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Madras Highways

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MADRAS HIGHWAYS

THE JOURNAL

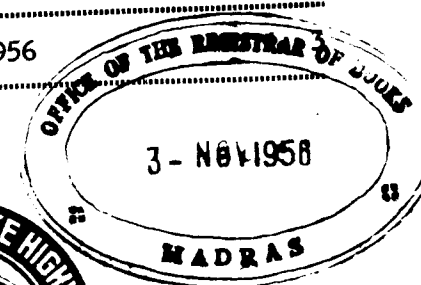
OF

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THE ASSOCIATION OF
MADRAS STATE HIGHWAY ENGINEERS

Vol. I

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1956—'57**

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THE JOURNAL**

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MADRAS STATE HIGHWAY ENGINEERS

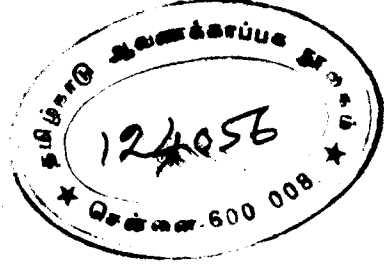
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*The Views expressed by the authors of the articles are purely their
individual Views and not those of association.*

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The 1st Annual Session at Madras (28-7-1956).

Ourselves

The annual session of Association which was eagerly awaited by our members, as it provided a happy get-together was held from 28th to 30th of July 1956 to produce and sustain *entente cordiale* among the members.

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As in the last year this time also the Session was held at the Institution of Engineers Building, Adams Road, Madras. The executive committee met on the morning of 28th and reviewed the work done during the year and the accounts. After the executive committee meeting, the general body met 82 members having attended. Our Patron Sri K. K. Nambiar, Chief Engineer (Highways) who always took a very lively interest in the shaping of our young Association was present throughout the meeting. The most interesting part of the general body meeting was, of course, the election of office bearers for the ensuing year. There was a lively competition amongst the younger members who had their own views as to who was most suitable amongst them to represent in the managing committee. Our hearty congratulation go to the members who have been elected to various offices. Our thanks are due to the office bearers of our Association who conducted the affairs during the year so successfully.

In the evening of 28th, the annual session was inaugurated by Sri O. V. Alagesan, Deputy Minister of Transport, Government of India. There was a big gathering and the hall of the Institution of Engineers building was packed to capacity. Many distinguished people were present and messages had been received

expressing success to the Association from many Ministers and other high ranking officials who could not find time to attend the function.

The function began with prayer. Our Secretary Sri K. Ramaswamy Reddy read the messages. The President of our Association Sri Kethara Mudaliar then spoke and gave a resume of the humble achievements of our young Association during the year and requested Sri O. V. Alagesan, Deputy Minister of Transport, Government of India to inaugurate the session.

The Deputy Minister inaugurating the Session expressed the hope that both the Centre and the States would wake up to the importance of road transport to supplement the chief transport system in the country namely the rail transport. He described the engineer as essentially a builder and expressed that the country turned to the engineers who alone could help in building the nation.

Our Patron, Sri K. K. Nambiar, Chief Engineer (Highways) during his address expressed that the road system had been considerably improved in Madras State under the First Five Year Plan. He also detailed some of the schemes under the Second plan.

On the morning of 29th Sri K. K. Nambiar, Chief Engineer (Highways) gave a talk on the implementing of local development works and National Extension Service Schemes and invited members to express their difficulties if any during their day to day work. Many senior members took part in the discussion, which proved very useful to others as well.

We had the technical discussion on the papers that had been published in our Association Journal 'Madras Highways' 84 members attended the paper meeting. The papers discussed were (i) Economy in the design of bridges (ii) Maintenance of Ghat Roads (iii) Metric System and its implications to Highway Engineer. Two of our elderly members Sri B. N. Shenoy, Retd. Superintending to Engineer and Sri P. A. Krishnaswamy, Retd. Tech. Asst. to the Chief Engineer (Highways) Madras; took part in the discussions and this particularly added greatly to the liveliness of the deliberations and we are grateful to them. There was a free exchange of opinions and our patron also took part in the discussions and evinced keen interest.

In the evening a visit has made to the soil stabilisation work under construction between Kelambakkam and Mahabalipuram. The visit was not only interesting but instructive.

We had a subscription dinner at night and this was largely attended. Sri O. V. Alagesan, Deputy Minister of Transport, Government of India, had kindly consented to be our chief guest.

Next day morning a visit had been arranged to the Integral Coach Factory. A good opportunity was provided for members to see, perhaps, the biggest coach building factory in the east. The authorities of Integral Coach Factory had made arrangements to take the members in batches and show them all the work that is being done in the factory. The visit was indeed a memorable one.

We are no doubt looking forward to the next session and we hope we can make it as interesting as the present one.

Presidential Address

BY

Sri T. S. KETHARA MUDALIAR,

Superintending Engineer, Highways, Coimbatore.

Honourable Sir, Ladies and Gentlemen,

As President of the Association of Madras State Highway Engineers, it is my pleasant duty and privilege to express our gratitude to you Sir, for having readily consented to inaugurate the session of the Madras State Highway Engineers Association amidst your multifarious duties and engagements especially at this period when important decisions are taken and details are being worked out for the States Reorganisation.

I extend the most cordial welcome to our distinguished guests, ladies and gentlemen who have so kindly and graciously responded to our invitation and spared time to attend the function. Verily an association like ours which is barely an year old, hopes to derive inspiration from and grow on from strength to strength at the interest which the officials and public take in its activities. Although technical details of our work may be a bit complicated and not easy for lay people to understand every member of the public can appreciate good planning and timely and good execution of roads and other structures connected with them. Surely contact like this enable us to gauge how far we have been able to provide amenities to the public in general, and road users in particular.

To the members of the executive committee and delegates who have assembled here I offer my hearty congratulations on their achievement during the first

year of the association. The achievement is however not spectacular, nor could it be so at the very inception of the association. But I am sure, taking into consideration the zeal with which you formed the association and your hard and intelligent work which you were displaying in forming the association, forming the memorandum of association and regulations and disseminating professional knowledge to brother members of the association through the very limited number of papers contributed during the year we will be able to place a better record, a real catalogue of achievements worthy of ourselves during next year. We have to therefore to pick up again the threads of our discussion from where we left and go ahead gathering and disseminating our professional knowledge and perfecting technics through which we hope to play an important roll in the nation's march to prosperity.

Our road system in Madras State was just beginning to take a definite shape and pattern at the end of the second decade, of the present century *i.e.* in the year 1920. The motor traffic was then in its infancy and travels from one part of the country to another were much limited in scope. Consequently the traffic flows on Highways were light and the loads carried were not considerable. Light pavements of 8 to 10 feet width were just catering to the needs of the travelling public. Almost all the roads except a few ghat roads and roads over canals and tank bunds were under the control of the respective District Boards. The cost of construction and maintenance of communications were essentially met from the resources of the local bodies concerned supplemented by a moiety of contribution in the form of grants doled out by the Government

towards the maintenance of the trunk roads and Second Class and marketing roads. These roads have been classified as National Highways, Provincial Highways or State Highways and Major District Roads at the momentous conference of the Chief Engineers held in Nagpur in 1943. The main sources of the revenue of the local bodies were derived from the road cess and collection of tolls.

During and after the World's Second Great War, there was considerable increase in traffic all over the country, warranting an accelerated pace in road development. There was no doubt considerable activity in respect of road development during the war, as a war measure, but this slackened off immediately the war was over and not much progress was made before the country launched on the first Five Year Plan.

Although the activity in respect of road development got slackened, the rate and volume of travel over roads did not diminish but on the other hand went on increasing day by day owing to various causes. In fact there is a cry for better and more roads everywhere. The District Boards with its inelastic resources and depletion of big slices of revenue owing to the abolition of tolls, found themselves helpless and unequal to cope up with the increased demand by the public on communications. It was at this juncture the Madras Government took the bold step of relieving the Local Bodies of their financial responsibilities of constructing and maintaining the main arteries of the communication and assumed full responsibility of the same in the year 1946. The Highways Department was constituted in the same year to co-ordinate and control the policy of

road development in the Madras State and the Government undertook direct responsibility of constructing and maintaining all important main lines of communications of the State excepting the National Highways outside urban areas which are financed entirely by the Government of India, while the less important major District Boards, other District Roads and Village Roads alone were left under the control of the Local Bodies. But all the same all works connected with the construction and maintenance works of all the roads in the State right from the National Highway to the Village roads are planned and executed by the Highways Department. The Highways Department is at present in sole charge of executing works on 1088 miles of National Highway 1665 miles of Provincial Highway, 9154 miles of Major District roads (Both Government and District Board) 5225 miles of other District Roads and 9252 miles of village roads. (*i.e.* as on 31-3-'55). In fine this department is managing the whole road system of Madras State excepting a small mileage of Municipal Roads and Streets. In this connection I have to mention that the Madras State, not only has the largest net work of all weather motorable roads maintained and operated to a high standard but also the largest mileage of all roads when compared with any other state in India. Unlike in other states where the Highway work is entrusted to the Irrigation and Building Engineers of the Public Works Department, it is in this state that a separate department is in charge of construction and maintenance of roads. Many responsible officials and non-officials who have toured throughout the length and breadth of the state have paid tributes to the Madras

State for possessing the largest number of motorable roads and largest miles of other roads in the state. This tribute may be taken as a testimony to show the Highways Department has justified its existence.

Yet it is rather disquieting and very discouraging to learn that in some quarters it is held that the Highway Engineering is a simple job which does not involve any skill and that the department can be manned by inferior calibre of Engineers and that the construction and maintenance works of roads are not comparable, to other kinds of Civil Engineering works such as Railways, Dams, and Harbours.

It is not for us to say whether this is a correct picture or not. We leave it to the general public and experts in road making to pass a true verdict.

Highway Engineering, as stated by our patron and the Chief Engineer (Highways) of the State in his address to the association of the Madras State Highway Engineers "is a vast and complex subject requiring specialisation as a separate branch of engineering, construction of roads and bridges to modern standard of efficiency to cope with the ever increasing traffic of the present time, calls for a high standard of equipment". If one were to go through the deliberations and decisions arrived at the various Committees of the Indian Road Congress he will be convinced about the vastness and complexity of the subject referred to above. In the face of the above factors to say that the roads can be built and maintained without proper technical supervision will be merely perpetuating the long standing prejudice against the road engineers.

Opinion is also held some quarters that communications is not an essential factor which requires immediate attention and that roads may be given very low priority.

The provision of comparatively meagre funds for roads in the various schemes and plans including the Five Year Plans will show that the roads are not considered so important for the development of the country as electricity, irrigation etc. Some are of the opinion that unlike electricity and irrigation departments, the Highways Department does not bring direct revenue to the Government. It may be that the out turn is not specified as an item in the estimate nor in the specification report. It is not also possible to specify the out turn likewise as the out turn from communication is indirect and all comprehensive and hence not easily susceptible of assessment. It will really rack the brain of a statistician if he were to compile and assess the value of out turn that good roads produce by way of saving petrol, tyres, spare parts, increased capacity of haulage and comparative deductions in the cost of freight and the last but not the least saving in time which is a precious factor in this atomic age.

Quick and easy communications between communities, states, and Nations is indisputably one of the greatest forces in modern civilization. This applies to the transformation of passengers, freight and the mails. The public roads obviously constitute that part of the transformation system which comes closest to all the people in the daily life both in the town and in the country abroad. The country people are entirely dependent on the road to connect them up with all the

rest of the world. Hence if we wish the benefits of modern progress and civilization to be enjoyed by all, and to increase the standard of living both in the town and in the country we must provide good roads.

I may be permitted to quote from the transport communications monthly review of March 1955 the benefits of good roads.

1. Good roads decrease the cost of hauling everything.
2. Good roads save the "bad road tax".
3. Good roads allow a wider choice of market for farm products, and for purchasing supplies.
4. Good roads permit choice of time for marketing products, so as to get the best price.
5. Good road building furnishes a useful and profitable market for large quantities of material that would otherwise be without value.
6. Good roads allow the hauling to be done when other work is impossible.
7. Good roads allow greater production with a given number of men and teams.
8. Good roads increase the area which may be devoted to raising high-proceed commodities.
9. Good roads permit and encourage diversification in crops.
10. Good roads tend to equalize the business on the rail-roads and in the towns, and thus keep market prices stable, and business conditions more uniform.

11. Good roads assist co-operative buying and selling.

12. Good roads permit the use of better stock and better vehicles.

13. Good roads increase the value of land everywhere.

14. Good roads induce tourist travel in all parts of the country.

15. Good roads invite more people and more investments in every line of development.

16. Good roads tend to increase the rural population.

17. Good roads conserve the farmer's energy, both mental and physical, and give him greater initiative to conceive and execute plans for development.

18. Good roads make possible the rural mail delivery.

19. Good roads promote good schools in the country and make the town schools more accessible to the country children.

20. Good roads promote better living conditions in the country.

21. Good roads improve the social conditions in the country.

22. Good roads make possible the work of the "social centres" and other similar movements.

23. Good roads tend to unify the population by taking the town people to the country and the country people to town.

24. Good roads make for a broader outlook and a better citizenship in every phase of life.

It may therefore be seen from the above that a country which is lacking behind in the matter of good road system is bound to lack behind in all other matters of progress and advancement. We therefore wish that a right place of priority is assigned to the Department and adequate funds provided for to come up with the demand of the public for better and more roads, and to enable the Road development works to keep pace with the other plans for the Nation's progress.

Though the Highways Department of the Madras State came into being in 1946 the department had no association of its own to get together to discuss their problems. No doubt the members of the department had been taking active part in the annual meetings of the Indian Road Congress and in the Institute of Engineers. But such opportunities came only to a few members of the department and a good number of members were denied the opportunity to participate in such great organisations and to benefit by personal contact and discussion from Engineers all over India. The need for a separate departmental association for Highway Engineers of this State was a long felt want and this association was inaugurated during January '55 by Honourable Minister for Public Works of the Madras State. An association of this kind has much to offer particularly to younger section. It provides an opportunity for young men to mingle with the other and

older members of the profession and to learn from them all about perfecting technical knowledge and its applicability in practice.

As mentioned elsewhere above the achievement of the association during the year is not as much as anticipated. I am sure in the coming years the association will be holding a successful conferences in which interesting technical papers will be read and discussed.

We have just emerged from the first five year plan at the threshold of the Second Five Year Plan. During the first five year plan we were caught in the mid stream and it was with great difficulty we were able to steer ahead and reached the destination with great strain and turmoil but as far as the Second Five Year Plan is concerned we have started taking it seriously far ahead off the plan period itself. Every one of us had a little part to play in the preparation of the plan which is almost nearing finalisation. Our patron and Chief Engineer of the Madras State has already stressed at the inauguration of the association during January '55 that "it should be our aim not merely to achieve physical targets fixed in the plan but also to make further headway so as to mesh to gear with the accelerated tempo expected of us". In the Second Five Year Plan the volume of work contemplated is far above the one provided for in the first five year plan. During the first Five Year Plan only a sum of Rs. 5 crores was allotted for the then composite Madras State. In the Second Five Year Plan the target of expenditure for the works alone excluding the provision of .95 crores made for tools and plant will be Rs. 7.12 crores for the residuary Madras State alone. But in order to maintain the tempo in the pace of Development and to provide

continuity in execution and mesh into gear of the target for the successive years of the Second Five Year Plan works to the tune of Rs. 14.33 crores for the entire State, will be taken up against the targetted expenditure of about 8 crores of rupees. In order to achieve the targets for each year of the Second Five Year Plan period every one of us will have to throw full weight of our technical skill, experience, ability and endurance to do hard work at all times overcoming whatever impediment that come in the way. The Government and the public are relying on the capacity intelligence and integrity of the Officers to achieve their targets in the plan period. They also expect us to co-operate with the public to as large a measure as possible in implementing the Second Five Year Plan. Hence we should feel it our sacred duty to draw out our very best, sparing no pains to rise equal to the occasion.

It is no doubt true that we are handicapped in many ways and that we are not able to keep up our programme as targetted. We are short of technical hands and securing necessary quantities of controlled articles such as iron and cement has become a problem. But then other departments have also got similar problems and similar shortage of personnel. We have therefore to be up and doing, overcoming all difficulties and resolving all Bottle necks and successfully execute all works entrusted to us with speed and alacrity so as to achieve the targets for each year of the plan period.

Such hard work is not a new thing to us. In addition to our departmental work we may be called upon to offer our services to other nation building schemes with particular reference to communications such as works coming under Community Projects,

National Extension Service and Local Development Works. It may be stated with pardonable pride that the services of the members of this department alone are requisitioned for executing village development works. Almost all the Collectors have stated in unambiguous language that but for the hard work and hearty co-operation of the Highway Divisional Engineers and their subordinates they would not have so successfully carried out the works in the first five year plan. Here I have to caution the members of this department that this is not time to feel elated and must content with such tributes from the District Officials but we should girdle up our loins, be prepared for more arduous sustained and hard work during the Second Five Year Plan period.

In the execution of the village development works the members of the department come into contact and co-operate with several local authorities non-officials and the general public. Your experience in the first five year plan should stand in good stead in implementing the Second Five Year Plan. You should have gained experience in working with the several local authorities and should have been struck by the different reactions of the various committees to the officials; you should also have noticed that the different reactions do not always depend upon the measure of confidence the officials have warranted. Some of them regard the officials as employees to carry out their instructions whether they may be good or bad. Of course the more enlightened authorities and members of committees will look upon the officials as their advisers, welcome their criticisms and advice and having reached a decision thereon will leave the officials to execute the works

without interfering with the designs and construction of the works and matters of normal day to day administration. We should have therefore courage of our convictions and rise to the occasion. As a piece of advice, I would enjoin you all to make your reports in writing briefly discriminating between policy and technical advice. In the matter of policy you can of course offer different points of view which occur to you, but in matter of technical advice, you should be firm and decisive.

We, road engineers should indeed be very happy at the increased tempo of road development; but we have to be prepared to shoulder much greater responsibilities and put in much harder work than ever before. In order to successfully implement our big plans we require not only expert knowledge but also have to cultivate many other intellectual and moral qualities such as integrity, courage, independence of thought, and sound judgment.

I thank you honourable Sir Ladies and Gentlemen and brother members of the Association for the patient hearing. I request you honourable Sir, to inaugurate this annual session of the Association of the Madras State Highway Engineers.

We are deeply indebted to the Secretary of the Institute of Engineers who has been kind enough to place their buildings at our disposal for conducting the present sessions.

‘JAI HIND’.

Reply to the Address

BY

Sri O. V. ALAGESAN

Inaugurating the annual session of the Association of Madras State Highway Engineers



Sri O. V. Alagesan

Mr. O. V. Alagesan, Union Deputy Minister for Transport, expressed the hope that both the Centre and the States would wake up to the importance of road transport to supplement the chief transport system in the country, namely, the rail transport. He said that while the budget for

National Highways was something like Rs. 55 crores in the Second Plan period, “perhaps we will be asked to sanction more than that amount” and added that the works might go upto even Rs. 80 or Rs. 85 crores.

Mr. Alagesan said that there was no need for Engineers of the Highways Department to have any inferiority complex when compared to their brother

Engineers in other fields. He had no doubt, that by their steady work, they would dispel any such erroneous notion at no distant date.

Describing the engineer as essentially a builder, Mr. Alagesan said that the country which had been stagnant both in mind and limbs for several centuries had, at the dawn of freedom, woke up and there was great activity and naturally they turned to the engineers who alone could help in building the nation. He said that Madras could very well be proud of having started this Highways Department ten years ago. This State also enjoyed pride of place in the total length of motorable roads. But in spite of the achievements he found that they in Madras were a little timid. This again added a little grace to their personality. While saying that the Madras engineer had thus earned a name, Mr. Alagesan said that lately he noticed the Madras engineer who was proverbial for his thrift was taking leave of it and his estimates which used to be simple now amounted to lakhs.

ROAD CONSTRUCTION

Mr. Alagesan said that as far as road construction went, the target in the First Five-Year Plan had been fully accomplished and perhaps exceeded a little. He had no doubt that they would put forth their best efforts and accomplish the target set in the Second Five-Year Plan also.

The Budget for National Highways, Mr. Alagesan said, was something like Rs. 55 crores. Perhaps, the Government would be asked to sanction more than that

amount for works which might go up to even Rs. 80 or Rs. 85 crores. Not only with regard to National Highways but with regard to other roads also, the State Government he said, should have budgeted for a much larger expenditure in the Second Five-Year Plan than in the First. This was important at the present moment when they were struggling to find enough transport to meet the needs of the Second Five-Year Plan. They were told that rail transport would not be able to meet the situation fully, unless more funds were forthcoming. And so roads had become more important in the context and he hoped that both the Centre and the States would wake up to the importance of roads to supplement the chief transport system in the country, namely, the railways. They had to be more and more liberal in the grant of permit for both passenger vehicles and goods vehicles on roads. It was no use making good roads and allow them to be used only by bullock carts.

If they had to get a full return for the capital invested on good roads, Mr. Alagesan said, it was very necessary that they should put enough vehicular traffic on the roads. Thereby, they would be comforted by the feeling that they were supplementing rail transport. "I have been feeling", he added, "that road transport has to play a more increasing role in supplementing the transport requirements of the country if the Second Five-Year Plan is to be a success. He would therefore ask them to consume the moneys placed at their disposal at as quick a pace as possible. If perhaps it was possible to spend all the money ear-marked to be spent in the five years within three or three and a half years, it would be a good thing. Those in charge of the

affairs of the country might be forced somehow to find more sources to stretch the Plan a little further. There were those who raised fears and alarms about the gaps to be filled, but he for one felt that they need not be alarmed. If the millions of people in the country could supplement the Plan with real effort in money and in manual labour, the target set in the Plan could easily be exceeded.

Expressing satisfaction at the record of achievements made already, Mr. Alagesan said that perhaps no Government had a more impressive record to show in the impressionable years of a renaissance country than our Government. But still as a growing country desiring to hold its place in the comity of nations its people had to work hard.

Address

BY

Sri K. K. NAMBIAR

B.E., M.I.E. (Ind.), F. Inst. H.E. (Eng.), M.I. Mun. E. (Eng.), M.Am. Soc., C.E.,

Chief Engineer (Highways), Madras

It is now a year since the Association of the Madras State Highway Engineers was inaugurated. When I addressed you last year, I discussed the need for a separate organisation like this notwithstanding the existence of other Forums like the Institution of Engineers and the Indian Roads Congress, where technical problems relating to Highways Department could also be discussed. Whether a separate institution is necessary for Highway Engineers, seems to agitate the minds of other persons also. It was only recently that the Chief Minister of the Andhra State, Sri B. Gopala Reddi, who was reported to have remarked that this different institutions and associations of the P. W. D., Highways, Electricity etc., could all be combined into one association. But in these days of specialisation in technical subjects, I feel it is certainly worthwhile to have separate technical associations for different departments to deal with specialised problems of their own. This is amply justified by the record of the work of our association for the past one year. If one goes through the issues of the journal of our association published during this one year period, one cannot fail to be impressed by the useful work being done by the association. Very interesting and illuminating papers have been contributed by some of the members. To

mention only a few, papers have been contributed on Traffic Engineering and traffic control devices which deal with the problems of building safety into our roads, on soil stabilisation, on economical design of bridges and culverts, on prestressed concrete work, construction and maintenance of ghat roads, etc., etc. These papers certainly reflect credit to our association. I have therefore no hesitation to say that this association has justified its separate existence during this short period of one year. It seems to me appropriate on this occasion that marks the first anniversary of our association to take stock of what has been accomplished by the members of the association. In effect it would mean reviewing the work of this department in general during the one year that has elapsed since the inauguration of this association.

The event of the greatest importance is of course the closure of the first Five Year Plan and the ushering in of the Second Plan. We have every reason to be happy for the work turned out during the period of the first Five Year Plan. I need not bother you by going into the details of the physical targets and achievements of the first Five Year Plan. It would suffice if I say, the achievements of the Highways Department during this period are by no means small or insignificant. Our road system has been considerably improved during this period.

Since 1946 about 3,600 miles of new roads have been formed to give access to villages which lay isolated. 2,140 miles of water bound macadam roads have been converted into dustless roads by provision of black top surfacing including reaches executed under maintenance

grant. Practically the entire mileage of National Highways in the State have been provided with at least single lane carriageway of black top surfacing. In certain heavily trafficked stretches, dual carriageways of 22' have been provided with improved surfacing. Several large and small bridges and causeways have been constructed to provide all-weather crossing across rivers which intersected our communication system. In addition, this department has played an important part in the execution of various development works under the Community Project, National Extension and Local Development Schemes all over the State.

When I recount these accomplishments of ours during the first Five Year Plan period, let me not convey to you the idea that we have done enough and that we could rest on our oars for some time to come. It is far from the real state of affairs. There is no room whatsoever for complacency. The second Five Year Plan as you will know, envisages for more ambitious targets. Unless we gird up our loins and put our shoulders unhesitatingly to the task before us, it will not be possible for us to fulfil these targets. Whereas we cement concreted 25 miles of roads during the first Plan, we have during the next five years to provide cement concrete surfacing to 86 miles. Similarly as against 76 miles of black top done during the first Plan excluding reaches done under maintenance, the targets for the second Plan is 740 miles. With regard to construction of new roads, we accomplished 1,388 miles during the first Plan period. The second Plan expects us to form 2,300 miles of new roads. Even during the first year of the second Plan, we have to incur expenditure

on original works to the tune of Rs. 45 lakhs on Government roads. For District Board works there is a provision of Rs. 41.40 lakhs under Grant in aid in the budget for 1956-'57. The works to be executed consist of provision of improved surfacing such as cement concrete, black top etc., to roads; construction of new village roads; construction of bridges, culverts etc. There are very many bottlenecks to be overcome before such works could be completed. Without acquisition of lands, new road formation will not be possible. The bridges, causeways, culverts etc., require controlled materials such as steel and cement which are in short supply. Unless the requirements of these materials are foreseen in advance and adequate arrangements are made to procure and supply these materials in time, the progress of our works will be badly hampered. All these need careful planning and programming in advance.

I need not tell you that Government attach very great importance to the execution of works contemplated in the second Five-Year Plan and no excuse whatsoever will be accepted for failure to achieve the targets fixed from year to year for execution of the Plan. Several periodical returns, conferences, and committees are arranged with a view to ensure the speedy execution of these works by personal discussions with regard to bottlenecks in the execution of the Plan. Let me urge you therefore to phase the programme for the execution of these works on a well thought out plan and to see that the programme is adhered to. The periodical returns called for should be submitted on due dates by all the officers concerned so as to enable the Chief Engineer to compile and submit returns to Government

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on due dates. Stereotype replies that the reference is pending with some one else, or that the reports are awaited from subordinate officers are of no use. The Government and the general public expect the department to push through the schemes as quickly and efficiently as possible. It is poor consolation to a villager to be told that the construction of the much-longed-for village road or the bridge across the interrupting river is awaiting acquisition of land or supply of materials or preparation of estimate by certain officials. What he looks for is the completed road or the bridge to have an easy access to the nearby market or town to convey his produce or to send his children to school or to have medical assistance immediately when required. Therefore our object should be to get things done as quickly as possible without parading our problems and difficulties before the general public. With this end in view everyone of us must realise and share his part of the responsibility as a cog in the wheel of the administrative machinery and pull together so as "to deliver the goods" in business parlance.

Please do not feel embarrassed that I am taking undue advantage of this opportunity in your annual celebrations to harangue you on the work of this department. Even if it be so, it will not be out of place; for I cannot think of a more laudable objective for a service association like this than to equip its members to better discharge their duties and obligations. I therefore trust that this advice will be taken by all of you in the spirit in which it is tendered.

Construction and maintenance of roads and bridges is the main task of the officers of this department.

The importance of road communications in the economy of the people need not be stressed to an audience like this. Yet it is at times disheartening to see that the importance of road communications is not fully realised in certain quarters. Other constructive schemes which produce tangible returns immediately carry off the palm in the priority of planning. Look, for example at the provision made in the second Five-Year Plan for roads. Out of a total of Rs. 4,800 crores, an amount of Rs. 246 crores has been provided for roads. This is only 5.1% of the total provision as against 5.5% provided in the first Five-Year Plan. It is difficult to understand the reason for this downward trend in the provision for roads in the second Five-Year Plan. While the second Plan envisages rapid industrialisation of the country by starting numerous industries large and small, and also looks forward to a sizable increase in the national income, so as to raise the standard of living in the country, unless the communication system is also geared up to match these developments, the results cannot be expected to be satisfactory. Take the case of transport of a material like cement, for example. It is stated that millions of tons of cement will have to be imported from foreign countries to make up the deficit in production of cement in India, if our schemes in the second Five-Year Plan are all to be executed in time. Such stupendous quantities of cement imported at our major ports have to be carried by rail or road to their destinations if the imports are to be used. The additional strain on the communication system is bound to be considerable. Are we not expected to increase the capacity of the road and rail communication before such extra load could be thrown on them?

Similarly the construction of large irrigation and power projects involves transport of heavy machinery and large quantities of materials along the roads in the vicinity. We have had a number of requests in recent years regarding problems of transporting indivisible units of machinery weighing 50 tons and more along some of the roads leading to project areas in the State. The bridges and culverts which were designed for very much lighter loads years ago cannot with safety permit the movement of such heavy loads and have therefore to be reconstructed or strengthened. Similarly the starting of a large factory will induce heavier traffic on the approach roads by way of more raw materials having to be transported to the factory and also the finished products from the factory having to be taken to the nearest railway station or Port. The provision of the approach roads to proper standard is as important as the construction of the factory itself; for the approach road is only the continuation of the assembly line technique adopted inside the factory.

In other words it has to be conceded that improvement to the road communications should precede other form of development if good and economic results are to be looked for. It is only people who cannot see beyond their noses that will underrate the priority of road among the nation building activities.

Let me take this opportunity to refer to another matter of importance with regard to the construction and maintenance of roads. Provision of improved surfacing to roads is going on at a fast pace in our State attracting greater speed on the roads. At the same time, it has to be regretfully stated that sufficient

attention is not being paid to improvements to the geometric standards. Whereas on an indifferent dusty water-bound macadam surface, motorists were content to travel at 30 miles per hour, a smooth and dustless black top or cement concrete surface invites them to step on the throttle to maintain speeds of 50 miles per hour and more. The bumpy culverts, narrow corners and sharp curves with inadequate or no super-elevation which did not present serious discomfort at 30 miles per hour cannot cater to this high speed of 50 or 60 miles per hour, without creating traffic hazards. Hence, I would reiterate to you on this occasion the imperative need for adequately stepping up the geometric standards to be in conformity with the higher speeds to be anticipated whenever improvement to the surface of a road is undertaken. Steps should simultaneously be taken to improve curvature, to provide adequate super-elevation and extra width in curves, as also reduce the bumps over culverts, and regrade the dips by provision of suitable vertical curves. Visibility around corners and across ridges should also be not lost sight of.

As funds will not permit us to have two-lane carriageway on all our roads in the immediate future, we have to adapt the single lane road to serve the best interest of the traffic for some time to come. Stabilisation of berms to provide for safe and easy overtaking and passing of vehicles should receive important consideration. The time old practice of dumping earth or gravel on the berms will not be of any lasting benefit. Very often it is blown away by winds or dissipated by traffic in a few months' time. On the other hand, if the berms are strengthened with the metal, it would provide

extra width for overtaking and passing under all weather conditions. Besides, it would in the long run serve as a base for increasing the carriageway.

It is a general complaint now-a-days that great difficulty is experienced by motorists during nights owing to truck drivers sticking to the centre of the single lane carriageway of the road with dazzling head lights. Their reluctance to leave the middle of the carriageway and take to the berms can easily be understood. The motorist, to avoid the head-on collision has to swerve to the margin and wait till the truck passes him. Unless the margins are of stable construction and free from slush, potholes and gullies, it is risky for the motorists to swerve and take refuge on the berms on such occasions.

The problem of dealing with such dazzling head lights of truck and stage carriages is engaging the active consideration of our Government. It is seen that the Andhra Government have already issued amendments to the traffic rules requiring buses and lorries to slow down when approaching motor vehicles coming in the opposite direction. A person driving a goods vehicle has actually to stop the vehicle when he is within a distance of 50 yards from a motor car coming in the opposite direction and shall not resume motion till the other vehicle has completely passed it. It is hoped that similar, if not more effective, regulations will be passed by the Madras Government also. I am only referring to this instance in passing, to emphasise the need for maintaining the berms in good riding condition.

Another notable event during the past one year is the damage caused to our roads by the cyclone and floods in December last. You, Officers of the Highways Department did rise up to the occasion and spared no pains to repair the cyclone and flood damages as quickly, economically and efficiently as possible and to restore communications on all roads. The part played by this department in this restoration work has been commended favourably both by the Government and by the general public alike.

I should also make a reference to that auspicious function of laying the foundation stone of the Highways Research Station by the Governor of Madras. That occasion was of great significance to this department, as the Research Station and its allied activities will have an important bearing on the efficiency of the work of this department in years to come. I trust that the building will be completed and equipped soon to enable the Research in various branches of Highway Engineering and bridge construction to be carried out resulting in economy in construction and maintenance of roads and bridges in this State.

The introduction of the Highway Manual from 1st April of this year is also a landmark of great importance in the annals of the Highways Department. No other State in India has been able to complete a manual of this type to regulate and guide the officers engaged in construction and maintenance of roads and bridges. Its publication has been received very favourably by the members of this profession all over India and has been reviewed well by engineering journals. There have

been demands from very many engineers of other States for copies of the manual which testify to its usefulness. Its companion volumes 2 and 3 are in the offing. When these, with the fund of information which they contain as well as the type designs of bridges and culverts incorporated therein, are also made available to the engineers of this department, they will serve us valuable reference books to guide them effectively in the discharge of their day-to-day duties.

Now a word about the Community Development and the National Extension works. The one year that has elapsed since this association was inaugurated has witnessed a considerable increase in the tempo of Community Development works and the National Extension Service. Many more blocks have been added to those already in operation. The technical staff employed for the execution of these works has also been augmented by the creation of several additional posts. You have been rightly chosen for carrying out these development works for the welfare of the people. It is not by any accident that the Officers of the Highways Department happened to be chosen to execute the works of this constructive programme. By your all round experience in the past, your association with the local bodies and your ability to move with the masses and their chosen representatives, you are well suited to arrange for the execution of these development works in which peoples' participation should also form an integral part. When these development programmes are extended from year to year, covering larger areas so as to cover the whole State by the close of the second Five Year Plan, you would have done a great deal of useful work to ameliorate the living conditions of the

people of this State. That in itself should be a great objective to be aimed at and to work for with pride and enthusiasm, for there is no greater reward for our work than the satisfaction that we have been of some service to the people.

I am afraid I have taken a good deal of your time. I cannot better close this address than by commending for your adoption, the famous motto of the Rotarians "Service before self".

Highway Maintenance Practice

BY

Sri P. A. KRISHNASWAMI

1. INTRODUCTORY

1. 1. Maintenance is the act of 'maintaining' or 'keeping up' or 'preserving from deterioration'. Highway maintenance therefore consists in preserving a public road from deterioration or keeping it up in the same condition or very nearly the same condition as it was when it was newly built. It should be remembered that maintenance starts on the very day a new highway comes into use, and it is a common mistake to think that it can be forgotten because the road is new or the surface is of superior design.

1. 2. The evolution of highway maintenance practice is the outcome of changed traffic conditions necessitated by a desire for greater progress and quicker and easier travel. Traffic and weather conditions are the most powerful in causing damage to the road, which has to be made good. Design and construction are comparatively easy as they are designed to meet certain specific conditions, whereas maintenance will be difficult since in actual use the highway is not always subjected to such traffic conditions alone, both in their intensity and co-existence. Hence maintenance calls for greater vigilance, promptness, and skill than in the case of new construction. Greater and closer personal supervision and proper training of labour force employed in maintenance thus assume importance. These difficult tasks will be rendered easy by keeping in touch with modern trends and results of latest researches, cultivating

sincerity in work and a legitimate pride in the resulting good. The personal factor of the officer charged with maintenance thus comes into play and has an immense effect.

1. 3. In days by gone (1918-1920 say) when motor vehicles on the road were few (practically only the district officials owned cars then) road maintenance problem was not difficult since the country carts could negotiate even badly maintained roads and there were no complaints also from any quarters! Even officials used mostly push cycles, bullock carts or horse carriages for their tours. One district collector once remarked that the roads were quite good for cycling and he did not see the necessity for extra grants. Maintenance was not a problem in those days to the extent it is now. It seems to have been considered that better surfaced roads were not essential to be formed or maintained under those conditions. Further it seems to have been considered not necessary in times prior to 1917 to employ even technically qualified persons to look after road maintenance. There were very few power rollers available with most Road Authorities then, for use on metalling works. Mostly soft broken stone metal from local quarries was in use for the water-bound macadam surfacings. The result was the formation of pot holes and weak spots. The maximum speed of motor vehicles then was between 12 and 20 miles per hour, and so these defects did not matter much. The necessity for higher types of surfacing than water-bound macadam was not keenly felt.

1. 4. After 1920 with the advent of self-government at the State (then Province) level and coming into use of more motor vehicles, and with the

development of closer contacts between the public and their elected representatives in government and local bodies, road maintenance practice began to improve and continued to cater for the increased traffic and speed. Thus as the pattern of traffic changed, methods of maintenance also changed to suit. The extent of such change however depended on several factors including finance and method of administration. Most of the roads including the Trunk, the District, and the Village roads were in charge of Local Bodies whose financial condition was not good owing to the sources of income being in-elastic, and to the expansion needed in the matter of Education, Medical Aid and Public Health. There was thus very little scope for improving highway maintenance until this expansion of educational and health services in turn became responsible for increase in traffic and the realisation of the need for more and better surfaced roads. There was also a large demand for improving the existing cart tracks to the larger villages. By this time fast traffic continued to be more in evidence both in their number and speed. Better types of surface then came into existence to meet this condition, and with change in type came change in their maintenance methods.

1. 5. Present day conditions as all know demand more and better attention to roads and this is impossible unless better materials are used and better technique adopted. This needs to a high degree both technical and scientific skill on the part of officers. Traffic conditions are however so varying, especially the combination of motor and non-motor traffic, that there can be no set solution to cover all cases, though fundamentals remain the same. Experience of prevailing

traffic and a scientific knowledge of materials and the effects of weather and traffic in each case are quite essential for success in these days. Selection of the right type of materials and adoption of proper technique in construction and maintenance are both necessary. Besides experience (which can only help us to a small extent) highway research has come to our help in finding for us the right type of material and technique. Highway Research has thus become an important adjunct to road construction and maintenance. Money spent on it will be repaid in the shape of construction and maintenance saving that will accrue.

1. 6. Upto 1924 officers were mostly confined to works in one district. This denied to them opportunities for acquiring varied experience possible by periodical transfers to other districts where conditions of soil, traffic and climate differed. There was no chance for gaining wider experience except by exchange of ideas and experience at the annual meetings of the Local Municipal Engineers' Association which was formed in 1917, by study of articles in the Association Journals or perusing foreign journals. This last no doubt had the disadvantage of not fitting in with our conditions. Want of equipment and machinery for special works like asphalt surfacings or concrete roads was an influencing factor till about 1930. There was no central pool of tools and plant to draw from, except the P. W. D. Workshops or the Asphalt dealers like Burmah Shell or the Standard Vacuum Oil Co., who were good enough to help the Local Bodies with their plant. Fast traffic conditions demand prompt attention and time factor has, therefore, always been important. Delayed maintenance will cost several times more than

that executed in time, besides its attendant worry and annoyance to all concerned. Sometimes manual labour may not suffice to meet the demands of time. Recourse must then be had to machinery. Lack of machinery meant naturally delayed work and extra expense. This emphasises the need for equipment and machinery. The lack of these or otherwise to some extent affected highway practice in the districts in former times. To meet these conditions the Administrations pursued a policy of acquiring to a limited extent the necessary major Tools and Plant for their improvement and maintenance works so as to be independent of outside help.

1. 7. With the provincialisation of the L. F. Assistant Engineers' Service in 1938 their experience and services became more useful and this was helpful in various ways. Finally with the formation of the Madras Highways Department in 1946 the needs of all administrations in charge of roads came to be catered for, especially in the matter of equipment and machinery and technical aid. Attempts are now afoot to ensure proper and timely non-lapsing grants for works, and better financial conditions may prevail hereafter conducing to greater economy and surer work.

1. 8. With this back ground of information it may be possible to easily understand the progress in highway maintenance from 1918 till the formation of the Highways Department. Another important factor to be remembered is that the jurisdiction of officers was much larger than at present and the members of the service had not undergone any special highway course. Although this did not matter much yet it had its own

effect in the matter of supervision and tackling problems on the spot. At present, however, a number of officers in the department had been also on foreign tours and seen for themselves the developments taking place in those countries. With this knowledge they are in a better position to make further advances in the matter of providing better highway services. If the past practices in road work in the State be examined in the light of the above facts it will reveal to what extent the past engineers were handicapped in dealing with the situation, and how by their hardwork and courage and experience they were able to succeed in their efforts.

2. SCOPE

2. 1. This article is the outcome of a request of one of the office bearers of the Association to contribute to the journal of the Association, and is based on the writer's experience in active road work for 22 years and in road administration for 8 years, besides his contact with other engineers in charge of road works in the State during the same period. As the writer's personal experience on works relate only to two districts some of the views expressed herein may not be fully representative of the practices employed in some or many of the other districts. To that extent the article may be considered deficient and purely of local interest. While making general remarks or drawing conclusions care is taken to give reference to the former L. & M. Engineers' Journals wherein such general views or conclusions had been given vent to. In the absence of such references the views may be taken for what they are worth, and as the writer's reverie on his past work.

3. HIGHWAY COMPONENTS REQUIRING MAINTENANCE

3. 1. Highway Maintenance generally consists of attention not only to the surfaced portion of the carriageway but also to the berms and shoulders, the road embankment (if any) and its slopes and margins, and the side drains (and catch drains in hilly areas), and attention to the culverts, bridges and other masonry works like Irish dams (or causeways), retaining walls in high banks etc. Attention is also needed to road appurtenances such as avenues, mile and furlong stones, warning and direction signs, fences or demarcation stones marking the road boundary, metal loading and stacking platforms, wells or earthen pits dug at roadside for storage of water for road works and so on.

3. 2. As already indicated highway maintenance has been demanding the use of tools and plant, minor and major, side by side with manual labour. The maintenance of these in a serviceable condition is therefore also an important part of highway maintenance, and should not be forgotten.

3. 3. Each one of the items has a specific period in the year when climatic and other conditions are most favourable for its execution, which, if so timed bestows the maximum benefit. Climatic conditions therefore play a vital part in highway maintenance. Continuous rain has the effect of softening the road sub-structure and diminishing or destroying its supporting power, depending on the extent of drainage facilities provided in the road bed and surfacing. Continuous drought has the effect of depleting the moisture content of the soil and of the water-bound macadam surfacing to such an extent as to cause both to disintegrate and crumble

under traffic. Another point for consideration used to be the frequency of road maintenance works, and this depended on the intensity of traffic, climate, and physical characteristics of the country traversed by the highway. Thus frequent attention would be necessary in hilly areas rolling country, in the case of steep gradients, and in very heavy rainfall areas. But the frequency and extent of maintenance repair had to be varied depending on finance that was available rather than the actual needs at times. But now with the use of machinery seasonal work is not so important.

4. DRAINAGE

4. 1. Want of drainage is the severest factor causing rapid deterioration of roads with permeable surface. In the past, surface drainage had been provided for, while the sub-soil drainage does not appear to have received much attention. Surface drainage was taken care of by the provision of cambered carriageway, side drains and catch drains. whereas, under-drainage was not specifically provided for except to the extent that the side drains aided in lowering capillary rise of moisture in road beds. This problem was therefore serious in situations where road bed moisture reached a critical percentage, resulting in frequent formation of pot holes and ruts, and sometimes in impassable road conditions.

4. 2. The usual method practised for maintaining surface drainage was to have all the side drains cleared in advance of the monsoons, and sometimes during the monsoon itself and prevent water stagnation on road by preserving camber. The difficulty in the early days, when gang coolies were not employed, was to get

sufficient labour just prior to monsoon, most of the labour force being drawn from the village agricultural workers. But attempts were made to train the village labour on road works with success. Still these men will not care for the road works until their field work was over. It was not possible to have gangs on monthly wages on most roads owing to want of funds. In the words* of late (R. B.) K. Krishnan Nair (a pioneer of those times) "the mile cooly system if well worked is good but costly But I was never keen on the system as the abuses will creep in slowly" Apart from the fear of abuse, funds allotted to roads were insufficient. The road camber for effecting surface drainage received attention either by patching up holes or periodical renewals but not to the extent desirable owing again to want of funds to replace were as and

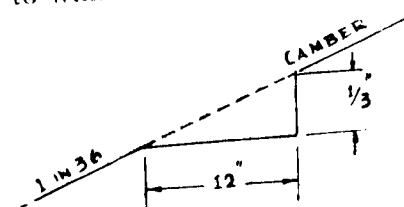


FIG. 1

when it occurred. The depth of ruts and holes at which, during their formation, repairs are necessary to effect drainage is a function of the slope of the camber and the width of rut or hole. Thus in a 1 in 36 cambered road ruts 12 inches wide should be repaired when their depth reaches $\frac{1}{3}$ inch (*vide* fig. 1). Otherwise they will hold up water which will soak into the surface and soften the soil. Although the berms were not attended to throughout the entire length of a road, this received attention in the reaches where the surface was renewed.

**Vide* The L. & M. Engineers' Journal, Dec. 1921.

The importance of keeping the berms trim and to proper slope to drain off water falling on the carriage-way was gradually impressed on the coolies and subordinates by increasing the estimate provisions and enforcing earthwork. In the early stages metalling was the only work receiving attention. It was also an item which was paying to the contractors. Templates were reluctantly used or not used at all and eye judgment was relied upon. But in course of time use of templates not only for the surface but for the berms as well was insisted upon and the men began to get accustomed to its use. It has been the experience that surface gets deteriorated once the drainage is neglected. A suitable camber not only keeps the surface from ruts and holes but also the berms free from gullies and erosions. These develop where the camber of the berms or/and the surface is excessive. What should be the camber is usually a matter which not possible of quick solution. It is however ascertained in this way. In a locality a stretch of road that is keeping up well is selected and the camber actually existing is measured. That will suit similar localities for similar material. This worked very well in practice. Further, by gradually instituting timely patch work the necessity for providing for metalling to the same extent as before had vanished and the saving thus effected was utilised for berm and other earthwork on the reach. At the present it may be possible to use a caterpillar tractor with grader and back sloper for these works without having to depend on labour when labour is scarce and thus ensure timely work and avoid unnecessary expense due to delayed maintenance which would otherwise result. It was also found that in many cases the earth cleared from the side drains was not all usefully employed even when

the soil was good. It used to be also thrown in such a way that it used to be washed into the drain again after a rain. It was insisted that the spoil, if of good earth, must be used for either widening the berms or strengthening the approaches to culvert in the near vicinity or for closing small erosions in the margins. When it was sandy or silty it was got thrown as a ridge at the extreme road limit or used as a filling for avenue pits.

4. 3. All this was possible on main roads. But the village roads could not be given any attention at all, firstly because the fund available was quite insufficient for even levelling the ruts formed by traffic. These roads were first administered by the Taluk Boards which had a large number of such roads to be maintained on paper but could not spare enough funds for the purpose. So they were maintained in a somewhat passable condition for carts, which did not demand a high level of maintenance. This was the case in the later twenties and early thirties. But soon cars began to filter into villages with the result that better attention was called for. Then the unimportant village tracks were eliminated from the list of maintenance and so more allotments came to be available for those left in the list. It was at this stage that culvert constructions and surfacing for village roads started.

4. 4. The most troublesome reach used to be that with heavy or high embankments. Water flowing down the slopes had to be diverted along troughs provided in the slopes, and the slopes turfed or revetted. Even the slopes needed for the banks were not rationally related to the nature of earth forming the banks. Where the soil was fairly good and hard $1\frac{1}{2}$ to 1 slope was adopted.

In loams and soft clay soils 2 to 1 and in very loose soils 3 to 1 was prescribed as a thumb rule. But now with the advances made in soil mechanics and the establishment of a soils laboratory, the scientific adoption of bank slopes to suit the soil characteristics has become possible. It is also possible to eliminate all possibility of water reaching the sub-soil to the extent of reducing its bearing capacity, by selecting the right type of soil for the formation or by suitable improvement of existing soil composition where this is possible. In this way under-drainage problem can be solved.

4. 5. The following extract of Telford's specification published in the Journal of the L. & M. Engineers in 1926 as worthy of adoption then, will show what was considered sufficient for work in those time :

I. SHAPE OR CROSS-SECTIONS

“Upon a road of 30 feet width, the sides should be 9 inches below the surface of the middle. The best line of the cross section is a segment of a flat ellipse. This shape not only assists the water to pass from the centre towards the sides, but contributes to the drying of the road by allowing the action of the sun and air to produce a great degree of evaporation. Surveyors ought to use a level in giving roads a proper shape, in order that the surface may be of one uniform curvature, without the smallest deviation in any one spot from the prescribed line of the cross section”.

II. DRAINAGE

“All ditches ought to be on the field side of the road fences, and to be connected with the natural water courses of the country”.

“The stone cross drains and culverts which pass under the road should be numerous, and continued under the fences into the ditches”.

“In order to keep a road perfectly dry, openings of masonwork should be made from the side drains of the road into all these cross drains, to carry off the water collected from the surface of it. The bottom of these cross drains must be well paved, particularly at these openings”.

“It ought never to be forgotten that in order to have the surface of a road perfect, it must be kept completely dry”.

“All land springs ought to be carried from the side of the road by under-draining”.

4. 6. With advance of time, as traffic increased, the income from tolls (which was a good source of income for Local Bodies) increased and more funds were allotted for roads. It was then possible to have permanent gang coolies at least on Trunk roads (now N. H. and P. H.), and heavily trafficked II class roads (Now Dt. roads). These gangs were provided with a template made out of a wooden scantling 3 inches by 1 inch and 4 feet long. In most cases where remetalling the surface was done the picked up unserviceable stuff from the old road used to be spread and levelled on both sides. This to a certain extent stabilised the berms. Growth of turf further stabilised these. In old high embankments with loose soil the use of the edge bunds (see fig. 2), to prevent indiscriminate erosion of berms and slopes was introduced. This helped in diverting the road surface drainage water into the troughs (also

called water shoots) provided in the slopes. These bunds were useful at the approaches of bridges and culverts also. These were turfed and maintained.

4. 7. In quite a number of cases the available road land width was so small that the side drains were rather close to the toes of the road embankments. In such instances maintenance used to be difficult and costly demanding more frequent clearance of the drains. In cases where the highway ran alongside a stream or river and almost parallel to it for some distance, road

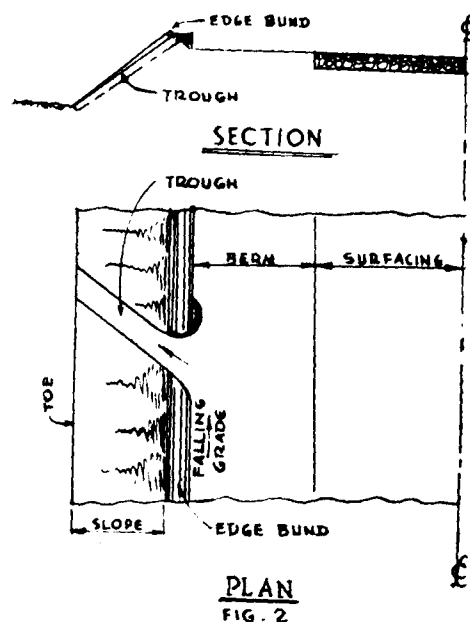


FIG. 2

margins and bed get endangered during times of high floods.* Protective works such as revetting of the bank slopes, and training works by planting 'nanal' of weeds or building groynes had to be done. All these shown the necessity to plan from the very start to build a road

* Kortalayar Bridge to Puthur road in Chingleput Dt. and Madura-Tondi road in Ramnad are instances of this nature.

so that surface and under-drainage water will drain away quickly leaving the road dry, and firm. Even today perhaps the problem of under-drainage in the case of old roads continues and awaits a satisfactory solution. Clearing blocked culvert vents come under drainage. This will be dealt with in greater detail later under culverts and bridges.

4. 8. Defects in road drainage were not of much consequence in days prior to motor traffic. But in later years (after 1928) this problem was keenly felt. The following extract from the L. & M. Engineers' Association Journal for Dec. '30 will show the position as it stood then:

"Where drainage arrangements are defective, as is the case in most parts of our roads, we find the roads yielding and huge pot holes formed during the rainy season. Except perhaps in the Chingleput and Kistna Districts the road crust has no soling to support it and is hardly 9 inches thick; and in several portions not even 6 inches thick. Side drains and catch drains are not kept in good repairs to carry off storm water. Perfect drainage arrangement is therefore the first thing to be attended to if we are to economise in the thickness of metalling. In the dry weather all roads are good provided loose metal is removed from the surface, and the road carpeted with a thin coat of gravel. It is however a different spectacle during the wet weather. It is therefore essential that, where the inundation level of the country is high and the excavated drains cannot be kept dry, the road embankments have to be raised at least $1\frac{1}{2}$ foot above the inundation level. We cannot claim that we have done all that is necessary for safety and economy of the road in this matter".

The problem of heavy motor vehicles became more serious by 1937 when lorries and buses on roads (including a few village roads) increased, and due to their increased weights and impacts drainage defects got magnified and more frequent and constant attention had to be bestowed. This meant increased maintenance costs.

5. BERMS AND SHOULDERS

5. 1. Shoulder is that portion of the carriageway adjacent to the surfaced portion giving a lateral support to the surfacing. In roads laid out in the past it was no better than the portion of embankment or cutting prepared for receiving the carriageway surfacing. Berm is that portion of carriageway formation width beyond the surfaced portion. This was already referred to while discussing drainage.

5. 2. Shoulders and berms were of earth only on most roads. The soils used in the old formations were merely those that could be obtained from borrow pits at the locality and as such did not possess the characteristics needed for a fully drainable soil or soil with the requisite plasticity properties to withstand water action without deterioration. Their maintenance was therefore adversely affected by this defect in their original construction. Further, the problem of maintaining these was closely related to that of the surfacing which, in the bullock cart days, was maintained to widths ranging between 6 or 7 feet in the case of village and minor roads and 8 to 16 feet in the case of more important roads. The width of berms usually ranged from 4 to 6 feet or more. In the matter of maintenance, next in importance to drainage came the surfacing,

shoulders and berms, and the carriageway formation or sub-base. Narrow surfacings were adopted mainly as a measure of economy. In narrow surfaced roads it was seen that, even with bullock cart traffic, the margins came to be used by them while overtaking or meeting other traffic, and thus developed ruts and holes just like the surfacing. For maintaining these, the ruts and holes had to be filled up and the original camber and grade had to be maintained as in the case of surfacings. These defects developed exactly at the edges of the surfacing and invariably the surfacing also got damaged. Although in the early stages this filling up of sunken places in berms used to be with any excavated earth (sometimes even sand and silt) that was readily available, so long as there was no impact of fast traffic this appeared to serve its purpose temporarily for some time. But as fast traffic appeared and increased (and with the increased surfacing widths that came to be adopted as a sequel to this) better quality earth, gravel or well mooram or even the screenings of the picked up or scarified material from the road surfacings came to be used for the purpose. This practice had the effect of making the berms more serviceable and less vulnerable. Due to increase in motor traffic blinding of water-bound macadam road surfaces had to be done periodically as is explained in later paras. The motor vehicles travelling at high speeds had the effect of accumulating the blindage materials just outside the travelled way on either side. This formed, in course of time, a small ridge (*vide* fig. 3) on each side and unless cleared periodically and more especially before a rain, made the rain water stand in thin continuous sheets alongside the metalled portion and soak into the shoulder and weaken it. Wherever the mile-cooly

(gang cooly) system was available this accumulation used to be, then and there, got levelled or shoved on to the slopes beyond the berms. In the case of improved types of surfacing, even if this accumulation did not cause any serious harm, it used to present an unsightly appearance and had to be dealt with as above. Whenever a water-bound macadam surface was upgraded to a better type (asphalt or cement concrete) strong shoulders or kerbs were provided consisting of 12 inch by 12 inch stone packing

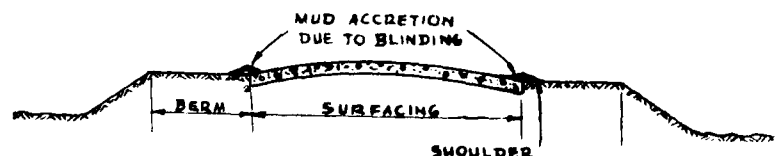


FIG. 3

or granite or c. c. kerbs. In course of time it was seen that a well compacted berm with good soil was found to turn sandy or become friable at the top making it difficult to be settled against traffic currents. This was due to the clay and silt fractions in the top soil having been washed away by the rains. When this happened clayey soil was added to the berm which had the effect of stabilising it. Wherever available, nodular kankar or well-mooram was used for this as these materials formed a homogeneous compact surface after rains, which was both smooth and hard in dry weather. The former however must be well consolidated with a rammer or roller. In spite of all the care rain gullies used to form during rains in berms, eroding the slopes in all embankments (see fig. 4). Promptly closing them as they formed had become important on all heavily trafficked roads and bus routes. Unless properly closed they will

reappear. The old method of merely dumping earth into these pell-mell and sectioning and levelling proved to be a waste. Therefore the method of benching these transversely and longitudinally and filling with earth in layers and consolidating came to be adopted as the only satisfactory solution. As an additional precaution



FIG. 4

the slopes and a foot width at top used to be turfed. The advance made in the science of soil mechanics has made it possible now to select the most suitable soil for the construction and maintenance of roads, more especially the sub-base, shoulders, and berms and thus minimise damage due to weather and traffic conditions resulting in less maintenance cost.

6. EMBANKMENTS

6. 1. Fairly high embankments will generally be met with in low-lying and inundated areas, at the approaches of bridges and culverts, when the road is taken over tank bunds, flood banks and the like, and in hill roads in ghat sections. Even in other areas, banks will be required to obtain the necessary grades although their heights may not be much. Sometimes banks and cuttings will be combined. In the case of embankments, maintenance problem used to be the prevention of their settlement, sliding or side-slipping due to traffic impact, water action or softening of the bank soil due to moisture creeping in. Settlement was usually provided for at the time of construction. Subsequent years of

slow traffic had further consolidating effect. Water pressure arose in cases of roads over tank bunds and in inundated areas. In the former case the authority in charge of tank took care to provide revetment to the water slope and in maintaining it. In inundated areas this had to be done by the road authority. Maintenance of such revetments where they existed had to be done by the department. The rear slopes of all the embankments had to be maintained by this department. The closing of rain gullies on the front slope fell to the lot of highway engineers. This proved to be expensive owing to long leads for earthwork usually involved. The roads in such situations were therefore a source of much worry to maintain with the inadequate funds available. Careful attention had to be given to the berms and slopes as indicated under drainage. Maintenance of protective works like the revetment proved to be costly and hence difficult with the slender allotments available for road maintenance. This emphasised the need to avoid alignment of roads entailing high embankments as far as practicable. Problems of sewage water was also there and very little could be done in the early years to prevent this except to minimise its harmful effects by lowering of the sub-soil water level by drains as already explained under drainage (see para 4. 1.). All settlements were made good by earthwork and patching.

7. DRAINS

7. 1. It was indicated in para 4. 2. that periodical and timely clearance of drains was essential. This needed care in execution more especially in regard to the fall necessary to effect proper flow of water. The only available supervision for this was that of maistries. Levels were not available and could not be maintained

scientifically. All that could be done was to see that water flowed without obstruction and there was no stagnation. This could be verified only at the times of rain. It was thus a work of trial and error. It was only in this way that a correct section and fall were maintained. Naturally it did not have the best effect.

7. 2. Where catch drains existed, in a few cases it was seen that the catch drain water was entering into the side drain. This was due to insufficient section of the catch drain and the bund between the side and catch drains not being kept up to the proper level. In such localities the catch drain was got widened and the bund strengthened to the proper level. It is perhaps too much to expect even in these days that these drains can be maintained to exact levels and standard cross sections with the aid of levelling instruments. In this can be accomplished it will be a very great improvement on maintenance.

8. CULVERTS AND BRIDGES

8. 1. The old constructions were mostly of brick or stone masonry with granite slabs or masonry arches, and some culverts with even earthenware pipes existed. Most of these were not strong enough theoretically to carry modern heavy traffic or even sufficiently wide. In some, laterite stone masonry had also been used. So long as there was only the country cart and horse carriage traffic the maintenance of these was not difficult. Several of these structures, especially the old ones were plastered or pointed with lime or surki mortar. Amongst the bridges were some steel structures also. The plastering or pointing had to be renovated wherever withered. The steel members needed periodical

repainting. It can not however be said that prompt attention was given to this part of maintenance. It was only after the advent of motor traffic that systematic attention was given to this.

8. 2. The width of roadway over several culverts was 8 to 12 feet, which proved insufficient after fast traffic developed, and was increased by lengthening the barrel on both sides in straight reaches and on the inner side in curves. The necessity for widening was a moot question then, as the following extract* will show :—

“It was thus necessary to fix a safe minimum width of roadway over culverts. The old culverts replaced could not be taken as a guidance. They were necessarily very broad; they had no parapets and their edges were notoriously unsafe for wheels. Nor could the permanent culverts in the district furnish any clue. They ranged from 8 ft. to 20 ft. and this wide range was not narrower even on one and the same road. There are even today on the most important roads 9 ft. widths over bridges and culverts. The maximum width which I have noticed as occupied by a cart and bulls is 6 ft. Seven feet is laid down as the maximum width to be allowed. Allowing 18 inches margin on either side, the width was fixed at 10 ft. which left in ordinary cases, at least 2 ft. space on either side with a cart in the centre”.

Now 24 ft. has been fixed by the I. R. C. as necessary for present needs, and it is the standard to be followed.

* The Madras L. & M. Engineers' Journal, 1920.

8. 3. While carrying out this improvement, repairs to the abutments, by way of reconstruction or underpinning of damaged and eroded portions and cement plastering were done. This helped to clear the blocked ventways of small culverts which could not be otherwise done satisfactorily. In not a few instances, this revealed that the masonry abutment had no concrete footing. These were provided with suitable flooring in the vent as a precaution against scour. Efficient drainage requirements demanded that the ventways should be kept clear and flooring in good condition. This came to be recognised when the effects of initial neglect became noticeable with the collapse of the side walls, scoured and exposed foundations, and breaches of approaches. The following instance will show the apathy of a maintenance gang. The existence of a culvert in a high bank was not known even when the bridges and culverts were serially numbered, because the tank never dried up and no one went down the bank for examination. When the tank bed was dry unusually in a year this was detected, and the culvert was brought on the list. The structure needed extensive repairs to the abutments, brick-arch and floor. Broken culvert granite slabs had to be frequently replaced as the intensity of motor traffic increased. This seems to be a common feature on some of the roads even at present. Before improved surfacings were provided these were replaced by precast R. C. slabs designed for the Madras B-Class loading (10 tons nominal steam road roller) and the culverts were widened to 36 ft. clear on Trunk roads and 24 ft. on II class roads. R. C. slabs *in situ* were also laid where facilities existed.

8. 4. On several roads there were very old culverts that were considered unsafe to carry either the 10-ton roller (the use of which had by then become essential to effect the consolidation of the hard metal which came to be adopted for the surfacings), or the modern fast traffic consisting of buses and lorries. They were got strengthened as and when funds became available. This lessened the frequency of failures of culverts on roads that were previously causing hardships and annoyance to the road users, not to speak of the dangers involved. In spite of all this a good deal of work still remained to be done. Several missing culvert parapets had to be built and cement plastered, keeping a uniform height of $2\frac{1}{2}$ to 3 ft. It was only in the case of long structures on high banks that taller parapets were maintained.

8. 5. In the case of bridges also, similar improvements and repairs were needed and carried out with a few exceptions. In these instances proposals for strengthening were kept back owing to want of funds or because alternative routes for heavy traffic existed. The steel bridges could only be painted once in 4 or 5 years and it was found insufficient to prevent rusting, pitting and deterioration. In fact two bridges on a trunk road deteriorated to such an extent that strengthening or replacement of truss members was necessary. In one of these the buckled plates of the flooring supporting the roadway rusted so badly inside that holes formed through them and road metal started falling down endangering traffic. This happened in spite of a layer of concrete provided over the buckled plates. The metal in use was laterite. The deep holes that formed on the bridge surface allowed rain water to soak

through; and the damage was caused. The plates and laterite metalling were replaced by R. C. slab and cement concrete surfacing.

8. 6. The culverts and bridges not only serve the traffic but are also helping to drain the roads. The extent to which this drainage is maintained so as not to cause flooding of the road will depend on the maintenance of the full waterway of the structure as designed. It is therefore important to see that the vents are not blocked up and that there are no shoals or other impediments to free flow of water in the vents, that the sections up and down stream are not restricted. Both irrigation and drainage culverts need clearance, more especially those with very small ventways. Pipe culverts used to be cleared with strong bamboo poles. In doing this care has to be taken that the pipes are not damaged. There used to be trouble unless proper sill was maintained. The channel up and down stream also is to be maintained. Earth required for strengthening berms or the culvert approaches used to be got out of the cuttings made to train the stream. Vents used to be blocked by growth of vegetation, by boulders and formation of shoals, which had to be removed periodically. The flooring in the vents, aprons and their retaining walls, and revetments of the approach banks where existing were also periodically attended to and repaired. Most of these could not be met out of maintenance although a real charge on it. Special grants were got allotted for the same. Normally maintenance grants should include all the above items of repairs. In one bridge the channel banks were getting badly eroded, and the rough stone flooring started sinking, and the stream had developed shoals (see fig. 5.) Besides revetting the banks

and repairing the floor, a leading channel for more than a furlong was cut and groynes constructed to train the river. Generally culverts needed more attention

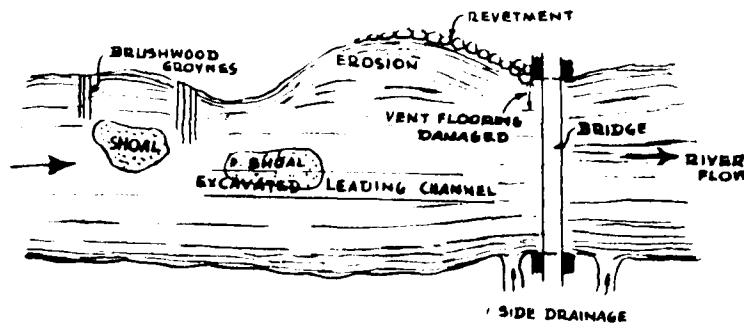


FIG. 5

than bridges being too small in its components, and too many in number. The roller or sliding expansion bearings of bridges used to present difficulties. The arrangements provided used to be not quite satisfactory and at times inaccessible; and greasing and keeping them sliding difficult. Unless interest was taken by higher supervisory staff this would never be satisfactorily maintained. Want of free expansion showed itself in cracked piers and abutments in the vicinity of the bearings and sliding plates. These had to be often cleaned, free of road dust and mud and greased and well kept.

8. 7. The Irish or vented dams or causeways were maintained similar to culverts and bridges. Where there were water level gauges at the ends of a causeway the maximum safe water level over it was indicated by painting red the portion at and above this level to prevent traffic using the causeway during such unfordable floods. During fordable floods the roadway over

the causeway would have to be frequently inspected in the case of waterbound surfaces, and scours made good (if possible) or traffic warned about it. This was not always feasible. So the roadway in such places was paved with stones or concrete to prevent scours or sinking of the roadway. All these repairs and improvements could not all be done together and were carried out gradually in stages.

(to be continued)

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"To increase the efficiency in motor transport, it should be made possible for vehicles to carry more weight, and to reduce operational costs, road surfaces should be greatly improved and well maintained. To enable vehicles to carry more tonnage it is essential that bridges and culverts should be substantially strengthened. Against the weight limit of approximately 32,000 lbs. for a transport vehicle as was visualized by the Policy Committee of the Indian Roads Congress in 1940, the present permissible weight limits in the country range from 14,500 lbs. to 20,000 lbs. This one single factor is responsible for an appreciable portion of the present high cost of motor transport by limitation of loads. Therefore in my opinion a top rate priority should be given to surveying bridges and culverts and strengthening them where necessary to carry the following laden weights:

National Highways	... 28,000 to 32,000 lbs.
State Highways	... 22,000 to 26,000 lbs.
Other Roads	... 18,000 to 20,000 lbs.

Most of the new bridges and culverts which have been constructed since 1943, should be capable of carrying these loads, and if the older bridges and culverts are likewise strengthened during the next five years, the efficiency of the nation's road transport will be benefited far more than by constructing new roads".

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"It is possible that if these two priorities are adopted and proceeded with that not much money may remain out of the Commission's allotment for the construction of purely new roads except those that are financed out of community projects, but I cannot help but feel that it is far more important to ensue that existing roads, bridges and culverts be improved so that they can carry an optimum load at greater speeds and at lower costs, all of which will provide more, better and more economic transport. As transport is improved and is developed on the present road system, and many more vehicles find it economical to operate, revenues from motor transport will increase and from these new revenues new roads can then be built. In the interest of increasing the nation's transport and especially road transport, and to likewise make it more economical, I earnestly suggest these two priorities to the Planning Commission for careful attention during the next five years".

—Extracted from "The Auto Spark" February 1956.

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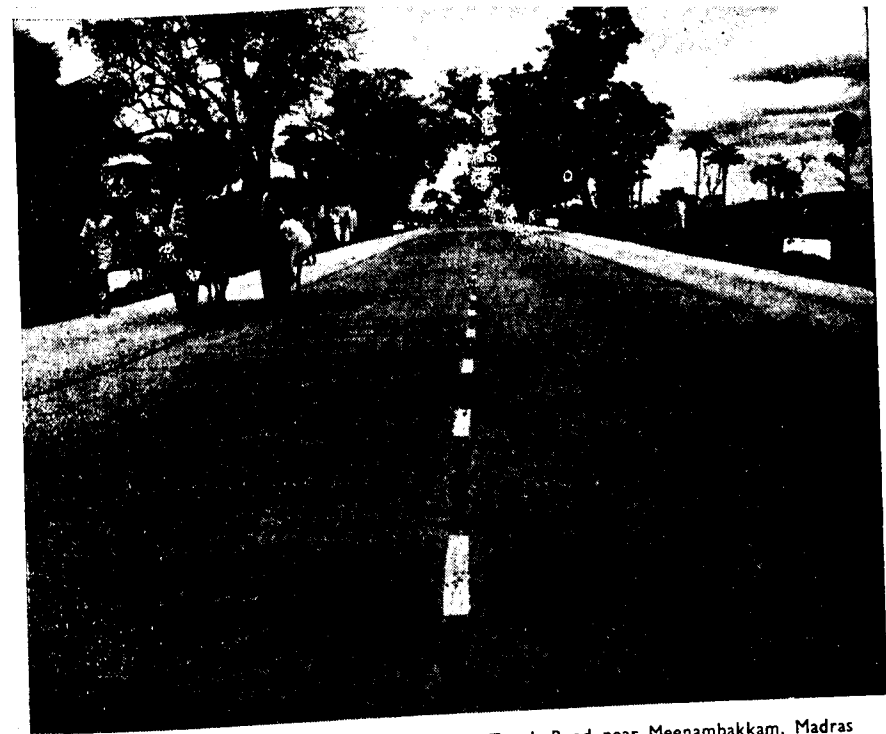


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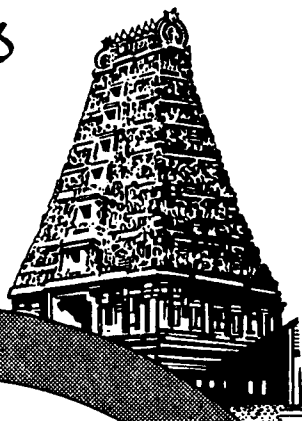


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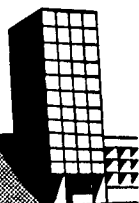
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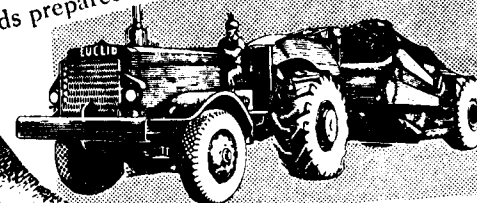
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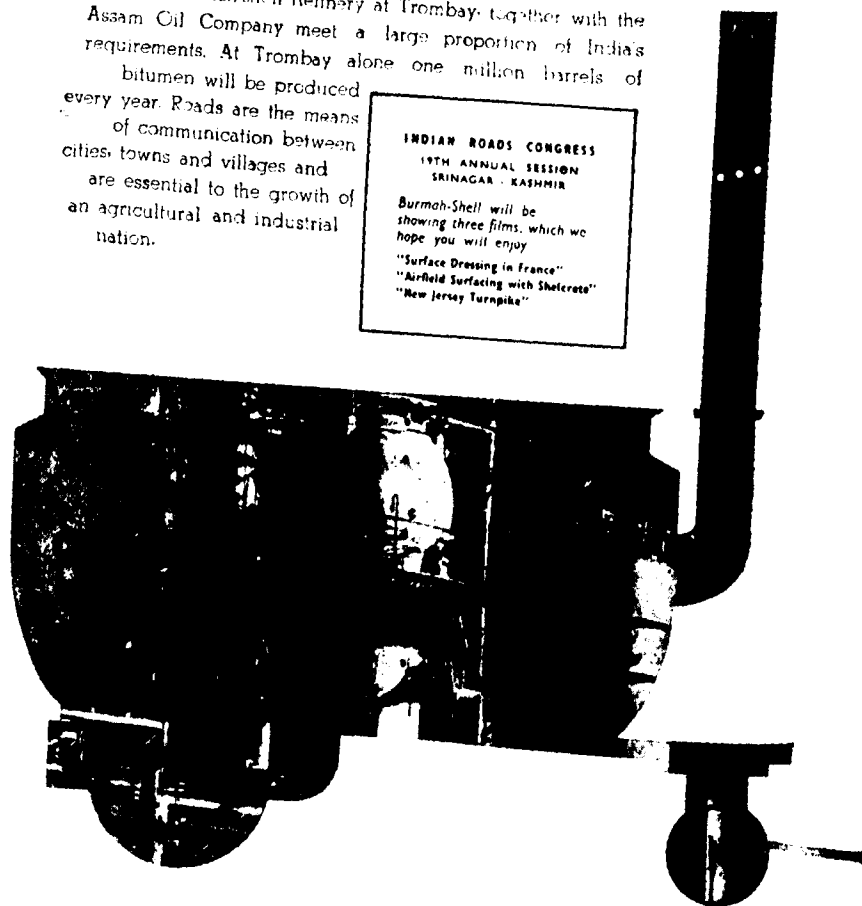
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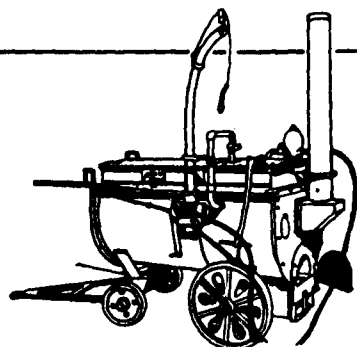


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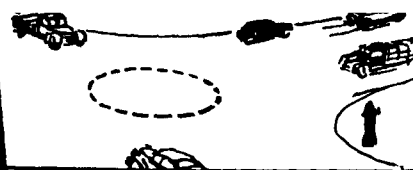
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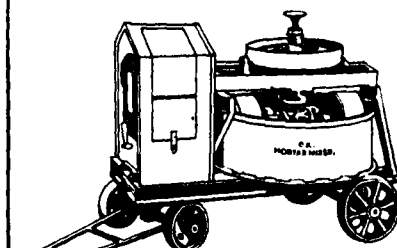


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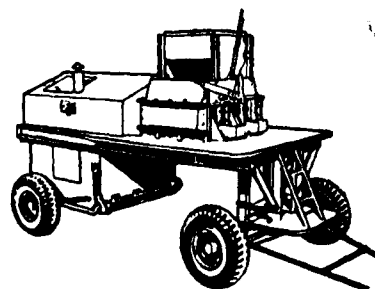
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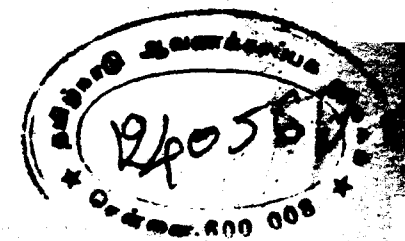
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