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# TRANSPORT- COMMUNICATIONS

MONTHLY REVIEW

FEBRUARY 1958—No. 130



INDIAN ROADS CONGRESS, NEW DELHI



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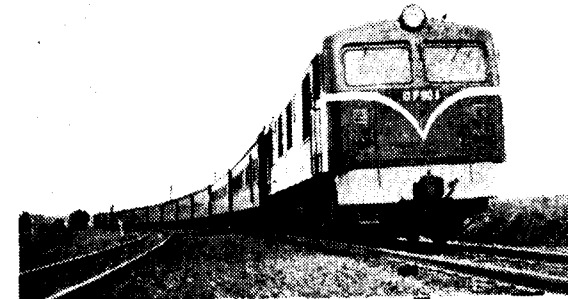
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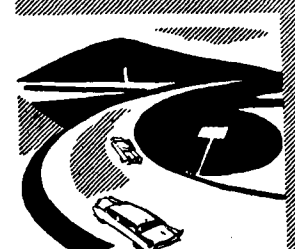
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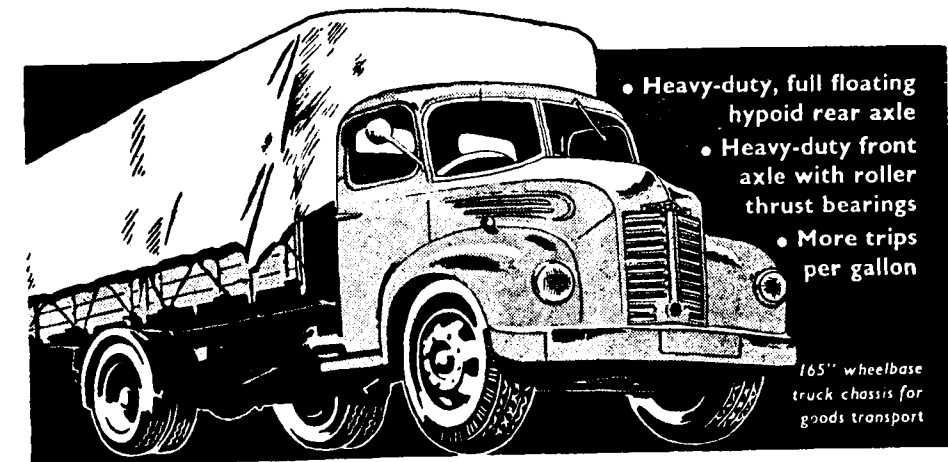
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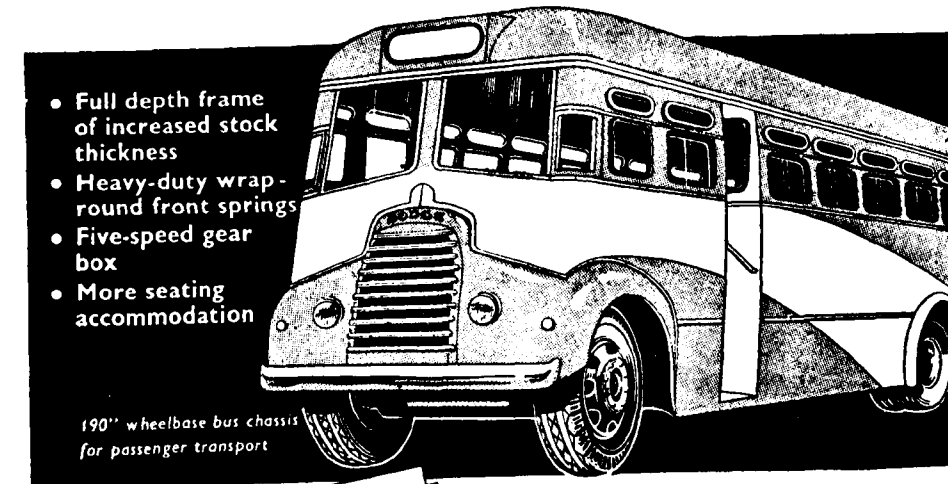


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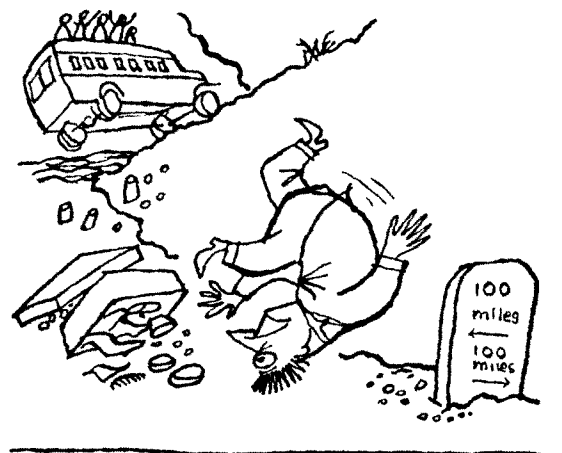
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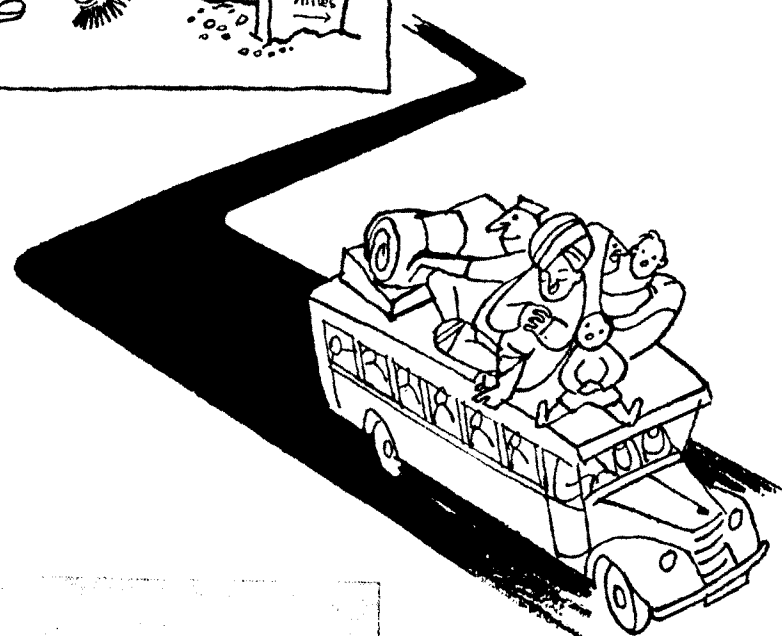
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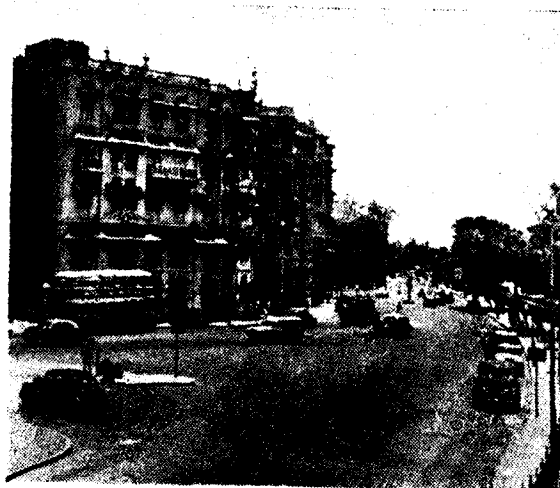
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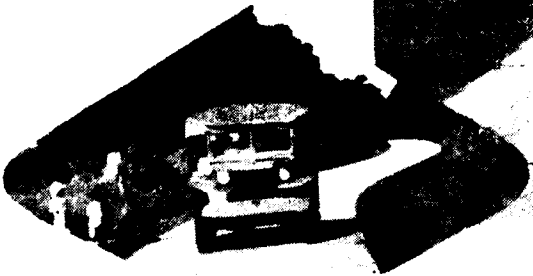
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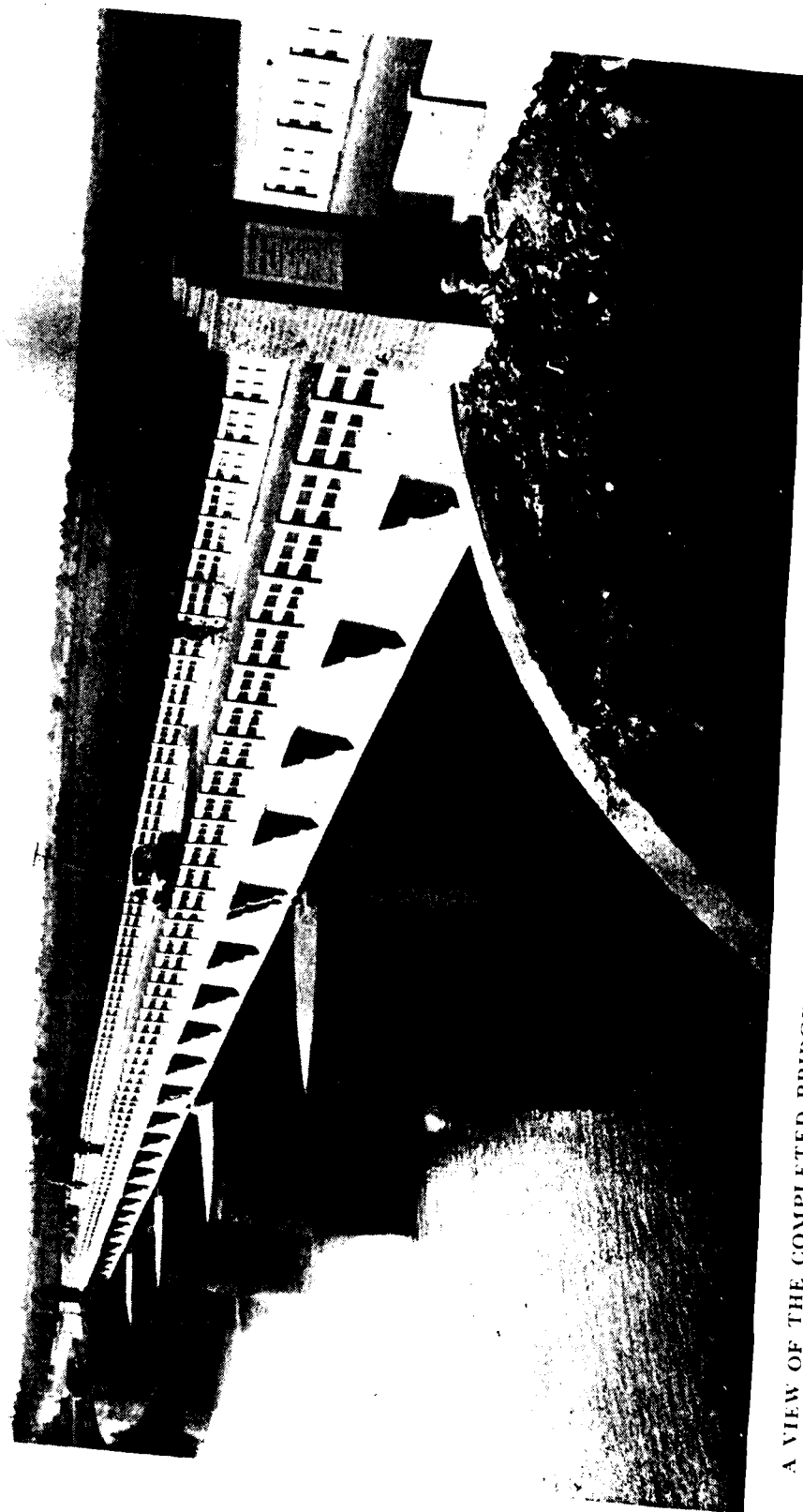
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A VIEW OF THE COMPLETED BRIDGE OVER HINDAN RIVER NEAR GAZIABAD. THIS WAS INSPECTED BY THE I.R.C. DELEGATES ON THE 9TH JANUARY 1958.

## TRANSPORT-COMMUNICATIONS MONTHLY REVIEW

A REVIEW OF  
ROAD ENGINEERING, DEVELOPMENT & TRANSPORT

FEBRUARY 1958

### A MEMORABLE SESSION

THE Session of the Indian Roads Congress concluded last month will linger in our memories for a long time. It was a memorable session indeed for several reasons. For the first time in its history, the Indian Roads Congress had the honour and the privilege to welcome in their midst the Head of the Nation to inaugurate the Session. The Rashtrapati in his Inaugural Address, which we have the pleasure to reproduce elsewhere in this issue, said something nice that any one has ever said before about the importance of roads not only in regard to their economic aspect but also their social and cultural aspect which has not received the emphasis it deserves. He pointed out: "This social and cultural aspect of roads is not in any way less important than the economic aspect. After all, it is not human beings alone who travel by roads. It is not goods or commodities of various kinds alone which are transported through roads. The traffic of ideas also takes place through social intermingling which is made possible by roads. This last aspect of roads is, in my opinion, of fundamental importance, particularly for a country like ours which is populated by communities and groups belonging to varying levels of economic and social development."

Earlier, in his Presidential Address, which is also reproduced in full in this issue, Shri M. S. Bisht had stressed the importance of roads and road transport in the implementation of our Five-Year Plans, discussed the question of highway economics—how the factors of costs, revenues and benefits have to be correlated for a balanced development, pointed out the need for co-ordinated road research and a scientific approach to the problem of design of pavements and road structures, and last but not the least, focussed attention on the question of engineering personnel and specialization in our P.W.D. or Highway Departments.

The point stressed by Shri Bisht regarding a scientific approach to the development of roads is of particular interest to road engineers who have now to provide for a fast increasing volume and intensity of traffic in keeping with the country's development plans which are in hand. This consideration is important even in the context of **low-cost roads** which formed the subject of a Seminar of the ECAFE countries just after the Session of the Indian Roads Congress.

"What is all the noise about low-cost roads?" a layman might ask with justification, and a little clarification will therefore not be out of place. The fact is that available meagre resources—both financial and otherwise—in comparison with the enormous requirements have to go as far as possible in providing an extensive road mileage through the length and breadth of the country, particularly in the remote areas in the interior which are not adequately served by any other means of communication. As pointed out by Shri Lal

Bahadur Shastri in his Opening Address to the Seminar, "faced with the difficulty of adequate finance for the various development programmes of which road development is one, we have to devise means of using every rupee to the best advantage". It is true that the roads constructed in the past in rural areas were not high-cost roads, but with recent advances in the field of soil mechanics and in the knowledge of properties and behaviour of road building materials, both in the laboratory and in the field, we can make the best use of available resources to meet the present demands as far as possible while at the same time make provision in our road development programmes for future requirements in a foreseeable period of time. In this way, full results would be obtained of stage construction methods in low-cost road construction.

Soil which is the cheapest local material constitutes a primary consideration in low-cost roads and its treatment by suitable means provides a clue to economy. Stabilization of soil by scientific methods has been successfully tried in the construction of low-cost roads in different regions of the country with modifications to suit local conditions. This has been done on a sufficiently wide scale as not to leave any doubt regarding the applicability of this method of road construction. The visit to roads in Batala area in the Punjab, which the delegates saw for themselves, amply demonstrated this. With a view both to economy and durability, best possible use has to be made of local soils and other road construction materials not only by methods of grading, admixture, compaction, moisture control, etc., but also by proper exploration, in the first instance, of local conditions, economic sources of materials and resources and their utilization and organization to the best advantage. Detailed consideration of these factors came up before the Seminar and the conclusions reached will make a lot easier the approach to the problem of low-cost roads.

The Sessions of the Roads Congress and the Seminar were not just confined to theoretical deliberations. As usual, the progress made in road research, construction and equipment in different parts of the country was on display at the Technical Exhibition organized under the auspices of the two conferences. Mechanical equipment has come to play an increasingly important role in our development projects not excluding construction of roads and bridges. In India and other similarly placed countries where there is no dearth of manpower, the problem is how to integrate mechanical equipment with manual labour in the construction of road and bridge works on grounds of economy and speedy execution. The Bhakra Nangal Project which the delegates visited during inspection tours is a notable instance of high-power mechanization necessitated by the nature and immensity of the project. Mechanization has undoubtedly a significant part to play even in road construction on a big scale. A large-scale programme of low-cost roads will also derive its share of benefit by a proper blending of the two modes of construction.

While sessions of the type we have recently had serve to clarify many old ideas and teach new ones, the friendly gatherings of engineers from different parts of the country and outside do not go without their impact on the cultural and educative side of life, in moulding outlook and broadening understanding, particularly of the younger members. To all, young and old, they are certainly events for cherished memories.

### THE SOILS LABORATORY

*The soils laboratory has taught the designer and the builder to consider soils not as dirt but as a structural material and just that idea is a long step forward.*

—E. S. Ward.

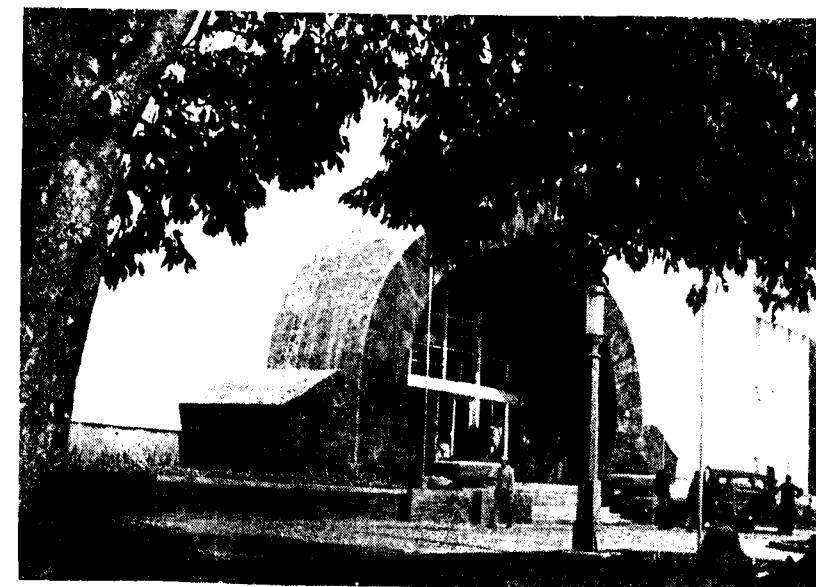
(Fifth Annual National Highway Conference, U.S.A.)

## INDIAN ROADS CONGRESS

### TWENTY-SECOND SESSION—NEW DELHI—JANUARY 1958

NEW Delhi, the Capital of our country, played host to the 22nd Annual Session of the Indian Roads Congress. The 5th January 1958 was a proud day for the Congress when the President of India inaugurated the Session. Three hundred and two delegates from various parts of India attended the Session. This was the second time that a Session of the Indian Roads Congress was held in New Delhi: the first was held in December 1934.

All meetings were held in the spacious premises of *Vigyan Bhavan*, the venue of the recent UNESCO Session.



Vigyan Bhavan, the Venue of the I.R.C. Session

Shri M. S. Bisht, Chief Engineer, Public Works Department, Uttar Pradesh, in his Presidential Address explained the significance of the new All-India Road Development Plan. He also dwelt at length on the subject of Highway Economics. He stated that highway revenues must not only be sufficient to meet costs but must, in addition, be warranted and backed up by the resulting benefits. The benefits of highway transport are many and varied. It is but proper that revenues should be derived from the beneficiaries, and therefore, it becomes necessary not only to evaluate total benefits but also to effect a benefit distribution in an equitable manner. So far the burden of taxation had been mostly carried by the motorists whereas other beneficiaries were not paying though they also derived benefits resulting from the development. It is only reasonable that they should share the taxation burden and help to promote road development and road transport.

The President of the Indian Roads Congress also emphasised the need for providing a non-lapsing fund for the construction and maintenance of roads. Such a step will enable the Road Engineer to plan his projects on a more rational and scientific basis. The need for setting up separate Highway Departments in every State was also emphasised.

Other subjects dealt with in the Presidential Address were need for utilization of the benefits of road research, adoption of proper geometric standards on highways, scientific design of rigid and flexible pavements, etc.



The President of India arrives to inaugurate the Session

out their road building programme. He hoped this useful work would be continued and wished the Congress good luck.

"The Indian Roads Congress Medal" was awarded to Messrs K. C. Ray, R. Subramoniam & S. Badaruddin for their Paper No. 193—"Influence Fields for Finite Concrete Slabs supported freely along Two Opposite Edges and free at the other Two." Two other Papers which were highly commended are (1) Paper No. 191—"Resistance to Abrasion of Concrete Pavements" by Messrs P. J. Jagus & M. R. Chatterji, and (2) Paper No. 192—"Design and Construction of a Prestressed Concrete Bridge across River Coleroon" by Messrs K. K. Nambiar & P. G. Nambiar.



The President of India awarding the Medal

Messages of goodwill from the Prime Minister of India, Governor of U.P., Minister of Works, Housing & Supply and several others were read. The Chief of the Transport Division, ECAFE also read out a message of good wishes for the Congress.

Seven Papers were discussed. About seventy five speakers took part in the discussions.

The President of India in his Inaugural Speech gave a new touch to the subject of roads when he said that he considered the existence of good roads as a vital factor in determining whether our Society can become equalitarian homogeneous one or will continue merely as a conglomeration of social groups leading their own separate lives and maintaining different levels of social and economic development. The traffic of ideas also takes place through social intermingling which is made possible by roads. This last aspect of roads is, in his opinion, of fundamental importance, particularly for a country like ours which is populated by communities and groups belonging to varying levels of economic and social development.

The President also stated that development of roads bringing the far-flung villages and even the remotely situated hamlets within the network of our communication system was so imperative that without accomplishing it our plans of economic development would ever remain incomplete and infructuous.

In the end, the President congratulated the Congress on its success in evolving highly useful and practical methods which have proved of considerable utility to the State Governments in carrying

With a view to obtaining and exchanging up-to-date information and experience on the use of soil in all-weather road construction, a panel discussion was arranged.

The Report on Road Research carried out in India for the period ending the 31st March 1957 also came up for discussion. Many speakers took part in the discussion. This was the second report, the first report was discussed in May 1957. The discussion aroused keen interest among engineers engaged in construction and research workers working in various fields of research. It is believed that such an open discussion on the subjects of common interest will help a great deal for the proper blending of research and its application in actual practice which is a pre-requisite for scientific advancement of highway engineering. The discussions will also help in avoiding duplication of work.



A meeting of the Test Track Committee

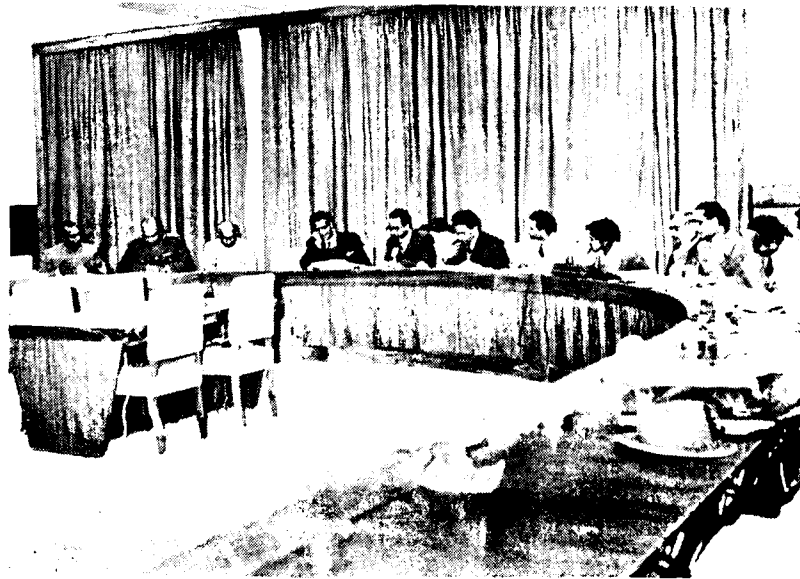
Various Committees of the Congress also met during the Session and examined various problems entrusted to them. The Specifications and Standards Committee discussed the design and location of petrol service stations so that they do not prove a hindrance to traffic. The next question which came up for discussion was design of cycle tracks. The results of research carried out by the Punjab P.W.D. and the C.R.R.I. were discussed. It was felt that the problem of cyclists was more important in Delhi than at any other place and it might continue to be so for some more time until some other cheap transport was available. The problem needs serious attention as the same difficulty might be faced in other cities also when the number of cyclists increases there. The Committee also discussed the method of numbering bridges and culverts on account of the adoption of kilometers on our roads.

The Test Track Committee discussed various specifications being tested at the Road Test Track, Calcutta.

The Education Committee discussed the question of including Highway Engineering as one of the subjects in the curriculum of Engineering Colleges. Another subject discussed by this Committee was about Refresher Courses for Engineers. It was pointed out that the States should be urged to spare engineers for this course. Another subject which came up for discussion was syllabus for Refresher Courses for junior engineers. A Subcommittee was appointed to look into the question.

The Road Transport Operation Cost Committee which was appointed at the instance of the Government of India to study (i) the cost of operation of motor vehicles on different classes of roads and (ii) the economy resulting from road improvements, considered the results of the various experiments carried out by Bombay and Uttar Pradesh State Transport undertakings according to design and specifications supplied by this Committee. The experiments are being conducted both on kacha and pucca roads. The Committee studied the Report on the analysis of the data received so far.

The data revealed some deficiencies in observations and it was decided to evolve a more rational form of co-relating the primary data. It was further decided to widen the scope of the study by including hill roads also and Assam and Himachal Pradesh Governments would be approached to conduct similar experiments.



A meeting of Research Organization Committee

The Research Organisation Committee examined the points arising out of the discussion on the first Road Research Report discussed at the last Session of the Congress. The Road Research Report of the period ending 31-3-1957 was also discussed.

The Soil Research Committee discussed the stabilization of black-cotton soil in India. Other subjects which came up for discussion by the Committee was soil-cement blocks for urgent river protection works; specifications for stabilized soil base courses and wearing courses; application of the results of researches, sponsoring the use of soil as a road making material, etc.

The Traffic Engineering Committee at their meeting decided a programme of their Work. It was also suggested that 'Study Weeks' in Traffic Engineering and Road Safety should be organised as is done in various foreign countries and the I.R.C. should associate itself with this work.



50th Council meeting

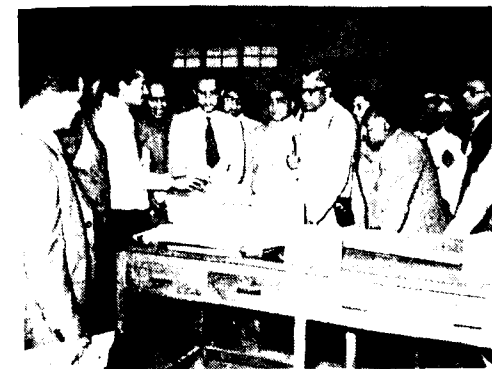
The Council at their 50th meeting in addition to transacting the ordinary business of the Congress, made very important recommendations suggesting ways and means to increase the road transport capacity both on a long range basis and for the implementation of the Second Five-Year Plan. One of the main recommendations was that the Central and State Governments should be requested to allocate more money for roads in order that it may be possible to cope with the increased transport requirements. Particular emphasis was laid on improvement of existing roads to enable them to carry heavier loads.

The General Body of Members at their meeting held on the 8th forenoon transacted the ordinary business of the Congress. They also reviewed the work done by



51st Council meeting

various Committees and the Council. The new Council was also elected. The meeting of the new Council was held in the afternoon. Shri W. N. Mascarenhas, Chief Engineer, P.W.D., Bombay was elected new President of the Indian Roads Congress. The new Vice-Presidents elected were Messrs J. M. Rijhwani, Sujan Singh and D. C. Sharma. Shri A. J. D'Costa was re-elected as Secretary.



I.R.C. Delegates visit the Central Road Research Institute

On the 9th January after paying their homage at Rajghat the delegates visited the National Physical Laboratory and later inspected the Hindan Bridge near Gazia-bad. In the afternoon, they were taken round the Central Road Research Institute.

On the occasion of the Session an engineering exhibition an account of which is given elsewhere in this issue was also organized by the Congress.

**PRESIDENTIAL ADDRESS**  
TO THE  
**TWENTY-SECOND SESSION**  
OF THE  
**INDIAN ROADS CONGRESS**

*By*

SHRI M. S. BISHT

*New Delhi, January 5, 1958*

Rashtrapati Ji, Ladies and Gentlemen,

IT is a privilege and an honour to extend to you, Sir, a most respectful welcome on behalf of the Indian Roads Congress. We are most grateful to you for the honour you have done us in having graciously agreed, and found time amidst your manifold engagements and urgent affairs of the State, to be present with us and inaugurate this, the 22nd Session of the Indian Roads Congress, in the Capital of our Country.

This is the second time that a Session of the Indian Roads Congress is being held in Delhi; the first was held in December, 1934. Since then much water has flowed under the bridges and great changes have taken place during recent years.

The country is pulsating with new life and energy and fresh hopes fill the heart of the nation. During the ten years of our independence vast changes have taken place and decades of inaction are being wiped out by the collective effort of the nation to develop the country and thus ameliorate the condition of the masses. All this creates new horizons for all of us.

In this short period of our freedom we have marched forward in the face of incredible difficulties and registered successes, economic, political and social, which to the future historian may seem miraculous. The partition brought in its wake serious disruption of our economy and truncation of our already inadequate and overstrained transport system. The uprooting of millions of people from their homes when the country was already in the grip of food shortage caused by the Second World War tended to paralyse the nation. In those distressing circumstances we had little to support us but the courage in our hearts and the faith in our destiny. Much of this now seems past history and we look back with satisfaction at what has been achieved under your wise guidance and the brilliant leadership of our Prime Minister. The nation has survived the crisis and continues to forge ahead.

We have made spectacular progress on all sides. Big river valley projects have been undertaken and many successfully completed; great strides have been made in generation of electric power; rail transport system is being rapidly rehabilitated and strengthened; big and small industries are springing up and giant steel plants are coming up. In the matter of road transport, too, much has been done and our National and State Highways have been considerably improved and extended. Many missing bridges have been built and many more are in the course of construction. Many miles of missing road links have been constructed and road surfaces improved. Considerable work still remains to be done to make our road system play its proper role in the expanding economy of our country.



The President of I.R.C. delivering his speech

We have abundance of man power but are short of equipment and some essential materials of construction. Many industrial plants are producing materials in increasing quantities but production is outpaced by the demand arising from the ascending pace of developmental activities all round.

We completed the First Five-Year plan successfully and are now in the midst of the Second Five-Year Plan. During the First Five-Year Plan period, a sum of Rs 27.62 crores was spent in the Central Sector on the development of National Highways: 636 miles of missing road links and 30 major bridges were constructed. Also, the surface of 4,000 miles of existing National Highways was improved and asphalted. A sum of Rs 6.75 crores was spent on improving the surface of selected roads other than National Highways and a sum of Rs 15 crores was spent from the Central Road Fund in addition to Rs 106.46 crores (including expenditure on Community Project Schemes) in the State Sector. Thus, the overall expenditure was about Rs 155.83 crores. It is gratifying to say that the targets set were not only achieved but exceeded in some cases. Modest as the sum provided was, it helped in a significant measure to integrate the road system of India in accordance with the Nagpur Plan and to encourage development of road transport. Since money was required for so many purposes, roads received a modest share of the available resources.

The Second Plan makes a provision of Rs 263 crores for roads and road transport. The share of National Highways is Rs 55 crores and this provides for construction of 1,200 miles of missing links and construction of 116 major bridges. At the close of the Second Five-Year Plan, the National Highway system will have emerged stronger and better capable of meeting the transport needs of the country with practically all the missing links completed and most of the major bridges either completed or in the course of construction. In the State Sector, the Second Plan provides for expenditure of 164 crores of rupees under which 60,000 miles of new roads of which 18,000 miles would be hard surfaced, would be constructed. At the close of the Second

### Importance of Roads

A very careful examination of the targets for the production of commodities mentioned in the Second Five-Year Plan has shown that there will be an increase of about 110 per cent in the transport requirements of the country as compared to 1950-51 facilities. It is estimated that by 1961 the total traffic to be moved will be of the order of 181 million tons. The railways expect to make a big contribution towards meeting the increasing demand by large scale procurement of rolling stock, increase in line capacity and improvement in the operational fields. According to the Planning Commission they will not be in a position to carry all the additional traffic and the facilities provided by them may fall short of the estimated requirements by about 10 per cent.

The Indian Roads & Transport Development Association has put this at a higher figure and consider that against a shortfall of 18 million tons it may well be 33 million tons. In any case, it is obvious that there is going to be a big gap between the traffic offered and traffic moved and efforts have now to be made to provide alternative means of transport for movement of this traffic.

It is certain that to carry this traffic the present road vehicle capacity plus the annual growth of road transport will not suffice. Either we shall have to increase the output of motor vehicles in this country or to import them from abroad. The latter seems to be out of the question because of foreign exchange difficulties. The solution lies in speeding up manufacture of goods vehicles.

On this subject it would be as well to consider what burden the road transport carries in this country. Various authorities have assessed taxation of motor vehicles in India as higher than anywhere else in the world. Motor vehicle taxation here stands at Rs 2,070/- per vehicle per year against Rs 800/- in France, Rs 950/- in Austria, Rs 1,300/- in U.K., Rs 1,550/- in Italy and Rs 1,200/- in Germany. The taxation consists of:

(a) **The Central taxes comprising :**

1. Central petrol duty.
2. Import duty on the vehicles or such conveyances as are imported.
3. Import duty on spares.
4. Excise duty on tyres and tubes.

(b) **The State taxation comprising :**

1. Vehicle tax.
2. Petrol sales tax.
3. Sales tax on vehicles and accessories.

The sum total works up to a formidable figure.

Certainly, the high cost of vehicles plus similarly high cost of fuel does not help to lower the operation cost or encourage the growth of road transport. If it is developing in spite of these handicaps it only serves to emphasise the great demand for it.

Perhaps, with the increase in the number of motor vehicles and increase in the overall consumption of motor fuel, it would be possible to lower the taxation burden as after all it is the overall revenue that matters and not the incidence of taxation per vehicle or per gallon of fuel oil. If by lowering the overall taxation, more vehicles can be put on the road, then surely revenue is not likely to suffer and the cause we all have at heart, i.e., growth of road transport will be greatly helped. In this matter

the automobile industry can play a very notable part by reducing prices and it is to be hoped that the Oil and Gas Division of the Govt. of India will also play an equally notable part in the matter of fuel in the near future.

The Govt. of India have already taken a lead by amending the Motor Vehicles Taxation Act of 1939 which imposed many unnecessary restrictions on road transport. More and better roads will undoubtedly go a long way in helping road transport, and if all these factors are taken into consideration collectively, we shall have provided the necessary stimulus for accelerating the growth of road transport.

Also, allied with this problem is the one of permissible laden weights of motor vehicles on roads. There is a general demand on the part of trade for higher laden weights. The introduction of diesel driven trucks and buses has helped to reduce operating cost by permitting heavier loads to be carried, but our roads are not always fit to carry these heavy loads. I have seen many modernised roads go to pieces under these heavy diesel trucks because these roads were not designed and built for either high speed or the weight of these heavy vehicles. Roads with a low crust thickness are utterly unsuited for modern vehicular traffic. Then the widths of our roads are also an important consideration. Therefore, the problem of widening our roads and improving their carrying capacity is assuming very great urgency. Serious consideration has to be given to this question and required funds have to be made available to meet this important problem before it develops into a crisis.

The Road Transport Development Committee of the Indian Roads Congress which went into this question have submitted their report recently. They have suggested the following measures :

1. Maximum permissible limit—laden weight of vehicles be raised to 27,000 lb.
2. Truck trailer combination or articulated vehicles be permitted.
3. Short distance railway traffic be diverted to roads by adopting the following measures :
  - A. Railway freights on "Small" should be so adjusted as to divert to roads the bulk of this traffic.
  - B. The first limit in the railway class rates should be raised from 300 to 450 miles.
4. In view of the large gap in the transport capacity, provision for road development in the Plan should be increased by 50 per cent.

The Committee has worked out in great detail that additional requirement of trucks and buses up to 1960-61, exclusive of replacements, would be of the order of 3,20,000.

It is obvious that unless our production of these vehicles is considerably increased, nothing like this number will be available.

Employment considerations are strongly in favour of road transport, as it provides employment to a very large number of people at comparatively cheaper cost. Currently, the Indian Roads Transport employs about 15 lakh workers and it is controlled by some 47,000 operators. Considerable employment is found for our labour both skilled and unskilled in road construction as well as maintenance. It is estimated that at the current rate of construction and on the overall mileage that we have, some 628 thousand men are employed per day on new construction and 554 thousand on maintenance, bringing the total to 1 million 182 thousand. In this way some 2 million 700 thousand people are employed in road transport.

I shall now give some practical instances of how rural economy is helped by construction of a new road. In the Tarai region of Uttar Pradesh, farmers had been struggling to develop their farms by clearing forest land, cutting bushes, and breaking up land with the aid of tractors. The Tarai region is noted for its malarial character, surrounded by dense forest and inhabited by wild beasts of every description. There is a meter gauge railway line running through this region and it has been in existence for over half a century. Land reclamation did not seem to be making much progress in spite of the best efforts of agriculturists and farmers aided by modern machines and implements. Construction of a road through this region was taken up. It took over three years to build this 40 miles length of road through swampy infested region. The moment the road became fit for carrying trucks and vehicles, the condition of these farms began to change. In a couple of years the grass lands had been cleared and the forests cut down, the land completely broken up and food began to grow. In the scheme of things there was only one missing factor and that was good road communication. I have already stated that the railway line existed there for a long time and yet only when the road made its appearance, the whole 40 mile belt of territory on both sides of the road developed in a new way and took on a new meaning.

In another case, up in the hills, cash crops like fruits and potatoes used to be exported to the nearest rail head some hundred miles away on pack ponies and mules. As soon as the motor road was built connecting these fertile regions with rail head, freight dropped from sixteen rupees to about three rupees a maund and the producer began to earn 100 to 200 per cent more than what he had been earning before. I will cite an even more glaring case of orchards situated at a distance of 15 miles from a motor road. The moment the motor road was built, freight on a 10 seer box of apples dropped from Rs 2.8 to annas eight and the producer began to save Rs 2 straightaway on 10 seers of fruit. These instances only serve to show that there can be little incentive to a grower or a farmer to grow cash crops for export if he cannot market them economically at a price which would mean some saving to him.

How dangerous it can be to depend too much on one type of transportation system was borne out in the last war, when the seas became unsafe to go round India and everything had to be transported from the ports by rail. Great quantities of materials accumulated at the ports. These had to be moved by road. It was a common sight to see military convoys of a thousand vehicles or more passing every day on some of our arterial roads across the country. The roads were bad, disconnected and great efforts had to be made to make them fit for use. The importance of roads was realised none too early by the then Government. Much was done during the war in spite of so many handicaps to build roads and when that great military strategist, Lord Wavell, later ascended the Viceregal Gadi, he gave the highest priority to roads.

### Highway Economics

Highway economics comprehends the following essential phases or factor groups:

1. Costs
2. Revenue
3. Benefits

Every problem in this field can be directly studied through the proper co-relation of these factors and the soundness of any development or extension project can be measured by the various ratios of their inter-relation.

Revenues must be sufficient to balance costs, otherwise eventual bankruptcy will be inevitable. Highway revenues must not only be sufficient to meet costs but must, in addition, be warranted and backed up by the resulting benefits, else the set up eventually collapses for lack of public support and sanctions.

The benefits of highway transport are many and varied and they impinge upon several groups of beneficiaries in different ways and in different degrees. It is from these beneficiaries that revenues must be derived, and therefore it becomes necessary not only to evaluate total benefits but also to effect a benefit segregation so that revenue imposts may follow benefit distribution in an equitable manner. The beneficiaries may be grouped as follows:—

- A. The Governments because of improved facilities furnished by faster transportation of short distance hauls, facilities for inter-State commerce, and other factors.
- B. The road user because of decreased vehicular operating costs, increased riding comfort and safety and other factors.
- C. The general public because of decreased commodity costs, promotion of public health, better police facilities, etc.
- D. Abutting and/or adjacent property because of certain special benefits accruing thereto over and above general community benefits.

In regard to 'A's, it would be appreciated that highways have legitimate claim on the general financial resources of the country because of the benefits accruing to the Government. While it is true that all the taxes on fuel, petrol, lubricants and oil, etc., in fact, all revenues derived from road taxation are being ploughed back into road development, yet little is being made available from general revenues. Total revenues derived during the year 1955-56 are estimated at Rs 43.83 crores by the Centre and Rs 27.58 crores by the States. The total revenue derived by both Centre and State Govts., thus comes to Rs 71.41 crores. Against this, allocations from the Central Road Fund and other grants for roads have amounted to Rs 76.70 crores.

Under 'B', the road user, I mean the motorist and the truck owner, pays perhaps the highest taxation imposed anywhere in the world as already stated.

The same, perhaps, is not true in the case of bullock cart. Suggestions for imposing wheel tax have been coming up now and then, but for certain reasons it has not been possible to take up this form of taxation seriously and an important source of revenue is being missed.

It is estimated that the number of bullock carts in this country is in the neighbourhood of 102 lakhs and even if a tax of Re 1 per month is imposed, the total revenue from this source would be about 12 crores of rupees. Were this money to be set apart entirely for development of rural roads it would mean that something like 5,000 to 6,000 miles of katcha village roads would be metalled and made all-weather roads every year. What this would mean to the rural road user in lowering the cost of transport of his village produce, heavier loading capacity of his bullock cart, increase in the life of his cattle and appreciation in value of land and property, does not need to be narrated at length.

Under 'D', although there is no taxation on property but a betterment tax is usually levied in other countries. Assessment is based on the value of land and improvement. This betterment levy is only imposed for a limited period, i.e., up to such time as the expenditure on the road is redeemed by the tax after which betterment-levy ceases. If an area on an average of three miles on either side of a new road is benefited, then for one mile of new road construction the area liable to be taxed would be 3,840 acres. Assuming for the sake of argument that Rs 2 per acre is imposed as a betterment levy, then for one mile of new road construction the yearly revenue would be Rs 7,680. At the close of the Second Five-Year Plan, the metalled road mileage is expected to be 1,44,000. Therefore, the total revenue from this source would be about Rs 110.0 crores.

It will be seen that so far the burden of taxation has been mostly carried by the motorists whereas other beneficiaries are not paying though they also derive benefits resulting from road development. It is only reasonable that they should share the taxation burden and help promote road development and road transport.

### Non-lapsing Funds

I would also like to draw the attention of our administrators to the necessity of providing a non-lapsing fund for the construction and maintenance of roads. My predecessors in this office have stressed this point time and again and I would like to refer to it once more. We are all fully aware how road works and programmes have suffered in the past on account of the uncertainty of funds. Many a time in the past the road programme has had to be drastically cut down by the Government after we had overcome the difficulties in the initial stages of construction. To place the highway budgets outside the realm of uncertainty, it is essential to create a Statutory non-lapsing fund for financing the development and maintenance of roads. We have at present the "Central Road Fund" which does not lapse and a similar fund can be created in each State for the State works to which the budgetted amounts passed by the Legislature each year may be credited. Such a step will enable the Road Engineer to plan his projects on a more rational and scientific basis.

At present, the expenditure on roads is much less than the user taxes collected by the Centre and the States. It will go a long way to improve the standard of our roads if all the taxes collected from road users are credited to the Statutory Road Fund and their diversion to other purposes is prohibited by law.

### Road Research and its Benefits

Systematic road research was not carried out in India in the past, mainly due to lack of facilities. However, at present the position is different. We have now had the Central Road Research Institute functioning at New Delhi for some years. Other Research Laboratories and Institutes are also functioning in several States, finding solutions to many problems referred to them by the field Engineers. There are still some States where laboratories have not yet been set up. It is very essential that these States have such laboratories as early as possible. Already a broad scheme for establishing such laboratories has been prepared by the Central Road Research Institute, Delhi, and this should be implemented as early as possible.

The function of a road is to enable traffic of all kinds, whether of car drivers, cyclists, pedestrians, lorry drivers, or of farmers with their animals and their bullock carts, to move safely, expeditiously, economically and comfortably.

The Government and the local authorities have, however, limited funds at their disposal. We must perforce compromise and do our best to give the greatest return for the money that we can spend. Each road, whether it is a district road or a main highway, is to be constructed to perform efficiently, safely and economically the task for which it is built according to its class. The traffic to be catered for and the type of road making materials near at hand largely determine the type of construction employed. All these aims, including improvement of design and layout, promotion of safe traffic flow, reducing operational costs and adopting different methods of construction, can be achieved by a systematic and co-ordinated research work.

It is very essential that activities of all the Research Organisations in the country should be co-ordinated. Already some committees of the Indian Roads Congress, like the Road Research Organisation and Soil Research Committees are doing useful work in this respect by including representatives of various Research Organisations in these committees.

Application of the results of research is very necessary. We have already embarked on an ambitious programme of constructing many thousands of miles of

roads of all types and this opportunity of applying results of research carried out in this country and elsewhere should not be lost.

The primary bottleneck appears to be lack of funds to the extent required. Besides, we should be prepared to take certain risks and not be daunted by failures in experimental work.

It has been suggested that a small percentage of the funds for construction may be earmarked for road research. In America, 1½ per cent of all available funds are set apart for research and there is no reason why we should not follow the same policy.

The Council of Scientific and Industrial Research have constituted a committee known as the "Road Research Committee" in order to promote, guide and co-ordinate road research in India. This committee is initiating and fostering road research by recommending financial grants when required for various schemes. All possible efforts should be made by engineers and research workers to take advantage of this financial assistance.

### Geometrics

I would now like to deal with Geometrics on our roads. Geometric design of highways deals with dimensions of the visible features of the highway such as alignment, sight distances, widths, slopes, grades, etc., as distinguished from structural design which deals with the thickness of pavements, composition of materials, load carrying capacity, etc.

Available finances do not always permit of construction of the ideal in highway design. It is generally believed, however, that when economy is necessary it should be practised on some feature of the highway design other than the geometric. The road section can always be improved and widened at a reasonable cost if necessity arises. Likewise, the pavement can be widened and strengthened when finances permit but the geometric features of alignment, grade and sight distances when once moulded into the landscape and tied down to the pavement surfaces, are most expensive and difficult to rectify.

There is a tendency at present to align the road along the old existing village tracks and footpaths to avoid acquisition of land. The result is that many of our roads are generally crooked and unfit for fast moving traffic. This tendency has to be curbed, as there is little room for compromise in this regard. We must follow the set geometric standards invariably in all new constructions. Particular attention must be paid to the curves and grades. Traffic on our roads is growing faster than we can anticipate. It is not only necessary to construct the new roads for the present day requirements but to plan ahead and cater for the traffic likely to develop, say, in another 10 to 20 years' time. Even existing highways must be improved for safety and economy of vehicles plying on our roads.

This naturally brings us to the necessity and importance of road safety measures. In progressive countries, traffic has multiplied many-fold in the last decade. The number of mechanical vehicles now plying on the road has increased the traffic intensity considerably, throwing up problems of safety and control. Vigorous road safety campaigns are conducted in this country periodically by the Government in co-operation with the local authorities, Police and Education Departments. A system of pedestrian crossings has been introduced at many heavy traffic points and at some places where subways are under construction for pedestrians. But much more remains to be done. We have to apply our minds to this problem and lay down certain standards regulating the conduct of road users. The drivers of motor vehicles as well as bullock carts and also the pedestrians have to be trained so as to develop proper road sense.

### Need for Scientific Design of Rigid and Flexible Pavements

It is well over a century since Macadam pointed out that the entire load imposed by traffic on a road, together with the weight of the road itself, are really borne by the soil beneath, yet it was not until some twenty or twentyfive years ago that soil became the subject of systematic engineering investigation.

The reason why research on soils was neglected for so long is that no effective means existed of tackling the problem. The subject of soils does not lend itself to simple theoretical treatment in the same way as the theory of structures and the strength of materials which developed rapidly in the past century as branches of applied mechanics. No real advance in Soil Science was made till Terzaghi developed soil mechanics as a partnership between applied mechanics and the study of the physical properties of soil as they exist in the field.

One of the most important applications of soil mechanics to road engineering lies in the formulation of methods of calculating the thickness and strength of pavement which is to be placed on a soil foundation to provide a stable riding surface for specified traffic loads. This problem is known as pavement design. The rigid pavement, as we all know, includes all concrete roads, whereas flexible pavements cover all bituminous, water-bound macadam and kankar roads.

As the considerations involved in working out a purely rational method for the design of pavements are very complex, it has not been possible so far to evolve such a method anywhere. In the absence of well established rational design procedure, various organizations in the world have adopted mostly empirical methods based on experience within their own spheres. It has now been realised by all highway engineers that correct application of reliable methods of design can lead to important economies by avoiding costly failures and wastage due to over design which are matters of special importance to us at the present time.

In the past and even at present in most cases in our country, the design is based merely on the past experience. Much the same thickness of construction is sometimes placed on a weak clay as on a strong gravel subgrade. It has happened that in some cases insufficiently thick pavements have been laid on weak subgrades leading to failures. A small expenditure on preliminary soil testing and the intelligent use of design methods will lead to fewer road failures and lower the cost of construction.

The road system in India is developing at a fast rate and thousands of miles of roads will be constructed within the next few years. It is, therefore, very essential that the best possible use should be made of available empirical methods of design (such as the California Bearing Ratio method) by adapting them to the conditions existing in the country as regards traffic, climate and subgrade conditions, etc. Investigations should be directed to this aspect immediately and results made available to highway engineers. It is also necessary to develop method or methods of design of pavements suitable for our country.

For the evolution of suitable methods of design of road pavements, a lot of research and investigation work will be necessary both in the laboratory and in the field. In order to arrive at some conclusions early, co-ordination of such work among the various Research Organizations is essential. The Indian Roads Congress can fulfil this task very effectively and it is hoped we shall soon be able to evolve suitable methods of design for different conditions existing in this country.

### Bridging Activity

Bridges are vital links in a communication system and without bridges roads are generally rendered impassable during the rainy season. Even in summer, absence of bridges limits the utility of roads.

Bridges are, however, the most expensive single item in the communication system and, as such, their construction is usually postponed to a later date. Unfortunately, in this country this postponement has done great harm because construction of bridges over big rivers has been postponed right from the last century up till now, i.e., ever since roads began to be built in this country.

However, a great deal has been done in the last five years. Many big bridges have been constructed, for instance, Palar, Pugalur and Coleroon in Madras; Pennar in Andhra; Kathjuri and Kuakhai in Orissa; Ghaggar and Bein in Punjab; Mahi in Bombay; Baigul, Bhakra and Jharaghat in Uttar Pradesh; Mahanadi in Madhya Pradesh; Barakar, Kiul and Akaraghat in Bihar; Kaljani and Darakeshwar in West Bengal.

As already stated, all told some 40 bridges were completed in the course of the first Five-Year Plan and in the Second Five-Year Plan, 116 major Bridges are proposed to be built.

Bridge building is a precise and complicated branch of engineering. Collection of the correct hydraulic data of the rivers to be bridged is the first essential and thorough knowledge of river training works and river characteristics is another essential. Foundation problems are often difficult both in design and execution and the decision as to the right type of bridge to be built is yet another matter that needs sound judgment. There is a variety of types to choose from and very often the most economical type decides the choice.

While reinforced concrete was the material of choice for superstructure when cement and steel were easy to procure we are now beginning to adopt prestressed concrete because of the economy in both cement and steel.

High tensile wire is not being manufactured in this country and we have to import it. This brings us to the great difficulty of foreign exchange. Ordinary steel is in short supply and has to be imported in large quantities. Therefore, no saving in foreign exchange accrues by adopting reinforced concrete in preference to prestressed concrete. It is hoped that manufacture of high tensile wire will be taken up before long in this country.

For building our big bridges over alluvial rivers, foundation difficulties are very considerable and conservative methods of sinking wells are both difficult and expensive in comparison to the modern methods of sinking caissons. Air-lock system has to be adopted in certain circumstances.

It is heartening to see a number of big engineering firms in this country taking up bridge construction and adopting modern methods. Bridge construction activity on a large scale has no doubt helped in this transformation and I hope we shall before long have many firms undertaking big bridge construction with modern equipment on a rising scale.

So far as engineering personnel is concerned, I am glad to say that a great majority of States are undertaking both construction and design of bridges—large and small—with courage and ability and have rendered a good account of themselves in this respect. Training of engineers in modern technique is, however, important and we must continue to send engineers abroad for advanced training for sometime to come.

### Engineering Personnel

As our road-system is growing and more money is being invested for more and better roads, it is essential that we should have a regular flow of skilled and trained engineers for designing and executing road works. Highway Engineering is no longer a guess work for engineers. It is a highly scientific branch of engineering and requires considerable skill and knowledge both in design and execution. To mention some of

the aspects of highway engineering, we have surveys both geological and geodetic and sometimes aerial surveys, soil surveys, traffic surveys, pavement designs, bridge designs, river training, etc. Specialist engineers are required to deal with these various branches of highway engineering. Up till now we had Civil Engineering Colleges imparting general knowledge to engineers in a three-year course. After this, engineers were drafted to different branches, Railways, Irrigation, Roads, etc., and they gradually picked up work in these branches. Naturally, it took some time for the young engineers to gain proficiency and until then they remained a liability. The need for imparting post-graduate training to qualified engineers was keenly felt and many Engineering Colleges in India now offer training in different branches of Highway Engineering. This is appropriate because such engineers will undoubtedly prove valuable assets to the Highway Departments of the States.

Many States have now separate Highway Departments. Until a few years back, many States had but one department of the P.W.D. under one Chief Engineer who was expected to know all about Irrigation, Roads, Buildings and Public Health. Luckily, this state of affairs has ended. Now as far as I know, roads and buildings have been separated from other branches in nearly all the States. Although in some States, Roads and Buildings continue to be one department, yet some States have made a further advance by separating roads from buildings and developing Highway Departments. Generally speaking, both the Highway Departments and the Roads and Buildings Departments are functioning properly in their respective spheres.

The time for having various expert engineers under the Chief Engineer in these various branches has come. All these experts should work either under the supervision of a Superintending Engineer in charge of Planning and Research or two Superintending Engineers, one in charge of bridges and the other in charge of Planning and Research, should the expenditure involved justify it. In other words, the time for specialisation in Highway Engineering has come. This is so in other countries and the benefit that accrues thereby is very considerable.

Ladies and Gentlemen, I have taken quite a good deal of your time and I shall not tax your patience any longer. Briefly to recapitulate what I have said, I have stressed the importance of roads and road transport in the implementation of our Five-Year Plans, discussed the question of highway economics how the factors of costs, revenues and benefits have to be correlated for a balanced development, pointed out the need for co-ordinated road research and a scientific approach to the problem of design of pavements and road structures, and last but not the least, focussed attention on the question of engineering personnel and specialisation in our P.W.D. or Highway Departments.

In conclusion, I might say that we advance by a series of efforts and progress by a succession of strivings towards the goal. Each session of the Indian Roads Congress is a milestone in the long and uphill task of building roads through the length and breadth of this sub-continent, a humble contribution in the mighty adventure of building up the nation.

May I now request you, Sir, to declare the session open.

## INAUGURAL ADDRESS

*By*

DR. RAJENDRA PRASAD

President of India

*New Delhi, January 5, 1958*

It gives me great pleasure to be here today to inaugurate the Session of the Indian Roads Congress. I welcome this opportunity to associate myself with this function, because though I have been the patron of the Indian Roads Congress for some years, this is the first time that I could participate in a function connected with it.



The President of India delivering the Inaugural Address

In a vast country like India which is known for its long distances and for the variety of its terrain and the modes of its transport, roads constitute one of the most important means of communications. At the present time we have a network of railway system and a fast-developing airways and a system of river transport both traditional and modern, yet all this advance in the manner and speed of transport has not detracted a whit from the importance which roads occupy in our system of communications. In actual fact, far from having an adverse effect on the role of the roads, the present-day developments have tended to make it more and more necessary to improve surface transport of which roads constitute such a significant part.

During the last ten years or so we have been busy implementing our reconstruction programme. The improvement of old roads and the laying of new roads have attracted a good deal of attention. We have now centralised most of the important roads and declared them as National Highways. Their maintenance and upkeep are directly the concern of the Union Government. The national highways generally

connect the various States with one another and are therefore of great strategic importance. They fully deserve the attention which the Government and the Indian Roads Congress are devoting to them. I am glad this Congress as also the Union and State Governments have not overlooked the fact that the feeder roads connecting the various districts and the countryside with the national highways are of equal importance. Actually the development of these roads bringing the far-flung villages and even the remotely situated hamlets within the network of our communications system is so imperative that without accomplishing it our plans of economic development would ever remain incomplete and infructuous. If our road system has to supplement the railway system and other means of communications, it must look for coverage in the field which it has not been possible for our Railway to cover.

It is clear that field belongs to our rural areas which have for centuries maintained a remote existence, cut off from the stream of our national life because of the inadequacy of communications. What are known as backward areas or tribal belts existing in various states and hill tracts have remained so far backward primarily because the absence of roads or any dependable links of communication with other areas segregated them, throwing them on their own resources and imposing upon them an atmosphere of remoteness. **I, therefore, consider the existence of good roads as a vital factor in determining whether our society can become an equalitarian homogeneous one or will continue merely as a conglomeration of social groups leading their own separate lives and maintaining different levels of social and economic development.** This social and cultural aspect of roads is not in any way less important than the economic aspect. After all, it is not human beings alone who travel by roads. It is not goods or commodities of various kinds alone which are transported through roads. The traffic of ideas also takes place through social intermingling which is made possible by roads. This last aspect of roads is, in my opinion, of fundamental importance, particularly for a country like ours which is populated by communities and groups belonging to varying levels of economic and social development.

When we have recognised these facts, nothing much need be said about the role of roads in a nation's life. Our nation is inspired by the ideal of equal opportunities for all and of speedier development of the backward areas so that they catch up with the more developed areas. This is a problem for the solution of which the development of our road system is very essential. I, therefore, attach great importance to the work of the Indian Roads Congress. Though this work belongs to the science of engineering and has to be executed by engineers, I have always looked upon it as having a tremendous bearing on our economic development, our social awakening and our political advance. You can legitimately feel proud of the great potentialities of your undertaking and work in that spirit for the improvement of the roads that we have and the providing of roads where none at present exist.

In the modern age road making, particularly the construction of bridges, is a highly technical undertaking, and it has developed as an independent branch of engineering. With the progress of researches in the field of science and the advance in our knowledge, the technique of road-building has also undergone great many changes. Modern engineers are called upon to construct roads which may be able to stand the inclemencies of weather, the none too infrequent vagaries of nature in the forms of floods, earthquakes, etc., and the great strain which traffic might put upon them. For evolving suitable techniques to meet these requirements a co-ordinated study of road problems and persistent research in the materials used for constructing them are necessary. It is in this respect that your Congress has done yeoman service by advising the Government on technical matters. Functioning as it does through various technical committees, the Indian Roads Congress has successfully evolved standard specifications in respect of various items of road work and new techniques and methods involved in constructing roads. You have rightly laid emphasis on guiding and co-ordinating research in road and bridge engineering. What has,

however, particularly interested me is your study of the problem of low-cost roads in India, because our requirements in the matter of roads are vast and our resources are limited and even so there are too many other claims on them. No road programme which does not eliminate wastage and ensure the most economical use of the material available and provide for the longest coverage at the cheapest cost can be practical for our country. I am very happy to know that you have not only kept this point in view but have been conducting field experiments for the achievement of this objective.

I congratulate the Indian Roads Congress on its success in evolving highly useful and practical methods which have proved of considerable utility to the State Governments in carrying out their road-building programme. I hope you will continue this useful work and achieve still greater success in your efforts for equipping India with a road system in keeping with our plan of development and suited to our economic resources.

I wish the Indian Roads Congress and all those connected with it the best of luck, and have great pleasure in inaugurating this Session of the Congress.

#### I.R.C. PRESIDENT'S CONCLUDING REMARKS

ON behalf of the Indian Roads Congress and on my own behalf I wish to express my deepest gratitude to Dr. Rajendra Prasad for giving us his valuable time to-day to inaugurate our Annual Session. His presence here is a source of inspiration to us and will greatly encourage us in our task in contributing our mite to the service of the country. We gather inspiration from his towering personality and his life of dedication to the cause of the country.

We of the Indian Roads Congress have had the real privilege of listening to his counsels of wisdom and it shall be our duty to follow his advice in the minutest detail.

I thank our numerous distinguished guests for responding to our invitation and for gracing the session by their presence.

I thank you all ladies and gentlemen.

May I now request you to award "The Indian Roads Congress Medal" to Messrs K. C. Ray, R. Subramoniam and S. Badaruddin for the following paper contributed to the Indian Roads Congress at their last Session.

Paper No. 193 - "Influence Fields for Finite Concrete Slabs supported freely along Two Opposite Edges and free at the other Two".

I also request you to announce that the following Papers have been highly commended :

- (1) Paper No. 191 - "Resistance of Abrasion of Concrete Pavements" by Messrs P. J. Jagus & M. R. Chatterji.
- (2) Paper No. 192 - "Design and Construction of a Prestressed Concrete Bridge Across River Coleroon" by Messrs. K. K. Nambiar & P. G. Nambiar.

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## MESSAGES

to

*The 22nd Session of the I.R.C.*

**Shri K. C. REDDY,**

**MINISTER FOR WORKS, HOUSING AND SUPPLY, GOVT. OF INDIA.**

“Highways of the country are the arteries of Industry and any effort towards the improvement of our Highways will materially contribute towards the industrial advancement and the economic progress of the country. I wish the Congress all success”.

2. Wishes for the success of the Session have also been received from the following :

- (i) Prime Minister.
- (ii) Governor of Uttar Pradesh.
- (iii) Minister for Finance, Govt. of India.
- (iv) Sir Kenneth Mitchell.
- (v) Shri G. M. McKelvie.
- (vi) Shri J. B. Vesugar.

### INSTITUTIONS :

- 1. American Society of Civil Engineers.
- 2. The Bureau of Public Roads, U.S.A.
- 3. Highway Research Board, U.S.A.
- 4. American Road Builders Association.
- 5. The Institution of Civil Engineers, U. K.
- 6. The Institution of Engineers, Australia.
- 7. Main Roads Department, Australia.

## INDIAN ROADS CONGRESS

### TECHNICAL - EXHIBITION

JANUARY—1958

ON the occasion of the 22nd Annual Session, the Indian Roads Congress organized an Engineering Exhibition at Exhibition Grounds, Mathura Road, New Delhi. The exhibition was opened on the 5th January 1958 by Shri Raj Bahadur, Minister of Shipping, Government of India. Speaking on this occasion, the Minister stated that the need for such exhibitions was very great. They enable the Highway Engineers to know the improved methods and techniques of design and construction developed after prolonged research and tests. These exhibitions also serve to educate the common man about the scientific methods and their application. Some details of the exhibits are given below. Complete text of the speech of the Minister is reproduced elsewhere in this issue.



A Stall at the Exhibition

#### (1) Central Road Research Institute, Okhla, New Delhi

In the soils section, exhibits dealing with the strengthening of black cotton soil, stabilized soil road construction, importance of subgrade treatment, etc., were shown. In the concrete pavements section, apparatus for measuring abrasive resistance of concrete, use of surkhi in place of cement, membrane curing, sonic method of testing concrete without destroying it, concrete cutting machine, etc., were exhibited. In the bituminous carpet section various design charts, suggestions for use of sand in bituminous work, etc., were on view. In the road design and construction section, several design charts of traffic movement, traffic counters, line markers, brake testing equipment, etc. were displayed. In addition to these, the Institute actually laid three sections of road constructed to three different specifications.



Stall of the Central Road  
Research Institute

**(2) Ministry of Transport & Communications,  
Department of Transport, Roads Wing.**

Models of the Jawahar Tunnel, roads in various stages of development and designs of difficult road junctions were exhibited. Photographs of important bridges and road maps showing National Highways and other roads were also shown. Statistical charts of interest to road and traffic engineers were the other exhibits displayed. Models of intersections and grade crossings were also on the view.



Stall of the Roads wing of the Ministry of Transport and Communications

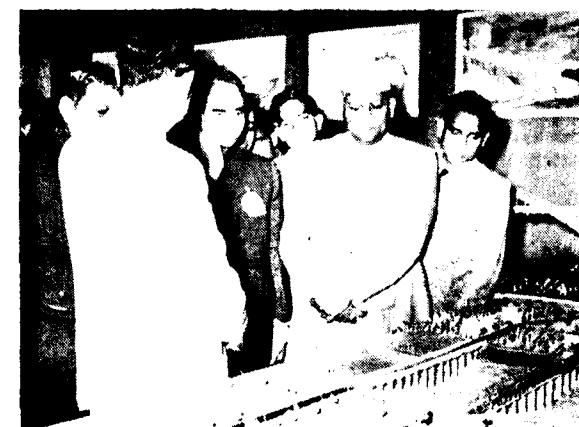
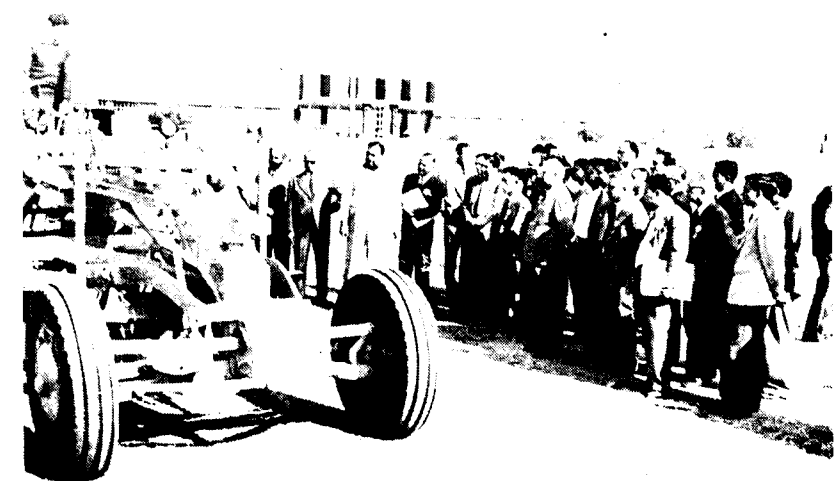
**(3) Ministry of Works, Housing & Supply &  
National Buildings Organization.**

The Ministry of Works, Housing & Supply and National Buildings Organization showed work done on building research and low-cost housing.

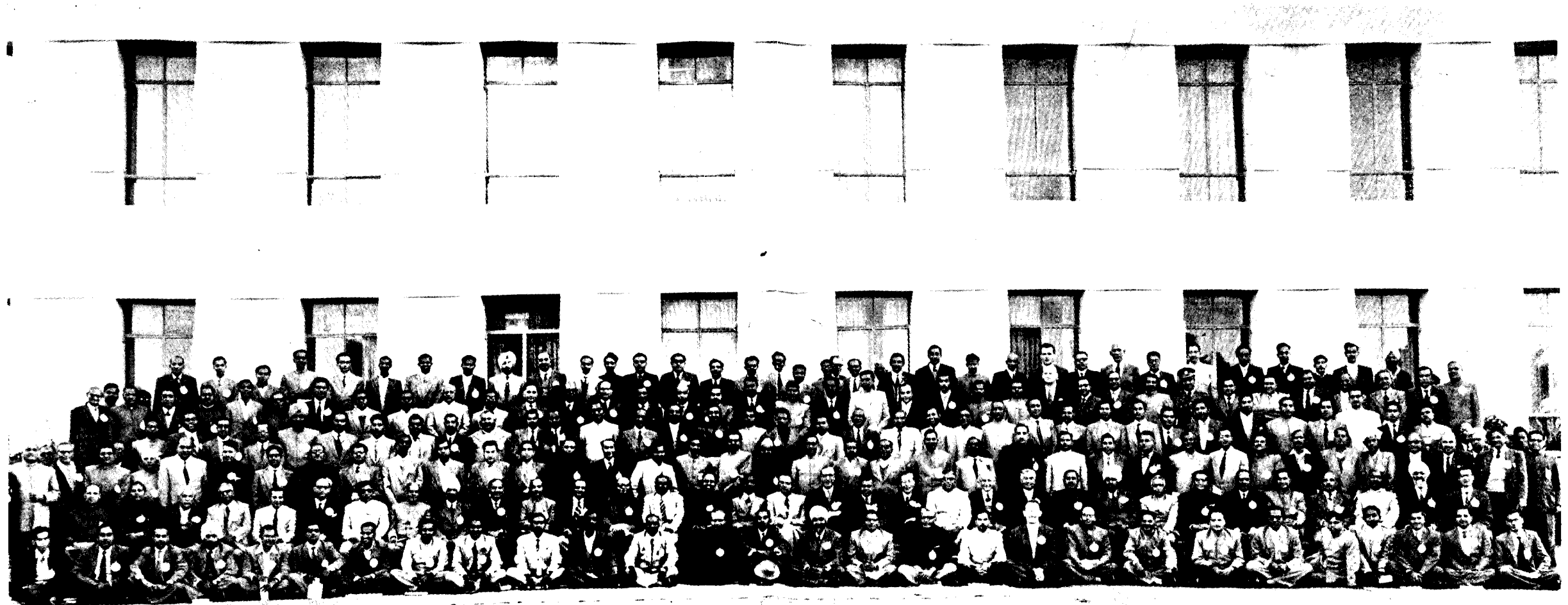


Stall of the Govt. of West Bengal

Delegates  
watching an  
item of Road  
Making  
Machinery



Stall of the Govt. of U.P.



INDIAN ROADS CONGRESS, TWENTY-SECOND SESSION, NEW DELHI, JANUARY 1958.

**(4) Central Public Works Department, New Delhi.**

The Central P. W. D., showed various models and photographs of buildings and roads.

**(5) Indian Council of Agricultural Research, New Delhi.**

The Indian Council of Agricultural Research showed results of improved methods of agriculture and animal husbandary.



A social fuction at the Exhibition grounds

**(6) Government of West Bengal.**

The more important exhibits were the models of approaches to Calcutta, low-cost bridges, and reinforced concrete bearings. In the research section were indicated methods of collecting undisturbed soil samples and of determining bearing pressure of soils.

**(7) Government of Bombay.**

Charts showing progress in the first and second Plans of the state and models of prestressed, bowstring girder, steel truss, etc., types of bridges in the Bombay State.

**(8) Government of Rajasthan.**

In keeping with the position of Rajasthan in the field of production of precious stones, a road map made with stones of different colours was exhibited. Other exhibits were models of important bridges constructed or under construction on National Highways and other roads of the State.

**(9) Government of Uttar Pradesh.**

On exhibits were models of an ideal road crossing with the meeting of roads at different levels, Garhmukteswar bridge, Banaras Ghat, Alaknanda bridge, etc. There were also charts of traffic flow, the second plan, etc.

**(10) Punjab P.W.D. Laboratory, Karnal.**

In the general section, soil samples, constituents and blocks were shown. In the roads section models of surfaced and unsurfaced stabilised soil roads were exhibited. In the buildings section sun dried bricks with waterproof plaster, bricks of cement and saw dust, etc. were shown.

**(11) Government of Bihar.**

A road map of Bihar, models of several bridges, two models showing steel rein-

*(Continued on page 31)*

**SPEECH**

*by*

**SHRI RAJ BAHADUR,**

**MINISTER OF SHIPPING, GOVT. OF INDIA**

Mr. President, Ladies and Gentlemen,

IT is both a pleasure and a privilege for me to declare open this Technical Exhibition organized in conjunction with the 22nd Annual Session of the Indian Roads Congress. I am indeed grateful to the Indian Roads Congress for giving me this opportunity of meeting you all here.

Evidently the need for such exhibitions as the one you have organized here is very great. On the one hand they enable the Road Engineer to acquire in a concrete form an idea of the improved methods and techniques of design and construction developed after prolonged research and innumerable tests; and on the other, they help to educate the common man about roads and road-building activities going on in the country, along with the scientific methods and their application, the various processes and materials employed in the construction of roads and bridges. As a tax payer, he comes to know how the available funds are being utilised to the best advantage and this enables him to understand and appreciate the difficulties and problems that confront us today regarding the improvement, expansion and maintenance of our road system. An exhibition of this type thus serves to establish the much-needed contact between the "road-builder" and the "road-user".

Our country today is engaged on a vast and unprecedented programme of development on all fronts. Be it education, health and sanitation of the community, harnessing of turbulent nature in the shape of training wayward rivers or generating power. These gigantic developmental activities have unleashed colossal demands and pressures on roads and road transport system of the country, as not all the construction materials and other requisites, and the output of our farms and factories can be transported by railways. Even if they could do so, to reach the railheads from the widely scattered villages which dot our countryside, roads and road transport are of primary importance.

I would, therefore, like to emphasise that our energies and efforts should be directed towards providing cheaper roads to connect villages with the nearest markets or the railheads, so that the farms can transport their produce economically to the consumers and, in turn, be able to receive their requirements from outside. We have to ensure that in our zeal to provide good roads in cities, we do not neglect the villages. After all, roads are vital to the social and economic prosperity of every region.

The Community Projects and National Extension Services, which have been embarked upon during recent years, have gone a long way towards the much-needed awakening of rural India and have focussed attention on rural communications. In order that this work may be continued more intensively and extensively roads will have to be given the topmost priority. Without roads all progress is tardy or temporary.

In this connection, as a layman, I would suggest that more investigations should be carried out on the utilization of local materials for the construction of roads, so that materials like steel and cement, which are in short supply, could be diverted for use on urgent schemes of development. It may also be seen whether road construction could be done in stages so that, as our economy improves, the road crusts could be gradually built up to carry more and heavier loads.

It gives me great pleasure to learn that your Organization has already done a lot of research work in providing roads at a low-cost by making use of stabilized soil and other similar methods of construction, so that a greater mileage of roads be built for the benefit of many. In this modern age when startling progress and development are being made in the realm of science and technology, more and more emphasis is being laid on the use of mechanical equipment in the various schemes of development.

In a country like India where there is no dearth of man-power, mechanization would not be a substitute for manual labour but a complimentary aid to it. It has a part to play in all forms of development not excluding construction of roads and bridges. I hope the deliberations of the Congress and the Seminar on Low-Cost Roads, under whose auspices this exhibition has been arranged, will evolve some way of making use of mechanized equipment side by side with the utilization of available local resources in the construction of cheap and durable roads suited to the needs of the country.

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(Continued from page 30)

forcement in bridges and various samples of stones found in the State were exhibited.

#### (12) Government of Madras.

Charts showing progress in the first and second plans, pictorial representation of several soil stabilized roads including the road leading to the pilgrim centre of Rameswaram, models of prestressed concrete bridges across Palar and Coleroon rivers and a model of a proposed grade separation in Madras City were exhibited.

Other participants in the exhibition were the following :

- The Associated Cement Companies Ltd.
- (The Concrete Association of India)
- M S Associated Instrument Manufacturers (India) Ltd.
- M S Burmah Shell Oil Storage Distributing Co. of India Ltd.
- M S Escorts (Agents) Private Ltd.
- M S Kailash Bros. Private Ltd.
- M S Marshall Sons & Co. (India) Ltd.
- M/S Millars' Timber & Trading Co. Ltd.
- M S United Provinces Commercial Corporation.
- M S Voltas Limited.
- M S Willcox (Buckwell-India) Private Ltd.

## ECAFE SEMINAR ON LOW - COST ROADS AND SOIL STABILIZATION

NEW DELHI—JANUARY 1958.

NEW DELHI was the venue of the Seminar on Low-Cost Roads and Soil Stabilization organized by the Economic Commission for Asia and the Far East. The meetings were held in Vigyan Bhavan from the 10th to the 18th January 1958. Delegates from 15 countries including Malaya, Burma, Indonesia, Thailand, Japan, North Borneo, U.S.S.R. as well as the U.S.A. and the U.K. attended the Seminar.



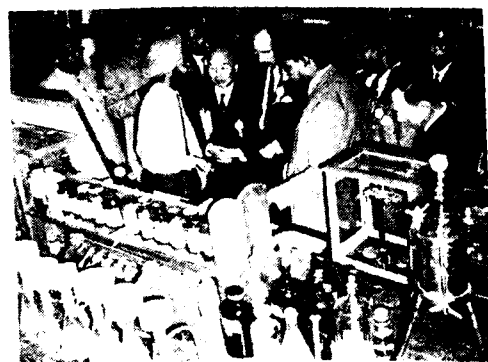
Delegates at the Inaugural Session of the ECAFE Seminar

The Seminar was inaugurated by Shri Lal Bahadur Shastri, Minister for Transport and Communications, Government of India. Addressing the Seminar, the Minister said that a formidable task which faced the under-developed countries of the region was to build themselves up. What was needed was an all-out and concerted effort in practically every sphere of activity including transport. The present condition of road transport facilities in the ECAFE Region was not generally satisfactory. The countries concerned need lifting their transport system to a higher level so as to meet the demand which was being rapidly generated by development plans. The most serious handicap was that of finance. With the present cost of construction it was obviously impossible for the under-developed countries to have an adequate road system which would meet the demands of development programmes and the resultant expanding economy. Hence there was an immediate and imperative need for cheapening the construction of roads. The techniques, which encouraged the use of local materials to the maximum extent possible, greatly reduced the cost of transport of materials of road construction, thereby resulting in an appreciable reduction in highway construction costs. The techniques required some knowledge of soil science and the countries should try to arrange for the necessary training of their personnel in this field.

The Minister also expressed the view that a special fund for financing rural road development plans should be created. He also suggested that the Member countries of the ECAFE should help each other by throwing open their training institutes for providing training to the engineers.

Shri M. S. Ahmad, Chief of the ECAFE Transport Division welcomed the experts to the Seminar. He also thanked the Government of India for the facilities for holding the Seminar and the Indian Roads Congress for their co-operation. In his address to the Seminar, he stated that to meet the requirements of rural transportation, it was essential to develop a type of road which was easy to build, while utilizing simple techniques and available local resources, so that initial investment might be kept down to a minimum employing at the same time to the maximum possible extent the cheap and abundant manual labour available in many parts of the region.

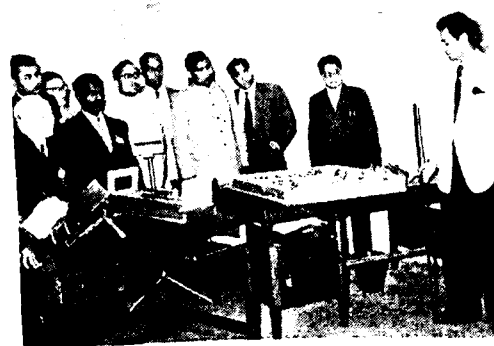
Shri Sujan Singh (Vice-President of the Indian Roads Congress) was happy to associate the Congress with the Seminar and he briefly explained the work done by the Congress.



Delegates seeing Soils Division,  
Central Road Research  
Institute



Delegates seeing Bitumen Division,  
Central Road Research  
Institute



Delegates seeing Traffic Division,  
Central Road Research  
Institute

The Seminar elected Shri H. P. Sinha, Consulting Engineer (Road Development) and Joint Secretary to the Government of India as its Chairman. Luang videt Yontrakich (Thailand) and Shri T. Mori (Japan) were elected as the first and second Chairman respectively. The delegates then formed themselves into different groups to deal with various subjects. A general report was later on compiled from the recommendations made by these groups and this report was discussed and adopted at the plenary session on the 18th January 1958. The recommendations made by the Seminar included a suggestion for the establishment of a separate road fund, for the building of which taxes on various items were suggested. The definitions of a Low-Cost Road and procedure for Route investigation were also laid down by the Seminar.

The Seminar also recommended that the allotment of funds for Road Development should be non-lapsable. Stressing on the development of Rural Roads, the need for ear-marking an appropriate portion of the Road Fund for these Roads was suggested. Other subjects on which the Seminar made recommendations are: (1) training of engineers in the technique of Low-Cost road construction; (2) standards for the construction of Low-Cost Roads such as land widths, gradients etc.; (3) cheap type



A social function at the Central Road Research Institute



Another social function

designs for the construction of culverts and bridges on roads. The Seminar also recommended that all authority with regard to traffic control should vest in the proper highway authority. Another most important recommendation made by the Seminar was about stabilization of soil. Improving the properties of the soil met with at the site of the road with a view to enable it to withstand the disintegrating effects of

traffic reduces the cost of the road to a minimum. Many miles of soil stabilized roads have been constructed in India and in some other countries of the region. The Seminar pooled the knowledge available in this branch of engineering and made recommendations on the technique of design and construction of such roads. The adoption of the recommendations, it is expected, will reduce the cost of construction considerably, especially in areas where the conventional road building materials are costly or are not available.



Delegates inspecting surface treated stabilised Soil Roads near Batala (Punjab)

The technique evolved to withstand bullock-cart traffic has been used with some success in India. The method, in brief, consists of suspending soft aggregates, which can withstand the wear and tear of the wheels of the bullock cart, in a matrix of soil whose properties have been improved by suitable blending of different types of soil. It is found that this type of road could stand low traffic intensity. When the traffic increases the surface could be improved by the application of a bituminous surface. Specifications in regard to this technique were recommended at the Seminar.



Delegates inspecting Stabilised Soil Roads near Batala

The delegates were taken round the the Central Road Research Institute on 14th January. On the 18th evening, they went on Inspection Tours to Batala and Bhakra Nangal. They travelled by a special train to these places. The delegates inspected the stabilized soil roads near Batala on the 19th January and the next day they visited the Bhakra Nangal Project and saw the various stages of construction of the mighty Bhakra Dam. Thus the Seminar came to a successful end.

## ECAFE SEMINAR ON LOW-COST ROADS & SOIL STABILIZATION

### OPENING ADDRESS

*By*

SHRI LAL BAHADUR SHASTRI  
Minister of Transport and Communications,  
Government of India

*Friday, the 10th January, 1958*

Ladies and Gentlemen,

It was indeed a welcome decision of the E.C.A.F.E. to have selected India as the venue of this Seminar and it is with great pleasure that I extend a warm welcome to the distinguished delegates who are here to take part in it. It was also a happy idea to have arranged this Seminar immediately after the Annual Session of the Indian Roads Congress—the premier association of the Engineers of this country, devoted to the cause of road development. This should give to our engineers a very unique opportunity to develop personal contacts with experts from abroad and to have mutually beneficial exchange of ideas.



Inauguration of the Seminar.

It is a strange phenomenon that whereas wars are bad in themselves and they have to be abjured at all costs, the last two world conflagrations resulted in releasing

forces which led to the freeing of a vast number of peoples of Asia and Africa. And to day we find ourselves in the midst of a fast changing world where country after country is coming into its own and now trying to develop and build itself up. The task is, however, a formidable one for the backwardness of the countries of this region in almost every sphere is something phenomenal. They have largely remained untouched and unaffected by the rapid developments in other countries as not long ago only the minimum and absolutely essential needs were attended to. Countries of this region are, therefore, to day faced with a serious situation. Take, for example, the question of transport. There is a tremendous shortage of roads and there are innumerable unbridged rivers. This comes in the way of general development of the people who feel somewhat frustrated that we cannot go faster. The people naturally do not want to wait for long and we must take due note of that factor. Comparison of conditions in this region with those in the highly developed countries of the West is apparently unrealistic but then there is no denying that the public mind often reacts in that way. We need not, however, feel pessimistic or diffident for if our problems are big, so are our potential resources. What is needed is a mighty effort and you who are gathered here have a vital role to play.

The present condition of road transport facilities in this region is thoroughly unsatisfactory. Vast areas still remain unserved and unconnected. In India the position is particularly difficult. Our area is large and population exceedingly big. The communications in the cities could perhaps be considered tolerable but if you just move away even two or three miles from the main urban areas, you would very nearly feel that you had gone to a different land altogether. Except for the National Highways which also are interspersed with gaps, even the metalled roads of Local Boards are in poor condition. And then, about half of our roads are 'kutchas' which mean undulating dusty pathways passing through narrow lanes in the villages and an arduous journey throughout. Most of the roads both in the smaller cities and in the rural areas are under the charge of Municipal and District Boards and they find themselves at sea, as they have neither the funds nor other resources to deal with the problem. Truly, the position of roads in the rural areas is beyond description. And then, we have large hilly tracts where roads can be the only means of transport. The cost of construction in such tracts is relatively much higher, but the fact remains that we must do a lot more for opening up these areas by building inter-connecting roads. Some priority is given to the needs of hilly tracts but we have not gone beyond the initial stage yet. It is from this stage that we have to lift our transportation system to a higher level so as to meet the demand which is being rapidly generated by our development plans. The pace of improvement would, I am afraid be very slow unless we are able to find methods for dealing with the problem effectively and quickly.

The most serious handicap in our way is that of finance. No one would dispute that we need more and better roads which are in fact the main arteries of a country through which the life blood of economic activity flows. But then we would need very large sums of money, much beyond the limits of available resources. Some idea of the financial implications can be had if I gave you some facts about my own country. If the current Plan targets of road construction are reached, they would bring our road system to a stage when no village in a well developed area would be more than five miles from a main road and in an undeveloped area more than 20 miles from such a road. If, however, we were to aim at bringing every village within three miles from the main road in developed agricultural area, within 9 miles in semi-developed area and forest area and within 20 miles in undeveloped area, that would involve an expenditure of something like Rs 4,000 crores. As against this, the total provision for the construction and development of roads in our current Plan is just Rs 290 crores and no more.

Faced with the difficulty of adequate finance for the various development programmes of which road development is one, we have to devise means of using every rupee to the best advantage. With the present cost of construction, it is

obviously impossible for the under-developed countries of Asia and the Far East to have an adequate road system which will meet the legitimate demands of the development programmes and the resultant expanding economy. Hence the immediate and imperative need for cheapening the construction of roads. This is a problem for the research workers and engineers and it is indeed gratifying to note that this Seminar is going to thrash it out in detail. In any case, it is obvious that if the road mileage is to be increased at a satisfactory pace, the cost of construction has got to be reduced and we would have to seek the help of the local people in terms of labour and possibly also in terms of money.

*Prima facie* the construction of low-cost roads by the adoption of the soil stabilization technique offers a solution of the problem which is worthy of pursuit. I understand that the technique has passed the laboratory stage and is being tried in field experiments, in order to reach definite conclusions on its comparative merits. It is also relatively complicated requiring the use of the laboratory and the services of the scientist. The transport of materials accounts for a considerable percentage of the cost of road construction and obviously if this item could be eliminated or greatly reduced by the maximum use of locally available materials after necessary treatment, it will result in appreciable reduction in cost. I am sure this Seminar representing the cream of the Engineers and experts in this part of the world will give a definite lead in this direction and that this lead would be followed up steadfastly in a spirit of adventure. If the comparative cheapness of this technique is established, the initial difficulties involved in the change-over should be faced boldly and overcome. The technique will also have to be simplified so that it can be easily adopted by the field worker.

Whatever may be the proposals regarding low-cost roads, the question of funds would still remain. What is needed in my view is the creation of a special fund for financing rural road development plans. This fund could be fed from different sources. Only the other day, the President of the Indian Roads Congress made a suggestion in this behalf. Other methods could also be thought of. For instance, could we not make a small levy on the users of the various forms of transport? This could be like a betterment fee, compensating the people for what they give, with something in a definite and positive shape. Nothing would be more helpful to a villager for developing his economy than proper roads reaching every nook and corner and inter-connecting the villages which have remained isolated so far. This would fetch him much more for his foodgrains and also reduce the cost of supply of other materials to him. If such a levy is considered feasible, it should be reasonably low so as not to impose any heavy burden and this could well be abolished after 10 or 15 years. The details of any such schemes would have to be worked out very carefully and it is for the experts to draw up a practicable and workable scheme.

I feel further that the problem of rural roads is of a such a fundamental importance that it would be well worthwhile for the State Governments to set up for this purpose separate and independent sections in their Public Works Departments. As we have Highway Engineers in some of our States, we could well have Village Road Engineers in all of them.

If we could on the one hand augment our resources and have proper road building organization, and on the other cut down the cost of road construction, it would open out a new phase in the history of road communications and raise the hopes and aspirations of our people very high indeed. At the present moment, for the villager to conceive a metalled road from his village or even 3 to 5 miles away therefrom is merely a dream.

Besides, the question of technical personnel is equally important. There is dearth of qualified engineers and overseers etc. And in the Asian and African countries

where developement has to take place on quite a big and extensive scale, the number required has also to be fairly large. Special steps have to be taken in this regard and member countries of the E.C.A.F.E. could very well help each other in this matter. Training institutes should be open to other countries also and their young men accommodated in them. I know you must already be bestowing adequate attention on this subject.

I hope and trust that the delegates from abroad would also avail of this opportunity to visit some parts of our country and see things for themselves. They would be able to enjoy our old and historic cultural attainments and also see our new ventures, big and small. I have no doubt that these different centres would be worth your visit. We would, I hope, be able to provide the needed facilities.

I am not a technical man, but I know the needs of our people and I can well visualise the same of the people of other countries who are in the process of building up after their liberation and I have, therefore, tried to place before you my ideas from that aspect. I know, I have contributed nothing new and I, therefore, feel all the more honoured for your having asked me to inaugurate this Seminar, which I gladly do, wishing you well and all success. May you be able to suggest the solution of a very difficult problem and be the recipient of the good wishes of the vast humanity specially of those living in the far flung rural areas of the Asian and African countries.

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*Cicero maintained that the greatest gift which could be offered to the State was to train youth and we may devoutly hope that in the new technological establishments now being created throughout the country, the development of character and culture shall proceed concurrently with the teaching of mathematics and science.*

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#### DEFINITIONS OF HIGHWAY ENGINEERING TERMS.

- SKEW-BRIDGE OR CULVERT:** A bridge or culvert of which the centre line is oblique to the axis of the crossing.
- SLAB BRIDGE OR CULVERT:** A bridge or a culvert having slabs only as its superstructure.
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### OPENING ADDRESS

By

SHRI M. S. AHMAD

(Chief of the Transport Division, ECARF)

IT gives me great pleasure on behalf of the Executive Secretary to welcome you to the Seminar on Low-Cost Roads and Soil Stabilization.

At the outset, I wish to place on record our deep sense of appreciation and gratitude to the Government of India, which, through its kind co-operation, has made it possible for the United Nations Economic Commission for Asia and the Far East and United Nations Technical Assistance Administration to hold this Seminar here. I would also like to take this opportunity to convey to the Government of India our warmest thanks for their excellent arrangements and kind hospitality, and for the effective technical liaison established with the secretariat in connection with the substantive work required for the convening of the Seminar. We are also very grateful to the Indian Roads Congress for their co-operation and help and particularly for their having agreed to include in their agenda the consideration of some of the aspects of Low-Cost Roads and Soil Stabilization. This has enabled the national experts to prepare papers on this subject, while the holding of the seminar immediately following the Indian Roads Congress Session has made it possible for many of these experts also to participate in the technical discussions at the seminar.

Thanks to the co-operation of UNTAA it has been possible to secure the services of three experts, two from the region and one from Europe for participating in our discussions. I need not expatiate on the advantage of a seminar such as this when discussing technical problems of the type now engaging our attention and sharing experience and knowledge on such problems. I have no doubt that full advantage will be taken by all of us to share experience and knowledge with one another at the seminar with a view to formulating recommendations which may be useful to the countries of the region.

To a group of experts such as yourselves, it is not necessary to dwell at length on the significant part played by low cost roads in the economic development of the ECARF region. As you are aware the type of roadway is largely dependent on the availability of resources and the type of traffic to be catered for. The existing pattern of transport development has been generally influenced by geographical, topographical and economic factors. Mountains, jungles, swamps and rivers have stood in the way of rapid development of modern transportation systems in many parts of the region. Heavy capital expenditure has also rendered it difficult for governments to find finances for adequately developing highways. Many countries urgently need for their economic development access to rural areas. Therefore to meet the requirements of rural transportation in the ECARF region, it is essential to develop a type of road which is easy to build, involving simple techniques and making use of available local resources so as to reduce cost, and at the same time utilizing the cheap and abundant manual labour available in many parts of the region. For the effective utilization of manual labour it is essential that simplified techniques of road construction and soil stabilization are developed so as to minimize the dependence on costly imported equipment which, aside from the initial investment, also require a high degree of skill and training for their operation and maintenance.

I am glad to note that many governments have devoted considerable thought and attention to this subject, and notable progress has been made under their community development projects and similar schemes. In this connection, I should like to mention that, one of the most important methods of low-cost road construction is the development of suitable techniques for soil stabilization. This subject is of interest not only to road transport authorities but also to the railways of the region and I am glad that at this seminar we have the active participation of railway experts who will give us the benefit of their knowledge and experience in finding solutions to this problem, which is of common interest both to the railway and highway experts.

I should now like to review briefly the work already undertaken by the ECAFE secretariat in this field. In response to the recommendation of the Highway Sub-Committee, the secretariat had undertaken a detailed study in which the problems of low-cost roads and soil stabilization techniques have been discussed in detail. This document, which is now before you, was considered by the Highway Sub-Committee at its third session in Manila in 1955 and the Railway Sub-Committee at its fourth session in New Delhi in 1956. Certain additional information in regard to soil stabilization as desired by the Highway Sub-Committee has been collected and is now presented for your consideration. Valuable work in this field has been carried out by Public Works Departments in many countries, and by a number of specialized institutions both within and outside the region, and I am happy to note that we have with us experts from some of these institutions who have contributed valuable technical documentation for the consideration of the seminar.

A tentative outline covering the main aspects of the problem is suggested in the Secretariat's note TRANS/Sub. 2/LCR/INF/1. But in case you wish to take up any other aspects you are of course free to amend the outline suitably.

Before I conclude, I would like to add that holding the seminar in India with its well developed techniques in the construction of low cost roads will provide us with extremely valuable opportunities for studying the problem. I have no doubt the experts participating in the seminar will take full advantage of it to study the various aspects of the problems under actual operating conditions. I look forward with keen interest to a very interesting seminar on a subject which is of such great interest especially to the rural communities of the region.

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*Daughter : " Father, can my new boy friend replace your business partner who died yesterday?"*

*Father : "It's all right with me—if you can arrange it with the undertaker."*

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# ECAFE SEMINAR ON LOW-COST ROADS AND SOIL STABILISATION

## SPEECH

*By*

SRI SUJAN SINGH,

Vice-President, Indian Roads Congress.

*Friday, the 10th January, 1958.*

HON'BLE Minister of Transport & Communications, Minister of Shipping, Minister of Civil Aviation, Deputy Minister for Railways, Chief of Transport, United Nations ECAFE, Delegates to the Seminar, Ladies & Gentlemen,

In the absence of the President of the Indian Roads Congress, this pleasant task of associating the Roads Congress with the Seminar on Low-Cost Roads has fallen on me. The Congress is very happy to take part in these deliberations and will strive its best to give all possible assistance.

As its name implies the Congress is vitally concerned with the development of roads. Therefore, when it was suggested to the Congress at its 21st Session held in Shillong in May, 1957 that it might hold its next session just before or after this Seminar, every one agreed to the suggestion most readily and we finished the 22nd Annual Session of the Congress only yesterday.

It was generally felt that the Seminar will be of mutual benefit as the Indian Roads Congress has also an Experts Committee on Low-Cost Roads and Soil Stabilisation and papers prepared by engineers from all over India were discussed at that Committee. It is now proposed to pass on those papers along with the recommendations of that Committee to the Seminar for their information. The experts from India who will be staying back, some of whom have also prepared papers for the Seminar, would get an opportunity of meeting and discussing with experts from other countries, both from within and outside the ECAFE region, various technical problems concerning low-cost roads. It is hoped that the Seminar would be able to find possible solutions of a number of specific problems in regard to low-cost roads and soil stabilisation techniques facing the ECAFE region as a whole.

The Indian Roads Congress is a non-official body and was formed in 1934. Its membership which is open to all technical persons and bodies interested in road development, now stands at 1,500. The basic work of the Congress is carried out in its eighteen Committees, each dealing with a particular technical aspect of road development such as specifications and standards, road research, soil stabilisation, bridges, education, construction equipment, traffic engineering, and so on. The tangible results of the effort put in by its members can be seen in the numerous publications on road and bridge standards brought out by the Congress. Another line of activity of the Congress, which is equally useful, is the discussion and publication of technical papers contributed by its members in respect of works on which they are engaged. This helps in a wide dissemination of the knowledge of engineering technique and practical experience.

A sizeable library of technical books and journals maintained by the Congress also plays a very important role in assisting the members of the Congress.

I have given these details of the Congress as some of the delegates to the Seminar who have come to India for the first time, may not be fully aware of the activities of the Congress. We shall feel honoured and derive the greatest satisfaction from giving the delegates whatever service is within our means.

On behalf of the Congress I wish the deliberations every success.

BRIDGING INDIA'S RIVERS  
PRESTRESSED CONCRETE BRIDGE ACROSS JAFFAR  
SAHEB CANAL ON N. H. NO. 5 IN ANDHRA

(Contributed)

JAFFAR Saheb canal is an irrigation channel which the south approach road to Pennar Bridge near Nellore has to cross immediately after leaving the Pennar Bridge.

This canal crosses the south approach road at a skew angle of  $31^{\circ}30'$  and a skew bridge of one span of 97 ft-0 in. clear and 101 ft-0 in. effective was constructed for the crossing with the abutments parallel to the flow of water.

The bridge is located at a distance of 42 ft-70 in. from the Pennar Bridge along the same centre line and at a distance of

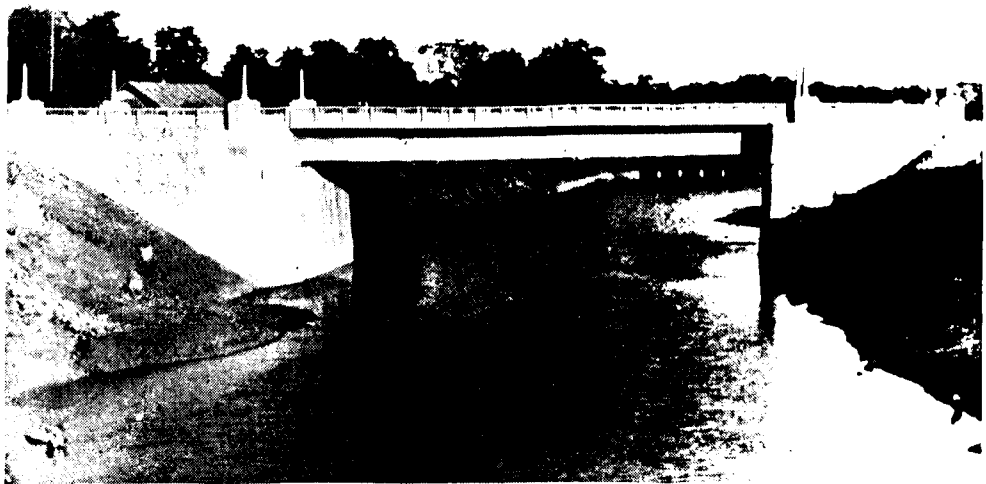
this strata at level plus 29.00 i.e., eleven feet below the bed level. Cement concrete 1 : 3 : 6 with  $1\frac{1}{2}$  in. granite metal was used in foundations. (Fig. 1)

Sub-Structure

The abutments and wings were of mass concrete 1 : 3 : 6 with  $1\frac{1}{2}$  in. granite metal and 25% plums of 6 in. to 8 in. size. Continuous bed blocks in R.C.C. 1 : 2 : 4 with  $\frac{3}{4}$  in. granite metal were laid to a depth of 1 ft-6 in.

Superstructure

The superstructure of the bridge was



300 ft-0 in. on the down-stream side of the existing railway bridge of the north east-line.

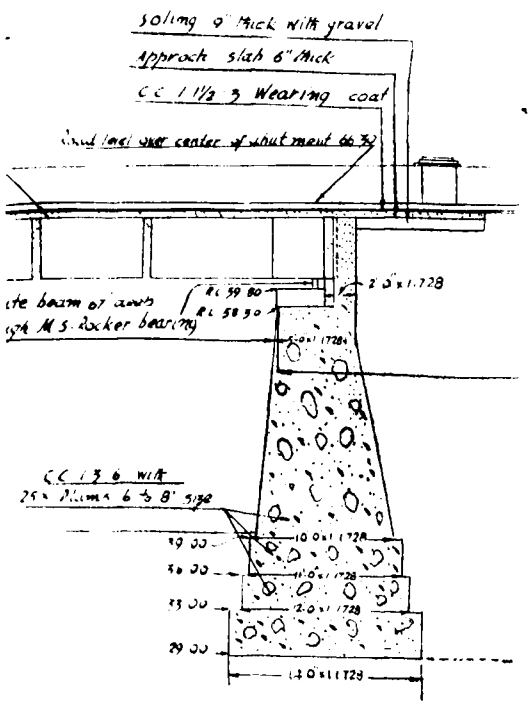
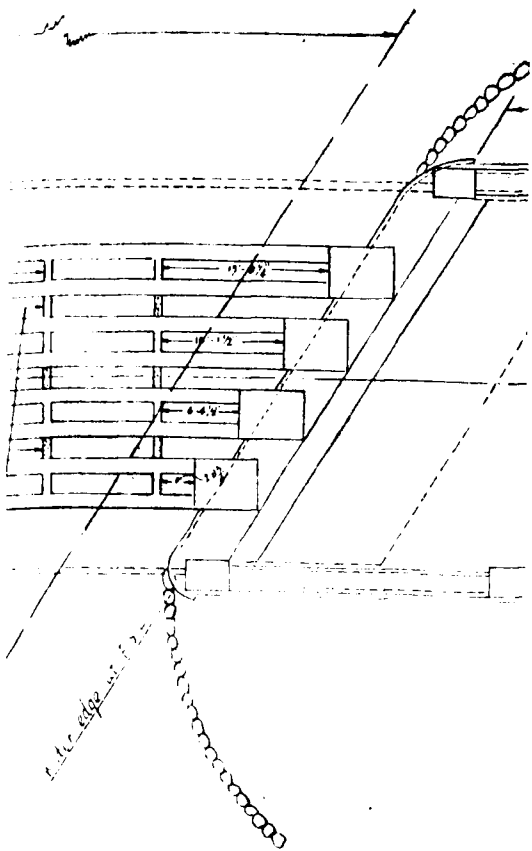
Foundations

The foundations were of open excavations in gravelly and laterite strata. Laterite rock was met with at R. L. 33.00 i.e., 7 ft-0 in. below the average bed level and this laterite layer extended to more than 8 ft-0 in. depth. The foundations of wings and abutments were made to rest on

kept in a grade of 1 in 85 in order to avoid introduction of vertical curves within a short length of 427'-0" available just below the bridge across Pennar.

The superstructure consists of 4 prestressed concrete beams of sizes  $41" \times 61"$  of 'U' shape as shown in Fig. 2. The beams are connected by cast in situ diaphragms and the thickness of the deck slab is 6".

(Continued on page 50)



SECTION ALONG BCD

BRIDGING INDIA'S RIVERS

PRESTRESSED CONCRETE BRIDGE ACROSS JAFFAR  
SAHEB CANAL ON N. H. NO. 5 IN ANDHRA

(Contributed)

JAFFAR Saheb canal is an irrigation channel which the south approach road to Pennar Bridge near Nellore has to cross immediately after leaving the Pennar Bridge.

This canal crosses the south approach road at a skew angle of 31°-30' and a skew bridge of one span of 97 ft-0 in. clear and 101 ft-0 in. effective was constructed for the crossing with the abutments parallel to the flow of water.

The bridge is located at a distance of 42 ft-70 in. from the Pennar Bridge along the same centre line and at a distance of

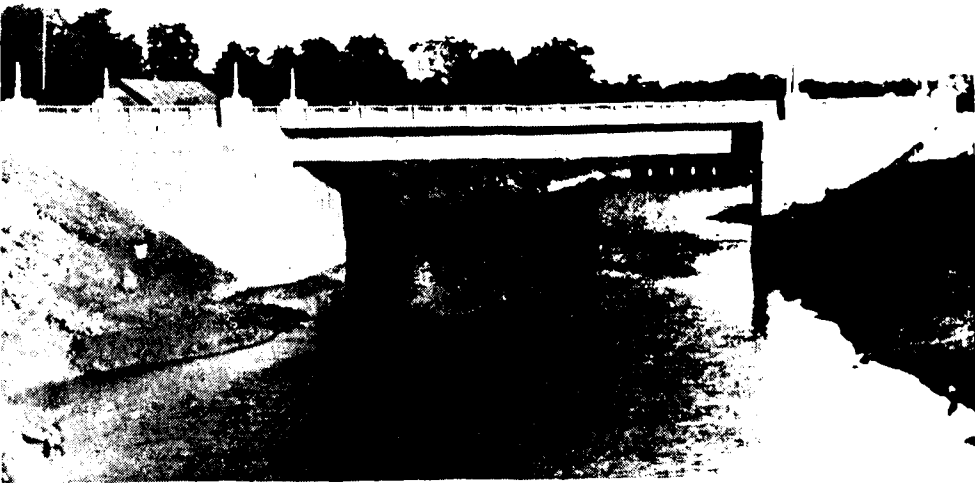
this strata at level plus 29.00 i.e., eleven feet below the bed level. Cement concrete 1 : 3 : 6 with 1½ in. granite metal was used in foundations. (Fig. 1)

Sub-Structure

The abutments and wings were of mass concrete 1 : 3 : 6 with 1½ in. granite metal and 25% phums of 6 in. to 8 in. size. Continuous bed blocks in R.C.C. 1 : 2 : 4 with ¾ in. granite metal were laid to a depth of 1 ft-6 in.

Superstructure

The superstructure of the bridge was



300 ft-0 in. on the down-stream side of the existing railway bridge of the north east-line.

Foundations

The foundations were of open excavations in gravelly and laterite strata. Laterite rock was met with at R. L. 33.00 i.e., 7 ft-0 in. below the average bed level and this laterite layer extended to more than 8 ft-0 in. depth. The foundations of wings and abutments were made to rest on

kept in a grade of 1 in 85 in order to avoid introduction of vertical curves within a short length of 127'-0" available just below the bridge across Pennar.

The superstructure consists of 4 prestressed concrete beams of sizes 41" x 61" of 'U' shape as shown in Fig. 2. The beams are connected by cast in situ diaphragms and the thickness of the deck slab is 6".

(Continued on page 50)

SPUR DIKES AT BRIDGE ENDS STREAMLINE FLOW

(Mississippi has adopted a series of standard earth dikes for upstream side of bridge ends to cut tendency to scour and increase efficiency of the structure.)

MANY of the bridges in Mississippi, and in other states, according to Karl Dupes, bridge designer of the Mississippi State Highway Department, writing in the May issue of Mississippi Highways, the department's magazine, must be placed in wide overflow planes where flood waters are forced to flow parallel to the roadway embankment for a considerable distance to reach the bridge opening.

When these currents reach the bridge opening, Mr. Dupes says, they are moving in a direction normal to the general flow through the bridge. Their velocity prevents them from changing immediately so they swing around the bridge-end shoulder in an arc that takes their thread into the opening before they become parallel to the general flow direction.

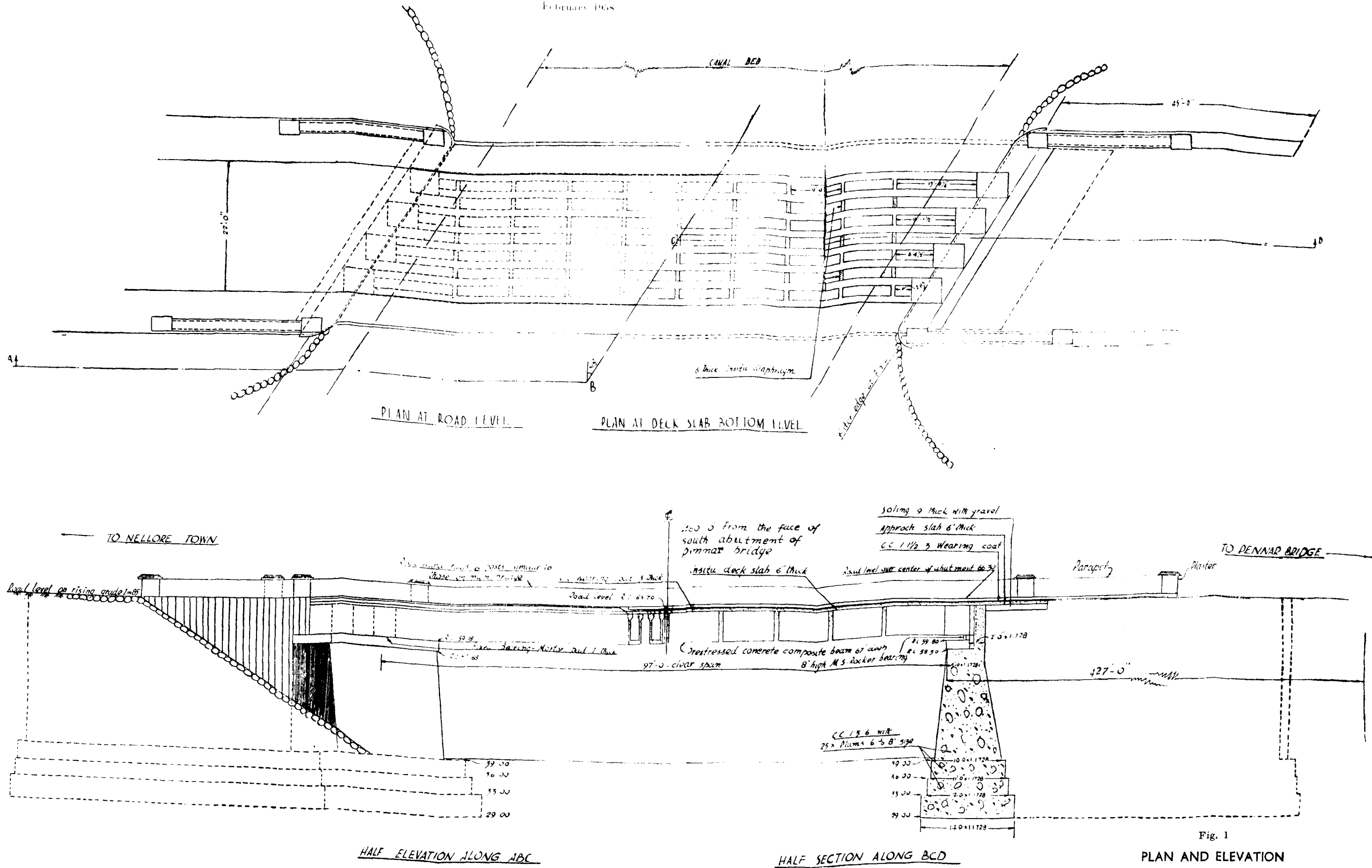


This wide swing develops an upstream eddy current at the bridge ends, in effect cutting down the effective opening and reducing the efficiency of the bridge.



There is always a line of draw-down just upstream of a bridge opening where the upstream stage is converted into velocity head to produce the necessary increase in velocity for the quantity of water passing through the bridge opening to equal the flow in the wide overflow plane above. Usually this line meets the roadway shoulders somewhere on the rounded or flared section just above the opening. The tendency for scour of the shoulders is greatest along this line.

February 1958



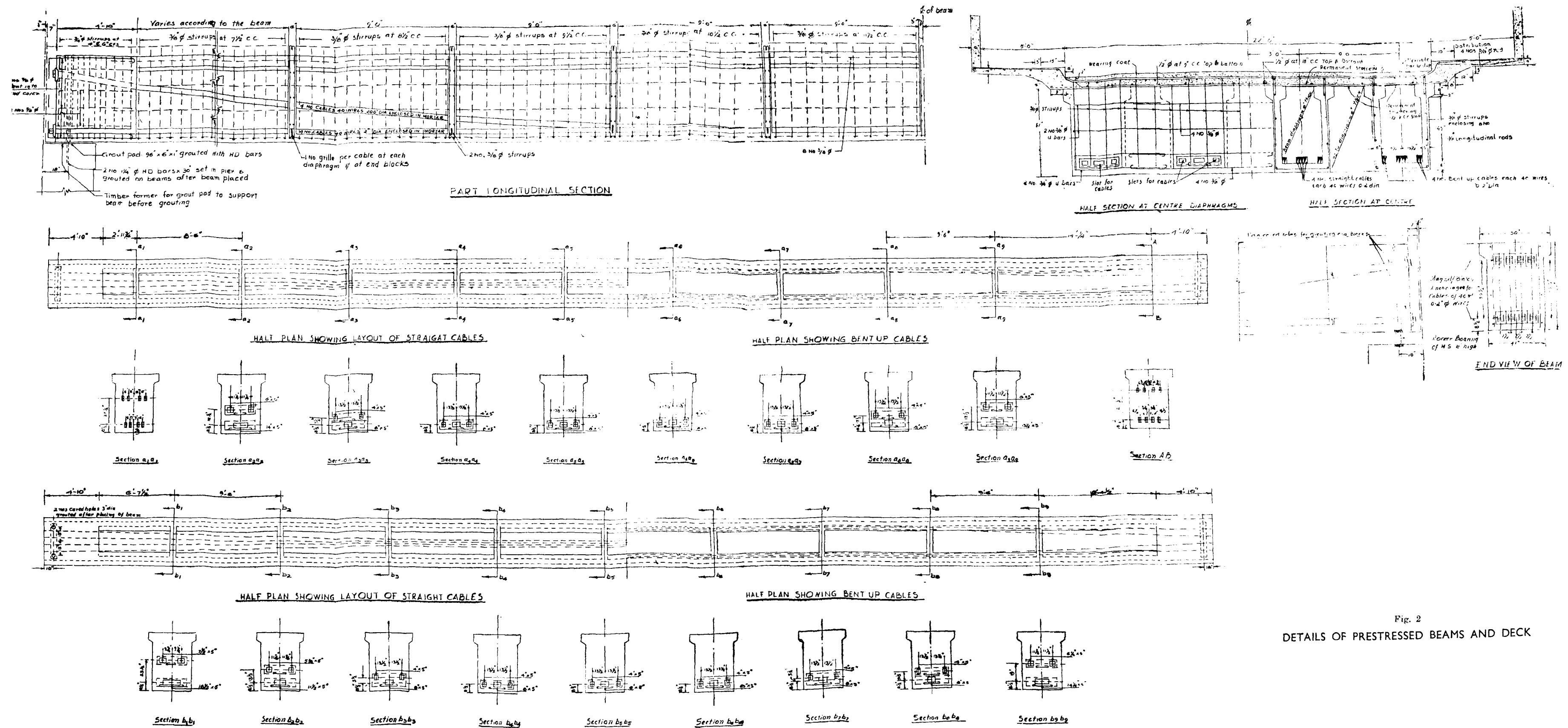


Fig. 2  
DETAILS OF PRESTRESSED BEAMS AND DECK

The reduced efficiency of bridge openings and the tendency to scour as a result of these upstream eddies at the bridge ends has been recognized for some years and considerable research has been carried on to find an economical means of streamlining the flow.

This research has indicated that some type of dike or jetty placed on the upstream side of the roadway shoulder can accomplish this. The material of which the dike is constructed, the length in relation to the bridge span, the placement in relation to the bridge end and the alignment have all been investigated.

As a result of these studies the Mississippi highway department has adopted a series of standard dikes constructed of earth, with 2 to 1 side slopes to match the spill-through roadway fill slopes at bridge ends, the side slope of the dike on the stream side forming a continuation of this spill-through slope. The lengths of the dikes are related to the bridge length—a minimum 50 ft dike is used with spans up to 200 ft; a 75 ft dike for lengths between 200 and 300 ft; a 100 ft dike for lengths between 300 and 400 ft; a 125 ft dike for length between 400 and 500 ft and the maximum 150 ft dike for lengths of more than 500 ft.

The use of dikes on new bridges is now standard practice. When conditions indi-

cate that the benefits are not justified the dike is omitted.

The contour adopted for dikes in Mississippi is a quarter ellipse with minor and major axis ratio of 1 : 3. This form was developed by the U.S. Waterways Experiment Station at Vicksburg in its studies for dikes at the entrance to diversion works under design by the Mississippi River Commission.

It has been found that this kind of dike is the most efficient form to develop smooth streamlining of flow from a wide floor plane through a constricted opening in an impermeable dike. The present standards call for riprap protections on the ends of the dikes up to high-water level from a point approximately 120 deg. from the tip of the dike on the land side, continuous around the end to the 0.70 ordinate point on the stream side. The extent of the riprap protection around the dikes may be changed with more experience.

Mr. Dupes reports that many of the bridges presently under contract will have the dikes. The dikes that have been installed on various bridges are performing very well. And district engineers and construction personnel have been impressed with the performance of the dikes and are adding them to some of the existing bridges.

(From "Better Roads" July, 1957.)

(Continued from page 46)

The width of roadway over the bridge is 22'-0" with 5'-0" wide cantilever footpaths on either side. Hand rails are of R.C.C.

Mild steel rocker bearings were provided below the beams on one side for movable bearings and 1" thick mortar pad with 1 1/4" dowel bars anchoring the beam with the bed block at the fixed end.

The bridge was designed for both I.R.C. class A loading double lane and class AA loading single lane whichever produced greater stresses in a particular member.

Prestressing of Beams

Each beam carried eight cables of 40 high tensile wires each of 0.2" dia., and they were prestressed, two wires at a time by hydraulic jacks till they produced sufficient tension and were anchored by the Magnel Blaton System. (Fig. 2)

Hoisting of Beams

A temporary bridge was erected with wooden piles and cribs forming the sub-structure and Hamilton trusses as the superstructure. Over the Hamilton trusses, a tramway line was laid so that the beam that was made to sit on two trolleys could be hauled across to a convenient position and side shifted by hydraulic jacks till it reached its correct position. The height of the tram way line was fixed in such a manner that when the beam came along in the trucks it was at the same level as the bed blocks.

Cost

|                                 | Rs       |
|---------------------------------|----------|
| Cost of the bridge              | 2,16,124 |
| Cost of foundation              | 29,990   |
| Cost of sub-structure           | 1,17,207 |
| Cost of superstructure          | 68,927   |
| Cost per running foot of bridge | 2,228    |
| Cost per foot width of bridge   | 6,754    |

CONTROL OF TRAFFIC SIGNALS

A new type of Autoflex vehicle-actuated road signal controller, developed by the Siemens & General Electric Railway Signal Co., Ltd. in conjunction with the Ministry of Transport, is arranged to provide several facilities which have been shown by experience with existing equipment to be desirable in the interests of improved traffic handling and greater safety for all road users. Two important changes are the introduction of variable minimum green periods and of amber periods which are separately timed, of unequal duration and relationship, forming a change-over period now referred to as the "Inter-Green period."

When a fixed minimum green is used, as hitherto, the period chosen to allow several vehicles to clear a crossing after waiting at a red signal may be unduly long at times of light traffic. However, if the period is shortened, vehicles towards the rear of those waiting at the signal may not have the opportunity to move forward and secure the continuance of the green period by passing over the vehicle detector before the signal changes back to red. In the new S.G.E. Type 15 controller, the electronic timing circuit employed successfully for ten years in the Company's Type 9 controller has been extended to meet the additional requirement of counting, and storing the count, of vehicles passing over the detector while the signal is at red, and of using this information to provide the variable minimum green facility. Typical resultant minimum periods are as follows:—

Minimum running period

|                                        |           |
|----------------------------------------|-----------|
| 1 vehicle waiting ... ..               | 8 seconds |
| 2    "       "       "       "       " | 10   "    |
| 3    "       "       "       "       " | 13   "    |
| 4    "       "       "       "       " | 14.5 "    |
| 5    "       "       "       "       " | 15.5 "    |
| More than 5 vehicle waiting...         | 16   "    |

The normal extensions of right-of-way obtained by vehicles running towards a green signal are still provided, and are obtained by an improved method of speed timing based on measuring the time inter-

val between the depression of the first and second tubes of the Autoflex detector.

**Separate Amber Periods.** The separately-timed amber facility has been introduced as a new contribution to the problem of preventing accidents caused by drivers moving off in the amber-with-red period (instead of waiting for green) and colliding with vehicles which have not stopped in the coincident amber period on the other road. With the new controller the existing 3 sec. amber period is retained but the amber-with-red period can be reduced to 2 sec., but in no case will amber-with-red be shown until the amber on the other road of the crossing has been displayed for at least one second. As with existing equipment, the amber-with-red period may be arranged to follow the start of the amber on the other road, or may be separated from it to give a period in which all signals show red.

**Controller Design.** In the new controller the outer case has the same overall dimensions as the earlier model despite the additional facilities provided. The valve timing unit is common to all controllers but a separate main relay set determines whether the controller is suitable for two, three or four traffic phases. These units are demountable for servicing, replacement or exchange for other types, the circuits to them being completed automatically upon mounting. Telephone relays form the basis of all switching including the signal lamps, and no revolving wheels, cams or spindles are employed. In addition to the usual push-buttons for manual operation by a traffic officer, an "end all-red" push-button enables each all-red condition to be retained or terminated as desired. The usual facility switch is provided to enable the controller to work as fully vehicle-actuated, as a fixed time controller, or under manual operation by the pushbuttons.

With the addition of a "progressive" or "linking" unit, the Type 15 controller can form part of an Autoflex progressive signalling scheme.

(From "Roads and Road Construction," November, 1957).

## HERE AND THERE

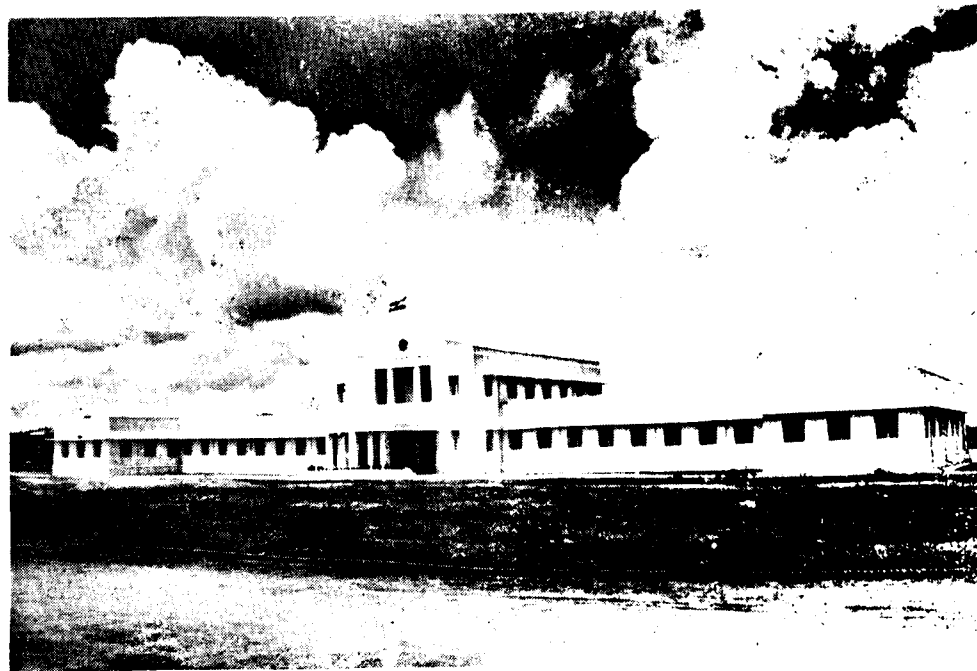
### 1. HIGHWAYS RESEARCH STATION—MADRAS

● THE Highways Research Station, Madras was opened on the 14th November 1957 by Shri K. Kamaraj, Chief Minister, Madras State.

The foundation stone of the building of the Highways Research Station, Madras was laid on 3rd February 1956, by Shri Sri Prakasa, the then Governor of Madras, and the work was commenced immediately after the sanction was communicated in April 1956. The work was

Room, Auditorium, Administrative Offices and Model Room. One of the Laboratory halls is provided with a basement section to store all the specimens and other samples.

On this occasion Shri K. K. Nambiar, Chief Engineer (Highways) in his statement said that the origin of roads dates back to prehistoric times. The roads that we have inherited and are now in our possession, are the result of the patient



Front View of the Highway Research Station, Madras.

work done by successfully completed in quick time, despite adverse conditions of foundation soil.

The building which houses different sections of the Research Station consists of nine blocks, four main testing laboratories being set up in the spacious halls 110 feet by 30 feet in the rear. The front section contains the Library, Indexing

Highway Engineers for the past 2,000 years. Progressive improvements have been made from time to time to the type and design of the road. Yet the rate of improvements to the roads can hardly keep up with the rapid strides with which the modern motor transport is growing in this country. It is often found that our road system constructed and maintained on traditional methods is inadequate for

the demands of modern vehicles with their ever increasing speeds and weights, with the result that these vehicles are not used to the full advantage. These conditions must be changed by evolving new ideas and new technique in road construction so that a time will come when, instead of designing the vehicles to suit the roads, the roads can be designed to suit the most advanced type of vehicles. This can be accomplished only by sustained research in laboratories and test tracks.

The primary function of the Research Station will be to cheapen the cost of construction and maintenance of roads and bridges.

The work of the Research Station is divided into roughly four sections: (1) Physical Division which will deal with the physical properties of road materials, surface characteristics and safety problems of roads and tests thereon; (2) Concrete Division which will deal with all problems of concrete road construction; (3) Bituminous Division which will deal with research on bituminous products used for road construction; and other problems connected with bituminous road construction; (4) Soils Division which will deal with the mechanical and physical properties of soils and other problems connected with foundations of roads and bridges.

In addition to the vast amount of routine testing conducted, the department will have always in progress several special investigations or research problems in the effort to improve methods of testing, to determine the suitability of proposed revisions of existing specifications, and to arrive at satisfactory specifications for new materials.

Much of this work will be conducted in co-operation with other highway laboratories, the Central Road Research Institute and the Indian Roads Congress. The Research Station will also maintain a library and publication section with a necessary indexing service to collect and disseminate technical data concerning

roads. It will also arrange for refresher courses and impart advanced training to the departmental officers and men.

The basic problems are essentially the same in all countries, although differences in climatic conditions may well throw the emphasis in different directions in different areas. For example the foundation problems in the Gangetic Plains of U. P. and Bengal, deficient in road stones, and in Assam subject to heaviest rains are very different from those of Madhya Bharat with black cotton soils; areas with heavy rainfalls will have skidding problems that hardly occur in areas of no or little rainfall; areas deficient in good road stone will have special surfacing problems that may not arise in areas with good road stones as in our state. Naturally with such varying conditions of climate, terrain and traffic obtaining in this sub-continent of India, several Road Research Stations have to be started to serve various zones, charged with the task of investigating problems peculiar to the respective areas. This Research Station will serve such a purpose in the South.

Proposals for establishment of this Research Station was put before the Government of Madras on 11th June 1951, and the Government of India, agreed on 8th June 1952 that the entire expenditure for building and equipping the Research Station, then roughly estimated to cost Rs 10 lakhs being charged from the Central Road Fund allocations to Madras and also agreed for giving a recurring grant of not exceeding Rs 15,000 every year from the Central Road Fund Reserve to cover the works expenditure for this in the matter of experimentation and testing.

Seventy five per cent of the money spent for the construction of highways is actually for materials and the cost of their transport and the testing of these materials ensure the quality required for a particular work so that the large amounts thus invested in the materials are always well spent. So a small percentage spent on research and testing is a good investment.

## 2. FIFTH ANNUAL NATIONAL HIGHWAY CONFERENCE FOR COUNTY ENGINEERS AND OFFICIALS (U. S. A.)

● THE way to public and legislative support is through understanding of the highway situation, Roy E. Jorgensen, engineering counsel of the National Highway Users Conference, said. "A good planning operation and regular programme reports can go a long way to get understanding".

Mr. Jorgensen listed the following as important elements in local road-programme planning procedures.

1. A procedure for road-section rating should be reasonably simple.
2. Road-section rating procedure should fit local conditions.
3. The procedure must be set up on a continuing basis.

4. Costs for improvement needs should be included as well as the miles and character of needs.

5. A good planning procedure requires the establishment and use of a codified and specific set of improvement standards.

6. The programme planning should be geared to the road system fiscal classifications.

What about the argument that you can't plan the programme until you know how much money you are going to have? Mr. Jorgensen believes that the experience on the national level and the experience in lesser governments have shown that, with persistent demonstration of need, financing may be expected to follow.

(From "Better Roads", November 1957.)

## 3. DENMARK HAS SPECIAL ROAD SURFACING TECHNIQUE

● DENMARK'S 33,000-Mile network of roads is reputed to be among the world's best, and large sums are spent every year on maintaining, improving, and extending it.

Main roads of non-ferro-concrete for fast through traffic are being constantly added to the network. All the latest roads are exclusively reserved for this steadily increasing traffic.

The clearest testimony to the quality of the network is the fact that nearly half of the secondary road mileage is asphalted.

Highly qualified technicians are in charge of maintenance. The central administration comes under a Road Directorate of the Ministry of Public Works, and research is carried out by a special Road Laboratory. The costs are partly covered by a Government Road Fund financed by taxes on cars and petrol.

Technicians have devoted particular attention to road surfacing, operating in recent years with a thin coating of bituminous material about half an inch thick.

The material, consisting of fine chips, is factory-compounded with asphalt and laid while still warm.

Experts have come from all over the world to study this surfacing technique.

Modern machines of Danish make are available for road-laying. A fair number of these are in operation abroad, including motor rollers which are considered to be the most up-to-date on the market. There is a variety of fully up-to-date Danish-designed spreading and surfacing machines for both concrete and asphalt.

On December 31, 1954, the following number of motor vehicles was registered -- 194,000 passenger cars and taxis, etc., more than 3,300 buses, 93,000 lorries and other commercial vehicles, 120,000 motor cycles of which 10,700 were with passenger side-car, and a considerable number of non-registered bicycles with auxiliary motor. There is a motor car for every 15 persons, a passenger car for every 23 and a commercial vehicle for every 49.

The country's comparative flatness and the density of the road network afford

good facilities for both private and public road traffic. In 1954 there were more than 1,100 bus routes linking all parts of the country, and practically all towns, even small ones, were served by at least one route. There is also an extensive network of goods services. The principal cities mostly have motor-coach stations for passenger traffic, usually complete with waiting rooms, restaurant, etc. and carriers centres for goods traffic. The total length of passenger routes in 1954

was over 30,000 km., the weekly mileage in summer being more than two million kilometers on all routes.

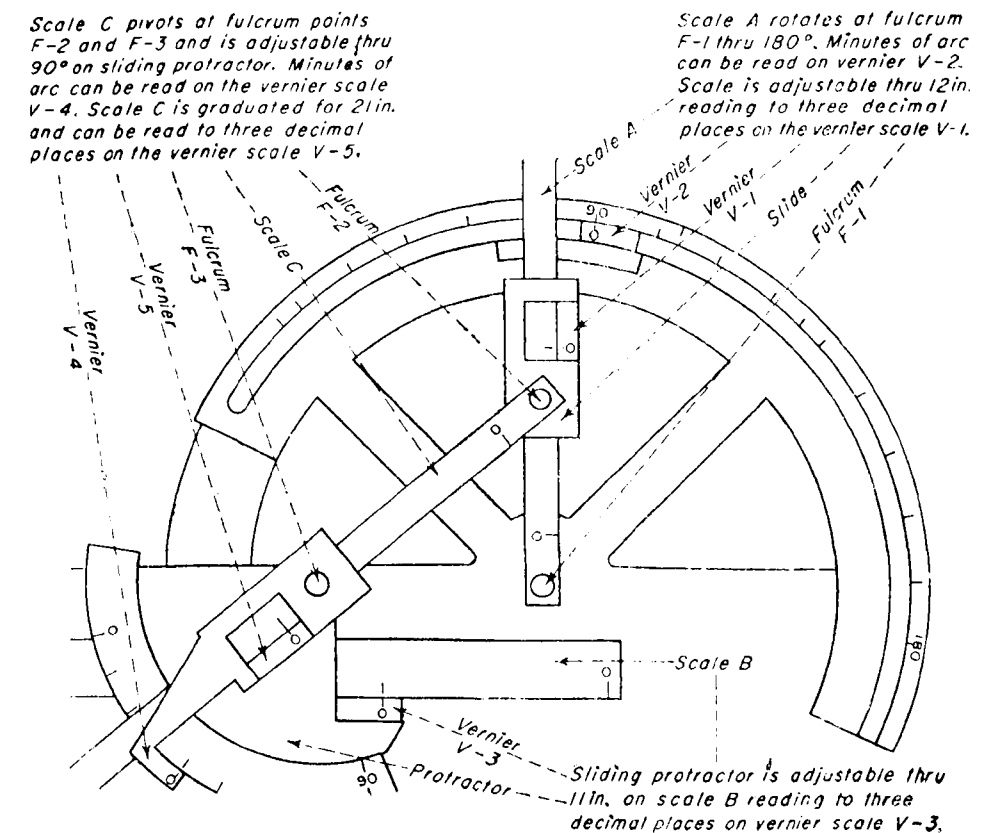
Coach services have also been established to other countries, for example Norway and Sweden to the north and nearly all Western European countries to the south.

(From "State Transport Review," Annual Number, 1957.)

## 4. TRIANGLES SOLVED DIRECTLY WITH NEW DEVICE

● UNKNOWN angles and sides of a triangle are read directly from vernier scales after simply forming the triangle with a new instrument known as the Trigulator. With a model for the struc-

nying sketch. Given two sides and an angle, a triangle can be solved in less than a minute compared to perhaps 15 or 20 minutes employing trigonometric formulas says the manufacturer,--FITCH



tural steel field, linear scales can be read to 1/16 in. in 100 ft and angular scales can be read to 1 min.

INSTRUMENTS INC., 1480 E. HIGH ST., POTTSTOWN, PA.

(From "Engineering News-Record", July 25, 1957).

Operation is indicated in the accompa-

5. "IMPROVE DIRT ROADS" PLEA

● SOUTH Africa's 62,000 miles of earth roads are costing the nation too much.

The South African Road Federation, in its official organ "The Open Road" says: "A small amount of capital and effort devoted to putting them into some sort of order would prove a wise and lucrative investment."

It points out that a great number of the Union's 117,000 farms are separated from railways or good roads by dirt roads.

These farms run the risk every year of not being able to transport their crops because of bad weather making roads impassable.

They are also faced with large repair bills on their vehicles.

"Before long a systematic improvement of farm roads may be forced upon the country," said the article.

(From "African Roads and Transport", November-December, 1957.)

6. RULE OF THE ROAD -LEFT OR RIGHT

● THE Royal Automobile Club believes it has discovered why nearly every other country than Britain and the Commonwealth uses the "wrong" side of the road. Until the end of the 18th Century, it was common practice throughout Europe to drive on the left-hand side of the road because swords were worn on the left and it was logical to keep one's horse on that side of the track in case of attack. Up to then, also, most armies attacked from the

left flank, Napoleon jettisoned this orthodox theory by launching offensives on the right flank with his cannon. He also found that the enemy was still further confused if the French troops moved on the right-hand side of the road and decreed that civilian traffic should also travel on the right.

(From "Modern Transport" December 28, 1957.)

SPORT

He: "I wonder why a girl can't catch a ball like a man?"

She: "A man is much bigger and much easier to catch".

CURRENT LITERATURE

ABSTRACTS

BITUMINOUS PAVING MIXTURES—Highway Research Board Bulletin 160, August 1957.

THIS Bulletin contains two Papers presented at the 36th Annual Meeting of the Highway Research Board, January 7-11, 1957.

The Paper "State Practices in the use of Bituminous Concrete" was presented by W. E. Chastain, Sr., of the Illinois Division of Highways. The Paper gives information furnished by 50 highway agencies concerning standard specifications, requirements and also general practices not outlined in detail in specifications.

This information was used as a guide to pattern the design and construction of the experimental flexible pavement for the AASHO Road Test.

The Paper "Foamed Asphalt in Bituminous Paving Mixtures" was prepared by Ladis H. Csanyi of the Engineering Experiment Station, Iowa State College. The Paper reports a study of the feasibility of producing a foam of bituminous binder in several forms. The applicability and efficacy of foamed binders in bituminous paving mixtures and in bituminous soil stabilization was investigated. Considerable data and some definite conclusions are presented.

ROAD CONSTRUCTION CONCRETE AND FLEXIBLE METHODS COMPARED, W. E. I. Armstrong, The Journal of the Institution of Municipal Engineers, Vol. 84, No. 6, December 1957.

IT may be said that concrete is normally best in the long run for the following roads:

- (a) those over poor subsoils (especially those susceptible to non-uniform movement).

- (b) those over subsoils containing bad sections (especially those containing pockets of peat with a depth of 15 ft below the surface).
- (c) roads over land with high water-tables, especially where these sometimes rise to near the surface.
- (d) roads in housing estate areas.
- (e) roads containing a number of bends, roundabouts, traffic controlled junctions, bus stops or steep hills, or liable to tank traffic, or to contamination with chemicals, and where disturbance to traffic has to be limited.

Black-top is normally the more economic form of construction over good subsoils and is often cheaper when a road is reconstructed along the lines of an old road, but this is not always so. It also has the advantage that the first cost is normally lower and often the base is laid with the same machinery as the surfacing.

Good workmanship in either case is, however, most important, and both methods of construction have a good future in their respective roles if used well and in the right places and economically.

INVESTIGATING AND FORECASTING TRAFFIC ACCIDENTS—Highway Research Board Bulletin No. 161, August 1957.

THIS bulletin contains five Papers presented at the 36th Annual Meeting, Highway Research Board, January 1957, under the auspices of either the Committee on Highway Safety Research or the Committee on Road User Characteristics. The Papers are as follows:

"Indexes of Motor Vehicle Accident Likelihood," by J. H. Mathewson and R. Brenner.

"Driver obedience to Stop and Slow signs," by William T. Jackson.

"Driver Behaviour and Highway Conditions as Causes of Winter Accidents," by Theodore W. Forbes and Milton S. Katz.

"A Method of Investigating Highway Traffic Accidents," by Thomas G. Brittenham, David M. Glancy, and Emmett H. Karrer.

"Predicting Accident Trends and Traffic Improvement," by Clifford O. Swanson and A. R. Laner.

**A SHORT-CUT GRAPHIC METHOD FOR FITTING THE BEST STRAIGHT LINE TO A SERIES OF POINTS ACCORDING TO THE CRITERION OF LEAST SQUARES\***; S. I. Askovitz, *Journal of the American Statistical Association*, Vol. 52, Number 277, March 1957.

A simple technique is presented for obtaining without calculation the best fitting line according to the least squares criterion, provided the points are equally spaced horizontally. A graphic measure of residual variability is also derived.

**SOME STUDIES ON THE DEFLECTION OF PRESTRESSED CONCRETE BEAMS**; C. A. Straubel and A. M. Ozell, *Journal of Prestressed Concrete Institute* (425 N. E. 5th St., Boca Raton, Fla.), Vol. 1, No. 4, pp. 5-26, March 1957.

THERE are several factors which influence the modulus of elasticity of concrete, the properties and size of aggregates, type of cement, the curing method, and the definition of modulus of elasticity itself,

whether tangent, initial, or secant modulus. The modulus may vary also with the speed of load application and with the type of specimen, whether a beam or a cylinder. With all these variables it is almost impossible to predict accurately the value of the modulus for a given concrete.

For low strength concrete, as employed in conventional reinforced concrete construction, it was found convenient to use empirical formulas to determine the value of the modulus of elasticity as a function of the ultimate strength. The results were liable for low strength concrete but for high strength concrete, they were not at all in agreement with the actual behaviour.

In general, test data on prestressed concrete beams indicate that the values of the modulus of elasticity determined from measured deflections are higher than those determined from measured strains. This observation gives rise to many questions. What, if any, is the relationship between the "deflection modulus" and the "strain modulus"? Can these moduli be related to the cylinder strength of the concrete? What is the relationship between the ultimate strength of concrete in compression and in flexure?

The purpose of this study was to define more accurately the behaviour of prestressed concrete in the so-called elastic range, or before cracking. A series of beams of various lengths, cross-sections, and prestress were tested and strain distribution and load-deflection measurements were taken. Test data on prestressed concrete published by other investigators were also collected. From this data a comparison was made with the theoretical approach, and the various assumptions checked for accuracy.

\* Revision of part of the paper "Rapid graphical methods in statistics," presented at the Mathematics Colloquium of the University of Pennsylvania, December 1, 1955. This work was started at the Ophthalmology Research Laboratory, Albert Einstein Medical Center, Northern Division, Philadelphia, under a research grant from the Weinstock Fund, and continued at the Department of Therapeutic Research, School of Medicine, University of Pennsylvania, Philadelphia, supported in part by Grant H-625 (C-7) from the National Heart Institute of the National Institutes of Health. For suggesting the addition of some measure of residual variability to the original manuscript, the author expresses his thanks to the referee.

## SELECTED RECENT LITERATURE IN ENGINEERING JOURNALS

### IV. SOIL ENGINEERING AND DRAINAGE

- Airfield Construction in Overseas Soils**; *The Surveyor*, Vol. CXVI, No. 3425, December 14, 1957, pp. 1293-1296.
- Mixed Soils Require Five Designs for one Dock Construction**; E. M. CUMMINGS, *Civil Engineering*, November 1957, pp. 62-65.
- What Happens When Hammer Hits Pile**; EDWARD A. SMITH, *Engineering News Record*, Vol. 159, No. 10, September 5, 1957, pp. 46-48.
- Settlement in Building Foundation**; DINESH MOHAN, *Journal of the Institution of Engineers (India)*, Vol. 38, No. 4, Part I, December 7, 1957, pp. 307-320.
- Thixotropic Characteristics of Compacted Clays**; H. B. SEED and C. K. CHAN, *Proceedings of the American Society of Civil Engineers, Journal of the Soil Mechanics Division*, Vol. 83, No. SM 4, November 1957, Part I, pp. 1-35, Paper 1427.
- Laterite Soils and Their Engineering Characteristics**; K. S. BAWA, *Proceedings of the American Society of Civil Engineers, Journal of the Soil Mechanics Division*, Vol. 83, No. SM 4, November, 1957, Part I, Paper 1438, pp. 1-15.
- Ganison Dam—Tunnel Test Section Investigation—A Symposium**; HARRIS H. BORKE, *Proceedings of the American Society of Civil Engineers, Journal of the Soil Mechanics Division*, Vol. 83, No. SM 4, November, 1957, Part I, Paper 1438, pp. 1-50.
- Ganison Dam -- Evaluation of Results from Tunnel Tests Section**; K. S. LANE, *Proceedings of the American Society of Civil Engineers, Journal of the Soil Mechanics Division*, Vol. 83, No. SM 4, November 1957, Part I, Paper 1439, pp. 1-49.
- Some Considerations on the Compacting of Layers of a Road**; J. DURSEU, *Revue Generale Des Routes et des Aerodromes*, Vol. 27, No. 309, October 1957, pp. 135-150 (In French).
- Chemicals Seal Foundation for New York Building**; CHESTER W. CAMPBELL, *Civil Engineering*, Vol. 27, No. 10, October 1957, pp. 47-51.
- Mexico City's Earthquake Damage Examined**; J. H. THORNBURY, PEDRO ALBIN, *Civil Engineering*, Vol. 27, No. 10, October 1957, pp. 76-80.
- Highway Design and Frost Susceptible Soils**; PROF. M.M. DEVIS, *Roads and Engineering Construction*, September 1957, pp. 98, 100 & 126-134.
- Soil Moisture Content Quickly Found**; MILTON E. BENDER, *Civil Engineering*, Vol. 27, No. 10, October 1957, pp. 82.
- Building Without Foundations on Moving Grounds**; DONALD GIBSON, *The Surveyor*, Vol. CXVI, No. 3419, pp. 1137-1139.
- Foundation Design and Behaviour of Tower Latino America in Mexico City**; LEONARDO ZEEVAERT, *Geotechnique*, Vol. VII, No. 3, September, 1957, pp. 115-133.
- The Use of Simple Relief Wells in Reducing Water Pressure beneath a Trench Excavation**; W. H. WARD, *Geotechnique*, Vol. VII, No. 3, September 1957, pp. 134-139.
- Stress-Strain Characteristics of a Granular Material**; A. W. T. DANIEL, *Engineering*, Vol. 184, No. 4766, July 12, 1957, pp. 45-46.
- Airfield Construction in Overseas Soils**; KENNETH ERNEST CLARE, *Part I: The Formation, Classification, and Characteristics of Tropical Soils, The Proceedings of the Institution of Civil Engineers*, Vol. 8, Session 1957-58, November 1957, pp. 211-222. Part II: Tropical Black Clays, pp. 223-231.

19. **Airfield Construction in Overseas Soils**; MICHAEL JOHN TOMLINSON, *Part 3: Saline Calcareous Soils, Proceedings of the Institution of Civil Engineers, Vol. 8, Session 1957-58, November 1957, pp. 232-246. Part IV: Alluvial Sands and Silts, November 1957, pp. 246-252.*
20. **Airfield Construction in Overseas Soils**; IVAN KINNERSLEY NIXON and BRYAN OPENSHAW SHIPP, *Part 5: Laterite, Proceedings of the Institution of Civil Engineers, Vol. 8, Session 1957-58, November 1957, pp. 253-275. Part 6: Tropical Red Clays, Proceedings of the Institution of Civil Engineers, Vol. 8, Session 1957-58, November 1957, pp. 275-292.*
21. **An Example of Surcharge Application to Speed Hill Settlement**; WILLIAM F. HALLSTEAD, *Roads and Streets, Vol. 100, No. 10, October, 1957, pp. 116-117 & 120.*
22. **Chalk Used as Construction Material at Gavins Point Dam**; HENREY A. SIKSO, *Civil Engineering, Vol. 27, No. 9, September 1957, pp. 48-50.*
23. **Norwegian Experiences With Steel Piles to rock**; L. BJERRUM, *Geotechnique, Vol. VII, No. 2, June 1957, pp. 73-96.*
24. **Laboratory and In-Situ Permeability of Sand**; CHARLES J. MANSUR, *Proceedings of the American Society of Civil Engineers, Journal of the Soil Mechanics and Foundations Division, Vol. 83, No. SM 1, January 1957, Paper 1142, pp. 1-21.*
25. **Floating Rig Takes Cone Samples in Deep Swift Waters**; ROBERT L. PERKINS, *Engineering News Record, Vol. 159, No. 11, September 12, 1957, pp. 60-62.*
26. **The Planning and design of the New Hong Kong Airport**; H. GRACE and J. K. M. HENRY, *Proceedings of the Institution of Civil Engineers, Vol. 7, Session 1956-57, June, 1957, Airport Paper No. 35, pp. 275-325.*
27. **Improved methods of Particle Size Analysis**; T. H. HUGHES, *The Engineer, Vol. 203, No. 5289, June 7, 1957, pp. 860-864.*
28. **Trench Excavation and Back Fitting**; GEORGE F. SOWERS, *Roads and Engineering Construction, May 1957, pp. 49-54, 151-154.*
29. **Horizontal Drains in California Highways**; T. W. SMITH and G. V. STAFFORD, *Proceedings of the American Society of Civil Engineers, Journal of the Soil Mechanics and Foundations Division, Vol. 83, No. SM 3, July 1957, Paper No. 1300, pp. 1-26.*
30. **A Review of the Theories for Sand Drains**; F. E. RICHART, *Proceedings of the American Society of Civil Engineers, Journal of the Soil Mechanics and Foundations Division, Vol. 83, No. SM 3, July 1957, Paper No. 1300, pp. 1-38.*
31. **Determination of the 0.02 mm Fraction in Granular Soils**; R. W. JOHNSON, *Proceedings of the American Society of Civil Engineers, Journal of the Soil Mechanics and Foundations Division, Vol. 83, No. SM 3, July 1957, Paper No. 1309, pp. 1-10.*
32. **Calculation of Settlement of a Stiffened Centrally Loaded Circular Plate in Layered Foundation**; KARL FISCHER, *Beton und Stahlbetonbau, Vol. 52, No. 10, October 1957, pp. 254-256 (In German).*
33. **Vibration Within a Defined Massive Soil Layer**; DR. KARL POLZ, *Die Bautechnik, Vol. 34, No. 5, May 1957, pp. 161-168 (In German).*
34. **Model tests with Anchoring in Cohesionless Materials**; DR. L. V. RABCEWIEZ, *Die Bautechnik, Vol. 34, No. 5, May 1957, pp. 171-173 (In German).*
35. **Using the K-Live for Computing the Sliding line from the Foot of the Wall**; DR. OTTO MUND, *Die Bautechnik, Vol. 34, No. 5, May 1957, pp. 207-209 (In German).*
36. **Pile Loading and Pull-Out Tests in Black Cotton Soils**; DINESH MOHAN and GIRIRAJ SINGH JAIN, *Journal of the Institution of Engineers (India), Vol. 38, No. 5, Part 1, January 1958, pp. 409-421.*
37. **Airfield Construction in Calcareous Soils—Difficulties of Saturated Subgrades After Surfacing**; *Highways and Bridges and Engineering Works, Vol. XXV, No. 1221, December 18, 1957, pp. 1 and 3.*

# RECENT ADDITIONS TO THE LIBRARY OF THE INDIAN ROADS CONGRESS

1. **B. S. 2566; 1955 Broad Flange Beams Heavy Flange T Beams and Long-Legged T. Bars**; British Standards Institution, British Standards House, 2, Park St., London, W. 1.
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3. **B. S. 2569; Part 2: 1955 Sprayed Metal Coatings—Part 2, Protection of Iron and Steel by Aluminium Against Corrosion at Temperatures Between 120 C and 950 C**; British Standards Institution, British Standards House, 2, Park St., London, W. 1.
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5. **B. S. 2584; 1955—Ratchet Screw Drivers**; British Standards Institution, British Standards House, 2, Park St., London, W. 1.
6. **'Kashmir'—Volume IV, No. 10, November 1954**; The Publications Division, Ministry of Information & Broadcasting, Government of India, New Delhi.
7. **B. S. 970; 1955—Wrought Steels (Bars, Billets and Forgings)**; British Standards Institution, British Standards House, 2, Park St., London, W. 1.
8. **B. S. 2596; 1955—Components Tractors and Earth Moving Equipment**; British Standards Institution, British Standards House, 2, Park St., London, W. 1.
9. **B. S. 2600; 1955—General Recommendations for the Radiographic Examination of Fusion Welded Joints in Thicknesses of Steel up to 2 Inches**; British Standards Institution, British Standards House, 2, Park St., London, W. 1.
10. **B. S. 2595; 1955—Descriptions & Methods of Measuring Sizes & Outputs of Crushing Machinery**; British Standards Institution, British Standards House, 2, Park St., London, W. 1.
11. **Madras Highways Manual—Volume I—Standard Specifications for Road and Bridge Construction (1955)**; Chief Engineer (Highways), Chepauk, Madras.
12. **"Transportation & Handling Costs of Selected Fresh Fruits & Vegetables in the San Francisco Bay Terminal Market Area"**; Stanford Research Institute, Report No. 2 (May 1952), U. S. Deptt. of Agriculture, Bureau of Agricultural Economics, Washington D.C.
13. **Engineering Applications of Soil Surveying and Mapping—Highway Research Board Bulletin No. 13 (1953)**; Highway Research Board, 2101-Constitution Ave, Washington, 25, D. C.
14. **Every Body's Guide to King's English, Eleventh Indian Edition**; R. Johnson Martin, D. B. Taraporevala Sons & Co. Ltd., 210, Hornby Road, Bombay.
15. **Correct English Usage—How to Avoid Errors in Speech & Writing, Eighth Edition**; W. McMordie, D. B. Taraporevala Sons & Co. Ltd., 210, Hornby Road, Bombay.
16. **Indian Railway Conference Association Coaching Tariff No. 16 (In Force from 1st February 1953)**; Indian Railway Conference Association, New Delhi.

## BUDGETS AND ADMINISTRATION REPORTS

## GOVERNMENT OF ASSAM BUDGET FOR 1957-58

The following extracts have been taken from the Civil Works Budget of the Government of Assam for the year 1957-58.

## Revenue (Civil Works)

| Heads                                                                                                          | (Rupees in lakh)   |                                |                               |
|----------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|-------------------------------|
|                                                                                                                | Actuals<br>1955-56 | Revised<br>Estimate<br>1956-57 | Budget<br>Estimate<br>1957-58 |
| Rents                                                                                                          | 2.87               | 3.28                           | 2.97                          |
| Ferry receipts                                                                                                 | 5.66               | 5.80                           | 5.80                          |
| Tolls on roads                                                                                                 | 0.05               | .25                            | .30                           |
| Recoveries of expenditure                                                                                      | 0.57               | .51                            | .57                           |
| Miscellaneous                                                                                                  | 3.17               | 4.72                           | 4.76                          |
| Transfer from Central Road development account                                                                 | 77.90              | 3.48                           | 26.38                         |
| Transfer from Central Road Fund Special Reserve                                                                | —                  | —                              | 93.14                         |
| Contribution from Government of India for construction of State roads of economic or Inter-state importance    | 12.43              | 9.49                           | 27.95                         |
| Contribution from Government of India towards the cost of construction of Jowai-Badarpur Road                  | —                  | 4.50                           | 7.50                          |
| Contribution from Government of India for construction of certain bridges on the North Bank of the Brahmaputra | —                  | 4.98                           | 6.50                          |
| Contribution from Government of India for construction of Kanakhya-Temple Road                                 | —                  | 2.00                           | 6.00                          |
| Contribution from Government of India for construction of Kohima-Phek-Phakungri-Road                           | —                  | 1.00                           | 10.00                         |
| Recoveries of over payment                                                                                     | .06                | —                              | —                             |
| Deduct-refunds                                                                                                 | -.06               | -.31                           | -.31                          |
| <b>Total</b>                                                                                                   | <b>102.64</b>      | <b>39.70</b>                   | <b>191.56</b>                 |

## Expenditure (Civil Works)

| Heads                                                 | (Rupees in lakh)   |                                |                               |
|-------------------------------------------------------|--------------------|--------------------------------|-------------------------------|
|                                                       | Actuals<br>1955-56 | Revised<br>Estimate<br>1956-57 | Budget<br>Estimate<br>1957-58 |
| <b>Buildings</b>                                      |                    |                                |                               |
| Original Works                                        | 62.04              | 62.90                          | 85.80                         |
| Repairs                                               | 20.33              | 20.66                          | 20.36                         |
| <b>Communications</b>                                 |                    |                                |                               |
| Original Works                                        | 94.12              | 112.98                         | 107.82                        |
| Repairs                                               | 144.32             | 152.68                         | 149.20                        |
| <b>Miscellaneous</b>                                  |                    |                                |                               |
| Original Works                                        | 0.23               | —                              | —                             |
| Repairs                                               | 0.09               | 0.09                           | 0.10                          |
| Stock and other suspense accounts                     | 20.05              | 2.27                           | 2.89                          |
| Regrant of lapses                                     | —                  | 8.00                           | 7.40                          |
| Grants-in-aid for communications                      | 12.86              | 12.97                          | 14.45                         |
| <b>Development Schemes<br/>(First Five-Year Plan)</b> |                    |                                |                               |
| <b>Buildings</b>                                      |                    |                                |                               |
| Original works                                        | 25.91              | —                              | —                             |
| Repairs                                               | 0.27               | 0.35                           | 1.34                          |
| <b>Communications</b>                                 |                    |                                |                               |
| Original works                                        | 158.16             | —                              | —                             |
| Repairs                                               | 14.37              | 26.02                          | 26.03                         |
| <b>Second Five-Year Plan</b>                          |                    |                                |                               |
| <b>Buildings</b>                                      |                    |                                |                               |
| Original works                                        | —                  | 25.69                          | 35.26                         |
| Repairs                                               | —                  | —                              | —                             |
| <b>Communications</b>                                 |                    |                                |                               |
| Original works                                        | —                  | 199.17                         | 196.28                        |
| Repairs                                               | —                  | —                              | —                             |
| Establishment                                         | 51.76              | 67.69                          | 73.51                         |
| Tools and Plant                                       | 16.72              | 18.00                          | 13.00                         |
| Deduct-Recoveries                                     | -28.47             | -136.36                        | -59.13                        |
| <b>Total</b>                                          | <b>552.66</b>      | <b>573.11</b>                  | <b>674.31</b>                 |

Capital Account of Civil Works outside the Revenue Account

| Heads                                                                        | (Rupees in lakh)   |                                |                               |
|------------------------------------------------------------------------------|--------------------|--------------------------------|-------------------------------|
|                                                                              | Actuals<br>1955-56 | Revised<br>Estimate<br>1956-57 | Budget<br>Estimate<br>1957-58 |
| <b>Original works</b>                                                        |                    |                                |                               |
| (a) Buildings                                                                | 21.50              | 49.38                          | 246.42                        |
| (b) Communication                                                            | 128.92             | 86.96                          | 257.45                        |
| (c) Miscellaneous                                                            | —                  | —                              | 2.00                          |
| Tools and Plant and establishment charges transferred from other departments | 8.17               | 15.01                          | 35.51                         |
|                                                                              | 158.59             | 151.35                         | 541.38                        |
| <b>Revenue from Roads</b>                                                    |                    |                                |                               |
| Receipts under the Indian Motor Vehicles Act                                 | 14.97              | 17.07                          | 18.43                         |
| Receipts under the Assam Motor Vehicles Taxation Act                         | 22.07              | 32.13                          | 37.59                         |
| Recoveries of over-payments                                                  | .10                | .42                            | .06                           |
| Fees and other receipts                                                      | .25                | —                              | .26                           |
| Deduct—Refunds                                                               | — .05              | — .03                          | — .15                         |
| Tax for goods carried by roads and inland waterways                          | 184.47             | 180.19                         | 182.68                        |
|                                                                              | 221.81             | 229.78                         | 238.87                        |

GOVERNMENT OF ASSAM BUDGET FOR 1957-58

(A brief review with reference to civil works)

THE budget of the Government of Assam for the year 1957-58 estimated Revenue Receipts of Rs 2428.82 lakhs against an estimated Revenue Expenditure of Rs 2889.75 lakhs leading to a deficit of Rs 460.93 lakhs. The revenue estimates for 1956-57 (Revised) placed Receipts at Rs 2201.47 lakhs and Expenditure at Rs 2396.72 lakhs indicating a deficit of Rs 195.25 lakhs. Actuals for 1955-56 revealed Revenue Receipt of Rs 2203.82 lakhs and expenditure of Rs 2445.46 lakhs resulting in a deficit of Rs 241.64 lakhs.

Revenue expenditure on civil works for

1957-58 is estimated at Rs 674.31 lakhs which works out to 27.8 per cent of the total State revenue. It was Rs 573.11 lakhs in 1956-57 (Revised estimates) and Rs 552.66 lakhs in 1955-56 (Actuals) which amounted to 26.0 per cent and 25.1 per cent respectively of the State revenue for the corresponding years.

Apart from the revenue expenditure a sum of Rs 541.38 lakhs has been provided for civil works for 1957-58 on account of capital expenditure outside the revenue account as against Rs 151.35 lakhs for 1956 (Revised estimate) and Rs 158.59 for 1955-56 (Actuals).

LIST OF APPROVED WORKS ON NATIONAL HIGHWAYS

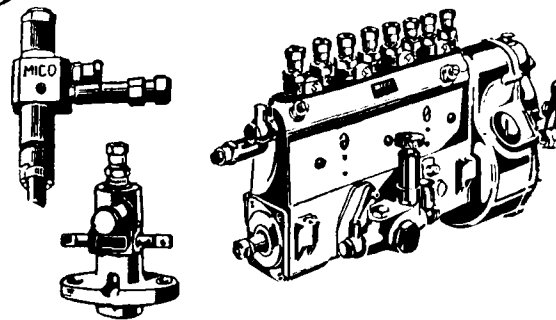
| Sr. No.                    | Job No.     | Name of work                                                                                                                               | Amount<br>(Rs in lakhs) |
|----------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>ANDHRA PRADESH</b>      |             |                                                                                                                                            |                         |
| 1.                         |             | Two works each costing less than 2 lakhs                                                                                                   | 2.86                    |
| <b>ASSAM</b>               |             |                                                                                                                                            |                         |
| 2.                         | 1816 AS 38  | Construction of a Bridge No. 334/1 of Tokopani on Makum-Ledo-Lekhapani Road, N. H.No. 40.                                                  | 0.41                    |
| <b>HIMACHAL PRADESH</b>    |             |                                                                                                                                            |                         |
| 3.                         | 1810 HP 22  | Purchase of special tools and plants required in connection with the construction of H. T. Road, National Highway No. 22.                  | 4.16                    |
| <b>JAMMU &amp; KASHMIR</b> |             |                                                                                                                                            |                         |
| 4.                         | 1815 JK 1-A | Purchase of a snow plough for clearing snow on the approaches of the Jawahar Tunnel at Banihal on Jammu-Srinagar Section of N. H. No. 1-A. | 0.54                    |
| <b>ORISSA</b>              |             |                                                                                                                                            |                         |
| 5.                         |             | Two works each costing less than 2 lakhs                                                                                                   | 1.46                    |
| <b>PUNJAB</b>              |             |                                                                                                                                            |                         |
| 6.                         | 1814 PB 22  | Improvements to curves in miles 77/2 of Kalka-Simla Road, National Highway No. 22.                                                         | 0.25                    |
| <b>WEST BENGAL</b>         |             |                                                                                                                                            |                         |
| 7.                         | 1809 BG 31  | Construction of a permanent R. C. bridge over the river Kurti near Chalsa on National Highway No. 31.                                      | 7.31                    |
| 8.                         | 1817 BG 2   | Surveying the bypass from Serampur to Saptagram including an overbridge near Baidyabati over Railway.                                      | 0.6                     |

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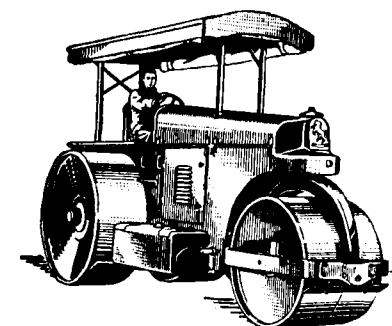
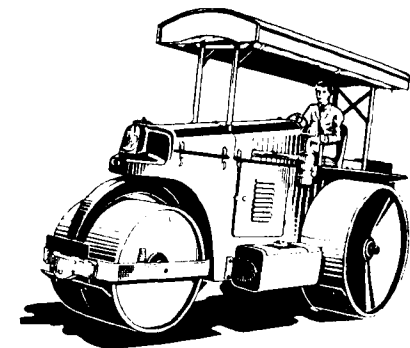
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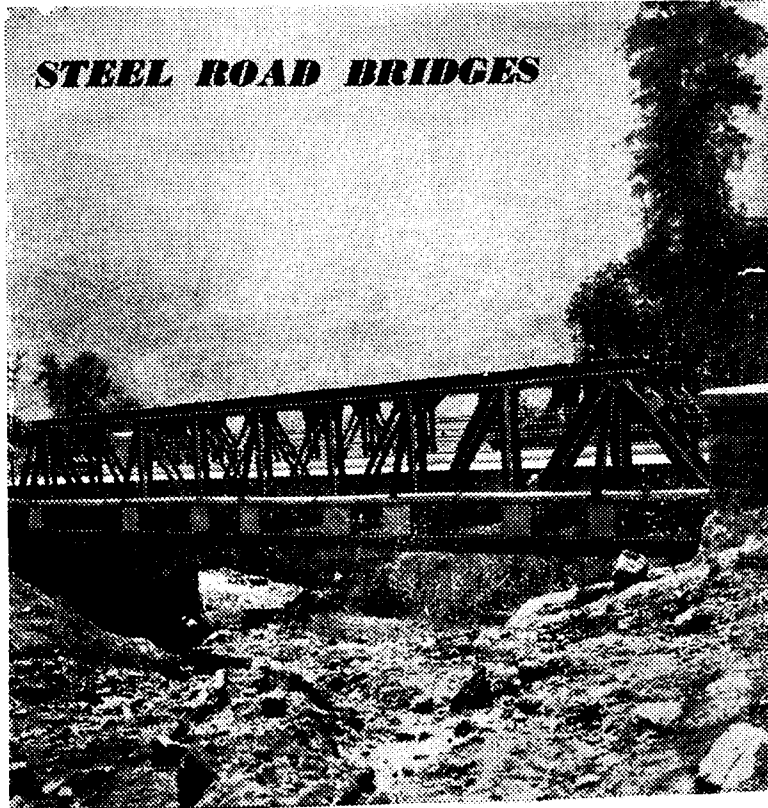
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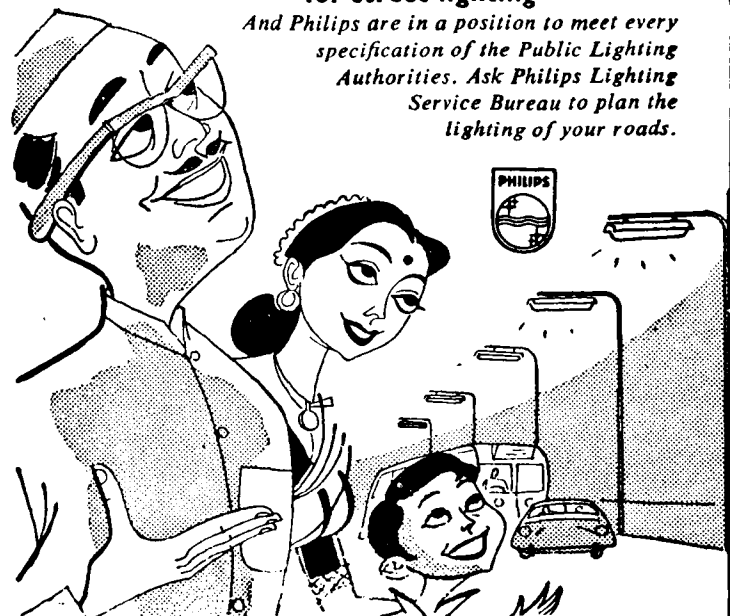
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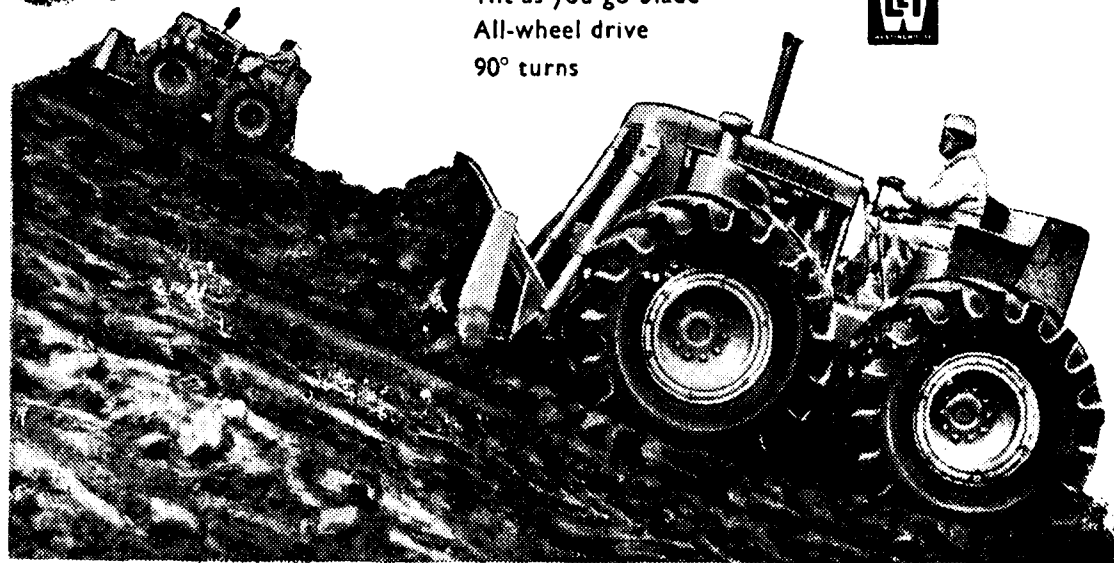
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- Fingertip air-actuated steering
- 18 m.p.h. travel speed
- Tilt-as-you-go blade
- All-wheel drive
- 90° turns



*Ask Jacks about it*

**William Jacks & Co. Ltd.**

JL

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