GOVERNMENT OF MADRAS

PUBLIC DEPARTMENT.

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PUBLIC WORKS—GENERAL

HISTORY OF THE DEPARTMENT

1 *Origin of the Madras Public Works Department, and character of public works* —The Public Works department of the Madras Presidency was first constituted, as a distinct and independent department under the direct control of Government, in the year 1858, but, for many years prior to that date, the public works scattered throughout the country had been under the charge of various agencies, which were finally, in the year 1858, merged into one large department The history of the department therefore divides itself naturally into two periods—the period anterior to the formation of the regular Public Works department in 1858, and the period subsequent to that date Before sketching the history of the department, it is necessary to premise that the great difficulties, which have occurred in its administration, have been, in the main, due to the character of the public works with which it has had to deal For the most part, these works consist of a vast property in tanks and channels, numbering over 31,000 and constructed long before the period of occupation of Southern India by the East India Company, are scattered over the whole area of the Presidency, and present a problem, as regards their effective maintenance, with which each successive Government has in vain attempted to deal satisfactorily To this fact may be traced the repeated reorganizations which the department has, at various times, undergone, and the unsatisfactory nature of such reorganizations At the present time, it is universally admitted that it is an absolute impossibility that the Public Works department can supervise and attend to the requirements of works so numerous and so scattered, and the question of the necessary steps to be taken for the effective maintenance of the great majority of the smaller tanks and channels is now in a fair way towards solution, and will be treated of under the head "Irrigation"

2 *Sketch of the administration of public works prior to the year* 1858 —Previous to the year 1858, all public works were carried out and maintained by three distinct and independent departments—

(1) *The "Maramut" department of the Board of Revenue*, which had the control of all irrigation works and navigable canals, all civil buildings in the provinces, and all roads and bridges not under the "Trunk Road department," or not situated in military cantonments
(2) *The Trunk Road department under the Superintendent of Roads*, which had the sole superintendence of the great lines of communication known as the "Trunk roads"
(3) *The Engineering department of the Military Board*, which had the superintendence of fortifications generally, of the roads, bridges, public buildings, both military and civil, at the Presidency town, together with all military buildings in the provinces, and roads and bridges in cantonments

By far the most important of these three departments was the "Maramut" department, which had practically the charge of the great majority of the public works of all kinds throughout the country, and on the efficiency of whose work was largely dependent the irrigation revenue of the Presidency The history of this department, together with that of the other two departments above mentioned, will now be briefly sketched from their formation down to their abolition in the year 1858

The Maramut Department —In the early times of British rule, the Collectors assumed the charge of the works of irrigation with that of collecting the revenue, and, without the aid of any professional assistants whatever, expended annually considerable sums of money in the upkeep and improvement of the works The natural consequence was much unprofitable expenditure and waste of public money In course of time, this state of things attracted attention, and Engineer officers were appointed, under the title of "Superintendents of Tank Repairs," to aid the Collectors, but, for many years, their numbers were too limited to be of any practical benefit At first, when the British possessions in Southern India were much smaller than they now are, there was only one such Superintendent, but, in the year 1809, a second was added, and the principal irrigated districts were divided between the two In the year 1819, the territories of the East India Company in the Presidency were divided into three divisions, each under the charge of a "Civil Engineer," with a suitable establishment, and the whole was placed under the control of an Engineer officer at the Presidency, styled the "Inspector-General of Civil Estimates" This may therefore be considered the date of the formation of the "Maramut" department In the year 1825, the whole "Maramut" department, including the Inspector-General himself, was placed under the Board of Revenue, the Inspector-General having however the power to record his views, for the information of Government, when they differed from those of the Board The department continued on this footing until the year 1836, when, with the object of giving it the benefit of the experience of the Chief Engineer, a change was made by giving that officer a seat at the Board of Revenue in the Public Works department The office of the "Inspector-General of Civil Estimates" was abolished, and an Engineer Secretary to the Board of Revenue in the Public Works department was appointed, upon whom devolved all the administrative duties previously performed by the Inspector-General In 1838, when the importance of the "Maramut" department to the revenue of the country, and the necessity for strengthening it so as to cope effectually with the vast amount of work devolving upon it, was daily becoming more apparent, a really material change was made The whole Presidency was re-arranged so as to form eight "Maramut" divisions, each under a "Civil Engineer," to whom were, at the same time, transferred the construction and repair of all civil buildings in the provinces formerly under charge of the Engineering department of the Military Board, whose establishments were accordingly decreased, while those of the "Maramut" department were increased On this footing the "Maramut" department remained, with the exception of minor changes in the strength of its establishment and arrangement of its divisions, until its abolition in 1858, but in 1845 its work was somewhat lightened by the transfer of the main lines of road to the "Trunk Road department"

The foregoing sketch has only dealt with the Engineering establishment of the "Maramut" department, and has not mentioned the agency by which public works were actually carried out The method of the execution of works, together with the general establishment of the department, will therefore now be treated of Until the abolition of the department in 1858, the duties of the "Civil Engineers," and of the establishment employed under them, were confined to projecting works, preparation of plans and estimates, inspection and direction of works under execution, and the measuring up of works when finished while the execution of the actual work on tanks, channels, roads, &c, rested with a separate establishment working under the orders of the tahsildars, and known as the "Revenue Maramut" establishment In certain cases, works (such as large buildings) were carried out by the "Civil Engineers" and their establishment, but these were exceptional, and, in the main, the duties of the "Maramut" department proper were of supervision only In the year 1852, the "Maramut" department numbered 24 officers of Engineers, besides 11 other officers of the line temporarily employed, 25 East Indian Surveyors or Assistants to the 'Civil Engineers," and 23 European Overseers belonging to the Sappers and Miners, while a trained native maistry was attached to each "Civil Engineer" This constituted the whole of the trained supervising "Maramut department" The "Revenue Maramut" establishment working under the tahsildars (who were practically the executive

officers by whom works were carried out) consisted of 12 "Superintendents of Maramut," or maistries of superior qualifications, trained by the "Civil Engineers," and transferred by them to the "Revenue Maramut" establishment, and 79 taluk maistries, who were generally without any proper training or qualifications of any sort, and worked under the supervision of the "Superintendents of Maramut" The whole establishment, whether for supervision or execution of works, remained on this footing till the "Maramut" department was finally broken up

The Trunk Road Department—This department was not constituted till the year 1845 Previous to that date, all roads, except those at the Presidency and in military cantonments, were first under the Collectors, and finally under the "Maramut" department of the Board of Revenue As a measure of relief to the overworked "Maramut" department, and to ensure the systematic improvement of the main lines of road, the Trunk Road department was formed in 1845 This department appears to have been altogether an abortive creation, and to have been practically a failure for many years, owing to the inadequate subordinate establishment placed at its disposal Its history can accordingly be briefly narrated As at first constituted in 1845, it was placed under an officer, styled the "Superintendent of Roads," to whose charge was entrusted the formation, maintenance and repair of the main lines of road, extending in the aggregate to a total length of 2,300 miles, all other roads previously in their charge being still retained by the "Maramut" department of the Board of Revenue The main lines of road were, at that time, in very bad order, for many years had been much neglected, and were generally unbridged and unformed In 1846, the Superintendent proposed, what he considered to be, the necessary subordinate establishment required by his department, in order to carry out properly the actual execution of the work to be done on roads, for which an annual expenditure of four lakhs had been sanctioned The establishment was refused, and the consequence was that the department, being utterly unable to cope with the work required of it, and to expend the funds allotted to it, gradually transferred much of its work to the "Maramut" department, which it was originally expressly designed to relieve In 1851, though the "trunk roads" were still nominally under charge of the Superintendent, their maintenance was attended to chiefly by the "Maramut" department, and only 390 miles of main road remained actually under the charge of the "Trunk Road department" By 1853, the department had been strengthened, so as to keep up fairly with the work then expected from it, and the establishment of Europeans for the duties of superintendence numbered 29 in all, viz, the Superintendent, 6 Assistants, and 22 upper subordinates

The Engineering Department of the Military Board—The Military Board of the Madras Presidency was formed as far back as the year 1785, and was divided into the Ordnance department and Engineer department, with the latter of which we have only to deal The engineering works under the Board were distributed in ten divisions, corresponding with the divisions of the army Five of these divisions were controlled by Superintending Engineers, with executive officers and a suitable establishment of Overseer-Serjeants, &c, for the execution of works In the remaining five divisions, there was no officer permanently under the orders of the Board, but the execution of works was undertaken by the Commanding or Staff officer In 1838, simultaneously with the reorganization of the "Maramut" department in that year, the Superintending Engineers of the Military Board were abolished, the charge of all the civil buildings in the provinces, formerly under the Military Board, was transferred to the "Civil Engineers" of the "Maramut" department, while the charge of the military buildings was transferred to the Staff officers of stations, together with a portion of the establishments trained under the Superintending Engineers The other works under the control of the Military Board, viz, the construction and maintenance of roads and bridges in Military cantonments, &c, were also placed at stations, under the Staff officer, and at division head-quarters under the Quartermaster-General of the division staff By this reorganization of 1838, the Staff officers of stations practically became—though quite unfitted for the post—the Executive Engineers of the Military Board. This system remained in force until the abolition of

the Board in 1858 Prior to its abolition the Military Board had given rise to universal dissatisfaction Its working was characterised by great delays, its supervision was most ineffective, and—to quote from a Government order of the day—it was "a mere clog to public business"

Allusion has been made, in the sketch of the history of the "Maramut" department, to the "Chief Engineer" The duties of this officer, prior to the formation of the Public Works department in 1858, appear to have been of the most multifarious character, and it is difficult to see where they began and where they ended Chief among them were that, besides being in immediate charge of certain works, and collecting certain items of revenue, he had two separate offices, besides his own office, to attend to, viz, the Public Works department of the Board of Revenue and the Military Board office, he had also control over all fortifications, inspected all work done under the orders of the Military Board, inspected all Government roads in the Presidency, and prepared drawings, &c, of certain works

3 *Formation of the Madras Public Works Department in* 1858—In 1850, the importance of the systematic management and execution of public works throughout the Presidency had attracted the attention of the Court of Directors in England, and, under their orders, a Public Works Commission was appointed in the following year This Commission issued, towards the end of 1852, a very full and particular account of the existing system of Public Works administration, and reviewed at length the working of (1) the "Maramut" department of the Board of Revenue, (2) the Trunk Road department, and (3) the Engineer department of the Military Board, they pointed out the generally neglected state of the public works of the country, except in a few favored districts, dwelt on the inadequacy of the annual grants allotted for public works, and on the inadequate establishments appointed to look after them, and brought to notice the benefits to be derived, by the State, from the systematic and judicious expenditure of public money in the promotion of public works The Commission proved conclusively that the Board of Revenue was no longer able to deal with the business of the "Maramut" department, owing to the vast and progressive increase in the works of this department, and the greatly increased proportions of its establishment, they brought to light many abuses in the execution of works, and commented on the inefficiency of the executive establishment employed, and finally they pointed out that, where public works are scattered over a very large area of country as in the Madras Presidency, it was unthrifty to have three separate establishments for the management of different classes of work, and recommended the establishment of one department for the management of all public works, civil or military They proposed that the establishment should consist of 13 Inspecting Engineers, and a District Engineer with a staff of assistants and subordinates for each Collectorate At the time the Commission wrote (1852), the entire cost of the Public Works establishment was Rs 5,79,474 per annum, and the expenditure on works, Rs 24,50,000 The proposals of the Commission involved an annual charge of Rs 14,69,000 for establishment, and an annual expenditure of 48 lakhs After a great deal of discussion with the Home Government and the Government of India during the years 1853—57, an establishment was finally sanctioned in the year 1858 at a cost of Rs 13,06,614, for the purposes both of supervision and execution of works, and thus, for the first time in its history, the department as a whole became regularly an executive department The sanctioned scale consisted of a Chief Engineer with an Assistant, 3 Inspecting Engineers, 20 District Engineers in immediate control of the Executive officers, 78 Executive and Assistant Engineers, 204 upper subordinates, composed of sub-engineers, supervisors and overseers, and 714 lower subordinates or sub-overseers This establishment looked after the public works of the whole Presidency, which was divided into 87 executive ranges

4 *Further history of the department from* 1858 *to* 1863—In consequence of the mutiny, the expenditure on public works was much restricted, and a considerable part of the Public Works establishment sanctioned in 1858 was accordingly discharged in the year 1859 In 1860, it was considered that the organization of 1858 was unnecessarily elaborate, and had failed to answer the expectations formed of it Various changes were advocated and considered, and, pending the consideration of these

measures, the Chief Engineer was appointed Secretary to Government in the Public Works department, the three Inspecting Engineers or Deputy Chief Engineers were temporarily vested with the powers of the Chief Engineer in their respective circles, and the question of the expediency of transferring the charges of the minor works of irrigation, and the district roads, to the Revenue officers, was referred to the Board of Revenue, and eventually to the Chief Engineer and a Committee of Engineer officers In 1863, the question of the complete reorganization of the Public Works department, so as to reduce the charge for establishment in accordance with the wishes of the Government of India, was referred to another Committee, upon whose recommendation the organization of 1858 was destroyed, and the following radical changes in the administration of the department were made—(1) the three Deputy Chief Engineers, and twenty District Engineers were abolished, and in their place were substituted eight Superintending Engineers, each with the full powers of a Chief Engineer in his division, (2) the 84 Public Works ranges into which the Presidency was then divided were placed in charge of Executive Engineers, Assistant Engineers and upper subordinates, under the direct control of the Superintending Engineer, and it was determined that no ranges should in future be placed under the charge of lower subordinates as was formerly the practice, while the class of sub-overseers was abolished altogether, (3) the Chief Engineer and Secretary to Government, Public Works department, was divested of all the duties formerly performed by him in his capacity as Chief Engineer, except the allotment of funds, the preparation of budgets, and the promotion of subordinates With regard to the question, originally raised in 1860, as to the expediency of transferring minor irrigation works to the Revenue department, the Commission deprecated any general transfer of works to the Revenue department, but urged that the law relating to "kudimaramat," or customary free labor of the people upon petty repairs of irrigation works, should be so modified, as to ensure the due enforcement of the obligation, and enable Government to make the maintenance of minor works of irrigation devolve on those interested in them, in consideration of a partial remission of revenue In accordance with this recommendation, the Government called for the opinion of the Board of Revenue and certain selected officers on the proposed modification of the labor law

5 *Public Works Commission of* 1870, *and reorganization of the department in* 1872 — The next event of importance in the history of the department was the appointment of a Chief Engineer for Irrigation in the year 1867, but with this exception, there was no important change in the organization of the department, as settled in 1863, until the year 1872 In the year 1870, in consequence of the increasing difficulty experienced in maintaining the minor works of irrigation throughout the country, a Public Works Commission was appointed to consider the agency by which they should in future be maintained, and to consider the expediency of reorganizing the Public Works department This Commission, though not unanimous in their report, enlarged on the increasing difficulty of enforcing the liability of the ryots to perform "kudimaramut," or customary labor upon irrigation works, and the evil results of the complete divorce of the Engineering agency from the Revenue department, they also pointed out the inadequate supervision by the superior officers of the Public Works department, owing to inherent defects in its constitution, whereby the eight Superintending Engineers had immediately under their control as many as 88 executive officers in charge of ranges, and they remarked that the organization of 1858 had never had a fair trial, and that the arrangement, resolved on in 1863, of rendering the range officers independent of any control but that of a few Superintending Engineers, was a mistake They therefore recommended, both as a means of securing more effective supervision, and of restoring the intimate co-operation of the Revenue department with the Public Works department (a point which they considered of vital importance) in the prosecution of public works, that the Superintending Engineers should be abolished, and the District Engineer organization of 1858 again restored, by appointing a District Engineer for each Collectorate to control the range officers within that Collectorate. With regard to the important question of the effective maintenance of the minor works of irrigation, the Committee (like that of 1863) were decidedly of opinion that they should not be handed over to the Revenue department,

but considered that, as their numbers were far too great to admit of their effective maintenance by any Government department, arrangements should be made for the execution of all ordinary repairs, not requiring professional skill, by the agency of the ryots themselves, by providing that a reduction of assessment, in the form of a remission of revenue, should be granted for the execution of such repairs The Committee also recommended the revival of "kudimaramut," or unpaid village labor of the ryots upon works of irrigation, by a legal enactment, and appended to their report a draft Act for its enforcement It was not, however, until the year 1872, that practical effect was given to the chief recommendations of the Committee, and in the latter part of that year the Public Works department was again reorganized, the principal changes made being (1) the abolition of the eight Superintending Engineers, and the appointment of 21 District Engineers in direct communication with the two Chief Engineers, and (2) in consequence of the abolition of the Superintending Engineers, who, under the constitution of 1863, exercised the full powers of a Chief Engineer in their own divisions, the restoration to the Secretary to Government, Public Works department, in the exercise of his capacity as Chief Engineer, of all the powers of the professional head of the department, which had been curtailed in the organization of 1863 The aggregate cost of the new establishment was Rs 21,50,000 per annum

6 *Further history of the department from* 1872 *to date* —The further changes made in the organization of the department were compressed into the short space of the three years 1878 to 1881, and can be briefly recounted The District Engineer organization of 1872 remained in force up to December 1878, when it was again abolished, in favor of the Superintending Engineer system The Presidency was divided into five circles of superintendence, each under a Superintending Engineer, and the number of executive divisions was reduced to 39 In the autumn of 1879, considerable reductions were made in the executive staff of the department, in consequence of the financial pressure, and the reduction of grants for expenditure on public works, and the number of executive divisions was further reduced to 29. It being found that, with the increased areas thus given to each division, the staff of the department was no longer equal to the task of executing the greater part of the public works of the Local Fund circles, all such works were, in the official year 1879-80, handed over to the Local Fund boards for execution by their own agency The consequent reduction in the contribution of local funds to the cost of the Public Works establishment, amounting to about 5½ lakhs, together with the financial pressure then existing, which involved extensive reductions in the grants for works for the year 1880-81, necessitated a still further reduction in the strength of the Public Works establishment, and fifteen officers of the Engineer establishment and 79 upper subordinates were accordingly retired The Presidency was divided into three Superintending Engineers' circles, instead of the five which had previously existed, the Public Works establishments were entirely withdrawn from certain parts of the country, and the number of executive divisions was reduced to 19, of which 13 were under the Superintending Engineers and the remaining six under charge of four Superintendents of Works, who were placed in direct communication with the Chief Engineers Finally, in the year 1881, a large increase was made in the Engineer and Upper Subordinate establishment, which admitted of the Presidency being re-arranged into six Superintending Engineers' circles, sub-divided into 30 executive divisions, of which four were divisions sanctioned for the execution of projects At the beginning of the official year 1884-85 this re-distribution was still in force, except that alterations had been made as regards the number of executive divisions as shown in paragraph 15

7 *Points requiring notice in the History of the Public Works Department* —A perusal of the foregoing paragraphs, relating to the history of the Public Works department, subsequent to its formation in 1858, will bring out two important points— (1) the gradual disuse of "kudimaramut," (2) the ever-recurring difficulty regarding the maintenance of the minor works of irrigation The decline of "kudimaramut" dates from the formation of the Public Works department in 1858 The officers of the new Department of Public Works then created were not vested with any powers for enforcing the obligation, while the Revenue authorities, having no longer the

executive charge of the repairs of the minor irrigation works, made no systematic effort to ensure that the obligation should be carried out It will be seen that both the Committee of 1863, and the Public Works Commission of 1870, attached great importance to the revival of "kudimaramut"

The decline of "kudimaramut" tended largely to the difficulty experienced in the effective maintenance of minor irrigation works, added to which (*vide* paragraph 1) the great number of these works and their scattered nature absolutely precluded, from the very first, their effective maintenance by on Government agency The frequent administrative changes made, from time to time, in the department since its formation in 1858, are largely due to the impossible nature of the attempt to provide for the maintenance of these minor irrigation works

ORGANIZATION AND ADMINISTRATION OF THE DEPARTMENT

8 *Main branches of the department*—As at present constituted, there are two executive branches of the Public Works department, viz, the General and Buildings and Roads branch and the Irrigation branch, each having a Chief Engineer as its responsible executive head The senior Chief Engineer is in charge of the General and Buildings and Roads branch, and is the professional head of the whole department In addition to his professional duties as Chief Engineer, Public Works department, he is also Secretary to Government in the Public Works department, and in his dual capacity deals with the general policy and administration of the department, and with the promotion, posting, and discipline of the whole establishment of the Public Works department He is assisted in his office work by a Deputy Chief Engineer, who is also Under Secretary to Government in the Public Works department

The junior Chief Engineer is the Chief Engineer for Irrigation, who is also Joint Secretary to Government in the Irrigation branch He is the professional adviser of Government in all matters connected with irrigation, and manages the Secretariat work of the Irrigation branch

In addition to the two executive branches of the department, there is a third branch, presided over by the Consulting Engineer for Railways who controls the operations of Guaranteed Railways and is the channel of communication between the Government and Railway officials The Consulting Engineer is assisted by two Deputies The officers of this branch are not borne on the Provincial list of the Madras Public Works department, but on the General Railway list of the Government of India The Consulting Engineer for Railways is gazetted as Joint Secretary to the Government of Madras in the Railway branch, and one of his Deputies as *ex-officio* Under Secretary in that branch.

Finally, there is the Accounts branch of the department under the Examiner of Public Works Accounts, which deals with the control and audit of the expenditure incurred by the two Executive branches, the Guaranteed Railways having a separate Accounts establishment

9. *General Establishment of the Department*—Although the executive work of the department is divided into two branches, no separate executive establishment is maintained for the work of each branch, as the great area of the Public Works divisions in the Madras Presidency, and the scattered nature of the public works, precludes any such division of establishment being advantageously made The one general executive establishment of the department is therefore employed indifferently in the general execution of all works, entrusted to the department, such as irrigation, roads, buildings, &c, and the services of each member of the department is therefore utilised in the execution of works in the best practicable way, irrespective of the kind of work to be carried out, or the service for which the work is required The only purely separate executive establishment employed is that known as the Navigation and Water Regulation establishment, which is a small special establishment maintained in connection with irrigation works, and charged to "Imperial irrigation." This extra establishment is employed in the [illegible] water for the purposes of irrigation, the regulation of the supply in [illegible] the control of the canal navigation

and the record of traffic, and the general conservancy of canals, channels and embankments The Accounts establishment is employed indifferently in the same way as the Executive establishment, and the cost of the one general establishment is divided arbitrarily between the several funds for which works are carried out The rules for the debit of the amount charged to "Irrigation" are given in paragraph 2 of the Article on Irrigation All other funds contribute 23 per cent on the outlay on works, and 5 per cent on the revenue collected in the Public Works department The balance of the establishment charges, whatever it may amount to, is charged to "Provincial," while, for the purposes of account, the whole Public Works establishment is regarded as Provincial, to which head the total charges for establishment are, in the first instance, debited During the official year 1882-83, the whole Public Works establishment charges amounted to Rs 18, 21,957, of which Rs 11,76,113 were charged to "Imperial" as follows —

	RS
Imperial, Irrigation	10,18,968
Imperial, Military	1,11,767
Imperial, other services	45,378

Rs 78,553 were charged to "Provincial," and Rs 43,182 to "Local" funds on account of work executed, while the balance of Rs 5,23,909 was the charge which "Provincial" had to bear of the establishment charges of the Public Works department Of the whole amount of Rs 18,21,957 for establishment, Rs 16,84,518 were for the Executive establishment, and Rs 1,37,439 for the Accounts establishment

10 *Classification of Establishment*—The establishment of the department is classified into two distinct branches—I *The Executive branch*, which includes all officers and other persons necessary for the preparation of designs and estimates, the supervision and control of public works, and the disbursement of money, together with the requisite office clerks and other persons II *The Accounts branch*, which includes the entire establishment maintained for the control and audit of all expenditure incurred from the annual grants for public works The Executive branch is sub-divided into (1) Engineer establishment, (2) Upper Subordinate establishment, (3) Lower Subordinate establishment, (4) Office establishment, and (5) Petty establishment, while the Accounts establishment is divided into the Control establishment corresponding to the "Engineer" establishment, and the Accountant establishment corresponding to the "Upper Subordinate" establishment, of the Executive branch

11 *The Engineer establishment*—The Engineer establishment is composed of (1) officers of the Royal Engineers, (2) passed students of the Royal Indian Engineering College, Cooper's Hill, (3) 'Stanley" Engineers appointed in England, (4) Civil Engineers appointed in India, (5) passed students of the Civil Engineering College, Madras, and (6) Engineers promoted from the upper subordinate grade, and is classed and graded as follows —

(*a*) Chief Engineers in two classes, (*b*) Superintending Engineers in three classes, (*c*) Executive Engineers, one class in four grades, (*d*) Assistant Engineers, one class in three grades The duties of a Chief Engineer are to control the general operations of his particular branch, to receive reports and communications from the Superintending Engineers, through whom he conducts the general business of the department, and to check projects and designs above a specific amount, and lay them before Government accompanied by a distinct expression of opinion as to their merits The Superintending Engineer controls the Executive Engineers within his circle, through whom he conducts all the details of business, he is vested with considerable powers of sanction of public money, and refers all questions beyond his powers to the Chief Engineer, and, finally, he is an Inspecting officer, and is required to make regular tours of inspection through all the divisions in his circle The Executive Engineers of divisions are in immediate charge of all public works within their divisions, and are concerned with the actual execution of works, the disbursement of money, and the custody of stores and material. They are vested with certain limited powers of sanction, and prepare designs and estimates for the approval of the Superintending Engineer. The Assistant Engineers usually hold charge of sub-divisions under the orders of the Executive Engineers,

and are practically his Assistants in the superintendence of works, the preparation of projects and designs, and the general duties of the department The following was the sanctioned scale of the Engineer establishment of the department at the beginning of the official year 1884-85 —

Chief Engineers	2
Superintending Engineers	6
Executive Engineers	42
Assistant Engineers	40
Total	90

12 *The Upper Subordinate establishment* —The Upper Subordinate establishment consists of men appointed from the non-commissioned officers and soldiers of Her Majesty's Army in India, or from Civilians, European or Native, who have obtained the required certificates from the Madras Civil Engineering College, or, in the case of Royal Engineer soldiers, that of the Commandant of Sappers and Miners, or again from men who, as Mechanical Engineers, &c, have a thorough practical knowledge and experience in some useful branch of engineering The Upper Subordinate establishment is classed and graded as follows —(1) Sub-Engineers, one class in three grades, (2) Supervisors, one class in two grades, and (3) Overseers, one class in three grades The members of this establishment have either charge of a sub-division of works, under the immediate orders of the Executive or Assistant Engineers, or are assigned other specific duties, not clerical, in connection with the execution of works or with the investigation of projects At the beginning of the official year 1884-85, the sanctioned number of the Upper Subordinate establishment was 185

13 *Lower Subordinate establishment, Office establishment, Petty establishment* — The Lower Subordinate establishment consists of natives who have a sufficient knowledge of ordinary building, and such acquaintance with plan drawing and surveying as will enable them to set out and supervise the construction of the minor class of works undertaken by the department The members of this establishment consist of the class of sub-overseers, divided into three grades

The office establishment consists of the clerks and draftsmen engaged on purely clerical duties, together with the inferior servants employed in offices The establishment of clerks is divided into five classes, of which the first four classes are sub-divided into three grades, and the fifth class into two grades, while the draftsmen are divided into three classes

The petty establishment includes all storekeepers, artificers, watchmen, lascars and other inferior servants not attached to officers, employed on general duties, whose salaries are not provided for in any estimate for a work

14 *Accounts establishment* —The Accounts establishment is a Provincial service as far as the incidence of charges is concerned, but the superior officers of the branch are under the orders of the Government of India The branch is divided into (1) Examiners arranged in four classes, of which the fourth class is divided into three grades, (2) Deputy Examiners, one class in two grades, (3) Assistant Examiners, one class in two grades, (4) Apprentices, and (5) Accountants The establishment comprised in (1), (2), (3) and (4) corresponds with the "Engineer" establishment, is recruited from much the same classes, and forms a general service under the direct orders of the Government of India The duties of the Examiner are to control the operations of the Accounts establishment in the Presidency, to audit the accounts of receipts and expenditure submitted to him by the Executive Engineers and other disbursing officers of the department, and subsequently to compile these accounts into one general account for the Presidency, to be submitted to the Accountant-General to the Government of India for incorporation in the general accounts of the empire The establishment of Accountants forms one class divided into five grades, and corresponds to the "Upper Subordinate' establishment of the Executive branch It is composed both of Europeans and Natives who have passed the principal tests. The members of it are under the orders of the Madras Government, and are employed indifferently either in the Central office at Madras in auditing and compiling the divisional accounts,

or at the head-quarters of the several divisions in preparing the accounts from the cash-books, and other initial records, maintained by the Executive Disbursing officers

15 *General sketch of the Public Works system together with distribution of circles and divisions* —From the foregoing paragraphs concerning the administration and organization of the department, it will be clear, first, that the Chief Engineers direct the general operations of their particular branch through the Superintending Engineers, and are, in the main, administrative officers, second, that the Superintending Engineers are inspecting and supervising officers, controlling the Executive Engineers within the limits of their circle, and third, that the Executive Engineers, and all the officers and subordinates employed under them, form the establishment actually concerned with the execution of works The whole Presidency is divided into six circles under the charge of Superintending Engineers, which circles are sub-divided into 28 permanent divisions, each in charge of an Executive Engineer In pursuance of a policy which has lately been introduced, important works of considerable magnitude are now being carried out by the aid of temporary establishments, the works themselves being kept apart from the other works undertaken in the permanent divisions in which they are situated, and a special temporary division being formed for their execution Of these temporary divisions there are now seven, which brings the total number of sanctioned divisions to 35 The following statement shows the Superintending Engineer circles, the sanctioned executive divisions, together with the area in square miles of each circle or division, and the district in which each division is situated, at the beginning of the official year 1884-85 —

STATEMENT showing the Public Works Circles and Divisions

Circles	Head quarters of circles		Divisions	Head-quarters of divisions	Areas of divisions in square miles	Areas of circles in square miles	Districts in which situated
No I	Dowlaishweram	1	Ganjam	Berhampore	5,674	18,226	Ganjam
		2	Rushikulya (temporary)	Do			Do
		3	Vizagapatam	Waltair	5,016¼		Vizagapatam.
		4	Godávari, Eastern	Dowlaishweram			Godávari
		5	Do Central (temporary)	Gunnavaram	7,535¾		Do
		6	Godávari Western.	Chettipett			Do
No II	Masulipatam (Bezváda)	7	Kistna, Eastern	Bezváda	8,387½	16,469½	Kistna.
		8	Gudiváda (temporary)	Gudiváda			Do
		9	Kistna, Western	Duggirala			Do
		10	Nellore	Nellore	8,082½		Nellore
		11	Sangam Project	Sangam			Do
		12	Buckingham Canal	Nellore			
No III	Bellary	13	Bellary	Bellary	11,051	26,358½	Bellary
		14	(C) Project	Do			Do
		15	Cuddapah	Cuddapah	8,304		Cuddapah
		16	Kurnool	Kurnool	7,003½		Kurnool
		17	Kurnool Canal	Do.			Do
		18	Nilgiri	Ootacamund	1,705		Nilgiri
		19	West Coast	Calicut	8,497		Malabar and Canara
No IV	Coimbatore	20	Coimbatore	Coimbatore	14,915	25,117	Coimbatore and Salem
		21	(B) Project	Do			Do
		22	Barur Project	Barur			Salem
No V	Madras	23	North Arcot	Vellore	7,029½	15,150¼	North Arcot
		24	South Arcot	Cuddalore	4,943¾		South Arcot
		25	Chingleput	St Thomas' Mount	3,139½		Ching'eput
		26	Presidency and Bangalore	Bangalore	38		Madras and Bangalore
		27	Presidency Work shops	Madras			Madras
No VI	Trichinopoly	28	Trichinopoly	Trichinopoly	4 599½	20,455¼	Trichinopoly
		29	Tanjore	Tanjore	1,667½		Tanjore
		30	Cauvery and Vennár Regulators (temporary)	Grand Anicut, Tanjore			Do
		31	Negapatam	Negapatam	1 825		Do
		32	Madura	Madura	8 419½		Madura
		33	Tinnevelly	Palamcottah	3,944		Tinnevelly

Statement showing the Public Works Circles and Divisions—*Continued*

Circles	Head-quarters of circles	Divisions	Head-quarters of divisions	Areas of divisions in square miles	Areas of circles in square miles	Districts in which situated
Supt of Works Tank Maintenance Scheme.	Madras	34 Consulting Architect	Chepâk			Madras
	Do	35 No 1 Tank (temporary)	Madura			At present in Madura
		36 No 2 Tank (temporary)	St Thomas Mount			At present in Chingleput
		37 Lower Coleroon Project	Cuddalore			South Arcot
				Total area	1,21,777¼	square miles

EXECUTION OF WORKS BY THE PUBLIC WORKS DEPARTMENT

16 *Functions of the department in regard to public works* —The Public Works department deals with all engineering works undertaken by the State, the construction or repair of which has to be carried out under professional superintendence Detailed designs and estimates for public buildings and other engineering works, required by any other department of Government, are drawn up by the Public Works department, and, after the general arrangements proposed have been approved, the Public Works department carries out the works as soon as funds are made available to meet the estimated expenditure The Public Works department is thus called upon to plan and execute works for the Government of India, for the Provincial Government, for the various Local Fund boards, for the Board of Revenue, and the heads of other departments as trustees of certain special funds which they administer; for the Court of Wards, and occasionally for municipal corporations

17 *Imperial works undertaken by the department* —For the Imperial Government, the Public Works department undertakes the construction and maintenance of the following works (*a*) *Irrigation*, including all works in connection with irrigation and river conservancy; (*b*) *Imperial* proper, sub-divided into (1) *Military*, including all works connected with the army, such as Fortifications, Barracks, Commissariat and Ordnance buildings, Military rest-houses, and Cantonment roads, (2) *Other Services* including all buildings and other works connected with the Postal, Telegraph and Salt departments, together with such mining operations, light-houses and other public improvements as may be considered to be rather of imperial than of local interest To meet the expenditure on these heads, grants are yearly made by the Imperial Government from the ordinary revenues of India, and also from loans raised by the Imperial Government for the purpose of constructing productive public works For the year 1884-85, the Imperial grants for "works" amounted to Rs 32,75,909 from Ordinary Revenue, and Rs 16,06,162 from Loan Funds The total grant was allotted as follows:

	RS
Irrigation	42,94,071
Imperial Military	4,73,300
Imperial Other Services	1,14,700
Total	48,82,071

By far the most important of the works thus carried out by the Public Works department for the Government of India are those connected with irrigation and conservancy of rivers

18 *Provincial works undertaken by the department* —For the Provincial Government, the Public Works department constructs and repairs all buildings in connection with the Judicial, Revenue, Customs, Police, Educational, Jail, Medical, Marine, and Ecclesiastical departments, as well as the navigable canals not forming part of a system of irrigation channels To these may be added a few special roads, all works connected with the improvements, water-supply, and drainage of towns other than municipalities, all works connected with harbours, and works connected with the light-houses required for the purely local coasting trade For the year 1884-85, the grants from Provincial funds for expenditure on "works" amounted to Rs 17,60,391

19 *Local and special works undertaken by the department* —Under existing arrangements, the Public Works department only executes a few works on behalf of Local Fund boards, and all roads in the Presidency, together with all other works, formerly undertaken by the Public Works department for the Local Fund boards, are practically constructed and maintained by the agency of establishments employed by the Local Fund boards, except such works as from time to time are specially excepted This system dates from the year 1879-80, when a very comprehensive measure of decentralization, with regard to all Local Fund works, was carried out, by giving full scope to Act IV of 1871, constituting the formation of Local Fund boards The duties of the Public Works department with regard to Local Fund works are, in the main, now confined to the professional scrutiny of important designs and estimates for bridges, &c An additional establishment is maintained in the offices of the Superintending Engineers and in that of the Chief Engineer, Public Works department, for the purpose of scrutinising such projects, and a contribution of Rs 21,250 is annually paid by Local Funds on account of the professional scrutiny of their estimates by the Public Works department establishment The "Special Works" undertaken by the Public Works department are executed from certain special funds administered by Government and by the Board of Revenue For the year 1884-85, the grants from Local and Special funds for expenditure on "works" amounted to only Rs. 16,710 and 25,700 respectively

20 *Method of execution of works* —The execution of public works in the Madras Presidency is, for the most part, carried out either by daily labor under the direction of the officers and subordinates of the department, or by petty contract under the same supervision The employment of large contractors is mainly confined to the preparation and supply of materials for large works, and to the construction of certain classes of buildings Large workshops are maintained at the Presidency town and at Dowlaishwaram and Bezvâda, the head-quarters respectively of the irrigation works of the Godâvari and Kistna Deltas, for the execution of repairs to machinery and the design and execution of the various classes of work usually turned out by engineering workshops, and required from time to time by the several executive divisions of the Public Works department Except in cases of emergency, Executive Engineers are not authorized to put in hand any work without a duly sanctioned estimate and an appropriation of funds An appropriation once made, the work is put in hand by the Executive Engineer after the necessary arrangements have been made with the Revenue officers for the formal acquisition of the land required Funds for the prosecution of the work are drawn by the Executive Engineer from the nearest treasury by cheques on his public account, and, on completion of any work estimated to cost over Rs 500, that officer prepares and signs a "completion report," certifying as to the manner in which the work has been carried out

21 *Incidence of Public Works Expenditure* —The grants for expenditure from Imperial funds on public works are made annually by the Government of India and are met from the revenue of the year, or from funds raised on loan (*vide* paragraph 17 *supra* and paragraph 3 of Article on Irrigation) The grants from Provincial funds for expenditure on public works are fixed annually by the Financial department of the Madras Government, and are, as far as practicable, regulated by the amounts set apart by the Government of India under Lord Mayo's decentralization scheme of 1870, whereby the permanent assignment made to "Provincial," for the Madras Presidency, was fixed at 23 3 lakhs for expenditure on public works The actual grants and expenditure have, however, fallen far short of this amount, as, excluding the famine year of 1877-78 (when an abnormal expenditure of Rs 60,88,309 was incurred), the average annual expenditure from Provincial, from the years 1871-72 to 1882-83, was only Rs 18,97,560 The grants to Provincial have, however, been increased by the Government of India for the year 1882-83, 1883-84, and for each remaining year of the current Provincial contract, *i e*, up to 1886-87 The total expenditure by the Public Works department from Imperial, Provincial and Local Funds from the years 1870-71 to 1882-83, including the charges for establishment and tools and plant, is shown in the accompanying statement —

Statement of total expenditure in the Public Works department from 1870-71 to 1882-83

Class of works	1870 71	1871 72	1872 73	1873-74	1874 75	1875-76	1876-77	1877-78	1878 79	1879-80	1880 81	1881 82	1882 83
Imperial	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs
Irrigation and Navigation—													
Original works	8 00 020	8,02 174	8 78 509	8 13 587	8 10 354	10,96,114	6 17,969	4 96 474	8,15,358	4,43 746	5,69,240	7,16 428	(a) 187,53,191
Repairs	11 44 826	11 22 500	12 61 303	14 00 194	15 43 707	10 22,742	14 56 378	15,44 063	12 09,127	11 35 630	11,91,402	12 20,224	16 25,069
Establishment	1,34 877	1,97 131	6 36 032	6,34 694	8,28 231	8 51 904	7 64 072	14,92 821	8,91 143	7,44 298	6,24 172	6 61,764	10,18,218
Tools and plant	10,702	6,532	2,30,625	44 216	83,216	1,35,352	1 46 980	1,71,353	92,279	1,26,077	1,83,662	1,30,222	1,61 046
Total	20 94,925	21 28,337	29,79,469	28,92,691	32,65 548	36 06,112	29 85,399	37,04 211	30,07,907	24,50,051	25,68,476	27,28 638	215,57,524
Military—													
Original works	3 32 353	2,10 667	2 84 121	2,69 461	3 28 534	3 87,165	2,90 575	3 05 898	2,17 110	21 227	1 39,576	1,15,574	2 48,365
Repairs	2 23,005	2,23,485	2 43 069	2 59,703	2 32 218	2 60 593	2 32 256	2 40 403	2 00,779	1,90 125	2,77,447	2,69,097	2,92,925
Establishment			1,39 730	1,19 082	1,46 350	1,63 465	1,62 822	1,53,120	1,69 998	1,58 709	99,205	96,161	1,11,767
Tools and plant			20,888	10,097	28,078	23,605	25,367	10,176	15,731	16,023	9,925	9,603	7,221
Total	5,55,358	4,34,152	6,87,808	6,63,343	7,35,180	8,34,828	7,1 ,020	7,14 597	6,03 618	3,86,084	5,26,203	4,90,435	6,60,308
Other Services—													
Original works	11 83 000	32,310	47,760	21,046	28,634	17 602	29 753	27 011	23 237	34 145	1,19 131	1,92,582	2,01,206
Repairs	10,39 410	2,805	3 396	3 996	4,715	8 836	2 573	8 985	12,900	4 865	3 313	5,672	5,099
Establishment	14 75,473	5,89,994	13,506	5,914	16,158	22 954	20 202	16,134	45 062	38,557	28,362	64,311	45,378
Tools and plant	1,47,772	61,709	2,026	714	2,766	843	3 389	1 718	1,335	2,957	3,040	6,627	3,028
Total	(d) 38,4),605	6,86,918	66,738	31 670	52 273	50,235	55,917	53,848	82,534	80,524	1,53,846	2,69,192	2,54 711
Provincial													
Irrigation and Navigation—													
Original works										1,50 167	1,17,839	1 05,463	1 49,604
Repairs										64,741	1,22,929	81 503	1,24 321
Establishment										42,777	60 192	51 405	73 739
Tools and plant										4,016	6 019	10,675	5,194
Total										2,16 701	3,06,979	2,49,046	3,52,858
Roads and Buildings—													
Original works		5 18 112	7 20 790	9 65 324	7 71,727	10 99 324	9,02 042	36,55,789	10 25,412	4,01,815	8 01,266	4,74,295	11,32 525
Repairs		1 42,107	1 66 998	1,94 853	2,05 135	4,27 878	3 79 673	6 63 833	5,67,444	1,76 371	1,30,427	1 47 922	1 86,659
Establishment		1,81,191	2,26,696	2,51,577	2,05,070	5,28,609	5 39 598	12 79 506	11,27 000	6,35,690	5,50 554	7,05 784	5,23,909
Tools and plant		47,147	70,637	4,973	55,508	77,492	1,27 605	3 15,376	35,782	2,64,868	18,837	31,802	69 491
Total		8,88,557	11,85,121	14,16,727	12,37,440	21,33,303	19,48,918	59,14,504	27,55,638	9,49,008	14 63,410	12,96,199	17,73,602
Local													
Original works	12,93 759	14,30 382	13 11 052	18,54 008	16 24 916	10 13 553	14,07 713	9,50 437	5 24 971	3,99,686	1,14,750	92,362	68,500
Repairs	7 21,577	17 35,585	19,74,507	20 76 338	21 32,060	19 58 922	18 22 059	12 41 109	15 93,195	17 02,196	1,54,015	1,60 318	38,405
Establishment	2,99 369	9,60,923	9,87,477	10,32,031	8,80 905	5,71 503	7,43 559	3,96 071	5,73 341	4,69,131	62,689	31,932	43 182
Tools and plant	13 467	31,264	37,923	54,463	28 050	37,106	36,198	88,777	50 043	44,884	6,141	4,413	2,623
Total	23 28 172	41,58 144	43,10,959	50,16,840	46,65,931	35,81,084	40,09,529	26,76,394	27,47,050	26,60,897	3,37,595	2,89,025	1,52,760
Grand total—													
Original works	36,09 132	29 93 645	32 42 232	39 23 426	35,64 205	36 13 758	32 48 052	(b) 54 35,609	26,06,088	14 05 786	18,61,802	16 96,704	(a) 205,53,391
Repairs	31,28 818	32,26 532	36 49,273	39 35 084	41 17 315	41 78 971	38 92 939	(d) 36 98 393	30,83 445	33 23 928	18,79,033	18,84,736	22,72,558
Establishment	19,09 719	19,29,239	20,03 491	20 43 298	20,76 714	21 38 435	22,30 253	(c) 33 37 152	28 06 544	20,89,462	14,25 224	16,11 357	18 16,193
Tools and plant	1,76,441	1,46 692	3,35,099	1 19,463	1 97,618	2,74,398	3,39 539	5,92,400	2,00,670	70,911	1,89,950	1,29,738	1,09,621
Total	88,24,110	82,96,108	92,30,095	100,21,271	99,56,372	102,05 562	97,10,783	130 63,504	91,96,747	67,48 265	53,56,509	53,22,035	247,51,763
Madras Harbour Works—													
Works						76,809	5,74 998	3,95 196	7,78 030	11,66 211	13,84,164	6,63,858	4,12,823
Establishment						25 814	64 901	48 080	53 021	50,295	68 632	71,083	56,243
Tools and plant						24 212	3,66 799	1 01,892	4,770	4,275	8,779	54,817	2,334
Total						1,26,835	10 06,698	5,45,168	8,35,821	12,20,781	14,61,575	7,89,758	4,71,400

(a) Of this Rs 176 25,050 represents the purchase value of the Kurnool canal
(b) This was a famine year and the total outlay shown is inclusive of Rs 44 46 504, being the normal value charged on account of famine
(c) The excess under this head is attributable to the cost of the extra establishment employed on Famine Relief works
(d) Includes works that are now classed as "Provincial"

The method of the debit of establishment charges has already been explained in paragraph 9 Tools and Plant charges are also, in the first instance, charged to "Provincial," as in the case of establishment charges, and a percentage of 1½ per cent on expenditure and repairs is charged to all funds, on account of general tools and plant, except in the case of Irrigation and Navigation works for which Capital and Revenue accounts are kept, when the *actual* expenditure incurred is charged to the works Where tools and plant are specially procured for a work, the cost of such "Special tools and plant" is charged to the work

DESCRIPTION OF IMPORTANT PUBLIC WORKS

22 *Classes of public works* —The most important of the public works of the Madras Presidency—other than those of irrigation, which are treated of in a separate Article—can be divided into three main classes, viz , (1) Communications, (2) Harbours, (3) Buildings. With a very few exceptions, no works of the first class remain at the present time under the charge of the Public Works department, but are entirely maintained by the establishment of the Local Fund boards The main lines of communication of the Presidency, together with the large bridges thereon, were, however, constructed by the agency of the Public Works department, and, together with all other roads, were, in the main, maintained by the same agency until the year 1879, when a complete transfer of the charges of "Communications" was made to an Engineering establishment directly employed by the Local Fund boards Under the head of "Communications" will, therefore, be briefly described the developement of the systems of road in the Presidency and of such navigable canals of importance as have not been described in the Article on Irrigation Under "Harbours" an account will be given of the Madras Harbour works and the other Marine works and harbour improvements undertaken by the Public Works department from time to time; while under the head of "Buildings" will be very briefly described the principal works of that class executed by the department

23 *Communications—Sketch of the development of roads until the formation of Public Works department in* 1858 —When Southern India first came under British rule, no roads suitable for wheel traffic existed, even in the main streets of the largest towns, and it was not until the year 1845, when the Trunk Road department was formed, that any systematic progress in the construction of roads was made by the British Government In the early days of British rule, the only "made" roads were the mountain passes, which were originally opened for the passage of troops and artillery Subsequent to the construction of these roads were formed rough roads connecting the military arsenals and cantonments, but no roads for other than military purposes were constructed, or thought of, until the year 1813, when the necessity for the construction of roads for commercial purposes first engaged the attention of Government No systematic progress was made, however, for many years in the development of "communications," though in certain districts the energy of individual officers accomplished a great deal in this respect within the limits of their charges About the year 1823 an abortive attempt was made to construct roads by the agency of the Corps of Pioneers, which at that time numbered about 2,000 strong, and were notoriously a hardworking, useful body of men, little hampered by customs of caste, and therefore ready for any employment that might be given to them This measure was a total failure owing to the lack of any professional knowledge whatever on the part of the officers of the corps, which was then entirely officered by regiments of the line, and in 1831 Government finally abandoned the idea of any considerable improvement and development of roads as a task of too great magnitude From 1837—1844, some important lines of road were opened or improved, but, owing to a want of system in the management of the several undertakings, much wasteful and unprofitable expenditure was incurred, which circumstance led to the idea of the formation of a special department, whose sole duty it was to design and construct a great system of trunk roads, or main lines of communication, throughout the presidency In the following year therefore the Trunk Road department was constituted, and from that time until the year 1858 gradually proceeded to construct the trunk roads of the presidency, which, it will be observed, for the most part follow the lines connecting the military

arsenals and cantonments, and therefore owe their origin to the rough roads originally traced out many years previously Reviewing the expenditure on "communications" up to the year 1845, we find that, in the 20 years from 1826 to 1845, the average outlay on the communications of the whole presidency was only Rs 1,16,926 With the year 1845, however, a new era commenced in the history of the roads of the presidency Previous to that date, the whole of the expenditure on roads was under the control of the Board of Revenue, under whom was also (paragraph 3) the Engineering establishment employed on them, but in 1845 the control of the expenditure passed into the hands of the Superintendent of Roads In paragraph 3, the working of the Trunk Road department has been briefly described, and it will therefore be sufficient to say that, while not accomplishing what was expected and required of it, owing to administrative defects in its constitution, it did much good work, gradually expanded its operations, and proceeded with the bridging, formation, and improvement of the trunk roads on a systematic and uniform plan until its final abolition in the year 1858

24 *Further development of roads until the formation of Local Fund Boards in* 1871 —After the formation of the Public Works department in the year 1858, the construction of the main road of the country was carried out by the department from Imperial funds, while the duty of keeping the minor district roads also devolved, in most districts, almost entirely on the Public Works department For some years, however, the funds provided for the main district roads were exceedingly inadequate, and were provided from Imperial revenue and from funds raised from local sources In the year 1862, the attention of Government was directed to the question of the entire provision of funds for such roads as were of local rather than Imperial importance from funds raised locally It was then roughly determined, pending further investigation, that there were only 6,360 miles of road which could properly be maintained from Imperial funds, viz , the 2,610 miles of trunk road then existing, and 3,750 miles of first-class district roads The remaining roads, amounting to about 10,000 miles of district lines, were considered to be merely of local importance, and various measures were proposed for the formation of a fund to be raised in each district, adequate to provide for their completion and maintenance The income of the Local Funds of the presidency, at that time available for expenditure on district roads, was only Rs 2,26,873 (derived from ferry and grass rents, bridge tolls, and cattle fines, &c), and therefore only allowed very inadequate grants being spent upon the district roads It was estimated at that time (1862) that the following sums were required for the completion and maintenance of the 6,360 miles of road already mentioned —

	Complete construction	Annual maintenance
	RS	RS
For trunk roads	58,93,008	4,44,498
For district roads	1,53,90,337	10,29,072
Total ..	2,12,80,345	14,73,570

Whereas the total expenditure upon roads and communications for the five years preceding was as follows —

Year	Expenditure		Total
	New Works	Repairs	
	RS	RS	RS
1856-57 . .	13,75,611	5,41,195	19,16,806
1857-58	5,01,478	5,51,791	10,53,269
1858-59 . .	3,81,736	7,98 268	11,80,004
1859-60	4,35,030	9,09,708	13,44,738
1860-61	6,17,260	9,82,285	15,25,545
Total .	33,11,115	37,09,247	70,20,362
Average per annum ..	6,62,000	7,40,000	14,04,000

It was therefore plain that more must be done for the development of roads than had been the case for the past few years, and in 1862 orders were therefore issued for the preparation of detailed lists of the roads to be classed as Imperial and to be constructed and maintained from Imperial funds, and the subject of the creation of some scheme for augmenting the local resources in order to provide for the construction and maintenance of all other lines of road, which were to be denominated "district roads" in contradistinction to those classed as "Imperial," was referred to the Board of Revenue In 1865 the wants of the districts in the way of local communications were every day becoming more urgent and as considerable reductions in the Imperial grants given annually by the Government of India were made about that time, the question of the necessary provision of funds to be raised locally for expenditure upon roads (for which no definite scheme had then been prepared) was again taken up by Government calling upon the Board of Revenue to prepare and submit a draft Act for the levy of a district road-cess on all land-holders for the construction and maintenance of district roads, "as it was clear that the increasing demands upon the general revenues rendered it hopeless to expect that the Government would ever be in a position to do more than complete and maintain the chief lines of communications" Accordingly, in April 1866, the Bill known as the "District Road-cess Act III of 1866" was passed into law, by which a cess, not exceeding half an anna in the rupee on the rent value of occupied land, was imposed so as to form a fund for the construction and maintenance of the district roads The amount raised by this cess subsequently attained very considerable dimensions, while, in the year immediately after the Act was passed, the general income from Local funds went up with a bound from an average of Rs 6,84,150 in the three years, 1864-65—1866-67, to Rs 22,33,379 in the year 1867-68, and Rs 32,27,379 in the year 1868-69, of which latter amount Rs 15,17,097 was expended upon the construction of district roads Meanwhile, the final classification of all roads into "Imperial" roads and "District" roads was proceeding under the officers of the Revenue and Public Works departments, but was not finally settled until the year 1868-69, when it was decided that the expenditure from Imperial funds should be restricted to (1) certain specified main lines of communication, 25 in number, of a total length of 4,000 miles, (2) the ghát roads and certain special roads, amounting in all to a length of 650 miles, and (3) the salt roads, 23 in number, and 500 miles in length, while all other roads should be classed as district roads Until the formation of Local Fund Boards in 1871, the Imperial and District roads, as thus determined, were therefore maintained and constructed respectively from Imperial funds and from the "District Road Fund" raised under the Act of 1866, while the general agency of execution was the Public Works department Reviewing the expenditure incurred and the work done during this period, we find that the expenditure on roads in the year 1868-69, for new works from Imperial funds, was Rs 12,17,455, and was devoted chiefly (1) to the construction and improvement of the Great Northern Trunk Road from Madras to Calcutta in the districts of Madras, Nellore, Kistna, Vizagapatam, and Ganjam, and (2) the construction of ghát roads in the Coimbatore, Malabar, and Wynaad districts, while the expenditure from the "District Road Fund" on new works amounted to Rs 15,17,097, and was principally expended in completing a network of minor communications, of which the most important were the railway feeders and the construction of embanked roads in the deltaic tracts of the Godávari, Kistna, and Tanjore districts

25 *Construction and maintenance of roads under the Local Fund Boards* —Local Fund Boards in the Madras Presidency were first constituted by the Local Funds Act IV of 1871, which repealed the District Road-cess Act of 1866, and provided for the unexpended balance of the "District Road Fund," raised under the Act of 1866, being transferred to the Local Fund Boards The Local Funds Act provided for the imposition of a cess similar to the district road cess, but with a maximum of one anna in the rupee, and for the establishment of tolls upon roads, two-thirds of the cess and the whole of the tolls being expended on roads The agency of execution was, as before, the Public Works department, and to pay for the Public Works establishment employed on the roads, the Local Fund Boards were charged at the rate of 25 per cent on the actual outlay incurred In addition to the funds made available for expenditure on roads by the passing of the Local Funds Act, annual contributions

from Provincial Funds were given by Government to the Local Fund Boards as grants-in-aid for expenditure upon the main lines of road, and from June 1871 the distinction formerly in vogue between "Imperial" and "District" roads was abolished, and the total annual assignment of grants in-aid from "Provincial," together with the assignment from "Local funds," was treated as one general fund under the designation of "Road Fund" which provided for the construction and maintenance of all roads, including those formerly provided for from the Imperial grant for communications From the year 1872-73 to 1879-80 no change was made regarding the agency of execution of work upon roads, and the provision of funds for expenditure thereon and all roads continued up to 1879-80 to be carried out by the Public Works department for the Local Fund Boards, while the expenditure relating thereto was accounted for in the Public Works department In 1879-80 an important change was made, inasmuch as the entire execution of the maintenance and construction of roads was transferred from the Public Works department to the Local Fund Boards, who forthwith employed their own Engineering establishments directly responsible to them Since that date the Public Works department has, with the exception of certain special works, such as the Potinghi Ghát, &c, had nothing to do with the roads of the presidency generally, except as regards the check and examination of certain estimates as already explained in paragraph 19 The following statement shows the total expenditure incurred upon roads (not including the establishment charges) during the period of execution of work upon them by the Public Works department, viz, from the year 1872-73 to 1879-80 —

Statement of expenditure on roads from 1872-73 to 1879-80

Year	Expenditure on Roads from "Provincial Funds"			Expenditure on Roads form Local Funds			Grand Total.
	New Works	Repairs.	Total	New Works	Repairs	Total	
	RS	RS	RS	RS	RS	RS	RS.
1872-73	1,09 828	45,994	1,55 822	11 96,521	19 01,416	30,97,937	32,53,759
1873 74	1 96 143	29 679	2 25 822	16 47,768	19 59,152	36,06 920	38 32,742
1874 75	1 66 258	32 353	1,98,611	13 17,300	20 17,239	33,34 539	35,33,150
1875-76	6 91 185	2 92 621	9 83 806	7,16 536	18,36 672	25 53,228	35 37,034
1876-77	2 82,443	2 44 304	5,26 747	11 28 748	16 93,471	28,22 219	33 48,966
1877-78	31 44 334	4 19 387	35,63 721	7 25 091	10,95 228	18 20,319	53 84,040
1878 79	6,21 510	4,33,614	10,85 124	3,85,839	15,05 426	18,91,265	29,76 389
1879-80	43,759	36,327	80,086	3,08,560	16,33,024	19,41,584	20,21,670

The expenditure of 1876-77 was abnormal, and was due to the famine The expenditure shown under the head "Provincial" was that incurred by the department on certain roads specially so classed The expenditure shown under the head of "Local Funds" includes the grants-in aid from "Provincial" which, as already explained, were amalgamated with the assignments from Local funds into one general fund These Provincial grants-in-aid were first given in the year 1872-73, and from 1876-77 have been much reduced in amount, as the following statement will show —

Statement showing the amounts of grants-in-aid from Provincial to Local for the years from 1872-73 to 1879-80

Year	Amount RS
1872-73	11,26,000
1873-74	12,00,000
1874-75	12,00,000
1875-76	11,10,000
1876-77	2,43,390
1877-78	1,18,230
1878-79	62,500
1879-80	1,25,000

The communications of the presidency are now therefore entirely under the Local Fund Boards, who provide for their construction and maintenance from their own

revenues, of which the chief item is that raised by the land-cess, aided by a small contribution from Provincial. In the year 1882-83, the number of the Local Fund engineering circles was 30, the total length of roads, exclusive of village roads under their charge, was 21,019 miles, while the total expenditure incurred on roads was Rs 28,52,083, or 47 per cent of the whole Local fund expenditure

The chief lines of road are shown in the accompanying map Of these, the most important at the present day (as it traverses districts in which there is no line of railway) is the Great Northern Trunk Road from Madras to Calcutta, passing through the districts of Nellore, Kistna, Godávari, Vizagapatam, and Ganjam This road crosses the entire drainage of the country at right angles to its course, and is provided with numerous bridges Next, in order of importance, come the Great Southern Trunk Road from Madras to the Travancore frontier, the Great Western Trunk Road from Madras to Calicut, and the ghat roads leading from the Nílgiri to the Malabar Coast, the Mysore plateau, and the Madras railway at Mettupálaiyam

26 *Proposed extension of main roads and scheme for tramways or light railways* — In the interests of the coffee industry, carried on mainly by European planters in the Nílgiri and Wynaad districts, and also to aid in developing the gold-mining enterprises which have of late years been started in the Wynaad, a scheme for the extension and improvement of the existing lines of communication between the Malabar Coast and the Nílgiri plateau has lately attracted the attention of Government, and a special Public Works officer is now engaged in making the requisite surveys and estimates for the conversion of the existing lines of road into first-class metalled roads capable of bearing traffic during the monsoon The Wynaad roads, like all other roads in the presidency, are at present under the charge of the Local Fund Boards, and, though it is intended that the Public Works department should ultimately execute the improvements proposed, existing arrangements for the maintenance of the road by the agency of the Local Fund Engineer establishment will not be disturbed until such time as funds are available and the Public Works department is in a position to take over the work of complete restoration The improvements proposed will cost a large sum, and the work will extend over some years As the line most required at present is, in the opinion of the Wynaad Planters' Association, the road from the seaport of Calicut to Vayitri, a detailed survey and estimate of this line, through the Tamrachéri ghat, is now in progress under the special Public Works officers employed in the Wynaad

In the year 1882, the Government of Madras submitted to the Government of India a scheme for the construction of 1,000 miles of light railway or tramway on the existing roads in the tracts of the presidency most liable to famine, and suggested that the tramways should be classed as "protective" works (*vide* paragraph 3 of article on irrigation), and should be carried out from funds provided from the Imperial protective grant The Government of India, in reply, declined to expend Imperial funds on detached distributary lines, until the main arterial protective lines were completed, and pointed out that, the provision of the light distributary lines proposed would only benefit the tracts of country they immediately served, and should therefore be provided by the local Government The Madras Government thereupon appointed a committee to consider the best method of connecting the great centres of production and consumption with the main arterial protective lines Towards the end of the year 1883 the committee submitted their report, and recommended the construction of the following five light metre-gauge lines of railway on existing roads where practicable, and elsewhere on independent embankments —

(1) Guntakal *viâ* Anantapur to Hindupur—a length of line of about 100 miles in the Bellary district
(2) Vellore *via* Tiruvannámalai to Villupuram—a length of line of about 90 miles in the North Arcot and South Arcot districts
(3) Porto Novo *viâ* Vriddháchalam to Kallakurchi—a length of about 60 miles in the South Arcot district

(4) Pálghat to Dindigul (a length of about 100 miles in the Coimbatore and Madura districts) or Karur to Dharapuram—a length of about 60 miles in the Coimbatore district
(5) Madura to Ramnad, a length of about 70 miles in the Madura district

The recommendations of the committee were generally approved by Government Lines (2) and (3) are now being surveyed, orders have been issued for the survey of (4) Pálghat to Dindigul on completion of the surveys of (2) and (3), and the consideration of the remaining lines has, for the present, been postponed.

27 *The Upper Godávari Navigation Works* —The Upper Godávari navigation project was first urged upon the notice of the Government by Sir Arthur Cotton in 1851, and had as its object the opening up of the navigation of the river Godávari from the important cotton mart of Nachangaon, 60 miles south-west of Nagpore, and situated on the river Wardha, a tributary of the Godávari to the sea port of Cocanada in the Godávari district By making this portion of the river navigable, it was anticipated that the cotton from Hinganghát, a great emporium for cotton, and a large area of country containing some of the finest cotton fields in India, would be sent down the river to Cocanada, and that, in return, there would be considerable importations up the river A great trade was thus expected to be developed, and a remunerative return on the outlay necessary to make the river navigable was looked for The main obstacles to navigation consisted of three remarkable rocky barriers, forming rapids only navigable in floods, but, these points excepted, the river was reported to be navigable for shallow river steamers for nine months in the year The first barrier is at Dumagudiem, 150 miles from the sea, and is 20 miles long The second is 14 miles long and 220 miles from the sea The third is 310 miles from the sea, is 35 miles long, is 75 miles distant from Chanda in the Central Provinces, and 115 miles from the cotton mart of Hinganghát The works necessary to make navigation practicable consisted of the construction of canals round the three barriers by means of anicuts and locks, and the clearance of the river bed in places by blasting The necessary surveys of the river were commenced in 1854, and by 1861 two lakhs of rupees had been spent in surveys and preliminary operations In 1861 the works at the first barrier were commenced, and at the beginning of the year 1863, seventy lakhs had been expended on the works at the first and second barriers In January 1863 Sir Richard Temple inspected the works, and recommended that the works at the first and second barriers and in the river up to the foot of the third barrier should be proceeded with at an estimated cost of Rs 25,50,000, so that the navigation might be open to the foot of the third barrier (to which point the road from Nagpore to Chanda was to be extended) by May 1865 By August 1865, two-fifths of the anicut at the first barrier, with the other masonry works, were completed In 1871 the works at the first barrier were almost completed; the works at the second barrier were entirely suspended and were in an incomplete state, the works at the third barrier were not commenced, while the total expenditure incurred was Rs
There was at that time a steamer towing boats from the second barrier to the coast, and the *Wainganga* steamer continued the communication between the second and third barriers, but the amount of traffic was small In a despatch, dated August 1871, the Secretary of State proposed that the navigation works should be completed on the smallest possible scale as far as the foot of the third barrier, whence a road should be made to Chanda, but in October of the same year, at the request of the Government of India, the whole scheme was abandoned as involving expenditure which did not give promise of any adequate return From October 1871, therefore, the work has been in abeyance In September 1881, in consequence of reports of impending injury at the anicut at the first barrier at Dumagudiem (which, however, turned out to be without foundation), the Superintending Engineer of the circle visited the anicut, and an upper subordinate has since been stationed at Dumagudiem to attend to all necessary repairs and to undertake certain investigations having for their object an extension and improvement of the existing traffic on the Upper Godávari.

HARBOURS

28 *Inquiries regarding Madras anchorages, and general sketch of marine works undertaken by the Public Works department* —The officers of the Public Works

department have at various times been called upon to submit reports and estimates for the improvements of the harbours of the East and West Coasts of the Presidency, and the department has also executed various marine works from time to time The works of this class undertaken by the Public Works department date as far back as the year 1838, when the deepening of the Pámban passage was first commenced The first detailed inquiry into Madras anchorages was in 1870, when Mr George Robertson, a Harbour Engineer, made a minute and careful inspection of the ports of Mangalore, Cannanore, Calicut, Beypore, Cochin, and Quilon on the West Coast, and of Tuticorin, Pámban Pass, Negapatam, Madras, and Cocanada on the East Coast He considered Quilon capable of being made the finest close harbour in India, and published an elaborate report embodying certain recommendations regarding various ports His recommendations were acted upon by Government, and the Public Works department was accordingly ordered to execute certain improvements which were forthwith carried out, principally to the harbours of Mangalore and Cochin In the following year Mr Robertson again visited the Pámban Pass to report on the subject of a ship canal through the island of Pámban In the year 1875-76, the works of the Madras Harbour, designed by Mr W Parkes, were commenced The next inspection of Madras anchorages was made in the year 1881 by Mr Parkes, who visited the harbours of Vizagapatam, Bimlipatam, Calingapatam, and Quilon, in order to report on their capabilities for the formation of first-class harbours He reported, in due course, that the natural advantages of Vizagapatam were superior to those of Bimlipatam or Calingapatam, but that, at all these three ports, it was absolutely out of the question to construct first-class harbours capable of giving remunerative returns from the trade of the port He recommended, however, that hydrographic surveys of the three ports should be made, and in accordance with his suggestion a hydrographic survey of the port of Vizagapatam was undertaken by the Public Works department in the year 1883, but the work was subsequently transferred to the Indian Marine Survey department The report by Mr Parkes on the Quilon harbour was of a much more favorable character He considered that a well-sheltered harbour could be made at a moderate cost, and that by means of a short canal the harbour could be connected with the West Coast canal system The question of the improvements to the Quilon harbour is now under the consideration of the Travancore Sarkar

The improvement of the Cocanada harbour by means of lengthening the groynes at the mouth of the Cocanada river has engaged the attention of the department for some time, and in the year 1882-83 an estimate of Rs 53,608 was sanctioned for the purpose A decision has also been arrived at with regard to the improvement of the ports of Vizagapatam, Cochin, and Gopálpur At the first port the project for the erection of an iron pier, which has been for some time under consideration, is now held in abeyance, and it has been decided that no permanent improvement of the Cochin harbour is possible except at a prohibitive cost With regard to Gopálpur, the erection of a wrought-iron screw pier has been favorably viewed by Government, and the preparation of a detailed estimate for a pier, 900 feet in length and roughly estimated to cost about two lakhs, is now being undertaken by the Madras contractors, Messrs Massey and Co

29 *Works at the Pámban Pass*.—The Pámban Pass is the narrow artificial strait running north and south from Palk's Straits into the Gulf of Manaar, and separating the Ramnad zemindari, situated on the mainland in the Madura district, from the island of Rámesvaram Originally this gap was bridged by a continuous isthmus, but in the year 1480 a violent storm breached the isthmus and permanently separated the island of Rámesvaram from the mainland of the Madura district, thus making a break in the great connecting link of islands, rocks, and shoals that separate Ceylon from the mainland of India The natural passage thus made was, however, impracticable for ships, being too shallow, and also being obstructed by two parallel ridges of rock The first proposal to clear and deepen the passage so as to allow of ships passing through and thus shortening the voyage from India to the island of Ceylon, was made about the year 1800, but no practical action in the matter was taken until 1882, when a survey was made by Ensign (now Sir Arthur) Cotton. The survey being favorable, various operations were begun on a small scale in the year 1828, but it was not until the year 1838 that the work of deepening and widening the channel was regularly started From that date up to the present time, the works have been continually in progress The work was first started in 1838 by the employment of gangs of convicts, under the supervision of Madras Sappers and Miners, a special Engineer officer being placed in charge under the direct control of the Chief Engineer, but after the organization of the regular Public Works department in 1858, the works were directed by the Public Works officers in charge of the Madura district In 1873, the jail at Pámban was abolished, and from that date convicts, under the supervision of the Public Works department, were no longer employed on the works Finally in 1879, the works were transferred from the Public Works department to the Marine department Tracing the progress of the works, we find that in 1844 the passage had been deepened to 8 feet of water at low spring tides, while the total expenditure up to that date was Rs 1,55,950. By 1854, the depth had been increased to 10½ feet, the passage was navigable for keeled boats of 200 tons, and the total expenditure had amounted to Rs 3,25,000 In 1875, the passage had been deepened to 14 feet and to a width of 80 feet The works undertaken consisted mainly of blasting and dredging operations They have on the whole been a great success, and have enormously benefited the coasting trade of sailing vessels, by which it is largely used During the official year 1883-84, the number of vessels which passed through the Pámban Pass was 1,485, having a total tonnage of 176,743 tons, while the pilotage fees realized therefrom were Rs 19,402 Originally the works were started merely with the intention of providing a passage for small sailing vessels, but in 1854 Colonel Cotton projected a scheme for making the pass available for all classes of vessels, and also for the large mail steamers between Calcutta and Suez The weight of marine and nautical opinion was, however, entirely against this scheme, which, it was clearly shown, would involve an enormous expenditure without an adequate return. This project was therefore definitely shelved in favor of the original scheme

30 *The proposed Pámban Ship Canal*.—A project for cutting a ship canal through the island of Manaar was mooted as long ago as the year 1832 Some time after that period, the idea of cutting a large ship canal through the adjoining island of Rámesvaram was started, and in the year 1862 a Parliamentary Committee took evidence on the practicability of the project, and the benefits to be derived from it In the same year, Sir W. Denison, the Governor of Madras, visited Rámesvaram, and selected, as suitable for a ship canal, a line about 2 miles in length through the island of Rámesvaram and about 2¾ miles east of the Pámban lighthouse In the year 1870, Sir Hercules Robinson, the Governor of Ceylon, and other officials of the Ceylon Government, visited Rámesvaram, and a line for a ship canal was proposed by Mr Stoddard about three-fourths of a mile to the west of that selected by Sir W Denison In the following year, Admiral Sir James Elphinstone carefully inspected the locality, and while emphatically deciding against any attempt to adopt the Pámban Pass for big vessels—a scheme which had also been considered together with that of cutting a ship canal through the island of Rámesvaram—on the ground that such a long and tortuous passage could not be made safe for big ships, advocated the cutting of a canal, 7½ miles in length through the Ramnad promontory on the mainland, together with the formation of a large sheltered harbour In the same year, a discussion regarding the various proposals made, for a ship canal, was raised in Parliament, and in the year 1872, Mr George Robertson was specially deputed to report on the various schemes which had been brought forward up to that time The result of Mr Robertson's inquiries was to recommend as most suitable for the cutting of a ship canal a line, through the eastern end of the island of Rámesvaram, one mile east of the Pámban lighthouse, 1¾ miles west of the line selected by Sir W Denison in 1862, and one mile west of that chosen by Mr Stoddard The line selected by Mr Robertson was 2¼ miles from water-line to water-line, and was considered by him to be better sheltered at its entrance from the swell of the south-west monsoon than either of the other lines proposed Nothing more was done regarding the project for a ship canal until the year 1881, when the Chief Engineer and Master Attendant, Madras, visited Rámesvaram, reviewed the various schemes already detailed, and reported that,

if ever the scheme for a ship canal was seriously thought of, preference should be given to a line in the neighbourhood of that selected by Sir W Denison On this report, borings along the line chosen by Sir W Denison were ordered by Government, and were subsequently carried out by the Marine department It will be evident that all the steps above detailed were taken with a view to sift the merits of the different schemes proposed from time to time for a ship canal In the year 1882, practical effect was, for the first time, given to the results of these investigations, by the formation of a company by Messrs Grindlod, Jenkins and Company of London for the cutting of a canal, to be entitled the Pamban ship canal, through the island of Rameswaram The company's scheme, in addition to the cutting of a large ship canal, included the provision of dry docks. The capital of the company was to be raised in England, and a concession was asked for from the Madras Government for the right of cutting the canal The Government have now granted to the company a general concession for cutting the canal through the island of Rámesvaram, subject to the condition that, the land being private property, the company shall arrange terms of acquisition with the owners, and shall submit for approval the scale of dues which it is proposed to levy on all vessels making use of the canal At the end of the year 1883-84, the agents of the company were engaged in arranging with the several owners of property in the island of Rameswaram, the terms of compensation for land to be taken up by the canal

31 *History of the construction, Madras Harbour Works* —The design for the construction of the Madras harbour was made by Mr Parkes, a Civil Engineer in London, and the original estimate, amounting to Rs 50,50,000, was sanctioned in March 1875 by the Secretary of State The expenditure on the work was to be provided from Imperial funds from money raised on loan The design consisted of a close harbour, providing accommodation for 13 large ships to swing at their moorings, in addition to space for several smaller craft The enclosed space was to be formed by two breakwaters, equidistant from the existing iron screw pile pier, running parallel to, and at a distance of 1,000 yards from, each other, to a length of 1,200 yards into 7 fathom water, where, on a curve of 568 feet radius, both were to turn inwards at right angles, leaving between them an entrance to the enclosure of 450 feet in width The two breakwaters were to be constructed of packet concrete blocks, each about 27 tons in weight, not built in one bonded mass, but built in two parallel walls placed side by side in juxtaposition, having a vertical point between them, and laid on a rubble base of from 4 to 20 feet in depth The works were begun in the official year 1875-76, and by the end of the year an expenditure of Rs 3,41,703 had been incurred upon them During May, June, July 1876, the works were carried on under difficulties owing to the heavy surf prevailing In March 1877, it was discovered by the divers that the rubble base foundation of the north pier was entirely buried in sand For several months every possible means was taken to remove this sand accumulation by dredging, by working in caissons, by jets of steam and jets of water at high pressure, but without avail Finally the Superintendent of the works determined to build the concrete blocks upon the sand and allow them to sink through to the rubble base, and this was accordingly done Owing to this serious obstacle, the works were much retarded during the greater part of the year 1877-78 In May 1877, the works were severely tried by a cyclonic storm, but suffered no damage of any importance, and hardly any settlement occurred in the work at either pier In November and December 1878, the works were greatly interrupted by bad weather, and in January and March 1879 by the breaking down of the titan cranes, and the delay in the receipt of stores from England At the end of the official year 1878-79, the total expenditure on the harbour amounted to Rs 26,12,822, and it was estimated that the works would be completed by March 1881 Considerable progress was made on the works during the official year 1879-80, and by the end of the year the north pier had advanced to a total length of 2,745 feet, of which the last 445 feet was built on a curve of 568 feet radius, and the south pier had been carried to a total length of 2,146 feet During the official year 1880-81, the progress was more considerable than in any previous year At the end of the year, the expenditure amounted to a grand total of Rs 53,52,890, the north pier was advanced to a total length from the shore of

3,845 feet, or within 21 feet of its termination, the south pier was carried to a total length of 3,635 feet from the shore, while both piers terminated in water 8 fathoms below mean sea level, and the distance between their terminations was only 890 feet, or 340 feet more than the proposed ultimate width of the harbour entrance, which it had been decided to increase to a total width of 550 feet instead of 450 feet as originally designed by Mr Parkes By October 1881, both the north and south pier had been brought to their full length, so as to leave an open space of 550 feet as an entrance, but on the 12th November 1881 the works were greatly damaged by a cyclone which struck Madras with great suddenness All further progress on the harbour works was stopped in consequence On 29th, 30th and 31st December 1881, another cyclone passed over Madras, but, owing to its centre being near, the sea was not very high, and no further damage was caused to the works Up to 12th November 1881, when the damages caused by the cyclone occurred, the total amount of work done consisted of 7,836 lineal feet of breakwater constructed, 13,309 concrete blocks set in position, 13,643 concrete blocks made and 930,758 tons of stone deposited for the surf banks and rubble bases The total expenditure incurred up to the same date was Rs 58,09,629 The construction of the Madras harbour works may be said to have terminated with the cyclone of November, and at the end of 1883-84 was still deferred pending the decision regarding the revised design to be given to the work

32 *Damages caused by the cyclone of November* 1881, *and works since undertaken* —The damages due by the cyclone of November 1881 were half mile of breakwater breached, and, on an average, the two top courses of concrete blocks thrown into the harbour, two titan cranes thrown over and destroyed, rubble base lowered and spread out, 1½ miles of single line railway carried away, twin barges *Salisbury* and *Hobart* foundered and lost with the loss of 13 lives, besides minor damages such as the loss of small boats, injury to the iron pier, encroachments by the sea and damage of private property During the remainder of the official year 1881-82 subsequent to the cyclone, the chief work done consisted of repairs, such as relaying the lines of railway, levelling up with concrete the top of the north pier, clamping together the walls of the north pier, and repairing and strengthening the beach protective works From April 1882 to March 1883 the work done was limited to necessary repairs, block-making and protection of the shore, which had been much encroached upon by the sea, owing largely to the obstruction caused by the harbour walls In March 1883, all active work was stopped, except repairs to plant, and the harbour staff was reduced as much as possible, pending the resumption of operations, when the details of the design for the restoration of the harbour had been definitely settled Up to the end of the official year 1883-84, the additional expenditure incurred since the cyclone of November 1881 was only Rs 8,69,233, while the total expenditure incurred was Rs 66,78,862

33 *Measures taken for the completion of the Harbour* —Shortly after the cyclone of November 1881, reports regarding the damage done, accompanied by proposals for completing the harbour, were drawn up by Mr Parkes, the Chief Engineer, Public Works department, and officers specially deputed by the Government of India, and were forwarded to the Secretary of State, who referred them to a London committee consisting of Sir J Hawkshaw, Sir J. Coode and Professor Stokes The reports showed a concensus of opinion on three points, viz, that (1) the piers had up to the occurrence of the cyclone been pushed forward on a plan which insured both economy and expedition in a marked degree, (2) shelter had thus in great measure been provided in all ordinary weather, and still existed to the great advantage of the port, (3) the injuries caused by the cyclone could be made good, and the work rendered safe, in about three years, at a cost which would still make the harbour a comparatively cheap work of its kind In January 1883, the London committee issued their report, criticised the system of construction adopted by Mr. Parkes, which—while admitting that it conduced to rapidity of construction—they remarked they could not recommend were the work to be begun again, but should prefer to see the work bonded throughout They reviewed three alternative systems of reconstruction, expressed a favorable opinion regarding the safety of the "random-block" system, and made certain definite recommendations regarding the restoration of the work, of which the principal points

were to the effect that (1) the extra strength required should be given by the addition of a large wave-breaker, consisting of concrete blocks tipped over the seaward faces of the work, (2) the piers should be raised to a considerably higher level than was originally contemplated, and should be, when finished, not less than 12 feet above high water mark, and (3) that the entrance should be narrowed to 450 feet. On receipt of this report, the Government appointed a Madras committee to frame detailed estimates, and to consider the best way to give effect to the proposals of the London committee In June 1883, the Madras committee issued their report, accompanied by estimates of the cost of completing the works on the several systems suggested by the London committee The estimates showed that the works could be completed for a sum of from 45 to 50 lakhs, according to the system and details of reconstruction followed The committee expressed a decided preference for the "random-block" system of construction, and made two important proposals—(1) the closing of the present eastern entrance to the harbour, and the opening of a new entrance, 500 feet in width, in from 7 to 7½ fathoms of water, at the north-east angle of the harbour, with a protecting horn 6)0 feet long, (2) the omission of the wave-breaker of concrete blocks along the south pier, which they considered was not subject to heavy seas, and was sufficiently protected by sand accumulations This report was subsequently referred by the Secretary of State to the London committee, who, in March 1884, issued a second report, in which they adhered to their former decision on all points, and consequently recommended that the entrance to the harbour should be retained in its original position, and should be narrowed to 450 feet—an opinion which was accordingly endorsed by the Secretary of State To this latter decision, the Madras Government, acting on the advice of their professional advisers and supported by the entire nautical and commercial interests of the port, have replied, have pointed out that the recommendations of the London committee, regarding the retention of the eastern entrance, were based upon incomplete information, and have strongly recommended, as a point of the first importance, that the harbour entrance should be placed at the north-east angle of the harbour, in from 7 to 7½ fathoms of water, as recommended by the Madras committee At this stage therefore the question of the restoration of the harbour now stands

34 *Buildings constructed, or under construction, by the Public Works Department* —The Public Works department have, from earliest times, constructed and maintained all important public buildings At first, their duties in this respect were mainly confined to the building of civil courts and cutcherries, public bungalows and military hospitals, secondly, to the building of large barracks for the accommodation of British troops, and to the construction of jails; and, lastly, to the provision of the new buildings required by the expansion of business in the Postal, Telegraph, Educational, Medical and other departments of the State In proportion to its size and importance, the Madras presidency has probably fewer modern buildings of any architectural pretensions than any other province of India, and it is only during recent years that the few handsome buildings it possesses have been constructed As an instance of the paucity of modern public buildings, it may be noticed that the Secretariat offices at the presidency town, with the exception of the Public Works Secretariat, are still located in their old quarters within the ramparts of Fort St George, while the High Court of Madras is lodged in old and ill-adapted buildings on the sea-face The more important of the public buildings constructed by the Public Works department since its regular formation in 1858, will now be briefly noticed under the respective heads of Military and Civil Buildings

Military Buildings —The largest and most important building of this kind that has yet been constructed is the Military Convalescent Depôt at the station of Wellington on the Nilgiri Hills This building was commenced as far back as 1852, but occupied many years in construction, owing to the difficulties experienced in procuring labor and materials for the work As each block of the buildings was completed, it was handed over by the Public Works department to the military authorities for occupation, and, at the end of the official year 1860-61, a total expenditure of Rs 17,59,961 had been incurred on the barracks, and its subsidiary buildings and connected works The barracks are commodious and well placed, but the building

generally is of a plain and unpretending character The next military building in order of importance is the Lawrence Asylum at Lovedale, 3 miles from the station of Ootacamund, in the Nilgiri Hills This building was commenced about the year 1864-65, and also took many years in construction, owing to the difficulties found in supplying labor and materials Convicts were largely employed in the works under the superintendence of the Public Works department The asylum was intended, and has been used, as a training school for the free education of sons and daughters of European soldiers of the army An estimate of Rs 11,38,310 was sanctioned for the work, and by the end of 1876-77 (when the building was practically finished), an expenditure of Rs 8,60,910 had been incurred, of which Rs 54,000 were defrayed by private contributions The building is in the Lombard style, and occupies an open and commanding site The remaining military buildings of importance, constructed by the Public Works department, together with the expenditure incurred on them, are shown in the following list —

Family Quarters in Fort St George—Estimate Rs 1,58,100 —Begun in 1863-64, finished in 1865 at a total cost of Rs 1,60,910

Cannanore Barracks, Married Quarters—Estimate Rs 1,27,723 —Commenced in 1866-67, completed in 1873-74 at an outlay of Rs 1,20,147

Artillery Barracks, Cannanore—Estimate Rs 1,05,300 —Begun in 1866-67; finished in 1868-6) at a total cost of Rs 1,05,974

Family Quarters for Warrant and Non-commissioned Officers of the Ordnance Department at the Presidency—Estimate Rs 1,03,910 —Begun in 1866-67, finished in 1869-70 at a total outlay of Rs 1,03,044

Artillery Barracks, St Thomas' Mount—Estimate Rs 2,46,920 —Commenced in 1868, completed in 1876 at a total cost of Rs 2,48,146

Additions to Parade Barracks, Bangalore—Estimate Rs 2,19,830 —Work finished in 1876-77 at a total outlay of Rs 2,19,622

Barracks for European Infantry at Cannanore—Estimate Rs 2,97,430 —Work completed in 1876-77 at a total cost of Rs 2,74,245

Race-course Barracks, Bangalore—Estimate Rs 5,92,540 —Work finished in 1876-77 at a total outlay of Rs 6,16,402

Double-storied Barracks for a second Battery of Field Artillery at St Thomas' Mount —Estimate Rs 2,46,920 —Work completed in 1876-77 at a total cost of Rupees 2,48,146

Barracks for European Infantry at Bellary—Estimate Rs 3,62,988 —Work completed in 1877-78 at a total outlay of Rs 3,83,265

Barracks for European Infantry, Fort St George—Estimate Rs 2,27,350 —Work finished in 1874-75 at a total cost of Rs 2,29,706.

Royal Horse Artillery Barracks, St Thomas' Mount—Estimate Rs. 1,35,050 — Work still in progress, and expenditure up to June 1884, Rs 91,343

Improvements to Gun Carriage Factory, Madras—Estimate Rs 2,48,492 —Expenditure to end of June 1884, Rs 2,15,949

Civil Buildings —The buildings of this class which require particular notice are not numerous First, in order of importance as regards the expenditure incurred, is Government House, Ootacamund, for which an estimate of Rs 7,79,150 has lately been sanctioned The building has no architectural features, and is, in fact, of the plainest type Up to June 1884, an expenditure of Rs 6,08,178 had been incurred against the sanctioned estimate The next building in order of importance is the new Postal and Telegraph office, Madras, which is now rapidly approaching completion This building, which is incomparably the first in the presidency town, was begun as long ago as 1874, when the foundations of the Telegraph office were commenced, but, owing to a variety of causes, the building was not regularly put in hand until the year 1881-82 The sanctioned estimate for the work is Rs 6,18,414, and the expenditure incurred up to the end of June 1884 was Rs 6,12,574 The building is in the Hindu-Saracenic style, occupies a central position on the beach nearly facing the Madras harbour, amid a number of very old and plain-looking buildings, and may be said to be the most prominent architectural feature of the presidency town Two other buildings in Madras, viz, the Senate-house of the Madras University and the

Presidency College, are worthy of especial mention, and are interesting as being the buildings for the design of which the Madras Government, in April 1864, invited open competition by advertisements in the daily and official papers The designs of Mr R F Chisholm (then of the Bengal Public Works department) were accepted by the committee of adjudication, and a prize of Rs 3,000 was awarded to that gentleman, who was shortly afterwards appointed Consulting Architect to the Government of Madras, an appointment which he still holds The Presidency College is in the pure Italian style, was commenced in 1864-65 and was completed in 1870-71 at a cost of Rupees 3,12,697 The Senate-house is an imposing building, in no particular style of architecture, but with a leaning to the Byzantine style It was commenced in April 1874 and was finished in March 1879 at a cost of Rs 2,89,729 The only other building which requires particular notice is the Public Works Secretariat buildings at Chepâk, on which a considerable expenditure has been incurred The building was constructed during 1864-65 to 1867-68 at a cost of Rs 1,12,233 for the accommodation of the Public Works Workshops stores and foundry During the years 1876-77 to 1879-80, it was improved and adapted, at a cost of Rs 1,26,403, for the accommodation of the Public Works Secretariat, who were in the latter year transferred thereto from their old quarters in Fort St George, while the Public Works Workshops were removed to an old building at the Seven Wells Lastly, in the year 1883-84 further improvements were begun and are still in progress, against a sanctioned estimate of Rupees 1,00,545, for the extension and embellishment of the premises The building, which was formerly devoid of the slightest ornament, and was of an extremely plain design, is now a handsome and commodious structure in keeping with the Chepâk Palace, Senate-house, and Presidency College, which are all situated in its immediate vicinity, on the sea-face at Chepâk

The jails of the presidency were mostly constructed about the same period, and the most important of them, together with other important civil buildings, are enumerated in the following list —

—	Estimate	Begun	Completed	Cost
	Rs			
Central Jails				
Rajahmundry	3,53,597	1863-64	1870-71	3,27,804
Vellore	3,75,294	October 1866	March 1873	3,73,235
Trichinopoly	3,78,892	December 1866	December 1872	3,79,297
Coimbatore		1863-64	1867-68	3,76,338
Cannanore	3,27,000	November 1866	March 1873	3,14,264
District Jails				
Palamcottah	2,08,000	June 1876	In progress	* 1,33,850
Tanjore	2,11,100	March 1882	Do	* 92,070
General				
Improvements to General Hospital, Madras	2,19,500		1865-66	2,51,015
Improvements to the office of the Board of Revenue, Chepâk	1,80,305	1868-69	1873-74	1,82,154
Lunatic Asylum, Madras	2,43,500	1866-67	1871-72	2,30,387
Converting Rayapettah Police Court into house for Prince of Arcot	1,49,696	February 1877	February 1878	1,31,585
Lying-in Hospital, Madras	1,78,660	April 1877	January 1883	1,78,758

* Expenditure to end of June 1884

33 *Restoration of buildings of Archæological interest* —The most important work of this class, undertaken by the department, is the restoration of Tirumal Naick's Palace at Madura, on which an expenditure of Rs 2,35,350 had been incurred up to June 1884. The work of restoration was begun as far back as the year 1870-71, when the existing structure was on the point of falling to pieces, and has been in progress ever

since that date under the supervision of the Government Architect In addition to the works which have been taken to ensure the security of this ancient building, the ornamentation of the palace has been carefully renewed, and the interior of the building has been adapted for the accommodation of the Collector's office, the court of the District Judge, and all the chief Government offices of the Madura district In the years 1880-81, 1881-82, works of preservation were carried out at the Seven Pagodas, and consisted chiefly of the removal of the drift sand from the immediate neighbourhood of the monolithic rafts, the cutting off of drainage which was injuriously affecting the sculptures, and the necessary works to provide for the security of the stone temple Some work has also been carried out at the Vellore temple and at the ruins of Hampi in the Bellary district, and measures are now under consideration for the restoration of the ancient palace of Chandragiri, and for its adaptation for the use of public offices

No 567

Transferred to the Chief Secretary to Government in continuation of endorsement, No 566 E, dated 27th August 1884, with remark that the article is approved generally in the Public Works department

OOTACAMUND, *27th August* 1884 (Signed) J SHAW-STEWART, Colonel, R E, *Secretary to Government, P W D*

To the Chief Secretary to Government (with article)

ORDER—dated 23rd January 1885, No 203, Public

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To the Public Works department

Exd J Wright

Govt. of {1885} Madras.

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JANUARY.

Manual of the Administration.

Recording article contributed by the Public Works department on the "General Branch"

GOVERNMENT OF MADRAS

PUBLIC DEPARTMENT

READ—the following paper —

History of the Department

1 Origin of the Madras Public Works department, and character of public works
2 Sketch of Public Works administration up to the year 1858
3 Formation of the Madras Public Works department in 1858
4 Further history of the department from 1858 to 1863
5 Public Works Commission of 1870, and reorganization of the department in 1872
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Organization and Administration of the Department

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15 General sketch of administrative system, together with distribution of circles and divisions

Execution of Works by the Department

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28 Inquiries regarding Madras anchorages, and general sketch of Marine works undertaken by the Public Works department
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31 History of the construction of the Madras Harbour
32 Damages caused to the harbour by cyclone of November 1881, and works since undertaken
33 Measures taken for the completion of the harbour
34 Buildings constructed or under construction by the Public Works department
35 Restoration of buildings of archæological interest

PUBLIC WORKS—GENERAL

HISTORY OF THE DEPARTMENT

1 *Origin of the Madras Public Works Department, and character of public works* —The Public Works department of the Madras Presidency was first constituted, as a distinct and independent department under the direct control of Government, in the year 1858, but, for many years prior to that date, the public works scattered throughout the country had been under the charge of various agencies, which were finally, in the year 1858, merged into one large department The history of the department therefore divides itself naturally into two periods—the period anterior to the formation of the regular Public Works department in 1858, and the period subsequent to that date Before sketching the history of the department, it is necessary to premise that the great difficulties, which have occurred in its administration, have been, in the main, due to the character of the public works with which it has had to deal For the most part, these works consist of a vast property in tanks and channels, numbering over 31,000 and constructed long before the period of occupation of Southern India by the East India Company, are scattered over the whole area of the Presidency, and present a problem, as regards their effective maintenance, with which each successive Government has in vain attempted to deal satisfactorily To this fact may be traced the repeated reorganizations which the department has, at various times, undergone, and the unsatisfactory nature of such reorganizations At the present time, it is universally admitted that it is an absolute impossibility that the Public Works department can supervise and attend to the requirements of works so numerous and so scattered, and the question of the necessary steps to be taken for the effective maintenance of the great majority of the smaller tanks and channels is now in a fair way towards solution, and will be treated of under the head "Irrigation"

2 *Sketch of the administration of public works prior to the year* 1858 —Previous to the year 1858, all public works were carried out and maintained by three distinct and independent departments—

(1) *The "Maramut" department of the Board of Revenue*, which had the control of all irrigation works and navigable canals, all civil buildings in the provinces, and all roads and bridges not under the "Trunk Road department," or not situated in military cantonments
(2) *The Trunk Road department under the Superintendent of Roads*, which had the sole superintendence of the great lines of communication known as the "Trunk roads"
(3) *The Engineering department of the Military Board*, which had the superintendence of fortifications generally, of the roads, bridges, public buildings, both military and civil, at the Presidency town, together with all military buildings in the provinces, and roads and bridges in cantonments

By far the most important of these three departments was the "Maramut" department, which had practically the charge of the great majority of the public works of all kinds throughout the country, and on the efficiency of whose work was largely dependent the irrigation revenue of the Presidency The history of this department, together with that of the other two departments above mentioned, will now be briefly sketched from their formation down to their abolition in the year 1858

The Maramut Department —In the early times of British rule, the Collectors assumed the charge of the works of irrigation with that of collecting the revenue, and, without the aid of any professional assistants whatever, expended annually considerable sums of money in the upkeep and improvement of the works The natural consequence was much unprofitable expenditure and waste of public money In course of time, this state of things attracted attention, and Engineer officers were appointed, under the title of "Superintendents of Tank Repairs," to aid the Collectors, but, for many years, their numbers were too limited to be of any practical benefit At first, when the British possessions in Southern India were much smaller than they now are, there was only one such Superintendent, but, in the year 1809, a second was added, and the principal irrigated districts were divided between the two In the year 1819, the territories of the East India Company in the Presidency were divided into three divisions, each under the charge of a "Civil Engineer," with a suitable establishment, and the whole was placed under the control of an Engineer officer at the Presidency, styled the "Inspector-General of Civil Estimates" This may therefore be considered the date of the formation of the "Maramut" department In the year 1825, the whole "Maramut" department, including the Inspector-General himself, was placed under the Board of Revenue, the Inspector-General having however the power to record his views, for the information of Government, when they differed from those of the Board The department continued on this footing until the year 1836, when, with the object of giving it the benefit of the experience of the Chief Engineer, a change was made by giving that officer a seat at the Board of Revenue in the Public Works department The office of the "Inspector-General of Civil Estimates" was abolished, and an Engineer Secretary to the Board of Revenue in the Public Works department was appointed, upon whom devolved all the administrative duties previously performed by the Inspector-General In 1838, when the importance of the "Maramut" department to the revenue of the country, and the necessity for strengthening it so as to cope effectually with the vast amount of work devolving upon it, was daily becoming more apparent, a really material change was made The whole Presidency was re-arranged so as to form eight "Maramut" divisions, each under a "Civil Engineer," to whom were, at the same time, transferred the construction and repair of all civil buildings in the provinces formerly under charge of the Engineering department of the Military Board, whose establishments were accordingly decreased, while those of the "Maramut" department were increased On this footing the "Maramut" department remained, with the exception of minor changes in the strength of its establishment and arrangement of its divisions, until its abolition in 1858, but in 1845 its work was somewhat lightened by the transfer of the main lines of road to the "Trunk Road department"

The foregoing sketch has only dealt with the Engineering establishment of the "Maramut" department, and has not mentioned the agency by which public works were actually carried out The method of the execution of works, together with the general establishment of the department, will therefore now be treated of Until the abolition of the department in 1858, the duties of the "Civil Engineers," and of the establishment employed under them, were confined to projecting works, preparation of plans and estimates, inspection and direction of works under execution, and the measuring up of works when finished, while the execution of the actual work on tanks, channels, roads, &c, rested with a separate establishment working under the orders of the tahsildars, and known as the "Revenue Maramut" establishment In certain cases, works (such as large buildings) were carried out by the "Civil Engineers" and their establishment, but these were exceptional, and, in the main, the duties of the "Maramut" department proper were of supervision only In the year 1852, the "Maramut" department numbered 24 officers of Engineers, besides 11 other officers of the line temporarily employed, 25 East Indian Surveyors or Assistants to the 'Civil Engineers," and 23 European Overseers belonging to the Sappers and Miners, while a trained native maistry was attached to each "Civil Engineer" This constituted the whole of the trained supervising "Maramut department" The "Revenue Maramut" establishment working under the tahsildars (who were practically the executive

officers by whom works were carried out) consisted of 12 "Superintendents of Maramut," or maistries of superior qualifications, trained by the "Civil Engineers," and transferred by them to the "Revenue Maramut" establishment, and 79 taluk maistries, who were generally without any proper training or qualifications of any sort, and worked under the supervision of the "Superintendents of Maramut" The whole establishment, whether for supervision or execution of works, remained on this footing till the "Maramut" department was finally broken up

The Trunk Road Department—This department was not constituted till the year 1845 Previous to that date, all roads, except those at the Presidency and in military cantonments, were first under the Collectors, and finally under the "Maramut" department of the Board of Revenue As a measure of relief to the overworked "Maramut" department, and to ensure the systematic improvement of the main lines of road, the Trunk Road department was formed in 1845 This department appears to have been altogether an abortive creation, and to have been practically a failure for many years, owing to the inadequate subordinate establishment placed at its disposal Its history can accordingly be briefly narrated As at first constituted in 1845, it was placed under an officer, styled the "Superintendent of Roads," to whose charge was entrusted the formation, maintenance and repair of the main lines of road, extending in the aggregate to a total length of 2,300 miles, all other roads previously in their charge being still retained by the "Maramut" department of the Board of Revenue The main lines of road were, at that time, in very bad order, for many years had been much neglected, and were generally unbridged and unformed In 1846, the Superintendent proposed, what he considered to be, the necessary subordinate establishment required by his department, in order to carry out properly the actual execution of the work to be done on roads, for which an annual expenditure of four lakhs had been sanctioned The establishment was refused, and the consequence was that the department, being utterly unable to cope with the work required of it, and to expend the funds allotted to it, gradually transferred much of its work to the "Maramut" department, which it was originally expressly designed to relieve In 1851, though the "trunk roads" were still nominally under charge of the Superintendent, their maintenance was attended to chiefly by the "Maramut" department, and only 390 miles of main road remained actually under the charge of the "Trunk Road department" By 1853, the department had been strengthened, so as to keep up fairly with the work then expected from it, and the establishment of Europeans for the duties of superintendence numbered 29 in all, viz, the Superintendent, 6 Assistants, and 22 upper subordinates

The Engineering Department of the Military Board—The Military Board of the Madras Presidency was formed as far back as the year 1785, and was divided into the Ordnance department and Engineer department, with the latter of which we have only to deal The engineering works under the Board were distributed in ten divisions, corresponding with the divisions of the army. Five of these divisions were controlled by Superintending Engineers, with executive officers and a suitable establishment of Overseer-Serjeants, &c, for the execution of works In the remaining five divisions, there was no officer permanently under the orders of the Board, but the execution of works was undertaken by the Commanding or Staff officer In 1838, simultaneously with the reorganization of the "Maramut" department in that year, the Superintending Engineers of the Military Board were abolished, the charge of all the civil buildings in the provinces, formerly under the Military Board, was transferred to the "Civil Engineers" of the "Maramut" department, while the charge of the military buildings was transferred to the Staff officers of stations, together with a portion of the establishments trained under the Superintending Engineers. The other works under the control of the Military Board, viz, the construction and maintenance of roads and bridges in Military cantonments, &c, were also placed, at stations, under the Staff officer, and at division head-quarters under the Quarter-master-General of the division staff By this reorganization of 1838, the Staff officers of stations practically became—though quite unfitted for the post—the Executive Engineers of the Military Board This system remained in force until the abolition of

the Board in 1858 Prior to its abolition the Military Board had given rise to universal dissatisfaction Its working was characterised by great delays, its supervision was most ineffective, and—to quote from a Government order of the day—it was "a mere clog to public business"

Allusion has been made, in the sketch of the history of the "Maramut" department, to the "Chief Engineer" The duties of this officer, prior to the formation of the Public Works department in 1858, appear to have been of the most multifarious character, and it is difficult to see where they began and where they ended Chief among them were that, besides being in immediate charge of certain works, and collecting certain items of revenue, he had two separate offices, besides his own office, to attend to, viz, the Public Works department of the Board of Revenue and the Military Board office, he had also control over all fortifications, inspected all work done under the orders of the Military Board, inspected all Government roads in the Presidency, and prepared drawings, &c, of certain works

3 *Formation of the Madras Public Works Department in* 1858—In 1850, the importance of the systematic management and execution of public works throughout the Presidency had attracted the attention of the Court of Directors in England, and, under their orders, a Public Works Commission was appointed in the following year This Commission issued, towards the end of 1852, a very full and particular account of the existing system of Public Works administration, and reviewed at length the working of (1) the "Maramut" department of the Board of Revenue, (2) the Trunk Road department, and (3) the Engineer department of the Military Board, they pointed out the generally neglected state of the public works of the country, except in a few favored districts, dwelt on the inadequacy of the annual grants allotted for public works, and on the inadequate establishments appointed to look after them, and brought to notice the benefits to be derived, by the State, from the systematic and judicious expenditure of public money in the promotion of public works The Commission proved conclusively that the Board of Revenue was no longer able to deal with the business of the "Maramut" department, owing to the vast and progressive increase in the works of this department, and the greatly increased proportions of its establishment, they brought to light many abuses in the execution of works, and commented on the inefficiency of the executive establishment employed, and finally they pointed out that, where public works are scattered over a very large area of country as in the Madras Presidency, it was unthrifty to have three separate establishments for the management of different classes of work, and recommended the establishment of one department for the management of all public works, civil or military They proposed that the establishment should consist of 13 Inspecting Engineers, and a District Engineer with a staff of assistants and subordinates for each Collectorate At the time the Commission wrote (1852), the entire cost of the Public Works establishment was Rs 5,79,474 per annum, and the expenditure on works, Rs 24,50,000 The proposals of the Commission involved an annual charge of Rs 14,69,000 for establishment, and an annual expenditure of 48 lakhs After a great deal of discussion with the Home Government and the Government of India during the years 1853—57, an establishment was finally sanctioned in the year 1858 at a cost of Rs 13,06,614, for the purposes both of supervision and execution of works, and thus, for the first time in its history, the department as a whole became regularly an executive department The sanctioned scale consisted of a Chief Engineer with an Assistant, 3 Inspecting Engineers, 20 District Engineers in immediate control of the Executive officers, 78 Executive and Assistant Engineers, 204 upper subordinates, composed of sub-engineers, supervisors and overseers, and 714 lower subordinates or sub-overseers This establishment looked after the public works of the whole Presidency, which was divided into 87 executive ranges

4 *Further history of the department from* 1858 *to* 1863—In consequence of the mutiny, the expenditure on public works was much restricted, and a considerable part of the Public Works establishment sanctioned in 1858 was accordingly discharged in the year 1859 In 1860, it was considered that the organization of 1858 was unnecessarily elaborate, and had failed to answer the expectations formed of it Various changes were advocated and considered, and, pending the consideration of these

measures, the Chief Engineer was appointed Secretary to Government in the Public Works department, the three Inspecting Engineers or Deputy Chief Engineers were temporarily vested with the powers of the Chief Engineer in their respective circles, and the question of the expediency of transferring the charges of the minor works of irrigation, and the district roads, to the Revenue officers, was referred to the Board of Revenue, and eventually to the Chief Engineer and a Committee of Engineer officers In 1863, the question of the complete reorganization of the Public Works department, so as to reduce the charge for establishment in accordance with the wishes of the Government of India, was referred to another Committee, upon whose recommendation the organization of 1858 was destroyed, and the following radical changes in the administration of the department were made—(1) the three Deputy Chief Engineers, and twenty District Engineers were abolished, and in their place were substituted eight Superintending Engineers, each with the full powers of a Chief Engineer in his division, (2) the 84 Public Works ranges into which the Presidency was then divided were placed in charge of Executive Engineers, Assistant Engineers and upper subordinates, under the direct control of the Superintending Engineer, and it was determined that no ranges should in future be placed under the charge of lower subordinates as was formerly the practice, while the class of sub-overseers was abolished altogether, (3) the Chief Engineer and Secretary to Government, Public Works department, was divested of all the duties formerly performed by him in his capacity as Chief Engineer, except the allotment of funds, the preparation of budgets, and the promotion of subordinates With regard to the question, originally raised in 1860, as to the expediency of transferring minor irrigation works to the Revenue department, the Commission deprecated any general transfer of works to the Revenue department, but urged that the law relating to "kudimaramat," or customary free labor of the people upon petty repairs of irrigation works, should be so modified, as to ensure the due enforcement of the obligation, and enable Government to make the maintenance of minor works of irrigation devolve on those interested in them, in consideration of a partial remission of revenue In accordance with this recommendation, the Government called for the opinion of the Board of Revenue and certain selected officers on the proposed modification of the labor law

5 *Public Works Commission of* 1870, *and reorganization of the department in* 1872 — The next event of importance in the history of the department was the appointment of a Chief Engineer for Irrigation in the year 1867, but with this exception, there was no important change in the organization of the department, as settled in 1863, until the year 1872 In the year 1870, in consequence of the increasing difficulty experienced in maintaining the minor works of irrigation throughout the country, a Public Works Commission was appointed to consider the agency by which they should in future be maintained, and to consider the expediency of reorganizing the Public Works department This Commission, though not unanimous in their report, enlarged on the increasing difficulty of enforcing the liability of the ryots to perform "kudimaramut," or customary labor upon irrigation works, and the evil results of the complete divorce of the Engineering agency from the Revenue department, they also pointed out the inadequate supervision by the superior officers of the Public Works department, owing to inherent defects in its constitution, whereby the eight Superintending Engineers had immediately under their control as many as 88 executive officers in charge of ranges, and they remarked that the organization of 1858 had never had a fair trial, and that the arrangement, resolved on in 1863, of rendering the range officers independent of any control but that of a few Superintending Engineers, was a mistake They therefore recommended, both as a means of securing more effective supervision, and of restoring the intimate co-operation of the Revenue department with the Public Works department (a point which they considered of vital importance) in the prosecution of public works, that the Superintending Engineers should be abolished, and the District Engineer organization of 1858 again restored, by appointing a District Engineer for each Collectorate to control the range officers within that Collectorate With regard to the important question of the effective maintenance of the minor works of irrigation, the Committee (like that of 1863) were decidedly of opinion that they should not be handed over to the Revenue department,

but considered that, as their numbers were far too great to admit of their effective maintenance by any Government department, arrangements should be made for the execution of all ordinary repairs, not requiring professional skill, by the agency of the ryots themselves, by providing that a reduction of assessment, in the form of a remission of revenue, should be granted for the execution of such repairs The Committee also recommended the revival of "kudimaramut," or unpaid village labor of the ryots upon works of irrigation, by a legal enactment, and appended to their report a draft Act for its enforcement It was not, however, until the year 1872, that practical effect was given to the chief recommendations of the Committee, and in the latter part of that year the Public Works department was again reorganized, the principal changes made being (1) the abolition of the eight Superintending Engineers, and the appointment of 21 District Engineers in direct communication with the two Chief Engineers, and (2) in consequence of the abolition of the Superintending Engineers, who, under the constitution of 1863, exercised the full powers of a Chief Engineer in their own divisions, the restoration to the Secretary to Government, Public Works department, in the exercise of his capacity as Chief Engineer, of all the powers of the professional head of the department, which had been curtailed in the organization of 1863 The aggregate cost of the new establishment was Rs 21,50,000 per annum

6 *Further history of the department from* 1872 *to date* —The further changes made in the organization of the department were compressed into the short space of the three years 1878 to 1881, and can be briefly recounted The District Engineer organization of 1872 remained in force up to December 1878, when it was again abolished, in favor of the Superintending Engineer system The Presidency was divided into five circles of superintendence, each under a Superintending Engineer, and the number of executive divisions was reduced to 39 In the autumn of 1879, considerable reductions were made in the executive staff of the department, in consequence of the financial pressure and the reduction of grants for expenditure on public works, and the number of executive divisions was further reduced to 29 It being found that, with the increased areas thus given to each division, the staff of the department was no longer equal to the task of executing the greater part of the public works of the Local Fund circles, all such works were, in the official year 1879-80, handed over to the Local Fund boards for execution by their own agency The consequent reduction in the contribution of local funds to the cost of the Public Works establishment, amounting to about 5½ lakhs, together with the financial pressure then existing, which involved extensive reductions in the grants for works for the year 1880-81, necessitated a still further reduction in the strength of the Public Works establishment, and fifteen officers of the Engineer establishment and 79 upper subordinates were accordingly retired The Presidency was divided into three Superintending Engineers' circles, instead of the five which had previously existed, the Public Works establishments were entirely withdrawn from certain parts of the country, and the number of executive divisions was reduced to 19, of which 13 were under the Superintending Engineers and the remaining six under charge of four Superintendents of Works, who were placed in direct communication with the Chief Engineers Finally, in the year 1881, a large increase was made in the Engineer and Upper Subordinate establishment, which admitted of the Presidency being re-arranged into six Superintending Engineers' circles, sub-divided into 30 executive divisions, of which four were divisions sanctioned for the execution of projects At the beginning of the official year 1884-85 this re-distribution was still in force, except that alterations had been made as regards the number of executive divisions as shown in paragraph 15

7 *Points requiring notice in the History of the Public Works Department* —A perusal of the foregoing paragraphs, relating to the history of the Public Works department, subsequent to its formation in 1858, will bring out two important points— (1) the gradual disuse of "kudimaramut," (2) the ever-recurring difficulty regarding the maintenance of the minor works of irrigation The decline of "kudimaramut" dates from the formation of the Public Works department in 1858 The officers of the new Department of Public Works then created were not vested with any powers for enforcing the obligation, while the Revenue authorities, having no longer the

executive charge of the repairs of the minor irrigation works, made no systematic effort to ensure that the obligation should be carried out It will be seen that both the Committee of 1863, and the Public Works Commission of 1870, attached great importance to the revival of "kudimaramut"

The decline of "kudimaramut" tended largely to the difficulty experienced in the effective maintenance of minor irrigation works, added to which (*vide* paragraph 1) the great number of these works and their scattered nature absolutely precluded, from the very first, their effective maintenance by on Government agency The frequent administrative changes made, from time to time, in the department since its formation in 1858, are largely due to the impossible nature of the attempt to provide for the maintenance of these minor irrigation works

ORGANIZATION AND ADMINISTRATION OF THE DEPARTMENT

8 *Main branches of the department*—As at present constituted, there are two executive branches of the Public Works department, viz, the General and Buildings and Roads branch and the Irrigation branch, each having a Chief Engineer as its responsible executive head The senior Chief Engineer is in charge of the General and Buildings and Roads branch, and is the professional head of the whole department In addition to his professional duties as Chief Engineer, Public Works department, he is also Secretary to Government in the Public Works department, and in his dual capacity deals with the general policy and administration of the department, and with the promotion, posting, and discipline of the whole establishment of the Public Works department He is assisted in his office work by a Deputy Chief Engineer, who is also Under Secretary to Government in the Public Works department

The junior Chief Engineer is the Chief Engineer for Irrigation, who is also Joint Secretary to Government in the Irrigation branch He is the professional adviser of Government in all matters connected with irrigation, and manages the Secretariat work of the Irrigation branch

In addition to the two executive branches of the department, there is a third branch, presided over by the Consulting Engineer for Railways who controls the operations of Guaranteed Railways and is the channel of communication between the Government and Railway officials The Consulting Engineer is assisted by two Deputies The officers of this branch are not borne on the Provincial list of the Madras Public Works department, but on the General Railway list of the Government of India The Consulting Engineer for Railways is gazetted as Joint Secretary to the Government of Madras in the Railway branch, and one of his Deputies as *ex-officio* Under Secretary in that branch

Finally, there is the Accounts branch of the department under the Examiner of Public Works Accounts, which deals with the control and audit of the expenditure incurred by the two Executive branches, the Guaranteed Railways having a separate Accounts establishment

9 *General Establishment of the Department*—Although the executive work of the department is divided into two branches, no separate executive establishment is maintained for the work of each branch, as the great area of the Public Works divisions in the Madras Presidency, and the scattered nature of the public works, precludes any such division of establishment being advantageously made The one general executive establishment of the department is therefore employed indifferently in the general execution of all works, entrusted to the department, such as irrigation, roads, buildings, &c, and the services of each member of the department is therefore utilised in the execution of works in the best practicable way, irrespective of the kind of work to be carried out, or the service for which the work is required The only purely separate executive establishment employed is that known as the Navigation and Water Regulation establishment, which is a small special establishment maintained in connection with irrigation works, and charged to "Imperial irrigation" This extra establishment is employed in the distribution of water for the purposes of irrigation, the regulation of the supply in canals and channels, the control of the canal navigation

and the record of traffic, and the general conservancy of canals, channels and embankments The Accounts establishment is employed indifferently in the same way as the Executive establishment, and the cost of the one general establishment is divided arbitrarily between the several funds for which works are carried out The rules for the debit of the amount charged to "Irrigation" are given in paragraph 2 of the Article on Irrigation All other funds contribute 23 per cent on the outlay on works, and 5 per cent on the revenue collected in the Public Works department The balance of the establishment charges, whatever it may amount to, is charged to "Provincial," while, for the purposes of account, the whole Public Works establishment is regarded as Provincial, to which head the total charges for establishment are, in the first instance, debited During the official year 1882-83, the whole Public Works establishment charges amounted to Rs 18, 21,957, of which Rs 11,76,113 were charged to "Imperial" as follows —

	Rs
Imperial, Irrigation	10,18,968
Imperial, Military	1,11,767
Imperial, other services	45,378

Rs 78,553 were charged to "Provincial," and Rs 43,182 to "Local" funds on account of work executed, while the balance of Rs 5,23,909 was the charge which "Provincial" had to bear of the establishment charges of the Public Works department Of the whole amount of Rs 18,21,957 for establishment, Rs 16,84,518 were for the Executive establishment, and Rs 1,37,439 for the Accounts establishment

10 *Classification of Establishment*—The establishment of the department is classified into two distinct branches—I *The Executive branch*, which includes all officers and other persons necessary for the preparation of designs and estimates, the supervision and control of public works, and the disbursement of money, together with the requisite office clerks and other persons II *The Accounts branch*, which includes the entire establishment maintained for the control and audit of all expenditure incurred from the annual grants for public works The Executive branch is sub-divided into (1) Engineer establishment, (2) Upper Subordinate establishment, (3) Lower Subordinate establishment, (4) Office establishment, and (5) Petty establishment, while the Accounts establishment is divided into the Control establishment corresponding to the "Engineer" establishment, and the Accountant establishment corresponding to the "Upper Subordinate" establishment, of the Executive branch.

11 *The Engineer establishment*—The Engineer establishment is composed of (1) officers of the Royal Engineers, (2) passed students of the Royal Indian Engineering College, Cooper's Hill, (3) 'Stanley" Engineers appointed in England, (4) Civil Engineers appointed in India, (5) passed students of the Civil Engineering College, Madras, and (6) Engineers promoted from the upper subordinate grade, and is classed and graded as follows —

(*a*) Chief Engineers in two classes, (*b*) Superintending Engineers in three classes, (*c*) Executive Engineers, one class in four grades, (*d*) Assistant Engineers, one class in three grades The duties of a Chief Engineer are to control the general operations of his particular branch, to receive reports and communications from the Superintending Engineers, through whom he conducts the general business of the department, and to check projects and designs above a specific amount, and lay them before Government accompanied by a distinct expression of opinion as to their merits The Superintending Engineer controls the Executive Engineers within his circle, through whom he conducts all the details of business, he is vested with considerable powers of sanction of public money, and refers all questions beyond his powers to the Chief Engineer, and, finally, he is an Inspecting officer, and is required to make regular tours of inspection through all the divisions in his circle The Executive Engineers of divisions are in immediate charge of all public works within their divisions, and are concerned with the actual execution of works, the disbursement of money, and the custody of stores and material They are vested with certain limited powers of sanction, and prepare designs and estimates for the approval of the Superintending Engineer The Assistant Engineers usually hold charge of sub-divisions under the orders of the Executive Engineers,

and are practically his Assistants in the superintendence of works, the preparation of projects and designs, and the general duties of the department The following was the sanctioned scale of the Engineer establishment of the department at the beginning of the official year 1884-85 —

Chief Engineers	2
Superintending Engineers	6
Executive Engineers	42
Assistant Engineers	40
Total	90

12 *The Upper Subordinate establishment* —The Upper Subordinate establishment consists of men appointed from the non-commissioned officers and soldiers of Her Majesty's Army in India, or from Civilians, European or Native, who have obtained the required certificates from the Madras Civil Engineering College, or, in the case of Royal Engineer soldiers, that of the Commandant of Sappers and Miners, or again from men who, as Mechanical Engineers, &c, have a thorough practical knowledge and experience in some useful branch of engineering The Upper Subordinate establishment is classed and graded as follows —(1) Sub-Engineers, one class in three grades, (2) Supervisors, one class in two grades, and (3) Overseers, one class in three grades The members of this establishment have either charge of a sub-division of works, under the immediate orders of the Executive or Assistant Engineers, or are assigned other specific duties, not clerical, in connection with the execution of works or with the investigation of projects At the beginning of the official year 1884-85, the sanctioned number of the Upper Subordinate establishment was 185

13 *Lower Subordinate establishment, Office establishment, Petty establishment* — The Lower Subordinate establishment consists of natives who have a sufficient knowledge of ordinary building, and such acquaintance with plan drawing and surveying as will enable them to set out and supervise the construction of the minor class of works undertaken by the department. The members of this establishment consist of the class of sub-overseers, divided into three grades

The office establishment consists of the clerks and draftsmen engaged on purely clerical duties, together with the inferior servants employed in offices The establishment of clerks is divided into five classes, of which the first four classes are sub-divided into three grades, and the fifth class into two grades, while the draftsmen are divided into three classes

The petty establishment includes all storekeepers, artificers, watchmen, lascars and other inferior servants not attached to officers, employed on general duties, whose salaries are not provided for in any estimate for a work

14 *Accounts establishment* —The Accounts establishment is a Provincial service as far as the incidence of charges is concerned, but the superior officers of the branch are under the orders of the Government of India The branch is divided into (1) Examiners arranged in four classes, of which the fourth class is divided into three grades, (2) Deputy Examiners, one class in two grades, (3) Assistant Examiners, one class in two grades, (4) Apprentices, and (5) Accountants The establishment comprised in (1), (2), (3) and (4) corresponds with the "Engineer" establishment, is recruited from much the same classes, and forms a general service under the direct orders of the Government of India The duties of the Examiner are to control the operations of the Accounts establishment in the Presidency, to audit the accounts of receipts and expenditure submitted to him by the Executive Engineers and other disbursing officers of the department, and subsequently to compile these accounts into one general account for the Presidency, to be submitted to the Accountant-General to the Government of India for incorporation in the general accounts of the empire The establishment of Accountants forms one class divided into five grades, and corresponds to the "Upper Subordinate" establishment of the Executive branch It is composed both of Europeans and Natives who have passed the principal tests The members of it are under the orders of the Madras Government, and are employed indifferently, either in the Central office at Madras in auditing and compiling the divisional accounts,

or at the head-quarters of the several divisions in preparing the accounts from the cash-books, and other initial records, maintained by the Executive Disbursing officers

15 *General sketch of the Public Works system together with distribution of circles and divisions* —From the foregoing paragraphs concerning the administration and organization of the department, it will be clear, first, that the Chief Engineers direct the general operations of their particular branch through the Superintending Engineers, and are, in the main, administrative officers, second, that the Superintending Engineers are inspecting and supervising officers, controlling the Executive Engineers within the limits of their circle, and third, that the Executive Engineers, and all the officers and subordinates employed under them, form the establishment actually concerned with the execution of works The whole Presidency is divided into six circles under the charge of Superintending Engineers, which circles are sub-divided into 28 permanent divisions, each in charge of an Executive Engineer In pursuance of a policy which has lately been introduced, important works of considerable magnitude are now being carried out by the aid of temporary establishments, the works themselves being kept apart from the other works undertaken in the permanent divisions in which they are situated, and a special temporary division being formed for their execution Of these temporary divisions there are now seven, which brings the total number of sanctioned divisions to 35 The following statement shows the Superintending Engineer circles, the sanctioned executive divisions, together with the area in square miles of each circle or division, and the district in which each division is situated, at the beginning of the official year 1884-85 —

STATEMENT showing the Public Works Circles and Divisions

Circles	Head quarters of circles.	Divisions	Head-quarters of divisions	Areas of divisions in square miles	Areas of circles in square miles	Districts in which situated
No. I	Dowlaishweram	1 Ganjam	Berhampore	5,674	18,226	Ganjam
		2 Rushikulya (temporary)	Do			Do
		3 Vizagapatam	Waltair	5,016¼		Vizagapatam.
		4 Godávari, Eastern	Dowlaishweram	7,535¼		Godávari
		5 Do Central (temporary)	Gunnavaram			Do
		6 Godávari, Western	Chettipett			Do
No II	Masulipatam (Bezváda)	7 Kistna, Eastern	Bezváda	8,387½	16,469¼	Kistna
		8 Gudiváda (temporary)	Gudiváda			Do
		9 Kistna, Western	Duggirala	8,082¼		Do
		10 Nellore	Nellore			Nellore
		11 Sangam Project	Sangam			Do
		12 Buckingham Canal	Nellore			
No III	Bellary	13 Bellary	Bellary	11,051	26,358½	Bellary
		14 (C) Project	Do			Do
		15 Cuddapah	Cuddapah	8,304		Cuddapah
		16 Kurnool	Kurnool	7,003½		Kurnool
		17 Kurnool Canal	Do			Do
		18 Nilgiri	Ootacamund	1 705		Nilgiri
		19 West Coast	Calicut	8,497		Malabar and Canara
No IV	Coimbatore	20 Coimbatore	Coimbatore	14,915	20,117	Coimbatore and Salem
		21 (B) Project	Do			Do
		22 Barur Project	Barur			Salem
		23 North Arcot	Vellore	7,029½		North Arcot
		24 South Arcot	Cuddalore	4,943¾		South Arcot
		25 Chingleput	St Thomas' Mount	3,139¾		Chingleput
No V	Madras	26 Presidency and Bangalore	Bangalore	38	15,150¾	Madras and Bangalore
		27 Presidency Workshops	Madras			Madras
No VI	Trichinopoly	28 Trichinopoly	Trichinopoly	4,599½	20,455½	Trichinopoly
		29 Tanjore	Tanjore	1,667¾		Tanjore
		30 Cauvery and Vennár Regulators (temporary)	Grand Anicut, Tanjore			Do
		31 Negapatam	Negapatam	1 825		Do
		32 Madura	Madura	8 419½		Madura
		33 Tinnevelly	Palamcottah	3 944		Tinnevelly

Statement showing the Public Works Circles and Divisions—*Continued*

Circles	Head-quarters of circles	Divisions	Head-quarters of divisions	Areas of divisions in square miles	Areas of circles in square miles	Districts in which situated
Supt of Works, Tank Maintenance Scheme.	Madras	34 Consulting Architect	Chepák			Madras.
	Do	35 No 1 Tank (temporary)	Madura			At present in Madura
		36 No 2 Tank (temporary)	St Thomas Mount			At present in Chingleput
		37 Lower Coleroon Project.	Cuddalore			South Arcot
				Total area	1,21,777½	square miles

EXECUTION OF WORKS BY THE PUBLIC WORKS DEPARTMENT

16 *Functions of the department in regard to public works* —The Public Works department deals with all engineering works undertaken by the State, the construction or repair of which has to be carried out under professional superintendence Detailed designs and estimates for public buildings and other engineering works, required by any other department of Government, are drawn up by the Public Works department, and, after the general arrangements proposed have been approved, the Public Works department carries out the works as soon as funds are made available to meet the estimated expenditure The Public Works department is thus called upon to plan and execute works for the Government of India, for the Provincial Government, for the various Local Fund boards, for the Board of Revenue, and the heads of other departments as trustees of certain special funds which they administer, for the Court of Wards, and occasionally for municipal corporations

17 *Imperial works undertaken by the department* —For the Imperial Government, the Public Works department undertakes the construction and maintenance of the following works (*a*) *Irrigation*, including all works in connection with irrigation and river conservancy, (*b*) *Imperial* proper, sub-divided into (1) *Military*, including all works connected with the army, such as Fortifications, Barracks, Commissariat and Ordnance buildings, Military rest-houses, and Cantonment roads, (2) *Other Services* including all buildings and other works connected with the Postal, Telegraph and Salt departments, together with such mining operations, light-houses and other public improvements as may be considered to be rather of imperial than of local interest To meet the expenditure on these heads, grants are yearly made by the Imperial Government from the ordinary revenues of India, and also from loans raised by the Imperial Government for the purpose of constructing productive public works For the year 1884-85, the Imperial grants for "works" amounted to Rs. 32,75,909 from Ordinary Revenue, and Rs 16,06,162 from Loan Funds The total grant was allotted as follows

	Rs
Irrigation	42,94,071
Imperial Military	4,73,300
Imperial Other Services	1,14,700
Total .	48,82,071

By far the most important of the works thus carried out by the Public Works department for the Government of India are those connected with irrigation and conservancy of rivers

18 *Provincial works undertaken by the department* —For the Provincial Government, the Public Works department constructs and repairs all buildings in connection with the Judicial, Revenue, Customs, Police, Educational, Jail, Medical, Marine, and Ecclesiastical departments, as well as the navigable canals not forming part of a system of irrigation channels To these may be added a few special roads, all works connected with the improvements, water-supply, and drainage of towns other than municipalities, all works connected with harbours, and works connected with the light-houses required for the purely local coasting trade For the year 1884-85, the grants from Provincial funds for expenditure on "works" amounted to Rs 17,60,391.

19 *Local and special works undertaken by the department* —Under existing arrangements, the Public Works department only executes a few works on behalf of Local Fund boards, and all roads in the Presidency, together with all other works, formerly undertaken by the Public Works department for the Local Fund boards, are practically constructed and maintained by the agency of establishments employed by the Local Fund boards, except such works as from time to time are specially excepted This system dates from the year 1879-80, when a very comprehensive measure of decentralization, with regard to all Local Fund works, was carried out, by giving full scope to Act IV of 1871, constituting the formation of Local Fund boards The duties of the Public Works department with regard to Local Fund works are, in the main, now confined to the professional scrutiny of important designs and estimates for bridges, &c An additional establishment is maintained in the offices of the Superintending Engineers and in that of the Chief Engineer, Public Works department, for the purpose of scrutinising such projects, and a contribution of Rs 21,250 is annually paid by Local Funds on account of the professional scrutiny of their estimates by the Public Works department establishment The "Special Works" undertaken by the Public Works department are executed from certain special funds administered by Government and by the Board of Revenue For the year 1884-85, the grants from Local and Special funds for expenditure on "works" amounted to only Rs. 16,710 and 25,700 respectively

20 *Method of execution of works* —The execution of public works in the Madras Presidency is, for the most part, carried out either by daily labor under the direction of the officers and subordinates of the department, or by petty contract under the same supervision The employment of large contractors is mainly confined to the preparation and supply of materials for large works, and to the construction of certain classes of buildings Large workshops are maintained at the Presidency town and at Dowlaishwaram and Bezváda, the head-quarters respectively of the irrigation works of the Godávari and Kistna Deltas, for the execution of repairs to machinery and the design and execution of the various classes of work usually turned out by engineering workshops, and required from time to time by the several executive divisions of the Public Works department Except in cases of emergency, Executive Engineers are not authorized to put in hand any work without a duly sanctioned estimate and an appropriation of funds An appropriation once made, the work is put in hand by the Executive Engineer after the necessary arrangements have been made with the Revenue officers for the formal acquisition of the land required Funds for the prosecution of the work are drawn by the Executive Engineer from the nearest treasury by cheques on his public account, and, on completion of any work estimated to cost over Rs 500, that officer prepares and signs a "completion report," certifying as to the manner in which the work has been carried out

21 *Incidence of Public Works Expenditure* —The grants for expenditure from Imperial funds on public works are made annually by the Government of India and are met from the revenue of the year, or from funds raised on loan (*vide* paragraph 17 *supra* and paragraph 3 of Article on Irrigation) The grants from Provincial funds for expenditure on public works are fixed annually by the Financial department of the Madras Government, and are, as far as practicable, regulated by the amounts set apart by the Government of India under Lord Mayo's decentralization scheme of 1870, whereby the permanent assignment made to "Provincial," for the Madras Presidency, was fixed at 23 3 lakhs for expenditure on public works The actual grants and expenditure have, however, fallen far short of this amount; as, excluding the famine year of 1877-78 (when an abnormal expenditure of Rs 60,88,309 was incurred), the average annual expenditure from Provincial, from the years 1871-72 to 1882-83, was only Rs 18,97,560 The grants to Provincial have, however, been increased by the Government of India for the year 1882-83, 1883-84, and for each remaining year of the current Provincial contract, *i e*, up to 1886-87 The total expenditure by the Public Works department from Imperial, Provincial and Local Funds from the years 1870-71 to 1882-83, including the charges for establishment and tools and plant, is shown in the accompanying statement —

Statement of total expenditure in the Public Works

Class of works	1870 71	1871-72	1872-73	1873-74	1874-75
Imperial	Rs.	Rs	Rs	Rs	Rs
Irrigation and Navigation—					
Original works	8,00 020	8 02 174	8,78,509	8 13 587	8 10 354
Repairs	11,44 826	11 22 500	12,61 303	14 00,194	15 43 707
Establishment	1,34 877	1,97 131	6 36 032	6,34 694	8 28 231
Tools and plant	1o,702	6,532	2,30,625	44,216	83 216
Total	20 94,925	21,28,337	29,79 469	28,92,691	32,6o 548
Military—					
Original works	3 32 3o3	2 10 667	2 84 121	2 69 461	3,28,534
Repairs	2,23 005	2,23,48o	2 43 069	2 59 703	2 32 218
Establishment			1 89 730	1,19,082	1 46 350
Tools and plant			20,888	1o,097	28,078
Total	5 55 3o8	4,34 1o2	6,87,808	6 63 343	7,35,180
Other services—					
Original works	11,83 000	32,310	47 760	21,046	28,634
Repairs	10 39 410	2,856	3 396	3 996	4 715
Establishment	14 75 473	5 89,994	13 o26	5,914	16 158
Tools and plant	1,47,772	61,759	2,026	714	2 766
Total	(*d*) 38 4o,655	6 86,918	66,738	31,670	52,273
Provincial					
Irrigation and Navigation—					
Original works					
Repairs					
Establishment					
Tools and plant					
Total					
Roads and Buildings—					
Original works		5,18 112	7 20 790	9 65 924	7 71,727
Repairs		1 42,107	1 66 998	1,94 853	2,0o,136
Establishment		1,81 191	2,26 696	2,51 577	2,0o,070
Tools and plant		47,147	70,637	4,973	5o,508
Total		8 88 557	11,85,121	14,16,727	12,37,440
Local					
Original works	12,93,759	14,30,382	13 11 052	18 54 008	16,24 916
Repairs	7 21,577	17 35,58o	19,74 507	20 76 338	21,32 060
Establishment	2,99,369	9,60,923	9,87 477	10,32 031	8,80 905
Tools and plant	13 467	31,2o4	37,923	54,463	28,050
Total	23 28,172	41,58,144	43,10,9o9	50,16 840	46,65,931
Grand total—					
Original works	36,09 132	29 93 645	32 42,232	39 23,426	3o,64,205
Repairs	31 28 818	32,26 532	36 49 273	39 35,084	41,17,335
Establishment	19,09 719	19 29 239	20 03 491	20 43 298	20,76 714
Tools and plant	1,76,441	1,46,692	3 35,099	1,19,463	1,97,618
Total	88,24 110	82 96,108	92,30 095	100,21,271	99,56,372
Madras Harbour Works—					
Works					
Establishment					
Tools and plant					
Total					

(*a*) Of this Rs 176 2o 050 represents the purchase
(*b*) This was a famine year and the total outlay
(*c*) The excess under this head is attributable to
(*d*) Includes works that are now classed as

department from 1870-71 to 1882-83

1875-76	1876-77	1877-78	1878-79	1879 80	1880 81	1881 82	1882 83
Rs	Rs	Rs	Rs	Rs	Rs	Rs	Rs
10 96,114	6 17,969	4 96 474	8 15,3o8	4 43 716	5 69 240	7 16 428	(*a*) 187,53 191
1o 22,742	14 o6 378	1o 44 063	12 09,127	11,35 630	11,91,402	12,20 224	16 2o 069
8 o1 904	7 64 072	14,92 321	8,91 143	7 44,o98	6,24,172	6 61 764	10 18 218
1,35 352	1,46 980	1,71,353	92,279	1,26,077	1,83 662	1,30,222	1,61,046
36 06,112	29,85 399	37,04,211	30,07,907	24,50,o81	25,68,476	27,28,638	215,57 o24
3 87,16o	2 90 o7o	3 o5,898	2,17,110	21 227	1,39,576	1 15 o74	2 48 36o
2 60 o93	2,12 2o6	2,40 403	2,00 779	1,90,125	2,77,447	2,69 097	2,92,9o8
1,63 465	1 62 822	1,53 120	1,69 998	1,o8 709	99 25o	96 161	1,11 767
23,60o	2o 367	1o,176	15,731	16 023	9,925	9,603	7,221
8,34,828	7,1 ,020	7,14,o97	6,03,618	3 86,084	5,26,203	4,90 43o	6 60,308
17 602	29 7o3	27 011	23 237	34 145	1,19 131	1,92, ,82	2,01,206
8 8,6	2,o73	8 985	12,900	4,86o	3 313	5,672	5 099
22,9o4	20 202	16 134	45 062	38,o57	28 362	64,311	45,378
843	3 389	1,718	1 335	2 957	3,040	6,627	3,028
50 235	5o,917	53,848	82,534	80 524	1,53,846	2,69,192	2,o4 711
				1,50,167	1 17,839	1 05 463	1,49 604
				64 741	1,22 929	81 503	1 24 321
				42 777	60 192	o1 405	73 739
				4,016	6 019	10,675	5 194
				2,16,701	3 06,979	2 49,046	3,52,8o8
10 99 324	9 02,042	36 oo 789	10,25 412	4,01,815	8 01,266	4,74,29o	11,32 525
4,27 878	3 79 673	6 63 833	5,67,444	1,76 371	1,30 427	1,47 922	1 86,659
5,28,609	5 39,598	12 79 506	11,27 000	6,35 690	5 50,o54	7,05 784	5 23 909
77 492	1,27 60o	3,15,376	35,782	2 64 868	18,837	31,802	69,491
21 33,303	19 48,918	59,14,o04	27,55,638	9,49,008	14 63 410	12,96,199	17 73,602
10 13 5o3	14 07 713	9,50,437	5 24 971	3,99 686	1,14,7o0	92,362	68 500
19 o8 922	18 22 o59	12 41 109	15 93 19o	17,o2,196	1,o4,015	1,60 318	38,455
5,71,503	7 43 5o9	3,96 071	5,73 341	4,69,131	62,689	31,932	43 182
37,106	36,198	88,777	5o o43	44,884	6,141	4,413	2,623
3o 81 084	40,09,529	26,76,394	27,47,050	26,6o,897	3,37,595	2,89,025	1,52,760
36,13 7o8	32,48 052	(*b*) 54 3o 609	26 06 088	14,05 786	18,61,802	16 96,704	(*a*) 20o,53 391
41,78 971	38 92 939	(*d*) 36 98 393	35,83 445	33 23 928	18,79,533	18 84,736	22 72,5o8
21 38 43o	22 30 2o3	(*c*) 33 37 152	28,06 544	20,89,462	14,25 224	16,11 357	18 16,193
2,74,398	3,39,539	5,92,400	2,00,670	70,911	1,89,9o0	1,29,738	1,69,621
102,0o 562	97,10,783	130,63,554	91,96,747	67,48 265	53,56,509	53,22 o35	247,51,763
76 809	5,74 998	3,95 196	7,78 030	11,66 211	13,84 164	6,63 858	4 12 823
2o 514	64,901	48 080	53 021	50 295	68,632	71,083	56,243
24,212	3,66 799	1 01,892	4,770	4,27o	8,779	54,817	2 334
1,26,33o	10 06,698	5,45,168	8,35,821	12 20,781	14,61,o75	7,89,758	4,71 400

value of the Kurnool canal
shown is inclusive of Rs 44 46 594, being the normal value charged on account of famine
the cost of the extra establishment employed on Famine Relief works
"Provincial"

The method of the debit of establishment charges has already been explained in paragraph 9 Tools and Plant charges are also, in the first instance, charged to "Provincial," as in the case of establishment charges, and a percentage of 1½ per cent on expenditure and repairs is charged to all funds, on account of general tools and plant, except in the case of Irrigation and Navigation works for which Capital and Revenue accounts are kept, when the *actual* expenditure incurred is charged to the works Where tools and plant are specially procured for a work, the cost of such "Special tools and plant" is charged to the work

DESCRIPTION OF IMPORTANT PUBLIC WORKS

22 *Classes of public works* —The most important of the public works of the Madras Presidency—other than those of irrigation, which are treated of in a separate Article—can be divided into three main classes, viz , (1) Communications, (2) Harbours, (3) Buildings With a very few exceptions, no works of the first class remain at the present time under the charge of the Public Works department, but are entirely maintained by the establishment of the Local Fund boards The main lines of communication of the Presidency, together with the large bridges thereon, were, however, constructed by the agency of the Public Works department, and, together with all other roads, were, in the main, maintained by the same agency until the year 1879, when a complete transfer of the charges of "Communications" was made to an Engineering establishment directly employed by the Local Fund boards Under the head of "Communications" will, therefore, be briefly described the developement of the systems of road in the Presidency and of such navigable canals of importance as have not been described in the Article on Irrigation Under "Harbours" an account will be given of the Madras Harbour works and the other Marine works and harbour improvements undertaken by the Public Works department from time to time , while under the head of "Buildings" will be very briefly described the principal works of that class executed by the department

23 *Communications—Sketch of the development of roads until the formation of Public Works department in* 1858 —When Southern India first came under British rule, no roads suitable for wheel traffic existed, even in the main streets of the largest towns, and it was not until the year 1845, when the Trunk Road department was formed, that any systematic progress in the construction of roads was made by the British Government In the early days of British rule, the only "made" roads were the mountain passes, which were originally opened for the passage of troops and artillery Subsequent to the construction of these roads were formed rough roads connecting the military arsenals and cantonments, but no roads for other than military purposes were constructed, or thought of, until the year 1813, when the necessity for the construction of roads for commercial purposes first engaged the attention of Government No systematic progress was made, however, for many years in the development of "communications," though in certain districts the energy of individual officers accomplished a great deal in this respect within the limits of their charges About the year 1823 an abortive attempt was made to construct roads by the agency of the Corps of Pioneers, which at that time numbered about 2,000 strong, and were notoriously a hardworking, useful body of men, little hampered by customs of caste, and therefore ready for any employment that might be given to them This measure was a total failure owing to the lack of any professional knowledge whatever on the part of the officers of the corps, which was then entirely officered by regiments of the line , and in 1831 Government finally abandoned the idea of any considerable improvement and development of roads as a task of too great magnitude From 1837—1844, some important lines of road were opened or improved, but, owing to a want of system in the management of the several undertakings, much wasteful and unprofitable expenditure was incurred, which circumstance led to the idea of the formation of a special department, whose sole duty it was to design and construct a great system of trunk roads, or main lines of communication, throughout the presidency In the following year therefore the Trunk Road department was constituted, and from that time until the year 1858 gradually proceeded to construct the trunk roads of the presidency, which, it will be observed, for the most part follow the lines connecting the military

arsenals and cantonments, and therefore owe their origin to the rough roads originally traced out many years previously Reviewing the expenditure on "communications" up to the year 1845, we find that, in the 20 years from 1826 to 1845, the average outlay on the communications of the whole presidency was only Rs 1,16,926 With the year 1845, however, a new era commenced in the history of the roads of the presidency Previous to that date, the whole of the expenditure on roads was under the control of the Board of Revenue, under whom was also (paragraph 3) the Engineering establishment employed on them, but in 1845 the control of the expenditure passed into the hands of the Superintendent of Roads In paragraph 3, the working of the Trunk Road department has been briefly described, and it will therefore be sufficient to say that, while not accomplishing what was expected and required of it owing to administrative defects in its constitution, it did much good work, gradually expanded its operations, and proceeded with the bridging, formation, and improvement of the trunk roads on a systematic and uniform plan until its final abolition in the year 1858 .

24 *Further development of roads until the formation of Local Fund Boards in* 1871 —After the formation of the Public Works department in the year 1858, the construction of the main road of the country was carried out by the department from Imperial funds, while the duty of keeping the minor district roads also devolved, in most districts, almost entirely on the Public Works department For some years, however, the funds provided for the main district roads were exceedingly inadequate, and were provided from Imperial revenue and from funds raised from local sources In the year 1862, the attention of Government was directed to the question of the entire provision of funds for such roads as were of local rather than Imperial importance from funds raised locally It was then roughly determined, pending further investigation, that there were only 6,360 miles of road which could properly be maintained from Imperial funds, viz , the 2,610 miles of trunk road then existing, and 3,750 miles of first-class district roads The remaining roads, amounting to about 10,000 miles of district lines, were considered to be merely of local importance, and various measures were proposed for the formation of a fund to be raised in each district, adequate to provide for their completion and maintenance. The income of the Local Funds of the presidency, at that time available for expenditure on district roads, was only Rs 2,26,873 (derived from ferry and grass rents, bridge tolls, and cattle fines, &c), and therefore only allowed very inadequate grants being spent upon the district roads It was estimated at that time (1862) that the following sums were required for the completion and maintenance of the 6,360 miles of road already mentioned —

	Complete construction	Annual maintenance
	RS	RS
For trunk roads	58,93,008	4,44,498
For district roads	1,53,90,337	10,29,072
Total	2,12,80,345	14,73,570

Whereas the total expenditure upon roads and communications for the five years preceding was as follows —

Year	Expenditure		Total
	New Works	Repairs	
	RS	RS	RS
1856-57	13,75,611	5,41,195	19,16,806
1857-58	5,01,478	5,51,791	10,53,269
1858-59	3,81,736	7,98,268	11,80,004
1859-60	4,35,030	9,09,708	13,44,738
1860-61	6,17,260	9,82,285	15,25,545
Total	33,11,115	37,09,247	70,20,362
Average per annum	6,62,000	7,40,000	14,04,000

It was therefore plain that more must be done for the development of roads than had been the case for the past few years, and in 1862 orders were therefore issued for the preparation of detailed lists of the roads to be classed as Imperial and to be constructed and maintained from Imperial funds, and the subject of the creation of some scheme for augmenting the local resources in order to provide for the construction and maintenance of all other lines of road, which were to be denominated "district roads" in contradistinction to those classed as "Imperial," was referred to the Board of Revenue In 1865 the wants of the districts in the way of local communications were every day becoming more urgent, and as considerable reductions in the Imperial grants given annually by the Government of India were made about that time, the question of the necessary provision of funds to be raised locally for expenditure upon roads (for which no definite scheme had then been prepared) was again taken up by Government calling upon the Board of Revenue to prepare and submit a draft Act for the levy of a district road-cess on all land-holders for the construction and maintenance of district roads, "as it was clear that the increasing demands upon the general revenues rendered it hopeless to expect that the Government would ever be in a position to do more than complete and maintain the chief lines of communications" Accordingly, in April 1866, the Bill known as the "District Road-cess Act III of 1866" was passed into law, by which a cess, not exceeding half an anna in the rupee on the rent value of occupied land, was imposed so as to form a fund for the construction and maintenance of the district roads The amount raised by this cess subsequently attained very considerable dimensions, while, in the year immediately after the Act was passed, the general income from Local funds went up with a bound from an average of Rs 6,84,150 in the three years, 1864-65—1866-67, to Rs 22,33,379 in the year 1867-68, and Rs 32,27,379 in the year 1868-69, of which latter amount Rs 15,17,097 was expended upon the construction of district roads Meanwhile, the final classification of all roads into "Imperial" roads and "District" roads was proceeding under the officers of the Revenue and Public Works departments, but was not finally settled until the year 1868-69, when it was decided that the expenditure from Imperial funds should be restricted to (1) certain specified main lines of communication, 25 in number, of a total length of 4,000 miles, (2) the ghát roads and certain special roads, amounting in all to a length of 650 miles, and (3) the salt roads, 23 in number, and 500 miles in length, while all other roads should be classed as district roads Until the formation of Local Fund Boards in 1871, the Imperial and District roads, as thus determined, were therefore maintained and constructed respectively from Imperial funds and from the "District Road Fund" raised under the Act of 1866, while the general agency of execution was the Public Works department Reviewing the expenditure incurred and the work done during this period, we find that the expenditure on roads in the year 1868-69, for new works from Imperial funds, was Rs 12,17,455, and was devoted chiefly (1) to the construction and improvement of the Great Northern Trunk Road from Madras to Calcutta in the districts of Madras, Nellore, Kistna, Vizagapatam, and Ganjam, and (2) the construction of ghát roads in the Coimbatore, Malabar, and Wynaad districts, while the expenditure from the "District Road Fund" on new works amounted to Rs 15,17,097, and was principally expended in completing a network of minor communications, of which the most important were the railway feeders and the construction of embanked roads in the deltaic tracts of the Godávari, Kistna, and Tanjore districts

25 *Construction and maintenance of roads under the Local Fund Boards* —Local Fund Boards in the Madras Presidency were first constituted by the Local Funds Act IV of 1871, which repealed the District Road-cess Act of 1866, and provided for the unexpended balance of the "District Road Fund," raised under the Act of 18[illegible]66, being transferred to the Local Fund Boards The Local Funds Act provided for the imposition of a cess similar to the district road cess, but with a maximum [illegible] for the in the rupee, and for the establishment of tolls upon roads, two-thirds of one anna the whole of the tolls being expended on roads The agency [illegible] of the cess and before, the Public Works department, and to pay for the Pu[illegible] of execution was, as employed on the roads, the Local Fund Boards were [illegible] Works establishment cent on the actual outlay incurred. In addition [illegible]harged at the rate of 25 per expenditure on roads by the passing of the [illegible] to the funds made available for [illegible] Local Funds Act, annual contributions

from Provincial Funds were given by Government to the Local Fund Boards as grants-in-aid for expenditure upon the main lines of road, and from June 1871 the distinction formerly in vogue between "Imperial" and "District" roads was abolished, and the total annual assignment of grants-in-aid from "Provincial," together with the assignment from "Local funds," was treated as one general fund under the designation of "Road Fund" which provided for the construction and maintenance of all roads, including those formerly provided for from the Imperial grant for communications From the year 1872-73 to 1879-80 no change was made regarding the agency of execution of work upon roads, and the provision of funds for expenditure thereon and all roads continued up to 1879-80 to be carried out by the Public Works department for the Local Fund Boards, while the expenditure relating thereto was accounted for in the Public Works department In 1879-80 an important change was made, inasmuch as the entire execution of the maintenance and construction of roads was transferred from the Public Works department to the Local Fund Boards, who forthwith employed their own Engineering establishments directly responsible to them Since that date the Public Works department has, with the exception of certain special works, such as the Potinghi Ghát, &c, had nothing to do with the roads of the presidency generally, except as regards the check and examination of certain estimates as already explained in paragraph 19 The following statement shows the total expenditure incurred upon roads (not including the establishment charges) during the period of execution of work upon them by the Public Works department, viz, from the year 1872-73 to 1879-80 —

Statement of expenditure on roads from 1872-73 to 1879-80

Year	Expenditure on Roads from "Provincial Funds"			Expenditure on Roads form Local Funds			Grand Total
	New Works	Repairs	Total	New Works	Repairs	Total.	
	RS	RS	RS	RS	RS	RS	RS
1872 73	1,09 828	45 994	1 55 822	11,96,521	19 01,416	30 97 937	32,53,759
1873-74	1 96 143	29,679	2,25 822	16 47,768	19,59,152	36,06,920	38,32,742
1874 75	1 66 208	32 353	1 98 611	13 17 300	20 17,239	33 34 539	35,33,150
1875 76	6 91 185	2 92 621	9,83 806	7 16,536	18,36 672	25 53 228	35 37,034
1876 77	2 82 443	2 44 304	5,26 747	11 28,748	16 93 471	28 22 219	33 48 966
1877 78	31 44,334	4 19 387	35 63 721	7 25 091	10 90 228	18,20 319	53 84 040
1878 79	6,51 610	4,33,614	10,85 124	3 85,839	15,05 426	18 91,265	29 76 389
1879 80	43,709	36,627	80,086	3,08,560	16,33,024	19,41,584	20,21,670

The expenditure of 1876-77 was abnormal, and was due to the famine The expenditure shown under the head "Provincial" was that incurred by the department on certain roads specially so classed The expenditure shown under the head of "Local Funds" includes the grants-in aid from "Provincial" which, as already explained, were amalgamated with the assignments from Local funds into one general fund These Provincial grants-in-aid were first given in the year 1872-73, and from 1876-77 have been much reduced in amount, as the following statement will show —

Statement showing the amounts of grants-in-aid from Provincial to Local for the years from 1872-73 to 1879-80

Year	Amount RS
1872-73	11,26,000
1873-74	12,00,000
1874-75	12,00,000
1875-76	11,10,000
1876-77	2,43,390
1877-78	1,18,230
1878-79	62,500
1879-80	1,25,000

The communications of the presidency are now therefore entirely under the Local Fund Boards, who provide for their construction and maintenance from their own

revenues, of which the chief item is that raised by the land-cess, aided by a small contribution from Provincial In the year 1882-83, the number of the Local Fund engineering circles was 30, the total length of roads, exclusive of village roads under their charge, was 21,019 miles, while the total expenditure incurred on roads was Rs 28,52,083, or 47 per cent of the whole Local fund expenditure

The chief lines of road are shown in the accompanying map Of these, the most important at the present day (as it traverses districts in which there is no line of railway) is the Great Northern Trunk Road from Madras to Calcutta, passing through the districts of Nellore, Kistna, Godávari, Vizagapatam, and Ganjam This road crosses the entire drainage of the country at right angles to its course, and is provided with numerous bridges Next, in order of importance, come the Great Southern Trunk Road from Madras to the Travancore frontier, the Great Western Trunk Road from Madras to Calicut, and the ghat roads leading from the Nílgiri to the Malabar Coast, the Mysore plateau, and the Madras railway at Mettupálaiyam

26 *Proposed extension of main roads and scheme for tramways or light railways* — In the interests of the coffee industry, carried on mainly by European planters in the Nílgiri and Wynaad districts, and also to aid in developing the gold-mining enterprises which have of late years been started in the Wynaad, a scheme for the extension and improvement of the existing lines of communication between the Malabar Coast and the Nílgiri plateau has lately attracted the attention of Government, and a special Public Works officer is now engaged in making the requisite surveys and estimates for the conversion of the existing lines of road into first-class metalled roads capable of bearing traffic during the monsoon The Wynaad roads, like all other roads in the presidency, are at present under the charge of the Local Fund Boards, and, though it is intended that the Public Works department should ultimately execute the improvements proposed, existing arrangements for the maintenance of the road by the agency of the Local Fund Engineer establishment will not be disturbed until such time as funds are available and the Public Works department is in a position to take over the work of complete restoration The improvements proposed will cost a large sum, and the work will extend over some years As the line most required at present is, in the opinion of the Wynaad Planters' Association, the road from the seaport of Calicut to Vayitri, a detailed survey and estimate of this line, through the Tamrachéri ghát, is now in progress under the special Public Works officers employed in the Wynaad

In the year 1882, the Government of Madras submitted to the Government of India a scheme for the construction of 1,000 miles of light railway or tramway on the existing roads in the tracts of the presidency most liable to famine, and suggested that the tramways should be classed as "protective" works (*vide* paragraph 3 of article on irrigation), and should be carried out from funds provided from the Imperial protective grant The Government of India, in reply, declined to expend Imperial funds on detached distributary lines, until the main arterial protective lines were completed, and pointed out that the provision of the light distributary lines proposed would only benefit the tracts of country they immediately served, and should therefore be provided by the local Government The Madras Government thereupon appointed a committee to consider the best method of connecting the great centres of production and consumption with the main arterial protective lines Towards the end of the year 1883 the committee submitted their report, and recommended the construction of the following five light metre-gauge lines of railway on existing roads where practicable, and elsewhere on independent embankments —

(1) Guntakal *viâ* Anantapur to Hindupur—a length of line of about 100 miles in the Bellary district
(2) Vellore *via* Tiruvannámalai to Villupuram—a length of line of about 90 miles in the North Arcot and South Arcot districts
(3) Porto Novo *via* Vriddháchalam to Kallakurchi—a length of about 60 miles in the South Arcot district

(4) Pálghat to Dindigul (a length of about 100 miles in the Coimbatore and Madura districts) or Karúr to Dhárapuram—a length of about 60 miles in the Coimbatore district
(5) Madura to Ramnad, a length of about 70 miles in the Madura district

The recommendations of the committee were generally approved by Government Lines (2) and (3) are now being surveyed, orders have been issued for the survey of (4) Pálghat to Dindigul on completion of the surveys of (2) and (3), and the consideration of the remaining lines has, for the present, been postponed

27 *The Upper Godávari Navigation Works* —The Upper Godávari navigation project was first urged upon the notice of the Government by Sir Arthur Cotton in 1851, and had as its object the opening up of the navigation of the river Godávari from the important cotton mart of Nachangaon, 60 miles south-west of Nagpore, and situated on the river Wardha, a tributary of the Godávari to the sea port of Cocanada in the Godávari district By making this portion of the river navigable, it was anticipated that the cotton from Hinganghát, a great emporium for cotton, and a large area of country containing some of the finest cotton fields in India, would be sent down the river to Cocanada, and that, in return, there would be considerable importations up the river A great trade was thus expected to be developed, and a remunerative return on the outlay necessary to make the river navigable was looked for The main obstacles to navigation consisted of three remarkable rocky barriers, forming rapids only navigable in floods, but, these points excepted, the river was reported to be navigable for shallow river steamers for nine months in the year The first barrier is at Dumagudiem, 150 miles from the sea, and is 20 miles long The second is 14 miles long and 220 miles from the sea The third is 310 miles from the sea, is 35 miles long, is 75 miles distant from Chanda in the Central Provinces, and 115 miles from the cotton mart of Hinganghát The works necessary to make navigation practicable consisted of the construction of canals round the three barriers by means of anicuts and locks, and the clearance of the river bed in places by blasting The necessary surveys of the river were commenced in 1854, and by 1861 two lakhs of rupees had been spent in surveys and preliminary operations In 1861 the works at the first barrier were commenced, and at the beginning of the year 1863, seventy lakhs had been expended on the works at the first and second barriers In January 1863 Sir Richard Temple inspected the works, and recommended that the works at the first and second barriers and in the river up to the foot of the third barrier should be proceeded with at an estimated cost of Rs 25,50,000, so that the navigation might be open to the foot of the third barrier (to which point the road from Nagpore to Chanda was to be extended) by May 1865. By August 1865, two-fifths of the anicut at the first barrier, with the other masonry works, were completed In 1871 the works at the first barrier were almost completed, the works at the second barrier were entirely suspended and were in an incomplete state, the works at the third barrier were not commenced, while the total expenditure incurred was Rs
There was at that time a steamer towing boats from the second barrier to the coast, and the *Wainganga* steamer continued the communication between the second and third barriers, but the amount of traffic was small In a despatch, dated August 1871, the Secretary of State proposed that the navigation works should be completed on the smallest possible scale as far as the foot of the third barrier, whence a road should be made to Chanda, but in October of the same year, at the request of the Government of India, the whole scheme was abandoned as involving expenditure which did not give promise of any adequate return From October 1871, therefore, the work has been in abeyance In September 1881, in consequence of reports of impending injury at the anicut at the first barrier at Dumagudiem (which, however, turned out to be without foundation), the Superintending Engineer of the circle visited the anicut, and an upper subordinate has since been stationed at Dumagudiem to attend to all necessary repairs and to undertake certain investigations having for their object an extension and improvement of the existing traffic on the Upper Godávari

HARBOURS

28 *Inquiries regarding Madras anchorages, and general sketch of marine works undertaken by the Public Works department.*—The officers of the Public Works

department have at various times been called upon to submit reports and estimates for the improvements of the harbours of the East and West Coasts of the Presidency, and the department has also executed various marine works from time to time The works of this class undertaken by the Public Works department date as far back as the year 1838, when the deepening of the Pamban passage was first commenced The first detailed inquiry into Madras anchorages was in 1870, when Mr George Robertson, a Harbour Engineer, made a minute and careful inspection of the ports of Mangalore, Cannanore, Calicut, Beypore, Cochin, and Quilon on the West Coast, and of Tuticorin, Pámban Pass, Negapatam, Madras, and Cocanada on the East Coast He considered Quilon capable of being made the finest close harbour in India, and published an elaborate report embodying certain recommendations regarding various ports His recommendations were acted upon by Government, and the Public Works department was accordingly ordered to execute certain improvements which were forthwith carried out, principally to the harbours of Mangalore and Cochin In the following year Mr Robertson again visited the Pamban Pass to report on the subject of a ship canal through the island of Pámban In the year 1875-76, the works of the Madras Harbour, designed by Mr W Parkes, were commenced The next inspection of Madras anchorages was made in the year 1881 by Mr Parkes, who visited the harbours of Vizagapatam, Bimlipatam, Calingapatam, and Quilon, in order to report on their capabilities for the formation of first-class harbours He reported, in due course, that the natural advantages of Vizagapatam were superior to those of Bimlipatam or Calingapatam, but that, at all these three ports, it was absolutely out of the question to construct first-class harbours capable of giving remunerative returns from the trade of the port He recommended, however that hydrographic surveys of the three ports should be made, and in accordance with his suggestion a hydrographic survey of the port of Vizagapatam was undertaken by the Public Works department in the year 1883, but the work was subsequently transferred to the Indian Marine Survey department The report by Mr Parkes on the Quilon harbour was of a much more favorable character He considered that a well-sheltered harbour could be made at a moderate cost, and that by means of a short canal the harbour could be connected with the West Coast canal system The question of the improvements to the Quilon harbour is now under the consideration of the Travancore Sarkar

The improvement of the Cocanada harbour by means of lengthening the groynes at the mouth of the Cocanada river has engaged the attention of the department for some time, and in the year 1882-83 an estimate of Rs 53,608 was sanctioned for the purpose A decision has also been arrived at with regard to the improvement of the ports of Vizagapatam, Cochin, and Gopalpur At the first port the project for the erection of an iron pier, which has been for some time under consideration, is now held in abeyance, and it has been decided that no permanent improvement of the Cochin harbour is possible except at a prohibitive cost With regard to Gopalpur, the erection of a wrought-iron screw pier has been favorably viewed by Government, and the preparation of a detailed estimate for a pier, 900 feet in length and roughly estimated to cost about two lakhs, is now being undertaken by the Madras contractors, Messrs Massey and Co

29 *Works at the Pámban Pass*.—The Pámban Pass is the narrow artificial strait running north and south from Palk's Straits into the Gulf of Manaar, and separating the Ramnad zemindari, situated on the mainland in the Madura district, from the island of Ramesvaram Originally this gap was bridged by a continuous isthmus, but in the year 1480 a violent storm breached the isthmus and permanently separated the island of Ramesvaram from the mainland of the Madura district, thus making a break in the great connecting link of islands, rocks, and shoals that separate Ceylon from the mainland of India The natural passage thus made was, however, impracticable for ships, being too shallow, and also being obstructed by two parallel ridges of rock The first proposal to clear and deepen the passage so as to allow of ships passing through and thus shortening the voyage from India to the island of Ceylon, was made about the year 1800, but no practical action in the matter was taken until 1882, when a survey was made by Ensign (now Sir Arthur) Cotton The survey being favorable, various operations were begun on a small scale in the year 1828, but it was not until the year 1838 that the work of deepening and widening the channel was regularly started From that date up to the present time, the works have been continually in progress The work was first started in 1838 by the employment of gangs of convicts, under the supervision of Madras Sappers and Miners, a special Engineer officer being placed in charge under the direct control of the Chief Engineer, but after the organization of the regular Public Works department in 1858, the works were directed by the Public Works officers in charge of the Madura district In 1873, the jail at Pámban was abolished, and from that date convicts, under the supervision of the Public Works department, were no longer employed on the works Finally in 1879, the works were transferred from the Public Works department to the Marine department Tracing the progress of the works, we find that in 1844 the passage had been deepened to 8 feet of water at low spring tides, while the total expenditure up to that date was Rs 1,55,950 By 1854, the depth had been increased to $10\frac{1}{2}$ feet, the passage was navigable for keeled boats of 200 tons, and the total expenditure had amounted to Rs 3,25,000 In 1875, the passage had been deepened to 14 feet and to a width of 80 feet The works undertaken consisted mainly of blasting and dredging operations They have on the whole been a great success, and have enormously benefited the coasting trade of sailing vessels, by which it is largely used During the official year 1883-84, the number of vessels which passed through the Pámban Pass was 1,485, having a total tonnage of 176,743 tons, while the pilotage fees realized therefrom were Rs 19,402 Originally the works were started merely with the intention of providing a passage for small sailing vessels, but in 1854 Colonel Cotton projected a scheme for making the pass available for all classes of vessels, and also for the large mail steamers between Calcutta and Suez The weight of marine and nautical opinion was, however, entirely against this scheme, which, it was clearly shown, would involve an enormous expenditure without an adequate return This project was therefore definitely shelved in favor of the original scheme

30 *The proposed Pámban Ship Canal*.—A project for cutting a ship canal through the island of Manaar was mooted as long ago as the year 1832 Some time after that period, the idea of cutting a large ship canal through the adjoining island of Rámesvaram was started, and in the year 1862 a Parliamentary Committee took evidence on the practicability of the project, and the benefits to be derived from it In the same year, Sir W Denison, the Governor of Madras, visited Rámesvaram, and selected, as suitable for a ship canal, a line about 2 miles in length through the island of Rámesvaram and about $2\frac{3}{4}$ miles east of the Pámban lighthouse In the year 1870, Sir Hercules Robinson, the Governor of Ceylon, and other officials of the Ceylon Government, visited Rámesvaram, and a line for a ship canal was proposed by Mr Stoddard about three-fourths of a mile to the west of that selected by Sir W Denison In the following year, Admiral Sir James Elphinstone carefully inspected the locality, and while emphatically deciding against any attempt to adopt the Pámban Pass for big vessels—a scheme which had also been considered together with that of cutting a ship canal through the island of Rámesvaram—on the ground that such a long and tortuous passage could not be made safe for big ships, advocated the cutting of a canal, $7\frac{1}{2}$ miles in length through the Ramnad promontory on the mainland, together with the formation of a large sheltered harbour In the same year, a discussion regarding the various proposals made, for a ship canal, was raised in Parliament, and in the year 1872, Mr George Robertson was specially deputed to report on the various schemes which had been brought forward up to that time The result of Mr Robertson's inquiries was to recommend as most suitable for the cutting of a ship canal a line, through the eastern end of the island of Rámesvaram, one mile east of the Pámban lighthouse, $1\frac{3}{4}$ miles west of the line selected by Sir W Denison in 1862, and one mile west of that chosen by Mr Stoddard The line selected by Mr Robertson was $2\frac{1}{4}$ miles from water-line to water-line, and was considered by him to be better sheltered at its entrance from the swell of the south-west monsoon than either of the other lines proposed Nothing more was done regarding the project for a ship canal until the year 1881, when the Chief Engineer and Master Attendant, Madras, visited Rámesvaram, reviewed the various schemes already detailed, and reported that,

if ever the scheme for a ship canal was seriously thought of, preference should be given to a line in the neighbourhood of that selected by Sir W Denison On this report, borings along the line chosen by Sir W Denison were ordered by Government, and were subsequently carried out by the Marine department It will be evident that all the steps above detailed were taken with a view to sift the merits of the different schemes proposed from time to time for a ship canal In the year 1882, practical effect was, for the first time, given to the results of these investigations, by the formation of a company by Messrs Grindrod, Jenkins and Company of London for the cutting of a canal, to be entitled the Pamban ship canal, through the island of Rámesvaram The company's scheme, in addition to the cutting of a large ship canal, included the provision of dry docks The capital of the company was to be raised in England, and a concession was asked for from the Madras Government for the right of cutting the canal The Government have now granted to the company a general concession for cutting the canal through the island of Rámesvaram, subject to the condition that, the land being private property, the company shall arrange terms of acquisition with the owners, and shall submit for approval the scale of dues which it is proposed to levy on all vessels making use of the canal At the end of the year 1883-84, the agents of the company were engaged in arranging with the several owners of property in the island of Rámesvaram, the terms of compensation for land to be taken up by the canal.

31 *History of the construction, Madras Harbour Works* —The design for the construction of the Madras harbour was made by Mr Parkes, a Civil Engineer in London, and the original estimate, amounting to Rs 50,50,000, was sanctioned in March 1875 by the Secretary of State The expenditure on the work was to be provided from Imperial funds from money raised on loan The design consisted of a close harbour, providing accommodation for 13 large ships to swing at their moorings, in addition to space for several smaller craft The enclosed space was to be formed by two breakwaters, equidistant from the existing iron screw pile pier, running parallel to, and at a distance of 1,000 yards from, each other, to a length of 1,200 yards into 7 fathom water, where, on a curve of 568 feet radius, both were to turn inwards at right angles, leaving between them an entrance to the enclosure of 450 feet in width The two breakwaters were to be constructed of packet concrete blocks, each about 27 tons in weight, not built in one bonded mass, but built in two parallel walls placed side by side in juxtaposition, having a vertical joint between them, and laid on a rubble base of from 4 to 20 feet in depth The works were begun in the official year 1875-76, and by the end of the year an expenditure of Rs 3,41,703 had been incurred upon them During May, June, July 1876, the works were carried on under difficulties owing to the heavy surf prevailing In March 1877, it was discovered by the divers that the rubble base foundation of the north pier was entirely buried in sand For several months every possible means was taken to remove this sand accumulation by dredging, by working in caissons, by jets of steam and jets of water at high pressure, but without avail Finally the Superintendent of the works determined to build the concrete blocks upon the sand and allow them to sink through to the rubble base, and this was accordingly done Owing to this serious obstacle, the works were much retarded during the greater part of the year 1877-78 In May 1877, the works were severely tried by a cyclonic storm, but suffered no damage of any importance, and hardly any settlement occurred in the work at either pier In November and December 1878, the works were greatly interrupted by bad weather, and in January and March 1879 by the breaking down of the titan cranes, and the delay in the receipt of stores from England At the end of the official year 1878-79, the total expenditure on the harbour amounted to Rs 26,12,822, and it was estimated that the works would be completed by March 1881 Considerable progress was made on the works during the official year 1879-80, and by the end of the year the north pier had advanced to a total length of 2,745 feet, of which the last 445 feet was built on a curve of 568 feet radius, and the south pier had been carried to a total length of 2,146 feet During the official year 1880-81, the progress was more considerable than in any previous year At the end of the year, the expenditure amounted to a grand total of Rs 53,52,890, the north pier was advanced to a total length from the shore of

3,845 feet, or within 21 feet of its termination, the south pier was carried to a total length of 3,635 feet from the shore, while both piers terminated in water 8 fathoms below mean sea level, and the distance between their terminations was only 890 feet, or 340 feet more than the proposed ultimate width of the harbour entrance, which it had been decided to increase to a total width of 550 feet instead of 450 feet as originally designed by Mr Parkes By October 1881, both the north and south pier had been brought to their full length, so as to leave an open space of 550 feet as an entrance, but on the 12th November 1881 the works were greatly damaged by a cyclone which struck Madras with great suddenness All further progress on the harbour works was stopped in consequence On 29th, 30th and 31st December 1881, another cyclone passed over Madras, but, owing to its centre being near, the sea was not very high, and no further damage was caused to the works Up to 12th November 1881, when the damages caused by the cyclone occurred, the total amount of work done consisted of 7,836 lineal feet of breakwater constructed, 13,309 concrete blocks set in position, 13,643 concrete blocks made and 930,758 tons of stone deposited for the surf banks and rubble bases The total expenditure incurred up to the same date was Rs 58,09,629 The construction of the Madras harbour works may be said to have terminated with the cyclone of November, and at the end of 1883-84 was still deferred pending the decision regarding the revised design to be given to the work

32. *Damages caused by the cyclone of November* 1881, *and works since undertaken* —The damages due by the cyclone of November 1881 were half mile of breakwater breached, and, on an average, the two top courses of concrete blocks thrown into the harbour, two titan cranes thrown over and destroyed, rubble base lowered and spread out, 1½ miles of single line railway carried away, twin barges *Salisbury* and *Hobart* foundered and lost with the loss of 13 lives, besides minor damages such as the loss of small boats, injury to the iron pier, encroachments by the sea and damage of private property During the remainder of the official year 1881-82 subsequent to the cyclone, the chief work done consisted of repairs, such as relaying the lines of railway, levelling up with concrete the top of the north pier, clamping together the walls of the north pier, and repairing and strengthening the beach protective works From April 1882 to March 1883 the work done was limited to necessary repairs, block-making and protection of the shore, which had been much encroached upon by the sea, owing largely to the obstruction caused by the harbour walls In March 1883, all active work was stopped, except repairs to plant, and the harbour staff was reduced as much as possible, pending the resumption of operations, when the details of the design for the restoration of the harbour had been definitely settled. Up to the end of the official year 1883 84, the additional expenditure incurred since the cyclone of November 1881 was only Rs 8,69,233, while the total expenditure incurred was Rs 66,78,862

33 *Measures taken for the completion of the Harbour* —Shortly after the cyclone of November 1881, reports regarding the damage done, accompanied by proposals for completing the harbour, were drawn up by Mr Parkes, the Chief Engineer, Public Works department, and officers specially deputed by the Government of India, and were forwarded to the Secretary of State, who referred them to a London committee consisting of Sir J Hawkshaw, Sir J Coode and Professor Stokes The reports showed a concensus of opinion on three points, viz, that (1) the piers had up to the occurrence of the cyclone been pushed forward on a plan which insured both economy and expedition in a marked degree, (2) shelter had thus in great measure been provided in all ordinary weather, and still existed to the great advantage of the port, (3) the injuries caused by the cyclone could be made good, and the work rendered safe, in about three years, at a cost which would still make the harbour a comparatively cheap work of its kind. In January 1883, the London committee issued their report, criticised the system of construction adopted by Mr Parkes, which—while admitting that it conduced to rapidity of construction—they remarked they could not recommend were the work to be begun again, but should prefer to see the work bonded throughout They reviewed three alternative systems of reconstruction, expressed a favorable opinion regarding the safety of the "random-block" system, and made certain definite recommendations regarding the restoration of the work, of which the principal points

were to the effect that (1) the extra strength required should be given by the addition of a large wave-breaker, consisting of concrete blocks tipped over the seaward faces of the work, (2) the piers should be raised to a considerably higher level than was originally contemplated, and should be, when finished, not less than 12 feet above high water mark, and (3) that the entrance should be narrowed to 450 feet On receipt of this report, the Government appointed a Madras committee to frame detailed estimates, and to consider the best way to give effect to the proposals of the London committee In June 1883, the Madras committee issued their report, accompanied by estimates of the cost of completing the works on the several systems suggested by the London committee The estimates showed that the works could be completed for a sum of from 45 to 50 lakhs, according to the system and details of reconstruction followed The committee expressed a decided preference for the "random-block" system of construction, and made two important proposals—(1) the closing of the present eastern entrance to the harbour, and the opening of a new entrance, 500 feet in width, in from 7 to 7½ fathoms of water, at the north-east angle of the harbour, with a protecting horn 6 50 feet long, (2) the omission of the wave-breaker of concrete blocks along the south pier, which they considered was not subject to heavy seas, and was sufficiently protected by sand accumulations This report was subsequently referred by the Secretary of State to the London committee, who, in March 1884, issued a second report, in which they adhered to their former decision on all points, and consequently recommended that the entrance to the harbour should be retained in its original position, and should be narrowed to 450 feet—an opinion which was accordingly endorsed by the Secretary of State To this latter decision, the Madras Government, acting on the advice of their professional advisers and supported by the entire nautical and commercial interests of the port, have replied, have pointed out that the recommendations of the London committee, regarding the retention of the eastern entrance, were based upon incomplete information, and have strongly recommended, as a point of the first importance, that the harbour entrance should be placed at the north-east angle of the harbour, in from 7 to 7½ fathoms of water, as recommended by the Madras committee At this stage therefore the question of the restoration of the harbour now stands

34 *Buildings constructed, or under construction, by the Public Works Department.*—The Public Works department have, from earliest times, constructed and maintained all important public buildings At first, their duties in this respect were mainly confined to the building of civil courts and cutcherries, public bungalows and military hospitals, secondly, to the building of large barracks for the accommodation of British troops, and to the construction of jails, and, lastly, to the provision of the new buildings required by the expansion of business in the Postal, Telegraph, Educational, Medical and other departments of the State In proportion to its size and importance, the Madras presidency has probably fewer modern buildings of any architectural pretensions than any other province of India, and it is only during recent years that the few handsome buildings it possesses have been constructed As an instance of the paucity of modern public buildings, it may be noticed that the Secretariat offices at the presidency town, with the exception of the Public Works Secretariat, are still located in their old quarters within the ramparts of Fort St George, while the High Court of Madras is lodged in old and ill-adapted buildings on the sea-face The more important of the public buildings constructed by the Public Works department since its regular formation in 1858, will now be briefly noticed under the respective heads of Military and Civil Buildings

Military Buildings—The largest and most important building of this kind that has yet been constructed is the Military Convalescent Depot at the station of Wellington on the Nilgiri Hills This building was commenced as far back as 1852, but occupied many years in construction, owing to the difficulties experienced in procuring labor and materials for the work As each block of the buildings was completed, it was handed over by the Public Works department to the military authorities for occupation, and, at the end of the official year 1860-61, a total expenditure of Rs 17,59,961 had been incurred on the barracks, and its subsidiary buildings and connected works The barracks are commodious and well placed, but the building

generally is of a plain and unpretending character The next military building in order of importance is the Lawrence Asylum at Lovedale, 3 miles from the station of Ootacamund, in the Nilgiri Hills This building was commenced about the year 1864-65, and also took many years in construction, owing to the difficulties found in supplying labor and materials Convicts were largely employed in the works under the superintendence of the Public Works department The asylum was intended, and has been used, as a training school for the free education of sons and daughters of European soldiers of the army An estimate of Rs 11,38,310 was sanctioned for the work, and by the end of 1876-77 (when the building was practically finished), an expenditure of Rs 8,60,910 had been incurred, of which Rs 54,000 were defrayed by private contributions The building is in the Lombard style, and occupies an open and commanding site The remaining military buildings of importance, constructed by the Public Works department, together with the expenditure incurred on them, are shown in the following list —

Family Quarters in Fort St George—Estimate Rs 1,58,100 —Begun in 1863-64, finished in 1865 at a total cost of Rs 1,60,910

Cannanore Barracks, Married Quarters—Estimate Rs 1,27,723 —Commenced in 1866-67; completed in 1873-74 at an outlay of Rs 1,20,147

Artillery Barracks, Cannanore—Estimate Rs 1,05,300 —Begun in 1866-67, finished in 1868-69 at a total cost of Rs 1,05,974

Family Quarters for Warrant and Non-commissioned Officers of the Ordnance Department at the Presidency—Estimate Rs 1,03,910 —Begun in 1866-67, finished in 1869-70 at a total outlay of Rs 1,03,044

Artillery Barracks, St Thomas' Mount—Estimate Rs 2,46,920 —Commenced in 1868, completed in 1876 at a total cost of Rs 2,48,146

Additions to Parade Barracks, Bangalore—Estimate Rs 2,19,830 —Work finished in 1876-77 at a total outlay of Rs 2,19,622

Barracks for European Infantry at Cannanore—Estimate Rs 2,97,430 —Work completed in 1876-77 at a total cost of Rs 2,74,245

Race-course Barracks, Bangalore—Estimate Rs 5,92,540 —Work finished in 1876-77 at a total outlay of Rs 6,16,402

Double-storied Barracks for a second Battery of Field Artillery at St Thomas' Mount —Estimate Rs 2,46,920 —Work completed in 1876-77 at a total cost of Rupees 2,48,146

Barracks for European Infantry at Bellary—Estimate Rs 3,62,988 —Work completed in 1877-78 at a total outlay of Rs 3,83,265

Barracks for European Infantry, Fort St George—Estimate Rs 2,27,350 —Work finished in 1874-75 at a total cost of Rs. 2,29,706

Royal Horse Artillery Barracks, St Thomas' Mount—Estimate Rs. 1,35,050 —Work still in progress, and expenditure up to June 1884, Rs 91,343

Improvements to Gun Carriage Factory, Madras—Estimate Rs 2,48,492 —Expenditure to end of June 1884, Rs 2,15,949

Civil Buildings—The buildings of this class which require particular notice are not numerous First, in order of importance as regards the expenditure incurred, is Government House, Ootacamund, for which an estimate of Rs 7,79,150 has lately been sanctioned The building has no architectural features, and is, in fact, of the plainest type Up to June 1884, an expenditure of Rs 6,08,178 had been incurred against the sanctioned estimate The next building in order of importance is the new Postal and Telegraph office, Madras, which is now rapidly approaching completion This building, which is incomparably the first in the presidency town, was begun as long ago as 1874, when the foundations of the Telegraph office were commenced, but, owing to a variety of causes, the building was not regularly put in hand until the year 1881-82 The sanctioned estimate for the work is Rs 6,18,414, and the expenditure incurred up to the end of June 1884 was Rs 6,12,574 The building is in the Hindu-Saracenic style, occupies a central position on the beach nearly facing the Madras harbour, amid a number of very old and plain-looking buildings, and may be said to be the most prominent architectural feature of the presidency town Two other buildings in Madras, viz, the Senate-house of the Madras University and the

Presidency College, are worthy of especial mention, and are interesting as being the buildings for the design of which the Madras Government, in April 1864, invited open competition by advertisements in the daily and official papers The designs of Mr R F Chisholm (then of the Bengal Public Works department) were accepted by the committee of adjudication, and a prize of Rs 3,000 was awarded to that gentleman, who was shortly afterwards appointed Consulting Architect to the Government of Madras, an appointment which he still holds The Presidency College is in the pure Italian style, was commenced in 1864-65 and was completed in 1870-71 at a cost of Rupees 3,12,697. The Senate-house is an imposing building, in no particular style of architecture, but with a leaning to the Byzantine style It was commenced in April 1874 and was finished in March 1879 at a cost of Rs 2,89,729 The only other building which requires particular notice is the Public Works Secretariat buildings at Chepâk, on which a considerable expenditure has been incurred The building was constructed during 1864-65 to 1867-68 at a cost of Rs 1,12,233 for the accommodation of the Public Works Workshops stores and foundry During the years 1876-77 to 1879-80, it was improved and adapted, at a cost of Rs 1,26,403, for the accommodation of the Public Works Secretariat, who were in the latter year transferred thereto from their old quarters in Fort St. George, while the Public Works Workshops were removed to an old building at the Seven Wells Lastly, in the year 1883-84 further improvements were begun and are still in progress, against a sanctioned estimate of Rupees 1,00,545, for the extension and embellishment of the premises The building, which was formerly devoid of the slightest ornament, and was of an extremely plain design, is now a handsome and commodious structure in keeping with the Chepâk Palace, Senate-house, and Presidency College, which are all situated in its immediate vicinity, on the sea face at Chepâk

The jails of the presidency were mostly constructed about the same period, and the most important of them, together with other important civil buildings, are enumerated in the following list —

—	Estimate.	Begun	Completed	Cost
Central Jails	RS			
Rajahmundry	3,53,597	1863-64	1870-71	3,27,804
Vellore	3,75,294	October 1866	March 1873	3,73,233
Trichinopoly	3,78,892	December 1866	December 1872	3,79,297
Coimbatore		1863-64	1867-68	3,76,338
Cannanore	3,27,000	November 1866	March 1873	3,14,264
District Jails				
Palamcottah	2,08,000	June 1876	In progress	* 1,33,850
Tanjore	2,11,100	March 1882	Do	* 92,070
General				
Improvements to General Hospital, Madras	2,19,500		1865-66	2,51,013
Improvements to the office of the Board of Revenue, Chepâk	1,80,305	1868-69	1873-74	1,82,154
Lunatic Asylum, Madras	2,43,500	1866-67	1871-72	2,30,387
Converting Rayapettah Police Court into house for Prince of Arcot	1,49,696	February 1877	February 1878	1,33,585
Lying-in Hospital, Madras	1,78,660	April 1877	January 1883	1,78,758

* Expenditure to end of June 1884

33 *Restoration of buildings of Archæological interest* —The most important work of this class, undertaken by the department, is the restoration of Tirumal Naick's Palace at Madura, on which an expenditure of Rs 2,35,350 had been incurred up to June 1884 The work of restoration was begun as far back as the year 1870-71, when the existing structure was on the point of falling to pieces, and has been in progress ever

since that date under the supervision of the Government Architect In addition to the works which have been taken to ensure the security of this ancient building, the ornamentation of the palace has been carefully renewed, and the interior of the building has been adapted for the accommodation of the Collector's office, the court of the District Judge, and all the chief Government offices of the Madura district In the years 1880-81, 1881-82, works of preservation were carried out at the Seven Pagodas, and consisted chiefly of the removal of the drift sand from the immediate neighbourhood of the monolithic rafts, the cutting off of drainage which was injuriously affecting the sculptures, and the necessary works to provide for the security of the stone temple Some work has also been carried out at the Vellore temple and at the ruins of Hampi in the Bellary district, and measures are now under consideration for the restoration of the ancient palace of Chandragiri, and for its adaptation for the use of public offices.

No. 567 E

Transferred to the Chief Secretary to Government in continuation of endorsement, No 566 E, dated 27th August 1884, with remark that the article is approved generally in the Public Works department

OOTACAMUND, *27th August* 1884 (Signed) J SHAW-STEWART, Colonel, R E, *Secretary to Government, P W D.*

To the Chief Secretary to Government (with article)

ORDER—dated 23rd January 1885, No 203, Public

Recorded

(True Extract)

R S BENSON,
Ag. Under Secy to Govt,

To the Public Works department

Exd J Wright

be sent to the Public Dept. Should be taken to substitute the revised Statement. The matter being in type, a few words of the material would not give much trouble, while printed slips would not fit in well with the contracted space allowed to the original Statement.

R.S. 4.2.85.

Govt. of [1885] Madras.

PUBLIC.

Issued

Recd *Encl.*

G O, 23rd January 1885, No. 203.

R. 357 of 13.1.85

JANUARY.

Manual of the Administration.

Recording article contributed by the Public Works department on the "General Branch"

GOVERNMENT OF MADRAS

PUBLIC DEPARTMENT

READ—the following paper —

History of the Department

1 Origin of the Madras Public Works department, and character of public works
2 Sketch of Public Works administration up to the year 1858
3 Formation of the Madras Public Works department in 1858
4 Further history of the department from 1858 to 1863
5 Public Works Commission of 1870, and reorganization of the department in 1872
6 Further history of the department from 1872 to date
7 Points requiring notice in the history of the Public Works department

Organization and Administration of the Department

8 Main branches of the department
9 General establishment of the department
10 Classification of establishment
11 The Engineer establishment
12 The Upper Subordinate establishment
13 Lower Subordinate, Office, and Petty establishments
14 Accounts establishment
15 General sketch of administrative system, together with distribution of circles and divisions.

Execution of Works by the Department

16 Functions of the department in regard to Public Works
17 Imperial works undertaken by the department
18 Provincial works undertaken by the department
19 Local and special works undertaken by the department
20 Method of execution of works
21 Incidence of Public Works expenditure

Description of principal public works

22 Classes of public works
23 Sketch of development of roads until formation of the Public Works department in 1858
24 Further development of roads until formation of Local Fund boards in 1871
25 Construction and maintenance of roads under the Local Fund boards
26 Proposed extension of main roads, and scheme for tramways or light railways
27 The Upper Godávari Navigation Works
28 Inquiries regarding Madras anchorages, and general sketch of Marine works undertaken by the Public Works department
29 Works at the Pamban Pass
30 The proposed Pamban Ship Canal

officers by whom works were carried out) consisted of 12 "Superintendents of Maramut," or maistries of superior qualifications, trained by the "Civil Engineers," and transferred by them to the "Revenue Maramut" establishment, and 79 taluk maistries, who were generally without any proper training or qualifications of any sort, and worked under the supervision of the "Superintendents of Maramut" The whole establishment, whether for supervision or execution of works, remained on this footing till the "Maramut" department was finally broken up

The Trunk Road Department—This department was not constituted till the year 1845 Previous to that date, all roads, except those at the Presidency and in military cantonments, were first under the Collectors, and finally under the "Maramut" department of the Board of Revenue As a measure of relief to the overworked "Maramut" department, and to ensure the systematic improvement of the main lines of road, the Trunk Road department was formed in 1845 This department appears to have been altogether an abortive creation, and to have been practically a failure for many years, owing to the inadequate subordinate establishment placed at its disposal Its history can accordingly be briefly narrated As at first constituted in 1845, it was placed under an officer, styled the "Superintendent of Roads," to whose charge was entrusted the formation, maintenance and repair of the main lines of road, extending in the aggregate to a total length of 2,300 miles, all other roads previously in their charge being still retained by the "Maramut" department of the Board of Revenue The main lines of road were, at that time, in very bad order, for many years had been much neglected, and were generally unbridged and unformed In 1846, the Superintendent proposed, what he considered to be, the necessary subordinate establishment required by his department, in order to carry out properly the actual execution of the work to be done on roads, for which an annual expenditure of four lakhs had been sanctioned The establishment was refused, and the consequence was that the department, being utterly unable to cope with the work required of it, and to expend the funds allotted to it, gradually transferred much of its work to the "Maramut" department, which it was originally expressly designed to relieve In 1851, though the "trunk roads" were still nominally under charge of the Superintendent, their maintenance was attended to chiefly by the "Maramut" department, and only 390 miles of main road remained actually under the charge of the "Trunk Road department" By 1853, the department had been strengthened, so as to keep up fairly with the work then expected from it, and the establishment of Europeans for the duties of superintendence numbered 29 in all, viz, the Superintendent, 6 Assistants, and 22 upper subordinates

The Engineering Department of the Military Board—The Military Board of the Madras Presidency was formed as far back as the year 1785, and was divided into the Ordnance department and Engineer department, with the latter of which we have only to deal The engineering works under the Board were distributed in ten divisions, corresponding with the divisions of the army Five of these divisions were controlled by Superintending Engineers, with executive officers and a suitable establishment of Overseer-Serjeants, &c, for the execution of works In the remaining five divisions, there was no officer permanently under the orders of the Board, but the execution of works was undertaken by the Commanding or Staff officer In 1838, simultaneously with the reorganization of the "Maramut" department in that year, the Superintending Engineers of the Military Board were abolished, the charge of all the civil buildings in the provinces, formerly under the Military Board, was transferred to the "Civil Engineers" of the "Maramut" department, while the charge of the military buildings was transferred to the Staff officers of stations, together with a portion of the establishments trained under the Superintending Engineers The other works under the control of the Military Board, viz, the construction and maintenance of roads and bridges in Military cantonments, &c, were also placed, at stations, under the Staff officer, and at division head-quarters under the Quartermaster-General of the division staff By this reorganization of 1838, the Staff officers of stations practically became—though quite unfitted for the post—the Executive Engineers of the Military Board. This system remained in force until the abolition of

the Board in 1858 Prior to its abolition the Military Board had given rise to universal dissatisfaction Its working was characterised by great delays, its supervision was most ineffective, and—to quote from a Government order of the day—it was "a mere clog to public business"

Allusion has been made, in the sketch of the history of the "Maramut" department, to the "Chief Engineer" The duties of this officer, prior to the formation of the Public Works department in 1858, appear to have been of the most multifarious character, and it is difficult to see where they began and where they ended Chief among them were that, besides being in immediate charge of certain works, and collecting certain items of revenue, he had two separate offices, besides his own office, to attend to, viz, the Public Works department of the Board of Revenue and the Military Board office, he had also control over all fortifications, inspected all work done under the orders of the Military Board, inspected all Government roads in the Presidency, and prepared drawings, &c, of certain works

3 *Formation of the Madras Public Works Department in* 1858—In 1850, the importance of the systematic management and execution of public works throughout the Presidency had attracted the attention of the Court of Directors in England, and, under their orders, a Public Works Commission was appointed in the following year This Commission issued, towards the end of 1852, a very full and particular account of the existing system of Public Works administration, and reviewed at length the working of (1) the "Maramut" department of the Board of Revenue, (2) the Trunk Road department, and (3) the Engineer department of the Military Board, they pointed out the generally neglected state of the public works of the country, except in a few favored districts, dwelt on the inadequacy of the annual grants allotted for public works, and on the inadequate establishments appointed to look after them, and brought to notice the benefits to be derived, by the State, from the systematic and judicious expenditure of public money in the promotion of public works The Commission proved conclusively that the Board of Revenue was no longer able to deal with the business of the "Maramut" department, owing to the vast and progressive increase in the works of this department, and the greatly increased proportions of its establishment, they brought to light many abuses in the execution of works, and commented on the inefficiency of the executive establishment employed, and finally they pointed out that, where public works are scattered over a very large area of country as in the Madras Presidency, it was unthrifty to have three separate establishments for the management of different classes of work, and recommended the establishment of one department for the management of all public works, civil or military They proposed that the establishment should consist of 13 Inspecting Engineers, and a District Engineer with a staff of assistants and subordinates for each Collectorate At the time the Commission wrote (1852), the entire cost of the Public Works establishment was Rs 5,79,474 per annum, and the expenditure on works, Rs 24,50,000 The proposals of the Commission involved an annual charge of Rs 14,69,000 for establishment, and an annual expenditure of 48 lakhs After a great deal of discussion with the Home Government and the Government of India during the years 1853—57, an establishment was finally sanctioned in the year 1858, at a cost of Rs 13,06,614, for the purposes both of supervision and execution of works, and thus, for the first time in its history, the department as a whole became regularly an executive department The sanctioned scale consisted of a Chief Engineer with an Assistant, 3 Inspecting Engineers, 20 District Engineers in immediate control of the Executive officers, 78 Executive and Assistant Engineers, 204 upper subordinates, composed of sub-engineers, supervisors and overseers, and 714 lower subordinates or sub-overseers This establishment looked after the public works of the whole Presidency, which was divided into 87 executive ranges

4 *Further history of the department from* 1858 *to* 1863—In consequence of the mutiny, the expenditure on public works was much restricted, and a considerable part of the Public Works establishment sanctioned in 1858 was accordingly discharged in the year 1859 In 1860, it was considered that the organization of 1858 was unnecessarily elaborate, and had failed to answer the expectations formed of it Various changes were advocated and considered, and, pending the consideration of these

executive charge of the repairs of the minor irrigation works, made no systematic effort to ensure that the obligation should be carried out It will be seen that both the Committee of 1863, and the Public Works Commission of 1870, attached great importance to the revival of "kudimaramut"

The decline of "kudimaramut" tended largely to the difficulty experienced in the effective maintenance of minor irrigation works, added to which (*vide* paragraph 1) the great number of these works and their scattered nature absolutely precluded, from the very first, their effective maintenance by on Government agency The frequent administrative changes made, from time to time, in the department since its formation in 1858, are largely due to the impossible nature of the attempt to provide for the maintenance of these minor irrigation works

ORGANIZATION AND ADMINISTRATION OF THE DEPARTMENT

8 *Main branches of the department*—As at present constituted, there are two executive branches of the Public Works department, viz, the General and Buildings and Roads branch and the Irrigation branch, each having a Chief Engineer as its responsible executive head The senior Chief Engineer is in charge of the General and Buildings and Roads branch, and is the professional head of the whole department In addition to his professional duties as Chief Engineer, Public Works department, he is also Secretary to Government in the Public Works department, and in his dual capacity deals with the general policy and administration of the department, and with the promotion, posting, and discipline of the whole establishment of the Public Works department He is assisted in his office work by a Deputy Chief Engineer, who is also Under Secretary to Government in the Public Works department

The junior Chief Engineer is the Chief Engineer for Irrigation, who is also Joint Secretary to Government in the Irrigation branch. He is the professional adviser of Government in all matters connected with irrigation, and manages the Secretariat work of the Irrigation branch

In addition to the two executive branches of the department, there is a third branch, presided over by the Consulting Engineer for Railways who controls the operations of Guaranteed Railways and is the channel of communication between the Government and Railway officials The Consulting Engineer is assisted by two Deputies. The officers of this branch are not borne on the Provincial list of the Madras Public Works department, but on the General Railway list of the Government of India The Consulting Engineer for Railways is gazetted as Joint Secretary to the Government of Madras in the Railway branch, and one of his Deputies as *ex-officio* Under Secretary in that branch

Finally, there is the Accounts branch of the department under the Examiner of Public Works Accounts, which deals with the control and audit of the expenditure incurred by the two Executive branches, the Guaranteed Railways having a separate Accounts establishment.

9 *General Establishment of the Department*—Although the executive work of the department is divided into two branches, no separate executive establishment, is maintained for the work of each branch, as the great area of the Public Works divisions in the Madras Presidency, and the scattered nature of the public works, precludes any such division of establishment being advantageously made The one general executive establishment of the department is therefore employed indifferently in the general execution of all works, entrusted to the department, such as irrigation, roads, buildings, &c, and the services of each member of the department is therefore utilised in the execution of works in the best practicable way, irrespective of the kind of work to be carried out, or the service for which the work is required The only purely separate executive establishment employed is that known as the Navigation and Water Regulation establishment, which is a small special establishment maintained in connection with irrigation works, and charged to "Imperial irrigation." This extra establishment is employed in the distribution of water for the purposes of irrigation, the regulation of the supply in canals and channels, the control of the canal navigation

and the record of traffic, and the general conservancy of canals, channels and embankments The Accounts establishment is employed indifferently in the same way as the Executive establishment, and the cost of the one general establishment is divided arbitrarily between the several funds for which works are carried out. The rules for the debit of the amount charged to "Irrigation" are given in paragraph 2 of the Article on Irrigation All other funds contribute 23 per cent on the outlay on works, and 5 per cent on the revenue collected in the Public Works department The balance of the establishment charges, whatever it may amount to, is charged to "Provincial," while, for the purposes of account, the whole Public Works establishment is regarded as Provincial, to which head the total charges for establishment are, in the first instance, debited During the official year 1882-83, the whole Public Works establishment charges amounted to Rs 18, 21,957, of which Rs 11,76,113 were charged to "Imperial" as follows —

	RS
Imperial, Irrigation	10,18,968
Imperial, Military	1,11,767
Imperial, other services	45,378

Rs 78,553 were charged to "Provincial," and Rs 43,182 to "Local" funds on account of work executed, while the balance of Rs 5,23,909 was the charge which "Provincial" had to bear of the establishment charges of the Public Works department Of the whole amount of Rs 18,21,957 for establishment, Rs 16,84,518 were for the Executive establishment, and Rs 1,37,439 for the Accounts establishment

10 *Classification of Establishment*—The establishment of the department is classified into two distinct branches—I *The Executive branch*, which includes all officers and other persons necessary for the preparation of designs and estimates, the supervision and control of public works, and the disbursement of money, together with the requisite office clerks and other persons II *The Accounts branch*, which includes the entire establishment maintained for the control and audit of all expenditure incurred from the annual grants for public works The Executive branch is sub-divided into (1) Engineer establishment, (2) Upper Subordinate establishment; (3) Lower Subordinate establishment, (4) Office establishment, and (5) Petty establishment, while the Accounts establishment is divided into the Control establishment corresponding to the "Engineer" establishment, and the Accountant establishment corresponding to the "Upper Subordinate" establishment, of the Executive branch

11 *The Engineer establishment*—The Engineer establishment is composed of (1) officers of the Royal Engineers, (2) passed students of the Royal Indian Engineering College, Cooper's Hill, (3) 'Stanley" Engineers appointed in England, (4) Civil Engineers appointed in India, (5) passed students of the Civil Engineering College, Madras, and (6) Engineers promoted from the upper subordinate grade, and is classed and graded as follows —

(*a*) Chief Engineers in two classes, (*b*) Superintending Engineers in three classes, (*c*) Executive Engineers, one class in four grades, (*d*) Assistant Engineers, one class in three grades The duties of a Chief Engineer are to control the general operations of his particular branch, to receive reports and communications from the Superintending Engineers, through whom he conducts the general business of the department, and to check projects and designs above a specific amount, and lay them before Government accompanied by a distinct expression of opinion as to their merits The Superintending Engineer controls the Executive Engineers within his circle, through whom he conducts all the details of business, he is vested with considerable powers of sanction of public money, and refers all questions beyond his powers to the Chief Engineer, and, finally, he is an Inspecting officer, and is required to make regular tours of inspection through all the divisions in his circle The Executive Engineers of divisions are in immediate charge of all public works within their divisions, and are concerned with the actual execution of works, the disbursement of money, and the custody of stores and material They are vested with certain limited powers of sanction, and prepare designs and estimates for the approval of the Superintending Engineer The Assistant Engineers usually hold charge of sub-divisions under the orders of the Executive Engineers,

and are practically his Assistants in the superintendence of works, the preparation of projects and designs, and the general duties of the department The following was the sanctioned scale of the Engineer establishment of the department at the beginning of the official year 1884-85 —

Chief Engineers	2
Superintending Engineers	6
Executive Engineers	42
Assistant Engineers	40
Total	90

12 *The Upper Subordinate establishment* —The Upper Subordinate establishment consists of men appointed from the non-commissioned officers and soldiers of Her Majesty's Army in India, or from Civilians, European or Native, who have obtained the required certificates from the Madras Civil Engineering College, or, in the case of Royal Engineer soldiers, that of the Commandant of Sappers and Miners, or again from men who, as Mechanical Engineers, &c, have a thorough practical knowledge and experience in some useful branch of engineering The Upper Subordinate establishment is classed and graded as follows —(1) Sub-Engineers, one class in three grades, (2) Supervisors, one class in two grades, and (3) Overseers, one class in three grades The members of this establishment have either charge of a sub-division of works, under the immediate orders of the Executive or Assistant Engineers, or are assigned other specific duties, not clerical, in connection with the execution of works or with the investigation of projects At the beginning of the official year 1884-85, the sanctioned number of the Upper Subordinate establishment was 185

13 *Lower Subordinate establishment, Office establishment, Petty establishment* — The Lower Subordinate establishment consists of natives who have a sufficient knowledge of ordinary building, and such acquaintance with plan drawing and surveying as will enable them to set out and supervise the construction of the minor class of works undertaken by the department. The members of this establishment consist of the class of sub-overseers, divided into three grades

The office establishment consists of the clerks and draftsmen engaged on purely clerical duties, together with the inferior servants employed in offices The establishment of clerks is divided into five classes, of which the first four classes are sub-divided into three grades, and the fifth class into two grades, while the draftsmen are divided into three classes

The petty establishment includes all storekeepers, artificers, watchmen, lascars and other inferior servants not attached to officers, employed on general duties, whose salaries are not provided for in any estimate for a work

14 *Accounts establishment* —The Accounts establishment is a Provincial service as far as the incidence of charges is concerned, but the superior officers of the branch are under the orders of the Government of India The branch is divided into (1) Examiners arranged in four classes, of which the fourth class is divided into three grades, (2) Deputy Examiners, one class in two grades, (3) Assistant Examiners, one class in two grades, (4) Apprentices, and (5) Accountants The establishment comprised in (1), (2), (3) and (4) corresponds with the "Engineer" establishment, is recruited from much the same classes, and forms a general service under the direct orders of the Government of India The duties of the Examiner are to control the operations of the Accounts establishment in the Presidency, to audit the accounts of receipts and expenditure submitted to him by the Executive Engineers and other disbursing officers of the department, and subsequently to compile these accounts into one general account for the Presidency, to be submitted to the Accountant-General to the Government of India for incorporation in the general accounts of the empire The establishment of Accountants forms one class divided into five grades, and corresponds to the "Upper Subordinate" establishment of the Executive branch It is composed both of Europeans and Natives who have passed the principal tests The members of it are under the orders of the Madras Government, and are employed indifferently, either in the Central office at Madras in auditing and compiling the divisional accounts,

or at the head-quarters of the several divisions in preparing the accounts from the cash-books, and other initial records, maintained by the Executive Disbursing officers

15 *General sketch of the Public Works system together with distribution of circles and divisions* —From the foregoing paragraphs concerning the administration and organization of the department, it will be clear, first, that the Chief Engineers direct the general operations of their particular branch through the Superintending Engineers, and are, in the main, administrative officers; second, that the Superintending Engineers are inspecting and supervising officers, controlling the Executive Engineers within the limits of their circle, and third, that the Executive Engineers, and all the officers and subordinates employed under them, form the establishment actually concerned with the execution of works The whole Presidency is divided into six circles under the charge of Superintending Engineers, which circles are sub-divided into 28 permanent divisions, each in charge of an Executive Engineer In pursuance of a policy which has lately been introduced, important works of considerable magnitude are now being carried out by the aid of temporary establishments, the works themselves being kept apart from the other works undertaken in the permanent divisions in which they are situated, and a special temporary division being formed for their execution Of these temporary divisions there are now seven, which brings the total number of sanctioned divisions to 35 The following statement shows the Superintending Engineer circles, the sanctioned executive divisions, together with the area in square miles of each circle or division, and the district in which each division is situated, at the beginning of the official year 1884-85 —

STATEMENT showing the Public Works Circles and Divisions

Circles	Head quarters of circles		Divisions.	Head-quarters of divisions	Areas of divisions in square miles	Areas of circles in square miles	Districts in which situated
No I	Dowlaishwaram	1	Ganjam	Berhampore	5,674	18,226	Ganjam
		2	Rushikulya (temporary)	Do			Do
		3	Vizagapatam	Waltair	5,016¼		Vizagapatam.
		4	Godávari, Eastern	Dowlaishweram			Godávari
		5	Do Central (temporary)	Gunnavaram	7,535¾		Do
		6	Godávari Western	Chettipett			Do
No. II	Masulipatam (Bezwada)	7	Kistna, Eastern	Bezváda	8,387½	16,469¾	Kistna
		8	Gudivada (temporary)	Gudivada			Do
		9	Kistna, Western	Duggirala			Do
		10	Nellore	Nellore	8,082¼		Nellore
		11	Sangam Project	Sangam			Do
No III	Bellary	12	Bellary	Bellary	11,051	26,358½	Bellary
		13	(C) project	Do			Do
		14	Cuddapah	Cuddapah	8,304		Cuddapah
		15	Kurnool	Kurnool	7,003½		Kurnool
		16	Kurnool Canal	Do			Do
		17	Nilgiri	Ootacamund	1,705		Nilgiri ~~and Malabar~~
		18	Coimbatore	Coimbatore	10,808		South Canara, Malabar and Coimbatore.
No IV	Coimbatore	19	(B) Project	Do.	7,604	32,146½	Coimbatore and Salem
		20	Salem	Salem			Salem
		21	Barúr project (temporary)	Barur			Do
No V	Madras	22	North Arcot	Vellore	7,029½	8,121¼	North Arcot
		23	South Arcot	Cuddalore	4,943¾		South Arcot
		24	Chingleput	St Thomas Mount	3,139½		Chingleput
		25	Buckingham Canal	~~Chepak~~			
		26	Presidency and Bangalore	Bangalore	38		Madras and Bangalore
No VI	Trichinopoly	27	Trichinopoly	Trichinopoly	4,599½	20,455¼	Trichinopoly
		28	Tanjore	Tanjore	1,667¾		Tanjore
		29	Cauvery and Venaur Regulators (temporary)	Grand Anicut, Tanjore			Do
		30	Negapatam	Negapatam	1,825		Do
		31	Madura	Madura	8,419½		Madura
		32	Tinnevelly	Palamcottah	3,944		Tinnevelly

Statement of total expenditure in the Public Works department from 1870-71 to 1882-83

Class of works	1870 71	1871 72	1872 73	1873-74	1874 75	1875-76	1876-77	1877-78	1878 79	1879 80	1880 81	1881 82	1882 83
Imperial	Rs.	Rs	Rs	Rs	Rs	Rs	Rs.	Rs	Rs	Rs	Rs	Rs	Rs
Irrigation and Navigation—													
Original works	8,00,020	8,02 174	8,78 509	8 13 587	8 10 354	10 96,114	6 17 969	4 96 474	8 15 358	4,43 746	5 69 240	7 16 428	(a) 187 53 191
Repairs	11,44,826	11 22 500	12,61,303	14,00,194	15 43 707	15 22 142	14 56 378	15 44 063	12 09,127	11,35 630	11 91 402	12 20 224	16 25,069
Establishment	1,34 877	1,97 131	6 36,032	6,34,694	8 28 231	8,51 904	7 64 072	14 92 321	8,91 143	7,44 098	6,24 172	6,61 764	10,18 218
Tools and plant	15,702	6,532	2,30,626	44,216	83,216	1,35 352	1,46 980	1,71 353	92,279	1 26,077	1,83 662	1,30,222	1,61,046
Total	20,94,925	21,28,337	29,79,469	28,92,691	32 60,548	36 06,112	29 85 399	37,04 211	30,07 907	24 50 051	25,68,476	27,28 638	215,57,524
Military—													
Original works	3,32 303	2 10,667	2 84,121	2 69 461	3 28 534	3,87 165	2 90 575	3 05 898	2,17 110	21 227	1 39 576	1,15 574	2 48 365
Repairs	2,23 005	2,23,480	2 43,069	2,59 703	2 32 218	2 60 593	2 32 256	2 40 403	2 00 779	1 90 125	2,77,447	2,69 097	2 92,955
Establishment			1,69 730	1,19 082	1 46,350	1 63 465	1,62 822	1,53 120	1,69 998	1,08,709	99,255	96 161	1,11 767
Tools and plant			20,888	15,097	28,078	23 605	25 367	15,176	15,731	16,023	9,925	9 603	7,221
Total	5,55,308	4,34,152	6,87,808	6,63,343	7,35,180	8,34 828	7 11,020	7 14 597	6,03 618	3 86 084	5 26,203	4,90 435	6,60,308
Other Services—													
Original works	11 83 000	32,810	47,760	21 046	28,634	17 602	29 753	27 011	23 237	34 145	1,19 131	1,92,582	2,01,206
Repairs	10,39 410	2,855	3,396	3 996	4 715	8 836	2 573	8,985	12 900	4 865	3,313	5 672	5 099
Establishment	14,75 473	5,89,994	13,226	5,914	16 158	22,934	20 202	16,134	45 062	38 557	28 362	64 311	45 378
Tools and plant	1 47,772	61,759	2,026	714	2,766	843	3 389	1 718	1,335	2,957	3,040	6 627	3,028
Total	(d) 38,45,655	6,86,918	66,738	31,670	52,273	50 235	55,917	53 848	82,034	80,524	1,53,846	2,69,192	2,54,711
Provincial													
Irrigation and Navigation—													
Original works										1 50 167	1 17,839	1 05 463	1,49,604
Repairs										64,741	1,22 929	81,503	1,24 321
Establishment										42 777	60 192	51 405	73 739
Tools and plant										4,016	6 019	10 675	5 194
Total										2,16,701	3,06,979	2 49 046	3,52,858
Roads and Buildings—													
Original works		5,18,112	7 20,790	9 65 324	7 71,727	10 99 324	9 02 042	36 05 789	10 25 412	4 01 815	8 01 266	4 74,295	11 32 525
Repairs		1,42,107	1,66,998	1 94 853	2 05 135	4 27 878	3,79 673	6 63 833	5 67 444	1 76 371	1,30 427	1 47 922	1 86 659
Establishment		1,81,191	2,26 696	2,51,077	2,05,070	5 28 609	5 39 598	12 79 506	11,27 000	6 35 690	5,50,554	7,05 784	5,23 909
Tools and plant		47,147	70,637	4,973	55,508	77,492	1,27 605	3,15 376	35,782	2 64,808	18,837	31,802	69,491
Total		8,88,557	11,85,121	14,16,727	12,37,440	21 33,303	19,48 918	59,14 504	27,55,638	9,49 008	14 63,410	12,96,199	17 73 602
Local													
Original works	12,93,759	14,30 382	13 11 052	18 54,008	16 24 916	10 13 553	14 07 713	9 50 437	5 24 971	3,99 686	1 14 750	92,362	68,500
Repairs	7,21 077	17,35 585	19,74,507	20,76 338	21 32 060	19 58 922	18 22 059	12 41 109	15 93 195	17 52 196	1,54 015	1 60 318	38,455
Establishment	2,99 369	9,60,923	9,87,477	10,32 031	8,80 905	5 71 503	7,43 559	3 96 071	5 73 341	4,69 131	62 689	31,932	43,182
Tools and plant	13,467	31,254	37,923	54,463	28,090	37,106	36,198	88,777	55 543	44 884	6,141	4,413	2,623
Total	23,28,172	41,58 144	43,10,959	50,16,840	46,65,931	35 81,084	40 09 529	26,76 394	27,47,050	26,65,897	3,37,595	2 89 025	1,52,760
Grand total—													
Original works	36,09 132	29 93,645	32,42,232	39 23,426	35,64 205	36,13 758	32 48 052	(b) 54 35 609	26 06 088	14,05 786	18 61,802	16 96 704	(a) 205,53 391
Repairs	31,28,818	32,26,532	36,49,273	39,35,084	41 17 835	41 78 971	38 92 939	(d) 36 98 393	35 83 445	33 23 928	18 79 539	18 84,736	22,72 658
Establishment	19 09,719	19,29 239	20,03,491	20,43 298	20 76,714	21 38 435	22 30 253	(c) 38 37 152	28 06 544	20,89 462	14,25 224	16,11,357	18 16 193
Tools and plant	1,76,441	1,46,692	3,35,099	1,19,463	1,97 618	2,74 398	3 39 539	5 92 400	2,00 670	70 911	1,89,900	1,29,738	1,09,621
Total	88,24,110	82,96,108	92,30,095	100,21,271	99,56,372	102,05 562	97,10,783	130 63 554	91,96 747	67 48 266	53,56,509	53 22 535	247,51,763
Madras Harbour Works—													
Works						76 809	5,74 998	3 95 196	7,78 030	11,66 211	13,84 164	6,63 858	4,12 823
Establishment						25 814	64 901	48 080	53 021	50,296	68 632	71,083	56,243
Tools and plant						24 212	3 66 799	1 01,892	4 770	4,275	8,779	54 817	2,334
Total						1,26,835	10 06,698	5 45 168	8,35 821	12,20,781	14,61,575	7,89,758	4 71,400

(a) Of this Rs 176,25,050 represents the purchase value of the Kurnool canal
(b) This was a famine year and the total outlay shown is inclusive of Rs 44 46 594 being the normal value charged on account of famine
(c) The excess under this head is attributable to the cost of the extra establishment employed on Famine Relief works
(d) Includes works that are now classed as "Provincial"

The method of the debit of establishment charges has already been explained in paragraph 9 Tools and Plant charges are also, in the first instance, charged to "Provincial," as in the case of establishment charges, and a percentage of 1½ per cent on expenditure and repairs is charged to all funds, on account of general tools and plant, except in the case of Irrigation and Navigation works for which Capital and Revenue accounts are kept, when the *actual* expenditure incurred is charged to the works Where tools and plant are specially procured for a work, the cost of such "Special tools and plant" is charged to the work

DESCRIPTION OF IMPORTANT PUBLIC WORKS

22 *Classes of public works*—The most important of the public works of the Madras Presidency—other than those of irrigation, which are treated of in a separate Article—can be divided into three main classes, viz, (1) Communications, (2) Harbours, (3) Buildings With a very few exceptions, no works of the first class remain at the present time under the charge of the Public Works department, but are entirely maintained by the establishment of the Local Fund boards The main lines of communication of the Presidency, together with the large bridges thereon, were, however, constructed by the agency of the Public Works department, and, together with all other roads, were, in the main, maintained by the same agency until the year 1879, when a complete transfer of the charges of "Communications" was made to an Engineering establishment directly employed by the Local Fund boards Under the head of "Communications" will, therefore, be briefly described the developement of the systems of road in the Presidency and of such navigable canals of importance as have not been described in the Article on Irrigation Under "Harbours" an account will be given of the Madras Harbour works and the other Marine works and harbour improvements undertaken by the Public Works department from time to time, while under the head of "Buildings" will be very briefly described the principal works of that class executed by the department.

23 *Communications—Sketch of the development of roads until the formation of Public Works department in* 1858—When Southern India first came under British rule, no roads suitable for wheel traffic existed, even in the main streets of the largest towns, and it was not until the year 1845, when the Trunk Road department was formed, that any systematic progress in the construction of roads was made by the British Government In the early days of British rule, the only "made" roads were the mountain passes, which were originally opened for the passage of troops and artillery Subsequent to the construction of these roads were formed rough roads connecting the military arsenals and cantonments, but no roads for other than military purposes were constructed, or thought of, until the year 1813, when the necessity for the construction of roads for commercial purposes first engaged the attention of Government No systematic progress was made, however, for many years in the development of "communications," though in certain districts the energy of individual officers accomplished a great deal in this respect within the limits of their charges About the year 1823 an abortive attempt was made to construct roads by the agency of the Corps of Pioneers, which at that time numbered about 2,000 strong, and were notoriously a hardworking, useful body of men, little hampered by customs of caste, and therefore ready for any employment that might be given to them This measure was a total failure owing to the lack of any professional knowledge whatever on the part of the officers of the corps, which was then entirely officered by regiments of the line, and in 1831 Government finally abandoned the idea of any considerable improvement and development of roads as a task of too great magnitude From 1837—1844, some important lines of road were opened or improved, but, owing to a want of system in the management of the several undertakings, much wasteful and unprofitable expenditure was incurred, which circumstance led to the idea of the formation of a special department, whose sole duty it was to design and construct a great system of trunk roads, or main lines of communication, throughout the presidency In the following year therefore the Trunk Road department was constituted, and from that time until the year 1858 gradually proceeded to construct the trunk roads of the presidency, which, it will be observed, for the most part follow the lines connecting the military

arsenals and cantonments, and therefore owe their origin to the rough roads originally traced out many years previously Reviewing the expenditure on "communications" up to the year 1845, we find that, in the 20 years from 1826 to 1845, the average outlay on the communications of the whole presidency was only Rs 1,16,926 With the year 1845, however, a new era commenced in the history of the roads of the presidency Previous to that date, the whole of the expenditure on roads was under the control of the Board of Revenue, under whom was also (paragraph 3) the Engineering establishment employed on them, but in 1845 the control of the expenditure passed into the hands of the Superintendent of Roads In paragraph 3, the working of the Trunk Road department has been briefly described, and it will therefore be sufficient to say that, while not accomplishing what was expected and required of it owing to administrative defects in its constitution, it did much good work, gradually expanded its operations, and proceeded with the bridging, formation, and improvement of the trunk roads on a systematic and uniform plan until its final abolition in the year 1858

24 *Further development of roads until the formation of Local Fund Boards in* 1871—After the formation of the Public Works department in the year 1858, the construction of the main road of the country was carried out by the department from Imperial funds, while the duty of keeping the minor district roads also devolved, in most districts, almost entirely on the Public Works department For some years, however, the funds provided for the main district roads were exceedingly inadequate, and were provided from Imperial revenue and from funds raised from local sources In the year 1862, the attention of Government was directed to the question of the entire provision of funds for such roads as were of local rather than Imperial importance from funds raised locally It was then roughly determined, pending further investigation, that there were only 6,360 miles of road which could properly be maintained from Imperial funds, viz, the 2,610 miles of trunk road then existing, and 3,750 miles of first-class district roads The remaining roads, amounting to about 10,000 miles of district lines, were considered to be merely of local importance, and various measures were proposed for the formation of a fund to be raised in each district, adequate to provide for their completion and maintenance The income of the Local Funds of the presidency, at that time available for expenditure on district roads, was only Rs 2,26,873 (derived from ferry and grass rents, bridge tolls, and cattle fines, &c), and therefore only allowed very inadequate grants being spent upon the district roads It was estimated at that time (1862) that the following sums were required for the completion and maintenance of the 6,360 miles of road already mentioned —

	Complete construction.	Annual maintenance
	RS	RS
For trunk roads	58,90,008	4,44,498
For district roads	1,53,90,337	10,29,072
Total	2,12,80,345	14,73,570

Whereas the total expenditure upon roads and communications for the five years preceding was as follows —

Year	Expenditure		Total
	New Works.	Repairs.	
	RS	RS	RS
1856-57	13,75,611	5,41,195	19,16,806
1857-58	5,01,478	5,51,791	10,53,269
1858-59	3,81,736	7,98 268	11,80,004
1859-60	4,35,030	9,09,708	13,44,738
1860-61	6,17,260	9,82,285	15,25,545
Total	33,11,115	37,09,247	70,20,362
Average per annum	6,62,000	7,40,000	14,04,000

It was therefore plain that more must be done for the development of roads than had been the case for the past few years, and in 1862 orders were therefore issued for the preparation of detailed lists of the roads to be classed as Imperial and to be constructed and maintained from Imperial funds, and the subject of the creation of some scheme for augmenting the local resources in order to provide for the construction and maintenance of all other lines of road, which were to be denominated "district roads" in contradistinction to those classed as "Imperial," was referred to the Board of Revenue. In 1865 the wants of the districts in the way of local communications were every day becoming more urgent and as considerable reductions in the Imperial grants given annually by the Government of India were made about that time, the question of the necessary provision of funds to be raised locally for expenditure upon roads (for which no definite scheme had then been prepared) was again taken up by Government calling upon the Board of Revenue to prepare and submit a draft Act for the levy of a district road-cess on all land-holders for the construction and maintenance of district roads, "as it was clear that the increasing demands upon the general revenues rendered it hopeless to expect that the Government would ever be in a position to do more than complete and maintain the chief lines of communications" Accordingly, in April 1866, the Bill known as the "District Road-cess Act III of 1866" was passed into law, by which a cess, not exceeding half an anna in the rupee on the rent value of occupied land, was imposed so as to form a fund for the construction and maintenance of the district roads The amount raised by this cess subsequently attained very considerable dimensions, while, in the year immediately after the Act was passed, the general income from Local funds went up with a bound from an average of Rs 6,84,150 in the three years, 1864-65—1866-67, to Rs 22,33,379 in the year 1867-68, and Rs 32,27,379 in the year 1868-69, of which latter amount Rs 15,17,097 was expended upon the construction of district roads Meanwhile, the final classification of all roads into "Imperial" roads and "District" roads was proceeding under the officers of the Revenue and Public Works departments, but was not finally settled until the year 1868-69, when it was decided that the expenditure from Imperial funds should be restricted to (1) certain specified main lines of communication, 25 in number, of a total length of 4,000 miles, (2) the ghát roads and certain special roads, amounting in all to a length of 650 miles, and (3) the salt roads, 23 in number, and 500 miles in length, while all other roads should be classed as district roads Until the formation of Local Fund Boards in 1871, the Imperial and District roads, as thus determined, were therefore maintained and constructed respectively from Imperial funds and from the "District Road Fund" raised under the Act of 1866, while the general agency of execution was the Public Works department Reviewing the expenditure incurred and the work done during this period, we find that the expenditure on roads in the year 18 8-69, for new works from Imperial funds, was Rs 12,17,455, and was devoted chiefly (1) to the construction and improvement of the Great Northern Trunk Road from Madras to Calcutta in the districts of Madras, Nellore, Kistna, Vizagapatam, and Ganjam, and (2) the construction of ghat roads in the Coimbatore, Malabar, and Wynaad districts, while the expenditure from the "District Road Fund" on new works amounted to Rs 15,17,097 and was principally expended in completing a network of minor communications, of which the most important were the railway feeders and the construction of embanked roads in the deltaic tracts of the Godavari, Kistna, and Tanjore districts

25 *Construction and maintenance of roads under the Local Fund Boards* —Local Fund Boards in the Madras Presidency were first constituted by the Local Funds Act IV of 1871, which repealed the District Road cess Act of 1866, and provided for the unexpended balance of the "District Road Fund," raised under the Act of 1866, being transferred to the Local Fund Boards The Local Funds Act provided for the imposition of a cess similar to the district road cess, but with a maximum of one anna in the rupee, and for the establishment of tolls upon roads, two thirds of the cess and the whole of the tolls being expended on roads The agency of execution was, as before, the Public Works department, and to pay for the Public Works establishment employed on the roads, the Local Fund Boards were charged at the rate of 25 per cent on the actual outlay incurred In addition to the funds made available for expenditure on roads by the passing of the Local Funds Act, annual contributions

from Provincial Funds were given by Government to the Local Fund Boards as grants-in-aid for expenditure upon the main lines of road, and from June 1871 the distinction formerly in vogue between "Imperial" and "District" roads was abolished, and the total annual assignment of grants-in-aid from "Provincial," together with the assignment from "Local funds," was treated as one general fund under the designation of "Road Fund" which provided for the construction and maintenance of all roads, including those formerly provided for from the Imperial grant for communications From the year 1872-73 to 1879-80 no change was made regarding the agency of execution of work upon roads, and the provision of funds for expenditure thereon and all roads continued up to 1879-80 to be carried out by the Public Works department for the Local Fund Boards, while the expenditure relating thereto was accounted for in the Public Works department In 1879-80 an important change was made, inasmuch as the entire execution of the maintenance and construction of roads was transferred from the Public Works department to the Local Fund Boards, who forthwith employed their own Engineering establishments directly responsible to them Since that date the Public Works department has, with the exception of certain special works, such as the Potunghi Ghát, &c, had nothing to do with the roads of the presidency generally, except as regards the check and examination of certain estimates as already explained in paragraph 19 The following statement shows the total expenditure incurred upon roads (not including the establishment charges) during the period of execution of work upon them by the Public Works department, viz, from the year 1872-73 to 1879-80 —

Statement of expenditure on roads from 1872-73 to 1879-80

Year	Expenditure on Roads from "Provincial Funds"			Expenditure on Roads form Local Funds			Grand Total
	New Works	Repairs.	Total	New Works	Repairs.	Total	
	Rs.	Rs	Rs	Rs	Rs	Rs	Rs.
1872-73	1 09 828	45 994	1 55 822	11 96 501	19 01,416	30 97 937	32 53 759
1873 74	1 96 143	29,679	2 25 822	16 47 768	19 59 182	36 06 920	38 32 742
1874 75	1 66 258	32 353	1 98,611	13 17 300	20 17,239	33 34 539	35 33,150
1875 76	6 91,185	2 02 621	9 83 806	7,16 536	18 36 672	25 53 228	35 37,034
1876 77	2 82,443	2 44 304	5 26 747	11 28 718	16 93 471	28 22,219	33 48 966
1877-78	31 44 334	4 19 387	35 63 721	7 25 091	10 95 228	18 20 319	53 84 040
1878-79	6,51 510	4 33 614	10 85 124	3 85,839	15 06 426	18,91,265	29 76 389
1879 80	43,709	36 427	80,086	3,08 560	16,33,024	19,41,084	20,21,670

The expenditure of 1876-77 was abnormal, and was due to the famine The expenditure shown under the head "Provincial" was that incurred by the department on certain roads specially so classed The expenditure shown under the head of "Local Funds" includes the grants-in aid from "Provincial" which, as already explained, were amalgamated with the assignments from Local funds into one general fund These Provincial grants-in-aid were first given in the year 1872-73, and from 1876-77 have been much reduced in amount, as the following statement will show —

Statement showing the amounts of grants-in-aid from Provincial to Local for the years from 1872-73 to 1879-80

Year	Amount Rs
1872-73	11,26,000
1873-74	12,00 000
1874-75	12,00,000
1875-76	11,10,000
1876-77	2,43,390
1877-78	1,18,230
1878-79	62,500
1879-80	1,25,000

The communications of the presidency are now therefore entirely under the Local Fund Boards, who provide for their construction and maintenance from their own

revenues, of which the chief item is that raised by the land-cess, aided by a small contribution from Provincial In the year 1882-83, the number of the Local Fund engineering circles was 30, the total length of roads, exclusive of village roads under their charge, was 21,019 miles, while the total expenditure incurred on roads was Rs 28,52,083, or 47 per cent of the whole Local fund expenditure

The chief lines of road are shown in the accompanying map Of these, the most important at the present day (as it traverses districts in which there is no line of railway) is the Great Northern Trunk Road from Madras to Calcutta, passing through the districts of Nellore, Kistna, Godavari, Vizagapatam, and Ganjam This road crosses the entire drainage of the country at right angles to its course, and is provided with numerous bridges Next, in order of importance, come the Great Southern Trunk Road from Madras to the Travancore frontier, the Great Western Trunk Road from Madras to Calicut, and the ghat roads leading from the Nílgiri to the Malabar Coast, the Mysore plateau, and the Madras railway at Mettupálaiyam

26 *Proposed extension of main roads and scheme for tramways or light railways* — In the interests of the coffee industry, carried on mainly by European planters in the Nílgiri and Wynaad districts, and also to aid in developing the gold-mining enterprises which have of late years been started in the Wynaad, a scheme for the extension and improvement of the existing lines of communication between the Malabar Coast and the Nílgiri plateau has lately attracted the attention of Government, and a special Public Works officer is now engaged in making the requisite surveys and estimates for the conversion of the existing lines of road into first-class metalled roads capable of bearing traffic during the monsoon The Wynaad roads, like all other roads in the presidency, are at present under the charge of the Local Fund Boards, and, though it is intended that the Public Works department should ultimately execute the improvements proposed, existing arrangements for the maintenance of the road by the agency of the Local Fund Engineer establishment will not be disturbed until such time as funds are available and the Public Works department is in a position to take over the work of complete restoration The improvements proposed will cost a large sum, and the work will extend over some years As the line most required at present is, in the opinion of the Wynaad Planters' Association, the road from the seaport of Calicut to Vayitri, a detailed survey and estimate of this line, through the Tamrachéri ghát, is now in progress under the special Public Works officers employed in the Wynaad.

In the year 1882, the Government of Madras submitted to the Government of India a scheme for the construction of 1,000 miles of light railway or tramway on the existing roads in the tracts of the presidency most liable to famine, and suggested that the tramways should be classed as "protective" works (*vide* paragraph 3 of article on irrigation), and should be carried out from funds provided from the Imperial protective grant The Government of India, in reply, declined to expend Imperial funds on detached distributary lines, until the main arterial protective lines were completed, and pointed out that the provision of the light distributary lines proposed would only benefit the tracts of country they immediately served, and should therefore be provided by the local Government The Madras Government thereupon appointed a committee to consider the best method of connecting the great centres of production and consumption with the main arterial protective lines Towards the end of the year 1883 the committee submitted their report, and recommended the construction of the following five light metre-gauge lines of railway on existing roads where praticable, and elsewhere on independent embankments —

(1) Guntakal *via* Anantapur to Hindupur—a length of line of about 100 miles in the Bellary district
(2) Vellore *viâ* Tiruvannámalai to Villupuram—a length of line of about 90 miles in the North Arcot and South Arcot districts
(3) Porto Novo *viâ* Vriddháchalam to Kallakurchi—a length of about 60 miles in the South Arcot district

(4) Pálghat to Dindigul (a length of about 100 miles in the Coimbatore and Madura districts) or Karúr to Dhírapuram—a length of about 60 miles in the Coimbatore district.
(5) Madura to Ramnad, a length of about 70 miles in the Madura district

The recommendations of the committee were generally approved by Government Lines (2) and (3) are now being surveyed, orders have been issued for the survey of (4) Pálghat to Dindigul on completion of the surveys of (2) and (3), and the consideration of the remaining lines has, for the present, been postponed

27 *The Upper Godávari Navigation Works* —The Upper Godávari navigation project was first urged upon the notice of the Government by Sir Arthur Cotton in 1851, and had as its object the opening up of the navigation of the river Godávari from the important cotton mart of Nachangaon, 60 miles south-west of Nagpore, and situated on the river Wardha, a tributary of the Godávari to the sea port of Cocanada in the Godávari district By making this portion of the river navigable, it was anticipated that the cotton from Hinganghát, a great emporium for cotton, and a large area of country containing some of the finest cotton fields in India, would be sent down the river to Cocanada, and that, in return, there would be considerable importations up the river A great trade was thus expected to be developed, and a remunerative return on the outlay necessary to make the river navigable was looked for The main obstacles to navigation consisted of three remarkable rocky barriers, forming rapids only navigable in floods, but, these points excepted, the river was reported to be navigable for shallow river steamers for nine months in the year The first barrier is at Dumagudiem, 150 miles from the sea, and is 20 miles long The second is 14 miles long and 220 miles from the sea The third is 310 miles from the sea, is 35 miles long, is 75 miles distant from Chanda in the Central Provinces, and 115 miles from the cotton mart of Hinganghát The works necessary to make navigation practicable consisted of the construction of canals round the three barriers by means of anicuts and locks, and the clearance of the river bed in places by blasting The necessary surveys of the river were commenced in 1854, and by 1861 two lakhs of rupees had been spent in surveys and preliminary operations In 1861 the works at the first barrier were commenced, and at the beginning of the year 1863, seventy lakhs had been expended on the works at the first and second barriers In January 1863 Sir Richard Temple inspected the works, and recommended that the works at the first and second barriers and in the river up to the foot of the third barrier should be proceeded with at an estimated cost of Rs 25,50,000, so that the navigation might be open to the foot of the third barrier (to which point the road from Nagpore to Chanda was to be extended) by May 1865 By August 1865, two-fifths of the anicut at the first barrier, with the other masonry works, were completed In 1871 the works at the first barrier were almost completed, the works at the second barrier were entirely suspended and were in an incomplete state, the works at the third barrier were not commenced, while the total expenditure incurred was Rs
There was at that time a steamer towing boats from the second barrier to the coast, and the *Wanganga* steamer continued the communication between the second and third barriers, but the amount of traffic was small In a despatch, dated August 1871, the Secretary of State proposed that the navigation works should be completed on the smallest possible scale as far as the foot of the third barrier, whence a road should be made to Chanda, but in October of the same year, at the request of the Government of India, the whole scheme was abandoned as involving expenditure which did not give promise of any adequate return From October 1871, therefore, the work has been in abeyance In September 1881, in consequence of reports of impending injury at the anicut at the first barrier at Dumagudiem (which, however, turned out to be without foundation), the Superintending Engineer of the circle visited the anicut, and an upper subordinate has since been stationed at Dumagudiem to attend to all necessary repairs and to undertake certain investigations having for their object an extension and improvement of the existing traffic on the Upper Godávari

HARBOURS

28 *Inquiries regarding Madras anchorages, and general sketch of marine works undertaken by the Public Works department* —The officers of the Public Works

department have at various times been called upon to submit reports and estimates for the improvements of the harbours of the East and West Coasts of the Presidency, and the department has also executed various marine works from time to time The works of this class undertaken by the Public Works department date as far back as the year 1838, when the deepening of the Pámban passage was first commenced The first detailed inquiry into Madras anchorages was in 1870, when Mr George Robertson, a Harbour Engineer, made a minute and careful inspection of the ports of Mangalore, Cannanore, Calicut, Beypore, Cochin, and Quilon on the West Coast, and of Tuticorin, Pámban Pass, Negapatam, Madras, and Cocanada on the East Coast He considered Quilon capable of being made the finest close harbour in India, and published an elaborate report embodying certain recommendations regarding various ports His recommendations were acted upon by Government, and the Public Works department was accordingly ordered to execute certain improvements which were forthwith carried out, principally to the harbours of Mangalore and Cochin In the following year Mr Robertson again visited the Pámban Pass to report on the subject of a ship canal through the island of Pamban In the year 1875-76, the works of the Madras Harbour, designed by Mr W Parkes, were commenced The next inspection of Madras anchorages was made in the year 1881 by Mr Parkes, who visited the harbours of Vizagapatam, Bimlipatam, Calingapatam, and Quilon, in order to report on their capabilities for the formation of first-class harbours He reported, in due course, that the natural advantages of Vizagapatam were superior to those of Bimlipatam or Calingapatam, but that, at all these three ports, it was absolutely out of the question to construct first-class harbours capable of giving remunerative returns from the trade of the port He recommended, however, that hydrographic surveys of the three ports should be made, and in accordance with his suggestion a hydrographic survey of the port of Vizagapatam was undertaken by the Public Works department in the year 1883, but the work was subsequently transferred to the Indian Marine Survey department The report by Mr Parkes on the Quilon harbour was of a much more favorable character He considered that a well-sheltered harbour could be made at a moderate cost, and that by means of a short canal the harbour could be connected with the West Coast canal system The question of the improvements to the Quilon harbour is now under the consideration of the Travancore Sarkar

The improvement of the Cocanada harbour by means of lengthening the groynes at the mouth of the Cocanada river has engaged the attention of the department for some time, and in the year 1882-83 an estimate of Rs 53,608 was sanctioned for the purpose A decision has also been arrived at with regard to the improvement of the ports of Vizagapatam, Cochin, and Gopálpur At the first port the project for the erection of an iron pier, which has been for some time under consideration, is now held in abeyance, and it has been decided that no permanent improvement of the Cochin harbour is possible except at a prohibitive cost With regard to Gopálpur, the erection of a wrought-iron screw pier has been favorably viewed by Government, and the preparation of a detailed estimate for a pier, 900 feet in length and roughly estimated to cost about two lakhs, is now being undertaken by the Madras contractors, Messrs Massey and Co

29 *Works at the Pamban Pass*.—The Pámban Pass is the narrow artificial strait running north and south from Palk's Straits into the Gulf of Manaar, and separating the Ramnad zemindari, situated on the mainland in the Madura district, from the island of Ramesvaram Originally this gap was bridged by a continuous isthmus, but in the year 1480 a violent storm breached the isthmus and permanently separated the island of Ramesvaram from the mainland of the Madura district, thus making a break in the great connecting link of islands, rocks, and shoals, that separate Ceylon from the mainland of India The natural passage thus made was, however, impracticable for ships, being too shallow, and also being obstructed by two parallel ridges of rock The first proposal to clear and deepen the passage so as to allow of ships passing through and thus shortening the voyage from India to the island of Ceylon, was made about the year 1800, but no practical action in the matter was taken until 1882, when a survey was made by Ensign (now Sir Arthur) Cotton The survey being favorable, various operations were begun on a small scale in the

year 1828, but it was not until the year 1838 that the work of deepening and widening the channel was regularly started From that date up to the present time, the works have been continually in progress The work was first started in 1838 by the employment of gangs of convicts, under the supervision of Madras Sappers and Miners, a special Engineer officer being placed in charge under the direct control of the Chief Engineer, but after the organization of the regular Public Works department in 1858, the works were directed by the Public Works officers in charge of the Madura district In 1873, the jail at Pámban was abolished, and from that date convicts, under the supervision of the Public Works department, were no longer employed on the works Finally in 1879, the works were transferred from the Public Works department to the Marine department Tracing the progress of the works, we find that in 1844 the passage had been deepened to 8 feet of water at low spring tides, while the total expenditure up to that date was Rs 1,55,950. By 1854, the depth had been increased to 10½ feet, the passage was navigable for keeled boats of 200 tons, and the total expenditure had amounted to Rs 3,25,000 In 1875, the passage had been deepened to 14 feet and to a width of 80 feet The works undertaken consisted mainly of blasting and dredging operations They have on the whole been a great success, and have enormously benefited the coasting trade of sailing vessels, by which it is largely used During the official year 1883-84, the number of vessels which passed through the Pámban Pass was 1,455, having a total tonnage of 176,743 tons, while the pilotage fees realized therefrom were Rs 19,402 Originally the works were started merely with the intention of providing a passage for small sailing vessels, but in 1854 Colonel Cotton projected a scheme for making the pass available for all classes of vessels, and also for the large mail steamers between Calcutta and Suez The weight of marine and nautical opinion was, however, entirely against this scheme, which, it was clearly shown, would involve an enormous expenditure without an adequate return This project was therefore definitely shelved in favor of the original scheme

30 *The proposed Pámban Ship Canal*.—A project for cutting a ship canal through the island of Manaar was mooted as long ago as the year 1832 Some time after that period, the idea of cutting a large ship canal through the adjoining island of Rámesvaram was started, and in the year 1862 a Parliamentary Committee took evidence on the practicability of the project, and the benefits to be derived from it In the same year, Sir W Denison, the Governor of Madras, visited Rámesvaram, and selected, as suitable for a ship canal, a line about 2 miles in length through the island of Rámesvaram and about 2¾ miles east of the Pámban lighthouse In the year 1870, Sir Hercules Robinson, the Governor of Ceylon, and other officials of the Ceylon Government, visited Rámesvaram, and a line for a ship canal was proposed by Mr Stoddard about three-fourths of a mile to the west of that selected by Sir W Denison In the following year, Admiral Sir James Elphinstone carefully inspected the locality, and while emphatically deciding against any attempt to adopt the Pámban Pass for big vessels—a scheme which had also been considered together with that of cutting a ship canal through the island of Rámesvaram—on the ground that such a long and tortuous passage could not be made safe for big ships, advocated the cutting of a canal, 7½ miles in length through the Ramnad promontory on the mainland, together with the formation of a large sheltered harbour In the same year, a discussion regarding the various proposals made, for a ship canal, was raised in Parliament, and in the year 1872, Mr George Robertson was specially deputed to report on the various schemes which had been brought forward up to that time The result of Mr Robertson's inquiries was to recommend as most suitable for the cutting of a ship canal a line, through the eastern end of the island of Rámesvaram, one mile east of the Pámban lighthouse, 1¾ miles west of the line selected by Sir W Denison in 1862, and one mile west of that chosen by Mr Stoddard The line selected by Mr Robertson was 2¼ miles from water-line to water-line, and was considered by him to be better sheltered at its entrance from the swell of the south-west monsoon than either of the other lines proposed Nothing more was done regarding the project for a ship canal until the year 1881, when the Chief Engineer and Master Attendant, Madras visited Rámesvaram, reviewed the various schemes already detailed, and reported that.

if ever the scheme for a ship canal was seriously thought of, preference should be given to a line in the neighbourhood of that selected by Sir W Denison On this report, borings along the line chosen by Sir W Denison were ordered by Government, and were subsequently carried out by the Marine department It will be evident that all the steps above detailed were taken with a view to sift the merits of the different schemes proposed from time to time for a ship canal In the year 1882, practical effect was, for the first time, given to the results of these investigations, by the formation of a company by Messrs Grindrod, Jenkins and Company of London for the cutting of a canal, to be entitled the Pamban ship canal, through the island of Rameswaram The company's scheme, in addition to the cutting of a large ship canal, included the provision of dry docks The capital of the company was to be raised in England, and a concession was asked for from the Madras Government for the right of cutting the canal. The Government have now granted to the company a general concession for cutting the canal through the island of Rámesvaram, subject to the condition that, the land being private property, the company shall arrange terms of acquisition with the owners, and shall submit for approval the scale of dues which it is proposed to levy on all vessels making use of the canal At the end of the year 1883-84, the agents of the company were engaged in arranging with the several owners of property in the island of Rameswaram, the terms of compensation for land to be taken up by the canal

31 *History of the construction, Madras Harbour Works* —The design for the construction of the Madras harbour was made by Mr Parkes, a Civil Engineer in London, and the original estimate, amounting to Rs 50,50,000, was sanctioned in March 1875 by the Secretary of State. The expenditure on the work was to be provided from Imperial funds from money raised on loan The design consisted of a close harbour, providing accommodation for 13 large ships to swing at their moorings, in addition to space for several smaller craft The enclosed space was to be formed by two breakwaters, equidistant from the existing iron screw pile pier, running parallel to, and at a distance of 1,000 yards from, each other, to a length of 1,200 yards into 7 fathom water, where, on a curve of 568 feet radius, both were to turn inwards at right angles, leaving between them an entrance to the enclosure of 450 feet in width The two breakwaters were to be constructed of packet concrete blocks, each about 27 tons in weight, not built in one bonded mass, but built in two parallel walls placed side by side in juxtaposition, having a vertical joint between them, and laid on a rubble base of from 4 to 20 feet in depth The works were begun in the official year 1875-76, and by the end of the year an expenditure of Rs 3,41,703 had been incurred upon them During May, June, July 1876, the works were carried on under difficulties owing to the heavy surf prevailing In March 1877, it was discovered by the divers that the rubble base foundation of the north pier was entirely buried in sand For several months every possible means was taken to remove this sand accumulation by dredging, by working in caissons, by jets of steam and jets of water at high pressure, but without avail Finally the Superintendent of the works determined to build the concrete blocks upon the sand and allow them to sink through to the rubble base, and this was accordingly done Owing to this serious obstacle, the works were much retarded during the greater part of the year 1877-78 In May 1877, the works were severely tried by a cyclonic storm, but suffered no damage of any importance, and hardly any settlement occurred in the work at either pier In November and December 1878, the works were greatly interrupted by bad weather, and in January and March 1879 by the breaking down of the titan cranes, and the delay in the receipt of stores from England At the end of the official year 1878-79, the total expenditure on the harbour amounted to Rs 26,12,822, and it was estimated that the works would be completed by March 1881 Considerable progress was made on the works during the official year 1879-80, and by the end of the year the north pier had advanced to a total length of 2,745 feet, of which the last 445 feet was built on a curve of 568 feet radius, and the south pier had been carried to a total length of 2,146 feet. During the official year 1880-81, the progress was more considerable than in any previous year At the end of the year, the expenditure amounted to a grand total of Rs 53,52,890, the north pier was advanced to a total length from the shore of

3,845 feet, or within 21 feet of its termination; the south pier was carried to a total length of 3,635 feet from the shore, while both piers terminated in water 8 fathoms below mean sea level, and the distance between their terminations was only 890 feet, or 340 feet more than the proposed ultimate width of the harbour entrance, which it had been decided to increase to a total width of 550 feet instead of 450 feet as originally designed by Mr Parkes By October 1881, both the north and south pier had been brought to their full length, so as to leave an open space of 550 feet as an entrance, but on the 12th November 1881 the works were greatly damaged by a cyclone which struck Madras with great suddenness All further progress on the harbour works was stopped in consequence On 29th, 30th and 31st December 1881, another cyclone passed over Madras, but, owing to its centre being near, the sea was not very high, and no further damage was caused to the works Up to 12th November 1881, when the damages caused by the cyclone occurred, the total amount of work done consisted of 7,836 lineal feet of breakwater constructed, 13,309 concrete blocks set in position, 13,643 concrete blocks made and 930,758 tons of stone deposited for the surf banks and rubble bases The total expenditure incurred up to the same date was Rs 58,09,629 The construction of the Madras harbour works may be said to have terminated with the cyclone of November, and at the end of 1883-84 was still deferred pending the decision regarding the revised design to be given to the work

32 *Damages caused by the cyclone of November* 1881, *and works since undertaken* —The damages due by the cyclone of November 1881 were half mile of breakwater breached, and, on an average, the two top courses of concrete blocks thrown into the harbour, two titan cranes thrown over and destroyed, rubble base lowered and spread out, 1½ miles of single line railway carried away, twin barges *Salisbury* and *Hobart* foundered and lost with the loss of 13 lives, besides minor damages such as the loss of small boats, injury to the iron pier, encroachments by the sea and damage of private property During the remainder of the official year 1881-82 subsequent to the cyclone, the chief work done consisted of repairs, such as relaying the lines of railway, levelling up with concrete the top of the north pier, clamping together the walls of the north pier, and repairing and strengthening the beach protective works From April 1882 to March 1883 the work done was limited to necessary repairs, block-making and protection of the shore, which had been much encroached upon by the sea, owing largely to the obstruction caused by the harbour walls In March 1883, all active work was stopped, except repairs to plant, and the harbour staff was reduced as much as possible, pending the resumption of operations, when the details of the design for the restoration of the harbour had been definitely settled Up to the end of the official year 1883-84, the additional expenditure incurred since the cyclone of November 1881 was only Rs 8,69,233, while the total expenditure incurred was Rs 66,78,862

33 *Measures taken for the completion of the Harbour* —Shortly after the cyclone of November 1881, reports regarding the damage done, accompanied by proposals for completing the harbour, were drawn up by Mr Parkes, the Chief Engineer, Public Works department, and officers specially deputed by the Government of India, and were forwarded to the Secretary of State, who referred them to a London committee consisting of Sir J Hawkshaw, Sir J Coode and Professor Stokes The reports showed a concensus of opinion on three points, viz, that (1) the piers had up to the occurrence of the cyclone been pushed forward on a plan which insured both economy and expedition in a marked degree; (2) shelter had thus in great measure been provided in all ordinary weather, and still existed to the great advantage of the port, (3) the injuries caused by the cyclone could be made good, and the work rendered safe, in about three years, at a cost which would still make the harbour a comparatively cheap work of its kind In January 1883, the London committee issued their report, criticised the system of construction adopted by Mr Parkes, which—while admitting that it conduced to rapidity of construction—they remarked they could not recommend were the work to be begun again, but should prefer to see the work bonded throughout They reviewed three alternative systems of reconstruction, expressed a favorable opinion regarding the safety of the "random-block" system, and made certain definite recommendations regarding the restoration of the work, of which the principal points

were to the effect that (1) the extra strength required should be given by the addition of a large wave-breaker, consisting of concrete blocks tipped over the seaward faces of the work, (2) the piers should be raised to a considerably higher level than was originally contemplated, and should be, when finished, not less than 12 feet above high water mark, and (3) that the entrance should be narrowed to 450 feet On receipt of this report, the Government appointed a Madras committee to frame detailed estimates, and to consider the best way to give effect to the proposals of the London committee In June 1883, the Madras committee issued their report, accompanied by estimates of the cost of completing the works on the several systems suggested by the London committee The estimates showed that the works could be completed for a sum of from 45 to 50 lakhs, according to the system and details of reconstruction followed The committee expressed a decided preference for the "random-block" system of construction, and made two important proposals—(1) the closing of the present eastern entrance to the harbour, and the opening of a new entrance, 500 feet in width, in from 7 to 7½ fathoms of water, at the north-east angle of the harbour, with a protecting horn 600 feet long, (2) the omission of the wave-breaker of concrete blocks along the south pier, which they considered was not subject to heavy seas, and was sufficiently protected by sand accumulations This report was subsequently referred by the Secretary of State to the London committee, who, in March 1884, issued a second report, in which they adhered to their former decision on all points, and consequently recommended that the entrance to the harbour should be retained in its original position, and should be narrowed to 450 feet—an opinion which was accordingly endorsed by the Secretary of State To this latter decision, the Madras Government, acting on the advice of their professional advisers and supported by the entire nautical and commercial interests of the port, have replied, have pointed out that the recommendations of the London committee, regarding the retention of the eastern entrance, were based upon incomplete information, and have strongly recommended, as a point of the first importance, that the harbour entrance should be placed at the north-east angle of the harbour, in from 7 to 7½ fathoms of water, as recommended by the Madras committee At this stage therefore the question of the restoration of the harbour now stands

34 *Buildings constructed, or under construction, by the Public Works Department* —The Public Works department have, from earliest times, constructed and maintained all important public buildings At first, their duties in this respect were mainly confined to the building of civil courts and cutcherries, public bungalows and military hospitals, secondly, to the building of large barracks for the accommodation of British troops, and to the construction of jails, and, lastly, to the provision of the new buildings required by the expansion of business in the Postal, Telegraph, Educational, Medical and other departments of the State In proportion to its size and importance, the Madras presidency has probably fewer modern buildings of any architectural pretensions than any other province of India, and it is only during recent years that the few handsome buildings it possesses have been constructed As an instance of the paucity of modern public buildings, it may be noticed that the Secretariat offices at the presidency town, with the exception of the Public Works Secretariat, are still located in their old quarters within the ramparts of Fort St George, while the High Court of Madras is lodged in old and ill-adapted buildings on the sea-face The more important of the public buildings constructed by the Public Works department since its regular formation in 1858, will now be briefly noticed under the respective heads of Military and Civil Buildings

Military Buildings —The largest and most important building of this kind that has yet been constructed is the Military Convalescent Depôt at the station of Wellington on the Nilgiri Hills This building was commenced as far back as 1852, but occupied many years in construction, owing to the difficulties experienced in procuring labor and materials for the work As each block of the buildings was completed, it was handed over by the Public Works department to the military authorities for occupation, and, at the end of the official year 1860-61, a total expenditure of Rs 17,59,961 had been incurred on the barracks, and its subsidiary [illegible] and connected works The barracks are commodious and well planned, but the building

generally is of a plain and unpretending character The next military building in order of importance is the Lawrence Asylum at Lovedale, 3 miles from the station of Ootacamund, in the Nilgiri Hills This building was commenced about the year 1864-65, and also took many years in construction, owing to the difficulties found in supplying labor and materials Convicts were largely employed in the works under the superintendence of the Public Works department The asylum was intended, and has been used, as a training school for the free education of sons and daughters of European soldiers of the army An estimate of Rs 11,38,310 was sanctioned for the work, and by the end of 1876-77 (when the building was practically finished), an expenditure of Rs 8,60,910 had been incurred, of which Rs 54,000 were defrayed by private contributions The building is in the Lombard style, and occupies an open and commanding site The remaining military buildings of importance, constructed by the Public Works department, together with the expenditure incurred on them, are shown in the following list —

Family Quarters in Fort St George—Estimate Rs 1,58,100 —Begun in 1863-64, finished in 1865 at a total cost of Rs 1,60,910

Cannanore Barracks, Married Quarters—Estimate Rs 1,27,723 —Commenced in 1866-67; completed in 1873-74 at an outlay of Rs 1,20,147

Artillery Barracks, Cannanore—Estimate Rs 1,05,300 —Begun in 1866-67; finished in 1868-69 at a total cost of Rs 1,05,974

Family Quarters for Warrant and Non-commissioned Officers of the Ordnance Department at the Presidency—Estimate Rs 1,03,910 —Begun in 1866-67, finished in 1869-70 at a total outlay of Rs 1,03,044

Artillery Barracks, St Thomas' Mount—Estimate Rs 2,46,920 —Commenced in 1868, completed in 1876 at a total cost of Rs 2,48,146

Additions to Parade Barracks, Bangalore—Estimate Rs 2,19,830 —Work finished in 1876-77 at a total outlay of Rs 2,19,622

Barracks for European Infantry at Cannanore—Estimate Rs 2,97,430 —Work completed in 1876-77 at a total cost of Rs 2,74,245

Race-course Barracks, Bangalore—Estimate Rs. 5,92,540 —Work finished in 1876-77 at a total outlay of Rs 6,16,402

Double-storied Barracks for a second Battery of Field Artillery at St Thomas' Mount —Estimate Rs 2,46,920 —Work completed in 1876-77 at a total cost of Rupees 2,48,146

Barracks for European Infantry at Bellary—Estimate Rs 3,62,988 —Work completed in 1877-78 at a total outlay of Rs 3,83,265

Barracks for European Infantry, Fort St George—Estimate Rs 2,27,350 —Work finished in 1874-75 at a total cost of Rs 2,29,706

Royal Horse Artillery Barracks, St Thomas' Mount—Estimate Rs 1,35,050 — Work still in progress, and expenditure up to June 1884, Rs 91,343

Improvements to Gun Carriage Factory, Madras—Estimate Rs 2,48,492.—Expenditure to end of June 1884, Rs 2,15,949

Civil Buildings —The buildings of this class which require particular notice are not numerous First, in order of importance as regards the expenditure incurred, is Government House, Ootacamund, for which an estimate of Rs 7,79,150 has lately been sanctioned The building has no architectural features, and is, in fact, of the plainest type Up to June 1884, an expenditure of Rs 6,08,178 had been incurred against the sanctioned estimate The next building in order of importance is the new Postal and Telegraph office, Madras, which is now rapidly approaching completion This building, which is incomparably the first in the presidency town, was begun as long ago as 1874, when the foundations of the Telegraph office were commenced, but, owing to a variety of causes, the building was not regularly put in hand until the year 1881-82 The sanctioned estimate for the work is Rs. 6,18,414, and the expenditure incurred up to the end of June 1884 was Rs 6,12,574 The building is in the Hindu-Saracenic style, occupies a central position on the beach nearly facing the Madras harbour, amid a number of very old and plain-looking buildings, and may be said to be the most prominent architectural feature of the presidency town Two other buildings in Madras, viz, the Senate-house of the Madras University and the

Presidency College, are worthy of especial mention, and are interesting as being the buildings for the design of which the Madras Government, in April 1864, invited open competition by advertisements in the daily and official papers The designs of Mr R F Chisholm (then of the Bengal Public Works department) were accepted by the committee of adjudication, and a prize of Rs 3,000 was awarded to that gentleman, who was shortly afterwards appointed Consulting Architect to the Government of Madras, an appointment which he still holds The Presidency College is in the pure Italian style, was commenced in 1864-65 and was completed in 1870-71 at a cost of Rupees 3,12,697 The Senate-house is an imposing building, in no particular style of architecture, but with a leaning to the Byzantine style It was commenced in April 1874 and was finished in March 1879 at a cost of Rs 2,89,729 The only other building which requires particular notice is the Public Works Secretariat buildings at Chepâk, on which a considerable expenditure has been incurred The building was constructed during 1864-65 to 1867-68 at a cost of Rs 1,12,233 for the accommodation of the Public Works Workshops stores and foundry During the years 1876-77 to 1879-80, it was improved and adapted, at a cost of Rs 1,26,403, for the accommodation of the Public Works Secretariat, who were in the latter year transferred thereto from their old quarters in Fort St George, while the Public Works Workshops were removed to an old building at the Seven Wells Lastly, in the year 1883-84 further improvements were begun and are still in progress, against a sanctioned estimate of Rupees 1,00,545, for the extension and embellishment of the premises The building, which was formerly devoid of the slightest ornament, and was of an extremely plain design, is now a handsome and commodious structure in keeping with the Chepâk Palace, Senate-house, and Presidency College, which are all situated in its immediate vicinity, on the sea-face at Chepâk

The jails of the presidency were mostly constructed about the same period, and the most important of them, together with other important civil buildings, are enumerated in the following list —

—	Estimate.	Begun	Completed	Cost
Central Jails	Rs			
Rajahmundry	3,53,597	1863-64	1870-71	3,27,804
Vellore	3,75,294	October 1866	March 1873	3,73,233
Trichinopoly	3,78,892	December 1866	December 1872	3 79,297
Coimbatore		1863-64	1867-68	3,76,338
Cannanore	3,27,000	November 1866	March 1873	3,14,264
District Jails				
Palamcottah	2,08,000	June 1876	In progress	* 1,33,850
Tanjore	2,11,100	March 1882	Do	* 92,070
General				
Improvements to General Hospital, Madras	2,19,500		1865-66	2,51,015
Improvements to the office of the Board of Revenue, Chepâk	1,80,305	1868-69	1873-74	1,82,154
Lunatic Asylum, Madras	2,43,500	1866-67	1871-72	2,30,387
Converting Rayapettah Police Court into house for Prince of Arcot	1,49,696	February 1877	February 1878	1,33,585
Lying-in Hospital, Madras	1,78,660	April 1877	January 1883	1,78,758

* Expenditure to end of June 1884

33 *Restoration of buildings of Archæological interest* —The most important work of this class, undertaken by the department, is the restoration of Tirumal Naick's Palace at Madura, on which an expenditure of Rs 2,35,950 had been incurred up to June 1884 The work of restoration was begun as far back as the year 1870-71, when the existing structure was on the point of falling to pieces, and has been in progress ever

since that date under the supervision of the Government Architect In addition to the works which have been taken to ensure the security of this ancient building, the ornamentation of the palace has been carefully renewed, and the interior of the building has been adapted for the accommodation of the Collector's office, the court of the District Judge, and all the chief Government offices of the Madura district In the years 1880-81, 1881-82, works of preservation were carried out at the Seven Pagodas, and consisted chiefly of the removal of the drift sand from the immediate neighbourhood of the monolithic rafts, the cutting off of drainage which was injuriously affecting the sculptures, and the necessary works to provide for the security of the stone temple Some work has also been carried out at the Vellore temple and at the ruins of Hampi in the Bellary district, and measures are now under consideration for the restoration of the ancient palace of Chandragiri, and for its adaptation for the use of public offices

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No 567 E.

Transferred to the Chief Secretary to Government in continuation of endorsement, No 566 E, dated 27th August 1884, with remark that the article is approved generally in the Public Works department

OOTACAMUND, *27th August* 1884 (Signed) J SHAW-STEWART, Colonel, R E, *Secretary to Government, P W D*

To the Chief Secretary to Government (with article)

ORDER—dated 23rd January 1885, No 203, Public

Recorded

(True Extract)

Ag Under Secy to Govt

To the Public Works department.

Ead J Wright

Govt. of [1885] Madras.

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SECRETARY TO GOVERNMENT MADRAS
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PUBLIC DEPARTMENT

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G.O, 23rd January 1885, No 203.

JANUARY.

Manual of the Administration.

Recording article contributed by the Public Works department on the "General Branch"

C.E. for Irr Dept 4/2/85
Exd P.W.A.

Hd Draftsman 19/2/85

With Orders