, No. 2230, dated September 7, 1882, which was inadvertently overlooked until the receipt of a reminder.

2. The following, of those mentioned by the Board, are the steam tramway lines, the construction of which seems to me most likely to be beneficial to the salt trade :—

Nellore.—Iskapalle or Krishnapatam *via* Sangam and Dornal Pass into Cuddapah.

South Arcot.—(1) Merkanam to Sámalpati, (2) Cuddalore *via* Kallakurchi, Chinna Salem and Atúr to Salem.

Madura.—Madura to Ramnad and Pámban (with a branch to Kíllakarai and possibly another branch to Devipatam).

3. To these I would add—

Tanjore.—Nídámangalam *via* Mannárgudi to Mutupet and Adirámpatnam.

Tinnevelly.—Tinnevelly (Railway Station) *via* Palamcottah, Pudugudi (Srívai-kuntham), Alvár Tinnevelly and Arumuganeri (salt-pans) to Káyalpatnam (port) and Tiruchendúr (great place of pilgrimage).

4. I think the usefulness of these two lines is obvious. They would carry grain towards the coast and salt from it, and passengers both ways. The passenger traffic between Mutupet and Káyalpatnam on this side and Cingalese ports on the other is, I believe, very considerable. On the whole, I should say that these two lines are as likely to pay as any which could be named. It is, at all events, certain that the Tanjore and Tinnevelly Local Fund Boards are at least as well able as those of any other district to guarantee interest on the cost of constructing tramway lines if that method of raising capital for their construction should find favor, as I think it should do.

5. With regard to the connection of Kurnool with the coast, which appears a most desirable preventive measure in the event of famine, I beg to point out that the Government of India has already ordered the survey of a line from that district to Guntúr. The line selected would presumably be from Kurnool by the existing pass through the Nallamalai Hills to Cumbum, and thence *via* Podili and Darsi; and the object would be to connect Kurnool with the deltas of the Kistna and Godáviri, where food-supplies should never fail. But Guntúr is, if I mistake not, separated by some distance from the deltaic tracts and from the canals by which their produce should be brought to the railway. It also appears to me a matter of importance that lines running inland should have a terminus at the best available port on the coast. I would therefore suggest, as an alternative route for this line, that it should run *via* Podili to Ongole, and thence turn northward to Ipurupálem, a good anchorage and a place already of sufficient trade for it to be worth while for the British India steamers to call there pretty regularly. With a very slight detour such a line would touch Kanuparti, whence the transport of salt into Kurnool and Bellary would then be greatly cheapened; and at its crossing of the Commamur Canal (possibly over the bridge already sanctioned on the road from Inkole to Chinna Ganjam) would communicate in the easiest manner with the whole navigation system of the East Coast, delivering direct into the canal boats the timber of Kurnool and receiving from them the rice of the two deltas. It may be that Guntúr is only intended as the temporary terminus of the Kurnool line; but I do not see how such a line can possibly pay, or even fulfil its purpose as a protection against famine, unless it is at least extended so as actually to join the great system of inland communication formed by the navigable canals branching from the Kistna and Godáviri rivers and by the Buckingham Canal, which traverses the whole length of the Nellore District. I may add that I believe Mr. Wilson, who is intimately acquainted with the Kistna District, has given considerable attention to the capabilities of the port of Ipurupálem, and would be able at once to say how far my idea that it is the natural terminus of the Kurnool line is correct.

Resolution—dated 5th January 1883, No. 14.

Submitted to Government in continuation of Board's Proceedings, dated 7th September 1882, No. 2230.

2. The Board have consulted Mr. Wilson regarding the capabilities of the port of Ipurupálem, and learn that he is of opinion that since the opening of through com-

munication by canal between Cocanada and Madras the prospect of its becoming a port of any importance has entirely disappeared; the steamers of the British India Steam Navigation Company have long ceased to call there. On the other hand, three villages of the Guntūr Taluk are situated within the Kistna Western Delta, and the town of Guntūr is only nine miles distant by a good road from the through canal.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Secretary.

READ—again G.O., dated 25th April 1883, No. 361 R., Public Works.

READ—also the following letter from Colonel W. S. TREVOR, R.E., Secretary to the Government of India, Public Works Department (Railway Construction), to the Secretary to the Government of Madras, Public Works Department, dated Simla, 28th April 1883, No. 364 R.C. :—

I am directed to acknowledge the receipt of your letter, No. 3347 W., dated 18th December 1882, forwarding, for the favorable consideration of the Government of India, certain documents containing proposals for a scheme of light railways to be constructed as protective works in the tracts of the Madras Presidency liable to famine. That scheme is summarised in the 55th paragraph of the Chief Engineer's Note, dated 11th November, which forms one of the accompaniments to your letter.

2. From the summary it would appear that nothing more definite than the bare outline of a general policy for the gradual improvement of the means of inland communication within the so-called famine zone has yet been matured.

3. It would further appear that the intention is to carry out these improvements from funds to be provided out of the Imperial protective grant under a new sub-head of "Famine Roads." The contributions from this source are to begin with one lakh in 1883-84, and to increase thereafter by one lakh annually until a maximum outlay of five lakhs per annum is reached.

4. It is also contemplated that the improvements under the scheme shall be limited to an aggregate of 1,000 miles of reformed roadway, and that in the first instance these improvements shall be confined to widening, metalling and otherwise improving as many of the selected lines of road as possible for the reception of permanent-way of such character as may hereafter be decided on. But, except for purely experimental purposes on a small scale, and as a reserve against possible contingency of severe scarcity or famine, no expenditure is to be incurred on the provision of permanent-way or rolling stock until the complete reformation of all the roadways embraced by the scheme has been effected.

5. Finally, it is expected that these operations will extend over a period of forty years, at the close of which term it is hoped that the whole of the 1,000 miles of road under treatment will have been converted into light railways or trams on the 2 feet gauge; though the final process of conversion will not practically begin until at least ten years after the scheme has been set on foot, that time being apparently needed to carry out the preliminary operation of putting the selected roads into proper order for the reception of the permanent-way.

6. If the above summary correctly expresses the character and scope of the proposals submitted for the approval of the Government of India, I am to say that His Excellency the Governor-General in Council regrets his inability to accept them. In the first place, His Excellency in Council is not prepared to relieve the provincial and local revenues of the obligation legitimately devolving on them to provide for the construction, improvement and maintenance of provincial and local roads at the expense of the general revenues of the empire, on which the burden of the protective grant falls.

7. Moreover, the application of funds from that grant to the construction of isolated tramways, or even light railways in short lengths for the exclusive benefit of a few restricted localities, is a measure which does not commend itself unreservedly to the Government of India. Until the main arterial protective lines, traversing trade-locked districts and connecting them with the great centres of production and consumption, have been made, it would, in the opinion of the Government of India, be a fatal mistake to expend the not too plentiful resources at its command on detached distributary or feeder lines of the lightest types, which, however much they might benefit the tracts they immediately serve, are incapable from their very character of coping with the exigencies of a severe famine affecting large areas of country and a vast population.

8. After the main arterial lines, projects for which are already under preparation, have been made through the most exposed tracts, and substantial security for an adequate supply of food being thrown into them on emergencies within reasonably accessible distances of the more populated parts has been afforded, the policy of applying the protective funds to the further development of the system by constructing minor distributaries to carry those supplies into the remoter villages may perhaps be considered. But until that desirable consummation is reached, I am to say that the Government of India cannot pledge itself to provide funds from Imperial sources for the prosecution of works which are essentially of a kind to be undertaken either directly by the Provincial Government itself or through the agency of Local Boards.

9. I am to observe, however, that though the Government of India is not prepared to take upon itself the financial responsibility of the scheme now submitted to it, it does not disapprove of the principle of adding to and improving internal communications on a systematic plan. Light railways and metalled roads are unquestionably valuable auxiliaries for the mitigation of distress in times of scarcity, as well for the general development of trade and prosperity in ordinary times. But it is the duty of the Local rather than of the Imperial Government to provide such auxiliaries.

10. To help the Local Government to carry out its object with the resources at its own command, the Government of India would be prepared to consider the propriety of any changes in the law which may be requisite in order to allow of Local Boards guaranteeing, under due control and to a limited extent, interest for works constructed by private agency in their districts. It must, however, be carefully considered in each case whether the system of guaranteeing interest to a private company is or is not preferable to a system under which the Boards would borrow direct and construct the lines without the intervention of any such agency. Under the revised rules of the Act of 1879 such local authorities are, moreover, not restricted to remunerative works in their borrowing. They already possess, therefore, the powers to raise the necessary funds for carrying on these protective works, and it seems to the Government of India that this power might with advantage be exercised for so beneficial an object, under the general controlling authority of the Local Government. I am, however, to explain that the above remarks are subject to any decision which may be arrived at on the question of railway policy in general, upon which the Government of India are in correspondence with the Secretary of State.

11. In conclusion, I am to say that His Excellency the Governor-General in Council will await any further proposals that the Government of Madras may have to make in respect to this matter.

G.O., dated 28th June 1883, No. 1335, Financial.

ORDER—dated 30th July 1883, No. 2062 W., Public Works.

In their letter of the 28th April 1883 recorded above, the Government of India reply to the proposals which have been laid before them for a scheme of light railways to be constructed as protective works in the tracts of the Madras Presidency liable to

famine. That Government are not, it is stated, prepared to undertake the financial responsibility of a scheme of auxiliary lines such as that recommended, but would be willing to help the local Government by considering the propriety of any changes in the law requisite to allow of Local Boards guaranteeing, under due control and to a limited extent, interest for works constructed by private agency within their circles.

2. As regards main lines of communication which the Government of India consider should first be undertaken, Railway Surveys are, it is observed, in active progress, and these will provide, so far as can now be judged, all that is needed in the way of trunk lines in the famine zone.

3. The immediate subjects for consideration therefore are—

(1) the best method of connecting the great centres of production and consumption with these main lines, and the routes to be followed ;

(2) the agency by which the work is to be done, and the source whence funds are to be drawn.

4. Under Item (1) should be considered whether it will be advisable to substitute mechanical power for animal draft, and, if so, whether it would be desirable to apply such power in the form of road-engines or steam-engines working on tram or light railways applied to existing roads improved for the purpose, or to light railways carried on independent embankments.

5. Should the preference be given to light railways, it is also for consideration whether the gauge should be the metre, or 2 feet.

6. To deal satisfactorily with these questions the Government resolve to nominate the following officers, who will form themselves into a Committee for the purpose, with power to add to their number :—

J. H. Garstin, Esq., C.S.I., President.	} Members.
Colonel J. H. M. Shaw-Stewart, R.E.,	
Colonel H. L. Prendergast, R.E.,	
Major C. Bowen, R.E.,	

7. The Committee will have power to take evidence *visà voce*, if necessary, from Collectors and Superintending Engineers, and to call on those officers to furnish reports direct. The latter will probably be preferable.

8. As regards Item (2), there seems little prospect of the ordinary establishment or resources of Government or Local Fund Boards being available to the required extent, but it would appear that by revised rules issued by the Government of India under the Local Loans Act, it will in future be practicable for Local Fund Boards to raise funds for works which are not strictly remunerative. The removal of this restriction by putting it in the power of Local Boards to open out lines of communication which, though unremunerative as a commercial investment will be useful in ordinary times, will doubtless to a certain extent facilitate the distribution of food in seasons of scarcity. The Committee should endeavour to ascertain how far local bodies may be depended on to co-operate in this direction with the State for the object in view.

9. The report of the Committee should reach Government not later than the middle of October.

(True Extract.)

(Signed) R. H. SANKEY, Major-General, R.E.,
Secretary to Government, P.W.D.

To the Members of the Committee.
„ Superintending Engineers.
„ the Consulting Engineer for Railways.
„ the Financial Department.

Exd. A. F. Goodall.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1883) Madras.
PUBLIC WORKS.

Dated July, 30th.

Recd.

Encl.

G.O., 30th July 1883, No. 2062 W.

JULY.

Light Railways

Appointing a Committee to report on questions connected with the scheme for the construction of — as protective works in tracts of the Madras Presidency liable to famine.

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1882) Madras.
PUBLIC WORKS.

Dated December, 18th.

Recd.

Encl.

18th Dec. 1882, No. 3347 W.

DECEMBER.

No. 130.

Tramways or Light Railways.

CONSTRUCTION OF — as protective works against famine.



18TH DECEMBER 1882, No. 3347 W., PUBLIC WORKS.

PUBLIC WORKS DEPARTMENT

Buildings and Roads,
Civil Works.

No. 130.

LETTER—from

COLONEL R. H. SANKEY, R.E., C.B.,
Secretary to the Government of Madras, Public Works Department,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,
PUBLIC WORKS DEPARTMENT.

SIR,

With reference to the correspondence quoted in the margin, I am now directed to forward, for the favorable consideration of the Government of India, the accompanying papers containing proposals for a scheme of light railways as protective works in the tracts of this Presidency liable to famine.

To Government of India, No. 1697 W., dated 9th July 1881.
G.O., No. 2018 W., dated 17th August 1881.
From Government of India, No. 437 I., dated 12th November 1881.
To do., No. 2965 W., dated 28th Nov. 1881.
From do., " 381-94 M., " 30th " "
To do., " 3198 W., " 31st Dec. "
From do., " 163 M., " 6th May 1882.
To do., " 466 L., " 13th June "
From do., " 161 M., " 6th May "
To do., " ¹⁴⁷⁵/_H W., " 13th June "
From do., " 270 M., " 5th Aug. "

2. The scheme for adapting 1,000 miles of selected existing roads within the famine zone as proposed in the Chief Engineer's Note accompanying these Proceedings was brought in a general manner under the notice of the Finance Minister, who seemed to think that the time named for completion of the scheme, viz., 40 years, was excessive, and that it might with advantage be abridged. There can, in the opinion of the Governor in Council, be little doubt as to the great advantage of completing a scheme of this kind in the shortest possible time, as, notwithstanding the generally poor country through which the railways will be carried, it is not improbable that owing to the economical style of construction recommended, the lines may prove to some extent remunerative.

3. In any case it is desirable that the matter should be taken up as early as possible, and I am accordingly to request that the orders of the Government of India may be communicated in time to admit of work being commenced next official year.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

FORT ST. GEORGE,
18th December 1882.

Exd. S. T. Austin.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1882} Madras.
PUBLIC WORKS.

Dated December, 18th.

Recd.

Encl.

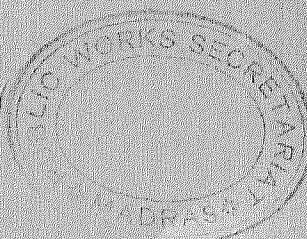
G.O., 18th Dec. 1882, No. 3346 W.

DECEMBER.

Nos. 128-129.

Tramways or Light Railways.

Construction of — as protective works
against famine.



GOVERNMENT OF MADRAS.
PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

No. 128.

READ—the following paper :—

Note by the Chief Engineer, Public Works Department, dated 11th November 1882, submitting papers on the subject of Tramways or Light Railways as protective works in Famine Tracts.

No. 129.

ORDER—dated 18th December 1882, No. 3346 W., Public Works.

The question of constructing tramways or light railways as protective works against famine has been engaging the attention of Government, and with his Note recorded above the Chief Engineer submits the results of the enquiries which have been made.

2. The information obtained is sufficiently complete to admit of some practical advance being made. The Right Honorable the Governor in Council accordingly resolves to forward the papers for the orders of the Government of India, with an expression of concurrence in the recommendations made by Colonel Sankey in paragraph 55 of his note.

3. The Government anticipate the best results from the extension of communication by means of light railways if constructed on the most economical principles. It is an admitted fact that even in the more favored localities traversed by the Madras and South Indian Railways, the traffic requirements would be sufficiently met by lighter and more economical means of conveyance than those which have been provided. It would thus be most unwise to construct similarly costly lines for protective purposes in the localities comprised within the less-favored famine zone of the Presidency.

4. The necessity for opening up such tracts by means of railways is forced on the attention of the Government by the fact that in times of scarcity, and particularly during a grass famine, the ordinary means of transport by cart and bullocks is rendered extremely difficult, if not impossible, owing to the dearth of fodder at such seasons. It is a *sine qua non* that the capital outlay should be reduced to a minimum if the whole famine zone has to be opened by this means of communication within a reasonable time.

5. The gauge most suitable, with other accessory details, must be left for consideration till the general outlines of the scheme have been finally approved and decided on by the Government of India.

(Here enter No. 3347 W., dated 18th December 1882.)

(True Extract.)

(Signed)

R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

To Superintending Engineers.
To the Revenue Department.
" Financial

Exd. S. T. Austin.

Spare Copies

APPENDIX A.

Distribution Statement of Reorganized Department Public Works, Madras.

Superintending Engineers' Circles.	Executive Divisions.	Sub-Divisions.	ESTABLISHMENT.		
			Executive Engineers.	Assistant Engineers.	Upper Subor- dinates.
No. I ...	1. Ganjam	2	1	1	4
	2. Vizagapatam	2	1	1	4
	3. Eastern Godavari	3	1	2	7
	4. Western do.	2	1	3	7
	5. (A) Project Division	...	1	2	3
No. II ...	6. Eastern Kistna	3	1	3	6
	7. Western do.	2	1	2	7
	8. Nellore	2	1	1	7
	9. Sungum Project	2	1	2	6
No. III ...	10. Bellary	2	1	...	4
	11. Cuddapah	2	1	1	6
	12. Kurnool	1	1	1	4
	13. Madras Irrigation and Canal Company's Canal	2	1	2	6
No. IV ...	14. (C) Project Division	...	1	2	3
	15. West Coast	3	1	2	12
	16. Coimbatore	2	1	1	5
	17. Salem	...	1	...	5
	18. North Arcot	2	1	2	5
No. V ...	19. (B) Project Division	...	1	1	4
	20. South Arcot	1	1	1	5
	21. Chingleput	2	1	1	6
	22. Buckingham Canal	3	1	1	4
No. VI ...	23. Presidency and Bangalore	2	1	2	7
	24. Trichinopoly	2	1	1	8
	25. Tanjore	2	1	2	8
	26. Negapatam	2	1	2	7
Supt. of Works.	27. Madura	2	1	1	8
	28. Tinnevely	2	1	2	7
	29. Consulting Architect	...	1	...	2
	30. (D) Project Division	...	1	...	...
Chief Engr. for Irrigation.	Secretariat	...	1	1	...
	Guaranteed Railways	...	2	...	...
	Supernumeraries	...	3	4	18
Totals ...		50	36	47	185

* Includes two for Workshops.

APPENDIX B.

Statement showing the proposed changes in the Establishment of the Public Works Department, Madras Presidency, under sanction accorded in letter from the Government of India. No. 681G, dated 5th May, 1881.

PRESENT SCALE.			PROPOSED SCALE.			INCREASE.		DECREASE.		Remarks.
Number.	Designation.	Amount of Pay.	Number.	Designation.	Amount of Pay.	Number.	Amount of Pay.	Number.	Amount of Pay.	
ENGINEER ESTABLISHMENT.										
CHIEF ENGINEERS.										
1	Chief Engineer, 1st Class	2,500	1	Chief Engineer, 1st Class	2,500	0	0	0	0	
1	Chief Engineer, 2nd Class	2,000	1	Chief Engineer, 2nd Class	2,000	0	0	0	0	
2	Chief Engineers	4,500	2	Chief Engineers	4,500	0	0	0	0	
SUPERINTENDING ENGINEERS.										
A										
3	Superintending Engineers, 1st Class at 1,600	4,800	3	Superintending Engineers, 1st Class at 1,600	4,800	0	0	0	0	A Includes the appointment of the Consulting Engineer for Guaranteed Railways, which is at present held by Colonel Shaw-Stewart, R. E., Chief Engineer, 3rd Class. The number (7) of Superintending Engineers suggested by the Government of India in letter No. 681 G., dated 5th May 1881, para 5, has been divided into the scale of 3, 2 and 2 with reference to para 66, Chap. I, Madras P. W. D. Code.
1	Superintending Engineer, 2nd Class	1,350	2	Superintending Engineers, 2nd Class at 1,350	2,700	1	1,350	0	0	
1	Superintending Engineer, 3rd Class	1,100	2	Superintending Engineers, 3rd Class at 1,100	2,200	1	1,100	0	0	
5	Superintending Engineers.	7,250	7	Superintending Engineers.	9,700	2	2,450	0	0	
EXECUTIVE ENGINEERS.										
B										
7	Executive Engineers, 1st Grade, at 950.	6,650	10	Executive Engineers, 1st Grade, at 950.	9,500	3	2,850	...	...	B Includes the two Deputy Consulting Engineers. In Government of India, letter No. 681, G., dated 5th May, 1881, quoted above, the scale proposed for Executive Engineers, is 9, 10, 10, 8, 32; to this has been added the four additional Executive Engineers, viz. For Madras Irrigation and Canal Company ... 1 " Sungum Project ... 1 " Omission from the scale submitted by Madras Government, to Government of India, in not putting down the proper number of Executive Engineers. For 10 per cent. required to take the place of absentees, only 1 being given instead of 3 Total ...
8	Executive Engineers, 2nd Grade, at 800.	6,400	11	Executive Engineers, 2nd Grade, at 800.	8,800	3	2,400	...	...	
7	Executive Engineers, 3rd Grade, at 650.	4,550	11	Executive Engineers, 3rd Grade, at 650.	7,150	4	2,600	...	...	
4	Executive Engineers, 4th Grade, at 550.	2,200	4	Executive Engineers, 4th Grade, at 550.	2,200	...	...	...	...	
B 26	Executive Engineers.	19,800	B 36	Executive Engineers.	27,650	10	7,850	...	...	

PRESENT SCALE.		PROPOSED SCALE.		INCREASE.		DECREASE.		Remarks.
Number.	Designation.	Amount of Pay.	Number.	Designation.	Amount of Pay.	Number.	Amount of Pay.	
20	Assistant Engineers, 1st Grade, at 450.	9,000	26	Assistant Engineers, 1st Grade, at 450.	11,700	6	2,700	To the scale of 24 and 19=43, suggested by the Government of India, in letter No. 681, G., quoted above, has been added 2 and 2=4, viz., For Madras Irrigation and Canal Company... .. 2 " Sungum Project... .. 2 Total... 4
16	Assistant Engineers, 2nd and 3rd Grades, at 350 and 250.	5,400	21	Assistant Engineers, 2nd and 3rd Grades.	7,050	5	1,650	
36	Assistant Engineers.	14,400	47	Assistant Engineers.	18,750	11	4,350	The 21 Assistant Engineers of the 2nd and 3rd Grades, now proposed, have been divided into 18, 2nd Grades, and 3, 3rd Grades.
69	Total Engineer Establishment.	45,950	92	Total Engineer Establishment.	60,600	23	14,650	

UPPER SUBORDINATE ESTABLISHMENT.

SUB-ENGINEERS.									
5	Sub-Engineers, 1st Grade at Rs.400.	2,000	9	Sub-Engineers, 1st Grade at 400	3,600	4	1,600	...	...
4	Do 2nd Grade at Rs.300.	1,200	9	Do 2nd Grade at 300	2,700	5	1,500	...	...
9	Do 3rd Grade at Rs.250.	2,250	17	Do 3rd Grade at 250	4,250	8	2,000	...	...
18	Sub-Engineers.	5,450	35	Sub-Engineers	10,550	17	5,100	...	...

14	Supervisors, 1st Grade at 200	2,800	22	Supervisors, 1st Grade at 200	4,400	8	1,600	...	...
22	Supervisors, 2nd Grade at Rs. 150	3,300	36	Do 2nd Grade at 150	5,400	14	2,100	...	...
36	Supervisors	6,100	58	Supervisors	9,800	22	3,700	...	...

32	Overseers, 1st Grade at 100	3,200	28	Overseers, 1st Grade at 100	2,800	...	4	400	The distribution into 1st, 2nd, and 3rd Grades of the 92 Overseers has been made as follows :— 1st Grade $\frac{3}{10}$ of total No. of Overseers ... 28 2nd do $\frac{3}{10}$ do do ... 28 3rd do $\frac{1}{10}$ do do or remainder... 36 Total... 92
32	Do 2nd Grade at Rs.80	2,560	28	Do 2nd Grade at Rs.80	2,240	...	4	320	
42	Do 3rd Grade at Rs.60	2,520	36	Do 3rd Grade at Rs.60	2,160	...	6	360	
106	Overseers	8,280	92	Overseers	7,200	...	14	1,080	
160	Total Upper Subordinate Establishment	19,830	185	Total Upper Subordinate Establishment	27,550	39	8,800	1,080	Net increase Rs.7720

STURVEYORS RANKING AS UPPER SUBORDINATES.

...	...	...	4	800	...	...	...	These Surveyors have been provided for the four Project Divisions which are to be formed for the preparation of projects for Famine Relief Works, &c. Vide para 7 of Government of India letter, No. 681 G., dated 5th May, 1881. Amounts noted as pay include Travelling Allowances.
...	...	...	4	600	...	...	...	
...	...	...	4	400	...	...	...	
...	...	...	4	320	...	...	...	
...	Surveyors	...	16	2,120	...	...	...	The numbers and amounts entered in column "Present Scale" represent the Establishment of the Trichinopoly, Kurnool and Vizagapatam District at the close of last official year 1880-81. Since then the Local Fund works and establishment of the Vizagapatam District have been transferred to Local Fund Boards. The numbers 5 and 14 shown in column "Proposed Scale" represent the actual existing Lower Subordinate Establishment in Trichinopoly and Kurnool Districts.
160	Grand Total Upper Subordinates	19,830	201	Grand Total Upper Subordinates	29,670	55	10,920	1,080

LOWER SUBORDINATE ESTABLISHMENT.

5	Sub-Overseers, 1st Grade at 60	300	5	Sub-Overseers, 1st Grade at 60	300	...	...	The numbers entered in the column "Present Scale" are those for which provision was made in the Provincial Budget for 1881-82. (G. O. No. 1204 W. dated 20th May 1880.) To these numbers have been added 5 additional Storekeepers for the 5 new Divisions, the grading of each being given with reference to the classification of the new Divisions.
...	Sub-Overseers, 2nd Grade	...	...	Sub-Overseers, 2nd Grade	...	1	20	
15	Sub-Overseers, Third Grade at Rs.20.	300	14	Sub-Overseers, Third Grade at Rs.20.	280	...	20	
20	Total Lower Subordinate Establishment.	600	19	Total Lower Subordinate Establishment.	580	1	20	

PETTY ESTABLISHMENT.

4	Storekeepers @ 30	120	4	Storekeepers at 30	120	1	25	The amounts entered in columns "Present" and "Proposed Scale" represent contributions by the Public Works Department for the pay of the Medical Establishment at Berwada, Dowlaisvaram and Vizagapatam. Vide G. O. No. 1346 W. 1382 W., 1965 W, dated 8th and 14th June 1880 and 19th August 1880.
6	Do. @ 25	150	7	do at 25	175	1	20	
7	Do. @ 20	140	8	do at 20	160	3	45	
3	Do. @ 15	45	6	do at 15	90	5	90	
20	Total Petty Establishment.	455	25	Total Petty Establishment.	545	...	...	MEDICAL ESTABLISHMENT.

1	Assistant Apothecary.	62½	1	Assistant Apothecary.	62½	...	...	The amounts entered in columns "Present" and "Proposed Scale" represent contributions by the Public Works Department for the pay of the Medical Establishment at Berwada, Dowlaisvaram and Vizagapatam. Vide G. O. No. 1346 W. 1382 W., 1965 W, dated 8th and 14th June 1880 and 19th August 1880.
4	Hospital Assistants with Jeypore Allowance for one at Rs.25 per mensem.	...	4	Hospital Assistants with Jeypore Allowance for one at Rs.25 per mensem.	...	...	...	
11	Jeypore Al. } Rs.25. Lascars, Toties, Cook, &c., of the Medical Establishment.	175	11	Jeypore Al. } Rs.25. Lascars, Toties, Cook, &c., of the Medical Establishment.	175	...	...	
1	Gumastab.	44½	1	Gumastab.	44½	...	...	
17	Total Petty Establishment.	287	17	Total Petty Establishment.	287	...	...	

PRESENT SCALE.		PROPOSED SCALE.		INCREASE.		DECREASE.		Remarks.
Number.	Designation.	Amount of Pay.	Number.	Designation.	Amount of Pay.	Number.	Amount of Pay.	
1	Maistry.	40	1	Maistry.	40	...	...	For the Cuddapah Division, specially sanctioned by G.O. No. 1882 W. dated, 7th August 1880. The number (495) entered in the column 'Proposed Scale' has been arrived at as follows:— 6 Superintending Engineers' Offices at 4 each ... 24 24 Divisions at 3 each ... 72 1 Consulting Architect ... 2 50 Sub-Divisions at 3 each ... 150 182 Detached Officers, viz. 6 Asst. Engineers, 84 Sub-Engi- neers and Supervisors, and 92 Overseers, at 1 each ... 182 Buckingham Canal Division—Vide G. O. No. 1081, dated 25th April 1881 ... 5 P. W. Stores ... 12 Examiner's Office ... 3 Total. 450 Add 10 per cent for Contingencies ... 45 Total. 495
410	Lascars at 6.	2,460	495	Lascars at 6.	2,970	85	510	
448	Total Petty Establish- ment.	3,242	538	Total Petty Establish- ment.	3,842	90	600	

OFFICE ESTABLISHMENT.
FOR CHIEF ENGINEER AND SECRETARY TO GOVERNMENT, P. W. DEPARTMENT.

PRESENT SCALE.		PROPOSED SCALE.		INCREASE.		DECREASE.		Remarks.
Number.	Designation.	Amount of Pay.	Number.	Designation.	Amount of Pay.	Number.	Amount of Pay.	
1	Chief Assistan.	600	1	Chief Assistant.	600	...	...	For the Cuddapah Division, specially sanctioned by G.O. No. 1882 W. dated, 7th August 1880. The number (495) entered in the column 'Proposed Scale' has been arrived at as follows:— 6 Superintending Engineers' Offices at 4 each ... 24 24 Divisions at 3 each ... 72 1 Consulting Architect ... 2 50 Sub-Divisions at 3 each ... 150 182 Detached Officers, viz. 6 Asst. Engineers, 84 Sub-Engi- neers and Supervisors, and 92 Overseers, at 1 each ... 182 Buckingham Canal Division—Vide G. O. No. 1081, dated 25th April 1881 ... 5 P. W. Stores ... 12 Examiner's Office ... 3 Total. 450 Add 10 per cent for Contingencies ... 45 Total. 495
1	Second Assistant.	300	1	Second Assistant.	300	...	...	
1	Clerk I Class 3rd Grade.	225	1	Clerk I Class 3rd Grade.	225	...	...	
2	Clerks II Class, 2nd Grade at 140.	280	2	Clerk II Class, 2nd Grade at 140.	280	...	...	
1	Clerk II Class, 3rd Grade.	110	1	Clerk II Class, 3rd Grade.	110	...	...	
5	Clerks III Class 2nd Grade at 70.	350	5	Clerks III Class 2nd Grade at 70.	350	...	...	
3	Clerks III Class 3rd Grade at 55.	165	3	Clerks III Class, 3rd Grade at 55.	165	...	...	
1	Clerk IV Class, 1st Grade.	45	1	Clerk IV Class 1st Grade.	45	...	...	
2	Clerk IV Class, 2nd Grade at 35.	70	2	Clerks IV Class, 2nd Grade at 35.	70	...	...	
1	Clerk IV Class, 3rd Grade.	25	1	Clerk IV Class, 3rd Grade.	25	...	...	
18	Total Petty Establish- ment.	2,170	18	Total Petty Establish- ment.	2,170	...	...	

LYTHOGRAPHIC ESTABLISHMENT.

PRESENT SCALE.		PROPOSED SCALE.		INCREASE.		DECREASE.		Remarks.
Number.	Designation.	Amount of Pay.	Number.	Designation.	Amount of Pay.	Number.	Amount of Pay.	
1	Superintendent	250	1	Superintendent	250	...	...	For the Cuddapah Division, specially sanctioned by G.O. No. 1882 W. dated, 7th August 1880. The number (495) entered in the column 'Proposed Scale' has been arrived at as follows:— 6 Superintending Engineers' Offices at 4 each ... 24 24 Divisions at 3 each ... 72 1 Consulting Architect ... 2 50 Sub-Divisions at 3 each ... 150 182 Detached Officers, viz. 6 Asst. Engineers, 84 Sub-Engi- neers and Supervisors, and 92 Overseers, at 1 each ... 182 Buckingham Canal Division—Vide G. O. No. 1081, dated 25th April 1881 ... 5 P. W. Stores ... 12 Examiner's Office ... 3 Total. 450 Add 10 per cent for Contingencies ... 45 Total. 495
1	Head Draughtsman	120	1	Head Draughtsman	120	...	...	
1	Second do	100	1	Second do	100	...	...	
1	Third do	80	1	Third do	80	...	...	
1	Fourth do	60	1	Fourth do	60	...	...	
1	5th do	40	1	5th do	40	...	...	
1	6th do	30	1	6th do	30	...	...	
1	7th do	25	1	7th do	25	...	...	
1	8th do	20	1	8th do	20	...	...	
1	9th do	15	1	9th do	15	...	...	
1	10th do	10	1	10th do	10	...	...	
1	Tracer & Recordkeeper	25	1	Tracer & Recordkeeper	25	...	...	
1	Tracer and Muchi	16	1	Tracer and Muchi	16	...	...	
1	Head Printer	20	1	Head Printer	20	...	...	
1	2nd do	12	1	2nd do	12	...	...	
1	3rd do	12	1	3rd do	12	...	...	
2	Pressmen at 9	18	2	Pressmen at 9	18	...	...	
6	do at 8	48	6	do at 8	48	...	...	
2	do at 7	14	2	do at 7	14	...	...	
2	do at 5	10	2	do at 5	10	...	...	
28	Total Lithographic Establishment.	925	28	Total Lithographic Establishment.	925	...	...	

PRESENT SCALE.			PROPOSED SCALE.			INCREASE.		DECREASE.		Remarks.
Number.	Designation.	Amount of Pay.	Number.	Designation.	Amount of Pay.	Number.	Amount of Pay.	Number.	Amount of Pay.	
FOR CHIEF ENGINEER AND JOINT SECRETARY TO GOVERNMENT, (IRRIGATION BRANCH)										
1	Clerk I Class, 3rd Grade.	225	1	Clerk I Class, 3rd Grade.	225					
1	Do. II do. 2nd do...	140	1	Do. II do. 2nd do...	140					
1	Do. II do. 3rd do...	110	1	Do. II do. 3rd do...	110					
1	Do. III do. 1st do...	90	1	Do. III do. 1st do...	90					
1	Do. III do. 2nd do...	70	1	Do. III do. 2nd do...	70					
1	Do. III do. 3rd do...	55	1	Do. III do. 3rd do...	55					
2	Do. IV do. 1st Grade at 45	90	2	Do. IV do. 1st Grade at 45	90					
3	Do. IV do. 2nd Grade at 35	105	3	Do. IV do. 2nd Grade at 35	105					
1	Do. IV do. 3rd do...	25	1	Do. IV do. 3rd do...	25					
12		910	12		910					
1	Draughtsman 1st Class Do. 2nd do. at 42-8-0	60	1	Draughtsman 1st Class Do. 2nd do at 42-8-0	60					
2		85	2		85					
3		145	3		145					
2	Draughtsmen 3rd Class at 25	50	2	Draughtsmen 3rd Class at 25	50					
5		195	5		195					
1	Reference Picker	10	1	Reference Picker	10					
1	Muchi	10	1	Muchi	10					
1	Head Messenger	8	1	Head Messenger	8					
2	Messengers at 7	14	2	Messenger at 7	14					
2	Do. at 6	12	2	Do. at 6	12					
3	Lascars at 7	21	3	Lascars at 7	21					
10		75	10		75					
27	Total Office Establishment for Chief Engineer for Irrigation.	1180	27	Total Office Establishment for Chief Engineer for Irrigation.	1180					

FOR SUPERINTENDING ENGINEERS.

The one additional Clerk IV Class, 3rd Grade, provided for in current year's (1881-82) Budget for each Superintending Engineer's Office has been added in the column "Proposed Scale," and allowed for the three additional Superintending Engineers' Offices also.										
1	Clerk II Class 3rd Grade	110	1	Clerk II Class 3rd Grade	110					
1	Do III do 2nd do...	70	1	Do III do 2nd do...	70					
1	Do IV do 1st do...	45	1	Do IV do 1st do...	45					
1	Do IV do 2nd do...	35	1	Do IV do 2nd do...	35					
1	Do IV do 3rd do...	25	2	Do IV do 3rd do...	50		25			
1	Draughtsman 1st Class.	60	1	Draughtsman 1st Class.	60					
1	Do 2nd do ..	42½	1	Do 2nd do ..	42½					
1	Messenger at 8	8	1	Messenger at 8	8					
3	Do at 6	18	3	Do at 6	18					
11		413½	12		438½		25			
22	Add similar establishment for two more Superintending Engineers	827	24	Add similar establishment for two more Superintending Engineers	877		50			
			36	Add similar establishment for 3 additional Superintending Engineers' Offices	1,315½		1,315½			
33	Total Office Establishment of Superintending Engineers	1,240½	72	Total Office Establishment of Superintending Engineers	2,631				1,390½	

FOR PRESIDENCY DIVISION.

The numbers and amounts shown in column "Present Scale" represent the scale for a 1st Class Division as laid down in Appendix C, No. 5, to G.O. No. 3674, W, dated 18th September 1878. To these have been added the additional establishment provided in the Provincial Budget, for the current year 1881-82, and the totals thus obtained have been shown in the column "Proposed Scale."										
1	Clerk III Class 2nd Grade	70	1	Clerk III Class, 2nd Grade	70					
1	Clerk IV Class 1st Grade	45	1	Clerk IV Class 1st Grade	45					
1	Do IV do 2nd do...	35	2	Do IV do 2nd Grade at 35	70				35	
1	Do IV do 3rd do...	25	3	Do IV do 3rd Grade at 25	75				50	
	Do V do 1st do...	...	2	Do V do 1st Grade at 17½	35				35	
1	Draughtsman 1st Class.	60	1	Draughtsman 1st Class.	60					
1	Do 2nd do ...	...	1	Do 2nd do ...	42½				42½	
1	Do 3rd do ...	25	3	Do 3rd Class at 25	75				50	
1	Messenger at 7	7	1	Messenger at 7	7					
1	Do at 6	6	1	Do at 6	6					
8	Total Office Establishment of Superintendent of Works, Presidency.	273	16	Total Office Establishment of Superintendent of Works, Presidency.	485½				212½	

PRESENT SCALE.			PROPOSED SCALE.			INCREASE.		DECREASE.		Remarks.
Number.	Designation.	Amount of Pay.	Number.	Designation.	Amount of Pay.	Number.	Amount of Pay.	Number.	Amount of Pay.	
						Grounds of proposition.				
FOR GODAVARI EASTERN AND KISTNA EASTERN DIVISIONS.										
1	Clerk, III Class, 2nd Grade	70	1	Clerk, III Class, 2nd Grade	70	...	...	...	...	The above remark applies equally to this Establishment.
1	Do. IV do. 1st do.	45	1	Do. IV do. 1st do.	45	...	...	...	...	
1	Do. IV do. 2nd do.	35	1	Do. IV do. 2nd do.	35	...	...	...	...	
1	Do. IV do. 3rd do.	25	3	Do. IV do. 3rd do. at 25	75	2	50	...	...	
1	Draughtsman, 1st Class	60	1	Draughtsman, 1st Class	60	...	...	...	...	
1	Do. 3rd do.	25	1	Do. 3rd do.	25	...	...	...	...	
1	Messenger, at 7	7	1	Messenger at 7.	7	...	...	...	...	
1	Do. at 6	6	1	Do. at 6.	6	...	...	...	...	
8	Add similar Establishment for one more office.	273	10		323	2	50	...	...	
8		273	10		323	2	50	...	...	
16	Total Office Establishment Godavari Eastern and Kistna Eastern Divisions.	546	20		646	4	100	...	...	

FOR 7th 1st CLASS DIVISIONS.

1	Clerk, III Class, 2nd Grade.	70	1	Clerk, III Class, 2nd Grade.	70	...	...	...	...	...	...	The foregoing remark applies equally to this Establishment. To the existing number (6) excluding Godavari Eastern and Kistna Eastern, of 1st Class Executive Divisions, has been added the "Madras Irrigation and Canal" Division, which has also been ranked as 1st Class. * 1. Godavari Western. 2. Kistna Western. 3. Madras Irrigation and Canal. 4. South Arcot. 5. Buckingham Canal. 6. Tanjore. 7. Rimevelly.
1	Do. IV do. 1st do.	45	1	Do. IV do. 1st do.	45	...	...	...	...	...	...	
1	Do. IV do. 2nd do.	35	1	Do. IV do. 2nd do.	35	...	...	...	...	...	...	
1	Do. IV do. 3rd do.	25	2	Do. IV do. 3rd do. at 25.	50	...	25	...	...	...	...	
1	Draughtsman, 1st Class	60	1	Draughtsman, 1st Class	60	...	...	...	...	...	...	
1	Do. 3rd do.	25	1	Do. 3rd do.	25	...	...	...	...	...	...	
1	Messenger at 7.	7	1	Messenger at 7.	7	...	...	...	...	...	...	
1	Do. at 6.	6	1	Do. at 6.	6	...	...	...	...	...	...	
8		273	9		298	1	25	...	...	...	...	
40	Add similar Establishment for five more 1st Class Divisions.	1365	45	Add similar Establishment for five more 1st Class Divisions.	1490	5	125	...	...	...	...	
			9	Add similar Establishment for one additional office (Madras Irrigation & Canal.)	298	9	298	...	...	...	...	
48	Total Office Establishment 6, 1st Class Divisions	1638	63	Total Office Establishment for 7, 1st Class Divisions.	2086	15	448	...	...	...	...	

FOR 9, 2ND CLASS DIVISIONS.*

1	Clerk, III Class, 2nd Grade.	70	1	Clerk, III Class, 2nd Grade.	70	...	...	...	...	...	...	The Establishment for 2nd Class Executive Divisions remains in accordance with the scale laid down in Appendix C, No. 6, to G. O. No. 3674 W. dated 18th September 1873, no additional Establishment having been provided in current year's Budget. To the existing number (8) of 2nd Class Divisions, has been added the "Sungum Project Division," which has also been ranked as 2nd Class. * 1. Nellore. 2. Cuddapah. 3. West Coast. 4. Coimbatore. 5. North Arcot. 6. Chingleput. 7. Trichinopoly. 8. Negapatam. 9. Sungum Project Division.
1	Clerk, IV Class, 2nd Grade.	35	1	Clerk, IV Class, 2nd Grade.	35	...	...	...	...	...	...	
2	Clerks, IV Class, 3rd Grade at 25.	50	2	Clerks, IV Class, 3rd Grade at 25.	50	...	...	...	...	...	...	
1	Draughtsman, 1st Class	60	1	Draughtsman, 1st Class	60	...	...	...	...	...	...	
1	Do. 3rd Class.	25	1	Do. 3rd Class	25	...	...	...	...	...	...	
1	Messenger at 7	7	1	Messenger at 7	7	...	...	...	...	...	...	
1	Do at 6	6	1	Do at 6	6	...	...	...	...	...	...	
8		253	8		253	8	253	...	...	...	...	
56	Add similar Establishment for 7 more 2nd Class Divisions.	1,771	56	Add similar Establishment for 7 more 2nd Class Divisions.	1,771	...	...	...	...	...	...	
64	Total Office Establishment for 9 2nd Class Divisions.	2,024	72	Total Office Establishment for 9 2nd Class Divisions.	2,277	8	253	...	...	...	...	

FOR 5, 3RD CLASS DIVISIONS.*

1	Clerk, III Class, 3rd Grade.	55	1	Clerk, III Class, 3rd Grade.	55	...	...	...	...	...	...	The Establishment for the 3rd Class Divisions also remains in accordance with the scale laid down in Appendix C, No. 7 to G. O. No. 3674 W., dated 18th September 1878. To the existing number (2) of 3rd Class Divisions have been added the following three new Divisions, which have been ranked as 3rd Class :— Ganjam Bellary Madura * 1. Ganjam. 2. Viragapatam. 3. Bellary. 4. Salem. 5. Madura.
1	Clerk, IV Class, 2nd Grade.	35	1	Clerk, IV Class, 2nd Grade.	35	...	...	...	...	...	...	
2	Clerks, IV Class, 3rd Grade at 25.	50	2	Clerks, IV Class, 3rd Grade at 25.	50	...	...	...	...	...	...	
1	Draughtsman 2nd Class	42½	1	Draughtsman 2nd Class	42½	...	...	...	...	...	...	
1	Do 3rd Class.	25	1	Do 3rd Class.	25	...	...	...	...	...	...	
1	Messenger at 7.	7	1	Messenger at 7	7	...	...	...	...	...	...	
1	Do 6.	6	1	Do 6	6	...	...	...	...	...	...	
8		220½	8		220½	...	...	...	...	...	...	
8	Add similar Establishment for one more 3rd Class Office.	220½	8	Add similar Establishment for one more 3rd Class Office.	220½	...	...	...	...	...	...	
16	Total Office Establishment for 5, 3rd Class Divisions.	441	40	Total Office, Establishment for 5, 3rd Class Divisions.	1,102½	24	661½	...	...	...	...	

PRESENT SCALE.			PROPOSED SCALE.			INCREASE.			DECREASE.			Remarks.
Number.	Designation.	Amount of Pay.	Number.	Designation.	Amount of Pay.	Number.	Amount of Pay.	Number.	Amount of Pay.	Number.	Amount of Pay.	
FOR THE CONSULTING ARCHITECT.												
1	Clerk, IV. Class, First Grade.	45	1	Clerk, IV. Class, First Grade.	45							
1	Draughtsman & Estimator	145	1	Draughtsman & Estimator	145							
1	Draughtsman 2nd Class	42½	1	Draughtsman 2nd Class	42½							
1	Do. 3rd do.	25	1	Do. 3rd do.	25							
1	Messenger at 7.	7	1	Messenger at 7.	7							
1	Do. at 6.	6	1	Do. at 6.	6							
6	Total Office Establishment of Consulting Architect.	270½	6	Total Office Establishment of Consulting Architect.	270½							
FOR PUBLIC WORKS STORES.												
1	Clerk, II Class, Second Grade.	140	1	Clerk, II Class, Second Grade	140							
1	Do. III do.	70	1	Do. III do.	70							
1	Do. IV do.	35	1	Do. IV do.	35							
1	Do. IV 3rd do.	25	1	Do. IV 3rd do.	25							
1	Messenger	8	1	Messenger.	8							
2	Do. at 7	14	2	Do. at 7	14							
2	Do. at 6½	13	2	Do. at 6½	13							
9	Total Office Establishment, P. W. Stores.	305	9	Total Office Establishment, P. W. Stores.	305							
OFFICE ESTABLISHMENT FOR 2 SUPERINTENDENTS OF WORKS (GODAVARI AND KISTNA.)												
1	Clerk, III Class, 2nd Grade.	70										The offices close under the new arrangements and therefore no provision for it has been made.
1	Clerk, IV Class, 1st Grade.	45										
1	Clerk, IV Class, 2nd Grade.	35										
1	Clerk, IV Class, 3rd Grade.	25										
1	Draughtsman, 1st Class	60										
1	Draughtsman, 3rd Class	25										
1	Messenger at 7	7										
1	Messenger at 6.	6										
8	Add similar Establishment for one more Superintendent of Works office.	273										
8		273										
16		546								16	546	

The offices close under the new arrangements and therefore no provision for it has been made.

FOR THE FOUR NEW PROJECT DIVISIONS.

2	Draughtsmen, 1st Class at 60.	120	2	120		
2	Draughtsmen, 2nd Class at 42½.	85	2	85		
1	Clerk, IV Class, 2nd Grade.	35	1	35		
1	Clerk, V Class, 1st Grade.	17½	1	17½		
1	Messenger at 7.	7	1	7		
1	Messenger at 6.	6	1	6		
8	Total for each office.	270½	8	270½		
24	Add similar Establishments for 3 more such offices.	811½	24	811½		
32	Total Office Establishment, Project Divisions.	1,082	32	1,082		

FOR 50 SUB-DIVISIONAL OFFICES.

1	Clerk, IV Class, 3rd Grade	25	1	Clerk, IV Class, 3rd Grade	25		
1	Messenger	6	1	Messenger	6		
2	Total for one Office	31	2	Total for one Office	31		
78	Add similar Establishment for 39 more Sub-Division Offices	1,209	78	Add similar Establishment for 39 more Sub-Division Offices	1,209		
20	Add similar Establishment for 10 additional Offices	310	20	Add similar Establishment for 10 additional Offices	310		
100	Total Sub-Divisional Office Establishment	1,550	100	Total Sub-Divisional Office Establishment	1,550		

FOR 88 DETACHED OFFICERS.

1	Clerk Apprentice, 1st Grade, now called 5th Class, 1st Grade	17½	1	Clerk, IV Class, 3rd Grade	25		
39	Add similar Establishment for 39 more detached Officers (Upper Subordinates above the grade of Overseer)	682½	39	Add similar Establishment for 39 more detached Officers	975		
						7½	
						292½	

To the existing number (40) of Sub-Divisions have been added the 10 additional Sub-Divisions as follows:—

For Sungum Project...	...	...	2
" Madras Irrigation and Canal	...	...	2
" Ganjam	...	...	2
" Bellary	...	...	2
" Madura	...	...	2
Total...	10		

And Office Establishment provided for each in accordance with the scale given in Appendix C. No. 10 to G. O. No. 3674 W. dated 18th September 1878.

PRESENT SCALE.			PROPOSED SCALE.			INCREASE.		DECREASE.		Grounds of proposition.	Remarks.
Number	Designation.	Amount of Pay.	Number	Designation.	Amount of Pay.	Number	Amount of Pay.	Number	Amount of Pay.		
FOR 88 DETACHED OFFICERS—(Continued.)											
40	Total Office Establishment, detached Officers	700	SS	Add similar Establishment for 48 additional detached Officers, viz: Officers and Upper Subordinates above the rank of Overseer who are not in charge of Sub-Divisions	1,200	48	1,200				
				Total Office Establishment, detached Officers	2,200	48	1,500				
FOR 92 OVERSEERS.											
			1	Clerk, IV Class, 1st Grade.	17½	1	17½				
			91	Add similar Establishment for 91 more Overseers.	1592½	91	1592½				
			92	Total Office Establishment for Overseers.	1610	92	1610				
A provision of one Clerk, V Class, 1st Grade, has been made for each Overseer.											

OFFICE [TOLL] ESTABLISHMENT, BUCKINGHAM CANAL.

72	Clerks, &c.	761	72	Clerks, &c.	761							
ABSTRACT OF OFFICE ESTABLISHMENT.												
32	Chief Engineer and Secretary to Govt., P. W. Department.	2,433½	32	Chief Engineer and Secretary to Govt., P. W. Department.	2,433½							
28	Lithographic Establishment.	925	28	Lithographic Establishment.	925							
27	Chief Engineer for Irrigation.	1,180	27	Chief Engineer for Irrigation.	1,180							
33	Superintending Engineer's Offices.	1,240½	72	Superintending Engineer's Offices.	2,631	39	1,390½					
8	Superintendent of Works, Presidency.	273	16	Presidency Division.	485½	8	212½					
16	Godavari and Kistna Eastern Divisions.	546	20	Godavari and Kistna Eastern Divisions.	646	4	100					

48	Six 1st Class Executive Divisions	1,638	63	Six 1st Class Executive Divisions	2,086	15	448					
64	Eight 2nd Class Executive Divisions	2,024	72	Nine 2nd Class Executive Divisions	2,277	8	253					
16	Two 3rd Class Executive Divisions	441	40	Five 3rd Class Executive Divisions	1,102½	24	661½					
6	Consulting Architect's Office	270½	6	Consulting Architect's Office	270½							
9	Public Works Stores	305	9	Public Works Stores	305							
16	Office Establishment, Works, Godavari and Kistna	546						16	546			
			32	Office Establishment, Project Divisions	1,082	32	1,082					
80	Sub-Divisional Offices	1,240	100	Sub-Divisional Offices	1,550	20	310					
40	Office Establishment, Detached Officers	700	88	Office Establishment, Detached Officers	2,200	48	1,500					
			92	Office Establishment, for Overseers	1,610	92	1,610					
72	Office (Toll) Establishment Buckingham Canal	761	72	Office (Toll) Establishment Buckingham Canal	761							
495	Total Office Establishment	14,523½	769	Total Office Establishment	21,545	290	7,567½	16	546			

IRRIGATION ESTABLISHMENTS.

	Water Regulation Navigation River Conservancy	7,528 2,462 260		Water Regulation Navigation River Conservancy	7,528 2,462 260							
	Total Irrigation Establishment	10,250		Total Irrigation Establishment	10,250							
ABSTRACT OF EXECUTIVE BRANCH.												
69	Engineer Establishment Upper Subordinate	45,950	92	Engineer Establishment Upper Subordinate	60,600	23	14,650	14	1,080			
160	Lower do	19,830	201	Lower do	29,670	55	10,920	1	20			
20	Petty Establishment	600	19	Petty Establishment	580	90	600	16	546			
448	Office do	3,242	538	Office do	3,842	290	7,567½					
495	Irrigation do	14,523½	769	Irrigation do	21,545		10,250					
	Total Executive Branch	94,395½		Total Executive Branch	126,487		33,787½		1,646			

PRESENT SCALE.		PROPOSED SCALE.		INCREASE.		DECREASE.		Grounds of proposition.	Remarks.
Designation.	Amount of Pay.	Number.	Designation.	Amount of Pay.	Number.	Amount of Pay.	Number.		
Examiner 3rd Class ... Deputy Examiner 1st Grade. Assistant Examiner 2nd Grade.	1,100 550 250	1 2 1	Examiner 3rd Class ... Deputy Examiners 1st Grade at 550. Assistant Examiner 2nd Grade.	1,100 1,100 250	1 — —	550	—		The number of officers at present attached to this Presidency has been taken as the "Present Scale," to which has been added, one to Deputy Examiner, 1st Grade, and the totals thus arrived at have been shown as the "Proposed Scale." The provision of the extra Deputy Examiner has been made in view to the more frequent inspection of the Executive Engineer's Officers, considered to be absolutely essential with the introduction of the new forms of account, and also in view to the proposed large increase to the operations of the Department.
Total Examiner Establishment.	1,900	4	Total Examiner Establishment.	2,450	1	550	—		

Accountant 1st Grade Accountants 2nd Grade at 295 Accountants 3rd Grade at 200 Accountants 4th Grade at 115 Accountants 5th Grade at 57½	400 885 800 1,150 1,955	1 3 6 15 31	Accountant 1st Grade Accountants 2nd Grade at 295 Accountants 3rd Grade at 200 Accountants 4th Grade at 115 Accountants 5th Grade at 57½	400 885 1,200 1,725 1,782½	— — 2 5 —	575	3	172½	
Total Accountant Establishment.	5,190	56	Total Accountant Establishment.	5,992½	7	975	—	172½	and this total has been distributed with reference to P.W.D. Code, Chap. I, Para 77, as follows:— 1st and 2nd Grades $\frac{25}{8}$ 4 (omitting fraction less than half) 2nd Grade to be always more than 1st Grade, i.e., 1st Grade = 1 at 400 = 400 2nd Grade = 3 at 295 = 885 3rd Grade $\frac{25}{4}$ = 9 at 200 = 1800 4th Grade (re- = 22 at 115 = 2,530 remainder) (adding 1 for fraction more than half)
							Total...35		Costing Rs.5,615

Recasting the above to bring in the 5th Grade Accountants the Establishment will be—
 1st Grade 1 at 400 = 400
 2nd Do 3 at 295 = 885
 3rd Do 6 at 200 = 1200
 4th Do 13 at 115 = 1,495
 5th Do 29 at 57½ = 1,667½
 52 Costing Rs.5,647½

* The small excess difference of Rs.22½ is due to the redistribution

Add one Accountant each for Presidency and Dowlaishvaram Workshops, one for Madras Harbour Works and one for Central Office = 4 i.e. 2, 4th Grades at 115 = 230
 2, 5th do at 57½ = 115
 Total...56 Costing 5,992½

To the present number of Clerks have been added four Clerks (2, III Class, 2nd Grade at 70 each, and 2, III Class 3rd Grade at 55 each) on account of the four Project Divisions for which no Accountants have been provided.
 A small addition of two Clerks (1, IV Class, 1st Grade at 45, and 1, IV Class, 3rd Grade at 25) has also been made to the existing establishment on account of the increase in number from 20 to 25 of Executive Divisions, which necessarily will entail an increase in the clerical work of the Central Office.

PRESENT SCALE.		PROPOSED SCALE.		INCREASE.		DECREASE.		Grounds of proposition.	Remarks.
Designation.	Amount of Pay.	Number.	Designation.	Amount of Pay.	Number.	Amount of Pay.	Number.		
Clerk II Class 2nd Grade Do III do 1st do... Do III do 2nd Grade at 70 Clerk III do 3rd do... Do IV do 1st Grade at 45 Clerk IV do 2nd Grade at 35 Clerk IV do 3rd Grade at 25 Clerk V do 1st Grade at 17½	140 90 70 165 225 210 250 52½	1 1 3 5 6 6 11 3	Clerk II Class 2nd Grade Do III do 1st do... Do III do 2nd Grade at 70 Clerk III do 3rd do... Do IV do 1st Grade at 45 Clerk IV do 2nd Grade at 35 Clerk IV do 3rd Grade at 25 Clerk V do 1st Grade at 17½	140 90 210 275 270 210 275 52½	— — 2 2 1 — 1 —	— — — — — — — —	— — — — — — — —		
Total Clerks	1,202½	36	Total Clerks	1,522½	6	320	—		
Menial Servants ...	102½	1	Moochi at 10 Do at 8 Head Messenger Head Messenger Messengers at 7 Do. at 6 Rollers at 5	10 8 10 8 28 36 10 110	— — — — — — 0	— — — — — — —	— — — — — — —		
Total Office Establishment.	1,305	52	Total Office Establishment.	1,632½	—	327½	—		

ABSTRACT OF ACCOUNTS BRANCH.

Examiners Accountants Office Establishment	1,900 5,190 1,305	4 56 52	Examiners Accountants Office Establishment	2,450 5,992½ 1,632½	1 7 —	550 975 327½	3	172½ ... —
Total Accounts Branch	8,395	—	Total Accounts Branch	10,075	—	1,852½	—	172½

ABSTRACT.

Executive Branch	1,26,487
Accounts Branch	10,075

Grand Total...1,36,562 per mensem or per annum ...Rs. 16,38,744

ADD.—Approximate amount on account of Military pay and allowances of Military Officers, per mensem ...Rs. 8,000

Approximate amount on account of Military pay and allowances of Military Subordinates, per mensem... „ 1,500 or per annum...Rs. 1,14,000

„ 9,500

Sub-Divisional Allowance for 15 Upper Subordinates at 30... „ 450 or per annum...Rs. 5,400

Local allowances, approximate, Upper Godavari allowance per mensem... 50

Wynaad allowance per mensem ... 200

Potinghy Ghat or Jeypore allowance per mensem ... 600

850

...Rs. 10,200

Charge allowance for Fifth Grade Accountants recommended in letter No. 241 W. dated 19th March 1881, from the Examiner P. W. Accountant to the Local Government ...Rs. 400 ...Rs. 4,800

Do do Presidency allowance, & Presidency house rent, Executive Branch ...Rs. 1,200

Accounts Branch ... „ 1,650

2,850

...Rs. 34,200

Total Permanent Establishment salaries...Rs. 18,07,344

Travelling allowance Executive Branch* ...Rs. 16,666 $\frac{2}{3}$

Accounts Branch ... „ 400

„ 17,066 $\frac{2}{3}$

... „ 2,04,800

Contingencies.— Executive Branch ... „ 4,000

Accounts Branch ... „ 400

„ 4,400

... „ 52,800

Total Permanent Establishment... „ 20,64,944

EXECUTIVE BRANCH.

Per mensem. Per annum.

Rs.

Rs.

Irrigation Survey 1,250 15,000

Special Revenue Investigation Establishment... 1,000 12,000

Temporary Executive Branch 2,083 $\frac{1}{2}$ 25,000

4,333 $\frac{1}{2}$

52,000

ACCOUNTS BRANCH.

Temporary Establishment for the preparation of Capital & Revenue Accounts of Irrigation works. 800 9,600

5,133 $\frac{1}{3}$

61,600

...Rs. 61,600

Grand Total Establishment... „ 21,26,544

Grand Total Establishments ... Rs. 21,26,544
EXECUTIVE BRANCH.

DEDUCT.

Per mensem. Per annum.
Rs.

Pay and allowances of Consulting Engineer and two Deputy Consulting Engineers for Railways chargeable to Imperial ... 4,023 48,276

Moiety of pay and allowance of Superintendent P. W. Stores and Workshops chargeable to Workshops ... 335 4,020

Pay of two Upper Subordinates chargeable to Workshops ... 400 4,800

ACCOUNTS BRANCH.

Pay and allowances of four Accountants chargeable to P. W. workshops (Dowlaishvaram and Presidency) and Madras Harbour Works ... 445 5,340

62,436

Net Total Establishment Permanent and Temporary including Travelling allowances and contingencies ...

20,64,108

*Per mensem to give in round numbers 2,00,000 for the year.

APPENDIX C.

Gradation List as proposed under the new organization with effect from 1st August, 1881.

NAME.	DATE OF FIRST APPOINTMENT TO THE DEPARTMENT.	PRESENT PERMANENT GRADING IN THE DEPARTMENT OF THOSE OFFICERS WHO ARE TO BE PROMOTED.
CHIEF ENGINEER, 1ST CLASS, (1.)		
Col. R. H. Sankey C.B. R. E.	May 1850	
CHIEF ENGINEER, 2ND CLASS, (1.)		
Col. J. Mullins, R. E.	February 1852	
CHIEF ENGINEER, 3RD CLASS, (1.)		
Col. J. H. M. Shaw-Stewart, R.E., (A.I.C.E.)	January 1854	
SUPERINTENDING ENGINEERS, 1ST CLASS, (2.)		
Lieut.-Col. J. Beatty, R. E.	March 1855	
„ J. O. Hasted, R. E.	January 1856	
SUPERINTENDING ENGINEERS, 2ND CLASS, (2.)		
Lieut.-Col. H. L. Prendergast, R. E.	November 1857	
Lieut.-Col. W. Chrystie, R. E.	October 1855	Superintending Engr., 3rd Class
SUPERINTENDING ENGINEERS, 3RD CLASS, (2.)		
Major H. R. Mead, R. E.	January 1858	
Mr. J. W. Rundall, M.I.C.E.	August 1855	Executive Engineer, 1st Grade
EXECUTIVE ENGINEERS, 1ST GRADE, (9+1=10.)		
Major C. J. Smith, R. E.	January 1858	
Mr. R. F. Chisholm, F.R.I.B.A.	February 1859	
Lieut.-Col. J. N. Hunter, R. E.	March 1855	
Major H. Smalley, R. E.	July 1859	
„ P. Montgomerie, R. E.	November 1860	
Lieut.-Col. W. H. Burton, R. E.	May 1858	
Major H. M. Vibart, R. E.	September, 1861	
„ J. Pennycuick, R. E.	April 1862	
Lieut.-Col. Ross Thomson, R. E.	August 1863	
Major J. L. L. Morant, R. E.	January 1864	
EXECUTIVE ENGINEERS, 2ND GRADE, (10+1=11.)		
Mr. G. T. Walch, M.I.C.E.	February 1866	
Major A. T. Fraser, R. E.	March 1860	
„ S. C. Clarke, R. E.	October 1862	
Capt. R. R. E. Drake-Brockman, R. E.	November 1864	
„ W. H. Coaker, R. E.	April 1866	
Mr. T. D. Harris.	August 1855	
Capt. A. C. Smith, R. E.	September 1864	
„ A. Awdry, R. E., A.I.C.E.	January 1868	
Mr. K. F. Nordmann.	June 1862	
„ E. H. Pringle.	January 1868	
Capt. D. McNeil Campbell, R. E.	April 1869	Executive Engineer, 3rd Grade
EXECUTIVE ENGINEERS, 3RD GRADE, (10+1=11.)		
Mr. J. Hannan.	July 1866	
Mr. R. W. Norris.	July 1867	
Captain R. F. Morris, R. E.	March 1864	Reappointment
Mr. G. D. Wybrow.	July 1867	
„ J. W. Martin.	December 1867	
„ J. D. Grant, A.I.C.E.	July 1868	

NAME.	DATE OF FIRST AP- POINTMENT TO THE DEPARTMENT.	PRESENT PERMANENT GRADING IN THE DEPARTMENT OF THOSE OFFICERS WHO ARE TO BE PROMOTED.
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EXECUTIVE ENGINEERS, 3RD GRADE,—(Continued.)

<i>Mr. C. J. Peters.</i>	July 1867	Executive Engineer, 4th Grade
„ <i>W. Hughes, B.A.</i>	July 1868	Do
„ <i>J. C. Larminie.</i>	March 1869	Do
„ <i>J. M. Bell.</i>	December 1867	Do
<i>Captain A. W. Smart, R. E.</i>	March 1871	Do

EXECUTIVE ENGINEERS, 4TH GRADE, (3+1=4.)

Captain C. C. Rawson, R. E.	June 1871	
Captain A. R. F. Dorward, R. E.	August 1871	
<i>Mr. J. Grimes.</i>	June 1861	Assistant Engineer, 1st Grade
<i>Lieutenant G. B. Henderson, R. E.</i>	April 1873	Do
<i>Mr. Wilks.</i>	...	Temporary Probationary Appointment

ASSISTANT ENGINEERS, 1ST GRADE, (24+2=26.)

Lieutenant O. V. Boddy, R. E.	April 1873	
„ L. Langley, R. E.	April 1873	
„ F. G. Romilly, R. E.	April 1873	
Captain W. Jackson.	September 1872	Counted as an Upper Subordinate
Mr. C. H. T. Norfor.	August 1870	
Lieutenant R. E. Hamilton, R. E.	June 1875	Dy. Cong. Engr. for Railways
„ W. L. C. Baddeley, R. E.	July 1875	
Mr. W. B. De Winton.	October 1874	
Lieutenant S. C. Plummer.	January 1855	Counted as an Upper Subordinate
Mr. C. Vincent.	October 1874	
„ A. H. Garrett.	October 1874	
„ J. P. Davidson.	October 1874	
„ J. C. Johnson.	February 1873	
„ H. S. Taylor.	October 1875	
„ A. S. Russell.	October 1875	
„ C. M. Smith.	October 1875	
S. Subroya Chariur, B.C.E.	May 1865	
<i>Mr. W. C. De Morgan.</i>	October 1874	Assistant Engineer, 2nd Grade
„ <i>W. L. Bird.</i>	October 1875	Do
„ <i>J. E. Paul.</i>	October 1875	Do
„ <i>G. P. Carless.</i>	February 1876	Do
„ <i>J. Trail.</i>	October 1874	Do
„ <i>C. H. B. Burlton.</i>	October 1875	Do
„ <i>H. E. G. Evans.</i>	October 1875	Do
„ <i>C. . Ussher.</i>	October 1877	Do
„ <i>G. E. Manson.</i>	October 1877	Do
„ <i>A. A. G. Malet.</i>	October 1877	Do
„ <i>W. Jopp.</i>	October 1877	Do

ASSISTANT ENGINEERS, 2ND AND 3RD GRADES, (19+2=21.)

Mr. B. H. Young,	October 1877	
„ G. B. Lambert.	October 1877	
„ H. H. O'Connell.	September 1878	
„ A. R. Boyle.	October 1880	
„ A. M. Hayes.	October 1880	
„ F. J. Wilson.	October 1880	
„ F. B. Hanson.	October 1880	
„ A. M. Foord.	September 1879	
„ R. H. Dorman.	October 1880	
„ H. E. Clerk.	October 1880	
„ S. D. Pears.	October 1880	
N. Ruthnasubapathy Pillay, B.C.E.	April 1874	
S. Gopalakrishna Iyengar, B.C.E.	September 1880	
Lieutenant D. Falvey.	July 1870	Counted as an Upper Subordinate

N. B.—Those officers shown in italics will receive promotion.

APPENDIX D.

Protective Works Projects now in hand or proposed, para 8 Government of India Letter, No. 681 G, dated 5th May, 1981.

Name of Project.	Division and Circle.	Brief Explanation of each.	Probable amount of Estimate.	Forecast of provision to be made in the Budgets of the Current and following years.		
			Lakhs.	1881-82.	1882-83.	1883-84.
(a.) Ganjam, Gopaulpore, tidal Canal.	A Project Division 1st Circle.	During the last famine a tidal canal 9 miles in length, was completed from Ramba at south end of the Chilka Lake to Ganjam, thus with the system of Canals to the North connecting the latter place with Cuttack, Midnapur, &c. It is now absolutely essential that this Canal should be extended southwards about 12 miles to the port of Gopaulpore, the most important emporium of the district, thus securing the means of distributing food grains in case of famine and of creating for ordinary seasons a highly promising artery of trade. A detailed estimate for a high level fresh water canal, amounting to Rs.1,72,000 was framed some years since, but late information appearing to show that a tidal canal will be preferable, arrangements are being made for completing the estimate, which should be ready for submission in six or eight months.	2.10	Nil.	Nil.	1.00
(b.) Road from Salur in the Vizagapatam Division, via Pottinghy Ghaut to Koraputt and Juggulpore in Bustar.	Do.	The primary link in this, the first cart road leading from the littoral of Vizagapatam to, and through the country above the ghauts in Jeypore and Bustar, as yet attempted to be made, is the "Pottinghy Ghaut," on which such small sums (altogether inadequate however for securing proper progress) have hitherto been spent from Provincial funds as could be spared. While grain has been at famine prices in the low country, it has always been cheap above the ghauts, where the rainfall seems to be abundant and certain, and where land is apparently to be obtained for emigrants, the country being but sparsely populated. Of the revised estimate amounting to 3.40 Lakhs for the Pottinghy Ghaut now under examination (which will, if necessary, be forwarded to the Government of India) about one-third has already been spent, and it is thought that probably nine lakhs more would be needed to take the line 70 miles on to Juggulpore (new Bustar). No estimate has been framed for this latter portion, but with the new establishment, one should be ready a year hence in time for entry in the Budget of 1883-84.	10.50	0.75	1.00	2.00
(c.) Buckingham Canal.	At present Buckingham Canal Division. 1st Circle.	N. B.—Other roads suitable for cart traffic, e.g., for linking Koraputt with Raigurn and others leading towards Sumbalpoore north-east and through Kalahandy north-west will be certainly required in course of time as protective works, but need not be further adverted to here. From the early part of the century, a tidal canal connecting the backwaters of the east coast north of Madras was considered feasible and partially carried out. The scheme was more fully developed in the late famine by so far completing the works as to				

—(Continued)

Name of Project.	Division and Circle.	Brief Explanation of each.	Probable amount of Estimate.	Forecast of provision to be made in the Budgets of the Current and following years.		
			Lakhs	1881-82.	1882-83.	1883-84.
(d.) Buckingham Canal South of Markanum.		make a tidal communication now known as the "Buckingham Canal," extending nearly 200 miles north, and about 50 South of Madras. The total outlay from the commencement to date has been nearly 37.4 lakhs, of which 27.1 lakhs may be considered normal. The completion estimates now far advanced amount to about 29 lakhs, so that the normal outlay will, for the finished work be approximately, 56 lakhs. For the distribution of food grain during famine a safe interior line of coastal communication will be invaluable, while for ordinary trade purposes, its importance is daily on the increase. Already boats from Coconada come laden to Madras 400 miles, and it can hardly be doubted that eventually the whole line of coast will be similarly connected. A work of this character is wholly beyond the unaided Provincial resources, and as it is essentially "Protective" in its character, it is here included. The estimates should be ready for submission six months hence.	56.00	* Nil.	5.00	5.00
(e.) Baroor Tank.	B Project Division. 2nd Circle.	The extension southward of the above canal through the French territory (18 miles) and as far as Point Calimere has been regarded not merely as desirable for completing a much needed link in the coast communications, but as holding in readiness a work which is considered to be extremely well suited for execution during famine. The details of a considerable portion of the estimate were worked out some years ago, but its entire revision will be needed to allow of its being sanctioned by the Government of India. At the present moment, however, there is no very pressing necessity for the work, the time named for its submission may be for the Budget of 1884-85.	30.00	Nil.	Nil.	Nil.
(f.) Marandahully.	Do.	This work was commenced for Relief in last Famine. The project provides for an anicut across the Pooniar river, supply channel to Sarur Taluq, enlargement of the tank irrigation channels and head sluices to existing channels. The increase of cultivation is expected to be 5,610 acres, and of revenue, 22,137 rupees. The work is considered valuable as a famine protective work. Plans and estimates have been prepared and submitted to the Government of India, but were returned for revision. They will probably be resubmitted by the end of official year.	3.10	Nil.	1.00	2.00
(g.) Vaniar.	Do.	Work was commenced for Famine Relief. The project provides for an anicut across Sunadakumara river, supply channel to Sunganbasavan tank enlarging this and Jairy Talab, and channels from tanks. Provides for the storage of 667 millions of cubic feet of water. Increase of cultivation and revenue expected not yet known. It is understood that estimates are nearly ready for submission. This work is likely to be of value as a protective work.	3.90	Nil.	1.50	2.00
(h.) Hindupur.	C Do. 3rd Circle.	Work was commenced for Famine Relief, but probably the project cannot be carried out so as to utilize all the work then done. The project provides for the formation of a reservoir by damming the valley of the Vaniar river. Increase of cultivation expected is 9,500 acres, and of revenue 33,250 rupees. Plans and estimates have yet to be drawn up, and further enquiry made regarding the returns. It is not certain that the work will prove productive though it may be valuable as a protective work. The estimates might be ready by the end of the official year.	8.50	Nil.	Nil.	Nil.
(i.) Roddam.	Project Division. 3rd Circle.	The project provides for constructing an anicut across the Penniar River for the supply of 11 tanks with head sluices and channels. The district of Bellary having very little irrigation, the work would be of value as a protective work. Plans and estimates were prepared many years ago, but the project will need complete revision. Existing cultivation is expected to be improved, and 356 acres of waste land cultivated. Increased revenue expected, 10,906 rupees. Estimates may be submitted by the end of official year.	2.00	Nil.	1.50	0.50
(j.) Complete revised project for the Godavari Delta Works.	Do	The project provides for an anicut across the Pennair to supply Roddam large tank, and would, like the work above, be useful as a protective work. Plans and estimates were prepared many years ago, but the project needs complete revision. Existing cultivation is expected to be improved, and 1,344 acres of waste land cultivated. Increased revenue expected 9,105 rupees. Estimates may be submitted by the end of the official year.	1.40	Nil.	Nil.	1.00
(k.) Complete revised project for the Kistna Delta Works.	Do	The work to be done is the revision of certain of the estimates already sanctioned, the examination of estimates submitted, and framing one complete estimate. Beyond those already submitted, there will probably be estimates amounting to 24,00,000 rupees required. It is thought that under special arrangements now being made the estimates will be ready for submission in five or six months.	60.00	Nil.	5.00	5.00
(l.) Perryaur.	Do	The same work has to be done as above. Estimates have been prepared and but little revision is expected to be necessary. Revenue returns have to be obtained. These estimates may be expected to be ready for submission by the end of the year or a little after.	140.00	Nil.	5.00	5.00
(m.) Poogalur Channel.	Do	The project provides for constructing a concrete dam of 170 feet in height and turning the water of the Perryaur river, which now runs into Travancore, into the Madura District. It will it is thought prove invaluable as a protective work. The net return expected from the work is 5,15,000 rupees per annum constituting it also a "Productive." The out-door surveying &c., has been done, and the project has only to be put into shape and may be submitted by the end of the year.	7.00	Nil.	1.00	5.00

* N.B.—No outlay is shown in 1881-82 against the Buckingham Canal above, as the funds for the current year are being found for "Provincial." At the same time it is much to be desired that a portion if not the whole of the current years assignment may be charged against "Imperial Protective" so as to liberate Provincial Funds most urgently needed for other purposes.

Name of Project.	Division and Circle.	Brief Explanation of each.	Probable amount of Estimate. Lakhs.	Forecast of provision to be made in the Budgets of the Current and following years.		
				1881-82 Lakhs.	1882-83 Lakhs.	1883-84 Lakhs.
(n.) Rooshkoolia.	D Project Division. 3rd Circle.	been submitted and returned for revision, and may probably be ready by the end of the year. The project provides for an anicut across the Korakory river in the Ganjam District, improving and constructing channels and embanking a natural lagoon in a part of the country where protective works are much needed. Provision is made for 64 miles of navigable canal and for two reservoirs. The area to be irrigated is 1,20,000 acres, and a return of 4 per cent. on the total outlay is expected. The plans and estimates have been prepared, and may be put into shape for submission without delay.	3.70	Nil.	1.00	2.00
(o.) Palar Anicut.	Unassigned as yet.	The project is for improvements to existing channels under the anicut on the South side. Plans and estimates have been prepared, but not yet submitted, and information is needed as to cultivation and revenue expected.	26.00	Nil.	2.00	2.50
(p.) Atur Anicut.	Do.	This project provides for an anicut on the Guddebun in South Arcot District. The estimate has been submitted and returned for revision. Information regarding cultivation, &c., is as yet not available. The estimates might be completed in three or four months.	2.50	Nil.	Nil.	Nil.
(q.) Lower Coleroon Anicut.	Do.	This project provides for the improvement of existing irrigation under the Lower Coleroon Anicut in South Arcot; the subject has not yet been taken up, but it seems certain that great improvements can be made, and the cultivation extended. The estimates could be prepared within a year.	0.54	Nil.	Nil.	Nil.
(r.) Bhawani Reservoir	Do.	This is a project for forming a large reservoir on one of the tributaries of the Cavari river with a view to storing some portion of the flood waters which now runs to waste. Preliminary investigations have been made, and it is thought that by the construction of the reservoir, not only would the supply for the Tanjore Delta be thus improved, when occasionally deficient, but over 500,000 acres of additional direct irrigation be secured.	6.50	Nil.	Nil.	Nil.
			40.00	Nil.	Nil.	Nil.
		TOTALS ...	425.84	0.75	25.00	55.00

PUBLIC WORKS DEPARTMENT.

General
Establishment.

No. 1,697 W.

No. 9.

FROM

THE SECRETARY TO THE GOVERNMENT OF MADRAS,
Public Works Department,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,
Public Works Department.

SIR,—I am desired, in reply to your letter, No. 681 G., dated 5th May 1881, having reference to the normal strength of establishment for the Public Works Department in this Presidency, to state that the Government very thankfully accept the scale and the general arrangement into six Superintending Engineers' Circles as suggested by the Government of India, though as regards the former some additions have recently shown themselves to be necessary, and as regards the latter, local circumstances require slight modifications which will be immediately explained.

2. There is now, I am to observe, no further discussion as to the appointment of Superintendents of Works for—

- (1) Vizagapatam and Ganjam Divisions,
- (2) the Godavari Delta, do.
- (3) the Kistna Delta, do.
- (4) the Buckingham Canal,
- (5) the Presidency including Bangalore;

but one officer of this class will still remain, viz., the Consulting Architect assented to under paragraph 3 of your letter, No. 1,918 G., dated 4th November 1880.

3. It is also a matter of question with this Government whether the important station of Bangalore should not again be formed into a separate division, in case the new Army Organization Scheme be carried into effect, as it would then in all probability become Army Head-quarters for the Presidency. For the present, however, no immediate change seems necessary.

4. With reference to the additions required to the scale as originally sent up, I am in the first place to note that (1) the Madras Irrigation Company's Canal (soon about to be taken over) and the Sungum Project sanctioned by the Government of India in their letter, No. 188 I., dated 6th May 1881, in Nellore (the arrangements for prosecuting which have already been commenced by appointing the officers and several of the subordinates, &c.,) must be included.

5. To these requirements must further be added two officers in the grades of Executive Engineers omitted by a clerical error in the "Distribution Statement" which accompanied my letter, No. 2,277 W., dated 1st October 1880, where it will be observed that under the head "Supernumeraries" calculated at 10 per cent. only one officer has by oversight been shown in the grades of Executive Engineer instead of three.

6. The additions to the scale will therefore stand as under :—

	Executive Engineers.	Assistant Engineers.	Upper Subordinates.
For the Madras Irrigation and Canal Company, see Government of India letter, No. 207 I., dated 16th May 1881.	1	2	6
For the Sungum Project sanctioned by the Government of India letter, No. 188 I., dated 6th May 1881.	1	2	6
To rectify error in the previous Distribution Statement ...	2	...	...
Total ...	4	4	12

7. If the four additional Executive Engineers be distributed in the strength of one to each of the sanctioned grades and the Assistant Engineers be divided equally between the 1st grade and the 2nd and 3rd grades combined, the modified normal establishment would then stand as follows (paragraphs 5 and 6 of your letter under reply) :—

Chief Engineers.

1st Class	...	...	...	...	...	...	...	...	...	1
2nd „	...	...	...	...	...	...	...	...	...	1
3rd „	...	...	...	...	...	...	...	...	...	1
										3

Superintending Engineers.

1st Class	...	...	...	...	...	...	...	...	...	2
2nd „	...	...	...	...	...	...	...	...	...	2
3rd „	...	...	...	...	...	...	...	...	...	2
										6

Executive Engineers.

1st Grade	...	...	...	...	...	...	...	...	...	10
2nd „	...	...	...	...	...	...	...	...	...	11
3rd „	...	...	...	...	...	...	...	...	...	11
4th „	...	...	...	...	...	...	...	...	...	4
										36

Assistant Engineers.

1st Grade	...	...	...	...	...	...	...	...	...	26
2nd and 3rd Grades	...	...	...	...	...	...	...	...	...	21
										47

Upper Subordinates of all grades ... 185

8. The attached Distribution Appendix A shows the circles and divisions, and Appendix B the cost in prescribed form, both in substitution of those originally submitted for sanction.

9. As regards A, the distribution, it will be observed, differs somewhat from that suggested by the Government of India, though No. I Circle is the same as that given in paragraph 3 of your letter. No. II Circle will now consist of the two Kistna Divisions, the Sungum Project and Nellore instead of the Buckingham Canal, which latter will much better fit into No. V Circle.

10. The Nellore Division with the Sungum Project will be a sufficient addition to the Kistna Delta works, and should the completion estimates for the latter be sanctioned as may be early looked for, the Superintending Engineer will have quite as much if not more than he can satisfactorily administer.

11. All the other circles have been made out strictly with reference to the actual works in progress and proposed, so as at once to give each Superintending

Engineer ample employment and the best centre from which to supervise the operations of that portion of the department under his charge.

12. To three of these circles have also been assigned such of the new project divisions as fall naturally within their respective limits; the 4th of these, Division (D), being, however, reserved specially for personal supervision by the Chief Engineer for Irrigation for reasons subsequently to be explained.

13. Turning to Appendix B it will be noted that the total annual charge for establishment is raised from 16.13 (the total present charge) to 20.64 lakhs; but as the outlay on both Protective and Productive works increases annually till the total expenditure by the department more than doubles what it is at present (a little over 50 lakhs), the high percentage now apparent will disappear in course of time.

14. It being the intention of Government to initiate the redistribution of charges, &c., under the new scale from the 1st August, the total outlay on establishment for the current year would generally stand as follows :—

	At per Annum.	LAKHS.	LAKHS.
To four months, April to July (both inclusive) 1881, as per Part iii, Budget of Provincial Services for 1881-82 ...	...	16.13	5.38
To eight months from 1st August 1881 as per Appendix B ...	...	20.64	13.79
Total for Current Official Year ...	...	...	19.17

15. This amount cannot however be worked up to as it will take time to fill all vacancies in the Engineer and Subordinate grades.

There are moreover several modifications to be introduced later on when it is more accurately known how the vacancies in the Gradation List are to be filled up, and when instructions have been received as to the incidence of the charges affecting the Imperial and Provincial Budgets.

16. In regard to the latter point, your letter (paragraph 7) lays down that 2½ lakhs will be contributed during the current year from the general grant for “Protective” Public Works; and again in paragraph 10 an intimation is understood to be conveyed that the Government of India would not be indisposed to consider the advisability of debiting a portion of the charge for Irrigation Establishment against the revenue of the works on which they are engaged.

17. The subject of the latter proposal has already been submitted for the consideration of His Excellency the Governor-General in Council in G.O. of 12th April 1881, Nos. 269 and 270 I., and on receipt of a reply it will be possible to deal with the mode of distributing the charges among the different budgets.

18. With reference, however, to the contribution from Imperial of the 2½ lakhs, I am to state that this Government propose to appropriate at once Rs. 75,000 for pushing on as a “Protective” work the Pottinghy Ghat in Vizagapatam (to be adverted to further on), setting free a corresponding amount which is most urgently needed for the execution of a number of buildings, &c., which, as will be seen from Part B of the Provincial Budget for the current year, cannot otherwise be met for years to come, and to reserve the remaining Rs. 1,75,000 as a contribution towards the general establishment charges of the current year.

19. I am now to advert to the subject-matter of paragraph 11 of your letter under reply, and, in so doing, to submit for approval the Gradation List Appendix C containing the promotions which it is intended to give effect to from the 1st August, as being the date from which it is desired by this Government to constitute, as far as may be possible, the new divisions and circles of superintendence, and for which all the requisite arrangements are being made.

20. In reference to your remark that it would lead to inordinately rapid promotion to fill up the vacancies in the higher grades altogether from the lower grades of the present Madras staff, it may at once be stated that, owing to the number of Royal Engineers in the higher grades who went to England on the special furlough on the occasion of the late reductions, and who will shortly return to duty (Lieutenant-Colonel Burton, R.E., has been telegraphed for to take up the Presidency Division,

and will be here by 1st August), as also to other causes unnecessary to detail, there will practically be no promotions to speak of till the 3rd-grade Executive Engineer is reached, and only nine vacancies in the combined 2nd and 3rd grades Assistant Engineers to make up.

21. Among the Chief Engineers there is no promotion, while in the three classes of Superintending Engineers the first promotion is that of Colonel W. Chrystie from third to second class. This officer will not only have nearly twenty-six years' service in the department on the 1st August, but has frequently, during several years past, acted as Superintending Engineer, 2nd Grade, in both Mysore and Madras. The second promotion is that of Mr. Rundall from 1st-grade Executive Engineer to 3rd-class Superintending Engineer. He has likewise twenty-six years' service in the department, and has for some time acted, with great credit to himself, as Superintending Engineer.

22. These are both excellent officers of great experience, and could not possibly with any considerations of justice be superseded by an officer introduced from another province.

23. It is also especially to be observed with reference to this that the insertion of a fresh officer in any of the classes of Superintending Engineer would cause an excess of one in the number of 1st-grade Executive Engineers. This latter is now full and there will be no promotions.

24. In the 2nd grade, owing to the late introduction of Major A. T. Fraser from the Mysore Department, and the return of Major S. C. Clarke from the Railway Department under the Government of India, there is only one promotion from the 3rd grade—Captain D. McNeil Campbell, a very promising officer with twelve and-a-quarter years' service in the department.

25. Among the Executive Engineers, 3rd Grade, on the new scale there will be one officer reinstated, Mr. R. W. Norris, and five promotions from the 4th grade, viz., Messrs. Peters, Hughes, Larminie, Bell, and Captain Smart, R.E., all of whom have service in the department ranging from fourteen to over ten years.

26. Mr. Norris' case is peculiar. His name was included in the late reductions, and after retirement he accepted employment as Local Fund Engineer, North Arcot; but as he is a specially trained Irrigation Officer whose services would be very valuable, this Government have considered it desirable to reinstate him, and he has been directed to report himself for duty on 1st August. It is not considered desirable in the interests of the public service that any other of the officers previously reduced should now be reinstated.

27. The list shows two promotions from 1st-grade Assistant Engineer to 4th-grade Executive, viz., Mr. Grimes (an old officer who commenced as a military subordinate) and Lieutenant C. B. Henderson, R.E., who has more than eight years' service in the department.

28. In addition to these four officers who would complete the scale, it has been thought desirable to enter the name of Mr. Wilks as temporary Executive Engineer.

29. This officer is now second on the staff of the Madras Irrigation and Canal Company, and although, as previously reported (*vide* letter No. 202 I., dated 18th March 1881), it would be inexpedient to place him in the position of a Superintendent of Works for the canal on the work being taken over from the Company, it is thought that, owing to his local knowledge and experience as an Engineer, he may very possibly be quite capable of remaining in charge as Executive Engineer under the immediate direction of the Superintending Engineer of the Circle. In any case, I am to say, this Government is prepared to make the experiment, and as the best means of doing so would wish Mr. Wilks, during his term of probation (a year), to be borne on the strength of the department in the manner now proposed, should he be willing to accept the position.

30. If he subsequently gives satisfaction, his permanent grading will not occasion any serious difficulty, as in all probability before the time comes one or more vacancies in the higher grades will almost certainly occur.

31. Proceeding to the Assistant Engineers, it will be observed that there are eleven promotions from 2nd to 1st grade, the junior, Mr. W. Jopp, having very nearly four years' service in the department on 1st August. As the senior, Lieutenant O. V. Boddy, has a little over eight years' service, it is believed that these limits correspond very closely to the lengths of service in this grade, which it is the desire of the Government of India to secure for future working.

32. It was the original intention of this Government to promote into this grade, on precisely the same honorary footing as military subordinates, Sub-Engineers S. Ottmann and J. W. Ellis, whose cases were submitted specially (see margin) for the consideration of the Government of India, This department letter, No. 1,134 W., dated 2nd May 1881.

and even now the Government were prepared, failing this arrangement, to bring them permanently on the strength of the Engineer Establishment; but their promotion having lately been definitely barred by the orders contained in your letter, No. 797 G., dated 10th June 1881, their names have been removed from the list. I am, however, to submit that this Government still entertains a strong conviction that it would be both advantageous to the public service to promote these very deserving subordinates, and in every way politic to do so, especially at this juncture, when their advancement can be effected with much less hardship to others than would at any other time be possible.

33. I am therefore to solicit further consideration on this point, and to state that, if the Government of India sees fit to grant the concession, their names might be introduced immediately below that of Mr. H. E. G. Evans.

34. At the bottom of the list there are nine vacancies in the combined 2nd and 3rd grades of Assistant Engineers, and as it is unlikely that officers in these grades would care to be transferred from other provinces, this Government desires to be given complete freedom of selection within, of course, Code rules.

35. Should any Royal or Cooper's Hill Engineers, however, desire to enter, they could at once be posted according to length of service. Otherwise the Honorable the Governor in Council would be disposed to select one or two of the most promising youths who have of late years passed out of the Civil Engineering College, Madras, with certificates as Assistant Engineers, and fill up the remaining vacancies as opportunity offers.

36. In concluding this part of the subject, I am in the *first* place to observe that a comparison of the respective lengths of service of the officers in the Madras Department with those in other provinces more immediately under the Government of India as shown by the published classified lists, has established so clearly the fact that, the former have in all grades been hitherto unduly retarded in promotion, that the Honorable the Governor in Council would strongly deprecate the introduction, (certainly in any of the grades above Assistant Engineers) of officers from other provinces; and in the *second*, that a very early acceptance of the Gradation List by the Government of India as now sent up is so desirable (with a view to the promotions being gazetted by the 1st August) that, I am to solicit the favor of sanction to the same being telegraphed as soon as possible after receipt of the present communication.

37. In reference to the desire expressed, paragraph 13 of the letter under reply, that room should be found among the Upper Subordinates for those of this class who were originally transferred from Madras to Mysore, I am to state that this has already been done, and the three who could alone be spared from Mysore (see margin) have already joined this department.

Conductor FitzGibbon, Sub-Engineer, 2nd Grade.
Sergeant Heinig, Sub-Engineer, 3rd Grade.
Conductor Keenan, do. do.

38. I am now to invite attention to the four Divisions which it is proposed, in accordance with the original programme, to constitute with the object of preparing such projects as mainly fall within the class of *Protective* works, to be executed from the Imperial grant under this head.

39. As a convenience the information called for regarding this subject (paragraph 8 of your letter) giving the list of projects under preparation, and those which it is proposed to prepare during 1882-83, is shown in the Appendix D, regarding which the following general observations will, it is hoped, suffice.

40. Of the four divisions to be formed, one will be exclusively for *Roads and Buildings*, and the rest *Irrigation*, thus :—

Superintending Engineer's Circle.	Designation.	Branch of Department.	Class.	Names of Projects.
First Circle ...	A. Project Division.	Roads and Buildings.	(Imperial) Protective.	(a) Ganjam-Gopálpur Canal. (b) Road from Sálár viá Potinghy Ghat to Jagdalpore. (c) Buckingham Canal from end of Commamur Canal north to Merkanum south. (d) Do. south of Merkanum.
Fourth Circle ...	B. Project Division.	Irrigation...	(Imperial) Protective.	(e) Baroor Tank. (f) Marandahully. (g) Vaniar.
Third Circle ...	C. Project Division.	Irrigation...	(Imperial) Protective.	(h) Hindupur Reservoir. (i) Roddam do.
Immediately under Chief Engineer for Irrigation.	D. Project Division.	Irrigation...	(Imperial) Productive and Protective.	(j) Complete revised project for Godáviri Delta. (k) Completion project for the Kistna Delta. (l) Perryaur Project. (m) Pugalur do.

N.B.—(c) and particularly (d) will, when the time comes for completing the estimates, be transferred to the Superintending Engineer, Fifth Circle.

41. As regards (A) Division there can be no question, I am to observe, first that the works included in it are each and all of a strictly "*Protective*" character; and, second, that however urgently required, no sums which would allow of their making any adequate progress, can be assigned from unaided Provincial Funds, either during the current or in future years.

42. Allusion has already been made to the Potinghy Ghat (paragraph 18) and its extension westwards through Jeypore towards Bustar and the Central Provinces. The want of a trunk road through

all this tract, hitherto inaccessible to carts which nevertheless could, if opened out, supply the littoral districts with cheap grain in famine, is acknowledged to be a pressing necessity in a protective sense, and stands much on a par with the proposed railway from Bimlipatam viá Vizianagrum and Raipurh to Raepore. Both will open up vast tracts of country for the supply of cheap grain to the coast, and cannot fail to prove of the highest value for purposes of administration, as also, in all probability, for the encouragement of emigration in the manner advocated by the Finance Minister. It may here be observed parenthetically that no better employment could probably be found for the staff of Railway Engineers which, as stated in paragraph 11, the Government of India will very shortly have thrown on its hands without employ, than by utilizing these officers in preparing the estimate for the line of railway here adverted

to (see also the correspondence noted in the margin).
Letter to the Government of India, No. 564W., dated 21st February 1881.

Do. No. 150 R., dated 15th February 1881. 43. To allow of the works which are in progress on the Potinghy Ghât being pushed on during the current official year, Rs. 75,000 will now, as before observed, be

transferred from "*Provincial*," which cannot afford the amount to "*Imperial Protective*," the remainder of the 2½ lakhs being taken as a grant for establishment required for investigating the projects specified.

44. As regards the Buckingham Canal and the future extension of the work south of Merkanum, its character as a famine work has been too clearly demonstrated during the last calamity to need any remark here.

45. The works in (B) and (C) Project Divisions also call for no remark, as they strictly come within the classification of "*Protective*".

46. Regarding those included under the (D) Division it may be safely affirmed that they may be classed as Protective in addition to being Productive, the two last on the list belonging more particularly to the former class. It is needless to observe that, however remunerative the Godáviri and Kistna Delta Works have proved, the chief incentive under which they were commenced was the necessity, which presented itself to the Government of the day, to do all that lay in its power to counteract the evils of frequently recurring famines in these tracts.

47. Until the Protective works projects (with the exception of that for the Potinghy Ghat, which is ready and under execution) have been sanctioned by proper authority it would be out of place to name any specific sum in excess of the 2½ lakhs granted for the current official year from Imperial; but the Honorable the Governor in Council desires to take this opportunity of pressing on the attention of the Government of India the necessity for making assignments in future years, not merely in direct proportion to the contributions of this Presidency towards the Imperial Exchequer, but also in compensation for the long years of neglect under which it has most undeservedly been compelled to suffer, owing to the undue outlay conceded to other more favored provinces.

48. This subject has been already submitted for the consideration of the Government of India in my letter, No. 337 W., dated 8th February 1881, and it will therefore suffice here to observe that this Government consider themselves fully justified in looking for an assignment for Protective works from Imperial of 15 lakhs (to include 2½ or 3 lakhs for establishment) in 1882-83 and an addition of 10 lakhs in each succeeding year till a maximum of 80 lakhs per annum has been attained, as the least that can be given with reference to the large proportion of net revenue (5½ millions sterling per annum) which Madras has been shown to contribute to Imperial income, and as affording some substantial means towards guarding the Presidency in future against the horrors of famine.

49. In general connection with the subject of the normal scale of establishment for this department, I am in conclusion to solicit the decision of the Government of India as to the agency by which the Local Fund Boards' projects are to be supervised so far as concerns the larger class of works for which the machinery at present possessed by them or by the Revenue Board (which deals with their budgets and ordinary assignments for establishment and works) is at present inadequate.

50. Adverting to the correspondence on this subject concluding with my letter, No. 1,034 W., dated 22nd April 1881, I am desired to say that this Government are prepared to accept the arrangement suggested in paragraph 5 of your letter, No. 1,639 G., dated 17th September 1880, by which, in return for a general contribution on the part of Local Fund Boards of Rs. 21,250 per annum, this department would undertake the duties in question without, however, making any personal allowance to the officers to whom such duties may be assigned. The agency now placed at the disposal of the department will admit of the duty being performed in a manner satisfactory alike to Government and the Local Fund Boards.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

FORT ST. GEORGE,
9th July 1881.
Exd. A. F. Goodall.

BUILDINGS AND ROADS.
CIVIL WORKS.

Gobt. of (1881) Madras.
PUBLIC WORKS.

THE SECRETARY TO THE
GOVERNMENT OF INDIA.

Dated July, 9th.

Send

Recd.

Encl.

G. O., 9th July 1881, No. 1,687 W.

JULY.
No. 9.

RELATIVE to the normal strength of
establishment for the Public Works Depart-
ment, Madras Presidency.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

17th August 1881, No. 2,018 W.

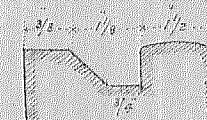
Buildings and Roads.
Civil Works.

Read the following papers :—

No. 65. MEMORANDUM by Major A. T. FRASER, R.E., on Steam Tramways for the Metalled Roads of India.

BEING at Wellington, New Zealand, in November 1879, where a steam tramway, two miles long, is in operation, I was much struck with the ease with which it was worked, the simplicity of construction, and the evident applicability of the system to Indian roads. The trains, consisting of an engine and two coupled omnibuses, were carried with steadiness and certainty, at a speed of ten miles an hour, over just such roads and gradients as are usual in India. There was no interruption of the ordinary traffic. The trains stopped like horsed omnibuses to take up and let down passengers, they turned sharp round the corners of streets, and went up inclines of one in thirty-five. It was marvellous with what unconcern stones, mud, and chance rubbish were passed at full steam, and though the groove in the rails was exceedingly slight the train showed no tendency to leave the line. The switches were simple hinged bars which the conductor got down and adjusted with his foot; the points, sidings, and crossings were all of the plainest and most obvious description, formed chiefly by common workmen out of the rails themselves. At one end of the line there was a shed to accommodate the rolling stock, and a small workshop for repairs. It was quite clear that if such a tramway could be run for two miles upon a comparatively uneven road, which accommodated at the same time a heavy traffic of quick moving vehicles, there was nothing to prevent its being successfully introduced for much longer distances on the metalled roads in India.

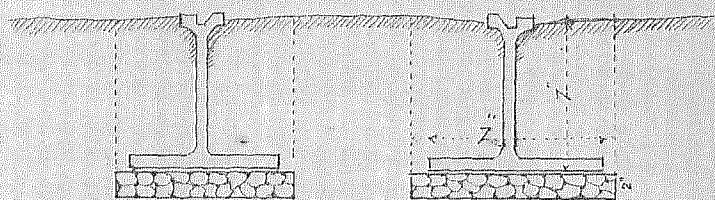
As regards its rails, the Wellington tramway is not a model for adoption. The rails are simple bars of iron, of about 3 inches by 1 inch in section, rolled with a groove. So far, being capable of being turned out in India, they have a useful form, but they require to be supported on a strong frame-work of longitudinal and cross sleepers, which would be much too costly for the ordinary roads. Perhaps if Portland cement concrete could be laid as a substructure instead of timber, bar rails could be fastened to slabs of concrete and thus employed. The plain bar is the handiest rail as well as the earliest pattern used on tramways, and experiment with concrete is desirable. In rolling however attention has to be given to the shape of the groove. Mr. Clark lays down the best form as that which has the side next the rolling surface vertical, and the whole of the slope on the inner side; or such a section as the following :—



It has been found that a depth of flange of only half an inch is sufficient to keep the wheels on the line. I saw a similar tramway to that at Wellington in work at Dunedin.

The only part of the Indian tramway problem which remained unsolved by what I observed in New Zealand was how to support the rails without the use of large quantities of expensive timber.

I happened to visit Manchester in April 1880, and there accidentally noticed a new description of steel tramway rail being laid in one of the streets, which was just the kind of permanent-way wanted for India. A diagram of the section is as under:—



Two parallel trenches were dug in the roadway, barely a couple of inches of concrete laid down, and upon this the flanges of two deep rolled steel joists having the top member formed into a tramway rail. The joists were rolled of one piece in 30 feet lengths, and I am informed the groove was subsequently planed out. When laid they were fished at the joints and the causeway was packed to restore the roadway.

It is obvious that such a rail is likely to keep a firm position imbedded in the metal of a road and, as it dispenses with all timber, is exactly suited to Indian requirements. Having been only recently introduced in England, so much so as not to be even noticed in the latest books on tramways, particulars as to its durability cannot be given, and in any case trial is necessary under Indian conditions before its advantages, which may be safely predicted, can be determined.

But if these steel rails turn out to be all they promise tramways can be opened with great rapidity. For unlike railways, which require surveys of new routes, a fresh set of cuttings and embankments and bridges, and supersede existing roads formed and maintained at considerable expense, tramways can be laid down on the roads as they stand, almost as quickly as the rails are delivered. No station buildings are required along the line, road and tramway maintenance can be amalgamated, and the ordinary traffic can still use the roads. But it is worth mentioning that while the traction on common macadamized roads is 44 to 67 lb. per ton on a level, it is only 17 to 25 lb. per ton on tramways. Hence it is probable that private enterprise would largely place cattle-drawn trucks on the line in addition to the public steam-trains, for which every facility could be given by appropriate crossings.

The engines on the Wellington tramway bore the name of Messrs. Merryweather and Sons, the makers of steam fire-engines in London. I have called at their office in Greenwich and obtained rough estimates of the plant needed to work a tramway.

Messrs. Merryweather can furnish a passenger tramway car, like those in photographs A and B, weighing 50 cwts. unloaded, and 5 tons loaded with 26 passengers inside and 20 outside for £250.

A locomotive of about 20 horse-power, weighing 7 to 8 tons, capable of a speed of 15 miles an hour, would, for occasional gradients of 1 in 30, draw three such cars and cost from £850 to £1,000.

They can supply goods wagons weighing 40 to 60 cwts., according as they are covered or open, at a cost of £180 to £200. The wagons will carry from 3 to 4 tons of goods.

A cheaper kind of passenger car seated for 20 placed back to back, as in photograph C, can be supplied for £60 to £80 each, and the cross seated pattern of photograph B for £130 each.

For India the working parts of the engine would have to be lifted out of reach of the dust which is so prevalent on the roads, and the furnace would have to be adapted to burn wood.

Merryweather's engine is stated to require 550 lb. coke per 100 miles run at $8\frac{1}{2}$ miles an hour average speed, from which basis calculations can be made of the demand of fuel for an Indian tramway.

It would not be difficult, as part of a tramway scheme, to have enough land taken up and forest planted to yield a constant supply of firewood along each line. India has no coal in the south, but can make up for this by the rapidity with which the growth of timber proceeds. Firewood could indeed be produced in India with far greater ease than the cattle food which would contribute an equal tractive force.

Although there are many tramways working, chiefly, however, in towns, I have not seen a single example which combines the rough and ready characteristics of the New Zealand lines with the use of the Manchester steel rail.

To give this system therefore a fair trial it would be necessary to lay down a few miles of tramway on a selected metalled road in India. There are obtainable at once in the market, the rails, cars and locomotives suited for the experiment.

For a length of 15 miles, or one and-a-half hours run at 10 miles an hour, the rough estimate would be as follows:—

2,541 tons of steel rail (10 per cent. spare) at £11-15	...	...	£.	29,857
Freight	...	...	...	3,811
3 Locomotives at £850	...	...	...	2,550
6 Passenger cars at £250	...	...	...	1,500
2 Open passenger cars at £80	...	...	...	160
4 Goods wagons at £200	...	...	...	800
Weight	...	...	...	75
				38,753
		at 1/9d per Re.	...	Rs. 4,42,891
15 miles laid, &c., in India at Rs. 2,000	...	...	...	30,000
Sheds and Workshop	...	...	...	8,000
				Rs. 4,80,891

so that for Rs. 4,81,000, or at the rate of Rs. 32,000 a mile, an experimental tramway 15 miles long could be set in operation.

Mr. Clark, an authority on tramways, mentions that the locomotives made by Messrs. Merryweather, from their moderate speed and indraught, only consume from a third to a fourth the fuel that a railway engine does per square foot of grate.

Six trains each way on 15 miles would give a train mileage of 180 miles, and a consumption of 990 lb. of coke, equivalent to 2,970 lb. or $1\frac{1}{4}$ tons of inferior firewood, during a day. Beyond fuel the working expenses would consist of the wages of a conductor for each car, a couple of stokers for each locomotive, a clerk or two to keep accounts, oil and petty stores, and a certain sum, yet to be ascertained, for renewals and repairs.

A mere allusion may be made at present to the prospect opened up by Colonel Beaumont's compressed air locomotive. It is stated that one of these, weighing $4\frac{1}{2}$ tons, with reservoirs for air at 1,000 lb. per square inch pressure affording 65 cubic feet space, can run for $6\frac{1}{2}$ miles on a level with a load of 4 to 5 tons. This type of engine will no doubt be further improved.

It would be convenient to have stationary compressing engines at fixed intervals, and that the locomotives should only carry air. Still more so when economical means of transferring power to a distance at pleasure through electro-motors has been discovered.

Meantime the question is whether rolled steel rails can be laid profitably as tramways on Indian roads. For better forms of rolling stock can hardly be imagined than those now procurable.

It may be asked why, if tramways are so cheap and simple, they are not universally put on the roads. As a matter of fact the system meets with a good deal of prejudice, and the countries which have adopted them in towns are those in which for the country a higher rate of speed is demanded than tramways can pretend to give. But nothing seems to have retarded their introduction more than the cumbrous staging which has hitherto formed the permanent-way of tramways.

LONDON,
2nd September 1880.

(Signed) A. T. FRASER.

No. 65-A. *Note by the Consulting Engineer for Railways on relative Cost of Broad and Metre Gauge Railways.*

For purposes of comparison based on the experience obtained in this Presidency, we may take the South Indian Railway which has constructed lines on both gauges. The cost of the 168 miles of broad gauge between Negapatam and Erode averaged, on 30th June 1870, £7,902 per mile. It had then been open on an average for nearly six years; and, on 30th June 1874, the cost had risen to £8,470 per mile. Since the latter date no separate accounts of it have been kept.

The cost of the 215 miles of metre gauge line south of Trichinopoly averaged, at the end of 1878, when it had been open for more than three years, a little over £5,000 per mile. The cost of the line from Madras to Tanjore is somewhat higher, and will probably average at the present time about £6,000 per mile.

The sections between Negapatam and Erode, and between Trichinopoly and Tuticorin, compare fairly as to the nature of the country traversed. Both have the same ruling gradient (1 in 100), and the amount of waterway per mile is probably nearly equal. Figures are not at hand for the old line; but the openings provided on the other section average 45 lineal feet per mile, which is somewhat below the average of other lines in this Presidency.

The permanent-way for the metre gauge lines was purchased when the price of iron was at its maximum; and, at present prices, a considerable saving would be effected.

The Madras Railway has cost £11,800 per mile; but the country traversed is more difficult than in the case of the South Indian Railway.

Owing to the experience gained in past years, it may be assumed that broad gauge lines could now be constructed somewhat more cheaply. The Nilgiri branch of the Madras Railway cost about £8,000 per mile, exclusive of rolling stock; and it is estimated that a branch to Cochin would not cost more than £9,000 per mile; also excluding rolling stock.

The figures here given provide for a first-class line of broad gauge railway. We have no experience of *light* broad gauge lines with rails weighing 56 or 60 lb. per yard, and with engine wheel-weights to correspond. The rails for the Madras Railway, and South Indian broad gauge, weigh 75 and 68 lb. respectively.

The accompanying Proceedings of Government contain some information respecting the cheapest lines of railway yet constructed in this country. The Muttra-Hathras line, therein referred to, has yielded an average dividend of 4.9 per cent. during the last three years.

The class of line to be selected must depend much on the nature of the country traversed, and the speed required. In difficult country the difference in cost between the broad and narrow gauge would probably be much greater than shown on the South Indian Railway. A metre gauge line can be opened out at reasonable cost, even through difficult country, *e.g.*, the line from Karwar to Gadak is estimated at £7,560 per mile only, including land, and interest during construction. In moderately easy country a metre gauge line could probably be opened out for Rs. 45,000 to Rs. 50,000 per mile, at present prices of iron, if station accommodation be restricted to actual wants and the speed be limited to 15 miles an hour. As the Vizagapatam lines will link in with the metre gauge extension of the Nagpur branch probably this would be the best gauge to adopt; but the country might be opened up at first by a tramway, if considered sufficient for the traffic expected. Some useful information on this point could probably be obtained from the Government of India, in regard to the Darjeeling tramway.

The following extract is a summary of Mr. Molesworth's conclusions respecting the broad and metre gauges:—

1st.—The capacity of the metre gauge is sufficient for all purposes of railway transport.

2nd.—The carriages and wagons on the metre gauge railway are nearly equal in capacity to the ordinary stock of English railways.

3rd.—The locomotives designed for low speed on the metre gauge are equal in tractive force to the large express engines designed for high speed on English railways.

4th.—The rolling-stock of the metre gauge will be perfectly safe at a speed twice as great as that proposed for the State Railways of India.

5th.—The metre gauge, in my (Mr. Molesworth's) opinion, is sufficient for all commercial and military purposes.

6th.—The cost of a broad gauge railway (60 lb. rails), with structures designed for the engines and other rolling-stock of the Guaranteed Railways, will (excluding very large bridges) exceed the cost of the narrow gauge by £1,650 or £2,000 per mile.

7th.—The cost of a broad gauge railway (45 lb. rails), with structures designed only for the carriage and wagon stock of the Guaranteed Railways, (but not for the engines,) will exceed the cost of a narrow gauge railway by £720 or £1,000 per mile.

8th.—The cost of a broad gauge railway (40 lb. rails), with structures designed for the same axle-loads as the narrow gauge, will exceed the cost of a narrow gauge railway by £350 or £500 per mile.

9th.—The last of these three would practically be as great an obstacle to the interchange of traffic as if a break of gauge existed.

10th.—There will be no appreciable difference between the working expenses of the broad and narrow gauge railways.

11th.—The break of gauge in a commercial point of view, though an evil, is not one sufficient to justify the condemnation of the narrow gauge.

(Signed) J. SHAW-STEWART, Col., R.E.,

Consulting Engineer for Railways.

6th October 1880.

No. 65-B. Steam Tramways for India, an introductory pamphlet by Mr. CLAUDE VINCENT, A.M.I.C.E., Under Secretary to Government, Public Works Department, Irrigation Branch.

No. 66. *Note by the Chief Engineer, Public Works Department.*

THE questions now under the consideration of Government with reference to the Famine Code, as also the correspondence as yet incomplete with the Government of India on the subject of "Protective" works, appear to invite special attention to the applicability of steam tramways for certain selected lines in the famine zone of this Presidency.

2. The Famine Commission (page 169 to 171, Part I of their Report) have gone at length into the subject of railways as a means of distributing food in famine, and they have assumed as an ideal system a series of lines, each 300 miles long, serving 25 miles of country on either side.

3. This was much the same as the plan Sir Andrew Clarke had previously in view when, in his speech in the Viceroy's Council on famine works, he observed that, "the railway system must continue to expand and will expand till every inhabitant of India is within 50 or 100 miles of a railway."

4. When applied, however, to the actual circumstances of the famine zone in this Presidency there are two very patent difficulties to be encountered:—

- (1.) Neither the Indian nor the metre gauge railways can be built with any hope in ordinary years of yielding any adequate return on their prime cost.
- (2.) Unless a sufficiently close net-work of lines be established, the means for distributing food grains will not meet the requirements of extreme famine, accompanied, as was the case in the last calamity, by the great loss of draught cattle.

5. Sir Andrew Clarke well observed in his speech that, "A grass famine may be said to be as bad as a grain famine," and the Famine Commission remark, "In

time of drought and famine the substitution of mechanical for animal power for purposes of transport is another very important advantage which it is not possible to reckon by any money standard."

6. Again, in his late pamphlet on steam tramways, Mr. Vincent remarks that the block at the Raichore Railway Station during the last famine, owing in very great measure to the thousands of bullocks that had died, "must have been seen to be believed."

7. Although it cannot for a moment be supposed that by the adoption of a cheap system of steam tramways for aiding in the distribution of food-grains during famine, the difficulties above adverted to can by any means be entirely overcome, it is still clear that they can be in great extent minimised.

8. As regards the question of expense, it will be seen from the annexed memorandum by Colonel Shaw-Stewart that, "In a moderately easy country a metre gauge line could probably be opened out for Rs. 45,000 to Rs. 50,000 per mile at present prices of iron, if station accommodation be restricted to actual wants and the speed be limited to 15 miles an hour."

9. In his pamphlet Mr. Vincent gives, as an approximate estimate, for a steam tramway on the standard $5\frac{1}{2}$ feet gauge, 15 miles in length, with Bessemer steel rails, 35 lb. to the yard, £2,500 (or Rs. 30,000 at 1s. 8d. per rupee) per mile; and for a similar work on the metre gauge, with steel rails 30 lb. to the yard, £2,200 or Rs. 26,400 to the mile.

10. Major Fraser, in his memorandum of the 2nd September 1880, gives also as his estimate for 15 miles of tramway on the Merryweather system the probable cost at Rs. 32,000 per mile.

11. Colonel Shaw-Stewart's estimate for a metre gauge railway does not, it is believed, include the cost of locomotives and rolling stock, while these are included in the above; it may therefore apparently be accepted *prima facie* that steam tramways on even the broad gauge could be built at two-thirds the prime cost of metre gauge railways.

12. But as the problem to be solved requires as a *sine qua non* that all outlay shall be reduced to an absolute minimum compatible with the attainment of the immediate object in view, it does not appear improbable that a very sensible reduction could be effected even on the low estimates above.

13. It is, in the first place, well recognised that the metre gauge for State Railways was a compromise of conflicting opinions, and that $2\frac{1}{2}$ feet represented much more nearly the width of a truly narrow gauge. The Port Modoc line is only 1 foot $11\frac{1}{2}$ inches gauge and works up to 30 miles per hour.

14. There may be technical objections to a gauge of 2 feet in reference to the most economical form for the engines, but if these could be overcome there is no other reason apparently against its adoption.

15. Speeds again of 15 and 20 miles per hour are solely accepted on the demands of the British travelling public, but are by no means applicable to the case under consideration, 6 or 7 miles per hour average speeds with 10 miles as a maximum would, it is thought, amply suffice.

Throughout the famine zone the beds of large streams and rivers are quite dry excepting for a very few days in the year, and they might easily be crossed by causeways, thus saving the cost of all large bridging.

These principles accepted, a corresponding reduction in the metals to 20 lb. or at most 25 lb. per yard might, it is believed, be effected. No fencing and few or no stations would be needed, as pointed out by Major Fraser.

On the whole, therefore, it is not too much to assume that lines of steam tramways might be established along selected routes for Rs. 20,000, or at most Rs. 25,000, per mile, or at little more than double the cost of a metalled and bridged cart road.

It may also be assumed that before very long, by employing compressed air, electro-motors, or other economical means as noticed by Major Fraser, great reductions may be effected in the working expenses.

It is now sufficiently recognized that in the famine zone of this Presidency navigable canals and new irrigation works of a promising, much less of a paying character are out of the question; there would thus appear to be only a choice of two alternatives if famine is to be effectually combated: (1) the people must move to the food on the one line of railway at present existing, or (2) mechanical means of distribution by steam tramways or road engines must be adopted.

For an agricultural population, who require to be sufficiently near the fields to take instant advantage of a favorable change in the weather, the first plan could hardly be adopted as a general working policy, though no doubt in some cases applicable.

Mechanical means for distribution seem therefore alone left for choice, and of these the ordinary road engine, at least in its present form (excessively cumbrous and expensive to work), is apparently not suitable for adoption.

If the Government are satisfied that an effort should be made in the direction above indicated, the following points might be made subject of early inquiry among selected Revenue and Public Works Officers, viz.:—

(1.) To what tracts tramways as protective works would specially apply.

(2.) The lines in order of importance within the famine zone (which consists of the marginally noted districts) which it might be desirable to carry out.

(3.) The probable cost per mile, the gauge rate of speed, &c.

(4.) A rough estimate of the traffic returns in ordinary years.

(5.) A general idea of the advantages that might result from the lines in famine years.

(6.) Whether, and if so to what extent, applicable outside the famine zone.

(Signed) R. H. SANKEY, Colonel, R.E.,
Chief Engineer, P.W.D.

4th August 1881.

No. 67.

ORDER THEREON, 17th August 1881, No. 2,018 W.

THE Honorable the Governor in Council fully concurs in the desirability of instituting the inquiries indicated by the Chief Engineer. The questions brought forward will therefore be considered and reported on as follows by Public Works Officers and such officers of the Revenue Department as may be nominated by the Board of Revenue:—

(1.)—By Superintending Engineers and Collectors.

(2.)—By do. do. do.

(3.)—By the Consulting Engineer for Railways.

(4.)—By Collectors.

(5.)—By do.

(6.)—By the Board of Revenue, through whom the replies of Revenue officers will be submitted.

2. The papers will also be forwarded to gentlemen not immediately in Government service who may be disposed to favor the Government with an expression of their views on the subject.

(True Extract.)

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

To Superintending Engineers.

To the Consulting Engineer for Railways.

„ Board of Revenue.

„ Revenue Department.

„ Financial „

Exd. S. T. Austin.

Spare Copies



BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of [1881] Madras.
PUBLIC WORKS.

To

SUPERINTENDING ENGINEERS,

&c., &c., &c.

Dated August, 17th.

Issued

Recd.

Encl.

G. O., 17th August 1881, No. 2,018 W.

AUGUST.

Nos. 65-67.

Introduction of Steam-tramways in the
Madras Presidency.

Copy

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

31st December 1881, No. 3197 W.

Buildings and Roads.
Civil Works.

Read the following paper:—

No. 101. From Major W. G. CUMMING, R.E., Officiating Assistant Secretary to the Government of India, Public Works Department, (Civil Works—Miscellaneous,) to the Secretary to the Government of Madras, Public Works Department, dated Fort William, 30th November 1881, Nos. 381—94 M.

THE Government of India having decided that it shall be the duty of the Public Works Department, acting under the orders of Local Governments and Administrations, to select works suitable for famine relief purposes, and to keep lists of works ready to be put in hand without delay on emergency, I am directed to request that steps may be taken, with as little delay as possible, towards preparation of the lists and investigation of the projects selected. The list of works should not be limited to tracts where famines have occurred, or are probable, but should cover all districts under each administration.

2. These lists should include a maximum scale of works proportioned to the probable greatest area and intensity of famine in each province, and should show the numbers and percentage of the population for whom employment could be provided for the space of one year.

3. In connection with this subject, I am to invite attention to paragraph 9 of the draft Famine Code which was circulated for consideration with the Government of India, Revenue and Agricultural Department, letter No. 163—79, dated 18th November 1880.

No. 102. ORDER THEREON, 31st December 1881, No. 3197 W.

ORDERED that the following reply be sent:—

(Here enter No. 3198 W., dated 31st December 1881.)

(True Extract.)

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

Exd. S. T. Austin.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1881) Madras
PUBLIC WORKS.

Date: December, 31st.

Issued.

Recd.

Encl.

G.O., 31st December 1881, No. 3197 W.

DECEMBER.

Nos. 101-102.

Famine Relief Works.—Regarding selection of —.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

No. 3198 W.

No. 103.

FROM

THE SECRETARY TO THE GOVERNMENT OF MADRAS,

Public Works Department,

TO

THE SECRETARY TO THE GOVERNMENT OF INDIA,

Public Works Department.

SIR,—With reference to the request preferred in your letter, Nos. 381—94 M of the 30th November 1881, that early steps might be taken for the preparation of the lists and investigation of the projects suitable for affording relief during famine for all the districts of this Presidency, I am desired by the Right Honorable the Governor in Council to convey his assurance that his most earnest attention has been, and will be given to this subject.

2. I am at the same time to state that it is the conviction of this Government that no such scheme of works is capable of being devised in what may be called the famine zone of this Presidency, as could even approximately meet the requirements of the case in the event of such a famine recurring as that of 1876-78.

3. The true bearings of the problem will be best seen from the following figures, taken from the official review of that calamity issued by this Government early in the current year.

4. The numbers thrown on the relief works when the famine was at its worst were as follows in the districts named :—

District.	Population as per Census of		Average daily numbers on Relief Works.	
	1871.	1881.	Worst Month.	Daily numbers on Works.
Nellore	1,376,811	1,220,385	January 1877.	55,512
Cuddapah	1,351,194	1,120,118	" "	194,425
Bellary	1,668,006	1,339,763	" "	360,597
Kurnool..	959,640	711,557	" "	298,568
Chingleput	938,184	955,354	July "	29,044
North Arcot	2,015,278	1,817,561	September "	70,485
Madura	2,266,615	2,167,381	August "	24,606
Coimbatore	1,763,274	1,658,567	September "	30,303
Salem	1,966,995	1,599,425	May "	55,824

5. An analysis of the work then executed (see Appendix Q of the Review of the Madras Famine of 1876-78) has made it only too clear to this Government that out of a total outlay on works of Rs. 357,76,401, no less than Rs. 223,57,749 was expended on wholly infructuous work : the greater share of this falling to the districts above named.

6. Although there can be no question as to the great value, and indeed absolute necessity, for preparing as early as possible a scheme of works of the character contemplated by the Government of India, this Government cannot, I am desired to say, conceal from themselves the impossibility of devising useful schemes of anything like sufficient magnitude to afford employment to the multitudes which may be thrown on their hands, if such a calamity as the late famine were to recur.

7. With this office letter No. 1697 W., dated 9th July 1881, submitting a scheme (since then sanctioned) for the normal establishment of this department, a list of projects (Appendix D), most of them being of a "Protective" character, was sent up, and the requisite machinery provided for framing the estimates.

8. There are eighteen projects in this programme, estimated to cost approximately 425 lakhs in the aggregate, but of the works enumerated therein only one really large work, and two small ones, all three of doubtful value, viz., the Bhavani, Hindupur and Roddam reservoirs, fall within the limits of the districts which suffered most in the last famine.

9. The establishment of the four project divisions specially charged with the preparation of the above-mentioned eighteen projects might, it is thought, become available for the preparation of projects in other portions of the Presidency, in two or at most three years; but as some of the estimates themselves will very probably ere that time have been sanctioned, most of the members of the establishment so employed will be required for their execution. It is unlikely, therefore, in the opinion of this Government, that many, if indeed any, of the officers and subordinates now engaged specially on these four project divisions can be counted on for framing estimates for the works suitable for famine relief in other districts. From the evidence, moreover, now before this Government, it is clear that if the preparation of the programme of works outside the four project divisions be thrown entirely on the existing working staff of the department, it may be delayed indefinitely from the want of hands, in spite of the most anxious desire on the part of this Government to push it on.

10. The Right Honorable the Governor in Council has already, I am to observe, instituted inquiries as to the feasibility of establishing, throughout the famine zone, such steam tramways or light railways as may facilitate the distribution of food, when as in the last calamity the cattle have died in large numbers from the absence of fodder and water, but the requisite information is at present wanting.

11. Works of this character cannot be placed in the category of those intended for relief during famine, as to be of value they should as a rule be ready and in working order before the necessity for their employment arises, and even if they were made during famine, from the fact that a large portion of the materials would have to come from England, there would be but little employment for laborers on the spot.

12. Were the investigations connected with works of this class, which are purely "Protective" in character, combined with those needed for an exhaustive inquiry as to the schemes which can be brought forward for relief during famine, especially within the famine zone, the fullest employment would be found for a special staff of officers and surveyors during the next three or four years, and I am now therefore to inquire whether, with this object, the Government of India would be disposed to receive proposals for the entertainment of an adequate establishment.

13. The Government are unwilling to close this communication on a subject of such importance, in connection with famine relief, without adding a word in regard to petty works, which though unsuited for entry in a programme, such as that contemplated by the Government of India, might at first sight be thought to afford a very sensible amount of relief during famine.

14. In addition to the small works in digging out ponds, clearing and sinking wells, making village roads, levelling old forts, &c., there are as is well known all over Southern India innumerable tanks, the raising of the earthen bunds of which would furnish work of an undoubtedly useful character.

15. Some of the works of this description may possibly find their way into the regular scheme of relief works, but it may at once be said that to estimate for the vast majority of these in advance would be wholly impossible, though lists may and should be kept of any that can be foreseen.

16. If supervision were available, and *carte blanche* given to repair every village tank in a famine, no doubt a large amount of work could be found in the aggregate, and great good effected; but to ensure the attainment of the object in view, viz., the *bond fide* employment of the labor in such manner as to afford relief from distress, and the proper execution of the work with the comparatively small amount of supervising agency which in all probability will be available, is it is to be feared impossible.

17. With lists of such minor works prepared and constantly revised, Collectors may through such reliable native agency as they may have at command be enabled to tide the people over a scarcity or afford relief during the early portion of a severe famine, but this kind of work cannot be relied on as sufficient or suitable in a famine on any thing like the same scale as that which lately visited this Presidency.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

FORT ST. GEORGE,
31st December 1881.

Exd. S T. Austin.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1881) Madras.
PUBLIC WORKS.

To

THE SECRETARY TO THE
GOVERNMENT OF INDIA.

Dated December, 31st.

Issued

Recd.

Encl.

31st December 1881, No. 3198 W.

DECEMBER.

No. 103.

PROJECTS SUITABLE FOR FAMINE RELIEF
PURPOSES IN THE MADRAS PRESIDENCY.
Regarding—

13TH JUNE 1882, No. $\frac{1475}{A}$ W., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

No. 93-A.

READ—the following letter from Colonel W. S. TREVOR, R.E., Secretary to the Government of India, Public Works Department (Civil Works—Miscellaneous), to the Secretary to the Government of Madras, Public Works Department, dated Simla, 6th May 1882, No. 161 M. :—

In reply to your letter, No. 3198 W., dated 31st December 1881, I am directed to state that in the letter, Nos. 381-94 M., dated 30th November 1881, from this Government, Local Public Works Departments were requested to prepare, under the orders of the Local Government or Administration, *lists of works suitable for purposes of famine relief*, and to take steps for the investigation of selected projects.

2. For the preparation of lists, such as those asked for by the Supreme Government, exhaustive enquiry does not appear to be a necessary preliminary. All that seems to be requisite is, that the Civil and Public Works Officers of each district or division should be called on to submit a list of works which could, in their opinion, be advantageously undertaken for purposes of famine relief. This list would only contain a brief general description of the nature of each work which it is proposed to undertake, and of the advantages derivable from its execution, and it does not appear to the Government of India that any special establishment is required for the preparation of such lists. Should it, however, be found necessary, in any particular case, to employ additional establishment for the purpose, it can be temporarily entertained according to the rules recently issued on the subject. From these lists the Local Government should have no difficulty in selecting and arranging works, in the order of their usefulness, for the special object in view, and for the ultimate advantage of the State.

3. All that the Government of India requires in the first instance is such a list of the most promising of the schemes recommended for adoption as that just described, containing a like brief general description of each project, accompanied by the remarks and recommendations of the Local Government, and by specific proposals for the establishment required, for such further detailed investigation as may be thought advisable.

4. Bearing in mind, however, that many years may elapse before the necessity arises for putting any of the works in hand, it is manifestly neither necessary nor advisable to draw up the first designs in great detail. All that is required is to collect and record clearly so much information as shall afford a rough approximate idea of the number of laborers, skilled and unskilled, for whom employment could be found on each work for some definite period, and of its probable cost at normal rates; and shall enable an Engineer, upon necessity arising, to lay it out on the ground, and set laborers at work upon it, without loss of time. In submitting the proposals for establishment mentioned in paragraph 3, this limitation of investigation must not be lost sight of. With regard to this establishment, I am to state that it must also be "temporary," as the Government of India stands pledged to Her Majesty's Secretary

of State to keep the permanent Engineer Establishment within the limits of present sanctioned strength.

5. That no such scheme of relief works can be devised, as could even approximately meet the requirements of such a famine as that of 1876—78, does not appear to the Government of India a valid argument against the preparation of the best scheme which the physical, agricultural, and commercial conditions of the country will admit. Indeed, the lamentable fact mentioned in paragraph 5 of your letter appears to this Government to prove conclusively that no arrangement could be worse than remaining in a state of unpreparedness and dependence entirely upon the inspiration of the moment for the plan of operations. Employment on the various minor and petty works scattered over the country is well calculated to afford relief to the distressed poor during the early stages of, what may ultimately prove to be, a severe famine. Such works, if properly supervised, may prove excellent auxiliaries for a time, but so far as the Public Works Department is concerned, reliance must be placed mainly on large earthworks in localities where the laborers can be properly organized, fed and looked after.

6. The main characteristic obviously desirable in works intended for the purpose of famine relief is that they shall afford a maximum of employment for unskilled labor. This characteristic is admitted in your letter under reply to be, as a general rule, markedly absent in "Steam Tramways" and "Light Railways," and the Supreme Government is therefore unable to approve of the suggestion that a general preliminary enquiry into the probable nature and cost of works best adapted for famine relief shall be mixed up with detailed and exhaustive examination of projects for "Tramways" and "Railways" which are "Protective" rather than "Relief" Works. The two lines of enquiry, as well as references on the two subjects of "Famine Relief" and "Protective Works," must be kept entirely separate.

No. 93-B.

READ—the following Note by Colonel R. H. SANKEY, C.B., R.E., Chief Engineer, Public Works Department, dated Ootacamund, 8th June 1882 :—

The Government of India, in letter No. 161 M., dated 6th May 1882, lays down the principle that as regards works suitable for famine relief exhaustive enquiry is not necessary, and that all that is required are lists of such works as the Civil and Public Works Officers may consider could be advantageously undertaken for such purpose.

2. Looking upon this as a vital point, I trust I may be pardoned for submitting, with the utmost deference, the following observations for consideration.

3. The remarks which I have to offer have no reference to petty village works of all classes, repairs to the earthwork of tanks, clearances of channels, metalling lines of road or other similar operations, which, however individually extensive and suitable for famine works, can have the requisite data determined, quantities and cost run out, and execution undertaken by an expert Engineer without hesitation or delay. Those I allude to are chiefly large irrigation or water-supply works, navigable canals, storage reservoirs and the like, which in the main compose the lists of works most suitable for relief, when the intensity of famine has so increased as to necessitate the employment of the people in the largest convenient aggregations, with a view to economize the available supervision, which under such circumstances must be limited.

4. Nothing, I must submit, can be more dangerous than for Government to find itself in face of a severe famine with only lists of works, even supposing these to have been compiled by the most experienced Engineers, instead of being able to make the needful selection from thoroughly investigated and sanctioned projects. If there be one lesson more than another which has been taught by the experience of every single famine, and especially by the late calamity, it is I venture to think this—that no large original project should be put in execution, unless it has previously gone through all stages of professional test up to final sanction, precisely as in ordinary times.

5. The startling fact that in this Presidency alone during the late famine no less than $223\frac{1}{2}$, out of a total outlay on works of $357\frac{3}{4}$ lakhs of rupees, were shown to have been expended on acknowledged infructuous work, and that even the residuum would on close scrutiny in all probability have proved to be much of the same character, should, it is thought, suffice to demonstrate the extreme hazard of having to depend at such times merely on lists of projected works.

6. That nothing short of the most exhaustive enquiries, can afford the slightest reliable basis for irrigation and water-supply works of all kinds, depending as they do on such factors as the available supplies of rivers, &c., is, I need hardly say, the conclusion, taught by long and dearly bought experience, of all right-minded Engineers; but as this is not in all probability so clear to others, I may here advert to some well-known facts in support.

7. In this Presidency we have as a striking example the Madras Irrigation and Canal Company's work, which, in consequence of the Bellary famine of 1853-54, was, although projected by quite the most experienced and successful hydraulic Engineers in India, commenced on insufficient data, and has, as well known, led to the most disastrous financial results. The leading facts connected with this undertaking are as follows :—

8. The first rough estimate amounted to $134\frac{1}{2}$ lakhs.* Annual returns to the Company were estimated at $42\frac{1}{2}$ lakhs, and to the Government on account of half water-rate at $33\frac{3}{4}$ lakhs; the expected area to be irrigated was taken at 1,350,000 acres. Works were commenced in 1860, and the Capital outlay to end of 1880-81 amounted to Rs. 1,61,09,370 and Revenue expenditure to Rs. 15,12,161. The total receipts to 30th June 1881 were Rs. 11,37,087. The area of irrigated land which in the famine year 1876-77 amounted to 90,372 acres and produced Rs. 2,47,434 had gradually decreased to 17,798 acres in 1880-81, producing only Rs. 61,519, which did not cover half the working expenses, and left untouched the interest on Capital outlay. This latter alone, as matters stand, amounts at 4 per cent. to nearly $6\frac{1}{2}$ lakhs per annum. If eventually the works pay their working expenses, the dead loss to the State may be therefore taken in round numbers at the latter figure.

9. But the lesson thus taught had by no means the effect which might reasonably have been expected. In order to make good the defects which revealed themselves as the work advanced, four great storage reservoirs, known as the Mauri Kunawai, Muddak-Masoor, Moodaba and Luckawally, were projected.

10. As shown by me in a memorandum drawn up in 1878 for the information of the Government of India, the cost of the three last-named reservoirs would with all their needful accessories have amounted to between $3\frac{1}{2}$ and 4 millions sterling to carry into execution!

11. However costly, the enquiries made were not sufficiently exhaustive, and the result is that these very projects stand enumerated among the projects suitable for famine relief (see items XV, XVI, and XVII, page 61 of Appendix V to the Report of the Famine Commission).

12. They are now, I hope, definitely and finally shelved, but it will be observed that these projects even more than comply, in point of detailed enquiry, with the tests considered sufficient under the present ruling of the Government of India. Several other works, e.g., the Upper Godavari Navigation Scheme, upon which some 78 lakhs were expended without visible result, prove the same truth, that anything short of exhaustive enquiry must be fatal in a financial point of view.

13. In Bombay the same results have followed on hasty projection of works for famine purposes. After his visit to that Presidency in January 1873, Lord Northbrook issued distinct instructions that the Mutha project (estimated to cost $63\frac{1}{2}$ lakhs) should be curtailed, the Taptee project suspended, and that no other large

* Of this amount, it was estimated that $22\frac{1}{2}$ lakhs would be spent on the Mauri Kunawai Reservoir and $41\frac{1}{2}$ on the Bellary Canal Scheme, consequently only $70\frac{1}{2}$ lakhs was at this time the estimated outlay on the Madras Irrigation and Canal Company's work as ultimately carried out. The two first-named works have not been carried out, nor are they likely to be so.

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1882) Madras.
PUBLIC WORKS.

Dated June, 13th.

Recd.

Encl.

G.O., 13th June 1882, No. $\frac{1475}{A}$ W.

JUNE.

Nos. 93-A—93-C.

Famine Relief Projects.

As to the necessity for complete enquiry
being undertaken in reference to all —.

13TH JUNE 1882, No. $\frac{1475}{B}$ W., PUBLIC WORKS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

No. 93-D.

LETTER—from

COLONEL R. H. SANKEY, C.B., R.E.,

*Secretary to Government, Public Works Department,
Madras,*

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,

PUBLIC WORKS DEPARTMENT.

SIR,

With reference to your letter, No. 161 M., dated 6th May 1882, and in immediate connection with the subject of my letter marginally quoted, submitting a

complete list of all the known projects for both "Productive" and "Protective" Works for this Presidency, I am desired by the Right Honorable the Governor in Council to forward the annexed memorandum by the Chief Engineer, dated the 8th instant, which he has considered it desirable to submit for the information of this Government, drawing attention to the necessity for a very complete enquiry being undertaken in reference to all famine relief projects, and especially those connected with Irrigation, Navigation, and Water Supply.

2. In my letter above quoted arrangements have been proposed which will, if approved, ensure so far as the present disposable establishment will admit, the thorough and systematic examination of all schemes which are considered to be in any way suitable for the important objects in view; and as this Government attaches great weight to the necessity for making exhaustive investigation in all such cases prior to sanction, I am to express a hope that the Government of India may be disposed to modify in this sense the instructions conveyed in their letter under reply.

3. The very exceptional circumstances of this Presidency in reference to hydraulic works are, I am to submit, such as must be fully weighed in deciding on new projects of the classes mentioned.

4. In no part of the world has the storage of the available water-supply been carried to anything like the same extent as in Southern India, where, including Mysore, there are not less than the enormous amount of 80,000 reservoirs, many of them of the largest size. To such an extent, moreover, had the principles of water storage been carried out, even before the introduction of British rule, that it may be fairly doubted whether it would be possible to construct ten completely new reservoirs of any magnitude without directly interfering with the legal rights, as regards water-supply, of the occupiers lower down in the drainages, where it might be proposed to carry out such new works.

5. Again, with reference to the flood waters which in most countries escape by rivers unused to the ocean, here the ancient inhabitants had entered on a system of turning such to account, which received its highest development in the Tanjore Delta works, where apparently not less than 800,000 acres were under rice cultivation prior to British occupation.

6. These principles of utilizing the river supplies to a greater extent than anywhere else have, under late scientific direction, as is well known, given Madras the unrivalled position which it occupies in the possession of great and remunerative irrigation works; but it must at the same time be clearly stated that what between the storage in reservoirs of all the upper waters and the utilization of the flood wave at the lower ends of the several rivers, the scope for intermediate works of a paying character has necessarily decreased; correctly stated, in fact, the great irrigated deltas and other tracts at the tail of the several drainages, are the highly favored gardens which to a great extent place under large contribution, if they do not exhaust the water-supply of the several catchment areas above them.

7. The schemes which have been submitted for completing the Kistna, Godáviri, and other great works will, when carried out, in all probability leave but small room for turning the available remaining water-supply to payable account, and it is chiefly in view to the state of matters that the necessity for the most careful enquiry and scrutiny is here so indispensable for the schemes now almost without exception left for selection. In other words, the improvement of the tank systems throughout the Presidency (a matter now engaging the attention of Government), and the completion of the great delta and other irrigation works situated chiefly along the littoral tracts, will leave but small scope for projects of a remunerative character.

8. It is not, I am to observe, intended by these observations to exclude from view those works which, though yielding no direct return, may, as "Protective" schemes, be on other grounds most suitable for carrying out either prior to, or during the currency of, a famine; but here again, judging from the experiences of works undertaken during past calamities, it appears to His Excellency in Council that exhaustive enquiries are especially needed, as the amount of loss to the State, in such cases inevitable and acknowledged, should be known and stated in the most precise terms, so as to admit of the Government accepting, with a complete knowledge of the facts, its responsibility in recommending them for execution.

9. In conclusion, I am to state that the Government of India will be kept constantly informed of, the progress made in investigation of projects according to the scheme sent up for famine relief.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

OOTACAMUND,
13th June 1882.

Exd. C. Howarth.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1882) Madras.
PUBLIC WORKS.

Dated June, 13th.

Recd.

Encl

13th June 1882, No. $\frac{1475}{B}$ W.

JUNE.
No. 93-D.

Famine Relief Projects.

As to the necessity for complete enquiry
being undertaken in reference to all —.

16TH OCTOBER 1882, No. 2695 W., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

General.
Establishment.

No. 96.

READ—the following papers :—

From Colonel W. S. TREVOR, R.E., Secretary to the Government of India,
Public Works Department, (General,) to the Secretary to the Government
of Madras, Public Works Department, dated Simla, 24th July 1882,
No. 1082 G.

I am directed to acknowledge your letter No. 1439 W., dated 9th June, making
certain proposals for working new divisions proposed to be made in the Delta Irriga-
tion Works, and to communicate the following remarks.

2. The plan proposed of engaging upper subordinates, after taking their pensions,
as Executive and Assistant Engineers, is opposed to the regulations of the Civil
Pension Code. It is moreover, in the opinion of the Government of India, not in the
interests of Government to entrust such large responsibility to men whose previous
training has been wholly in the Upper Subordinate Establishment.

3. But before any other method of increasing the strength of Engineers in
Madras is considered, I am to request that the previous question may be considered
whether any increase at all is required. The proposals just submitted by the Govern-
ment of Madras point to the conclusion that the present staff is sufficient to meet all or
nearly all requirements; for those proposals, if carried out, would only lead to an
increase of a few Overseers. The Government of India has all along considered the
sanctioned strength of Engineers in Madras to be extravagant, and one reason which
led to its acceptance of the proposals of the Madras Government in regard to the
permanent staff of Engineers was that it was thought the same staff would be able to
undertake extended work, when funds should be made available. After making due
allowance for revenue work, it seems probable that the whole establishment charges
in Madras are not much short of 40 per cent. on the outlay on works and repairs. This
disproportion has more than once been commented on by the Secretary of State. I am
to request therefore that the distribution and employment of the whole Engineer staff
may be carefully reviewed, and that no consideration of mere territorial occupation or
traditionary custom may be allowed to stand in the way of a stringent limitation of the
use of members of the Engineer Establishment to work which demands the exercise
of their higher training.

4. I am to state that it must be looked upon as fixed and settled that no
increase will be made to the permanent sanctioned scale of Engineers in Madras.
It would therefore seem advisable to provide the Executive Engineers for the new divi-
sions from the existing permanent staff, and if it should be found, after careful view,
that an increase to the engineering staff is absolutely necessary, that increase should
be obtained either by transfer from other Provinces or by the engagement of tempo-
rary Assistant Engineers or Upper Subordinates.

No. 96-A.

From the same Officer, dated Simla, 25th July 1882, No. 1087 G.

In reply to your letter No. 1448 W., dated 10th June 1882, affirming the inadequacy of the provision made for absentees in the establishment sanctioned for the Madras Public Works Department, and requesting that the provision may be increased so as to be more in consonance with actual experience gained in the Province, I am directed to observe that when the present scale of establishment for the Madras Public Works Department was sanctioned, the Government of Madras was told, in paragraph 6 of Public Works Department letter No. 1250 G., of 23rd September 1881, that the scale must be regarded as the maximum, and that provision for the superintendence of any works that might hereafter be taken in hand must be made without any increase of the permanent staff. The Secretary of State was also so informed.

2. A comparison of the percentage of establishments to works in some of the larger Provinces show that the existing establishment in Madras is by far the most expensive. The Secretary of State has on more than one occasion commented on the extravagance of the Public Works Establishments in Madras, and the Government of India regrets that it is unable to meet the wishes of the Madras Government.

3. If the Public Works Department in Madras is short handed, the first obvious step, I am to point out, is to recall to duty the officers on special leave. If this should not suffice, I am to say that the permanent establishment should be supplemented by the entertainment of temporary establishment.

No. 97.

ORDER—dated 16th October 1882, No. 2695 W., Public Works.

Ordered that the following letter be despatched to the Government of India.

(Here enter, No. 2696 W., dated 16th October 1882.)

(True Extract.)

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

APPENDIX A.

PART I.

Statement showing the Numbers and Pay of Staff, Numbers and Cost of Works in each Public Works Division, and Percentage Charge under "Construction" arranged according to

STAFF.																									WORKS.																
ENGINEER ESTABLISHMENT.									UPPER SUBORDINATE ESTABLISHMENT.										IMPERIAL.																						
Executive Engineer.			Assistant Engineer.			Total.			Sub-Engineer.			Supervisor.			Overseer.			Total.			Petty, Office, Temporary Establish-ment, Con-tingencies and Trav-elling Allowan-ces.	Total Construc-tion.	Military.			Other Services.															
No. Amount.			No. Amount.			No. Amount.			No. Amount.			No. Amount.			No. Amount.			Amount.			Amount.			New Works.			Repairs.			Total.			New Works.			Repairs.			Total.		
1		2		3		4		5		6		7		8		9		10		11			12			13			14			15			16			17			
First Circle.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.			Rs.			Rs.			Rs.			Rs.			Rs.						
Ganjam	..	..	..	1	6,600	1	6,600	1	3,000	..	..	3	2,400	4	5,400	12,636	24,636	..	..	1,034	1,034	11,459	12,493	..	..	896	896	66	5,725	33,172	..	..	..	..							
Vizagapatam	..	1	9,600	1	4,200	2	13,800	2	6,600	3	6,516	5	4,300	10	17,416	19,780	50,996	..	..	1,032	1,032	11,458	12,490	..	..	895	895	66	5,724	1,09,925	..	..	..	..							
Godavari Eastern	..	1	7,800	2	10,800	3	18,600	..	..	4	8,316	8	7,560	12	15,876	17,210	51,686	1	3,568	1,032	4,600	11,458	16,058	..	..	895	895	66	5,724	74,724	..	..	..	..							
Do. Western	..	..	..	1	5,400	1	5,400	1	3,000	1	2,400	6	5,280	8	10,680	15,904	31,984	..	..	1,032	1,032	11,458	12,490	..	..	895	895	66	5,724	31,450	..	..	..	..							
Total	..	2	17,400	5	27,000	7	44,400	4	12,600	8	17,232	22	19,540	24	49,362	66,530	1,59,302	1	3,568	4,130	7,698	45,833	53,531	..	..	581	3,581	2,666	22,897	2,49,271	..	..	..	..							
Second Circle.																																									
Kistna Eastern	..	1	7,800	3	13,800	4	21,600	1	3,600	2	4,116	5	4,080	8	11,796	17,956	51,352	..	..	1,378	1,378	15,277	16,655	..	..	895	1,195	896	7,632	61,850	..	..	..	..							
Do. Western	..	1	7,800	2	9,600	3	17,400	..	..	2	4,800	5	4,560	7	9,360	15,712	42,472	..	..	1,376	1,376	15,277	16,653	..	..	93	1,193	888	7,632	54,520	..	..	..	..							
Nellore	..	1	7,440	..	..	1	7,440	2	6,600	1	2,316	4	3,840	7	12,756	15,202	35,398	..	..	1,376	1,376	15,279	16,655	..	..	93	1,193	888	7,633	51,002	..	..	..	..							
Sangam Project	..	1	10,800	3	15,300	4	25,800	2	7,800	..	..	9	12,048	11	19,848	15,088	60,736	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..							
Total	..	4	33,840	8	38,400	12	72,240	5	18,000	5	11,232	23	24,528	33	53,760	63,958	1,89,958	..	..	4,130	4,130	45,833	49,963	..	..	31	3,581	2,666	22,897	1,67,372	..	..	..	..							
Third Circle.																																									
Bellary	..	1	9,600	..	..	1	9,600	1	3,000	2	4,200	5	6,084	8	13,284	14,662	37,546	5	47,310	1,378	48,688	15,279	63,967	..	..	15	1,195	896	7,633	40,002	..	..	..	..							
Cuddapah	..	1	6,600	..	..	1	6,600	..	..	1	1,800	5	4,300	6	6,100	14,220	26,920	..	..	1,376	1,376	15,277	16,653	..	..	13	1,193	888	7,632	40,000	..	..	..	..							
Kurnool	..	..	..	..	..	..	..	1	6,600	2	4,200	4	3,600	7	14,400	17,590	31,990	..	..	1,376	1,376	15,277	16,653	..	..	13	1,193	888	7,632	70,000	..	..	..	..							
Total	..	2	16,200	..	..	2	16,200	2	9,600	5	10,200	14	13,984	21	33,784	46,472	96,456	5	47,310	4,130	51,440	45,833	97,273	..	..	31	3,581	2,666	22,897	1,50,002	..	..	..	..							
Fourth Circle.																																									
West Coast	..	2	16,080	..	..	2	16,080	3	12,720	1	2,316	7	8,988	11	24,024	19,218	59,322	4	35,488	1,034	36,522	11,459	47,981	1	13,527	..	14,423	668	5,725	99,872	..	..	..	..							
Coimbatore	..	1	6,600	1	4,200	2	10,800	..	..	1	2,400	4	4,320	5	6,720	13,458	30,978	..	..	1,032	1,032	11,458	12,490	..	..	..	895	668	5,724	35,360	..	..	..	..							
Salem	..	1	7,800	..	..	1	7,800	1	3,000	1	1,800	4	3,840	6	8,640	13,204	29,644	..	..	1,032	1,032	11,458	12,490	..	..	..	895	668	5,724	58,000	..	..	..	..							
North Arcot	..	1	9,600	2	9,600	3	19,200	..	..	2	4,200	4	3,960	6	8,160	14,830	42,190	1	2,800	1,032	3,832	11,458	15,290	..	..	..	895	668	5,724	58,000	..	..	..	..							
Total	..	5	40,080	3	13,800	8	53,880	4	15,720	5	10,716	19	21,108	28	47,544	60,710	1,60,124	5	39,800	3,832	45,632	45,833	97,273	..	..	..	895	668	5,724	58,000	..	..	..	..							

WORK

Public Works.																							
												Total.											
												Works.		Repairs.		Total.		Works for which Revenue Account					
												Maintenance and Repairs.						Capital.					
												Works.						Works.		Exten and Im mer			
												No. Reserve. Total.		No. Amount		Amount.		Amount.		No. Amount. No. An			
												22		23		24		25		26		27	
												rs. rs.		rs. rs.		rs. rs.		rs. rs.		rs. rs.			
First Circle.																							
Ganjam	..	..	..	..	..	..	..	..	..	..	..	709	709	..	306	709	1,015	..	..	..			
Vizagapatam	..	..	..	..	..	..	..	..	..	..	..	708	708	..	306	708	1,014	..	..	..			
Godavari Eastern	..	..	..	13	000	..	..	..	..	..	..	708	95,708	15	1,29,712	95,708	2,25,420	..	..	..			
Do. Western	..	..	..	5	000	..	..	..	..	..	..	708	65,708	6	55,306	65,708	1,21,014	..	..	..			
Total	..	..	..	18	000	..	..	..	..	..	..	2,833	1,62,833	21	1,85,630	1,62,833	3,48,463	..	..	..			
Second Circle.																							
Kistna Eastern	..	..	..	7	000	..	..	..	..	..	..	709	75,709	8	1,61,950	75,709	2,37,659	..	..	..			
Do. Western	..	..	..	3	000	..	..	..	..	..	..	708	53,708	4	1,09,206	53,708	1,62,914	..	..	..			
Nellore	..	..	..	..	000	..	..	..	..	..	..	708	15,708	1	3,306	15,708	19,014	1	41,673	..			
Sangam Project	..	..	..	3	300	..	..	..	..	..	..	708	708	3	3,74,886	708	3,75,594	..	..	..			
Total	..	..	..	13	600	..	..	..	..	..	..	2,833	1,45,833	16	6,49,348	1,45,833	7,95,181	1	41,673	..			
Third Circle.																							
Bellary	..	..	..	..	..	..	..	..	..	..	..	944	944	..	408	944	1,352	..	..	..			
Cuddapah	..	..	..	..	..	..	..	..	..	..	..	945	945	..	409	945	1,354	..	..	..			
Kurnool	..	..	..	..	..	..	..	..	..	..	..	944	944	..	408	944	1,352	..	..	..			
Total	..	..	..	..	..	..	..	..	..	..	..	2,833	2,833	..	1,225	2,833	4,058	..	..	..			
Fourth Circle.																							
West Coast	..	..	..	..	..	..	..	..	..	..	..	708	708	..	306	708	1,014	..	..	..			
Comblatore	..	..	..	..	..	..	..	..	..	..	..	708	708	..	306	708	1,014	..	..	..			
Salem	..	..	..	..	..	..	..	..	..	..	..	708	708	..	306	708	1,014	..	..	..			
North Arcot	..	..	..	..	..	..	..	..	..	..	..	709	709	..	307	709	1,016	..	..	1			
Total	..	..	..	..	..	..	..	..	..	..	..	2,833	2,833	..	1,225	2,833	4,058	..	..	1			
Fifth Circle.																							
South Arcot	..	..	..	..	..	..	..	..	..	..	..	945	945	..	409	945	1,354	2	15,618	1			
Chingleput	..	..	..	..	..	..	..	..	..	..	..	944	944	..	408	944	1,352	..	..	1			
Buckingham Canal	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..			
Presidency	..	..	..	..	..	..	..	..	..	..	..	944	944	..	408	944	1,352	..	..	..			
Total	..	..	..	..	..	..	..	..	..	..	..	2,833	2,833	..	1,225	2,833	4,058	2	15,618	2			
Sixth Circle.																							
Trichinopoly	..	..	..	..	..	..	..	..	..	..	..	567	567	..	245	567	812	..	..	..			
Tanjore	..	..	..	..	..	..	..	..	..	..	..	30,000	567	2	18,252	30,567	48,819	..	..	..			
Nagapatam	..	..	..	..	..	..	..	..	..	..	..	30,000	567	1	10,245	30,567	40,812	..	..	..			
Madura	..	..	..	..	..	..	..	..	..	..	..	..	567	..	245	567	812	..	..	..			
Total	..	..	..	..	..	..	..	..	..	..	..	15,000	567	3	32,726	15,567	48,993	..	..	..			

ALS

Repairs.	ALS.		Percent- age of Estab- lishment	Remarks.
	Amount.	Grand Total, Works, Repairs.		
49	50	51	52	
First Class	RS.	RS.	RS.	
Ganjam ..	53,247	95,384	25.82	{ Full Divisional Staff here needed, as the district is in urgent need of improved communications. The great Rushikulya Irrigation Project has been submitted for sanction. Ganjam Gopulpore tidal Canal project nearly ready.
Vizagapatam	41,744	1,60,640	31.74	
Godavari Eastern	54,245	4,27,907	12.07	{ Owing to the enhanced work due to the late sanction for the completion of the Delta Works, a proposal for a third Executive (the Central Godavari) Division has been submitted to the Government of India.
Do. Western	1,10,242	2,25,081	14.21	
	3,59,478	9,09,012	17.52	
Second Class				
Kistna Eastern	1,30,444	3,34,964	13.33	{ Owing to the enhanced work due to the late sanction for the completion of the Delta Works a proposal for a third Executive (the Central Kistna) Division has been submitted to the Government of India.
Do. Western	1,01,241	2,75,683	15.40	
Nellore ..	92,448	1,99,156	17.77	{ Full Divisional Staff necessary for large irrigation works of the Pennér System, &c. The Survapalle Project now framing is in this division. Full Divisional Staff essential.
Sangam Project	1,245	3,78,607	16.04	
	3,25,378	12,38,410	15.33	
Third Class				
Bellary ..	75,663	1,89,932	19.76	{ In addition to Military Cantonment, irrigation works, &c., the investigation of projects for famine much needed. Full Staff necessary. Do. do. Local Fund Works also included in charge.
Cuddapah	66,659	1,26,615	21.26	
Kurnool	55,656	1,37,607	23.24	
	1,97,978	4,54,154	21.24	{ N.B.—Kurnool Canal having lately been taken over is being organized as a separate division with a full Staff.
Fourth Class				
West Coast	36,248	1,94,108	30.56	{ This having been found too large for a single division has been broken up. Even with this arrangement Staff insufficient.
Coimbatore	1,04,242	1,58,565	19.53	
Salem ..	54,242	1,53,885	19.26	{ Full Staff required. In addition to ordinary irrigation work the large Baroor Tank Project will probably soon have to be carried out here.
North Arcot	1,09,246	1,77,061	23.82	
				{ In addition to ordinary works special duties here

APPENDIX A.

PART II.

Abstract of Statement showing the Numbers and Pay of Staff, Numbers and Cost of Works in each Public Works Division, and Percentage Charge under "Construction" arranged according to Superintending Engineers' Circles.

Abstract of Statement showing the Numbers and Pay of Staff, Numbers and Cost of Works in each Public Works Division, and Percentage Charge.																																			
STAFF.															WORKS.																				
ENGINEER ESTABLISHMENT.											UPPER SUBORDINATE ESTABLISHMENT.				Petty, Office, Tempo- rary Establish- ment, Conting- encies, and Tra- velling Allowance.	Total Construc- tion.	IMPERIAL.						PROVINCIAL.												
Executive Engineer.			Assistant Engineer.			Total.		Sub Engi- neer.		Supervisor.		Overseer.		Total.			Military.			Other Services.			New Works.				Repairs.		Total.						
														New Works.			Repairs.		Total.		New Works.			Repairs.		Total.									
No.	Amount.		No.	Amount.		No.	Amount.		No.	Amount.		No.	Amount.				No.	Amount.	Reserve.	Total.	Amount.	Amount.	No.	Amount.	Reserve.	Total.	Amount.	Amount.		No.	Amount.	Reserve.	Total.	Amount.	Amount.

According to Superintending Engineers' Circles—cont.

ALS.			Remarks.
Repairs.	Grand Total, Works, Repairs.	Percentage of Establishment	
Amount.	Amount.	Amount.	
49	50	51	
<i>First Circle.</i>			Full Divisional Staff here needed, as the district is in urgent need of improved communications. The great Rushikulya Irrigation Project has been submitted for sanction. Ganjam Gopulpore tidal Canal project nearly ready.
Ganjam ..	53,247	95,384	
Vizagapatam	41,744	1,60,640	
Godavari Eastern	1,54,245	4,27,907	
Do. Western	1,10,242	2,25,081	
	3,59,478	9,09,012	17.52
<i>Second Circle.</i>			Owing to the enhanced work due to the late sanction for the completion of the Delta Works a proposal for a third Executive (the Central Kistna) Division has been submitted to the Government of India.
Kistna Eastern	1,30,444	3,84,964	
Do. Western	1,01,241	2,75,683	
Nellore ..	92,448	1,99,156	
Sangam Project	1,245	3,78,607	
	3,25,378	12,38,410	15.33
<i>Third Circle.</i>			In addition to Military Cantonment, irrigation works, &c., the investigation of projects for famine much needed. Full Staff necessary. Do. do. Local Fund Works also included in charge. N.B.—Kurnool Canal having lately been taken over is being organized as a separate division with a full Staff.
Bellary ..	75,663	1,89,932	
Cuddapah	66,659	1,26,615	
Kurnool	55,656	1,37,607	
	1,97,978	4,54,154	21.24
<i>Fourth Circle.</i>			This having been found too large for a single division has been broken up. Even with this arrangement Staff insufficient. Part above separated from the West Coast has been added to this division, but owing to large numbers of irrigation and other works doubtful if Staff will be sufficient. Full Staff required. In addition to ordinary irrigation work the large Baroor Tank Project will probably soon have to be carried out here. In addition to ordinary works special duties here
West Coast	36,248	1,94,108	
Coimbatore	1,04,242	1,58,565	
Salem ..	54,242	1,53,885	
North Arcot	1,09,246	1,77,061	

Abstract of Statement arranged according to Superintending Engineers' Circles—cont.

GATION AND AGRICULTURE ORDINARY.										
Agricultural Works.										
Total nor Revenue Accounts			Works for which neither Revenue nor Capital Accounts are kept.							
Repairs.			Works.			Repairs.				
Amount.	Reserve.	Total.	No.	Amount.	Reserve.	Total.	Amount.	Reserve.	Total.	
30			31			32				
RS.	RS.	RS.		RS.	RS.	RS.	RS.	RS.	RS.	RS.
No. I Circle ..	40,000	57,833	97,833	8	76,426	5,000	81,426	22,500	2,766	25,266
.. II do. ..	37,000	57,833	94,833	1	20,000	5,000	25,000	8,400	2,766	11,166
.. III do. ..	60,000	57,833	1,17,833	1	8,000	5,000	13,000	1,000	2,766	3,766
.. IV do. ..	1,37,000	57,833	1,94,833	..	..	5,000	5,000	10,000	2,766	12,766
.. V do. ..	1,08,000	57,833	1,65,833	..	..	5,000	5,000	10,000	2,766	18,766
.. VI do. ..	1,81,200	57,835	2,39,035	3	1,13,274	5,000	1,18,274	1,05,500	2,770	1,08,270
Architect ..	..	..	..	..	..	..	..	..	..	..
Total ..	5,63,200	3,47,000	9,10,200	13	2,17,700	30,000	2,47,700	1,03,400	16,600	1,80,000

Abstract of Statement showing the Numbers and Pay of Staff, Numbers and Cost of Works in each Public Works Division, and Percentage Charge under "Construction" arranged according to Superintending Engineers' Circles—cont.

WORKS— <i>cont.</i>																									Remarks.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
IRRIGATION AND NAVIGATION AND AGRICULTURAL ORDINARY— <i>cont.</i>						PROVINCIAL.			EXCLUDED LOCAL.			INCORPORATED LOCAL.						TOTALS.					Per-centage of Estab-lishment (under "Con-struction") to "Works"																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Totals.						Navigation Works.			Original Works.			Original Works.			Repairs, Local Funds.	Total.	New Works.		Ratable share of Reserve.	Repairs.	Grand Total, Works, Repairs.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
Totals.						Capital.	Revenue.	Total.	Port Fund.	Educa- tional.	Total.	Local Funds.	Canal and Ferry.	Total.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
Totals.						Capital.	Revenue.	Total.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
Works.						Works.	Repairs.	Total.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
No.	Amount.	Reserve.	Total.	Amount.	Total.	No.	Amount.	Amount.														Amount.		Amount.		Amount.	Amount.	Amount.	Amount.	Amount.	No.	Amount.	Amount.	Amount.	Amount.	Amount.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
33						34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
No.	I Circle	..	..	8	RS.	RS.	RS.	RS.	RS.	..	..	..	..	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	..	RS.	RS.	RS.	RS.	RS.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

According to Superintending Engineers' Circles—cont.

ALS.		Percentage of Establishment	Remarks.
Repairs.	Grand Total, Works, Repairs.		
Amount.	Amount.	Amount.	
49	50	51	52
<i>First Circle.</i>			
Ganjam ..	53,247	95,384	25.82
Vizagapatam	41,744	1,60,640	31.74
Godavari East	1,54,245	4,27,907	12.07
Do. West	1,10,242	2,25,681	14.21
	3,59,478	9,09,012	17.52
<i>Second Circle.</i>			
Kistna Eastern	1,30,444	3,84,964	13.33
Do. Western	1,01,241	2,75,683	15.40
Nellore ..	92,448	1,99,156	17.77
Sangam Project	1,245	3,78,607	16.04
	3,25,378	12,38,410	15.33
<i>Third Circle.</i>			
Bellary ..	75,663	1,89,932	19.76
Cuddapah	66,659	1,26,615	21.26
Kurnool	55,656	1,37,607	23.24
	1,97,978	4,54,154	21.24
<i>Fourth Circle.</i>			
West Coast	36,248	1,94,108	30.56
Coimbatore	1,01,242	1,58,565	19.53
Salem ..	54,242	1,53,885	19.26
North Arcot	1,09,246	1,77,061	23.82

Districts.	PRODUCTIVE PUBLIC WORKS				Revenue.	Remarks.
	Number of Anicuts.	Number of Channels.	Number of Tanks.	Area Irrigated.		
1	2	3	4	5	26	27
Ganjam ..	..	..	..	ACS.	..	The figures in columns showing area and revenue may be accepted as fairly accurate, those relating to Productive Public Works and Irrigation and Navigation Accounts are kept from the latest returns by Mr. W. Wilson, Special Officer in charge of Irrigation Accounts, and the others from the latest Proceedings of Government.
Vizagapatam	..	..	..	..	..	
Godavari ..	..	..	..	..	..	
Kistna ..	..	(a) 608	..	* 551,044,293	2,26,717	
Nellore ..	..	(b) 466	..	† 284,374,689	1,48,549	
Cuddapah ..	..	18	72	57,162,035	26,32,729	
Kurnool ..	..	..	..	..	13,41,774	
Bellary ..	..	..	..	..	9,46,079	
Chingleput ..	..	..	..	..	2,40,815	
North Arcot	..	..	..	..	1,33,616	
South Arcot	..	..	..	..	4,33,998	
Salem ..	..	..	..	..	10,43,855	
Coimbatore ..	..	..	..	..	5,01,838	
Tanjore ..	..	..	..	..	10,81,652	
Trichinopoly	..	1	89	828,100,033	1,63,493	
Madura ..	..	1	1	2,800,357	4,87,256	
Tinnevely ..	..	33	22	17,856,655	35,65,025	
					7,00,999	
					4,52,961	
					11,80,001	
Total .. (c)	6	1,215	94	1,781,336	329	1,52,81,357

Area. Revenue.	
(a) Eastern	..
Central	12,625 69,377
Western	20,528 73,285
(c) Excluding Sungum Anicut now under construction.	33,153 1,42,662

APPENDIX C.

Statement showing the Number, the Area irrigated, and Revenue derived from Irrigation Works under the charge of Collectors.

Districts.	NUMBER OF		Area Irrigated.	Revenue.	Remarks.
	Channels.	Tanks.			
1	2	3	4	5	6
			ACRES.	RS.	
Ganjam ...	...	2,661	213,237	3,18,459	N.B.—The figures for columns 2 and 3 have been taken from the Revenue Board's Proceedings, No. 1763 of 19th November 1880. The figures for columns 4 and 5 have been obtained by deducting from the figures shown in the Revenue Board's Proceedings, No. 1724 of 6th July 1882, the totals for works under the charge of the Public Works Department as shown in Appendix B; but in the case of the Godáviri District the figures have been got by deducting the figures in columns 20 and 21 of Appendix B. from those shown in G.O., No. 68 I. of January 1881 for the non-delta works in the Godáviri District. The amount of revenue due to the Godáviri Delta system as calculated by Mr. Wilson is more than that included in the amount shown by the Board of Revenue for the whole District, and therefore the former cannot be adopted to deduce the amount of revenue due to works under the charge of Collectors.
Vizagapatam...	...	370	120,776	1,55,907	
Godáviri ...	...	928	81,093	1,22,635	
Kistna ...	...	406	44,926	75,359	
Nellore ...	...	537	104,010	1,44,813	
Cuddapah ...	396	906	181,650	6,12,983	
Kurnool ...	103	248	16,896	58,682	
Bellary ...	...	675	88,535	2,79,963	
Chingleput ...	...	1,474	198,749	3,66,431	
North Arcot ...	675	1,897	215,187	8,68,892	
South Arcot ...	...	2,201	193,567	8,05,386	
Salem ...	...	1,338	81,527	3,21,003	
Coimbatore ...	38	79	27,275	1,47,283	
Tanjore ...	...	398	138,830	2,32,476	
Trichinopoly ...	...	651	54,994	98,682	
Madura ...	...	1,878	71,161	1,34,533	
Tinnevelly ...	...	2,038	104,271	2,85,915	
Total ...	1,212	18,685	1,936,684	50,29,402	

APPENDIX D.

Public Works Divisions sanctioned under the Normal Scale (See Appendix A, G.O., 14th July 1881, No. 1729 W.,) with the corresponding Civil Districts.

Superintending Engineers' Circles.	Public Works Divisions.	Corresponding Civil Districts or parts of Districts.
No. I ...	1. Ganjam ...	Certain works in parts of the Ganjam District.
	2. Vizagapatam ...	Do. Vizagapatam District.
	3. Eastern Godáviri ...	{ Only the irrigated portion of the Godáviri District and the river with banks as far up as Dumagudiem.
	4. Western do. ...	{
No. II ...	5. A. Project Division ...	Headquarters at present in Ganjam, but will soon move elsewhere.
	6. Eastern Kistna ...	{ Only the irrigated portion of the Kistna District.
	7. Western do. ...	{
	8. Nellore ...	Certain works in parts of the Nellore District.
No. III ...	9. Sangam Project ...	Also in the Nellore District.
	10. Bellary ...	Certain works in parts of the Bellary District.
	11. Cuddapah ...	Do. Cuddapah do.
	12. Kurnool ...	Most of the Kurnool District, the department here being still in charge of Local Fund Works.
No. IV ...	13. Kurnool Canal Division.	Certain works in parts of the Kurnool and Cuddapah Districts.
	14. C. Project Division ...	Do. Bellary and Cuddapah Districts at present.
	15. West Coast ...	Till lately work extended over Malabar, Canara, and Nilgiri Districts, and portion of Cochin.
	16. Coimbatore ...	Till lately occupied part of the Coimbatore District.
No. V ...	17. Salem ...	Certain works in part of the Salem District.
	18. North Arcot ...	Do. North Arcot District.
	19. B. Project Division ...	Till lately engaged in Salem and is now in Coimbatore.
	20. South Arcot ...	Most of the South Arcot District.
No. VI ...	21. Chingleput ...	Do. Chingleput do.
	22. Buckingham Canal ...	Runs through the Chingleput, Nellore, and Kistna Districts.
	23. Presidency and Bangalore.	Part in the Madras District and part in Mysore.
	24. Trichinopoly ...	Most of Trichinopoly District, as the department here still retains Local Fund Works.
Chief Engr....	25. Tanjore ...	Certain works in part of the Tanjore District.
	26. Negapatam ...	Do. do. do.
	27. Madura ...	Do. Madura do.
	28. Tinnevelly ...	Do. Tinnevelly do.
Chief Engr....	29. Consulting Architect ...	Chiefly in Madras District.
	30. D. Project Division ...	In office of Chief Engineer for Irrigation.

Remarks.

Of the sanctioned thirty Public Works Divisions, it will be observed that only two (Kurnool and Trichinopoly) are quite conterminous with the Civil Districts; others occupy parts as required by the works in hand, and others again, e.g., Nos. 5, 13, 14, 15, 19, 22, 23, and 29, have work extending over parts of two or more Civil Districts.

Quite lately much of the work belonging to the West Coast in the Canara and Malabar Districts and the Native State of Cochin has been transferred to Coimbatore, and the size of the West Coast Division reduced to the Nilgiris and parts of Wynad. None of the three newly proposed divisions, e.g., the Central Godáviri, Central Kistna, and Cauvery Regulators occupy any but fractional parts of Civil Districts, and their limits have been solely decided by the requirements of the works.

It may also be noticed that in letter to the Government of India, No. 1697 W., dated 9th July 1881, on the subject of the new normal scale, after showing how certain Superintending Engineers' Circles were to be formed, it was added, paragraph 11, that "all the other circles have been made out strictly with reference to the actual works in progress and proposed." No other principle has in fact been observed in the distribution of the charges, whether Superintending Engineers' Circles or Executive Engineers' Divisions.

APPENDIX E.

Memorandum on the Percentage Charge for Establishment in the Madras Public Works Department as compared with Outlay on Works.

To all acquainted with the varying conditions under which the work of a department like that of this Presidency, where operations of every conceivable character, large and small, concentrated and scattered, have to be provided for by a single establishment, the difficulties of applying the percentage charge as a test of economical and efficient management are such as call for great caution in application.

2. Where work is concentrated, funds supplied abundantly and all the conditions are favourable, the percentage charge is, or ought to be, small, and where to such ordinary advantages there is the additional facility of obtaining the materials to be employed in construction in a finished manufactured form from England or elsewhere, as generally is the case with railway work, iron bridges, pipes for water-supply works, &c., the charges for superintendence should be reduced to a minimum.

3. It has been shown for instance that on the work of the State Railways under the Government of India, the charge for establishment is not much more than nine per cent. The Madras Harbour Works affords even a more marked example. Here as proved by the figured statement which will be found lower down, the establishment charge for construction was only 6.8 per cent. in 1878-79, 4.3 in 1879-80, 4.9 in 1880-81. In 1881-82 with the self same establishment but owing to diminished outlay, the charge rose to 10.7 per cent., and in this year from a continuance of the same cause, the charge may very probably be as high as 20 per cent.

4. With an establishment, the strength and pay of which must in great measure remain unavoidably fixed, this question of the supply of funds is vital as affecting the percentage charge, as may at once be seen from what has occurred here in the last and present years. In 1881-82, the outlay on works being only Rs. 42,47,430, the unreduced charge was 39.6 per cent., though the cost of establishment owing to previous reductions was only Rs. 16,85,442, but in the current year, although from the late sanction of the increased normal scale of establishment the cost has risen to Rs. 20,99,314, the incidence is much less, being only 34.7 per cent. from the fact that it has been found possible to raise the outlay on works to Rs. 60,45,290.

5. The mere fact of difference in price of labor prevailing in one part of India as compared with another will of itself "*pro tanto*" alter the incidence of establishment charge. Where labor costs two, three or four times more in one place than it does in another, the percentage charge for the self same kind of work must necessarily be in inverse ratio to these numbers; *e.g.*, if in Burma, where labor is probably three times as dear as in Madras, the fair charge for the supervision of any specific operation be 15 per cent., it follows that 45 per cent. would be the correct equivalent in Madras, as the pay of members of the establishment does not vary with the province.

6. As regards the concentration or otherwise of the work, the Government of India has in Circular XX, P.W., dated 29th September 1881, fully recognised the effects on the incidence of the establishment charge. Here (paragraph 33) it is observed that "experience and inquiry show incontestably that petty and scattered works of the general nature of local works entail expense in respect of supervision if supervised professionally from three to six times as great as works that are concentrated or in large stations, however great the professional skill that the latter may demand."

7. In other words, if 9 per cent. as shown to prevail on the highly concentrated and otherwise favourably placed work of State Railways be accepted as fair in the one case, from 27 to 54 per cent. would be the corresponding rate in the case of scattered works.

8. But quite apart from these and other considerations of a general character, which more or less affect all branches of the department in India, there are special duties devolving on members of the department in Madras which places its establishment in a class by itself.

9. The first of these is the need for the development of irrigation and other works, suitable for either prevention of famine or for execution during famine. It is needless after all that has been said and written by the Famine Commission, by this Government and by the Government of India, to prove the absolute necessity for special arrangements being made as regards projects of this kind, Madras having notoriously suffered more than any other province in India from destructive famines. Suffice it to say that in full recognition of the requirements in this respect four full divisions of officers and subordinates (some not as yet however completely manned, See Appendix A) have throughout a great portion of the past year been engaged exclusively in the preparation of projects of the above character. Colonel Hasted's services were for several months similarly engaged, in bringing up the completion estimates for the Godavari system. Major Pennycuik has for the past three months been on special duty, in the preparation of the Perryaur Project—a protective work of great importance. Mr. Nordmann and a Sub-Engineer were also for a large portion of last year engaged in reconnoitring and surveying the country between Vizagapatam and Raipur, in view to the location of the proposed famine protective line of railway in this direction.

10. In these and all similar cases while there is a very heavy charge under Establishment there is absolutely no outlay under the head of "Works." Comparison is thus out of the ques-

tion, as the percentage charge would here be infinitely large. To mix up the cost of all establishment so employed is in fact misleading; yet from the method by which the charges are shown in the departmental accounts, this is what actually occurs in determining the percentage charges.

11. As shown by the correspondence in regard to famine works, the establishment thus specially set apart must yet for several years be engaged on the preparation of projects. Not only so; hardly a single Superintending or Executive Engineer but has some special work of a similar character to think of and devote some of his time to.

12. The next and much more important consideration in regard to the special duties devolving on the Madras Establishment, has reference to the care and maintenance of the existing irrigation works.

13. In this Presidency no less than 5,196,279 acres are classed as "Wet" land, the revenue under which is all dependent on irrigation works, of which the following are the numbers, omitting many very minor works:—

<i>Tanks.</i>				<i>Numbers.</i>	
Irrigating below 200 acres each	...	...	...	...	18,685
Do. above do.	...	...	...	...	3,116
				Total ...	21,801
<i>Channels.</i>					
Irrigating below 200 acres each	...	...	...	...	1,212
Do. above do.	...	...	...	...	1,867
				Total ...	3,079
<i>Anicuts.</i>				...	56

14. In Appendices B and C other details are given showing more particularly the distribution of the works under the Public Works and Civil Officers, respectively, but the mere enumeration of so many thousands of tanks, channels or other works can by itself convey but little real appreciation of the duties devolving in practice on the establishment. No one whose service has not been devoted to the care of these works, or whose attention has not been called daily to their requirements, can form any adequate idea of the practical effects of such a charge in reference to establishment.

15. This condition of matters has, it may be said without exaggeration, no approach to a parallel in any other part of the world; consequently deductions made from the experiences in Northern India or anywhere else where the conditions are entirely different are altogether inapplicable.

16. It is in the discharge of duties, often apparently of the most trivial description in maintaining the irrigation works, that the value of a trained and efficient establishment is best shown, though for that very reason least demonstrable by figures.

17. An establishment of this kind costing a large amount per annum, may by the careful and intelligent expenditure of only a very small amount on repairs, prevent the loss of enormous amounts of revenue, while on the other hand an inefficient and comparatively costless establishment may after expending large sums, fail to prevent large remissions of assessment. An establishment whose percentage charge is perhaps as high as 100 may in other words, if thoroughly efficient, prove infinitely more economical than one whose cost is only 25 per cent. Nowhere is this truth more clearly shown than in this Presidency.

18. Where as in the case of the delta works it has been found feasible to maintain a moderately large and efficient establishment the results have as well known been most encouraging, and the profits far in advance of any of the irrigation works in Northern India.

19. Nothing has in greater degree struck the Engineers accustomed to the unpretentious but much more effective works of Madras, than the great expenditure incurred in the designs of such schemes as the Ganges Canal, the Sone works, and others of a kindred character; but a little reflection will show that the system of judging the value of an establishment by its small percentage charge, directly leads to such results. The officer who carries out "grand" works regardless of expense is enabled of necessity to show the smallest percentage charge on his "works" outlay, and a direct premium is thus held out to lavish expenditure of all kinds. In Bombay these results are even more marked.

20. The only valid test must, it is thought, be that of useful effect, and to ensure true economy we must first ascertain precisely the work to be done; second, train up the most efficient establishment for its execution.

21. Efficiency and whatever it may cost to reach the needful standard is in fact the only true test, and by so much as the establishment fails in reaching that, must the Presidency pay by loss of revenue. As well expressed by a very able predecessor, the late General Charles Orr, cheap establishment means dear work.

22. Here it may not be out of place to observe that no efforts have been spared to place the Madras branch of the General Public Works Department on a satisfactory footing. Its Code, forms of account and system of control have all been improved and are believed to be quite on a par with any other in India. The reductions effected in 1879-80 had a very beneficial effect on the "personnel" of the establishment (though leaving it too weak numerically), and the late arrangement of the Superintending Engineers' Circles leaves little to be desired.

23. All now needed is (1) a more ample allowance than is at present admitted to provide against casualties from sickness, leave, &c., and (2) the gradual increase of the establishment under the head "Construction" "pari passu" with the enhanced means which it is hoped may soon be placed at disposal.

24. Improvements are needed to the curriculum of the Civil Engineering College, and the lower grades of the department and some of the office establishments require both reorganization and strengthening. The details of these improvements have been carefully worked out, but it is needless to dwell on these matters further here.

25. Turning now to the actual cost of the establishment of this department as shown in figures, the following table gives all the available information for five years including that now current:—

Statement of Percentage Charge of Establishment, Madras Public Works Department, based on actuals for the Years 1878-79 to 1881-82 and in the Budget Estimate for Current Official Year.

Co-lumns.	Description.	1878-79.	1879-80.	1880-81.	1881-82.	1882-83. Estimated.	Remarks.
		RS.	RS.	RS.	RS.	RS.	
(1)	Total outlay on works under all heads of service, Imperial, Provincial, Local excluding Harbour Works.	61,89,539	47,40,415	37,43,891	35,83,572	57,43,290	Figures in columns (1) to (9) inclusive have been given by the Examiner of Public Works Accounts, except (a) which has been assumed on the applications made to Government of India on account of the Harbour Works. Figures in column (10) have been taken from a return furnished by Mr. W. Wilson. Figures in column (12) assumed from information in the Office of the Chief Engineer for Irrigation.
(2)	Madras Harbour Works ..	7,78,029	11,66,211	13,84,164	6,63,858	(a) 3,05,000	
(3)	Total Outlay Works only ..	69,67,568	59,06,626	51,28,055	42,47,430	60,48,290	
(4)	Total Outlay on Establishment under all heads of service, excluding Harbour Works.	28,74,373	23,09,770	14,43,218	16,14,357	20,38,478	
(5)	Do. Madras Harbour Works.	53,020	50,295	68,632	71,085	60,836	
(6)	Total Outlay Establishment only.	29,27,393	23,60,065	15,11,850	16,85,442	20,99,314	
(7)	Percentage charge for Establishment without deductions of any kind.	42.0	39.9	29.4	39.6	34.7	
<i>Deductions.</i>							
(8)	Direct Revenue under Imperial, Provincial, Local.	8,91,890	4,12,153	5,06,283	6,29,147	4,28,971	
(9)	Ten per cent. on same ..	89,189	41,215	50,628	62,914	42,897	
(10)	Indirect Revenue Productive Works (Irrigation).	36,60,221	39,38,917	48,24,022	37,69,014	35,18,015	
(11)	Six per cent. on the same ..	2,19,613	2,36,334	2,89,441	2,25,540	2,11,080	
(12)	Indirect Revenue on Irrigation and Navigation Works other than Productive.	70,00,000	70,00,000	70,00,000	70,00,000	70,00,000	
(13)	Three per cent. on the same..	2,10,000	2,10,000	2,10,000	2,10,000	2,10,000	
(14)	Total Deductions, columns (9) + (11) + (13).	5,18,802	4,87,549	5,06,069	4,98,454	4,63,977	
(15)	Correct Establishment charge, columns (6) — (14).	24,08,591	18,72,516	10,05,781	11,86,988	16,35,337	
(16)	Correct percentage charge of Establishment, column (15) on (3).	34.5	31.7	19.6	27.9	27.0	

26. In order to meet the financial rules of the Government of India the establishment charges have hitherto been distributed at certain fixed percentages over Imperial and Local works. This has had the effect of always leaving a large residuum to be met from "Provincial" funds, which thus at times have had to bear disproportionately heavy charges.

27. The system is a purely artificial one, and quite untrue in fact, as from there being no separation of duties among the members of the department work of all classes, whether Imperial, Provincial, or Local (now only very few), is, and has always been, carried out by one and the same establishment.

28. This being the case it has been considered advisable to set aside the artificial element in the above table, and by bringing together works under all heads of service, to show the true percentage ratably distributed over all equally.

29. It will be observed that without taking into account any deductions which have to be made the highest percentage charge in the five years, including "Direction," "Construction," and "Accounts," has been 42.0 and the lowest 29.4.

30. In the matter of deductions discussions with the Government of India have continued now over some years, and have as yet been only partially concluded.

31. As a provisional arrangement the Government of India has ruled that, ten per cent. of direct revenue of all kinds claimable by the department may be shown as a contribution towards the cost of establishment; also that six per cent. may similarly be credited on the indirect revenue of Productive irrigation works.

32. There has been no difficulty in deciding on the amounts of direct revenues for the years dealt with; but as regards the indirect revenue the matter has been otherwise. Here from the different system of land tenure prevailing in this Presidency from that in Northern India, it has only been found possible after long inquiry by a specially qualified Civil Officer (Mr. W. Wilson) to decide, first as to what portion of the total revenue collection could fairly be considered as the profits, or increase of revenue, due to the several Productive works carried out by the department, and second the share of enhanced land revenue, apart from the value of the water also due to them.

33. Mr. Wilson has only quite lately been enabled definitely to settle under both the above heads, the amount of profits claimable by the Godavari, Kistna, Cauvery, Pennér, and Srivai-kuntham, works, and column 10 in the table gives the total figures ascertained for these systems.

34. This Government has also claimed that three per cent. should for analogous reasons be credited on account of the indirect revenue due to Imperial works of navigation and irrigation not classed as Productive, but as yet the Government of India have not been enabled to convey their assent, owing chiefly to the difficulties experienced in deciding on the precise amount of the revenue involved. It is not understood that any difference of opinion exists as to the propriety of the contribution, but merely as to its amount. The local Revenue authorities have as yet been unable to give the precise figures, but from the available evidence the amount cannot it is thought be approximately fixed at less than 70 lakhs per annum, which is accordingly the figure adopted provisionally in the table, as that on which the three per cent. may fairly be calculated, as a credit towards the cost of the Public Works establishments engaged on maintenance of the works.

35. Making the deductions above adverted to it will be observed that the maximum percentage cost of establishment in the five years has been 34.5 and the minimum 19.6.

36. It must not be supposed that the deductions as above claimed have been realized in the accounts of the several years to which they relate. As a fact they have not been so, and the figures given therefore merely indicate (excepting in the last official year, when a small instalment has been adjusted) how under a more equitable system than has hitherto prevailed the accounts should have stood, and that in defect of this Provincial has lost and Imperial gained not less than 22 lakhs of rupees in the period comprised. See column (14.)

37. Again it must not be thought that such adjustments and deductions are in any way exceptional or unrecognized in the other provinces of the empire. The reverse is in fact the case. Not only have such contributions been admitted in the provinces of Northern India, but to a very much greater extent than has ever been even claimed in Madras.

38. From the following statement supplied by the late Inspector-General of Irrigation, it appears that on averages of the years 1875-76 to 1879-80 there has yearly been admitted as a charge against the revenue of the following works the sums below mentioned in addition to the 25 per cent. on works charged in the Public Works Department for establishment, viz. :—

Averages for Years 1875-76 to 1879-80 inclusive.

Canals.	Outlay on Works.	ESTABLISHMENT.		Revenue.	Percentage of Column 4 on Column 5.	Percentage of Total Establishment Charges Column 3 + 4; if charged against Works only Column 2.
		25 per Cent. on Works.	Remainder.			
1	2	3	4	5	6	7
<i>Permanent.</i>						
Ganges Canal ...	RS. 3,94,011	RS. 98,503	RS. 5,12,446	RS. 31,36,781	RS. 16.3	RS. 155.0
East Jumna ...	89,520	22,380	95,946	9,15,350	10.5	132.2
West Jumna ...	1,38,165	34,541	2,29,631	13,47,306	17.0	191.3
Barce Doab ...	2,41,562	60,391	1,99,783	9,00,259	22.2	107.7
<i>Inundation.</i>						
Upper Sutlej Canal...	49,268	12,317	30,684	1,08,817	28.2	87.1
Indus ...	1,55,123	38,781	54,359	1,92,964	28.2	60.0

PUBLIC WORKS DEPARTMENT.

General.
Establishment.

No. 98.

LETTER—from

COLONEL R. H. SANKEY, R.E., C.B.,

Secretary to Government, Public Works Department,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,

PUBLIC WORKS DEPARTMENT.

SIR,

In your letters marginally noted the attention of this Government is drawn to what is held to be the extravagantly large
No. 1082 G., dated 24th July 1882. Establishment of this Department as proved
„ 1887 G., „ 25th „ „ by the percentage which its cost bears to
works compared with the results in other Provinces.

2. Since the receipt of the above communications, proposals have been made in my letter No. 2592 W., dated 4th October 1882 for organizing the establishment of the three new temporary divisions marginally
Godávári, Central. noted on a basis which has been approved
Kistna, do. by the Government of India ; my present
Cauvery and Vennár Regulators. communication will therefore, I am desired
to say, be confined to dealing with the more important question above adverted to.

3. The first point requiring attention is that contained in paragraph 3 of your letter No. 1082 G., calling for a review of the distribution and employment of the whole of the Engineer staff, and observing that “no consideration of mere territorial occupation or traditionary custom may be allowed to stand in the way of a stringent limitation of the use of the members of the Engineer Establishment.

4. To elucidate, as far as possible, this portion of the subject, I am to solicit a reference to Appendices A, B, and C, as also to the annexed index map showing the Civil Districts of this Presidency and their respective areas.

5. In Appendix A will be found the distribution of the establishment as existing on the 1st July 1882 (which is the most convenient date with reference to the returns), the proposed outlay on works under all heads of service, including the undistributed reserve for each division in the current official year, and the percentage cost of establishment as thus shown under “Construction.”

6. To admit of an opinion being formed as to the actual duties performed by the divisional staff, Appendices B and C must also be consulted. The first shows, as far as possible, the irrigation works classified under—

(a) Large “Productive works.”

(b) Smaller systems consisting, mainly of tanks and channels irrigating over 200 acres each, and provisionally classed as “Imperial.”

Appendix C, exhibits the Minor Irrigation Works irrigating each less than 200 acres.

7. Broadly speaking, all works (a) and (b) fall to the charge of the officers of this Department, who have likewise to maintain all tanks, whether great or small, composing the chains or series crossed by lines of railway. They have, moreover, the duty imposed on them of grouping all reservoirs, irrespective of size, shown in Appendix C—a work of considerable labor.

8. The minor irrigation works not having in all cases been grouped, the returns do not at present admit of giving accurately in detail the numbers, acreage, and revenue of works falling within the charge of the several Public Works Divisions under the reorganization of last year; it has only therefore been found practicable to give the figures according to the Civil Districts. The following however may be taken as affording a fair general view of the distribution of the works and of the interests involved:—

Description.	Number of Works.	Acreage.	Wet Revenues.
<i>I.—Under Public Works Officers.</i> (See Appendix B.)			RS.
Productive Works (six Irrigation Systems) * ...	1,315	1,781,336	79,33,254
Navigation and Irrigation Works other than Productive ...	3,724	1,505,993	73,48,103
Total Public Works Officers ...	5,039	3,287,329	1,52,81,357
<i>II.—Under Civil Officers.</i> (See Appendix C.)			
Minor Irrigation Works ...	19,897	1,936,684	50,29,402
Grand Total under both Departments ...	24,936	5,224,013	2,03,10,759

9. The vast amount of work involved in the proper maintenance of these works and their enormous importance will be more clearly recognized from remarks which will be found further on; but here it may suffice to observe that, in order to estimate even approximately the duties devolving on the several divisional officers, weight must be given to the area over which the works are spread, to their numbers, and to the revenue dependent on them.

10. It may however be doubted whether, in the absence of special local acquaintance with the works, any really correct idea of the duties involved in their maintenance can be formed, as it is needless to say that nothing even approaching to a comparison with the system of water storage in Southern India can be found in any other part of the world; deductions and experiences drawn from other Provinces are in fact wholly inapplicable to the case.

11. It will subsequently be shown that, far from being in adequate strength, the Department is altogether undermanned if due consideration be given to the interests of the irrigation works.

12. Regarding the observations as to the undesirability of allowing considerations of "territorial occupation or traditional custom" to weigh in deciding the distribution of the establishment, I am to request a reference to Appendix D, which affords detailed explanations on this point.

13. No such considerations as those supposed were allowed to weigh in the arrangement of divisions under the last sanctioned normal scale, and there is not, I am to observe, any desire on the part of this Government to permit the perpetuation of any arrangement not wholly regulated by the requirements of the works.

14. Whatever advantages may have been derived from a territorial arrangement of divisions, so long as the Local Fund works were executed by this department, have

* Excluding Sangam Anicut now under construction.

now in nearly all instances ceased to exist, owing to the disconnection with the works which followed on the reduction of establishment in 1879-80.

15. The second point calling for attention is that adverted to in paragraph 2 of your letter No. 1087 G., where it is observed, that a comparison of the percentage of establishment to works in some of the larger Provinces shows that the existing establishment in Madras is by far the most expensive, adding that "the Secretary of State has, on more than one occasion, commented on the extravagance of the Public Works Establishment in Madras."

16. Before dealing with the percentage charge I am desired to submit, in reference to the above quotation, that this Government had previous to the receipt of your letters under reply only on one occasion been made aware of the Secretary of State's opinion, and this, as will immediately be shown, was based on a misconception of the facts of the case.

17. In a despatch* of 1881, his Lordship observed, that an examination of the

figures of the Public Works Budgets
* No. 14 of 2nd June. showed a percentage charge of 84.4 on

works, but in the reply of this Government (despatch No. 41 of 16th July 1881) it was pointed out that had the full and correct figures been before his Lordship he would have seen that the percentage was about 47, and that even this apparently high rate was due, not so much to excessive numbers as to the curtailment of grants for works for this Presidency, to the great area over which works have to be supervised, and to the system adopted in Madras for debiting the charges which did not correspond with that followed in other Provinces under the Government of India.

18. As no rejoinder has been received from the Secretary of State, either to this despatch or to another connected with the same subject, No. 50-2017 W., dated 17th August 1881, it is only reasonable to conclude that his Lordship was satisfied with the explanations afforded. Both despatches were communicated to the Government of India, and special attention was drawn to the subject in my letter No. 2473 W., dated 8th October 1881.

19. In turning now to the point on which the Government of India lay most stress, viz., the high percentage charges for Establishment, I am desired to invite attention to Appendix E, which has been drawn up by the Chief Engineer for the information of this Government.

20. As the Government of India are aware that, for cogent reasons, the force of which has been admitted, it has never been found practicable to create separate branches for the Establishment, viz., for Irrigation, Military Works, General and Local; the result is that artificial arrangements connected with the method of showing the establishment charges, have for convenience in the matter of accounts been adopted under sanction of the Government of India. To avoid the complications inseparable from this method of dealing with the question, and to which previous misapprehensions may readily be traced, the establishment and work charges are now treated for five years, including that now current, as if no separate branches of the Department existed. The work as a whole, is taken as having been carried out by one undivided establishment, an assumption which in the case of this Presidency corresponds in every way with the facts. Any other method would be artificial and quite untrue.

21. The highest percentage in any of the five years examined has been found to be 42.0 without deductions of any kind, and the lowest 29.4. Taking however into account the contributions already conceded by the Government of India, and those which will in all probability be eventually granted on account of percentage due to indirect revenue of Irrigation and Navigation Works, not classed as Productive, the percentages are found to be reduced to 34.5 and 19.6 respectively.

22. Were precisely the same terms, as regards contributions on account of the indirect revenue of the irrigation works, conceded to this Presidency as are understood to prevail in Northern India, and further were the charges for establishments wholly engaged on the projection of famine works struck out of the accounts, as the individuals concerned have no executive duties chargeable to works, His Excellency the

Governor in Council sees no reason to doubt the correctness of the conclusions arrived at by the Chief Engineer, that the charge for the establishment would, as against "works," not exceed 20 per cent.

23. Considering the much more scattered character of the works in Southern India than elsewhere, the percentages as thus worked out would appear to compare not unfavorably with those of other Provinces so far as known, but as the Government is satisfied that a test of this description must prove fallacious and misleading, and only serving to divert attention from the real requirements of this Presidency, they now desire to place before the Government of India the following observations bearing upon this vital point.

24. Hitherto, I am to observe, the facts upon which the strength of the establishment of this department has been decided have mainly been (1) the sums which, after meeting other exigencies, could be conveniently spared to Madras; (2) the percentage charge which, under experience derived from other Provinces, it was held would suffice for an establishment to expend the sums thus placed at disposal.

25. His Excellency in Council, after a careful review of the Finance and Revenue Accounts of India, has been confirmed in the general conclusions submitted for the consideration of the Government of India in my letter No. 337 W., as to the measure meted out to Madras in the matter of assignments from the Imperial Revenue compared with those conceded to other Provinces; and while quite prepared to admit that there have been at times political reasons of sufficient weight to justify the occasional departure from what might appear to be a strictly rateable distribution of the general funds at the disposal of the Government of India, he feels it incumbent on him to submit that such reasons no longer exist, and that the time has arrived for conceding to this Presidency its fair rateable share of the available surplus.

26. His Excellency is fully persuaded that the Government of India will, on consideration, be prepared to admit the justice of a request of this character, for which there are, moreover, very special reasons connected with the peculiar circumstances of this Presidency, to which I am now to invite attention.

27. The first and chief of these is the well-recognized fact that Madras has from time immemorial suffered in a greater degree from destructive famines than any other part of India, while, unlike the Northern Provinces, it has been denied by nature the advantages of internal water communications, afforded by such rivers as the Indus, Ganges, and Brahmaputra with their navigable tributaries.

28. The facts in this connection are, however, too well known and recognized to call for further remark, and I am therefore now to submit, as the second special reason, for consideration the following remarks as to the actual condition of the ancient systems of irrigation works, on the proper maintenance of which the land revenue, and indeed the whole prosperity of the Presidency, mainly depends.

29. In the tours which His Excellency the Governor has since his arrival been enabled to make through various parts of the Presidency, no subject has more constantly been brought to notice in the addresses presented to him, than the need of greater outlay and attention in regard to the minor irrigation works. A précis of the evidence previously taken on the subject and other information of a specific character will, it is hoped, ere long be submitted, with definite proposals, to the Government of India; but, in the meanwhile, I am to solicit attention to Appendix F, which shows in concise form the entire cultivable area of the Presidency, and the losses which have been sustained in the form of remissions of revenue from the year 1863-64 to 1880-81, both inclusive.

30. Not to overburthen the statement, areas and assessment are expressed in lakhs of acres and rupees respectively. All the land as shown in the statement has at one time or another been classed as "wet," i.e., had means of irrigation afforded, but as will be observed from the remarks appended to the statement reasons exist in some cases for supposing that the classification is not strictly accurate: making however all desirable reductions on this account the facts revealed are almost startling.

31. Here it will be seen that year after year enormous areas of land which, were the works in order, should be under irrigation and bear wet assessment, are shown to have been thrown out of cultivation from the neglected condition of the tanks and channels. The aggregate losses each year in the opinion of the Revenue officers of Government amount to not less than 40 lakhs. The statement gives the aggregate loss in the 18 years recorded at 807 lakhs, but making all due deductions as above the actual amount, which, had means existed for bestowing proper attention on the works, should have been saved, cannot be estimated at less than 700 lakhs.

32. From the statements before Government the following was the reported condition of the irrigation works in the Presidency in 1879:—

	In Repair.	Out of Repair.	Total No.	Remarks.
Tanks	29,208	6,826	36,034	The figures here given were reported before the lists (Appendix B and C) were compiled and include the many very minor works there omitted.
River Channels	10,160	801	10,961	
Spring Channels	5,893	1,008	6,901	
Anicuts	1,836	515	2,351	
Wells	378,236	58,918	437,154	

33. It is impossible to test in all cases the accuracy of the returns on which these statements have been compiled, but it may generally be assumed that a very large proportion of the works are out of repair; and in regard to this it is necessary to bear in mind that, even where in so-called "repair," but very few tanks or channels are really doing at all the amount of effective work which, under proper scientific investigation and management they should be capable of. The Board of Revenue considered that the term "in repair" merely meant that the works "were not in an absolutely useless state."

34. And this leads to the third point for special consideration as to the claims of this Presidency, viz., the construction of new and extension of the area commanded by old irrigation works, were an adequate engineering staff and enhanced funds placed at the disposal of Government.

35. The following table, taken from page 106 of Sir John and General R. Strachey's late work on the Finances and Public Works of India, amply proves the truth of the observation made by a previous writer (Mr. Buckley) that the Madras works much "more than recoup all the deficiencies" of others of a similar character in India:—

Provinces.	Capital.	Net Revenue.	Interest at $4\frac{1}{2}$ per Cent.	Surplus.	Excess Charge.
	£	£	£	£	£
Bengal	4,980,000	18,000	220,000	...	202,000
North-West Provinces	5,346,000	269,000	237,000	32,000	...
Punjab	3,544,000	170,000	155,000	15,000	...
Madras	1,720,000	427,000	77,000	350,000	...
Bombay	1,333,000	10,000	59,000	...	49,000
Total ...	16,933,000	894,000	748,000	146,000	...

36. Not only have the Madras works languished year after year for want of funds and through insufficient strength of establishment, but, as here shown, ten times the amount have elsewhere been expended, too often with the result of heavy loss to the State. The table however only shows actuals of outlay down to 1879-80, and does not disclose the enormous amount of funds which has been sanctioned for outlay or sunk in lost interest on many of the works in Northern India, which it is

submitted have by no means as great a claim as the Madras works viewed either as Productive or Protective undertakings. It is believed that, in addition to the Capital outlay shown, not less than 15 millions sterling have been lost in interest or sanctioned for the completion of such works as the Sutlej Canal, Lower Ganges Canal, Sone works, &c., whereas Madras past, present and prospective will not have had $2\frac{1}{2}$ millions assigned for its great and highly remunerative works. Some 25 millions sterling have thus been spent or assigned from the Imperial exchequer without, it is believed any probability of the works producing anything approaching to the same results, either as paying schemes or as safeguards against famine as would have been produced from a smaller sum expended in Southern India.

37. From information in possession of the Irrigation Branch there are the best grounds to conclude that the irrigated area of the Presidency might be increased by 1,500,000 acres were the needful means afforded, and with every prospect of returns, which if not quite on a par with those derived from the productive works constructed at an earlier period, would in all probability prove much more remunerative than works of a corresponding class in other parts of India.

38. With a thoroughly trained and sufficiently strong establishment there is thus a well-founded hope that much of the sufferings due to famine might in future be counteracted, that 40 lakhs of annual remissions of revenue might be saved, and that some $1\frac{1}{2}$ millions of acres, with a revenue value of 60 lakhs per annum, might be added to the irrigated area.

39. There are other objects of a special character of hardly less importance to be attained, if the Government is to fulfil in any adequate sense the duties imposed on it. Chief among these stands the need of works of water-supply and drainage for certain large centres of population which are quite beyond the local means to execute. In reference to this the Secretary of State has lately, at the instance of the Army Sanitary Commission, pressed on the serious attention of this Government the necessity of coming to the aid of the Madras Municipality which is unable to complete from its own resources the needful works. The condition of matters at the Presidency town is little short of a disgrace to any civilized Government, and matters in other large centres are if anything in a worse condition. As the papers in connection with Madras will ere long be submitted through the Government of India for the information of the Secretary of State, His Excellency the Governor-General in Council will be enabled to see how very pressing is the need for action.

40. If it be inquired how sufficient ways and means are to be provided for meeting all the demands as above set forth for this Presidency, I am to state that nothing further is needed in the opinion of His Excellency in Council than such a re-adjustment of the Imperial charges as will throw upon Madras only its ratable share. From the Finance and Revenue Accounts, 1863-64 to 1879-80, it can be shown that this Presidency has hitherto contributed more than 22 per cent. of the Imperial charges—a disproportion so marked, whether judged from the stand point of Provincial receipts, land revenue or population, as to call for most careful consideration.

41. That such is also clear from the assignments made under the late decentralization scheme, it has only to be stated that, whereas 38.48 of the land revenue has been conceded to Bengal, 43.29 to the Punjab, 48.46 to the Central Provinces, 49.82 to Assam, 33.61 to British Burma, and no less than 58.55 to Bombay,* only 28.9 per cent. has been granted to this Presidency.

42. If the inequalities in the incidence of the public burdens which have hitherto obtained, and which, in the opinion of His Excellency the Governor in Council, there is no sufficient reason for continuing be removed, and further, if powers be granted for the needful increase of Provincial establishments adequate for the growing demands,

* The percentage is in fact very much higher, as from the manner in which inam lands are included in the Bombay land revenues, these in the last 17 years have been swelled by an anomalous asset of no less than 745.7 lakhs, or on an average of 43.8 lakhs per annum. The true amount assigned to Bombay is much more nearly 66.3 of its land revenue.

there should apparently be no difficulty in future in providing for all the most pressing wants of this Presidency or in largely swelling the Imperial revenue derived from many portions of its territory.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

Exd. S. T. Austin.

Spare Copies

GENERAL
ESTABLISHMENT.

Govt. of (1882) Madras.
PUBLIC WORKS.

Dated October, 16th.

Recd.

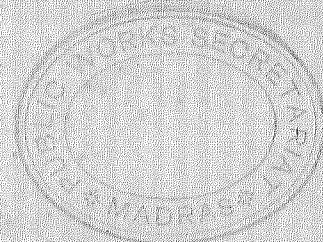
Encl.

16th Oct. 1882, No. 2696 W.

OCTOBER.
No. 98.

Public Works Establishment of
the Madras Presidency.

Regarding the scale of the —.



(1.) READ—the following Proceedings of Revenue, dated 7th September 1882, 1.

Read—again the following Proceedings of the Revenue, dated 27th October 1881, No. 2.

ABSTRACT.—Referring to certain Collectors, the points indicated by the Chief Engineer, Government Order regarding the inter steam tramways in the Madras Presidency.

Read—also the following papers :—

From the Collector of Anantapur,	dated	1882,	No. 45.
“ “ of North Arcot,	“ January “	“	27.
“ “ of “	“ January “	“	76.
“ “ of South Arcot,	“ y “	“	184.
“ “ of Chingleput,	“ January “	“	84.
“ “ of Coimbatore,	“ January “	“	9.
“ “ of “	“ January “	“	29.
“ “ of Cuddapah,	“ “ “	“	56.
“ “ of “	“ “ “	“	81.

From W. H. GLENNY, Esq., Collector of Kurnool, to the Secretary to the Board of Revenue, dated Kurnool, 13thber 1881, No. 567.

With reference to Board's Proceedings, N1 of 27th October 1881, I have the honor to say that, in my opinion, the idea of erecting in this district tramways as protective works against famine need not basly entertained.

2. I imagine that these works would bheir proper place in districts of short distances, open country, and dense popul. None of these conditions exist here. We have on the average only about seven persons to the square mile. The average area of each of our eight taluks is, en nine hundred and a thousand square miles. And our district is cut up locally by hill-ranges into three tracts, of which the most eastern is separated the other two by the formidable Nallamallai range which is crossed at present nly a single road practicable for cart-traffic: while the middle tract, the Kundelley, is on the west bounded by the Erramalais, which though they nowhere a any considerable height, and are passable at several points, are sufficiently high rugged to interpose a very serious barrier between the Kunderu valley and the wn tract, which is the basin of the Hindri.

3. The trans-Nallamalai tract consists of taluks of Cumbum and Markapur. Cumbum is 96½ miles from the Cuddapah Rail Station; and Markapur 16 miles north of Cumbum. The area of these two tal is 1,900 square miles and their population 192,712. It does not seem necessary even if I were in a position to offer a confident opinion) to touch upon the features the line of road between Cuddapah and Cumbum from an engineering point of view. It seems sufficient to add that these outlying and isolated taluks of our district are tolerably easy communication by road with the upland taluks of the Kistna Distri and also with the seaboard of the Nellore District, the distance from Cumbum to thport of Kottapatam being 65 miles.

4. Our middle tract, the valley of the Kunru, the richest part of the district, is traversed from end to end by the Madras Irrigation Company's Canal. This canal maintains communication for eight months of the year between Cuddapah, Nandyál,

and Kurnool. I need to show that in this valley, the best part of the district, the canal has ything in the nature of an iron road.

5. The western district consists of the taluks of Pattikonda and Rámallakót. The arewo taluks is 2,000 square miles, the population 1,99,501. If we had, this part of the district, Kurnool would be the terminus; the line migom the line of rail either at Gooty or at Aspari. I speak subject to profession, but I venture to pronounce a line from Gooty to Kurnool impracticabe of road passes through 57 miles of our district: the gradients are very d for the first ten miles from Gooty, and for the rest of the way the line n after basin of the affluents of the Hindri river, and traverses the very pot the district, closely flanked on the east by spurs of the Erramalais. The Aspari to Kurnool, 50 miles, is remarkably free from engineering difficult would be of exceedingly little use. Aspari is at the wrong side of the junction for grain coming from Madras, and is in the midst of a treeless rt that is sure to have a bad eminence in any future famine in these districts in the last famine; and the station is most unfortunately situated. A mising site for a large depôt could not well be imagined. But, turning inus of this line, which I take to be the only line that need for a momught of, I fail to see that much would be gained by throwing large quanttain into Kurnool. We have, it is true, 20,500 people in the town itself. t from the fact that grain from Madras could with much greater advantage bt to Kurnool itself, *via* Cuddapah, by the canal, it must be noted that as a distribution for the district, Kurnool is about as badly situated as it could byál, through which the canal passes, is centrally situated. Kurnool is in thvest corner of the district: on political and military grounds it is the head-of the district, but for no other reasons.

6. I happen to havevery intimate personal acquaintance in the late famine with the question of between Gooty and Kurnool; and I have now made inquiries among the its here. I think I am not wrong in saying that no grain was left at Gooty considerable length of time for want of cartage. Colonel Hicks and Messrs. End Sabapati and (earlier) Chithambaram Pillay seemed to be able to get as cartage as they wanted. And I am quite certain that a very great deal of gootone by the large and sustained demand for carts and bullocks on this line. Cof carts and bullocks came from all parts of this district and earned the keepemselves and their animals. Village to village distribution from Kurnool, ifd had a tramway in those days, would have been a poor substitute for steady ement on 60 miles of road. As Sir Andrew Clarke said, a grass famine is nearly as a grain famine. I would suggest that a grass famine is best met by early anained utilization, on a large scale, of the animal transport we find in the counthe beginning of the scarcity.

7. I do not think it wserve any good purpose to go further into this question. My opinion in rihat as we shall possess the canal we need not entertain the idea of a tramwaye only practically feasible line, viz., from Aspari to Kurnool.

From the Collector of Mad	dated 23rd December 1881, No. 550.
" " Nello "	4th February 1882, " 527.
" " " "	12th April " " 24.
" " Salem "	18th February " " 400.

Resolution—dated 7th September 82, No. 2230.

By G.O., 17th August 1881, 5. 2018 W., the Board were called upon to report, after communicating with such ofers of the Revenue Department as they might

think fit to consult, upon the following points in connection with a proposal to introduce steam tramways into the Madras Presidency :—

- To what tracts tramways as protective works would specially apply.
- A rough estimate of the traffic returns in ordinary years.
- A general idea of the advantages which might result from the lines in famine years.
- Whether, and if so to what extent, applicable outside the famine zone.

2. Upon receipt of the Government Order, the Board referred for their opinions to the Collectors of the districts noted in the margin, who, with the exception of the Collector of Bellary, who has not yet reported, have communicated their views in the letters read above.

Bellary.	Nellore.	Coimbatore.
Anantapur.	Chingleput.	Madura.
Kurnool.	North Arcot.	Salem.
Cuddapah.	South Arcot.	

3. A list is appended of the several lines of tramway which those Collectors who are in favor of them would cause to be constructed. Information regarding traffic is afforded in certain cases, but it is for the most part incomplete and untrustworthy.

4. The following is the substance of the several replies received :—

Anantapur.—The Collector of Anantapur proposes that a line be laid running through the district north and south to connect the north-west line, Madras

Railway, with the Mysore country, and eventually with Bangalore. Such a line would certainly carry all the traffic—by no means inconsiderable—which now passes along the old trunk road from Bangalore to Gooty, and would be of value during famine in the carriage of food-grain. The country through which the line would run is, however, comparatively poor and sparsely populated. As a financial speculation it is not likely that the undertaking would prove a success.

5. *Kurnool.*—The Collector of Kurnool (Mr. Glenny) is opposed to the introduction of steam tramways into his district, and maintains that the means of communication by road and canal are quite adequate to meet the requirements of any emergency. He considers that the only practically feasible line would be from Aspari Railway Station to Kurnool, and that such a line would be of little use. With a population of only 97 persons to the square mile, it is pretty certain that a tramway would not pay its way. As regards the value and the quantity of cartage available in time of famine, Mr. Glenny relates his own experience in 1877, and what he says will probably be borne out by every officer employed on famine duty in that neighbourhood at the time. Carriage for grain never failed, and thousands of bullocks, many of them doubtless set free from agricultural work, were kept throughout the season of drought in good working order. But in estimating the carrying power of the canal on such occasions, Mr. Glenny is over-sanguine. Water at such a time is necessarily scarce, and even in ordinary years the sluices at the anicut are opened to the Kistna on the 31st December, and as famine does not declare itself until November, when hope of the north-west monsoon is abandoned, it follows that carriage by canal would be possible for only two months before the worst period of scarcity, and during the hot months navigation would be impossible for want of water.

- Preddutur to Yerraguntla.
- Do. to Jammalamadugu.
- Jammalamadugu to Minnuladinne.
- Cuddapah to Vempalle.
- Vempalle to Pulivendla.
- Pulivendla to Tadpatri.
- Tirupati to Ráyachóti.
- Ráyachóti to Kadiri.
- Do. to Madanapalle.
- Badvel to Cumbum.
- Do. to Nandialampet.
- Nandialampet to Maidkur.
- Maidkur to Proddutur.

6. *Cuddapah.*—The Collector of Cuddapah explains that steam tramways would be of inestimable use in famine in a great part of the district, and forwards maps showing the several lines which he would suggest. He explains that the estimate of traffic which is given is of no great value, but it may be taken for granted that few, if any, of the lines suggested would be remunerative in ordinary years.

7. *Nellore*.—While indicating certain lines of tramway to pass through the western portion of the district into Cuddapah *via* Dornal, the Collector of Nellore records his opinion that only a small percentage of profit could be looked for upon the capital required. In a further letter he submits a proposal by the Local Fund Engineer for constructing what is called a "Wellington permanent-way" along the roads already in use.

8. *Chingleput*.—The Collector of Chingleput, whilst admitting that in times of famine steam tramways would be of value, states his opinion that in ordinary times they would never be remunerative, and that, as regards Chingleput, they are certainly not needed, and he adds that he is confident that they would not pay in any district with which he is acquainted.

9. *North Arcot*.—The Collector of North Arcot proposes three lines—one from the Vellore (Kátpádi) Railway Station through Vellore to Arni and thence to Pólur and Trinomalai; a second from Tirupati Railway Station to the town and thence to Damaleheruvu on the Northern Trunk Road; and a third from Vellore Station to Chittoor, to be prolonged eventually to join the Tirupati line at Damaleheruvu.

Mr. Whiteside speaks hopefully of the financial results which may be expected, and probably the lines from the Madras Railway Stations to the towns from which they derive their names may be expected to give a good return upon the outlay. For the rest it is impossible, in the absence of more complete statistics of traffic, to form any trustworthy estimate.

10. *South Arcot*.—The Collector of South Arcot proposes the construction of three lines in his district, with an aggregate length of upwards of 200 miles, and he would extend them into the neighbouring district of Salem. Mr. Cruickshank ventures no opinion upon the probable financial results to be looked for, having no sufficient data regarding traffic upon which to base calculations.

11. *Coimbatore*.—The Collector of Coimbatore suggests two lines, viz., one from Pálghat through Polláchi to Dindigul and one from Erode to Satyamangalam *via* Bhaváni. In regard to the first of these, he states its advantages as follows:—“(1) It would give an impetus to the commercial development of the country in ordinary years as well as (2) in famine years, when the gain in time, in distance, and in the use of steam as against half-starved cattle, will act as an extra protection from famine, as also (3) the advantage of a line fed from both ends by the South Indian and Madras Railways and on the west ending in a coast district never yet touched by famine.” And he adds that the passenger traffic in pilgrims to Madura and Rámesvaram will be large.

Regarding this proposal, it is observed that the matter has already been very fully discussed, but Mr. Stuart makes no reference to this fact, or to G.O., dated 8th August 1878, No. 750 R., in which the correspondence is printed.

12. *Madura*.—The Collector of Madura recites that three lines of tramway have been proposed in that district, and refers to former correspondence on the subject. He doubts whether any of these lines can be regarded as protective famine works, and says that during the last famine there was no difficulty in transporting grain.

- G.Os., dated 4th December 1878, No. 1228 R., and 23rd February 1881, No. 177 R.
1. Bangalore *via* Hosúr to Kelamangalam.
 2. Suramangalam to Namákal.
 3. Mórappúr to Pálakód *via* Dharmapuri.
 4. Salem to Atúr.
 5. Tirupatúr to Krishnagiri.

13. *Salem*.—The Collector of Salem proposes five lines in the order of importance noted in the margin, and gives rough estimates of the return upon outlay to be expected, but does not predict that they would be financially profitable.

14. The general result of inquiry made appears to be this—that tramways, as protective works against famine, are chiefly required in poor and thinly-populated tracts of country, and consequently that, viewed as a commercial speculation, the profits to be looked for ordinarily must necessarily be in inverse ratio to the value of the lines in time of scarcity.

15. With a view to affording opportunity for the fair trial which Major Frazer considers necessary in India, the Board would select, from among the several lines enumerated in the appended list, one or two of the most promising in a financial aspect for the purpose of experiment. Among these, one of the most suitable appears undoubtedly to be a line from the Vellore (Kátpádi) Railway Station to the town; the traffic on this road is both heavy and continuous, and assuming that there would be no difficulty in carrying the rails over the Pálár bridge, a fair prospect opens of the work proving successful, both financially and otherwise. Next to this, the line from Tirupati station to the town of that name promises well, and might be taken up either simultaneously or at a later date; it would in all probability prove remunerative, as well as a great convenience to the crowds of pilgrims who visit the celebrated temple on Tirupati Hill.

16. So far as the famine zone is concerned, the Board are not prepared to recommend that any more lines should at present be undertaken; the experience obtained from the two works suggested will doubtless be of value, and will probably enable the Government to take further steps for developing tramway communication in the future.

17. But in districts which lie outside the area liable to be affected by famine, the Board believe that the construction of tramways would be both beneficial and remunerative. In this connexion they would refer to certain proposals made by their First Member, when Collector of Tanjore, recorded in G.O., dated 1st April 1878,

No. 606, and to a more recent communication* relating to a similar scheme in Tinnevely. Lately, too, Government have

caused certain investigations to be made in Vizagapatam regarding a suggested line of railway from the coast to Raipore in the Central Provinces.† It is also possible

that light steam tramways might be of service in connection with salt works, and a copy of these Proceedings will accordingly be furnished to the Commissioner of Salt Revenue in case he should be disposed to offer any suggestions on the subject, and they will also be forwarded to all Collectors for information, and with the intimation that the Board will be glad to receive any further observations or proposals which may be regarded as deserving consideration, either with reference to the subject generally or to definite schemes.

APPENDIX.

Districts.	List of Tramways proposed.	Miles.
Anantapur	1. From Tadpatri Railway Station <i>via</i> Anantapur, Dharmavaram, Penukonda to Hindupur	94
	1. Proddutur to Yerraguntla Railway Station	7
	2. Do. to Jammalamadugu	11
	3. Jammalamadugu to Minnuladinne	10
	4. Cuddapah to Vempalle	25
	5. Vempalle to Pulivendla	18
	6. Pulivendla to Tadpatri (Bellary)	45
Cuddapah	7. Tirupati to Ráyachóti	65
	8. Ráyachóti to Kaduri	42
	9. Do. to Madanapalle	43
	10. Badvel to Cumbum (Kurnool)	65
	11. Do. to Nandialampet	22
	12. Nandialampet to Maidkur	5
	13. Maidkur to Proddutur	12
		2

Districts.

List of Tramways proposed—(Continued).

Miles.

Nellore	1. Kottapatam <i>via</i> Ongole, Addanki, Darsi, Podili, &c., and Venkatagiri to Tirupati Railway Station.	
	2. Iskapalle or Kistnapatam <i>via</i> Sangum and Dornal Pass into Cuddapah.	
North Arcot	1. Vellore Railway Station <i>via</i> Vellore, Arni, &c., to Pólár and Tiruvannámalai.	
	2. Tirupati Railway Station <i>via</i> Tirupati, Chandragiri, &c., to Damalcheruvu.	
	3. Vellore Railway Station to Chittoor and Damalcheruvu.	
South Arcot	1. Merkanam to Chengam <i>via</i> Tindivanam, Ginji and Tiruvannámalai	85
	Thence to Sámalpati (Madras Railway) <i>via</i> Uttankarai	(22)
	2. Panruti to Chinna Salem <i>via</i> Sevalai, Trinkolur, Tyága Drug and Kallakurchi	63
	Thence <i>via</i> Atúr to Salem	(51)
	3. Cuddalore to Tyága Drug <i>via</i> Kuringipadi, Vriddháchalam, Mandalam, Ulundurpet and Elavánásúr	67
Coimbatore	1. Pálghat <i>via</i> Polláchi, Udamalpet and Dhárápúram to Dindigul.	
Madura	2. From Erode to Satyamangalam <i>via</i> Bhaváni.	
	1. Madura to Ramnad to Pámban.	
	2. Ammayanáyakanúr to Periyakulam.	
Salem	1. Bangalore to Kelamangalam <i>via</i> Hosúr	35
	2. Suramangalam to Námakal	35
	3. Mórappúr to Pálakód <i>via</i> Dharmapuri	35
	4. Salem to Atúr	31
	5. Tirupatúr to Krishnagiri	26

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Secretary.

(2.)

G.O., dated 18th October 1882, Mis. No. 3438, Revenue.

Proceedings of the Board of Revenue, dated 2nd October 1882, No. 2414.

Read—the following letter from H. P. GORDON, Esq., Collector of Bellary, to the Secretary to the Board of Revenue, dated 19th September 1882, No. 3236 :—

With reference to Board's Proceedings, No. 2501, of 27th October 1881, I have the honor to report as follows :—

The tracts in this district to which tramways as protective works would specially apply are—

- (1) The taluks of Harpanahalli, Hadagally, and Kúdligi with the portion of Hospet west of Sandúr.
- (2) The tract lying south and south-south-east of Bellary and comprising the taluks of Ráyadrug and the Kalyándrúg Division of the Dharmavaram Taluk (now in Anantapur District) and some portions of Mysore territory as far as Madakasíra.
- (3) The northern portions of the Bellary and Alúr Taluks.

2. The lines which, in my opinion, it would be desirable to carry out are, in order of importance (as regards this district)—

- I. A line from the Mysore Frontier at Duggavati, south-south-west of Harpanahalli, *via* Harpanahalli, Ittigi, Naraindevakerra to Hospet, where it would join the Bellary-Marmagoa Railway (about 63 miles) with a branch from Ittigi to Kothur (Kúdligi), about 13 miles.
- II. A line from Bellary to Kalyándrúg Anantapur to be carried on *via* Cumbadur to Hindupur (both places in the Anantapur District), or should a line be extended from Gooty or Tadpatri to Anantapur and

Penukonda, then *via* Kundarpedrúg to Amarapuram in Madakasíra Taluk.

From Bellary to Kalyándrúg, I would prefer the direct road to that passing through the Kusbah town of Ráyadrug, because it is more direct and would be more convenient for the distribution of food to our population than the line *via* Ráyadrug which runs along the border of Mysore territory. The direct line is also that taken by through traffic in ordinary times between Hindupur and Bellary.

III. A line from Bellary to Siruguppa (due north 35 miles).

3. Line No. I should be made in connection with a line from Hurryhur (Mysore) to Duggavati. If the Mysore Government is not prepared to make such a line, I would not extend the line to the southwards beyond Harpanahalli.

4. There is no reliable information as to the traffic on any of these lines, and observations unless carried out with a special establishment for at least a year would not afford reliable data.

5. The local traffic on Line No. I is estimated at 100 bandies daily. An estimate, however, of local traffic on a road which carries a considerable quantity of through traffic must necessarily be very imperfect.

The trade returns for the three stations on the southern boundary of Harpanahalli for 12 months give the following results :—

Stations.	Maunds.	Value.	Number of Indian Maunds imported Monthly.	Number of Bandies at 12 Maunds for a Bandy-load.
Imports ... {	Duggavati ...	29,457	RS. 1,92,004 15 8	2,454
	Málgiri ...	36,510	87,423 2 4	3,042
	Boodihall ...	1,755	3,943 11 0	146
	Total ...	67,722	2,83,371 13 0	5,642

Stations.	Maunds	Value.	Number of Indian Maunds exported Monthly.	Number of Bandies at 12 Maunds for a Bandy-load.
Exports ... {	Duggavati ...	36,211	RS. 2,11,200 4 6	3,017
	Málgiri ...	194,406	94,705 3 4	16,200
	Boodihall ...	4,471	5,382 12 0	372
	Total ...	235,088	3,11,288 3 10	19,589
Add Imports ...		67,722	2,83,371 13 0	5,642
Grand Total ...		302,810	5,94,660 0 10	25,231

A considerable portion of the traffic entering and leaving at Boodihall probably passes to and from Kothur (the principal centre of trade in Kúdligi Taluk), but the mass of the traffic entering on the south of the taluk would probably take Line No. I.

6. Line No. II.—The traffic is estimated at thirty laden carts and thirty-six laden cattle daily.

7. The trade returns at Cumbadur and Kundarpedrúg for eight months give the following results. The routes through both these stations pass through Kallyandrúg :—

Stations.	Maunds.	Value.	Number of Indian Maunds imported Monthly.	Number of Bandies at 12 Maunds for a Bandy-load.
Imports ... { Kundarpedrúg ...	1,732	RS. 8,650 A. 4 P. 0	216	18
Cumbadur ...	2,771	9,502 12 11	346	28
Total ...	4,503	18,153 0 11	562	46

Stations.	Maunds.	Value.	Number of Indian Maunds imported Monthly.	Number of Bandies at 12 Maunds for a Bandy-load.
Exports .. { Kundarpedrúg ...	21,968	RS. 4,369 A. 14 P. 0	2,746	228
Cumbadur ...	13,425	22,303 5 6	1,678	139
Total ...	35,933	26,673 3 6	4,424	367
Add Imports ...	4,503	18,153 0 11	562	46
Grand Total ...	39,896	44,826 4 1	4,986	413

8. *Line No. III.*—The average traffic is estimated at about fifteen carts daily. The trade returns at Siruguppa show the following results for twelve months :—

Stations.	Maunds.	Value.	Number of Indian Maunds imported or exported Monthly.	Number of Bandies at 12 Maunds for a Bandy-load.
Imports { Siruguppa ...	23,293	RS. 1,36,033 A. 0 P. 0	1,941	162
Exports { ...	13,542	44,438 8 0	1,128	94
Total, Imports and Exports ...	36,835	1,80,471 8 0	3,069	256

9. The principal advantage of these lines in famine years would be the power of rapid distribution of food-grains.

10. All three lines pass through and render accessible tracts of country which are almost entirely dependent upon local rainfall.

11. In ordinary times they would do much to develop agriculture by opening up markets to the ryots.

RESOLUTION—dated 2nd October 1882, No. 2414.

Submitted to Government in continuation of Board's Proceedings, dated 7th September 1882, No. 2230.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Secretary.

Order—dated 18th October 1882, Mis. No. 3438, Revenue.

Transferred to the Public Works Department.

(Signed) E. F. WEBSTER,
Secretary to Government.

(3) Abstract of proposals made by the several Superintending Engineers, Madras Public Works Department, for the construction of light Railways or Tramways for famine purposes in their circles.

Districts.	Length in Miles.	Tramway or Railway Lines proposed.	Digest of reasons assigned very briefly.	Opinion of Writer as to whether they will pay or not in ordinary years.
1. VIZAGAPATAM. MR. G. T. WALCH. From Bimlipatam to Párvatipur ... Do. Calingapatam, viâ Chicacole, to Párvatipur. Total ...	75 68 143	Tramway Do. Do.	{ Would at all times be useful works, and in case of famine in the district would be most valuable as grain distributors. No special engineering difficulties in the way of their construction.	Both lines would doubtless give appreciable return, especially the first.
2. GANJAM. MR. G. T. WALCH. From port of Gopálpur, viâ Berhampore and Aska, to Russellkonda. Total ...	60 60	Do. Do.	Would be useful at all times, and as a famine protective work. No special engineering difficulties.	Not likely to prove remunerative from direct returns.
3. NORTH ARCOT. LIEUT.-COLONEL H. R. MEAD, R.E. From Vellore Railway Station through Vellore and Arni. Total ...	30 22 6 33 91	Railway Do. Do. Do. Do.	This district has the Madras Railway passing through it from east to west and also the North-west Line on its eastern boundary. The southern and north-western tracts might with advantage be opened out.	Some return might be expected in ordinary times.
3. From Vellore Railway Station to Chittoor. Do. Tirupati Station to the town of Lower Tirupati. Do. Tirupati Station through Chandragiri to Damaleheru. Total ...	22 6 33 91	Do. Do. Do. Do.	Do.	The short length of 6 miles would almost pay during feasts, &c., but beyond this the country is poor and thinly populated.

Districts.	Length in Miles.	Tramway or Railway Lines proposed.	Digest of reasons assigned very briefly.	Opinion of Writers as to whether they will pay or not in ordinary years.
4. SOUTH ARCOOT.				
LIEUT.-COLONEL H. R. MEAD, R.E.				
From Arni and on to Póúr and Tiruvannámalai.	38	Railway	This district has the Madras Railway passing through it from east to west and also the North-west Line on its eastern boundary. The southern and north-western tracts might with advantage be opened out.	Some return might be expected in ordinary times.
COLONEL H. L. PRENDERGAST, R.E.				
From Porto Novo to Vriddhachalam	30	Tramway	To open up the taluks of Tiruvannámalai, Tirukoilúr, Vriddhachalam and Kallakurchi in which the famine was most severely felt.	No opinion expressed.
Do. Vriddhachalam to Tallavasel	39	Do.		
Do. Tallavasel to Chinna Salem and on to Kallakurchi.	18	Do.		
Do. Pauruti to Tirukoilúr and on to Tiruvannámalai.	51	Do.		
Total ...	176			
5. SALEM.				
LIEUT.-COLONEL H. R. MEAD, R.E.				
From Bangalore to Hosúr	27	Do.	These tracts suffered severely during the famine and are not reached by the railway.	Do.
Do. Morappúr Station on the Madras line to Pálakód.	28	Do.		
Do. Salem to Námakal	38	Do.		
Do. Salem down to Atúr valley	30	Do.		
Total ...	123			
6. COIMBATORE.				
LIEUT.-COLONEL H. R. MEAD, R.E.				
From Pálghat Station to Dindigul	110	Rail or tramway.	This line would open the country that suffered so much during the last famine. For the protection of the northern portion of the district.	Might perhaps give some return. Country thickly populated.
Do. Erode to Satyamangalam.	40	Do.		
Total ...	150			

7. BELLARY.

COLONEL H. L. PRENDERGAST, R.E. From Hospet through Harpanahalli to Hurliur in Mysore.	73	Tramway	... The Bellary-Hubli Railway will cross the Tungabhadra near Hospet. The latter is therefore the point of departure for a tramway for the advantage of the Hadagalli, Harpanahalli and Kudligi taluks.
Do. Tadpatri through Anantapur to Penukonda.	75	Do. ...	... The main road between Hyderabad and Bangalore passes through Gooty, but there is a cross road from the Tadpatri station to Anantapur by which the crossing of the Pennér is avoided.
Do. Bellary southward through Hiri- hal on the Bangalore road through the Mysore territory.	35	Do. ...	... The extension of this line into Mysore territory will give assistance to the Kudligi taluk on the west and to the Raidrug, Anantapur, and Dharmava- rum taluks on the east.
Total ...		183	
8. KURNOOL.			
COLONEL H. L. PRENDERGAST, R.E. From Gooty through Pyápali to Kur- nool.	71½	Do. ...	} These two lines would throw supplies into the centre and southern part of Kurnool as well as the northern part of the Cuddapah district. This would provide for the northern part of the district.
Do. Pyápali through Banganapalli to Nandyál.	45	Do. ...	
Do. Kurnool eastward to Atmakúr on the road to Guntúr.	42	Do. ...	
Total ...		158½	
9. CUDDAPAH.			
COLONEL H. L. PRENDERGAST, R.E. From Madanapalle through Gurrúmkonda to Ráyachóti.	43	Do.	} No part of the Cuddapah District is far from the railway in a direct line, but the hills and the drop from the Mysore plateau prevent access being obtained laterally to the borders of the district. There are roads along the lines indicat- ed, and tramways along them would bring supplies to the high taluks. In the event of a tramway being laid from Vellore to Chittoor and thence on the road to Cuddapah to Peelair, the pro- longation of the line to Ráyachóti would be carried out with advantage.
Do. Madanapalle to Kadiri	50	Do.	
Do. Púér to Ráyachóti	34	Do. ...	
Total ...		127	

Abstract of proposals made by the several Superintending Engineers, Madras Public Works Department, for the construction of light Railways, &c.—cont.

Districts.	Length in Miles.	Tramway or Railway Lines proposed.	Digest of reasons assigned very briefly.	Opinion of Writer as to whether they will pay or not in ordinary years.
10. NELLORE.				
COLONEL H. L. PRENDERGAST, R.E.				
From Kottapatam on the canal through Ongole to Cumbum in the Kurnool District.	76	Tramway	This line would supply the eastern taluks of Kurnool and complete the lines of protective works for that district.	Colonel Prendergast expresses no opinion as to whether these lines will prove remunerative, but Major Pennywick considers that no such result can be looked for. The first two lines may yield a moderate return.
Do. Dunganápatnam to Gúdur and Rápur.	48	Do.	This line would supply the taluks of Gúdiri and Rápur and assist the Venkatarini Zemindari.	
Do. Tummalapenta by Kávali and Kaligiri to Udayagiri.	53	Do.	If an intermediate line be required in Nellore it will be best taken on this route.	
Do. Kistnapatam to Nellore	16	Do.	The above three lines are all at some distance from the head-quarters of the district, and it may be considered necessary to take the tramway into Nellore.	
Total ...	193			
11. MADURA.				
COLONEL J. BEATTY, R.E.				
From Dindigul to Palni ...	36	Tramway	The Palni and Dindigul taluks suffered worst of all in the famine of 1877. In G.O., No. 750 R., dated 8th August 1878, the Government recognised the importance of connecting Dindigul with Pálghat by a line of railway, but stated that the question of construction must stand over.	The Collector is of opinion that this line would be useful, but neither so useful nor so likely to pay as the Periyakulam-Ammayanáyakanur project.
Do. Palni to Pálghat eventually extended.	74	Steam Tramway.		
Do. Madura to Pámban <i>viâ</i> Ramnad ...	91	Do.	The desirableness of constructing a railway on this line has been under the consideration of Government, and the last order on the subject is G.O., 177 R., dated 23rd February 1882. The Ramnad Zemindari suffered very severely in the famine of 1877.	The Collector thinks that this line will not pay, the country being poor and thinly populated, with little trade.

From Ammayanáyakanur to Cumbum *viâ* Periyakulam.

The Collector considers this line would prove remunerative and useful in times of dearth.

The Local Fund Board of the Dindigul Circle have referred to Government the question of opening a tramway on this route, but as the Cumbum valley suffered least in the famine, the Superintending Engineer places the project last in order of importance as a protective work.

The lines would be a very losing concern in all ordinary times, and would not be of such use in periods of scarcity as to render it wise to incur the expense of their construction.

Tramways are not required in this district, through which the Madras Railway runs to the west, the South Indian Railway to the south, with the Chingleput-Arkónam branch, and the Buckingham Canal along the coast. If Government are prepared to undertake such works merely as a means of facilitating communication in times of famine, regardless of other considerations, then the lines mentioned would be desirable as linking the railways and the canal and making the Presidency town a centre of distribution.

12. CHINGLEPUT.

COLONEL H. L. PRENDERGAST, R.E.
From Pulicat to Tiruvallúr on the line of the Madras Railway
Do. Cheyaur to Madurántakam on the main line of South Indian Railway with a continuation to Utremurur.

ABSTRACT OF PROPOSALS.

	MILES.		MILES.
Vizagapatam	143	Cuddapah	127
Ganjam	60	Nellore	193
North Arcot	91	Madura	262
South Arcot	176	Chingleput	53
Salem	123		
Coimbatore	150	Total ..	1,719½
Bellary	183		
Kurnool	158½		

(4.) Memorandum by the Consulting Engineer to the Government of India for State Railways.

STEAM TRAMWAYS.

Comparisons (such as that which Mr. Vincent has made in his pamphlet) between a tramway costing about £2,000 per mile, and a railway costing from £6,000 to £7,000 per mile are calculated to mislead unless they are accompanied by a thorough knowledge of all the circumstances in each case, and by an explanation of the items of which the cost is composed; a so-called "tramway" is in reality nothing but a railway laid on an existing road, consequently the expense of surveys, earth-works, bridges, fencing, &c., having already been provided in the first construction of the road is not debited to the capital expenditure of the tramway. Mr. Vincent is in error in stating (page 7) that "Tramways generally are quite of modern origin, and steam tramways in particular may be said to be still in the earliest stage of development." He is also in error in stating that "To America belongs the credit of being the pioneer of this new mode of locomotion." Tramways were in common use in England before the existence of railways, and I can remember thirty years ago in Wales tramways worked by steam which were by no means new at that period, but which were afterwards converted at much expense into railways. All that America has done in the matter has been to popularise them for street traffic in their populous cities.

Mr. Vincent is also inaccurate in stating (in page 5) that "It is scarcely probable that even a light line of railway in India will ever be constructed for much less than from £6,000 to £7,000 a mile." Several of our State railways have been constructed at a much lower cost. I may instance the Bhownuggur-Gondal line, metre gauge, 75 miles in length, which has been constructed for Rs. 34,760 per mile (say £2,897 per mile), and the Miani line, metre gauge, 57 miles in length, which has been constructed for Rs. 37,320 per mile (say £3,110 per mile).

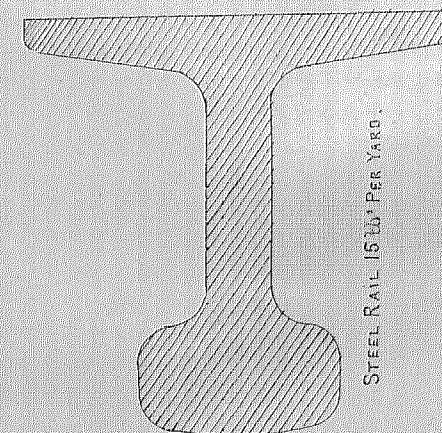
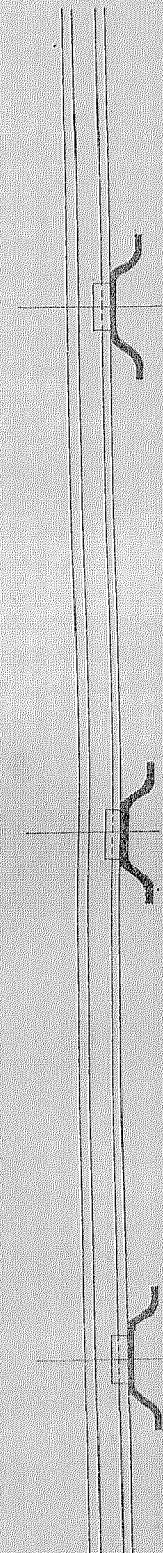
Taking as a basis for comparison the figures which Mr. Vincent has given in the case of the Milanese tramway and comparing these with similar items of cost of the Bhownuggur-Gondal railway after eliminating from the latter those items which, in the case of the tramway, have been provided free of cost by the existing road, the tramway appears to be the more costly of the two, as may be seen by the following comparison, in which I have for facility of comparison, reduced pounds sterling to the equivalent in rupees:—

Items.	Cost per Mile Rupees.	
	Milanese Tramway.	Bhownuggur Gondal Railway.
	RS.	RS.
Preliminary expenses ...		
Miscellaneous, Establishment... }	1,620	*2,331
Buildings, Stations and, Workshops ...	5,076	2,650
Ballast and Permanent-way ...	13,596	15,256
Rolling Stock ...	7,584	5,430
Total ...	27,876	25,667

To place this comparison on a fair equality with Indian rates, and to allow for the greater distance of India from the sources of supply of permanent-way and rolling stock, the Italian rates should be increased by at least 25 per cent., and if this were done the comparison would stand as follows:—

Cost of Tramway per mile ...	RS.
„ Railway „ ...	34,845
	25,667

* Includes Survey expenses, which cannot be separated.



4. Please return the tracing to me, and if you think the design a promising one I would suggest your writing to Mr. F. G. Stoney for estimates of its cost, &c.
I enclose a memorandum of my views on the subject of steam tramways.

ENCLOSURE.

Memorandum on Steam Tramways for Indian Roads.

I quite agree with Mr. Vincent on most points, and think steam tramways eminently suited to aid the traffic and develop the resources of districts which cannot afford to pay for railways even of the cheapest sort.

2. They should be laid on existing roads, and if possible divided from the portion set apart for ordinary conveyances by stout wire fencing, which would add more than Rs. 1,100 per mile to the original cost, and this would be more than recovered by the saving effected in the upkeep of the roadway occupied by the tramway, which if not fenced should be maintained for cart traffic.

3. The gauge most suitable would, I think be, either the metre, or 3'-6", nothing wider being needed; and by adopting either of these and placing the tram rails as near one side as possible, most roads on which there was traffic enough to need a tramway, would be most likely wide enough to permit of its being fenced off, and also to accommodate the cart traffic.

It might be necessary to widen a few bridges, and to improve bad curves, but it should be remembered that the cart and passenger traffic on a given road would be reduced by that carried by the tramway laid thereon, so that a smaller width of road would suffice to accommodate what remained.

4. Where metre-gauge railways exist, steam tramways should be made of the same gauge; and if it was arranged, as I propose, to fence them off from the rest of the road, the tramway rails might be of a similar, but lighter type, to those used on the railways with which they were connected; and be laid so as to stand 2 or 3 inches above the road level.

If so constructed there would be no great difficulty in arranging to run light metre-gauge railway wagons on the adjoining steam tramways; and this would no doubt be an advantage on lines likely to be needed as grain distributors in times of famine.

5. No useful end would, I think, be gained by making steam tramways adjoining 5'-6" gauge railways of the same width, because the ordinary tramway rails, &c., would not bear safely the loads which would be imposed on them by adjoining broad gauge loaded goods wagons; so that if they were made wide with this object (which is apparently the only one there is for such a course) much heavier rails, sleepers, &c., would be required, and bridges, &c., would also need to be proportionately stronger, so that the cost of a 5'-6" gauge steam tramway capable of carrying broad gauge wagons, would probably be from one and a-half to twice that of an ordinary metre-gauge tram.

The advantages gained would not, I think, be at all in proportion to the extra capital expended.

6. Break of gauge would be of small consequence, as there ought to be little, if any, difficulty by means of suitable appliances, in rapidly transshipping from railway to tramway wagons, or *vice versa*, all a tramway could carry.

7. Wood-burning steam locomotives would be, I believe, the most suitable and economical power to use; they might be fitted with arrangements for suppressing the exhaust and smoke for short periods, when passing horses, &c., by means of condensers or other suitable appliances.

There appears to me to be no practical objection to allowing the engines used to discharge their exhaust steam and smoke into their chimneys in ordinary work, provided that efficient spark catchers be used.

The South Indian Railway from Arkónam to Conjeeveram runs alongside the public road for miles, and the passing of ordinary trains does not apparently cause any trouble to the cart traffic on the adjacent road.

The South Indian Railway Harbour line at Madras is a still more notable example of this.

8. The estimates given by Mr. Vincent appear liberal, the cost of working short lengths of tramway having to support their own managers, &c., would be so great as to leave little chance of profit to any private Company, but some arrangement might perhaps be made by which Railway Companies would construct and work for Government, at cost price *plus* a small percentage for supervision, steam tramways from large towns along their line, such as Vellore, Salem, &c., the Government paying their cost either from local or other funds, and receiving the net earnings.

9. If an arrangement of this sort could be made, such steam tramways could be constructed and worked most economically; and in consideration of the advantages likely to be derived by the Railway Companies by these feeders, such a system as I suggest might perhaps be tried with success.



10. The road from Beypore to Calicut would, I think, offer exceptional advantages for the construction and trial of a steam tramway with every prospect of success, as it is level and straight, and there is much goods and passenger traffic over it.

Permanent-way materials and rolling stock could be shipped direct both to Beypore and Calicut, so that the cost of carriage would be reduced to a minimum.

The traffic on this road could, I presume, be accurately ascertained at a nominal cost.

(Signed) E. W. STONEY, B.C.E., M. Inst. C.E.

Hollow rail about 44 lb. per yard laid on small pit sleepers or chairs filled with concrete

and laid on longitudinal bed of concrete



The concrete in the chairs adheres fast to them and unites with the bed of concrete and no tie-bars are required. The peculiarity I propose is in constructing the rail so that while it forms a good basin it still allows a certain amount of elasticity between its feet below, which greatly facilitates the action of keying in places by means of iron keys and allows of small corrugations to be made in the key and in the jaw of the chair, so that nothing short of smart hammering could undermine a key, and the rail is securely held. The chair sleepers may be 3 feet apart for light trains and at the junction of two rails, the sleepers would be 15 feet apart and a fish or joint bar 18" long used *inside* the rail resting on each adjacent chair and confined by a stop endways on each chair, the fish bar to be so deep that the rails will bear on it and not on the chairs; the fish bar to fit tight into the rail on its upperside and to taper downwards the reverse way from the rail for clearance in keying up and facility of rolling, &c. The sketch will explain itself clearly. Rails, chairs, fishes, keys, iron or (steel rail) about 110 to 112 tons per mile.

18th September 1881.

(Signed) E. W. STONEY, B.C.E., M. Inst. C.E.

(6.) From F. H. TREVITHICK, Esq., Locomotive Superintendent, Madras Railway, to the Secretary to the Madras Government, Public Works Department, dated Perambūr, 18th November 1881, No. 2749-563.

Your No. 2176 W., dated 2nd September 1881.

Indian Tramways.—With reference to Proceedings of Government, dated 17th August 1881, No. 2018 W.

In reply to the questions raised in the above quoted order of Government I have the honor to make the following suggestions.

2. Assuming that the particular object of the proposed steam tramways is that they should serve as a means of distributing food in districts remote from railways during famine time; that they are not required in time of plenty, at least not required so much as to induce the Government to build them without the certainty of a fair return of interest for the outlay: but that it is expedient to construct them in certain districts as an insurance against famine even with the foreknowledge that they are not likely to return a fair rate of interest.

3. I would abandon altogether the idea of working them regularly by steam. A steam tramway worked with regular trains is practically a railway, and is pretty certain to soon acquire many expensive railway ideas in the way of stations, workshops, and highly paid staff.

4. The principle to be adopted should be concisely this. The tramway should be considered in time of plenty as nothing more than an improvement of the common roads, to be used by the native country-carts drawn by country bullocks, at a small charge for toll. If the traffic is sufficient to admit of a regular service in addition to this, so much the better; but to commence with, steam should not be used.

5. A supply of steam-engines should be kept at convenient Government depôts, and, as one end of every tramway would touch a railway, the tram-engines could be readily disposed where required.

6. The tramway should be laid, as suggested, on the common country roads; but much lighter and consequently cheaper than any proposed in the papers which accompanied your letter.

7. The rails should not exceed 15 lb. per yard; and the cost of the whole thing, including rolling stock, should not exceed Rs. 10,000 per mile. That this is practicable may be understood from the advertisements of sufficiently well-known makers in England, who undertake to deliver steel rails and iron sleepers at prices which admit of a road being made within this limit.

8. The ordinary rolling stock of the tramways should be built almost exactly like the ordinary country-carts; but each vehicle with two sets of wheels, one with flanges and one without. When the carts arrive, drawn as they generally would be by the consignees own bullocks, or by the bullocks of the bandy-men who now carry on the ordinary road traffic, at the point on the tram nearest their destination, the wheels would be changed (just as they are on the Paris and Versailles tram), and the load would proceed over the common field tracks.

9. The object of making the ordinary rolling stock thus is twofold, partly to admit of its running on the road as well as on the tram, and, partly, because it could be easily built and repaired without special appliances, by the means at hand in every village. Two-wheeled bandies would be inconvenient for steam traction; and a supply of four-wheeled bandies would also be required for use when the steam engine is applied. A train of half four-wheeled and half two-wheeled bandies drawn by an engine would work well enough.

10. The gauge of the line should be the usual gauge of the country bandy. The section of the rails should be that known as the Vignolles' section, and of the sleepers that known as Wood's system, or similar (see sketch). Flat bar rails would be convenient in many ways, but would never be stiff enough at the limit of weight and cost fixed to carry engines.

11. The necessary equipment at the outset for each tramway would be no more than a few country bandies fitted with flanged wheels to enable them to keep the rails, and a few extra flanged wheels to be used as required in the country-carts of private owners. In addition to this a few locomotives to be kept in store as equally applicable to all the trams in the district, and a few special four-wheeled vehicles of a rather larger calibre than the ordinary country cart, but built in exactly the same manner, to be used in trains at times when it becomes necessary to employ the locomotives.

12. There should be no stations or signals. The bandies should travel in convoys in charge of native pilots or guards belonging to the tram, who would arrange for the passing of the convoys at suitable and previously agreed places; where sidings or a so-called "turn-out" would be provided. A stray bandy meeting a convoy would simply pull off the rails till the convoy passed and then go on again. The speed even with the locomotives should never exceed 8 to 10 miles an hour, and at such a speed it is believed they could be safely worked in this manner; although no doubt, during the rush of such a famine traffic as was experienced in 1877, special and extraordinary arrangements would have to be made to work the trains even as they were with the railways.

13. Short lengths of 15, 20 or 30 miles of tram could not afford to maintain each an engineering staff; but being Government property they should be maintained by the same engineering staff that now looks to the roads.

14. It may be doubted that such a line, so worked, could pay at all under any circumstances. I think it could. Take, for example, a line 20 miles long, worth, at Rs. 10,000 a mile, Rs. 2,00,000. I take this length as being the limit of a day's work for bullocks. Any shorter length, so long as it still could be considered and paid for as a day's work, would be rather more advantageous.

15. It is customary to charge for freight, travelling long distances in bullock bandies, at so much per day. The weight of a two-wheeled country cart usually drawn by two bullocks is 800 to 900 lb. and it will carry or rather the bullocks will draw in it about 1,000 lb. of freight. They will travel 15 to 20 miles a day, and the charge is Rs. 2 per day, or, say, 1 anna 7 pie per mile, equal to Rs. 0-3-7 per ton per mile.

16. Now, if the same pair of bullocks that do the above work can be made by help of the tram to do double by carrying double the load at the same speed, the traffic such as it is could well afford to pay an extra toll.

17. The return in interest for this 20-mile line at 5 per cent. must be Rs. 10,000 per annum, and taking working expenses to be 50 per cent. of receipts the total earnings must be Rs. 20,000 per annum.

18. With the figures quoted the calculation depends on the power of a pair of bullocks to pull double as much in the tram as on the road. The rate at present in force on the roads is Rs. 2 per load of 1,000 lb. for a day's journey. Let the new rate be Rs. 3 per 2,000 lb., of which Rs. $2\frac{1}{2}$ go to the owner of the bandy and bullocks and Annas 8 to the tram. Then the receipts must be Rs. 55 per day, which would be realized by 110 journeys, or 55 bandies a day each way.

19. This number could certainly be easily worked if they were there to work, and I think there is good reason to believe that out of a number of tramways built and worked as described some at least would be likely to return a fair rate of interest on the money expended on their construction.

20. A passenger traffic in the tram has hardly been considered, but there would be no difficulty in providing very light and suitable vehicles to be drawn by horses or country tats.

(7.)

Note on the "Porteur Decauville."

The annexed table has been compiled to show the weight, cost, &c., of the permanent-way and locomotives for the different gauges. The cost of permanent-way for the 16 and 20 inches gauges is that supplied by Mr. Gostling, and for the other gauges the cost is based on those figures, with a due allowance for the cheaper rate at which the larger sections of rail could be obtained.

2. For permanent lines it is thought that the rail should weigh at least 24 lb. to the yard, and 30 lb. would be better. The lighter sections of rail would not give good results, as the engines, which it would then be necessary to use, could take only a small load on the gradients that would be met with on an ordinary Indian road.

3. In the item of cost the Porteur Decauville appears to compare unfavorably with an ordinary line of light railway with rails of similar section. With wooden sleepers the ordinary line would be far cheaper, and wrought-iron sleepers of the best description could be supplied for less than the cost of the Decauville system. This is due in great measure to the high price of the Porteur Decauville, which varies from Rs. 273 per ton for 9 lb. rails to Rs. 193 per ton for 30 lb. rails. Steel rails weighing 30 lb. per yard could probably be purchased in England for £7 per ton = Rs. 84; and allowing Rs. 20 for freight and insurance, their cost in Madras would be Rs. 104 per ton. The permanent-way of the South Indian Railway (40 lb. rails on creosoted pine sleepers) costs at the present time about Rs. 12,000 per mile, or almost the same as the Porteur Decauville with a 40 lb. rail.

4. With regard to the relative merits of the Porteur Decauville, and an ordinary light railway, it may be said that the former could be laid rather more rapidly, but if the ordinary rails were supplied in similar lengths (16 feet 5 inches) they would be nearly as portable with the sleepers attached. This could be done after the material was landed, and the component parts could be sent out separately, and would thus pack better on board ship.

5. The ordinary permanent-way has larger bearing surface, and could be more easily kept in good order during rains, when owing to the banks being soft the Porteur Decauville would be liable to become bent, and there would be some difficulty in straightening it. If bent transversely, the gauge would be lost. Owing to its small bearing surface the Porteur Decauville appears to be suited only for a metalled road, or a bank which has thoroughly consolidated, and has a good coating of gravel or stone ballast. It is observed that the Russians were unable to use the engines on a line laid on sand, and had to work the traffic by horses. An ordinary railway is on the other hand thoroughly efficient on sand. If during famines it be considered desirable to use the 16 inch or 20 inch gauge, it would probably be better to work

the small trucks by coolies. It is presumed that permanent tramways will be provided along the main roads before a famine; and the famine lines will probably be laid along cross-country roads or tracks incapable of sustaining the weight of an engine.

6. Ordinary railways can be laid with sufficient rapidity, provided the material be available in the country. As an instance of a famine line, it may be observed that in 1874 a temporary line on the metre gauge from the Ganges to Durbhanga, 53 miles in length, was opened after only 53 days work. If a stock of material is to be laid in against a famine, it would, it is thought, be better to have it of the ordinary type. If, on financial grounds, no steps are taken until after the commencement of a famine, probably the Porteur Decauville could be obtained in a shorter time than ordinary rails of small section which are not kept on hand in England.

7. The cost of laying the Porteur Decauville of 20 inch gauge (B) on a well-metalled road, with suitable gradients, would not greatly exceed the cost of the material, and allowing for rolling stock it may be thus estimated:—

	RS.
Cost of material as per statement	6,930
Carriage by train	504
Cost of laying (telescopically)	880
Ballast	200
Five trucks per mile, at Rs. 120	600
Sheds and sundries	600
Total	9,714

or say Rs. 10,000 per mile. This provides only for the conveyance of goods in small wagons hauled by coolies, or by ponies (if available).

8. It must be remembered, however, that even if a good road be available, alterations of gradient will generally be needed to suit it for a permanent tramway worked by engine-power. The following is an estimate of the cost of laying the 24" gauge (C) on a road which though not fully metalled is sufficiently wide and good for the tramway to be laid on one side of it, and with bridges sufficiently strong to carry a 5-ton engine:—

	RS.
Permanent-way	8,870
Carriage of permanent-way by train	702
Cost of laying (telescopically)	880
Altering gradients and curves	1,000
Ballast	300
Stations and Workshops	600
Establishment	500
Rolling stock	4,000
Contingencies, 5 per cent.	16,852
Cost of one mile	843
Cost of one mile	17,695

9. The cost of the 30 inch gauge (E) with 30 lb. rail laid entirely on a new bank may be estimated as follows:—

	RS.
Preliminary expenses	300
Land (10 acres at Rs. 100)	1,000
Earthwork (14,000 cubic yards at 2 annas)	1,750
Minor bridges (20 lineal feet at Rs. 100)	2,000
Large bridges and causeways	2,000
Level crossings	200
Ballast	600
Permanent-way	12,200
Carriage of permanent-way by train	1,130
Laying (telescopically)	1,200
Stations and Workshops	1,200
Plant	300
Rolling stock	5,000
Establishment	2,000
Contingencies, 5 per cent.	30,880
Cost of one mile	1,544
Cost of one mile	32,424

The estimate for earthwork provides for a bank 12 feet wide at top, with slopes of $1\frac{1}{2}$ to 1, averaging 4 feet high.

The rate for minor bridges is somewhat below the cost of these works on the South Indian Railway, but would, it is thought, be sufficient for foundations of moderate depth protected by aprons.

It is difficult to estimate the cost of large bridges and causeways. By a large bridge is meant one providing 60 feet of waterway or more; and although causeways might be generally used, it would probably be found desirable to build bridges in some cases, *e.g.*, over large irrigation channels. The amount entered would probably be sufficient for this purpose.

The cost of stations on the Southern Extension of the South Indian Railway was Rs. 4,000 per mile. The amount entered provides only for the cheapest description of accommodation for passengers and goods, sheds for engines and rolling stock, staff quarters, and station machinery.

Rolling stock is estimated on the following basis for a line 50 miles long:—

	RS.
Eight locomotives, at Rs. 9,700	77,600
Six composites (1st and 2nd Class), at Rs. 2,110	12,660
Thirty third-class carriages, at Rs. 1,200	36,000
Eight brakes, at Rs. 1,200	9,600
Eighty covered wagons, at Rs. 1,080	86,400
Forty open wagons, at Rs. 700	28,000

For 50 miles ... 2,50,260
= Rs. 5,000 per mile.

Provision is made for carriage of materials 300 miles by railway, on the supposition that the lines are laid in the Bellary and Kurnool Districts.

Particulars of Weight, Cost, &c., of "Porteur Decauville."

	GAUGE.				
	A. 16 Inch.	B. 20 Inch.	C. 24 Inch.	D. 30 Inch.	E. 30 Inch.
Weight of each length (16 feet 5 inches). lb.	117	187	259	332	420
Do. per lineal yard	21	34	47	60	76
Do. of single rail per yard	9	14	19	24	30
Do. of one mile of permanent-way. Tons.	16.4	26.7	37.2	47.1	59.7
Do. do. including 5 per cent.					
for sidings	17 $\frac{1}{4}$	28	39	50	63
Cost per lineal foot	Rs. .85	1.25	1.6	1.9	2.2
Do. mile (84 chains) including sidings	4,712	6,930	8,870	10,534	12,197
Landing charges and carriage by train for 300 miles, at 10 pies per ton mile.	310	504	702	900	1,134
Type of engine suitable for each rail.	No. ...	1	3	4 or 5	6
Cost of engine	Rs. ...	6,700	8,240	9,060	9,700
Weight of engine in steam	Tons. ...	3 $\frac{1}{2}$	5	7 $\frac{1}{2}$	10 $\frac{1}{2}$

22nd November 1881. (Signed) W. H. COAKER, Captain, R.E.,
Dy. Consulting Engineer for Railways.

(8.) From the Acting Chief Engineer, to the Agent and Manager, Madras Railway Company, dated Madras, 14th December 1881, No. C. 141/555.

Your endorsement on Consulting Engineer's letter, No. 719, forwarding Proceedings of Government, dated 17th August 1881, No. 2018 W.

I have had no experience in tramways, but from what I have read on the subject am of opinion that a gauge of $2\frac{1}{2}$ feet or even less would fully meet all the requirements of the country.

The most recent experiments prove that Meraski's compressed air locomotive takes $2\frac{1}{2}$ times as much fuel to move a ton one mile as Merryweather's direct steam locomotive to move the same weight the same distance.

It would therefore appear that until some very much more favorable results can be attained the idea of using compressed air as a motive power must be abandoned.

(9.) *Note on Tramways as Protective Works, with reference to Proceedings of Government, No. 2018 W., dated 17th August 1881.*

The points specially referred to this office for report are the probable cost per mile, the gauge, rate of speed, &c., but in making the recommendations that follow, it seems advisable to go rather further into the subject generally than is implied in these instructions.

DEFINITION OF "TRAMWAY" AND "LIGHT RAILWAY."—In dealing with the papers embodied in the Proceedings of Government under report, it is evidently necessary to lay down some definition of the term "tramway," as distinguished from what is known in this office as a "light railway," and for the purposes of this Note it is assumed that a tramway is an iron way laid flush with the road on which it rests, and that any other form of iron way is a railway. The "Commission for the investigation of the economies to be introduced in the construction and working of new

Minutes of Institution of Civil Engineers. railways in Italy, in November 1879," held "that in many cases cheap railways may be laid alongside the existing highways; and that a division, either by a fence, or by maintaining a different level for the road and the rail, is the main distinction in such cases between a railway and a tramway established according to the law of 29th July 1879."

THE "CONDITIONS" USUALLY TO BE MET BY TRAMWAYS.—Accepting this definition, it seems clear that "tramways" are designed to meet conditions that will rarely, if ever, be met with on the lines of communication which it is suggested should

	Weight of Rail per Yard.	Cost per Mile.	
	Lb.	£	
Bristol	43	1,749	be made for the purpose of protection
Southport	40	2,072	against famine, while a comparison of the
Manchester	40	2,320	cost of the permanent-way most generally
Average of 15 lines	...	2,084	used on such lines, exclusive of pavement,
South Indian Railway metre gauge (in England)	40	About 1,000	with that employed for light railways,
			shows that these conditions can only be
			met by largely increased outlay, and it
			seems hardly necessary to add that cheap
			expedients, such as timber substructures
			laid in an ordinary metalled road, with
			no provision for their drainage, cannot in the end secure economy.

REQUISITES FOR A TRAMWAY.—The first requisites for a tramway are that it shall be durable and independent of daily upkeep for the maintenance of its gauge and level, and that it shall as seldom as possible entail interference with the road surface, and therefore with the ordinary cart traffic on the road. A tramway is in fact, as

Tramways by D. K. Clark. described by Mr. D. K. Clark, "a pair of rigidly supported rails carried on an unyielding foundation."

TRAMWAYS AS A RULE OBJECTS FOR PRIVATE ENTERPRISE.—It is not denied that there may be short lines of existing road, some of them in connection with the railways in this Presidency, where the extent of the ordinary traffic,—the limited width of the road,—and other conditions, may necessitate recourse to the more expensive form of iron way peculiar to tramways; but none of these, it is thought, fall within the scope of this Note as protective lines against famine, or even as railway feeders; they are rather objects for private enterprise either as paying speculations or as furthering local interests.

LIGHT RAILWAYS PREFERABLE TO TRAMWAYS.—In my opinion therefore tramways proper are, as a rule, unsuited to the requirements of railway feeders, either with a view to protection against famine, or for the development of the ordinary traffic of the country. They involve an unnecessarily expensive form of permanent-way, render the interchange of railway rolling stock difficult to arrange, and offer few, if any, advantages that cannot be secured by light railways. It may be added that experience derived from the Madras Railway goes to prove that the bearing surface of concrete, inseparable from the tramway rail proper, would, besides entailing extra expense, be inapplicable to the black cotton soil and some other soils met with in India, where even an ordinary ballast bank, with a bottom width of perhaps 16 feet, continues year after year to sink until it almost reaches the subjacent lime-kunkur bed.

DESCRIPTION OF PERMANENT-WAY.—It is not stated in the Order of Government whether it is contemplated that lines of railway have to be laid for famine purposes over the open country, but it has been assumed that it is intended to construct and open the lines for ordinary traffic in the first instance as railway feeders, and in every case that the permanent-way will be laid, either on the ordinary roads of the country, or on an already consolidated embankment, fully bridged with the exception of large rivers.

The description of permanent-way I consider suitable for such lines is the ordinary flat-footed rail with timber or iron sleepers ballasted with broken stone or sand.

Should it be found necessary to lay such a line for famine purposes across the open country, I believe that few forms of permanent-way will compare with it either for expedition or efficiency.

Such a line can be laid at the rate of $\frac{1}{4}$ a mile a day from each face worked at, and a rate of one mile of track per day has been attained. The Durbunga line for instance, 53 miles in length, was laid for famine purposes and opened for traffic in 53 days.

A line of this description can be laid along an existing road, bridges being strengthened when necessary.

On the Mysore State Railway ordinary road arches of 62 feet span are now used in this way by engines weighing 18 tons (3 tons on a wheel). Where bridges are too narrow for both road and railway, some form of tramway rail would have to be substituted for that used elsewhere.

Large rivers still unbridged would be crossed on causeways.

GAUGE.—As regards the gauge that should be given to light railways in this Presidency, the fact that the South Indian Railway is on the metre gauge has an important bearing; for it is considered that the difference between even a 2' 0" and the metre gauge, either in first cost or in working, would not justify the abandonment of the advantages to be derived from the South Indian Railway goods vehicles being able to run over the branch lines, and from the facility with which extra stock could at all times be transferred from other metre gauge lines in India. It is certain that, were the proposed feeders laid on any other narrow gauge than the metre, spare stock would have to be procured sooner or later in proportion to the full carrying capacity of the line; and the greater part of it would, in all but famine time, lie idle and unremunerative.

In the case of feeders to the Madras Railway, although there must in any case be a break of gauge, the same consideration is in my opinion conclusively in favor of the metre gauge; the more so, as it is not improbable that lines first made as feeders to the Madras Railway will eventually be extended and joined to one or other of the metre gauge lines.

On a somewhat similar question, the Commission appointed by the French Minister of Public Works to inquire into the economical conditions of construction and working of secondary railways (chemins de fer de l'interet local) recommended as follows:—

- (1.) The gauge of the parent line, save in exceptional circumstances.
- (2.) A 2 feet 6 inches gauge, where existing roads are to be utilized.
- (3.) The metre gauge, where exceptional conditions render advisable the adoption of narrow gauge on its own track, as presenting the greatest advantages in respect of facility of working.

The exceptional circumstances, pointing to the necessity in my opinion for a departure from the gauge of the parent line in the case of the Madras Railway, lie in the fact that it is hopeless to expect that the branch line can be made to carry goods stock, having a wheel weight of 8 tons on an axle (33 per cent. greater than that of a South Indian Railway engine) that could earn a fair rate of interest on its cost with the traffic known to be forthcoming.

WEIGHT OF RAIL.—The weight of the rail to be used must be decided with reference to the wheel weight and the speed to which the line will be subjected. In the case of feeders to the South Indian Railway, I have no hesitation in recommending that the rail be of a weight capable of carrying, at a maximum speed of 10 miles an hour, the ordinary goods vehicle of the parent line.

On the metre gauge a fully laden wagon weighs 9 tons 12 cwt., or nearly 5 tons on an axle—a limit to which it is not difficult to restrict that of a suitable locomotive; for instance, the engines of the late Arkónam-Conjeeveram tramway weighed about 14 tons on six wheels (four of which were coupled), and on the metre gauge line between Hairoville and Triancourt, running alongside a high road, with a ruling gradient of 1 in 33 and ruling curve of 115 feet, an engine weighing in steam $15\frac{1}{2}$ tons on six wheels coupled draws a load of 60 tons; for such wheel weight and speed a 30 to 35 lb. still rail would be sufficient.

SLEEPERS.—Creosoted fir sleepers have on the South Indian Railway given very fair results as regards durability; but of late years several varieties of wrought-iron sleepers have been introduced, and from these probably an effective substitute for timber sleepers might be selected; although, except as regards durability, iron sleepers offer few advantages over timber ones.

ROLLING STOCK.—The description of goods stock to be used, the speed and wheel weight being fixed, depends to some extent upon the traffic to be dealt with. The goods stock on metre gauge State Railways has proved to be none too strong to stand the ordinary wear and tear of loading and unloading. The passenger stock in use on these lines is heavier than need be provided for the low speed proposed for the lines under report.

On the South Indian Railway, where the goods stock is somewhat heavier than that in use on the metre gauge State Railways, the cost of the different wagons is approximately as follows:—

	RS.
Covered goods	1,400
High sided open	1,100
Cotton truck	1,600
Low sided open	1,000

Stock of this description would be suitable for the branch lines proposed for this Presidency.

COST OF SUCH A LINE.—The following is an approximate estimate of the cost of laying one mile of unfenced metre gauge line on an existing road with 30 lb. steel rails on creosoted fir sleepers:—

	RS.
Permanent-way	9,406
Carriage of permanent-way for 200 miles at 10 pies per ton per mile	1,250
Leading and laying	1,200
	<hr/>
Add 4 th for sidings	1,185
	<hr/>
Total, Permanent-way	13,041
Ballast	600
Stations and shops	1,200
Altering masonry works	1,000
Rolling stock	5,000
Establishment	2,000
Contingencies	1,159
	<hr/>
Total	24,000

Rails and fastening 53½ tons at Rs. 105, 2,100 sleepers at Rs. 1-13-0.

With a 35 lb. rail the estimate would be Rs. 25,000, and with a 40 lb. rail Rs. 26,000.

Were such a line to be laid on an embankment specially made for it, the estimate would be as follows; assuming a formation width of 12 feet, an average height of bank of 4 feet, slopes of $1\frac{1}{2}$ to 1, and waterways aggregating 20 feet per mile of line for minor bridges (those affording waterway of less than 60 feet):—

	RS.
Preliminary expenses	300
Land	1,000
Earthwork	1,750
Minor bridges	2,000
Level crossings	200
	<hr/>
Contingencies	5,250
	<hr/>
	750
	<hr/>
Track, stock, and stations, &c., as before	6,000
	<hr/>
	24,000
	<hr/>
Total	30,000

But it must be remembered that this estimate provides for the least possible accommodation for traffic, no staff quarters, and no station-yard enclosures, &c. No provision, moreover, is made for the crossing of large rivers.

It may be added that the Mysore State Railway, 86 miles in length, will, it is expected, be finished for a sum not exceeding Rs. 40,000 per mile; but this sum provides for all large bridges, including 68 spans of 30 feet over the Cauvery river.

COMPARISON OF ESTIMATES FRAMED BY CONSULTING ENGINEER WITH THOSE OF MR. VINCENT AND MAJOR FRASER (SEE G.O., No. 2018 W., dated 17th August 1881).—As regards the cost of the South Indian Railway, it is observed that in paragraph 11 of the Note by the Chief Engineer, Public Works Department, embodied in Proceedings of Government, No. 2018 W., dated 17th August 1881, my estimate of Rs. 45,000 to Rs. 50,000 per mile for a metre gauge line, which was based to some extent on the cost of that line, is compared with the figures given in Mr. Vincent's pamphlet and by Major Fraser. But it seems to have escaped notice that the sum named includes the provision of a first-class railway on a fully bridged embankment; whereas the tramway estimates, with which the comparison is made, provide for the utilisation of existing roads, the cost of which is not included.

My estimates also provide for rolling stock.

14. DESCRIPTION OF SIMILAR LINES IN INDIA.—The following brief descriptions of cheap feeder lines that have been already constructed will be interesting, as illustrating the arguments adduced in favor of light railways.

On the line owned by the Gaickwar of Baroda, 58 miles in length of 2 feet 6 inches gauge, the rails are flat-footed, weighing 30 lb. to the yard, and are spiked to wooden sleepers. The entire line is on embankment, the formation width being 10 feet; the stations average 9 miles apart. This line is reported to have cost Rs. 19,813 per mile up to 1880, and earns Rs. 51 per mile per week, with net profits equivalent to 5·57 per cent. on Capital cost.

The Muthra-Hathras line (53 miles), a branch from the East Indian Railway, is of metre gauge; the rails weigh 30 lb. to the yard, and are spiked to wooden sleepers. It is laid partly on a metalled road, and is reported to have cost, up to 1880, Rs. 37,523 per mile. With gross earnings of Rs. 89 per mile per week it paid 5·3 per cent. on Capital cost. It is observed that it has been recently proposed to increase the weight of the rails.

The Nalhati line (27 miles in length), which meets the East Indian Railway at a point 145 miles from Calcutta, was constructed on the 4 feet gauge, with rails weighing 32 lb. to the yard, and was laid on one-half of a metalled road. It had cost Rs. 11,934 per mile in 1879, and with a gross earning of Rs. 65 per mile per week it paid 9·39 per cent. on its Capital cost, although in 1880 its working expenses appear to have more than absorbed its gross earnings. The so-called tramway between Arkónam and Conjeeveram was laid for the most part on an existing road with 36 lb. rails. It cost Rs. 34,560 per mile, including rolling stock, and the bridging of one

large river, together with improvements of gradient equivalent very nearly to the construction of a new track, with the exception of bridges.

15. An estimate was lately prepared by Mr. G. Anderson, for some years an Assistant Engineer on the South Indian Railway, and of considerable railway experience, for a light line 29 miles in length from Ammayanayakanur to Periyakulam at the foot of the Palni Hills. This estimate provides for occupying the existing road, with 4 miles in length of diversions where necessary, for a 30 lb. steel rail on jungle wood sleepers, for strengthening where necessary the existing bridges, and for the necessary rolling stock, station buildings, &c. The cost is estimated by Mr. Anderson at Rs. 18,000 a mile, and, were creosoted fir sleepers substituted for those of jungle wood, and superintendence provided for, it is probable that a rate of Rs. 20,000 to Rs. 25,000 per mile might suffice.

16. To conclude, I would recommend the adoption of the metre gauge, with 35 lb. steel rails, on either creosoted fir or iron sleepers; that the wheel weight be limited to $2\frac{1}{2}$ tons, and the speed to 10 miles an hour. I believe that lines of this character can be laid on existing roads for Rs. 25,000 per mile, and on embankments of their own for Rs. 30,000 to Rs. 35,000.

It must be added however that, before any such line is undertaken, it will be necessary to ascertain whether the Government of India is prepared, under Act IV of 1879, to sanction its being worked. Lines of this description would do more towards the development of traffic on railways in this Presidency than any other measures that can be suggested; and they would offer this advantage, that, should they in any instance be found unremunerative, both the permanent-way and the rolling stock could be removed and utilised on other existing State lines.

17. It should be remembered that economy in construction, and in the subsequent working of a line, are to be looked for not so much in the selection of the form of permanent-way to be used, or in the gauge, as in restricting the speed and wheel weight to all that the wants of trade and of the native community require. If a speed exceeding ten miles an hour be rendered by the character of the track and stock absolutely impracticable, the necessity at once ceases for fencing, signals, gates, high standard of maintenance, highly paid officials, station buildings, extensive bridges; in fact almost all that distinguishes a railway from the street tramway or a line of omnibuses; but, so long as a higher speed is practicable, public opinion will prove, as it has already proved, too strong to permit of its restriction, and economy in working becomes impossible.

18. There is one further point to which it may be well to call attention. It should be remembered, in comparing estimates for different descriptions of track, that small savings in prime cost, particularly in the matter of the ruling gradients and curves, may eventuate in costly traffic expenses. It will often be found expedient to improve the gradient of the existing road, or, with enhanced cost, to abandon it altogether, rather than to limit the loads and lessen the capacity of the engines. With engines weighing 12 tons, the loads possible with a ruling gradient of 1 in 100 will be very moderate compared with the traffic which must be forthcoming to secure financial success. In illustration of this, the computed loads of a locomotive engine recently built by the Société de St. Leonard, Liège, for a light railway, gauge 29.53 inches, may with advantage be studied.

The engine on eight wheels (six coupled) weighs in steam 18 tons, and with a working pressure of 132 lb. is computed to haul at a speed not exceeding 15 miles an hour—

	TONS.
On a level	456
One in 200	209
„ in 100	133
„ in 66 $\frac{2}{3}$	95
„ in 50	72
„ in 40	57
„ in 33 $\frac{1}{3}$	46 $\frac{1}{2}$

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Consulting Engineer for Railways.

30th January 1882.

(10.) From Major J. PENNYCUICK, R.E., Superintending Engineer, Third Circle, to the Chief Engineer, Public Works Department, dated Bellary, 21st April 1882, No. 105.

* * * * *

2. I do not believe in the existence of a single road ten miles long in this Presidency on which a tramway could be laid with the remotest possibility of even a moderate return, and I am quite sure that if any such road exists, it would be much better to construct a railway of a class suitable to the traffic than to lay a tramway on the road.

3. No trustworthy inference can be drawn from the results of tramways in England, France and elsewhere; the conditions required to make a tramway a success are entirely absent from the lines in this Presidency, and arguments drawn from experience in crowded English towns and in an exceptionally level and wealthy country like the neighbourhood of Milan are utterly worthless as applied to Madras.

4. It ought also to be noted that the so-called tramways in the neighbourhood of Milan (and I believe many of the French lines as well) are not really tramways at all, but light railways occupying a portion of the roads which are so wide that a portion of them can be given up entirely to the use of the rail traffic. The special condition of a tramway, namely that the road traffic shall pass freely over the rails, is wanting, the road and rail traffic being kept practically distinct.

5. To argue on generalities is always unsatisfactory, and the only way to arrive at a correct conclusion is to take an existing road, and prepare an estimate of cost and returns supported by proper data as to gradients, nature, amount of traffic, &c.

6. It may, however, be worth while to point out the principal reason which will in almost every case in this country cause a tramway to be more expensive than a light railway; this is the additional cost of the tramway *rail* over the railway rail for the same amount of traffic.

7. The railway rail requires only sufficient strength to bear the weight passing over it; the tramway rail requires additional substance to stand the lateral shocks to which it is exposed by the road traffic, and if the weights of existing tramway rails are examined, it will be found that they are in all cases, and especially in those of the latest construction, far greater than would be required for railways to carry the same traffic.

8. None of the tramway cars in regular use on the European lines weigh when loaded more than $1\frac{1}{2}$ tons on each wheel, a weight that could be easily carried on a railway by a 30 pound rail, but none of the lines on which these cars run have rails of less than 50 pounds per yard, and the average is more nearly 60.

9. Probably the *minimum* weight for a tramway rail to stand the shocks of the road traffic should be 30 pounds to the yard. But even if 25 lb. rails were admissible, the traffic contemplated could be carried with the greatest ease on a railway with 15 pound rails. The extra weight of rails alone would thus be about 17 tons per mile, and the cost of these would certainly more than cover any saving in construction by the use of the road as a surface on which to lay them.

10. In addition to this it must be borne in mind that the whole of the bearings and fastenings of a tramway must be of a much more expensive character than those of a railway to carry the same amount of traffic, while as regards cost of transport there is of course no comparison.

11. I am prepared to assert confidently that under no circumstances whatever, in any place in the Madras Presidency outside the limits of a large town, could a tramway on an existing road be laid, maintained or worked for the same cost as an independent railway to carry an equal amount of traffic.

12. It is altogether beside the question to compare the *estimated* cost of *proposed* tramways to carry a couple of hundred passengers and sixty tons of goods per day with the *actual* cost of completed railways carrying two thousand passengers and as many tons of goods; especially when we remember that the cost of the latter per mile includes that of bridging all rivers, a by no means inconsiderable item. Because no

railways have yet been constructed of a cheaper class than those now at work in this country, it does not follow that none can be.

13. As a matter of fact, a railway with 15 pound rails and a gauge of 2 feet or 2 feet 6 inches could be laid down for certainly not more than Rs. 12,000 per mile (exclusive of land) and would carry a traffic considerably greater than that now borne by any road fifteen miles long in the Madras Presidency.

14. The idea of tramway construction proving financially remunerative may be dismissed as chimerical, and indeed as hardly deserving discussion; and it may be taken as certain that if rail transport is to be employed in any given case the rails must be independent of the road.

15. In Colonel Prendergast's letter, No. 1700, of 5th October last, a list of roads is given on which it is considered that tramways might with advantage be laid. It will be seen that Colonel Prendergast does not commit himself to any expression of opinion as to their proving remunerative, and for the reasons given above I am obliged to say that I think no such result is to be looked for.

16. How far light railways laid independently of the roads, though following their general line, might pay a reasonable interest on their cost is a question that I cannot attempt to answer without more detailed information as to the nature of the country and amount of traffic than we at present possess.

17. As far as the first point is concerned, it is not probable that there are any special features about any of the lines in question which would raise their cost to more than Rs. 12,000 per mile including bridging of all streams except the largest, such as the Tungabhadra and Pennér, but exclusive of the cost of rolling stock, which, as it depends on the amount of traffic to be carried, is more conveniently considered as part of the cost of transport, and separate from the cost of construction. The practice of mixing up the cost of stocking per mile with that of construction is a very inconvenient one; two lines costing the same for construction may require very different quantities of rolling stock.

18. It is probable that on lines such as those under contemplation goods could be carried at a rate (including interest on cost of rolling stock) which would give a profit of two pies per ton per mile, and passengers at one, which would give one pie per head per mile.

19. To give a return of one per cent. on Rs. 12,000 would therefore require a traffic of 11,520 tons of goods, or 23,040 passengers per annum, or say 32 tons of goods, or 64 passengers per diem, or any intermediate combination of the two.

20. Whether two, three, four or five times the above quantities could be looked for on any of the lines in question is a point upon which, I am sorry to say, our information is exceedingly deficient.

21. Some months ago I asked Mr. Garrett to try and collect information as to the traffic on the different lines of road in the Bellary District, but the Collector informed him that no trustworthy information existed, and without a special establishment to collect it none could be obtained.

22. I am therefore obliged to speak with considerable reserve upon this point; but so far as my information extends there is no line in Cuddapah or Kurnool which could be expected to return two per cent. on its cost, and in Bellary only the lines from Hospet to Harpanahalli and from Tadpatri through Anantapur to Penukonda. These two might pay a moderate return; but if the subject is to be taken up seriously, the first step is to collect trustworthy statistics of traffic, existing and possible.

23. It will be seen that I am not sanguine as to the financial prospects of railways in this circle; there remains the question of their value for the conveyance of food during famine.

24. I certainly do not think it would be desirable to construct works of this class irrespective of their financial result merely with a view to their use as grain carriers during famine. It appears bad policy to saddle a country with unremunerative works for nineteen years on the chance of their being useful in the twentieth.

25. Certainly additional facilities for the distribution of grain during famine would be beneficial to the country, but I cannot but think that the deficiencies of the existing system of communication have been much exaggerated. A great deal has been made of the accumulation of grain at *Raichore* and on the Madras beach during the late famine; but this was obviously due not to the insufficient carrying power of the roads leading from the Madras Railway, but to the insufficient carrying power of that railway itself, and would not have been obviated if every road in the Presidency had been covered with a steam tramway. As a fact there was never any serious difficulty in getting the grain away from the railway except for a short time at Bellary; in Salem there was certainly none, and at no time was there any lack of food for people who had money to buy it.

26. Moreover, a special and temporary demand for the carriage of goods along an existing line of communication could be much better met by the use of traction engines when the emergency arose than by the construction of a tramway or a railway.

27. It is certain that the cost of transport, exclusive of cost of permanent-way, on a tramway is not less by more than half an anna per ton per mile than that of transport by means of traction engines. It is also certain that there was no road in this Presidency on which the total extra traffic due to the famine of 1877-78 reached 50,000 tons. The utmost saving in cost of transport by the use of a tramway as compared with traction engines on any individual road could not have exceeded Rs. 1,500 per mile.

28. It is not likely that such famines as that of 1877-78 would recur in the same district at shorter intervals than 30 years, during which period the loss on a tramway whose returns fell short of the interest on first cost by even one per cent. would amount to Rs. 6,000 per mile.

29. Traction engines moreover can be used where they are wanted, but a tramway in Bellary could not be moved to meet a future famine in Coimbatore.

30. There is an idea which appears to be encouraged by a passage in paragraph 15 of your Note, printed with G.O., No. 2018 W., of 17th August last, that the weight of traction engines is a drawback to their use on ordinary roads; but if so, the tramway engine is in a worse case; for on any gradient exceeding one in thirty-seven and a-half, a tramway engine must be heavier than a traction engine to draw the same weight of train, and there are very few roads where such a gradient as this does not occur at some point or other.

31. The co-efficients of adhesion and of resistance to traction on the tramway may be taken at $\frac{1}{6}$ and $\frac{1}{75}$ respectively; for a traction engine on an ordinary road they are $\frac{1}{3}$ and $\frac{1}{50}$, but as only about three-fourths of the weight of the latter engine rests on the driving wheels, the actual adhesion available is only $\frac{1}{4}$ the weight of the engine.

32. If E be the weight of the engine, T that of the train, and X the fraction representing the gradient, then for the tramway $(E + T) \left(\frac{1}{75} + X \right) = \frac{E}{6}$

$$\frac{E}{T} = \frac{2 + 150X}{23 - 150X} \quad \dots \quad (1.)$$

for the traction engine

$$(E + T) \left(\frac{1}{30} + X \right) = \frac{E}{4}$$

$$\frac{E}{T} = \frac{2 + 60X}{13 - 60X} \quad \dots \quad (2.)$$

(1) is greater than (2) if X be greater than $\frac{20}{750}$ or $\frac{1}{37.5}$, and as a practical fact the weights of traction engines in ordinary use do not average higher than those of tramway engines.

33. It must be understood that I am not now expressing any opinion as to the desirability of using steam power as compared with cattle, but merely wish to show that if steam is to be used on an ordinary road at all, for meeting an *abnormal* demand for transport, it had better be used through the traction engine than on a tramway.

34. The want of water is held to be one reason for the use of steam power in preference to cattle for transport during famine, but it does not seem to be generally known that to haul a ton of goods for a given distance, whether on a road, a railway or a tramway, or to do any other amount of mechanical work by steam, requires rather more water than to do the same amount of work by animal power.

35. A pair of bullocks will exert in net work about a mechanical horse-power for six hours per day, and will do very well on twenty gallons of water between them or thirty-three pounds per horse-power per hour; a locomotive or traction engine requires from thirty to thirty-five pounds per indicated horse-power, or from forty-five to fifty per net useful horse-power per hour.

36. Allusion is made in your note above quoted, and in Mr. Vincent's pamphlet to the Decauville system of light railways; this is only one of many similar systems, and is essentially a *railway* requiring its own ground to run on. It would be useless to attempt to lay it on a road; the first cart that came along would knock it to pieces. These systems are however mainly intended for temporary and not for permanent lines.

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(11.) *Note on Steam Tramways and Light Railways, by Captain Coaker, R.E.*

1. During the time I spent on the continent, inspecting the Rigi and other lines, I was able to see something of steam tramways, and light railways, now at work, and I have the honor to submit the following notes thereon.

2. MILAN TRAMWAYS.—As explained in Mr. Vincent's pamphlet these lines possess exceptional advantages in that the roads about Milan are almost level, and of more than ordinary width. In passing through towns and villages the lines are laid in all respects as street tramways; that is to say a guard rail is provided throughout and the whole of the road is paved and available for ordinary traffic. Outside towns the lines are laid in the road surface, without guard rail, and rail-level is therefore slightly raised above the surface of the road.

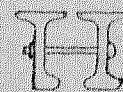
3. An important feature in the roads round Milan is a line of upright stones about 10 or 12 yards apart on each side. Where the road is of sufficient width one line of stones is moved in, and the rails are laid outside it, thus:—



In such cases the line of stones becomes, so far as wheel traffic is concerned, a fence, and no carriages or carts use the portion of road occupied by the tramway. Foot passengers, however, circulate freely over it; in fact, they generally walk along it.

4. Where the road is narrower the line of stones on the tramway side is removed altogether. The portion of road occupied by the tramway is not generally used by wheel traffic, but occasionally a vehicle, in turning or in passing another, may cross the inner rail. Practically therefore, except in towns and villages, or on bridges, where the whole of the road is required for vehicle traffic, these lines are light railways.

5. The horse tramways in the city of Milan are laid with rails as shown in sketch.



Instead of the grooved rail generally used, an ordinary Vignoles rail and a light rail with one upper flange only are bolted together at intervals of about 2 feet 6 inches,

the two rails breaking joint so as to afford one another mutual support. This form of permanent-way is well suited for the steam tramways outside the city; as where the line is required to be laid flush with the road surface, the second rail can be used, and the road being also paved, it becomes the same as a street tramway. The rails are laid on wooden cross sleepers.

6. The whole of the line laid on the roads partakes of the nature of a tramway so far that there are no maintenance gauges for the daily upkeep of the permanent-way. The sleepers are firmly embedded in the road, and covered with metal, the line being hardly touched until the sleepers require renewal. The cost of daily upkeep is saved at the expense of new sleepers after a few years; there being no provision for drainage their life is short.

7. The engines are boxed in to a certain extent, the sides being about 4 feet above frame, with a roof on iron standards about 3 feet 6 inches higher. The carriages are similar to ordinary tram cars; some have longitudinal and others cross seats. A train consists of 4 or 5 vehicles, most of them provided with brakes. There is also a brake on the engine. The coupling is central, but the slack is taken up by an ordinary screw coupling placed over the central buffer. A bell is rung when approaching points where other roads join, but speed is not slackened. There appear to be no fixed dimensions, and carriages often skirt a wall very closely. In going through streets a man with flag walks in front of the train; but in open country a speed of 15 miles an hour is not unusual. The sanctioned maximum is 11 miles an hour.

8. So far as I could learn the average cost of a line laid along a road is francs 30,000 per kilometre = £1,920 per mile. On the line from Milan to Barzano it has been necessary to diverge from the road for considerable distances owing to the road being narrow, gradients steep, or curves sharp. This line cost francs 46,000 per kilometre = £2,944 per mile. Short lengths of gradient of 1 in 30 are allowed, and curves of 130 feet radius. Railways are crossed on the level.

9. I was informed that most of these lines do not pay, partly from competition with the railways, and partly from the rigorous conditions now exacted by Government. The line from Milan to Lodi pays because the timing of trains on the railway is inconvenient, and people therefore use the tramway. No goods traffic is worked. Some bridges have to be strengthened to comply with the Government test. Tramway Companies pay one-fifth the cost of maintaining the portion of road not occupied by them, and 13.2 per cent. of their net receipts go to the Government as tax.

10. LIESTAL-WALDENBOURG LINE.—This is a cheap feeder line of light railway 9 miles long starting from Liestal on the Swiss Central Railway. The gauge is 2 feet 6 inches; rails weigh 30 lb. per yard, with timber cross sleepers 2' 7½" apart, fastened by wood screws. For ¾ mile the line follows the Swiss Central, being laid midway between the broad gauge rails, an arrangement which admits of the same sleepers being used for both. Special points and crossings are required where the lines diverge. It was found necessary to widen the road in places, and the line follows it except at two points, where short diversions are made to avoid steep gradients and sharp curves. Formation level follows generally that of the road, and the rails are raised about a foot above it by ballast. There are only a few small bridges.

11. The carriages are open at ends, each vehicle being provided with brake, and the guard walks along and puts on brakes when necessary. For connecting the vehicles a simple form of central coupling is used. The engines are of the ordinary type on four wheels; they weigh 8 tons, and take a load of 4 or 5 vehicles. The maximum gradient is 1 in 33, and the ruling curve 197 feet in main line, and 131 feet in sidings. Water is turned on to the flange of the leading wheels of engines, to enable them to pass more freely round these curves.

12. The maximum speed is 12½ miles an hour; through speed 9 miles, with 6 stoppages in that distance. There are no station buildings except at the terminus. Trains stop at the principal inns, where tickets are issued. There are short lay-byes for goods at certain points, but this traffic is small. Ordinary repairs are done in small shops at Waldenbourg, but engines and vehicles requiring heavy repair are

sent to the workshops of the Swiss Central Railway at Otten. At Liestal there are only a few short sidings for rolling stock, and one for transhipment of goods; no transfer platform.

13. The line is unprovided with fences; the train by which I travelled was stopped to allow two frightened horses to pass; but as a rule horses take very little notice of the trains. The ordinary road is maintained by the Railway Company, this being one of the conditions of the concession. There are no signals. The line cost about £1,920 per mile, and is very similar to that proposed by Mr. Anderson between Ammayanāyakanūr and Periyakulam.

14. PORTEUR DECAUVILLE.—This system of portable railway has lately been brought before the Indian public. The permanent-way is supplied complete in lengths of $16\frac{1}{2}$ feet, the two rails being connected by iron plates which form the sleepers, and the whole fastened by rivets. The rails weigh 9, 14, and 19 lb. per yard, and each length of permanent-way weighs 115, 187, and 259 lbs., the gauges being 16, 20, and 24 inches. The wheel weights for which the lines are suitable vary from 1 to $2\frac{1}{2}$ tons per axle. The movement of heavy weights is effected by using a number of small trucks so as to distribute the weight over several axles. The advantages claimed for this line are portability, durability, and the rapidity with which it can be laid. Trucks of every description suited to requirements can be supplied with the permanent-way, together with small locomotives for running on the heavier lines. The turn-tables, points, crossings, &c., are all made in one piece, and can be laid quickly, and without skilled labor.

15. I went over the works of M. Dreauxville, near Paris, and saw the construction of permanent-way and rolling stock throughout. Everything is done by machinery, and the work appears to be of the best description. The frames for rolling stock are made of four channel irons riveted together at the corners. Long wagons for running round sharp curves are on bogies, but the ordinary stock is mounted on four wheels brought close together. The 19 lb. rails have ordinary fish plates and bolts.

16. A gun weighing 4 tons, mounted on two small trucks (four wheels each), was run across a ditch 8 feet wide on the 14 lb. permanent-way without any intermediate support, a wooden sleeper only being laid at each side of the ditch for the permanent-way to rest upon. The deflection was considerable, but the permanent-way regained its original form. The gun was then run across a ploughed field on the same permanent-way which was moved rapidly from place to place. The permanent-way was not packed at all; it appears to possess great elasticity, and does not easily become bent. For a permanent line on ordinary soil a small quantity of ballast would be used. M. Decauville has a line with 14 lb. rails laid on his estate, and we went over this with an engine weighing 4 tons at about 8 miles an hour.

17. This description of road is too light for permanent lines of railway in this country, but it is, I believe, well adapted for laying temporary lines during a famine. It is exported to all parts of the world, and appears to be utilised chiefly in workshops, factories, on plantations in the Colonies, in opening out forests, and in carrying out excavations or large works of any kind, where it is desired to economise labor. The Russian expedition to Turkestan was provided with 66 miles of the 14 lb. rail, and in Tunis the French used 43 miles of the 19 lb. rail. In connection with the Panama Canal 14 miles have been sent out. It was found impossible in the military expeditions to use engines, and the small wagons were hauled by horses or mules. It is stated that by this means a horse was enabled to do 12 or 15 times as much effective work as in drawing an ordinary cart. In Turkestan the materials for a heavy railway, together with provisions and water for troops and workmen, were led forward by the Porteur Decauville, which was laid in advance of the permanent line.

18. During a famine these lines could be laid on the roads, and would be perfectly serviceable for use with bullocks. Thus one bullock would probably be enabled to do the work of ten, and the difficulty which was experienced in 1877 in providing means of transport could be overcome. Should it be found necessary the small wagons could be hauled or pushed by coolies. Such lines could be laid as fast as delivered, and though they are not perhaps quite suited to some roads in wet weather, still with the ample labor available during a famine sufficient ballast could be got together to give them a firm bedding. By using rough sleepers of any kind, here and there, under the permanent-way, there should be no difficulty in keeping the line in work-

ing order on unfavorable soils in bad weather, which, however, would not be frequent during a famine. One advantage in working these lines by horses or bullocks is that it is possible to surmount gradients over which a locomotive could not work, it being necessary only to keep additional power at these points.

19. The cost of a mile of line with 14 lb. rails delivered in Madras would be about Rs. 8,000, including 15 wagons; with 19 lb. rails the cost would be about Rs. 9,500. The price of this permanent-way per ton is high compared with the market rate for steel rails, after making allowance for the small section of the rails; but possibly a reduction might be made if several miles were taken. A short length of this line would be found useful in carrying out any large work, and it would, I think, be well for the Government to obtain a few miles by way of experiment.

20. THE BEST FORM OF TRAMWAY ON LIGHT RAILWAY FOR INDIA.—Three forms of communication have been described, two of which are suitable for permanent, and one for temporary lines. The Milan lines, and the Liestal-Waldenbourg line, present two distinct types, the former being in most respects a tramway, while the other is a light railway. The advantages possessed by the Milan lines are that they can be more easily laid and kept in order, the cost of upkeep being much less than on an ordinary line. They also offer less obstruction to foot passengers, who can walk freely along and across them. A disadvantage is that when laid with wooden sleepers these deteriorate rapidly from the absence of drainage; a difficulty which can, however, be got over by using iron sleepers. This form of line should, I think, be adopted where the roads are sufficiently good for the purpose, and the gradients are suitable for a tramway. These conditions are fulfilled between Vellore station and town; and this description of line appears to be especially suitable for laying between Beypore and Calicut, where houses occur at intervals along the whole length of the road. The metalling would probably be extended on both sides of the road, in order to provide as much room as possible for vehicle traffic.

21. Where the roads are not sufficiently good to admit of a line being laid in the metalling the lines should be similar to that between Liestal and Waldenbourg. There is some difficulty in providing for the proper drainage of a road in a line of this description, as a portion of it slopes towards the railway.

22. In the Note already submitted by this office on the question of steam tramways, it is recommended that all such lines should be of the metre gauge and capable of carrying the goods stock of the South Indian Railway, and if the foregoing principles as regards construction are approved, it is only necessary to determine the description of permanent-way to be used. It is thought that a Vignoles rail weighing 35 lb. per yard, with wrought-iron transverse sleepers, is the best that can be adopted. Several forms of wrought-iron and steel sleepers have been tried, but that which appears to have come into most general use is known as "Wood's patent." Large quantities of these sleepers have during the last year been exported, and a paper describing them was recently read at the Institution of Civil Engineers. An iron subway will cost more than wooden sleepers, but there can be no question as to its ultimate economy at present prices of iron. This system of permanent-way would be suitable for use in either a tramway or a light railway; and with the addition of a guard rail similar to that used in the Milan lines, there would be no objection to its passing through towns, or occupying the whole of a road where necessary, such as in crossing a bridge.

23. Probably there are few roads throughout which the gradients and curves are suitable for a tramway, and careful consideration will be necessary to determine to what extent they shall be followed. For the South Indian Railway rolling stock the curves should have a radius of not less than 5 chains. As a rule steeper gradients are allowed on tramways than on railways, but this has the effect of diminishing the loads. On the lines visited in Europe the maximum gradient was 1 in 30, and the load only 4 or 5 vehicles. It is evident that for even moderate earnings several such trains are required, and the cost of working the traffic in these small trains is greater than with longer trains. In cases where a line is laid on a separate track, it will be advantageous to make use of the large road bridges. It is probable that most bridges could be made to carry a 10-ton engine, by merely laying a timber framing over the arches to distribute the weight, as is done on the Mysore State Railway, where

arches of 62 feet span are crossed by engines weighing 18 tons. Where new works are found necessary, the smaller openings could be spanned with Madras Railway old rails. The tramway between Arkónam and Conjeeveram was nominally laid on the road; but the gradients were so much improved that practically but little advantage was derived from following the line of the road. Unless the gradients of a road are fairly suitable for a tramway, it would be better to lay the latter on a separate track. The gradients of the Arkónam tramway were made to correspond with those of ordinary railways, with the result that one train a day sufficed for the traffic. During the best year of its existence as a separate undertaking this line earned Rs. 2,200 per mile, with working expenses of Rs. 1,100 per mile, but the line was most economically managed.

24. The following are the conclusions arrived at:—

- (1.) The permanent-way for tramways or light railways should consist of 35 lb. steel rails, with wrought-iron cross sleepers.
- (2.) The line should be laid in the surface of roads, and covered with metal-ling, where the roads are sufficiently good for the purpose.
- (3.) Where the roads are not good enough to admit of lines being laid in the metalling, the tramway should be carried on ballast about a foot above road level.
- (4.) Where the gradients of roads are unsuitable, the line should be carried on a separate truck, but should join the roads at large bridges, so that these may be utilised.
- (5.) The Porteur Decauville is suitable for laying temporary famine lines to be worked by bullocks or coolies.
- (6.) No fence is required between tramway and the road.

(Signed) W. H. COAKER, Captain, R.E.,
Deputy Consulting Engineer for Railways.

1st November 1882.

Note by the Chief Engineer, Public Works Department, dated 11th November 1882.

1. In G.O., No. 2018 W., of the 17th August 1881, the opinions of officers of the Revenue and Public Works Departments were called for—

- (1.) As to what tracts subject to famine, tramways as protective works would specially apply.
- (2.) The lines in order of importance within the famine zone, which it might be desirable to carry out.
- (3.) The probable cost per mile, gauge, rate of speed to be considered as a maximum, &c.
- (4.) A rough estimate of the traffic returns in ordinary years.
- (5.) The advantages which might result from the tramways in famine years.
- (6.) Whether, and if so to what extent, these works might be applicable outside the famine zone.

2. The annexed Proceedings of the Board of Revenue, No. 2230, of 7th September 1882, and No. 2414, of 2nd October 1882, with a *résumé* of replies by Superintending Engineers and other selected officers, deal with the subject under inquiry. Some papers of special interest by Mr. G. Molesworth, Colonel H. M. Shaw-Stewart, Captain Coaker, &c., are printed *in extenso*. The paper by the last mentioned officer, dated the 1st instant, is specially valuable as giving the most recent experience and the results of personal inquiry on the spot, in regard to light railways and tramways in Italy and elsewhere on the continent.

3. It is needless to say that in dealing with a subject presenting so many peculiar features divergent opinions have been expressed; still, however, sufficient has been elicited to admit of definite proposals being submitted for the consideration and orders of the Government of India.

4. Before dealing with the replies that have been received to the several queries it may be observed that stress is laid by several of the professional officers consulted as to the inapplicability of the term "tramway" as applied to the Milanese system

advocated for adoption by Mr. Vincent in his pamphlet on the subject, and employed generally in my note of the 14th August 1881.

5. Strictly speaking a tramway consists of a pair of rigidly supported rails carried on an unyielding foundation, laid on a public road or street, and having the top of the rails flush, or nearly so, with the road surface to allow of ordinary passengers or wheeled vehicles passing from side to side.

6. To fulfil the conditions tramway rails must be of exceptional lateral strength and weight, (double probably in most cases that of ordinary rails) and be laid on a concrete foundation, or consist of a double set of rails bolted together at short intervals apart, in the manner described by Captain Coaker as common with the Milanese System, where passing through streets over bridges and at other places where there may be insufficient breadth of roadway, &c., all of which adds materially to the prime cost.

7. The system advocated by Mr. Vincent adopts as a rule where the roadway is wide enough, the much more economical flat-footed, or as it is called the Vignoles pattern rail. As this latter however projects not less than two inches above the surface of the roadway, it is considered that to protect it from the shocks of passing vehicles, the line must be either fenced off or be otherwise protected, thus constituting it virtually a system of light railways.

8. Technically speaking this distinction regarding the term "tramway" is perfectly correct and should be borne in mind; but as will be subsequently shown in the proposals which I have to submit, means can be adopted for combining the advantages of both tram and light railways in a manner, that will apparently secure in the best way the objects in view. Should these proposals, meet with approval, the practical bearing of the distinction alluded to will be of the less importance.

9. Turning now to the replies received to the first of the above questions, viz., as to what tracts subject to famine tramways as protective works would specially apply, it will be noted that while some of the officers consulted either warmly welcome such works, or tacitly accept them as valuable adjuncts in dealing with famine, others on the contrary dispute their supposed advantages, or at least consider their proposed construction of doubtful propriety.

10. The Collector of Kurnool, for example, trusting solely to the existing canal and railway, which both traverse his district, feels himself unable to recommend the construction of a light railway even to his headquarter station. He adds "I am quite certain that a very great deal of good was done by the large and sustained demand for carts and bullocks in this line (*i.e.*, from Gooty to Kurnool) during the famine. Owners of carts and bullocks came from all parts of the district, and earned the keep of themselves and their animals. Village to village distribution from Kurnool, if we had had a tramway in those days, would have been a poor substitute for steady employment in 60 miles of road."

11. The Board of Revenue, paragraph 5 of their Proceedings, No. 2230, observe that Mr. Glenn's experience as above "will probably be borne out by every officer employed on famine duty in that neighbourhood at the time." "Carriage," they add, "for grain never failed, and thousands of bullocks, many of them doubtless set free from agricultural work, were kept throughout the season of draught in good working order," and in their recommendations on the subject of employing mechanical means for distributing food, in view to first testing the remunerative returns, merely propose (paragraph 15, Proceedings, No. 2230) the construction of two very short lines connecting the towns with the railway stations at Vellore and Tirupati respectively.

12. In much the same way Major Pennycuik (paragraph 25 of his letter, No. 105, of 21st April 1882) says:—"As a fact there was never any serious difficulty in getting the grain away from the railway except for a short time at Bellary; in Salem there was certainly none, and at no time was there any lack of food for people who had money to buy it;" and further in paragraphs 33 and 34 shows that "a railway or a tramway, or to do any other amount of mechanical work by steam, requires rather more water than to do the same amount of work by animal power."

13. These are all no doubt strongly put arguments against doing anything in favor of endeavouring to substitute mechanical for animal power. I cannot however think they are altogether sound. Where a grass famine (which as Sir Andrew Clarke

pointed out may be as bad as a grain famine) exists, all cattle not immediately required for agricultural purposes, should it be thought be as much as possible driven off to the tracts where grazing is sufficiently abundant, and the home supplies of fodder carefully conserved for the remainder. For these latter, if less worked than usual, less will be consumed of the scant provision. Grain being much easier carried about the country than fodder, it would also in this sense be better policy to feed if necessary at a distance from their homes the owners of bullocks on whose preservation the entire prospect of future agriculture depends, than hold out inducements which would have the effect of the more rapidly exhausting the supplies of fodder. Certain it is that enormous numbers of cattle perished in these districts, and that agricultural operations have ever since it is believed suffered in consequence.

14. As stated in the Madras Famine Report, p. 40, there was a Special Transport Agency established under Colonel Hicks in December 1876. The total quantity of grain moved was 25,108 tons, and about 245 tons of tools for famine works. It is added that "by this agency about 4,500 carts, 9,000 bullocks, and 5,400 men were at one time actually employed daily and supported, besides about 800 carts, 1,600 bullocks, and 960 men engaged in carrying food and fodder to different halting places."

15. Even were steam as a motive power be not employed, the mere substitution of cattle tramways would have allowed of all this work being done with infinitely less outlay, as it is proved that a horse or bullock can do from twelve to fifteen times as much work if employed for haulage on a tramway, than in the usual way.

16. During the late famine in Mysore, owing partly to the losses of cattle or their absence in the grazing grounds of the western ghâts, where numbers were sent, grain particularly in the Chittledroog Division had to be distributed by means of carts dragged by coolies, men and women.

17. In Madras the Famine Report shows that cattle were "either sold by their owners or driven away to distant and more favored localities where grazing could be found," and Colonel Hicks distinctly says that "almost simultaneously with the Government transport operations ceasing, and the different transport routes being abandoned, the difficulty of obtaining carts increased until eventually carts drawn by bullocks almost entirely disappeared on many roads."

18. That great strain as regards the supply of cattle is one of the possibilities of a grass famine is, I think, sufficiently evident, and must be provided for. For such cattle as can, consistent with their receiving proper nourishment, be kept in the neighbourhood of the village, it will be advantageous that they should not be drawn away to any great distances under engagements for distributing grain; cultivators will thus be better able to take instant advantage of any favorable opportunities for commencing their ploughing operations. No objection would of course exist to their undertaking engagements for carrying grain to the comparatively short distances required in case a general tramway scheme is carried out, but for all not absolutely required on the spot it would apparently be better policy to send them to any available grazing grounds, and not to stimulate retention near their famine-stricken homes by needlessly artificial arrangements.

19. Further, it does not appear necessary to lay much stress on the fact, that animals as argued consume less water than steam motors for moving equal loads, as it is almost certain that along any line of rail or tramway exceptionally favorable arrangements can be made for the supply of water, which though enabling engines to do their work, would have but little or no effect in maintaining the cattle of a district, even did the fodder question not of itself present insuperable difficulties.

20. On the whole, therefore, if on other grounds light railways or tramways can be constructed on main lines, well suited for the distribution of food in famine, and at such moderate outlay as may be certain not to create any financial embarrassment, the arguments above quoted against the use of mechanical agency should not, I think, be allowed to weigh against an acknowledged beneficial measure.

21. The general financial considerations involved will be better dealt with when the extent and cost of the works proposed by the different authorities has been considered; here therefore it will be convenient to deal with the second head of inquiry, viz., "the lines in order of importance within the famine zone which it might be desirable to carry out."

22. To lay down any very definite limits for the so-called "famine zone" would be impracticable, but as a general idea of its extent, the areas shown on the annexed map as having suffered from "intense" and "severe" famine, in both 1866-67 and again in 1876-78, may be fairly accepted as indicating very nearly the extreme limits; unfortunately it covers a very large proportion of the area of this Presidency. On the same map will be found the existing or proposed Guaranteed and State lines of railway and the navigable canals; also the famine lines of tram or light railways as proposed by the several authorities which have been consulted.

23. The following table, compiled from the Proceedings of the Board of Revenue, and the reports of Public Works Officers, shows in the aggregate the lengths of lines suggested as suitable in their opinion for each district. The districts are given in the order in which they respectively stand according to the returns of the last famine, showing generally their need for development of communications of the description contemplated:—

Abstract of Proposals made by the Civil and Public Works Officers for either Tramways or light Railways in the several Districts most liable to Famine.

Civil Districts.	Maximum Numbers on Relief Works in any one Month, Famine of 1876-78—Daily Average.	PROPOSED LENGTHS OF ROAD, TRAM OR RAILWAY.		Remarks as to existing Railways or Navigable Canals.
		By Collectors.	By Public Works Officers.	
		MILES.	MILES.	
Bellary and Anantapur ..	January 1877—360,597 ..	255	183	District is traversed by Madras, Raichore, and Guntakal Hoobly Railway.
Kurnool	" .. 298,568 ..	..	158	Ditto by Kurnool Canal available for eight months annually, though not in the worst famine months.
Cuddapah	" .. 194,425 ..	370	127	Ditto by Madras Railway from North-West to South-East Raichore.
North Arcot	August .. 62,573 ..	112	91	Ditto by Madras Railway from South-West to East.
Salem	May .. 55,824 ..	162	133	Ditto by Madras Railway from South-West to North-East.
Nellore	January .. 55,512 ..	144	193	Ditto Buckingham Canal South to North.
Coimbatore	August .. 29,211 ..	131	150	Ditto by Madras Railway South-West to North-East.
Chingleput	" .. 28,245 ..	..	53	Ditto by Madras Railway, South Indian Railway, and Arkonam-Chingleput Railway; also by South Buckingham Canal South to North.
Madura	" .. 24,606 ..	144	263	Ditto by South Indian Railway.
South Arcot	May .. 1,559 ..	288	176	Ditto ditto.
Ganjam	Famine of 1866-67 ..	{ ..	60	Chilka Lake and Canal to Ganjam.
Vizagapatam			143	No Railway or Canal at present.
Total ..		1,606	1,730	

24. Without attempting to criticize minutely the general scheme here sketched by a number of independent authorities, who have viewed the requirements of their respective districts from a strictly local stand point, it may at once be concluded that when the Government has decided on the general principles to be observed in view to action, many of the proposed lines must apparently disappear, and the scheme as a whole be sensibly reduced.

25. In Bellary for instance it can scarcely be doubted that the suggested northern line to Siruguppa serving the Bellary and Alûr Taluks is not very essential, as no part of these is now more than 35 miles from a railway; again as regards the three southern branches, viz., Hospet to Duggarati, Bellary towards the Madaksîra Taluk of Mysore, and Tadpatri to Penukonda, probably one line in, if possible, continuation of the Mysore line now about to be constructed from Bangalore to Toomkoor, or at most two southern branches opening up sufficiently the great block of sparsely inhabited and nearly rainless country in this direction, would be found adequate for the object in view.

26. For the Kurnool District 50 miles of light railway will probably answer all purposes, and as regards Cuddapah it is clear that the Collector, in suggesting a series

of lines reticulating the district with no less than 370 miles of tramway, has lost sight of the now generally recognized principle suggested by Sir Andrew Clarke and accepted by the Famine Commission, that it would as a rule suffice if famine lines were about 50 miles apart.

27. On the whole, therefore, it may be concluded that the outside demands for works of this character to serve fairly well the whole of the famine zone in this Presidency will not exceed in the aggregate 1,000 miles when the details come to be finally worked out.

28. As to the next point, viz., the probable cost per mile, gauge, rate of speed, &c., much valuable evidence will be found in the papers which have been sent up. As shown by Mr. Molesworth, the Bownagur-Goondal line, metre gauge, 75 miles in length, has been constructed for Rs. 34,760 per mile, and the Miani line, 57 miles, on the same gauge, for Rs. 37,320 per mile. But if carried along an existing road the first would not have cost more than Rs. 25,667.

29. Colonel Shaw-Stewart, in his memorandum of 31st January 1882, gives the following examples among others of very cheap lines:—

I.—That constructed by the Gaekwar of Baroda, 58 miles in length, $2\frac{1}{2}$ feet gauge, 30 lb. rails, and independent embankment with 10 feet formation width, cost Rs. 19,813 per mile.

II.—Nalhatti line, 27 miles in length, 4 feet gauge, 32 lb. rails, laid on the existing road may cost only Rs. 11,934 per mile.

He recommends light railways on the metre-gauge, 35 lb. steel rails, Vignols' section, with creosoted fir or iron sleepers, wheel weight to be limited to $2\frac{1}{2}$ tons, and maximum speed to 10 miles per hour. Such lines, he considers, might generally speaking be built on existing lines of road at Rs. 25,000, and on independent embankments at between Rs. 30,000 and Rs. 35,000 per mile; in case of emergency they could be laid down at the rate of 1 mile per diem on existing roads, strengthening the bridges where necessary. Where bridges are too narrow for both road and railway some form of tramway rail would have to be substituted for that used elsewhere. Large unbridged rivers would have to be crossed on causeways.

30. The inquiries made regarding the suitability of the Decauville system of light railways, which was being brought under public notice when my previous memorandum was written, have resulted in an adverse opinion as to its suitability for permanent lines, though well adapted in many respects as temporary lines during famine when, in Captain Coaker's opinion, they would be perfectly serviceable for use with bullocks—one bullock in fact, in his opinion, would probably be enabled to do the work of ten if so employed, and the small wagons could be hauled or pushed by coolies. With such motive powers neither bad soils nor unfavorable gradients would be of much consequence. The cost of a mile of line with 14 lb. rails, including wagons, would be only Rupees 8,000, or with 19 lb. rails, Rupees 9,500 as delivered at Madras.

31. Steam could not be employed, in Captain Coaker's opinion, on a line built on the Decauville system of less than 24 to 30 inch gauge. He estimates the cost of the former generally, if laid on a fully metalled road and with bridges strong enough to bear a 5-ton engine, at Rupees 17,695; and of a line similarly laid, on the 30-inch gauge with 30 lb rails, on an independent embankment, at Rupees 32,424. Stations are not included. Both estimates include a moderate supply of rolling stock.

32. For permanent lines Captain Coaker is of opinion that those laid on the Milan system can be more easily laid and kept in order than others, the upkeep being in fact much less than on an ordinary railway; they also offer less obstruction to foot-passengers, who can walk freely along and across them. He considers that for the metre gauge a Vignols' pattern rail, weighing 35 lb. per yard, with wrought iron and steel sleepers, or what is known as "Wood's Patent," would be found most suitable. With the addition of a guard-rail, similar to that used in the Milan lines, there would, he thinks, "be no objection to its passing through towns, or occupying the whole of a road where necessary, such as in crossing a bridge."

33. For further details the papers above quoted should be referred to. As none of them deal, however, precisely with the description of permanent-way which I consider most suitable for meeting in all respects the case immediately under consideration, I will

here state very briefly my views of the subject and as all turns on this point, it would be essential to obtain a ruling from the Government of India before moving further in the matter.

34. In his memorandum above quoted, Colonel Shaw-Stewart considers the advantages which would accrue in times of famine, from being enabled to utilize the spare rolling stock of the South Indian Railway and other metre gauge lines, as sufficient in itself to decide the question of gauge in its favor; and Captain Coaker, apparently acquiescing in this decision, recommends that all the permanent famine lines should be of the metre gauge.

35. The advantages claimed might no doubt, under certain eventualities, be considerable, but in case of wide-spread famine, affecting the country through which the South Indian Railway passes, they would in great measure, if not indeed entirely, disappear; and as the question we are now considering affects the construction of a system aggregating no less than 1,000 miles of railway, it may with equal or even more force be contended, that if the whole proposed system be fully worked out, the advantages will, on the whole, be found to rest with the adoption of an entirely new and more truly narrow gauge system, adequately furnished with rolling stock, which might be interchanged or supplemented as needed.

36. I confess therefore, that in case the Government decide to enter on this great work however gradually, but with the firm determination to complete it within a definite number of years, the gauge should not, in my opinion, exceed 2 feet or the weight of the rail 20 lb. per yard.

37. Calculations of cost on hypothetical cases have already been given in abundance; without therefore needlessly continuing these, it may be assumed that to lay down such a permanent-way on the existing roadway on a system analogous to that of the Milanese lines, would not cost over Rs. 16,000 per mile, excluding however the expense of adapting the roadway itself to the requirements.

38. The latter will in all cases probably require a good deal of improvement in regard to gradients and curves, as also in widening the surfaces. Speaking under correction, it appears to me that to ensure fairly effective work from the engines, the gradients should nowhere exceed, and then only for short lengths 1 in 40, or the curves be of less radius than 150 feet. Although the rail to be employed, Vignols' section, only projects 2 inches above the roadway surface, it is doubtful whether carts would cross the line if guard-stones at intervals, as in the Milanese system, or other simple expedient be adopted, or in case of their even doing so whether, owing to the small loads ordinarily taken by carts in this country (not usually over half a ton), the shock would injure the rail. The cost of the separation of the portion of road occupied by the rails need not in any way be serious.

39. For a gauge of 2 feet it will apparently suffice to reserve 8 feet along one side of a road, and if to this be added 12 feet for meeting the requirements of ordinary cart traffic, the total normal width to which the existing roadway should be increased need not exceed 20 feet. However small the width thus left may appear, it must be borne in mind that once the new system has been fairly established on any road, a large proportion of the ordinary traffic should take to the rail; and further that as a fact on many of the existing ghât roads, accommodating an enormous amount of cart traffic, even so much as 12 feet cannot always be counted on as available, and is found to suffice. No serious inconvenience should therefore be occasioned on this account. Through towns, over bridges or wherever a greater than the present width of roadway cannot be secured without needless cost, some good form of tramway rail, as suggested by both Colonel Shaw-Stewart and Captain Coaker, might be substituted, and if necessary the whole roadway occupied.

40. To carry out the several modifications of the existing roads as above indicated, as also to provide for widening road-drains and minor bridges, as also to make some needful deviations from the existing line, metal the roadways throughout, &c., it will certainly suffice to allow Rs. 4,000 per mile, which added to the cost of permanent-way and rolling stock (Rs. 16,000) would bring the eventual total outlay to not over Rs. 20,000 per mile.

41. This system which combines as before mentioned the features of a light railway and those in part of a tramway should, if eventually carried out to its full

extent, establish permanent lines on the most economical plan, which, while meeting in the fullest way the requirements of famine, would aid materially in developing traffic at other times. Road engines could also, as recommended by Major Pennyuck, be freely used whenever desired.

42. At this stage of the inquiry it is needless to do more than express as has been done a general opinion as to the character of the permanent-way, the gauge, weight of rails, gradients, radius of curves, &c., as upon these and other technical points an authoritative ruling will doubtless be received from the Government of India.

43. As regards questions 4 and 5, viz., the returns which may be expected from traffic in ordinary years, and the advantages which might result in famine years, the papers sent up afford but little information of a reliable character. The Board of Revenue sum up with the observation (paragraph 14, Proceedings No. 2230,) that the general result of inquiry made appears to be this:—“that tramways as protective works against famine are chiefly required in poor and thinly-populated tracts of country, and consequently that viewed as a commercial speculation the profits to be looked for ordinarily must necessarily be in the inverse ratio to the value of the lines in times of scarcity.”

44. Major Pennyuck shows that to pay even 1 per cent. on a capital charge of Rs. 20,000 per mile over 50 tons, or say 100 bandy loads, must be moved daily along the whole distance, and as will be seen by a reference to the Collector's report, the local traffic on even the best line proposed in Bellary (letter from Mr. H. P. Gordon of 19th September 1882) only just amounts to this, while for the others the quantity moved falls far short of it.

45. Mr. Gordon is of opinion that in ordinary times the lines “would do much to develop agriculture by opening up markets to the ryots,” and if to the local be added probably as much again on account of through traffic and passengers, it does not appear improbable that 2 per cent. on outlay might be realized. The lately completed Bangalore-Mysore line, which runs through a very poor and difficult country, and has cost Rs. 40,000 per mile, has lately been shown by the Dewan to be paying already 3 per cent., and it is difficult to suppose that looking generally to the easier gradients over which the Bellary and Kurnool lines would be carried, that the profits would be less than one-third of this example.

46. So far as he can commit himself to an opinion on imperfect data, Major Pennyuck thinks there is no line in Cuddapah or Kurnool which would on his low basis of outlay, Rs. 12,000 per mile, return 2 per cent., and in Bellary only the lines from Hospet to Harpanahalli, and from Tadpatri through Anantapur to Penukonda might do so. He also looks upon it as bad policy to saddle a country with an unremunerative outlay for nineteen years, on the chance of the lines becoming useful in the twentieth.

47. The outlook from a commercial point of view is certainly by no means encouraging although sufficient allowance does not appear to have been made for the recognized powers of railways to stimulate traffic both of goods and passengers, but however bad the prospects in this sense, famine, like war, must be encountered on other grounds than those of a strictly financial character.

48. A case of precisely analogous character has been so clearly dealt with from the financial point of view, in the late work by Sir John and General R. Strachey, “Finances and Public Works of India,” that I make no apology for appending to this note their remarks (pages 186 to 193) chiefly relating to proposed lines of railway for the relief of Bundelkhand.

49. Here it is shown that from the annual imperial surplus of £1,500,000 a sum of £250,000 might, in the authors' opinion, “be distributed between the Local Governments according to the urgency of their wants,” in order to meet the demands of interest on fresh capital for “protective” works. It being notorious that Madras has suffered far more from famine than any other province in India, and further that hitherto it has never received anything approaching to its ratable share of the Imperial surpluses, it is not advancing too much to express a hope that of the sum above named, £50,000 per annum, might be assigned exclusively for meeting the case in question.

50. Taken in round numbers the 1,000 miles of famine lines would, when fully carried out, have as above roughly estimated cost $1,000 \times 20,000 = 200$ lakhs of rupees, so that the amount named if merely viewed as interest for meeting loan, would at 4 per cent. precisely meet the requirements.

51. There is however no need to suppose that the lines if carried out will be so barren of all profits as only just to cover the working expenses, or again to carry at once to completion an undertaking of such magnitude, in order to meet the contingency of a famine so wide-spread and disastrous as the last, which it may be hoped will not recur within the present generation.

52. Viewed in this light it seems to me that the operations for some years to come should be confined to widening, metalling and otherwise preparing as many of the selected lines of road as possible, for receiving the permanent-way of the character that may be decided on. Every mile of such improved road will, even without the permanent-way, be so much gained, and were scarcity or famine to recur in the interval, the work would all be of a character well adapted for affording relief, and road engines could be freely employed.

53. The time thus employed in raising and preparing the selected roads, would further afford the much needed opportunity for studying the details of the precise character of the permanent-way and rolling stock most likely to suit the object in view. This decided on an experiment might be made with one or two of the lines and, say, 100 miles of permanent-way also provided extra for meeting any special emergency arising from severe famine. A certain amount also of the “Porteur Decauville” 16 inch gauge, 14 lb. rails, with a few wagons might also with advantage be procured, as recommended by Captain Coaker, for experiment and for purely temporary use in famine.

54. Some temporary establishment would no doubt have to be engaged in addition to the present normal scale, but if the outlay on preparing the roads is not to exceed from three to five lakhs per annum at first, the present permanent divisional establishment, so far as can at present be judged, should not be overtaxed. When the time comes for laying down the metals, &c., other special arrangements will have to be made.

55. The proposals therefore which I desire to submit for the consideration of Government may be briefly summarised as follows, in reference to the scheme for distributing food during famine by mechanical means viz:—

I.—That a modified scheme be prepared, in conference between Collectors and the Superintending Engineers, which shall not exceed in the aggregate 1,000 miles of reformed roadway for the so-called famine zone.

II.—That detailed estimates be prepared for such of the individual portion as may receive the sanction of Government, exclusive of all cost of laying down permanent-way, rolling stock, &c.

III.—That the funds for such work be provided for in a distinct budget of the Roads and Buildings Branch, Imperial Protective Works, sub-head ‘Famine Roads.’

IV.—That commencing with an outlay of 1 lakh in 1883-84, including such extra temporary establishment as may be needed 1 lakh, per annum be added till a maximum annual expenditure of 5 lakhs shall have been reached.

V.—That no permanent-way or rolling stock shall be provided, excepting experimentally to the extent above indicated, till the complete reformation of the roadways for the entire scheme shall have been carried out, and excepting as a reserve against possible contingency of severe scarcity or famine.

VI.—That the Government of India be solicited to lay down authoritatively all details as regards gradients, curves, gauge, weight of rails, speeds, &c.

56. In conclusion I may observe that no reply seems now called for to the 6th inquiry, viz., as to whether, and if so, to what extent, tramways might be applicable

outside the famine zone, as judging from the communications received by Government from private parties and companies, offering to take up a number of such lines there will apparently be no lack in this respect.

11th November 1882.

(Signed) R. H. SANKEY, Colonel, R.E.,
Chief Engineer, Public Works Department.

APPENDIX TO NOTE BY THE CHIEF ENGINEER, P.W.D.

Extract from "the Finances and Public Works of India," by Sir John and General R. Strachey.

"But it was apparent that, under the strict rules laid down for the application of borrowed funds, no facilities existed for meeting a very important class of cases, in which, although it is obviously necessary to construct certain works for the prevention of famine, it cannot be assumed that they will be so directly remunerative as to yield a net income equal to the interest on the capital expended on them. The question therefore arose how to provide means for the construction of this class of works, called for the sake of distinction protective, when the required expenditure was too large to be met from ordinary income.

"The province of Bandelkhand supplies an illustration. It suffers frequently from serious drought, is peculiarly exposed to failure of the periodical rains and consequent famine. It is cut off from the existing railway system, and its means of communication are very imperfect. Designs for irrigation works and for cheap railways had been completed, which would render the province secure against serious danger, and would make its relief in case of necessity easy. But the country being naturally poor, it could not confidently be said that the direct money return from these works would cover the interest of the capital expended on their construction. It might, perhaps, for a good many years cover only half of it, and leave, say, £20,000 or £30,000 a year unprovided for. Under the existing rules these works could not be undertaken, except from the ordinary revenues, and, in the absence of funds from this source, Bandelkhand was left exposed to the dangers of famine.

"The first suggestion for dealing with such cases was that these protective works might properly be constructed from the famine insurance surplus, which would be reduced to a corresponding extent. But, although this plan had been proposed by the Secretary of State, the Government of India considered that it was not admissible. 'It is essential,' they wrote to the Secretary of State,* 'that the limited amount of that surplus should not be trenced upon to an extent that will frustrate the main object of its creation, viz., the prevention of any permanent increase of the public debt by reason of the public expenditure upon famines. If the assumption be true upon which our recent measures were founded, viz., that 1,500,000/ sterling is the amount which it is necessary to secure as a yearly surplus to provide for the cost of counteracting famines, it is plain that, if unremunerative works were carried out under conditions which caused a reduction of that surplus beyond a certain limit, additional taxation would be eventually required to make good the loss. This result could only be avoided if the works were found so useful as, when famine occurred, to cause a diminution of the expenditure which must otherwise have been incurred for purposes of relief, sufficient to compensate for the cost of the construction and maintenance of the works at other times.'

"The suggestion that the supply of funds from the famine surplus for the construction of protective works may be justified by such an expectation as that just referred to, should be received with much hesitation. The true object of these works is to give increased security against the greatest dangers that arise in extreme drought, to supply the means of saving life and averting suffering and misery, rather than to cause an eventual reduction in the cost of famine relief. Experience indicates no valid ground for hoping for any important diminution of the burden of such relief. On the contrary, the probabilities of the future, within any period to which for practical purposes we can now look forward, assuredly are in the direction of a constantly growing demand for a more bountiful administration, and of increased efficiency rather than for reduced costs. In short, no reduction of any insurance fund against future liabilities could be prudently accepted on grounds such as those just noticed.

"Further, one of the most essential conditions to be observed in the construction of great public works is that, when they have been commenced, they should be carried on to completion without interruption, at a certain and steady rate of expenditure; the neglect of this condition has notoriously been already a fruitful cause of wasteful expenditure in India; and consequently if the construction of protective works depended on the possession of a sufficient surplus, there could be no certainty that they would go on uninterruptedly for a single year, for their progress might at any time be disturbed by famine, or war, or other causes.

"For such reasons, to which no reply can be given, the Government of India rejected the proposal to provide from the famine special surplus the capital required for protective works

* Despatch from Government of India to Secretary of State, dated September 16, 1878.

demanding a large expenditure, or in other words to provide the money from ordinary revenues, making an equivalent reduction from the surplus of 1,500,000/.

"Lord Lytton's Government considered that there was only one way in which the works could be made with the speed which the necessity of protecting the country against famine required, and at the same time without financial risk. In any case, they said, in which it would be justifiable in principle, although not expedient in practice, to diminish our annual famine insurance surplus, with the object of defraying the capital expenditure on protective works, it would be unobjectionable to apply a portion of that surplus in payment of interest on the capital required. It was therefore proposed to allow, in case of necessity, money to be borrowed for these works, subject to the condition that the net charge for the interest on their capital cost, and for their maintenance, after setting off the income yielded by them, should not exceed a specific maximum amount, to be provided from the ordinary standard surplus. The amount of the liability thus admitted might be altered, from time to time, as experience was gained; but to be on the safe side, it was proposed, in the first instance, to fix at 250,000/ the sum by which the yearly charge for interest and maintenance might exceed the net revenue from the works. It was believed that the annual surplus of 1,500,000/ reserved for famine, might safely be reduced by this amount, not only because the construction of these works would reduce the ultimate liability for the relief of famines when they occur, but because, as the inquiries of the Famine Commission have since more decidedly shown, there is reason to think that, in originally determining the standard amount of that surplus, it was fixed at a sum somewhat higher than was really essential.

The sum of 250,000/, to be annually expended in paying interest on fresh capital for protective works, would have been distributed between the Local Governments according to the urgency of their wants; and as soon as the quota of any province became exhausted, the further capital outlay in that province would have been suspended until the growing income from the provincial works as a whole, or, under certain conditions, from other sources of provincial income, again relieved the provincial revenues and supplied a surplus.

Even if the works should produce no net income at all, and should merely cover their working expenses—a supposition so improbable that it does not really deserve to be considered—a capital sum of about 6,000,000/ might, under this plan, be gradually expended, and such a sum would go far towards providing the protective works most urgently required. But, in fact, the growing income would, without the least doubt, rapidly provide the means of extending the capital expenditure, while, as already said, the gain to the country from the improvement of its communications would far outweigh any deficiency in the direct return from the works. The adoption of this plan would create no fresh ultimate obligation beyond what has already been accepted; the interest payment would be nothing more than an indirect contribution of the capital itself, and no greater risk would be incurred than if the capital had been directly supplied from surplus revenue.

Govt. of (1883) Madras.

PUBLIC WORKS

Dated July, 2nd.

Recd.

Encl.

G.O., 2nd July 1883, No. 509 I.

JULY.

Irrigation Prod. & Public
WorksFORWARDING statement showing progress
of — (Capital Account) for 1882-83.

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GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Irrigation.

READ—the following papers:—

Statement showing the Progress of Irrigation Productive Public Works (Capital Account), for the Year 1882-83.

Name of Project and Description of Work.	Amount of Sanctioned Estimate.	Grant for 1882-83.	Expenditure during the Year 1882-83.	Total Expenditure up to end of 1882-83.	Succinct Account showing the state to which the works have been advanced up to date, &c.
GODAVARI DELTA SYSTEM.					
	RS.	RS.	RS.	RS.	
Old outlay	42,99,072	..	..	42,99,072	
[This report was received on the 9th May 1883.]					
EASTERN SECTION.					
(1.)—HEAD WORKS.					
B. Land	896	..	..	822	
C. Works	6,300	..	..	..	
K. Buildings	45,393	2,929	2,560	37,952	Completed, except the buildings in the Central Section. Amalapur rest-house raised up to floor level.
(2.)—MAIN CANALS AND BRANCHES.					
Main Canal.					
D. Regulators	12,538	..	..	12,538	Completed.
I. Navigation Works	1,400	1,900	416	116	Sheds for Lock Establishment in progress.
L. Earthwork	25,394	..	..	25,394	Completed.
Bank Canal.					
B. Land	7,550	500	..	822	
F. (1) Other Cross Drainage Works.	9,300	700	540	540	
H. Escapes	2,910	610	703	703	
I. Navigation Works	1,24,816	7,000	6,675	99,332	Completed, excepting the quarters for Lock Establishment and the lock at Thakuram.
L. Earthwork	1,42,780	17,000	17,616	1,30,887	
Cocanada Canal.					
B. Land	2,000	..	12	1,812	Compensation paid for 77-90 acres.
F. (1) Other Cross Drainage Works.	7,720	2,350	1,326	6,439	Inlets in progress.
I. Navigation Works	1,25,006	500	376	1,20,502	Completed, excepting the quarters for Lock Establishment.
L. Earthwork	37,943	..	..	37,887	Completed.
O. Miscellaneous	2,500	..	..	..	
Samalkot Canal.					
B. Land	1,000	..	..	835	Compensation paid for 63-60 acres.
G. Bridges	21,978	..	..	17,599	Completed, excepting two bridges.
H. Escapes	4,073	..	..	4,073	Completed.
I. Navigation Works	3,300	500	422	422	
L. Earthwork	88,143	..	..	88,143	Completed.
Mundapetta Canal.					
B. Land	..	..	..	6	Nearly completed.
I. Navigation Works	22,330	..	..	20,850	Completed.
L. Earthwork	12,700	..	..	12,700	
O. Miscellaneous	1,200	500	620	620	
Coringa Canal.					
B. Land	250	..	-1,386	246	
F. (1) Other Cross Drainage Works.	1,300	..	-475	7,412	Completed, excepting the quarters for Lock Establishment.
I. Navigation Works	11,547	..	..	34,667	Completed.
L. Earthwork	34,670	..	..	..	
O. Miscellaneous	1,200	..	..	..	
Injeram Canal.					
B. Land	..	..	-3,185	1	
H. Escapes	6,708	..	..	6,708	Completed.
I. Navigation Works	1,040	..	..	9,442	Completed.
L. Earthwork	9,442	..	..	..	
(3.)—DISTRIBUTARIES.					
Bank Canal.					
B. Land	1,800	..	..	..	
C. Works	11,310	..	..	..	
L. Earthwork	4,000	..	..	..	

Statement showing the Progress of Irrigation, Productive Public Works (Capital Account),
for the Year 1882-83—*cont.*

Name of Project and Description of Work.	Amount of Sanctioned Estimate.	Grant for 1882-83.	Expenditure during the Year 1882-83.	Total Expenditure up to end of 1882-83.	Succinct Account showing the state to which the works have been advanced up to date, &c.	
GODAVARI DELTA SYSTEM.						
—cont.						
EASTERN SECTION—cont.						
(3.)—DISTRIBUTARIES.—cont.						
Cocanada Canal.						
B. Land	2,100	..	..	..	Nearly completed. Do.	
C. Works	27,959	2,200	239	1,916		
L. Earthwork	13,393	1,000	1,384	24,843		
O. Miscellaneous	400	..	1,009	12,265		
.. ..	..	..	..	..		
Sankali Canal.						
B. Land	4,080	500	238	2,009	Compensation paid for 36.54 acres. Nearly completed. Do.	
C. Works	17,392	1,000	1,081	13,332		
L. Earthwork	17,398	3,000	2,087	14,308		
.. ..	..	..	..	..		
.. ..	..	..	..	..		
Mundapetta Canal.						
B. Land	3,290	..	..	2,722	Compensation for 28.6 acres paid. Four out of seven head-slucies and two other masonry works com- pleted. Five channels completed.	
C. Works	10,784	900	233	4,239		
.. ..	..	..	..	..		
.. ..	..	..	..	..		
L. Earthwork	8,396	300	..	7,296		
Coringa Canal.						
B. Land	1,800	..	1,386	1,766	Seven head-slucies and seven other masonry works completed. Seven channels completed.	
C. Works	18,989	..	..	12,177		
L. Earthwork	7,731	..	..	5,976		
.. ..	..	..	..	..		
.. ..	..	..	..	..		
Injeram Canal.						
B. Land	8,000	..	5,043	5,043	Three head-slucies completed. Three channels completed.	
C. Works	8,670	..	..	2,321		
L. Earthwork	8,318	..	..	4,618		
.. ..	..	..	..	..		
.. ..	..	..	..	..		
(4.)—DRAINAGE AND PROTECTIVE WORKS.						
Mundapetta Canal.						
L. Earthwork	342	..	..	342	Completed.	
Coringa Canal.						
L. Earthwork	500	..	..	..		
Tooliabaga Drain.						
B. Land	12,368	..	1,231	9,779		Tunnel under Velanghi straight cut finished.
C. Works	17,764	1,100	1,250	10,550		
L. Earthwork	1,18,504	2,000	927	99,462		
.. ..	..	..	..	..		
.. ..	..	..	..	..		
Biccarole Drain.						
B. Land	4,937	..	..	2,537	..	
C. Works	9,170	600	506	5,967		
L. Earthwork	58,700	..	43	47,061		
.. ..	..	..	..	..		
.. ..	..	..	..	..		
Pakee Drain.						
B. Land	12,897	725	1,321	5,103	..	
C. Works	15,089	..	..	7,489		
L. Earthwork	2,16,289	30,100	29,559	1,76,638		
.. ..	..	..	..	..		
.. ..	..	..	..	..		
Total, Eastern Section ..	1,418,407	77,014	73,756	11,59,589		
CENTRAL SECTION.						
[This report was received on the 1st May 1883.]						
Main Canal.						
D. Regulators	13,348	..	..	13,348	Completed.	
I. Navigation Works	1,220	..	..	..		
L. Earthwork	39,000	300	263	263		
.. ..	..	..	..	..		
.. ..	..	..	..	..		
Gunnaram Canal.						
B. Land	2,310	..	..	..	Ballampudi weir shutter made.	
F. River and Hill Torrent Works.	25,440	4,500	3,995	3,995		
H. Escapes	10,100	..	375	375		
I. Navigation Works	1,36,320	19,428	20,686	20,686		
L. Earthwork	1,15,600	10,000	11,975	11,975		
Bank Canal.						
B. Land	900	100	..	..	..	
F. River and Hill Torrent Works.	9,680	..	..	..		
F. (1) Other Cross Drainage Works.	5,010	..	..	..		
.. ..	..	..	..	..		
.. ..	..	..	..	..		

Statement showing the Progress of Irrigation, Productive Public Works (Capital Account),
for the Year 1882-83—*cont.*

Name of Project and Description of Work.	Amount of Sanctioned Estimate.	Grant for 1882-83.	Expenditure during the Year 1882-83.	Total Expenditure up to end of 1882-83.	Succinct Account showing the state to which the works have been advanced up to date, &c.
GODAVARI DELTA SYSTEM—<i>cont.</i>					
CENTRAL SECTION—<i>cont.</i>					
<i>Bank Canal—cont.</i>					
H. Escapes	660	..	..	..	
I. Navigation Works	94,150	4,281	4,813	4,813	
L. Earthwork	53,320	112	3	3	
<i>Amalapur Canal.</i>					
B. Land	120	..	..	..	
H. Escapes	18,950	..	..	..	
I. Navigation Works	43,460	..	..	..	
L. Earthwork	87,150	..	..	..	
<i>Bendamurtunka Canal.</i>					
B. Land	690	..	..	..	
I. Navigation Works	51,430	..	..	..	
L. Earthwork	9,000	..	..	..	
(3.)—DISTRIBUTARIES.					
<i>Main Canal.</i>					
C. Works	650	..	..	..	
<i>Gunnaram Canal.</i>					
C. Works	16,350	..	..	..	
L. Earthwork	5,000	..	..	..	
<i>Bank Canal.</i>					
C. Works	6,100	..	..	..	
L. Earthwork	1,000	..	..	..	
<i>Amalapur Canal.</i>					
C. Works	8,800	..	..	..	
L. Earthwork	5,000	..	..	..	
<i>Bendamurtunka Canal.</i>					
C. Works	3,950	..	..	..	
L. Earthwork	1,000	..	..	..	
(4.)—DRAINAGE AND PROTECTIVE WORKS.					
B. Land	1,900	..	..	..	
C. Works	2,700	..	..	..	
L. Earthwork	99,133	5,300	3,969	3,969	Pallivella drain about two-thirds finished.
Total, Central Section ..	8,69,441	44,391	46,079	59,427	
WESTERN SECTION.					
[This report was received on the 7th May 1883.]					
(2.)—MAIN CANALS AND BRANCHES.					
<i>Main Canal.</i>					
D. Regulators	14,861	..	..	14,861	Completed.
B. Land	2,000	..	..	1,308	Compensation paid for 11.88 acres.
I. Navigation Works	1,220	600	311	311	Materials for lock sheds partly collected.
L. Earthwork	36,509	..	..	36,509	Completed.
<i>Kakaraparra Canal.</i>					
B. Land	5,000	200	..	2,490	
F(1). Other Cross Drainage Works.	14,799	1,190	4,115	15,244	Under tunnels at 7 miles 44 chains and at 9 miles 12 chains completed.
L. Earthwork	24,528	..	2,476	24,528	Completed.
<i>Gostanadi and Felpur Canal.</i>					
B. Land	10,200	200	104	4,400	
E. Falls and Weirs	5,580	..	..	5,580	Weir at 14th mile completed.
H. Escapes	3,250	650	618	3,151	Mamudur surplus weir finished.
I. Navigation Works	37,932	500	463	36,675	Completed.
L. Earthwork	56,136	..	50	51,852	Do.

Statement showing the Progress of Irrigation, Productive Public Works (Capital Account),
for the Year 1882-83—*cont.*

Name of Project and Description of Work.	Amount of Sanctioned Estimate.	Grant for 1882-83.	Expenditure during the Year 1882-83.	Total Expenditure up to end of 1882-83.	Succinct Account showing the state to which the works have been advanced up to date, &c.
GODAVARI DELTA SYSTEM—<i>cont.</i>	RS.	RS.	RS.	RS.	
WESTERN SECTION—<i>cont.</i>					
(2.)—MAIN CANALS AND BRANCHES—<i>cont.</i>					
<i>Gostanadi and Velpur Canal Extension.</i>					
B. Land	2,900	..	..	..	
F(1). Other Cross Drainage Works.	3,100	..	..	..	
G. Bridges	8,000	..	..	..	
I. Navigation Works	47,620	11,500	9,791	9,791	Vissakoderu lock and weir in rapid progress.
L. Earthwork	17,314	3,600	2,915	2,915	Velpur canal extension completed as far as Fhirangi Khamedu Kodu sluice.
<i>Bank Canal.</i>					
B. Land	4,420	..	..	3,788	
H. Escapes	7,204	..	..	3,704	Completed.
I. Navigation Works	93,612	..	..	91,146	Do.
L. Earthwork	27,589	..	..	27,589	Do.
<i>Narsapur Canal.</i>					
B. Land	2,000	..	— 27	1,242	Compensation paid for 14.84 acres.
F(1). Other Cross Drainage Works.	7,236	..	..	7,236	Saripalli under-tunnel completed.
H. Escapes	2,664	..	..	2,664	Completed.
I. Navigation Works	1,54,649	1,000	2,250	1,48,900	Nearly completed.
L. Earthwork	19,628	..	..	19,628	Completed.
<i>Ellore Canal.</i>					
B. Land	2,400	..	..	908	
F. River and Hill Torrent Works.	13,714	310	78	9,651	Tunnel at 19 miles 16 chains completed.
H. Escapes	5,564	..	..	2,203	Almost completed; shutters with screw gearing have to be fitted.
I. Navigation Works	2,260	500	558	558	
L. Earthwork	48,991	..	..	48,991	Completed.
<i>Attili Canal.</i>					
B. Land	3,060	300	232	1,794	
H. Escapes	3,461	..	..	3,461	Surplus weir at 20th mile completed.
I. Navigation Works	33,874	..	..	31,795	Locks and lock weirs at Godicherla and Ganampad completed.
L. Earthwork	17,504	..	..	17,504	Completed.
O. Miscellaneous	..	..	— 48	..	
<i>Junction Canal.</i>					
B. Land	450	..	..	248	
H. Escapes	11,697	..	..	11,697	Nandamur surplus weir completed.
I. Navigation Works	41,460	..	..	40,060	Double lock at Muddapuram completed.
L. Earthwork	21,821	..	..	21,820	Completed.
<i>Venkia and Weyeru Canal.</i>					
H. Escapes	1,565	..	..	1,565	Completed.
I. Navigation Works	4,160	..	..	..	
<i>Undi Canal.</i>					
B. Land	1,800	25	25	1,522	
D. Regulators	2,047	..	..	2,047	Additional head-sluice completed.
H. Escapes	6,191	..	..	6,118	Completed.
I. Navigation Works	34,273	400	351	32,723	Nearly completed.
L. Earthwork	25,500	500	500	25,011	Do.
(3.)—DISTRIBUTARIES.					
<i>Kakaraparru Canal.</i>					
B. Land	540	..	..	..	
C. Works	9,433	6,510	6,046	9,512	Tunnel under Bhopiah channel completed, and Goteru and Irugaveram channel sluices and under-tunnels in hand.
L. Earthwork	3,550	3,550	2,521	2,521	Kavalipuram channel and drain partly finished.

Statement showing the Progress of Irrigation, Productive Public Works (Capital Account),
for the Year 1882-83—*cont.*

Name of Project and Description of Work.	Amount of Sanctioned Estimate.	Grant for 1882-83.	Expenditure during the Year 1882-83.	Total Expenditure up to end of 1882-83.	Succinct Account showing the state to which the works have been advanced up to date, &c.
GODAVARI DELTA SYSTEM—<i>cont.</i>	RS.	RS.	RS.	RS.	
WESTERN SECTION—<i>cont.</i>					
(2.)—MAIN CANALS AND BRANCHES—<i>cont.</i>					
<i>Gostanadi and Velpur Canal.</i>					
B. Land	1,290	..	..	..	
C. Works	17,662	3,625	3,034	19,261	Nine sluices in hand.
L. Earthwork	5,266	900	1,412	2,748	Gostanadi channel completed and Vandra right bank and left bank channels partly finished.
<i>Gostanadi and Velpur Canal Extension.</i>					
C. Works	2,570	..	1,028	1,028	Materials for Vissakoder channel weir collected.
<i>Bank Canal.</i>					
B. Land	450	..	..	..	
C. Works	7,448	..	..	3,748	Four out of five head-sluices, one dividing dam and two under-tunnels completed.
L. Earthwork	8,926	..	..	1,576	Parallel channel from above Koder lock completed.
<i>Narsapur Canal.</i>					
B. Land	1,350	..	— 27	1,154	Compensation paid for 29.56 acres.
C. Works	21,520	..	..	21,429	Completed.
L. Earthwork	9,177	..	..	9,177	Do.
<i>Ellore Canal.</i>					
B. Land	5,700	340	534	4,994	
C. Works	56,959	..	..	56,961	Completed.
L. Earthwork	48,579	..	— 771	48,529	Do.
O. Miscellaneous	772	..	..	771	
<i>Attili Canal.</i>					
C. Works	10,717	85	63	10,705	Completed.
L. Earthwork	12,646	..	..	12,646	Do.
<i>Venkia and Weyeru Canal.</i>					
B. Land	500	40	1	76	
C. Works	18,780	1,000	486	4,655	Seven sluices completed.
L. Earthwork	5,999	1,350	1,344	2,202	Two channels completed.
<i>Undi Canal.</i>					
B. Land	1,350	760	785	785	
C. Works	39,216	..	..	9,859	
L. Earthwork	34,123	785	1,058	17,532	Chilkuru channel extension partly finished.
B. Compensation for various canals	..	..	..	— 108	
(4.)—DRAINAGE AND PROTECTIVE WORKS.					
<i>Ellore Canal.</i>					
B. Land	4,500	30	28	2,535	
C. Works	23,653	..	..	23,653	Completed.
L. Earthwork	66,159	..	..	66,158	Do.
<i>Attili Canal.</i>					
C. Works	689	..	..	689	Completed.
<i>Undi Canal.</i>					
C. Works	6,160	..	..	..	
L. Earthwork	2,950	..	..	..	
<i>Nakkala Drain.</i>					
B. Land	400	..	..	..	
C. Works	22,300	..	..	..	
<i>Mogultar Drain.</i>					
B. Land	1,300	..	..	1,063	Compensation paid for 57.43 acres.
C. Works	2,363	..	..	2,363	Completed.
L. Earthwork	20,646	..	..	20,646	Do.

Statement showing the Progress of Irrigation, Productive Public Works (Capital Account),
for the Year 1882-83—cont.

Name of Project and Description of Work.	Amount of Sanctioned Estimate.	Grant for 1882-83.	Expenditure during the Year 1882-83.	Total Expenditure up to end of 1882-83.	Succinct Account showing the state to which the works have been advanced up to date, &c.
GODAVARI DELTA SYSTEM—cont.	rs.	rs.	rs.	rs.	
WESTERN SECTION—cont.					
(4.)—DRAINAGE AND PROTECTIVE WORKS—cont.					
<i>Gostanadi Outfall and Sluice.</i>					
<i>Gonter Drain.</i>					
B. Land	2,000	..	..	834	Compensation paid for 54-30 acres.
C. Works	..	..	..	..	..
L. Earthwork	22,500	..	2,300	17,384	Improvements to Gonter drain completed.
<i>Yemmamadu Drain.</i>					
C. Works	13,855	550	538	10,306	Six inlet sluices completed.
L. Earthwork	13,747	..	..	13,747	Completed.
<i>Other Drains.</i>					
B. Land	1,050	..	..	609	Compensation paid for 10-24 acres.
C. Works	6,626	..	..	6,626	Completed.
L. Earthwork	44,023	..	..	22,422	Kaza, Buggeshwaram and Bondada drains completed; as also the improvements to Royalum and Razukodu drains.
Total, Western Section ..	14,61,967	40,000	36,187	11,94,685	
Unforeseen Expenses ..	70,150	..	..	..	
Total, Godavari Delta System ..	81,19,037	1,61,405	1,56,022	67,12,773	
KISTNA DELTA SYSTEM.					
Old outlay	30,81,755	..	..	30,81,755	
EASTERN SECTION.					
[The reports for the Kistna Eastern and Gudivada Divisions were received on the 30th April 1883.]					
(1.)—HEAD WORKS.					
C. Works	1,30,500	..	..	372	
(2.)—MAIN CANALS AND BRANCHES.					
<i>Main Canal.</i>					
B. Land	4,500	..	..	5,188	Completed.
D. Regulators	14,300	..	..	14,344	Do.
G. Bridges	1,550	..	..	7,344	Completed.
I. Navigation Works	7,734	..	..	1,04,961	Do.
L. Earthwork	1,05,462	75	75	..	Diversion cut completed and paid for. Ring bunds raised. Foundations for Kesarapalli aqueduct being dug and materials most part collected.
<i>Ellore Canal.</i>					
F. River and Hill Torrent Works.	80,165	16,000	10,577	10,577	Outlet at 27 miles and 40 chains completed up to 42-00 level; 7 inches more rough stone and coping to be done.
I. Navigation Works	27,755	..	..	..	Head-sluice completed.
L. Earthwork	29,640	..	..	..	Foundations dug and materials collected for five inlets.
<i>Ryves' Canal.</i>					
B. Land	6,488	2,822	2,413	5,092	Gudivada rest-house purchased.
D. Regulators	20,884	1,350	1,281	20,541	Widened to full width for first 3 miles and 75 feet bottom width in 4th mile; some widening also done.
E. Falls and Weirs	5,816	..	..	2,176	Completed.
F(1). Other Cross Drainage Works.	5,651	2,500	2,176	2,853	Not required.
G. Bridges	39,859	..	..	16,811	
K. Buildings	2,853	..	..	2,853	
L. Earthwork	3,83,000	16,609	15,530	3,27,684	
O. Miscellaneous	1,795	..	..	..	
<i>Masulipatam Canal.</i>					
F(1). Other Cross Drainage Works.	22,204	..	..	22,205	
G. Bridges	2,820	..	..	..	
I. Navigation Works	38,860	..	..	..	
L. Earthwork	2,49,760	..	..	74,471	
<i>Bank Canal.</i>					
B. Land	10,000	..	..	..	
D. Regulators	6,940	..	..	..	
F. River and Hill Torrent Works.	3,58,500	..	..	..	
F(1). Other Cross Drainage Works.	6,650	..	..	..	

Statement showing the Progress of Irrigation, Productive Public Works (Capital Account),
for the Year 1882-83—cont.

Name of Project and Description of Work.	Amount of Sanctioned Estimate.	Grant for 1882-83.	Expenditure during the Year 1882-83.	Total Expenditure up to end of 1882-83.	Succinct Account showing the state to which the works have been advanced up to date, &c.
KISTNA DELTA SYSTEM—cont.	rs.	rs.	rs.	rs.	
EASTERN SECTION—cont.					
(2.)—MAIN CANALS AND BRANCHES—cont.					
<i>Bank Canal—cont.</i>					
G. Bridges	44,650	..	..	..	Work done for Famine Relief, 1877-78.
H. Escapes	5,830	..	..	..	
I. Navigation Works	11,970	..	..	..	
K. Buildings	8,400	..	..	..	
L. Earthwork	3,40,780	..	..	4,837	
O. Miscellaneous	9,665	..	..	..	
P. Maintenance	32,000	..	..	..	
<i>Pulleru Canal.</i>					
B. Land	5,000	..	..	3,762	Regulating bridge at Pamarru constructed.
D. Regulators	9,300	..	..	5,114	Completed.
E. Falls and Weirs	5,600	..	..	1,325	Do.
G. Bridges	18,420	..	..	79,568	Nearly completed.
I. Navigation Works	2,500	..	..	..	
L. Earthwork	84,440	..	..	..	
O. Miscellaneous	6,225	..	..	..	
<i>Polraz Canal.</i>					
B. Land	5,025	500	..	6,034	Lock work commenced and foundations being dug.
D. Regulators	795	..	..	100	
G. Bridges	5,900	..	..	210	
I. Navigation Works	78,134	9,500	6,034	1,165	The outlets have been abandoned; the materials at site will be utilized on other works.
K. Buildings	3,900	..	..	..	
L. Earthwork	39,902	5,000	100	..	
O. Miscellaneous	5,270	1,400	210	..	
H. Escapes	..	2,500	1,165	..	
<i>Bantamilli Canal.</i>					
B. Land	30	30	..	20	
D. Regulators	490	..	..	..	
G. Bridges	6,190	..	..	..	
H. Escapes	9,340	..	..	..	
I. Navigation Works	64,640	..	..	..	
K. Buildings	3,340	..	..	..	
L. Earthwork	43,460	..	..	..	
O. Miscellaneous	3,230	..	..	..	
(3.)—DISTRIBUTARIES.					
<i>Ellore Canal.</i>					
B. Land	7,000	..	..	..	
C. Works	14,465	1,000	770	..	
L. Earthwork	25,450	..	..	..	
<i>Ryves' Canal.</i>					
B. Land	11,435	..	..	9,976	
C. Works	35,325	..	..	2,556	
L. Earthwork	67,154	..	..	..	
O. Miscellaneous	3,676	..	..	..	
<i>Masulipatam Canal.</i>					
B. Land	3,000	..	..	46	
C. Works	17,936	..	..	10,389	
L. Earthwork	56,919	..	..	38,920	
O. Miscellaneous	1,500	..	..	..	
<i>Bank Canal.</i>					
B. Land	21,017	..	..	..	
C. Works	53,875	..	..	..	
L. Earthwork	1,11,325	..	..	..	
<i>Pulleru Canal.</i>					
B. Land	22,766	..	..	587	
C. Works	76,977	..	..	2,760	
L. Earthwork	1,72,863	..	..	..	
O. Miscellaneous	16,579	..	..	..	

Statement showing the Progress of Irrigation, Productive Public Works (Capital Account),
for the Year 1882-83—cont.

Name of Project and Description of Work.	Amount of Sanctioned Estimate.	Grant for 1882-83.	Expenditure during the Year 1882-83.	Total Expenditure up to end of 1882-83.	Succinct Account showing the state to which the works have been advanced up to date, &c.
KISTNA DELTA SYSTEM —cont.	RS.	RS.	RS.	RS.	
EASTERN SECTION—cont.					
(3.)—DISTRIBUTARIES—cont.					
<i>Polraz Canal.</i>					
B. Land	12,670	..	..	..	
C. Works	44,365	..	..	..	
L. Earthwork	91,521	..	..	..	
O. Miscellaneous	6,930	..	..	..	
<i>Bantamilli Canal.</i>					
B. Land	1,535	..	..	..	
C. Works	3,837	..	..	..	
L. Earthwork	9,210	..	..	..	
O. Miscellaneous	768	..	..	..	
(4.)—DRAINAGE AND PROTECTIVE WORKS.					
<i>Ellore Canal.</i>					
B. Land	4,075	..	..	..	
L. Earthwork	36,615	..	..	..	
O. Miscellaneous	11,965	..	..	..	
<i>Ryves' Canal.</i>					
B. Land	457	..	..	..	
C. Works	721	..	..	..	
L. Earthwork	1,171	..	..	..	
<i>Masulipatam Canal.</i>					
B. Land	383	..	..	..	
L. Earthwork	1,080	..	..	..	
O. Miscellaneous	58	..	..	..	
<i>Kanikala Main Drain.</i>					
B. Land	1,908	..	..	..	
C. Works	2,725	..	..	..	
L. Earthwork	14,687	..	..	..	
<i>Devanapally Drain.</i>					
L. Earthwork	333	..	..	..	
<i>Taluru (Divi) Drain.</i>					
B. Land	1,333	..	..	..	
C. Works	2,500	..	..	..	
L. Earthwork	16,667	..	..	..	
<i>Gudemotu (Divi) Drain.</i>					
B. Land	667	..	..	..	
C. Works	3,166	..	..	..	
L. Earthwork	4,500	..	..	..	
<i>Mopidevi Drain.</i>					
L. Earthwork	167	..	..	..	
<i>Pulleru Canal.</i>					
B. Land	465	..	..	..	
L. Earthwork	3,052	..	..	3,052	Completed.
<i>Uppuluru Drain.</i>					
B. Land	1,028	..	..	..	
C. Works	10,717	..	..	..	
L. Earthwork	16,719	..	..	..	
O. Miscellaneous	261	..	..	..	
<i>Chendrayakodu Drain.</i>					
B. Land	19,740	..	..	..	
C. Works	27,780	..	..	..	
L. Earthwork	92,763	..	88	88	
O. Miscellaneous	3,119	..	..	..	
<i>Polrazukodu Drain.</i>					
B. Land	23,830	1,000	..	..	
C. Works	53,868	4,112	24	24	
L. Earthwork	1,04,716	..	..	..	
O. Miscellaneous	4,716	..	..	..	

Statement showing the Progress of Irrigation, Productive Public Works (Capital Account).
for the Year 1882-83—cont.

Name of Project and Description of Work.	Amount of Sanctioned Estimate.	Grant for 1882-83.	Expenditure during the Year 1882-83.	Total Expenditure up to end of 1882-83.	Succinct Account showing the state to which the works have been advanced up to date, &c.
KISTNA DELTA SYSTEM —cont.	RS.	RS.	RS.	RS.	
EASTERN SECTION—cont.					
(4.)—DRAINAGE AND PROTECTIVE WORKS—cont.					
<i>Kolleru Embankment.</i>					
B. Land	904	..	..	..	
L. Earthwork	17,935	..	..	..	
<i>Polraz Canal.</i>					
B. Land	150	..	..	..	
L. Earthwork	3,505	..	..	..	
<i>Pullava Main Drain and Affluents.</i>					
B. Land	1,873	..	..	..	
C. Works	1,562	..	..	..	
L. Earthwork	16,645	..	..	..	
<i>Damidi Drain.</i>					
B. Land	500	..	..	..	
C. Works	709	..	..	..	
L. Earthwork	2,000	..	..	..	
<i>Peddakomera Drain and Affluents.</i>					
B. Land	4,167	..	..	..	
C. Works	3,271	..	..	..	
L. Earthwork	34,248	..	..	..	
<i>Peddalanka Main Drain and Affluents.</i>					
B. Land	7,417	..	..	..	
C. Works	900	..	..	..	
L. Earthwork	89,923	..	..	..	
<i>Bantamilli Canal.</i>					
B. Land	18,400	..	..	..	
C. Works	40,612	..	..	..	
L. Earthwork	1,54,446	..	..	..	
O. Miscellaneous	5,576	..	..	..	
<i>Sultanagaram Drain.</i>					
B. Land	412	..	..	..	
L. Earthwork	2,415	..	..	..	
<i>Kanchavally Drain.</i>					
B. Land	1,117	..	..	..	
C. Works	16,815	..	..	..	
L. Earthwork	8,760	..	..	..	
O. Miscellaneous	492	..	..	..	
<i>Giddor Swamp Minor Channels.</i>					
B. Land	375	..	..	..	
C. Works	1,500	..	..	..	
L. Earthwork	5,625	..	..	..	
Total, Eastern Section ..	42,09,479	64,398	40,572	7,82,819	
WESTERN SECTION.					
[This report was received on the 30th April 1883.]					
(2.)—MAIN CANALS AND BRANCHES.					
<i>Main Canal.</i>					
B. Land	3,500	3,500	2,000	2,000	Completed.
D. Regulators	15,720	..	..	15,720	Do.
I. Navigation Works	210	..	..	212	Widening to a bed width of 124 feet in progress.
L. Earthwork	5,34,520	49,000	47,934	90,419	
<i>Bank Canal.</i>					
B. Land	..	1,000	..	..	
D. Regulators	3,300	..	..	..	
F. (1) Other Cross Drainage Works.	7,275	..	..	..	
G. Bridges	19,310	..	..	..	
H. Escapes	5,600	..	..	..	
I. Navigation Works	1,02,000	2,500	2,505	2,505	Materials collected.
K. Buildings	5,000	..	..	..	
L. Earthwork	1,15,715	..	..	..	
O. Miscellaneous	9,750	..	..	..	

Statement showing the Progress of Irrigation, Productive Public Works (Capital Account),
for the Year 1882-83—*cont.*

Name of Project and Description of Work.	Amount of Sanctioned Estimate.	Grant for 1882-83.	Expenditure during the Year 1882-83.	Total Expenditure up to end of 1882-83.	Succinct Account showing the state to which the works have been advanced up to date, &c.
KISTNA DELTA SYSTEM — <i>cont.</i>	RS.	RS.	RS.	RS.	
WESTERN SECTION—<i>cont.</i>					
(2.)—MAIN CANALS AND BRANCHES — <i>cont.</i>					
<i>Nizamputam Canal.</i>					
L. Earthwork	10,645	..	..	..	
<i>Commamur Canal.</i>					
B. Land	11,420	6,495	231	2,910	
D. Regulators	2,613	..	..	..	
F. River and Hill Torrent Works..	2,42,708	32,920	28,889	81,567	Rough-stone body wall of Karenchedu outlet completed. Excavation of foundations for Karenchedu aqueduct in progress.
G. Bridges	41,557	3,500	4,163	5,053	Excavation of foundations for In-kollu bridge in progress.
I. Navigation Works	1,59,020	3,450	3,341	1,35,506	Santaravur lock bridge completed.
K. Buildings	4,400	..	..	48	
L. Earthwork	3,08,257	11,965	9,449	99,611	Raising banks 2nd reach nearly finished.
O. Miscellaneous	7,100	..	..	..	
(3.)—DISTRIBUTARIES.					
<i>Bank Canal.</i>					
B. Land	6,670	..	..	..	
C. Works	53,890	..	..	..	
L. Earthwork	80,910	..	..	..	
<i>Nizamputam Canal.</i>					
C. Works	5,061	1,089	819	3,329	Head-slucies Nos. 1, 2, and 3 nearly finished.
L. Earthwork	10,211	..	..	6,732	
<i>Commamur Canal.</i>					
B. Land	14,675	170	..	557	
C. Works	61,058	..	..	10,695	
L. Earthwork	1,45,723	..	..	38,733	
O. Miscellaneous	2,000	..	..	..	
(4.)—DRAINAGE AND PROTECTIVE WORKS.					
<i>Répalé Main Drain.</i>					
B. Land	12,689	2,000	..	..	
C. Works	29,124	..	..	..	
L. Earthwork	2,06,608	10,000	9,992	9,992	Excavation in last 3 miles completed to a bottom width of 30 feet and average depth of 5 feet.
O. Miscellaneous	2,666	..	..	..	
<i>Bhatepulu Main Drain.</i>					
C. Works	17,248	..	..	..	
L. Earthwork	28,168	..	..	..	
O. Miscellaneous	2,439	..	..	..	
<i>Minor Drains.</i>					
B. Land	1,249	..	..	..	
C. Works	3,534	..	..	..	
L. Earthwork	7,146	..	..	..	
<i>Toongabudra Drain and Affluents.</i>					
B. Land	17,032	..	..	..	
C. Works	99,794	..	..	..	
L. Earthwork	4,92,153	..	..	..	
O. Miscellaneous	6,152	..	..	..	
<i>Romperu Drain and Affluents.</i>					
B. Land	1,500	..	..	..	
C. Works	21,790	..	..	..	
L. Earthwork	1,60,810	..	..	..	
Total, Western Section ..	31,00,068	1,27,589	1,09,323	5,05,571	
Unforeseen Expenses ..	1,70,225	..	..	..	
Total, Kistna Delta ..	1,05,61,527	1,91,987	1,49,895	43,80,145	

Statement showing the Progress of Irrigation, Productive Public Works (Capital Account),
for the Year 1882-83—*cont.*

Name of Project and Description of Work.	Amount of Sanctioned Estimate.	Grant for 1882-83.	Expenditure during the Year 1882-83.	Total Expenditure up to end of 1882-83.	Succinct Account showing the state to which the works have been advanced up to date, &c.
SANGAM PROJECT.	RS.	RS.	RS.	RS.	
[This report was received on the 25th April 1883.]					
(1.)—HEAD WORKS.					
A. Preliminary Expenses	51,130	..	..	51,130	Completed.
B. Land	800	..	..	..	
C. Works	5,03,911	1,52,500	1,67,902	1,97,659	Anicut excavation carried down to + 97 throughout; 1,003' of body wall raised average + 97.250' of rear retaining wall raised + 97.500 wells in rear row built 10 feet high, and 300 of them sunk 10 feet. South wing-wall completed to + 113. Under-slucie concrete raised to + 94.5 and wings begun.
K. Buildings	23,180	1,062	1,063	19,955	Temporary buildings completed.
O. Miscellaneous	40,835	500	1,533	6,525	River bank nine-tenths done.
P. Maintenance	2,005	1,800	2,190	2,190	
(2.)—MAIN CANALS AND BRANCHES.					
<i>Kanigiri Canal.</i>					
B. Land	2,04,500	10,350	6,584	18,392	Head-slucie piers raised 9 feet; all small arches turned; one large arch turned and four in progress; gearing completed. Main Canal 4 miles nearly done.
D. Regulators	1,05,654	55,000	60,273	66,582	Drop at 4th mile completed, except apron and revetment.
E. Falls and Weirs	25,000	9,000	9,869	16,668	Bridge at 4th mile completed, except parapets and apron.
G. Bridges	26,083	17,000	16,920	18,949	
L. Earthwork	2,38,402	87,000	67,240	99,007	
M. Plantation	3,000	..	..	..	
N. Tanks and Reservoirs	2,13,525	46,000	51,318	54,525	Kanigiri tank earthwork about one-fourth done; 4,000 cubic yards materials carried to site, puddle one-fourth done. Escape excavation half done.
O. Miscellaneous	7,082	2,000	1,347	4,244	
<i>Duvuru Canal.</i>					
D. Regulators	1,000	..	..	..	
L. Earthwork	2,000	..	..	..	
M. Plantation	1,000	..	..	..	
N. Tanks and Reservoirs	5,935	..	..	..	
(3.)—DISTRIBUTARIES.					
<i>Eastern Channel.</i>					
B. Land	5,500	..	..	..	
C. Works	1,54,610	7,900	7,789	9,854	Excavation for foundation to head-slucie four-fifths done. Bricks prepared.
L. Earthwork	1,50,610	880	889	889	Eastern channel 150 yards at head nearly completed to a width of 40 feet.
<i>Vidavaluru Tank.</i>					
N. Tanks and Reservoirs	3,350	..	..	..	
<i>Chavakacherla Tank Supply Channel.</i>					
C. Works	2,170	..	..	..	
L. Earthwork	800	..	..	..	
<i>Tavilla Tank Supply Channel.</i>					
C. Works	1,700	..	..	..	
L. Earthwork	200	..	..	..	
<i>Yellayapallem Branch Channel.</i>					
C. Works	11,990	..	..	..	
L. Earthwork	3,410	..	..	..	
<i>Varni Branch Channel.</i>					
C. Works	8,350	..	..	..	
L. Earthwork	2,470	..	..	..	
<i>Varni Tank Supply Channel.</i>					
C. Works	1,500	..	..	..	
L. Earthwork	100	..	..	..	
N. Tanks and Reservoirs	8,100	..	..	..	
<i>Aluru Channel.</i>					
B. Land	4,450	..	..	..	
C. Works	17,520	..	..	..	
L. Earthwork	4,540	..	..	..	

General Abstract—cont.

Systems.	Amount of Estimate.	Grant for 1882-83.	Expenditure in 1882-83.	Total Expenditure.
<i>Pennér Anicut System.</i>	RS.	RS.	RS.	RS.
Works	10,77,387	...	...	11,14,339
Establishment	1,59,073	...	...	2,78,585
Tools and Plant	22,746	...	...	27,858
Suspense Account	...	...	...	8,081
Total ...	12,59,206	...	...	14,28,863
Less Receipts on Capital Account ...	...	...	...	1
Net ...	12,59,206	...	...	14,28,862
<i>Cauvery Delta System.</i>				
Works	13,06,966	25,000	14,605	7,92,821
Establishment	3,26,741	2,990	3,359	1,97,913
Tools and Plant	46,518	195	219	19,674
Suspense Account	...	...	...	24,957
Total ...	16,80,225	28,185	18,183	10,35,365
Less Receipts on Capital Account ...	8	...	...	8
Net ...	16,80,217	...	18,183	10,35,357
<i>Srivaikuntham Anicut System.</i>				
Works	10,59,051	17,227	11,022	9,54,597
Establishment	2,92,536	3,873	2,446	2,73,191
Tools and Plant	12,550	252	160	10,530
Suspense Account	...	...	...	...
Total ...	13,64,137	21,352	13,628	12,38,318
Less Receipts on Capital Account ...	...	...	...	240
Net ...	13,64,137	...	13,628	12,38,078
Grand Total ...	3,21,88,476	10,82,461	9,91,078	1,95,86,631

STATEMENT showing the Nature and Progress during the Year 1882-83 of all Preliminary Surveys and Inquiries under prosecution in connection with new Irrigation Projects intended to be carried out from Loan Funds:—

Districts.	Name of Projects or Systems.	Particulars of Progress of Investigation.
Godáviri ...	Anamalanka Project ...	Papers with the Chief Engineer for Irrigation.
Nellore ...	Pennér Anicut System ...	Out-door work for taking surveys and levels has been completed, and the preparation of the estimate is in progress.

Office Note from the Examiner of Public Works Accounts, dated 6th June 1883, No. 262.

No. 68 I.

Submitted to Government.

The figures representing the expenditure incurred during the year exclude the supplemental entries for March 1883.

2. The expenditure during the year amounted to Rs. 9,91,078 against a grant of Rs. 10,82,461, showing a short outlay of Rs. 91,383 due to—

First.—Land compensation not having been paid by the Revenue Department to the extent to which funds were provided.

Second.—Dispersion of coolies in consequence of prevalence of small-pox in the Kistna Western Division.

Third.—Permission for proceeding with the Srivaikuntham Anicut Project works having been received about six months after the commencement of the official year.

Fourth.—Want of sanctioned detailed estimates for certain works in the Kistna Delta Completion Estimates; and

Fifth.—Recovery of expenditure by the sale of useless tools in the Godáviri District.

Ootacamund,
21st June 1883.

(Signed) J. O. HASTED, Colonel, R.E.,
Ag. Chief Engineer for Irrigation.

To the Acting Joint Secretary to Government,
Public Works Department, Irrigation Branch.

ORDER—dated 2nd July 1883, No. 508 I., Public Works.

Ordered that the foregoing statement be forwarded to the Government of India.

(Here enter No. 509 I., dated 2nd July 1883.)

(True Extract.)

(Signed) J. O. HASTED, Colonel, R.E.,
Ag. Joint Secy. to Govt., P.W.D.,
Irrigation Branch.

To Superintending Engineers.
To the Chief Engineer for Irrigation.
„ Examiner, Public Works Accounts.
„ Revenue Department.
„ Board of Revenue.

ENDORSEMENT—dated 2nd July 1883, No. 509 I., Public Works.

Forwarded.

(Signed) J. O. HASTED, Colonel, R.E.,
Ag. Joint Secy. to Govt., P.W.D.,
Irrigation Branch.

Exd. A. F. Goodall.
Spare Copies

IRRIGATION.

Govt. of (1883) Madras.

PUBLIC WORKS

Dated July, 2nd.

Recd.

Encl.

G.O., 2nd July 1883, No. 509 I.

JULY.

**Irrigation Productive Public
Works**

FORWARDING statement showing progress
of — (Capital Account) for 1882-83.

IRRIGATION.

Govt. of (1882) Madras.

PUBLIC WORKS.

Dated June, 13th.

Recd.

Encl.

13th June 1882, No. 466 I.

JUNE.

No. 50.

**Irrigation Projects suitable for
Famine Relief.**

STATEMENTS of —, forwarded to the
Government of India with observations.

Atty

PUBLIC WORKS DEPARTMENT.

Irrigation.

No. 50.

LETTER—from

COLONEL R. H. SANKEY, C.B., R.E.,

Secretary to Government, Public Works Department,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,

PUBLIC WORKS DEPARTMENT.

SIR,

With reference to your letter No. 163, dated 6th ultimo, I am desired by the

- I. Statement of irrigation projects which have been disposed of.
- II. Statement of irrigation projects to be indefinitely postponed.
- III. Statement of irrigation projects showing the agency by which it is proposed they should be investigated.
- IV. Statement showing irrigation projects in progress, or to be taken up, in order of importance.

Right Honorable the Governor in Council to forward the four statements of irrigation projects, as per margin, with a Note by the Chief Engineer for Irrigation, dated 18th ultimo.

2. Of these statements, No. I enumerates practically ten works which have either been sanctioned or the projects for which have been framed or submitted. Though classed technically as "Productive," they are each and all necessarily "Protective," and would moreover be very suitable for famine works, should such a calamity occur while they are in course of ordinary execution.

3. Statement II contains 31 works, which, though previously proposed and many of them in great degree investigated, are now proposed to be indefinitely postponed for the reasons assigned opposite each. In order to save time and prevent misapprehension it is thought best by this Government to place these on a prohibited list. To this list will also be transferred all other projects which, on sufficient investigation, are proved to the satisfaction of Government, to be capable of classification neither as Productive nor Protective.

For the reasons assigned in another letter of this date, No. ¹²⁷⁵_B W. His Excellency in Council is wholly averse to the commencement of large works during famine which cannot be classed either as Productive or Protective, or which would not from their nature be undertaken in ordinary years were funds available, or again any works however classified, which have not undergone all the needful scrutiny and been sanctioned by Government in ordinary course.

4. Statement III contains 56 works which it is proposed to investigate, and Statement IV shows the order of importance in which such investigations are to be taken up, and the project divisions or other agency to be employed with this object.