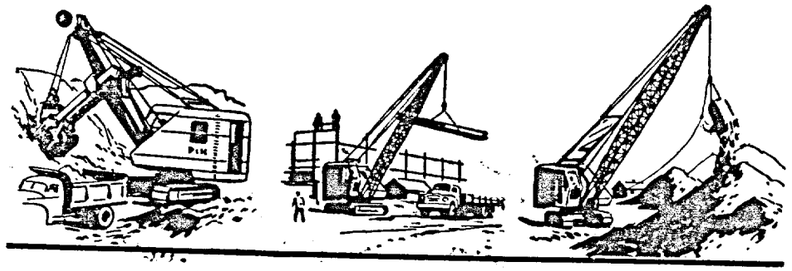
TRANSPORT-COMMUNICATIONS

MONTHLY REVIEW

JULY 1955—No. 99

INDIAN ROADS CONGRESS, NEW DELHI.



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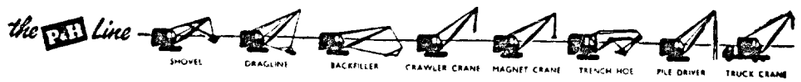

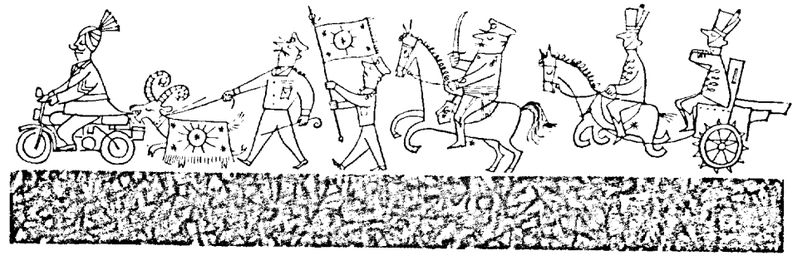

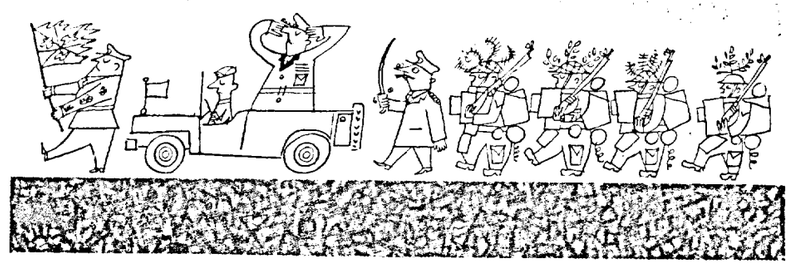

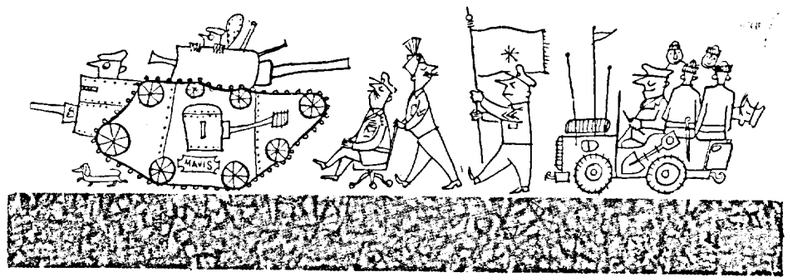

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TRANSPORT-COMMUNICATIONS

MONTHLY REVIEW
JULY 1955—No. 99

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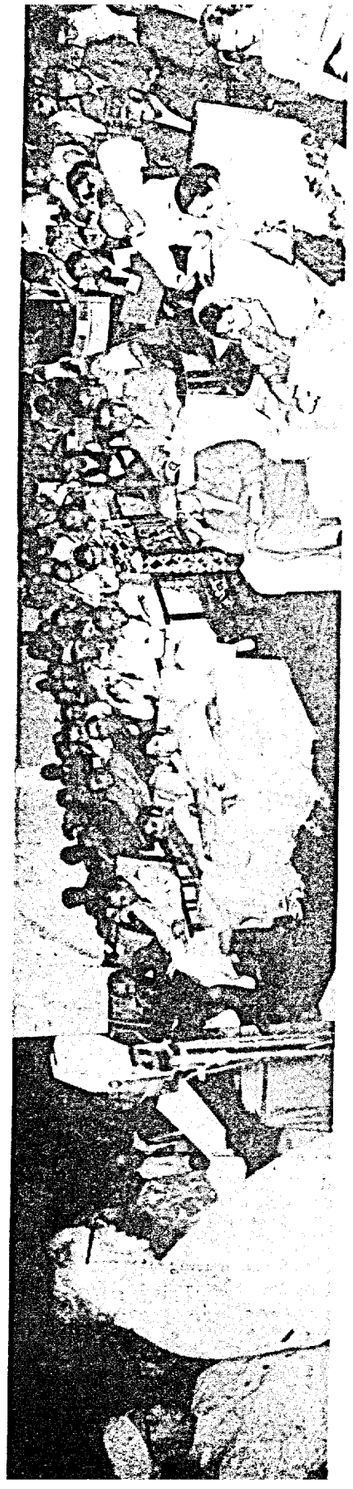
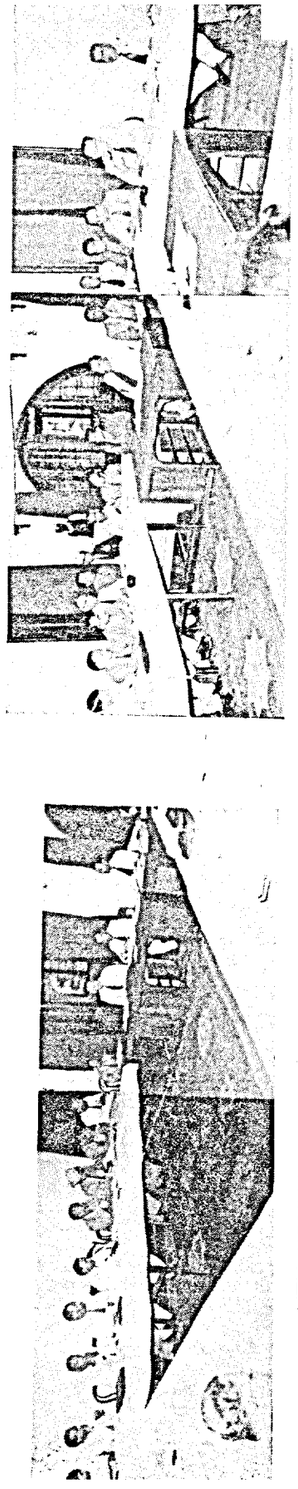


SHRI H. P. MATHRANI DELIVERING THE PRESIDENTIAL ADDRESS.



CHIEF ENGINEERS' MEETING.

44TH COUNCIL MEETING.

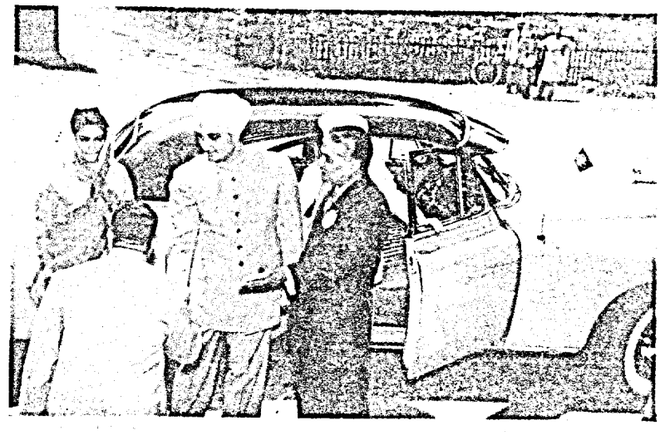
TRANSPORT-COMMUNICATIONS MONTHLY REVIEW

A REVIEW OF
ROAD ENGINEERING, DEVELOPMENT & TRANSPORT

JULY 1955

INDIAN ROADS CONGRESS
NINETEENTH SESSION—SRINAGAR 1955

THE Indian Roads Congress held its Nineteenth Annual Session from the 18th to 25th of June 1955 at Srinagar, the summer capital of Jammu & Kashmir State.



The President receiving the Sadar-I-Riyasat

The Session was inaugurated by Yuvaraj Karan Singhji, Sadar-i-Riyasat, Jammu and Kashmir State, on the 19th June, 1955. 233 delegates from all parts of India attended the Session. This was the first meeting of the Congress in the State.

Shri H. P. Mathrani, Consulting Engineer (Road Development) and Joint Secretary to the Government of India, Ministry of Transport, delivered the Presidential Address. The President said that the expenditure on road development in the second Five-Year Plan is likely to be about Rs 350 crores. Out of this, the Central expenditure will amount to Rs 125 crores including Rs 60 crores for National Highways. The President called upon research workers to evolve rational formulae for the design of pavements and emphasized the need for enacting Highway Laws to prevent ribbon development and encroachments on roadland.

Yuvaraj Karan Singhji, Sadar-i-Riyasat, Jammu and Kashmir State, inaugurating the Session said that because India was a vast and varied country it was important always to keep in mind its fundamental unity and strengthen it in every way. He added that in the development and strengthening of this national consciousness an improvement in the means of communications, particularly roads, will make a substantial contribution.

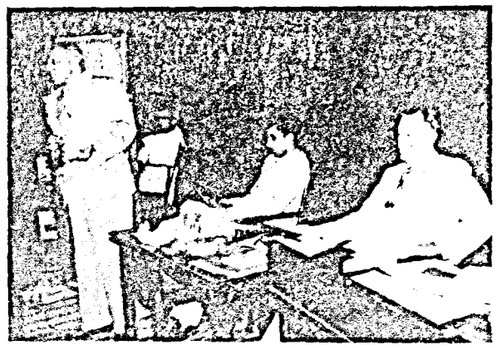
The "Indian Roads Congress Medal" was awarded to Shri Goverdhanlal for his Paper on "The Design of Small Bridges and Culverts". Also, the Paper on "The Stabilization of Certain Clayey Soils in India by Heat Treatment" by Col. S. K. Bose was commended.

Shri Goverdhanlal receiving the I. R. C. Medal.

Messages of goodwill from the Prime Minister of India, Vice-President of India, Deputy Minister for Railways and Transport, Government of India, Prime Minister of Jammu and Kashmir State and several others were received.

Nine Papers were discussed. About 70 speakers took part in the discussion.

The Panel discussion on "Surface Dressing with Bituminous Binders" was also arranged.



Shri Iyer replying to comments on his Paper.

There was the usual round of committees and Council meetings.

The Specifications and Standards Committee discussed, among other things, the specifications for physical tests for road stones, specifications for light chipping tar carpets, Hindi equivalents for Highway Engineering Terms, and Standard practice for location of borrow pits.

The Research Organization Division discussed many Research Notes on the work done in Road Research Laboratories in India.

The Education Subcommittee considered the details of a Refresher course to be introduced for the benefit of Highway Engineers holding posts of responsibility. The Subcommittee also approved the details of a syllabus for Highway Engineering Course for including in the curricula of Engineering Colleges in India.

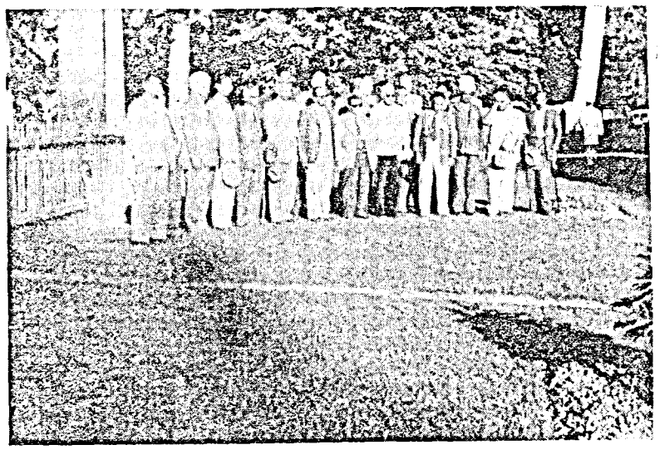
The Soil Research Subcommittee discussed the question of issuing specifications for stabilized soil road construction in India. The Subcommittee also considered the question of requesting the Government of India to finance the cost of construction of some experimental soil-cement stabilized subgrades for rural areas where the cost of soling is prohibitive.

The Manufacture of Road Making Machinery and Mechanization Subcommittee examined the question of the manufacture in India of concrete mixers. The question of manufacturing stone crushing plant in India was also examined. The Committee noted that it will be possible to manufacture Diesel Road Rollers in India within the next 18 months.

The Road Transport Operation Cost Committee met under the chairmanship of Shri H P. Mathrani, Consulting Engineer (Road Development), Government of India. The Committee studied the statistics supplied by private operators and State Transport undertakings and took into account the results of the extensive experiments conducted in the U.S.A. The Committee also had before them a report on experiment carried out by the Bombay State Road Transport Corporation for studying the question. The Committee felt that the various operators were working under widely different

conditions and consequently the figures supplied by them were not comparable. It was, therefore, decided that two major State Transport undertakings should be requested to carry out special experiments on the same lines as those carried out by the Bombay State Road Transport Corporation, but more carefully and scientifically designed and on a more extensive scale. The Committee decided to submit an Interim Report based on the results of the experiments of the Bombay State Road Transport Corporation, but their final report would be submitted only after the results of the proposed experiments are available.

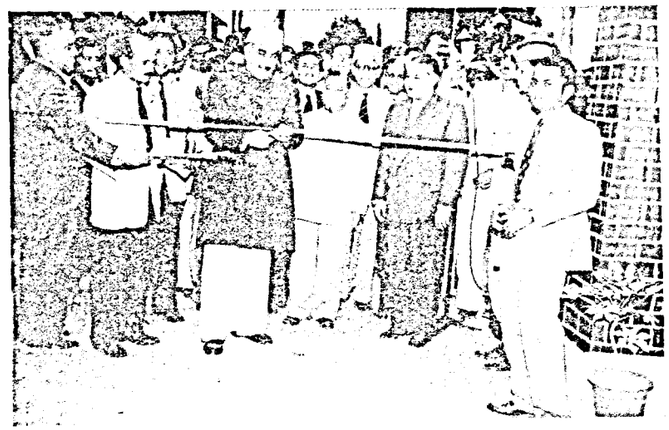
The Council held its 44th and 45th meetings. The Council reviewed the work done by the various committees and appointed a Road Transport Development Committee to study the transport problems of the country and to make recommendations. At the 45th Council meeting, Shri K. K. Nambiar, Chief Engineer (Highways), Madras, was elected President. The Vice-Presidents elected were Shri M. S. Bisht, Chief Engineer, P.W.D., B & R, Uttar Pradesh, Shri D. N. Gupta, Chief Engineer, P.W.D., B & R., Jammu & Kashmir, and Shri W. A. Griffiths, of Messrs Burmah-Shell Co., Ltd., Madras.



Some of the Council members who attended the 45th Council meeting.

The Chief Engineers also held a meeting during the Session. They discussed the progress in the preparation of the second Five-Year Plan of Road Development.

On the 19th evening, Bakhshi Ghulam Mohammad, Prime Minister, Jammu & Kashmir State, opened the Technical Exhibition arranged by the Indian Roads Congress. He visited every stall and showed keen interest in the exhibits.



Bakhshi Ghulam Mohammad declaring the exhibition open.

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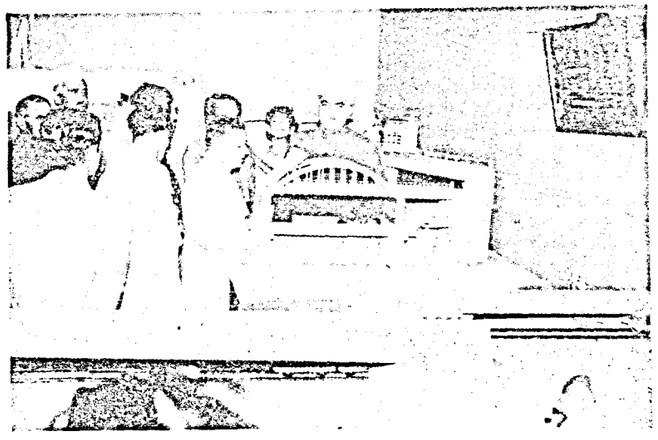
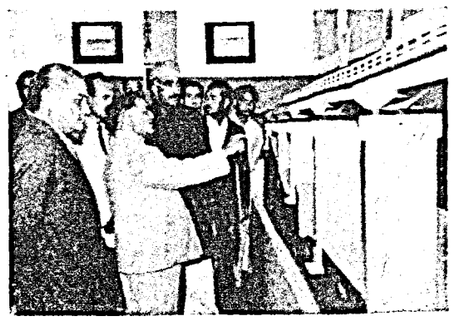
Many State P.W.Ds. and engineering firms participated in the exhibition. A list of Government Departments and firms, who participated in the exhibition, is published at page 21.



Bakhshi Ghulam Mohammad visiting a Stall.

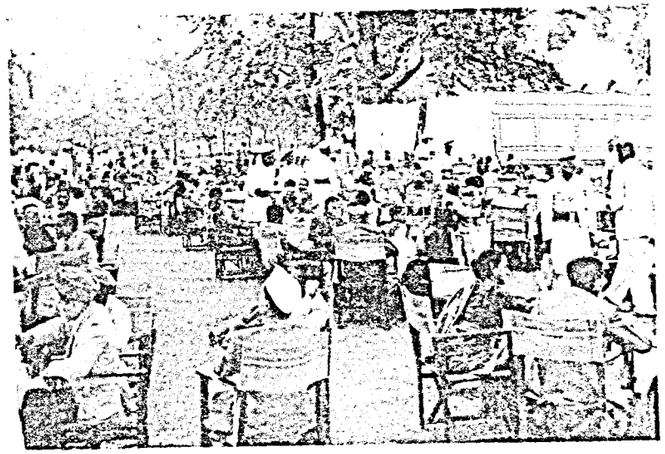


Bakhshi Ghulam Mohammad at other Stalls.

Yuvaraj Karan Singhji visiting stalls.

Trips to Gulmarg and Veerinag—the source of river Jhelum, were arranged. The inspection of Bannihal Tunnel under progress, the Sind Hydro-electric Works and the Government Joinery Mill was also arranged.

The Prime Minister, Jammu and Kashmir State was also 'At Home' to the delegates. He congratulated the Indian Roads Congress for its fine work and stressed on the role of engineers in Five-Year Plans. The construction of the road from Pathankot to Srinagar was a great achievement to the credit of engineers. Bannihal Tunnel will be a further step towards the progress of Kashmir. But more and more roads and tunnels will be required to develop Kashmir.



At Home to the Delegates

The Session which commenced on the 18th June concluded on the 25th June 1955.

PRESIDENTIAL ADDRESS

TO THE

NINETEENTH SESSION

OF THE

INDIAN ROADS CONGRESS

By

SHRI H. P. MATHRANI

Srinagar, June the 19th, 1955.

Sadar-I-Riyasat, Ladies and Gentlemen,

AS President of the Indian Roads Congress, it is my most pleasant duty and privilege to express our gratitude for your having kindly consented to inaugurate this the 19th Session of the Indian Roads Congress.

I extend a cordial welcome to our distinguished guests, ladies and gentlemen, who have so graciously responded to our invitation and spared time to attend this function. A Society like ours derives inspiration from, and grows on the interest, which you, the representatives of the public, take in its activities. Though the technical details of our work may be complicated and not easy for lay people to understand, every citizen can appreciate good planning and good execution of roads. It is your lively interest, judicious appreciation, and constructive criticism that help a great deal to keep us on even keel. It is in the course of contacts like this that our plans and problems are presented in their proper perspective before you with a view to evoking your understanding and co-operation.

To members and delegates who have assembled here, my hearty congratulations on yet another year's successes, through hard and intelligent work, in your endeavour to improve and expand the country's road system. We are here to pick up again the threads of our discussions from where we left, and go forward gathering and disseminating knowledge and perfecting techniques through which we hope to play no mean part in the nation's march to prosperity.

I am very glad to announce that we have received messages of encouragement from our Prime Minister, Shri Jawaharlal Nehru and from Shri Alagesan, Deputy Minister of Transport, Government of India. Before I proceed further I shall read these messages.

We are deeply indebted to the Government of Jammu and Kashmir for inviting us to hold this Session at Srinagar, the ancient city founded by Asoka, who was also the founder of highways in this country and which is surrounded by beautiful lakes and fine Mughal gardens. They have been inviting us so graciously for the past several years and, although the lure of the beautiful Kashmir was tantalising the minds of all of us, we had to restrain our feelings and to postpone the holding of a Session here to a time when we could see the construction of the Bannihal Tunnel.

A sincere word of thanks is also due from us to the local officers who have taken much pains and devoted considerable time to the making of excellent arrangements for our stay and work.

Lying in the lap of the lofty and hoary Himalayas, this valley of Kashmir is incomparable in beauty : the world has nothing more fair to show. Before proceeding

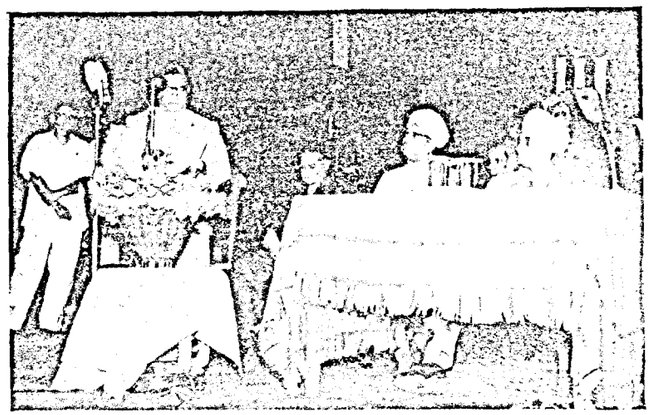
to the business part of my address, I pay my homage to this jewel among the valleys of the world. Though many poets have paid eloquent tributes to the eternal charms of this Paradise on Earth, I cannot restrain the urge of making a humble offering, artless but straight from the heart. Nature must have fashioned this land, with its legends and mythology going back to the epic past, as a sporting ground for gods and passed it on to man when he inherited this Earth.

The people of this valley are not only handsome of form and features, they are also intellectually a great race. The process of Evolution, by which Life is for ever straining to achieve physical and intellectual perfection, must indeed have reached rare heights in this race, from whom descends our beloved Prime Minister, that man of destiny who is trying ever so earnestly to prevent the human race from annihilating itself.

Srinagar is famous for its art and craftsmanship. We shall have some opportunities between our deliberations to see and appreciate its carpets, shawls, embroidery, wood and silver work. And I am sure every one of us will carry home some of these things as souvenirs.

The crisp and bracing climate of this place and the fascinations around us have already, within the short time we have been here toned up the body and mind. The spirit is now eager to get down to the work that lies ahead of us.

Kashmir, like the rest of India, is determined to push forward on the path of progress and, peacefully but unswervingly, reconstruct a stable and prosperous regime for herself. She is conscious of what is good or bad for her aspirations and we wish her Godspeed.



President delivering the Address.

Development of highways, as part of the essential programmes of a Welfare State, is not a new conception. In India, Emperor Asoka recognised, even in the 4th century B.C., the importance of highways for building up the strength and prosperity of his realms. He gave the country, as we know it, a good network of roads. Thereafter, over the centuries that rolled past, road development was slow and chequered, depending chiefly on the spurts of energy of some rulers who, in between their preoccupation with wars realised that roads were essential for promoting agriculture, stimulating trade, facilitating pilgrimage, warding off famines, and retaining control over the country.

In comparatively recent times, the invention of the steam engine gave impetus to the construction of railways and development of roads was neglected. But this did

not provoke any public protest because the bad condition of our roads did not seem to matter seriously to the bullock cart and the pack animal which remained, until recently, our only means of road transport.

With the advent of the automobile, however, quickly arose an urgent and insistent demand for well surfaced and fully bridged all-weather roads. It was then that the development of roads came in for serious consideration at the hands of Government.

The Jayakar Committee was appointed in 1927 to look into the requirements of the situation. As a result of their recommendations, the Central Road Fund was created in 1929. A part of the customs and excise duty on petrol began to be credited to the Fund. Grants from this Fund were given to States for road development, particularly in rural areas. But much work could not be done under this scheme as the annual contributions to the Fund amounted to Rs 1½ crores only. With the growth in petrol consumption and increase in the rate of contribution to the Fund from two annas to two annas six pies, the revenues of this Fund increased from Rs 1.5 crores to Rs 4.5 crores. Although this amount is very small compared with the needs of the country, a fair amount of work reckoned over a number of years has been carried out in the country by the resources provided by this Fund.

The Jayakar Committee also stressed the need for creating a forum for bringing together road engineers in the country, so that they should discuss the science and practice of road construction and maintenance. In pursuance of this recommendation, the Indian Roads Congress came into being in 1934 when the Central Road Fund was placed on a permanent footing by the Central Legislature.

Before the Indian Roads Congress was created, it was not possible for road engineers in India to get together and discuss questions relating to the administration, planning, design, construction, operation ,use and maintenance of roads. Very little of experimental or testing work was undertaken with a view to improve the technique of road construction, and that little was seldom correlated in an effective way. On policy matters, the Provincial and Central Governments had no organized way of obtaining the collective opinion of road engineers in the country. No standards of road and bridge design existed for uniform application throughout the country. The Indian Roads Congress was created to make up these deficiencies.

In the limited time at my disposal, it is not possible for me to give a complete picture of the useful work done by the Congress in the fulfilment of its objects. So I will be brief.

In the course of the last 21 years, it has done very valuable work. Its activities are many and have been enumerated on similar occasions in the past. I wish to mention that, working through its technical committees and subcommittees, it has prepared and published many useful standards for road and bridge design. It has sponsored and correlated research and disseminated knowledge gained through research. In its journals, it has published 170 technical Papers which have been discussed freely during its annual sessions.

The Congress has taken a very active hand in guiding Government in regard to questions connected with the road development policy and administration. For instance, it has been stressing the need for provincializing District Board Engineering Services concerned with roads, and has also been pressing for drawing up comprehensive road development plans and for providing assured finance for them. In matters like this, the Congress has frequently assembled conferences of all the Chief Engineers of the country to deliberate and make their recommendations to Government.

The most important of the Chief Engineers' conferences sponsored by the Indian Roads Congress was the one assembled in Nagpur in 1943. The well-known historic document on road development, known as the Nagpur Plan, emerged from the deliberations of that conference.

In the year 1943, the second World War had come to our own door and our railways were not able, by themselves, to cope with the large-scale movement of men and materials required by the exigencies of the war. Transport by railways had to be supplemented by road transport. During those days, frantic efforts were made to build many roads for the defence of the country and this was a forceful reminder to us of the woeful inadequacy of our roads *vis-a vis* the nation's needs of defence and trade. This awakened us to the imperative necessity of undertaking a comprehensive and well integrated countrywide programme of developing road communications.

The outcome was the Nagpur Plan which provided for balanced development of all classes of roads and laid down sound principles for determining priorities and phasing out execution of road projects essential for the immediate needs of the country.

This Plan provided for increasing the length of hard surfaced roads from 83,000 miles to approximately 1,23,000 miles, and the earthen roads from 1,32,000 miles to 2,08,000 miles, in the area of the Indian Union.

During the last war, there was considerable activity in respect of road development, but this slackened off immediately the war was over, and not much progress was made before we embarked on the first Five-Year Plan.

At the commencement of the Plan, the country had 97,000 miles of hard surfaced roads and 1,47,000 miles of unsurfaced roads. The Plan provides for an addition of 10,000 miles of hard surfaced roads and 20,000 miles of unsurfaced roads. Thus, at the end of the Plan period, we expect 1,07,000 miles of hard surfaced and 1,67,000 miles of unsurfaced roads.

The main deficiency in our roads was the lack of bridges, particularly across major rivers. The increase in the milage of roads, by itself, does not give an adequate idea of the magnitude of work involved in developing road communications in the country at the present stage, when almost all the big rivers have to be newly bridged. We are constructing thousands of culverts and small bridges and scores of very big bridges, varying in length from 500 ft to 7,000 ft, to give the country an all-weather road system. The mighty rivers of India present a number of difficult problems to the bridge engineer. These rivers meander about freely in alluvial beds and scour very deeply in high floods. In some of these rivers, the floods rise more than a 100 feet. Bridging them requires careful selection of sites where they meander least and elaborate calculations to determine the probable high flood discharges, the depth of possible scour, and the suitable type of construction. It is these problems that require all the ingenuity and skill the road engineer can muster.

On National Highways alone we have taken in hand the construction of 75 major bridges and hope to complete about half of them during the current Plan period. Considering the difficulties that we have met, this is not a small achievement.

In building a big bridge across the Katjuri river near Cuttack, we met with artesian conditions. Here, as soon as the wells that were being sunk for the foundations of the bridge, pierced through the impervious strata, the impounded water from below began to rush out through the wells. This, in turn, made the wells unstable and they began to sink rapidly by their own weight. It was an engineering feat to prevent them from going down indefinitely and to make them hold the weight of the bridge amounting to 1,200 tons per pier.

Coming to the progress of projects included in the first Five-Year Plan, we have, speaking broadly, been able to keep up to our programme of work and we hope to achieve the targets by the end of the Plan period. In fact, I have every hope that improvement of road surfaces, particularly of National Highways, will progress ahead of the plan.

Road engineers are now busy preparing a second Five-Year Plan and the Planning Commission have tentatively approved the proposals in respect of roads in the Central sector. This plan is likely to provide roughly Rs 60 crores for development of National Highways and Rs 44 crores for other roads like the West Coast Road for the development of which the Central Government have agreed to give financial assistance, and other roads of special economic and inter-State importance. This amount of Rs 104 crores will be further supplemented by grants from the Central Road Fund to the extent of about Rs 22 crores. Thus, the Central expenditure on road development in the second Five-Year Plan will amount to about Rs 125 crores against the total expenditure of approximately Rs 60 crores in the first Five-Year Plan period.

As regards the States sector, the plans are in the course of preparation and it is expected that the development expenditure on roads in this sector will be of the order of Rs 225 crores, against a provision of Rs 90 crores in the first Five-Year Plan.

Possibly at the rate now envisaged, the Nagpur Plan targets in respect of length of roads, metalled and unmetalled, will be nearly reached in the second Five-Year Plan. Targets in respect of bridges may, however, take one more plan to attain. The stage will then be set for bolder planning and greater achievement in the years to follow.

Mention must be made here of the highlights of road development in Jammu and Kashmir. For the hilly State of Jammu and Kashmir, roads are its life line as there are no railways or navigable streams, and roads provide practically the only means of communication. It was to provide the main artery of life that Pathankot-Jammu road was constructed in recent years at a cost of about Rs 3.3 crores. In view of the very rapid development of traffic on this road, widening of its carriageway to provide for two lane traffic and replacing its causeways with bridges, have been taken in hand and are now in progress. The construction of Udhampur-Dalhousie road, which is required for the economic development of a large area of the State, has also been recently taken in hand at the estimated cost of Rs 3.0 crores. The Pathankot-Jammu-Srinagar-Uri road has been (provisionally) classified as a National Highway and will now be maintained and improved from Central funds. The State started participating in the Central Road Fund in May 1954. It is gratifying to note that the State Government, too, has of late been going ahead with its own programme of road works. During the last two years, two hundred and nineteen miles of existing roads have been improved and developed, 4,500 ft of bridging has been nearly completed, and 225 miles of new roads and tracks have been added to the State's road system. By the end of 1955-56, 200 miles more of new roads and another 2,500 ft of major bridging are expected to be constructed, and 263 miles of existing roads upgraded, and all this is in addition to the 400 miles of roads maintained by the Army.

The most important feature of road development in the State is going to be the construction of the Bannihal Tunnel through the Pir Panjal range at an altitude of 7,300 ft, which is more or less the snowline. At present, the Jammu-Srinagar-Uri road, the main artery of the State, crosses the Pir Panjal at an altitude of about 9,000 ft and this part of the road remains snowbound for over four months in the year. Since this road is the only means of communication between the State and the rest of the country, it is essential to make it an all-weather road. With that object, the construction of the Bannihal Tunnel has been started. This tunnel will be over a mile and a half long and will be one of the longest road tunnels in the world, there being less than half a dozen road tunnels that can claim to be as long or a little longer. There exist several long railway tunnels, but the problems which a road tunnel

presents are much more difficult then those of a railway tunnel. Motor vehicles using the road tunnel generate a considerable amount of carbon monoxide and until and unless this poisonous gas is sufficiently diluted, there is danger to human life in long road tunnels. Apart from the problem of ventilation, there are other problems in long road tunnels, namely, fires, accidents to motor vehicles, lighting, etc., which have to be carefully tackled and necessary safety devices provided. After a study of many existing road tunnels of the world, it has been decided that it would be cheaper and safer to construct a two-tube tunnel, each tube for traffic in one direction, and to ventilate the two tubes by the forced longitudinal system of ventilation to dilute carbon monoxide in the tunnels sufficiently to make them safe for human beings. The two tubes will be inter-connected by cross links through which pedestrians could cross from the footpath of one tunnel to that of the other in case of fire or some other emergency. It is estimated that this tunnel, including its ventilation and safety devices, will cost about Rs 3 crores. This cost is being borne by the Central Government, as the Jammu-Srinagar-Uri road is a National Highway. The project is expected to be completed in all respects in about three years. It is, however, proposed to have one of the two tubes completed and brought into use in the cold weather of 1956-57 for regulated one-way traffic. I have not come across a single road tunnel of comparable length in the world which was designed and constructed in a period of less than six years from the date of conception of the idea to build the tunnel as will be the case in respect of this tunnel. In fact, I am not aware of any tunnel of corresponding magnitude, the completion of which took less than a quarter of a century from the date of conception of the idea to construct the tunnel. The idea of constructing the Bannihal Tunnel came from the Jammu and Kashmir Government in the beginning of 1952. At that time no detailed ground or geological surveys were available, nor was any information available about the meteorological conditions at the site. The ground and geological surveys were completed in the remarkably quick time of about eight months. Meteorological data is still being collected as these observations have to be made over a long period to get reliable data for designing artificial ventilation of the proper magnitude. This tunnel, when completed, will have very far reaching effects on the development of the Kashmir Valley. It is not possible today properly to appraise the role this tunnel will play in shaping the future of this part of our country. We, engineers, could be rightly proud of such an achievement.

We are now spending enormous sums of money on road development and have to aim at getting the best out of the country's money. This can be done by improving our standards and specifications so that the construction cost is lowered and the life of structures increased. These improvements have to be based on research—research inside the laboratory followed by experiments on models and then by trials on the field scale.

Research workers are busy throughout the world making valuable additions to our knowledge. We must also redouble our efforts in this field so that, in the context of our own requirements, we can claim that our theories of design and our processes of construction are not irrational and out-dated. It is not enough merely to assimilate what others are discovering and apply it to our conditions by chopping and changing here and there. We must find our own original solutions of the problems that face us.

Highway engineers require a rational theory for designing road pavement. Tremendous effort is being made all over the world to understand the mechanics of soil and its relation to the design of road pavements. I appeal to research workers in this country to take a hand in that effort. I am conscious that in matters of research, we have had to start from scratch and all I wish to point out is that we must keep alive the desire to make up the leeway and come abreast of our requirements arising out of our colossal road development programmes.

It is not only essential to build more and better roads but we must also ensure that the roads we build remain free from haphazard growth of building called " ribbon development" along them and from encroachments. This can be done by improving

the working of the present laws and enacting new Highway Laws. A beginning has been made in respect of the latter in some States but we must step up the progress, as otherwise there is risk of our beautiful new roads being ruined, particularly near towns and cities by the unregulated growth of buildings along them. At present road engineers have no powers to get encroachments within highway limits removed. All that they can do is to request the local revenue authorities to do so. In this respect, our experience is sad, with the result that encroachments are increasing and highways being built at tremendous cost are being spoiled. Indeed, the present system is working so adversely against road interests that new legislation giving necessary powers to the road authorities to remove encroachments should have preceded our embarking on large road development programmes.

I cannot over-emphasize the imperative need for passing Highway Laws, if we wish to derive the maximum benefit from our roads. The traffic must flow freely along them. You are all aware of the congestion and risk of accidents that exist on roads in built-up areas. It costs colossal amounts of money and yet it is not always possible to improve roads, once they get built upon, to meet the increasing needs of traffic and to ensure safety of life. I may mention that the Government of India are seriously concerned with the problem of improving existing links of through roads in urban areas, constructing by-passes round towns replacing level crossings with over-bridges, and so on. The benefit that these measures are intended to give can be made permanent only if encroachments are rigorously stopped and ribbon development is prevented.

We, Road Engineers, are happy at the road development but we have to be prepared to shoulder much greater responsibilities and put in much harder work than ever before. For the successful implementation of our big plans, engineers will require not only expert knowledge but also have to cultivate many other intellectual and moral qualities, such as honesty, courage, independence of thought, sound judgment, fairness and good sense. A practical engineer must have all these qualities to be successful in his professional and technical work. And, when he has them, his responsibilities will no longer be confined to the tendering of technical advice only; he will inevitably be called upon to take an active part in framing policies on economic and administrative problems associated with his projects.

I thank you, Ladies and Gentlemen, for your giving me a patient hearing. I request you, Sir, to declare open this Nineteenth Session of the Indian Roads Congress.

JAI HIND

DEFINITIONS OF HIGHWAY ENGINEERING TERMS

CUT: The material excavated to make a cutting.

CUTTING: That portion of the site of a road where the formation is attained by excavation below ground level.

Research is an investment in knowledge—It is probably the highest yielding form of investment in economic history.

Lord Hulsbury.

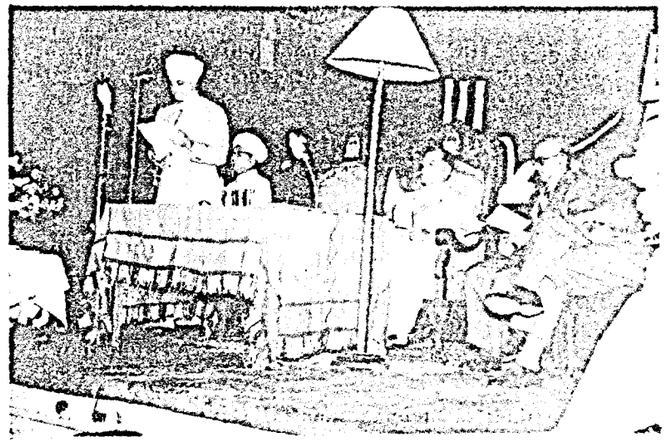
INAUGURAL ADDRESS

Delivered by Sadar-I-Riyasat Yuvaraj Karan Singh,
at the Nineteenth Session of the Indian Roads Congress,
at SRINAGAR, on the 19th June, 1955.

Ladies and Gentlemen,

I am happy to welcome you all to Kashmir. If the venue of a conference has any effect upon its deliberations I am sure your holding this session amidst such charming and inspiring surroundings will add greatly to the success of your work. For many of you I expect this is your first visit to the Valley, and I hope that your stay here will be comfortable and pleasant.

Roads can truly be described as the Lifelines of Civilization. Ever since the dawn of recorded history men have travelled over the face of the earth, and as the primary means of locomotion available to us are our legs, the paths whereby man travelled from one place to another took on great importance. Through the centuries forests were cut, mighty rivers spanned and mountains bored until today we see that over a larger part of the world's land mass there is an extensive system of roads. Here in India we have a tradition of road-building going back several thousand years and some of our greatest emperors were keen road-builders. Nevertheless, keeping in view the vast land space that our country occupies and our huge population, it has to be admitted that our road development is still far behind our requirements.



Yuvraj Karan Singhji delivering the Inaugural Address.

Until recently the economic development of our country had been proceeding upon a somewhat haphazard basis and roads also did not come under any really co-ordinated system of national development. With the advent of freedom, however, came the realization that if we are to rapidly and substantially improve the living standards of our people and add to the national wealth of our country it was essential

that our economic development should be properly planned, so that we could use our resources in a balanced and co-ordinated manner to bring about the best possible results in the shortest possible time. The first step towards this was our first Five Year Plan which is now drawing to a close. Keeping in view the tremendous difficulties involved in planning with very limited resources and without adequate statistics or experience, I think we have no reason to be ashamed of what has been achieved. Nevertheless this represents only a beginning in tackling the huge problem of national economic reconstruction that from now on is bound to be our predominant concern. In this great adventure the development of communications will play an invaluable part and, as roads are still by and large the main arteries of travel, it is clear that the development of roads in our country has an importance that cannot be over-estimated. Obviously the concept of the Welfare State will not become a reality if large sections of our population remain cut off from the main streams of progress.

There are to my mind several aspects which bring out this great importance. To begin with it is hardly necessary to repeat that economic progress will be greatly hastened by an improvement and expansion in the network of roads. The age-old concept of the self-sufficient village has, for better or for worse, broken down and it is now essential that even the remotest village in India should be incorporated in the national economy. This can only be done if every village is connected with a motorable road and, however staggering the implication of this may be, it is surely the goal towards which we must look forward. Secondly, there is the question of defence. We are a nation pledged to peace and we are doing all we can in the international sphere to contribute towards harmony and a lessening of tensions. Nevertheless, we must always be prepared to defend aggression against our country, and for this purpose a well-developed system of roads takes on considerable significance.

In addition to economic development and defence there is another aspect which, though less tangible, is certainly nonetheless important. Our country is so vast and varied that it is important always to keep in mind its fundamental unity and to strengthen this in every way possible. It is time that we stop thinking of ourselves in provincial or regional terms, and begin to consider ourselves Indians first and foremost and, after that, as members of the great brotherhood of Humanity of which nations are after all but constituent units. In the development and strengthening of this national consciousness an improvement in the means of communication, particularly roads, will make a substantial contribution.

I might now turn to the special significance of roads in our State. This has already been well brought out by Shri Mathrani in his presidential address and it remains for me only to reiterate that our terrain is among the most difficult in the world and that without a well-developed system of roads we are completely isolated. Since 1947, mainly as a result of the peculiar conditions that arose here, great improvements have been made. The Pathankot-Srinagar road has been tremendously improved, and I must pay a tribute to the Engineers and men of the Indian Army who have built roads over very high passes and mountainous terrain in the face of great difficulties and hardships. These roads have opened out large areas of our State which were previously quite inaccessible except on foot or horseback, and have thus contributed greatly towards their economic development. In our development plans we are laying great stress upon a further improvement in our roads, and the new Banihal Tunnel which has been undertaken by the Central Government will be the highlight of this programme. The Udhampur-Dalhousie road, work on which has already begun, will also be a project of major importance.

I would like here to take the opportunity of stressing the importance of road development not only in Kashmir but in the entire mountainous and submontane region of our northern frontier stretching from Kashmir all the way to Assam. This development is of great national importance from many points of view and we can draw inspiration from the remarkable achievement of our friendly neighbour, the

great nation of China. They have completed within a comparatively short time two mighty highways, the Tibet-Sikiang and the Tibet-Tsinghai roads. This was done in the face of the most incredible difficulties and will rank among the major achievements of the road-building in the history of the world. I am confident we shall not lag behind in this respect.

Finally, I would like to dwell for a moment upon the great importance of the Indian Roads Congress, and to congratulate the organization for the excellent work that it has been doing in the service of the nation. A forum where road engineers from all over the nation can regularly get together for technical consultation, research and co-ordination is clearly of the utmost importance, and I am confident that as time goes by it will progressively play a still more important and valuable role in the unfolding of our national destiny.

I wish you all success in your deliberations.

MESSAGES

to

the Nineteenth Session of

THE INDIAN ROADS CONGRESS

held at Srinagar from 18th to 25th June, 1955.

SHRI JAWAHAR LAL NEHRU, PRIME MINISTER OF INDIA.

I SEND my good wishes to the Annual Session of the Indian Roads Congress, which is going to meet in Srinagar next month. Communications of all kinds are essential in any system of planning. There is grave danger that while we produce goods, we cannot transport them easily.

In particular, communications have to be developed in our hill areas which have been largely neglected in the past.

SHRI O. V. ALAGESAN,

DEPUTY MINISTER FOR TRANSPORT & RAILWAYS,

GOVERNMENT OF INDIA.

I HAVE great pleasure in sending my greetings and good wishes to the 19th Session of the Indian Roads Congress which is meeting at Srinagar in beautiful Kashmir.

Srinagar is more than 200 miles away from the nearest railhead and as such, you could not have chosen a better place in order to emphasise the importance of road communication. Kashmir provides the proper setting for your annual confabulations. I have no doubt you will be inspired by its divine beauty. You are doubly fortunate in that the young and progressive Sadar-i-Riyasat of Jammu & Kashmir has consented to open your Conference. I personally know the great interest he is taking in the development of road communication in his State, and you will profit by his lead.

You are meeting in the last year of our first Five-Year Plan and on the eve of the Second Plan. You may have the quiet satisfaction of having achieved the targets set in the First Plan. The Size of the Second Plan is going to be much bigger than the first one. You will be called upon to achieve much more during the Second Plan period. Rural communication is bound to claim a greater share of our attention and resources. It should not be said at the end of the Second plan that any village in India is left without a road. I have no doubt that both the country and the Engineers of the country will rise to the occasion.

I wish every success to the Srinagar Session.

SHRI S. RADHAKRISHNAN, THE VICE PRESIDENT OF INDIA.

I am glad to know that the next session of the Indian Roads Congress is scheduled to be held at Srinagar from the 18th to 25th June. I send my best wishes for the success of the session.

BAKHSHI GHULAM MOHAMMAD,

PRIME MINISTER OF JAMMU & KASHMIR

It was a good thought to hold the session of the Indian Roads Congress in Kashmir this year. There is no doubt that in the sphere of social reconstruction of India, engineers have to play increasingly a vital role. Progress in the modern world is a race for mastery of up-to-date technological methods.

It is urgently important for the economic development of our country that we should have a wide net-work of dependable and cheap roads so that greater economic activity is stimulated and accelerated in all parts. Lack of a good system of communications is a sign of backwardness and it should be the concern of all that the entire length and breadth of India is welded together in a corporate way with common social and economic pursuits and collective endeavour for their accomplishment.

Messages of Good Wishes and Success of the Session have also been received from Shri G. M. McKelvie, and the following Technical Institutions from Australia, U. S. A., and U. K.

(i) Country Roads Board, Australia.
(ii) Highway Research Board, U. S. A.
(iii) The Institution of Engineers, Australia.
(iv) The Institution of Civil Engineers, U. K.
(v) American Association of State Highway Officials, U. S. A.
(vi) American Society of Civil Engineers.
(vii) Bureau of Public Roads, U. S. A.
(viii) Queensland Main Roads Commission, Australia.

LIST OF GOVERNMENT DEPARTMENTS AND ENGINEERING FIRMS WHO PARTICIPATED IN THE TECHNICAL EXHIBITION AT SRINAGAR.

GOVERNMENT OF INDIA.

Central Public Works Department. Central Road Research Institute.
Ministry of Transport, Roads Wing.

STATES

Andhra – Highways Department
Bombay – P. W. D.
Bombay State Road Transport Corporation.
Bhopal – P. W. D.
Bihar – P. W. D.
Jammu and Kashmir – P. W. D.
Jammu and Kashmir – Agriculture Department.
Jammu and Kashmir – Forests Department.
Jammu and Kashmir – Publicity Department.
Jammu and Kashmir – Tourist Department.
Madras – Highways Department.
Punjab – P. W. D., B & R Laboratory, Karnal.
West Bengal – Road Development Department.
Uttar Pradesh – P. W. D., B & R.

ENGINEERING FIRMS

M/s. Associated Imports and Exports Limited.
M/s. Burmah Shell Oil Distributing & Storage Co., Ltd.
M/s. Caltex (India) Ltd.
M/s. Concrete Association of India Ltd.
M/s. Greaves Cotton & Co. Ltd.
M/s. Standard Vacuum Oil Co.
M/s. Willcox (Buckwell-India) Ltd.
M/s. William Jacks & Co. Ltd.

TOP OF THE CLASS

"WHAT," asked the teacher, "do we call a person who goes on talking when no one is interested?"

"Please, sir, do you mean a Councillor?"

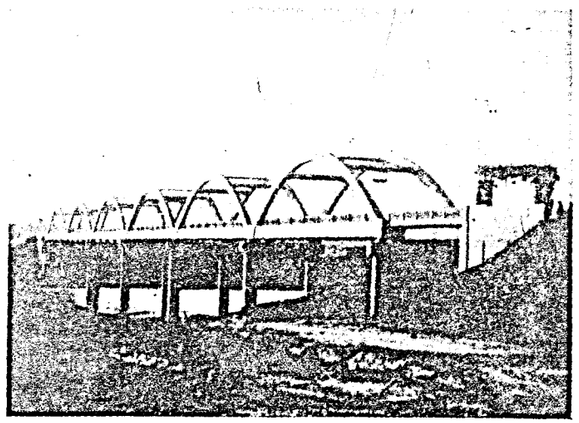
THE COMPLETE HIGHWAY

If maximum service to the public is to be realised, environment is an essential consideration in fitting the highway into its surroundings and in protecting it from undesirable encroachments.

ROAD DEVELOPMENT IN ORISSA

By C. M. BENNETT

ORISSA used to be part of the Presidency of Bengal. Subsequently, the Province of Bihar and Orissa was formed, but it was not until 1936 that Orissa was created as a separate State. Even then, about half of what is now Orissa consisted of a large number of States and these were merged with Orissa in 1948. The result of these changes was that there was no planned development of roads in this State prior to 1948; a large number of the so-called roads were merely earthen tracks and there were a very large number of unbridged river crossings.



Bonum Bridge on the Sambalpur-Jharsuguda Road

In 1948 a map based on the Nagpur Plan, showing National Highways, State Highways and Major District Roads was prepared. This was approved by Government and except for a few subsequent minor changes, this classification of roads has been adopted in planning the development of roads.

As regards National Highways, parts of N. H. 5 (Madras-Calcutta), N. H. 6 (Bombay-Calcutta), N. H. 43 (Vizianagram-Raipur) and the whole of N. H. 42 (Cuttack-Sambalpur) pass through Orissa. Taking these as a base, a network of State Highways and Major District Roads, to cover the whole of the State has been evolved.

Across Orissa, four large rivers (1) the Mahanadi, (2) the Brahmini (3) the Baitarani and (4) the Subernarekha flow to the sea. The deltas of these rivers are very flat with the result that the area between the Eastern Railway line and the sea is liable to flooding. In these areas, the roads are in a very bad condition and improvement is both difficult and expensive—difficult because raising the formation level may introduce flood problems, and expensive as no stone or gravel is available.

In the remaining portion of Orissa, however, road work is comparatively simple, as suitable materials are readily available and except for the large number of bridges which are required, there are no problems.

During the First Five-year's Plan about Rs 200 lakhs will have been spent on improvement of State roads.

As regards National Highways, a bridge over the Mahanadi on N. H. 6 has been completed, while construction of bridges over the Brahmini, Baitarani and Subernarekha on the same road is in progress. It is hoped that provision for bridges over the Mahanadi, Birupa, Brahmini, Kharsua and Baitarani on N. H. 5 will be made in the 2nd Five Year's Plan, so that by the end of this 2nd Plan period, all the National Highways in Orissa will be motorable throughout the year.

REFERENCES :—

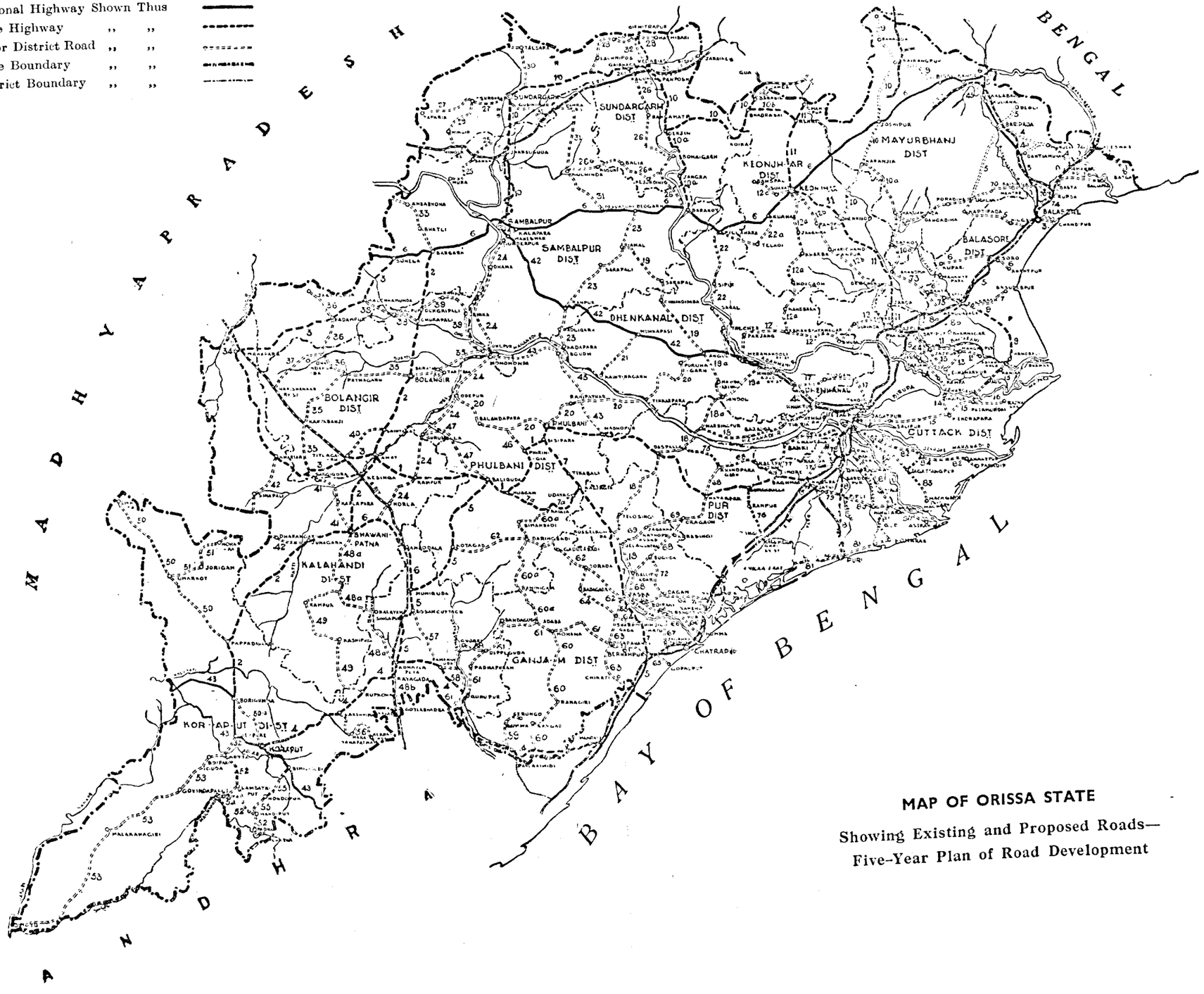
National Highway Shown Thus

State Highway ,, ,,

Major District Road ,, ,,

State Boundary ,, ,,

District Boundary ,, ,,



MAP OF ORISSA STATE

Showing Existing and Proposed Roads—
Five-Year Plan of Road Development

THE AMERICAN SYSTEM OF HIGHWAYS

ROADS

OF the 2,993,000 miles of rural roads in the United States today, almost 371,000 are included in the primary State highway systems. These are the main routes, carrying most of the traffic, and they reach every city in the United States.

About 2,537,000 miles are secondary roads that serve the land and connect the farms and the countless harmlets and cross-roads settlements with the main highways. The countless have control of 1,709,000 miles of these secondary roads, and the town and township governments have control of 609,000 miles. In recent years, some States have taken over many or all of the secondary roads within their borders. The total of secondary roads under state control is now 219,000 miles. The State have 9,000 miles of roads in States forests and parks, also.

The 350,000 miles of city streets in the United States are largely under the control of the cities themselves. There are about 38,000 miles of principal streets, which serve as connections for the State highways, that are controlled by the State highway departments.

The Federal Government has 76,000 miles of National forest, National park, and Indian reservation roads under its control. These, by the way, are the only roads built and maintained wholly by the Federal Government. The United States has no national highway system such as there are in many other countries.

Out of the 3,343,000 miles of roads and streets in our country, the most important ones, about 145,000 miles of them, are numbered and marked with the well-known U S shield. The U S numbered system has nothing to do with the control of the roads. There are no particular funds for the system, and no special laws apply to it. It is an arrangement by the States, begun in 1928, to provide a convenient and simple way to guide travellers from city to city across the country. It is a very practical and useful system, indeed.

The Federal-Aid Systems

The Federal-aid systems do not include any roads that have not already been described. They are made up of roads which are parts of the State and local systems. While Federal-aid funds are used in building these roads, they remain under the control of the State and local Governments to which they belong.

The oldest of the systems is the Federal aid primary highway system, of which the rural portion called the Federal-aid rural primary system, was first laid out by the states and the Bureau of Public Roads in 1921. It has, of course been changed somewhat from time to time as the needs of traffic have changed. The Federal-aid primary highway system includes 233, 309 miles of roads and streets, of which 215,973 miles are rural roads. They are the most important State highway roads.

The remainder of the Federal-aid primary highway system, called the Federal-aid urban primary system, consists of 17,336 miles of roads within urban areas. These are the major connections of the State highway routes through cities, and other principal city traffic arteries. During the first 20 years of Federal aid, the main effort was to get the rural roads surfaced. In the depression of the 1930's, some Federal help was given to cities for highway work, in order to make useful jobs for people who were out of work. Congress first began to provide Federal-aid funds specifically for urban highways in the Federal-aid law of 1944. The State highway departments handle these urban Federal-aid funds, but of course they work in co-operation with the cities.

Relatively small amounts of Federal aid had been provided since 1933 for secondary or farm-to-market roads. The Federal-aid law of 1944 called for the selection of a Federal-aid secondary highway system, and the larger amounts of Federal money now provided for secondary roads must be used on this system. The routes in the system are the most important secondary roads, feeding

traffic from farms and villages into the main highways and to the market centres. They were chosen by the States, the local governments, and the Bureau of Public Roads, working together. The system, almost equally divided between local-and State-controlled highways, now has 439,104 miles.

Included in the Federal-aid primary highway system is the National System of Inter-state Highways, perhaps the most important of all. This inter-state system was created by the 1944 law, after its need was clearly shown by several careful studies by the State highway departments and the Bureau of Public Roads. The system is limited by law to 40,000 miles. Its routes, connecting all the major cities and production centres, were selected by the States and the Bureau of Public Roads, and are the most heavily travelled in the country. Recognizing the importance of this system, the Congress provided, in the Federal-aid Highway Act of 1952, 25 million dollars for exclusive use on the system in each of the fiscal years 1954 and 1955. In addition, regular Federal-aid, primary and urban funds are used for its improvement.

The operation of the Federal-aid programme under the supervision of the Bureau of Public Roads has already been described. The Bureau has its main office in Washington. In order to work closely with the State highway departments, the Bureau has 9 division offices across the country, and a small district office in each State. The Bureau works in close co-operation with the State highway departments. Aside from its job of handling the Federal-aid programme, the Bureau also builds roads for the Federal Government, mostly in Federal lands such as National parks, forests, and reservations.

The Bureau, as one of its major responsibilities conducts an extensive programme in all phases of highway research. Far from being abstract, this research is an important tool in administrative and technical progress. The Highway Research Board, the State highway departments, universities, and other organizations also do much highway research work.

The Bureau is now operating extensively overseas, giving technical aid to countries that have had little experience in modern highway practice. It has provided funds and engineers to the Central America republics to help survey and build the Inter-American Highway, and to the Philippines for rehabilitation of its war-destroyed roads and bridges. Bureau engineers are advising the highway departments in Turkey, Ethiopia, and Liberia.

THE STATE HIGHWAY DEPARTMENTS

Every State has a highway department, which handles the construction, maintenance, and management of the State highway system. These are the most important and the best organized and equipped road-building agencies of the Nation. Most States are divided into districts so that the men who supervise the construction and maintenance work will be closer to it. The top management of the highway departments varies among the States: 14 of them are run by one executive, usually called the commissioner; 28 are supervised by a group of men, or commission; and 6 have both an executive and a commission.

The departments employ many engineers. But they also have accountants, lawyers, real-estate experts, draftsman, stenographers and clerks. Many of the engineers are specialists, in a particular kind of highway work, such as road or bridge design, surveying, traffic, maintenance, materials, soils, etc. Some of them work at research or testing of materials.

While the highway departments design the road and bridge projects, they generally hire contractors to do the actual building. Usually each job is advertised, and contractors send in their bids. The one who offers to do the work for the least money gets the job, if he is responsible and capable. During construction, highway department engineers stay at the job to see that it is done properly.

Maintenance of State highways is done largely by employees of the State highway department. This is a big job. It means patching broken pavement, putting bituminous coatings on rough surfaces, painting bridges and traffic stripes, cutting weeds, planting trees, removing snow, setting up traffic signs and signals, operating draw bridges and ferries, and many other kinds of repair and upkeep. This housekeeping of the existing highways is just to the motorist as the building of new roads.

THE LOCAL RURAL ROADS

More than 18,000 local governmental units have an interest of some kind in the local rural roads. These include 2,750 counties, 14,500 towns and townships, and 950 special road districts. In New England the local roads are largely controlled by the towns, and in Pennsylvania by the townships. In the Southern and Western States the counties generally handle local road affairs. In the rest of the country, with some exceptions, the counties have charge of the more important local roads and the townships take care of the remainder. The townships in a few States have voluntarily handed over their road responsibilities to the counties. Some States have taken the more heavily travelled local roads into their State highway systems, and in Delaware, North Carolina, Virginia (except in three counties), and West Virginia all rural roads are under State control.

The local road units vary in size from little districts only a mile square to California's San Bernardino County, which is bigger than New Hampshire and Vermont put together. The road systems these local governments control range from less than 5 miles to more than 5,000 miles in length. The money they have to spend for highway work varies from 500 dollars to more than 10 million dollars a year. The size of their highway units runs all the way from a single part-time worker to organizations with more than 500 employees.

Many of the local highway departments, particularly the larger ones, operate in much the same way as do the State highway departments. Since a large part of their road systems are earth or gravel, they do a good deal of construction with their own men and machinery. Those that are properly manned and equipped do an excellent job in maintaining the local roads.

Some of the smaller local road units, howerve, are not so efficiently operated or well managed. They have small mileages of roads to maintain, and so cannot afford specialized machinery or an engineering staff. There are several possible solutions to these problems. State-aid and Federal-aid secondary road funds help the local governments financially. Many of the State highway departments have special staffs of engineers to advise the counties and townships in highway planning and building. In recent years some of the local units have pooled their work, in groups of two or more, so as to make better use of equipment and skilled employees. All of these efforts toward better local road management have been encouraged by the Federal Government through the Federal-aid laws.

THE CITIES

There are about 17,000 cities, boroughs, and villages that are engaged in construction and maintenance of the streets and highways within their limits. Like the local rural governments, the size and nature of their work varies greatly from the little village with a few blocks of "Main street" to the great cities like New York and Chicago. In many States the cities receive State-aid funds, and in some States the principal streets carrying the State highway routes into and through the cities are under State control. The most important streets are often on the Fedral-aid urban system and can be improved with Federal-aid funds.

City streets, like rural roads, are of varying degrees of importance. The main thoroughfares, radiating like the spokes of a wheel, bring traffic into the business and industrial centres from the inter-city and inter-state highways and from the nearby suburbs. Important cross-town streets connect these spokes, linking the different parts of the city. The remainder of the streets provide local service to residential areas.

The city highway departments have the same basic work to do as the counties and townships, or the State highway departments. They build, repair, and control traffic on the streets. But in the larger

cities the work is difficult and complicated. Traffic is very heavy, especially during the morning and evening hours when people are going to and from work. Most of the streets have to be paved with hard surfaces. They are subject to terrific wear and are frequently cut into for repair of underground facilities like sewer, water and gas pipes, and electric and telephone wires. Street car and bus lines, and the loading and unloading of trucks, are complications the rural governments do not have to deal with. To keep traffic moving as smoothly as possible, cities need many traffic signals and police officers. In the very large cities, the modern expressway, which eliminates cross traffic, is the only solution to traffic congestion on the major thoroughfares.

The lack of parking space is one of the worst of our present highway problems, and it exists in cities of all sizes. Parking meters have helped in making good use of available space along the curbs, but much more space is needed. It can only be provided by more parking lots and, in the larger cities, by parking garages. Many cities are encouraging business men to construct parking places. Some cities are building garages with public funds and either operating them or renting them to private operators.

It is a popular idea that main highways should by-pass the cities. A lot of traffic goes in one side and comes out the other, so why not take it around? Traffic studies of origin and destination reveal, however, that the vehicles coming out are not the same ones that go in on the other side. Many of them stay in the city, or at least stop for a while, and relatively few go right through. For instance, in cities of 25,000 to 50,000 population, about 22 per cent of the vehicles want to go through. About 30 per cent head for the central business district, and the remainder are bound for some other part of the city. And the larger the city, the larger the proportion of traffic that wants to stop. Thus the main highways will serve traffic best if they enter all but the smallest cities and skirt the area of the central business district. In the smallest urban places, it is desirable to locate the bypass as close as possible to the city.

(From "Highway in the United States, U. S. Department of Commerce, Bureau of Public Roads", Washington, 1954).

A VERY GOOD REASON

A TEACHER, in a health talk to her pupils warned them never to kiss animals. "Can you give me an instance of the dangers of this," she asked.

"Yes, miss, my Cousin Alice used to kiss her dog."

"And what happened?"

"It died."

FALSE ECONOMY

"By paying lower wages to inferior workmen the employer thinks he is saving money."

CONCRETE ROADS IN CANADA

THE vast area of Canada, the great distances between cities and centres, would seem to call for all the road-building enterprise and ingenuity which has been shown by the United States. Yet Canada has, in fact, lagged behind other countries in constructing her highways and other roads.

The reasons for this comparative lack of good roads in Canada are not far to seek. They lie in the excellence of the railway system, the early growth of air transport, the difficulties of the terrain, the sparse population and the general lack of Federal co-ordination of highway projects.

Set against these advantages in other methods of transport is the fact that geographically Canada offers in some regions almost insuperable obstacles to road-building, such as vast rock-bound tract of land, the Rocky mountains, deep, fast-flowing rivers, poorly drained clay belts, and the 'muskeg', a soft vegetable swamp into which entire engines vanished in the railway building days. The climate, too, is often most unsuitable for road building.

In addition to these physical difficulties the country is sparsely populated, with settlements mostly spread out along the United States Border: 70 per cent of all Canadians live within 100 miles of that country. Also road development and jurisdiction has been largely an internal matter within the Provinces, and any federal assistance has been of a very desultory nature, until the passing of the Trans-Canada Highway Act in 1949, Co-ordination of Inter-provincial road building has therefore been negligible.

Canadian concrete roads may be said to have begun in Windsor, Ontario, in 1908, when that municipality considered about three miles of residential and business roads in concrete. Rural highways in concrete were started in 1914, when thirty-five miles of concrete were laid between Hamilton and Toronto. Methods of construction have in the main followed American practice because of the interchange of ideas between Canadian and American highway authorities, the availability of American construction equipment, and the similarity of climate. In Ontario from 1921 to about 1937 the thickened edge type of construction was generally used, with either a 6 in. or 7 in. centre thickness, and an 8 in. or 10 in. edge thickness, usually without reinforcement or expansion joints. This was the standard type of construction for all class A highways during that period. During the depression years of the early 1930's a considerable milage of single-lane concrete roads was constructed, and double-tracked at a later date.

More recent practice in expressway design has been to construct a 9 in. uniform section in successive lanes with dummy contraction joints at 20 ft intervals and (if construction is carried out during the winter) transverse expansion joints at 300 ft intervals. The Queen Elizabeth Way was built on those lines. This highway is the first of a series of similar projected expressways to important parts of the border; it was built to relieve traffic in the Niagara Peninsula, through which more than half of the annual tourist traffic enters Canada. The 97 miles of this road stretch from Toronto to the United States border at Fort Erie, opposite Buffalo, on the Niagara river, and it connects the United States and Canada at the Peace Bridge, built to commemorate a hundred years of friendship between the two countries.

The expressway has a dual carriageway, each carriageway 23 ft wide and divided by a grass central strip approximately 30 ft wide. There are twenty-three intersections; either of the full or semi-cloverleaf type and fifty bridges, mostly of reinforced concrete, over streams, canals and railways. Most of the intersections and bridges were built before grading operations started—an unusual construction feature. Another point of interest is

that explosives were used to settle fills across the 'muskegs' or swamps. The depth of the swamp was established by drill holes, the new fill, equal in depth to the swamp, was placed over the swamp, and this was then blasted out from under the new fill, which settled to the solid foundations. The 9 in. slab was placed on top of 6 in. of gravel. The concrete used has an average compression strength of about 4,500 lb per sq. in.

A major advantage of this type of highway is that heavy snow, so often damaging to Canadian roads, can be moved quickly from the concrete surface. With this in view drainage has been provided both in the centre strip and at the sides where snow can be piled up and melt.

Average speeds of 45 to 50 miles per hour were obtained with motorized units, whereas on other roads only 25 to 30 miles per hour were possible; the movement of materials and goods was equally speedy. The peak load of traffic in 1941 was 38,000 vehicles a day—still far below the maximum of 60,000 a day which the Highway Department considers can use the road with speed and safety.

From Toronto another important expressway—King's Highway 2A—is a divided highway with two 22 ft carriageways constructed with a uniform 9-in. slab of concrete supported on a 12-in. granular base course 26 ft wide. The 32-ft wide centre strip is designed with a fall to the centre where frequent drains lead into a concrete-lined culvert. This design was adopted in order to facilitate the storage and clearance of snow in the winter.

Construction practice in Quebec in the 1930's also favoured the thickened edge, 9 in.-6 in.-9 in., 9 in.-7 in.-9 in., or 10 in.-7 in.-10 in. Unlike Ontario however, heavy bar mat reinforcement was generally used, weighing about 70 lb per 100 sq. ft, and 3/8 in. expansion joints were made every 40 ft. The roads were sometimes two, sometimes three lanes wide and tie bars were used to link the 10 ft or 11 ft wide slabs, with dowel bars at the transverse joints. During the 1940's the practice in Quebec changed to the 9 in. slab for main highways. With a number of these highways one lane only was built during the war years, and another added later.

Manitoba has built concrete roads to a uniform 8 in. section, with heavy steel reinforcement, expansion joints at 90 ft intervals, and intermediate dummy contraction joints at 30 ft intervals. Dowel bars are also used at all joints. The success of this design was fully proved on No. 75 Highway from Winnipeg to Emerson, which suffered from severe floods in 1950. A great deal of the sub-base was washed away, but it was eventually reconsolidated without damage to the slab, and the riding surface was in no way impaired. Other old concrete roads, built in the suburbs of Winnipeg in 1921, are still in service after thirty-three years.

Concrete is also playing its part in the 5,000 mile Trans-Canada Highway, some of which is to be concrete and some bituminous. This is the first major occasion in which the Federal Government has entered into highway construction, and a fund of 150 million dollars has been appropriated, to be matched dollar for dollar by the provinces in building "the shortest practical east-west route."

The Trans-Canada Highway Agreement specifies the Federal Government's right to establish design standards, and the Government has exhorted the provinces to build up to the highest practicable standards. The road will be a two-lane highway, between 22 ft and 24 ft wide and designed to carry a repeating axle load of 18,000 lb, with shoulders between 5 ft and 10 ft wide on each side. The maximum permitted gradient is 6 per cent and curvature is not to exceed 6 degrees. When it is completed, this will be one of the longest highways ever built.

(From 'Concrete Quarterly 24'—Jan.-March, 1955.)

"There is no affinity between engineering skill and political skill; they are completely different."

THE "COWLEY" LEVEL—ITS USE AND APPLICATIONS

THE London firm of Hilger and Watts have introduced an entirely new form of levelling instrument which is simple, light in weight, relatively cheap, and accurate enough for a great deal of the levelling work which occurs in civil engineering. If, for example, this new levelling apparatus is set up midway between two points, 200 feet apart, the reduced level of each point can be determined to an accuracy of one-quarter of an inch (.02 of a foot), or its equivalent, 6 mm. in 30 metres.

The accuracy of the instrument is increased if the sighting distance is decreased below this limit and if less accuracy can be tolerated the sighting distance can be increased beyond 100 feet.

In external appearance the instrument, which has been named the "Cowley" level, is merely a metal box of rectangular form, with rounded corners, $5\frac{1}{2}$ inches deep by $4\frac{3}{4}$ inches wide, by 2 inches thick, somewhat resembling a cine-camera. There is a viewing aperture in the narrow front face and an eyepiece in the top face, but no adjusting screws, spirit-levels, telescopic devices, or other complications.

It is normally used by setting it up on a tripod which is fitted with a vertical pin engaging with a hole in the bottom rear corner of the metal instrument casing. It should be set up reasonably level but precision in this respect is not essential. If required the instrument can be set up on a brick wall, or similar support, without using the tripod, a special supporting frame being available for this purpose.

When an observation is taken through the eyepiece it will be seen that the distant view is split into two halves, one erect and the other inverted, and if a staff with a horizontal cross-piece is visible in the eyepiece the cross-piece will normally be split into two halves which do not coincide. If, however, this cross-piece is capable of vertical adjustment up or down the staff, it will be possible to find a position in which the two halves meet on the vertical division line of the eyepiece. When this occurs the cross-piece is on a horizontal line passing through the optical centre of the instrument.

In actual practice greater precision is obtained by observing to a horizontal line ruled on the cross-piece and an index, coinciding with this line, travels over a scale on the back of the staff graduated in feet, inches and quarter-inches. Metric graduation of comparable fineness is also available.

Considering, again, two points 200 feet apart, with the level set up midway between them, if the horizontal cross-piece is adjusted to give coincidence of the images and the reading is taken by the staff holder at each point in turn, the difference between the readings will clearly give the difference in level between the two points.

The working principle of this ingenious instrument is simple and foolproof. One of the images seen through the eyepiece is formed by reflection from two fixed mirrors which are so arranged that the angle between the entering and emergent rays is 100°, even if the level is tilted. The other image is formed by reflection from three mirrors, one of which is mounted on a pendulum in such a way that it is always horizontal. In order to accelerate the setting of this pendulum in a vertical position, it is arranged to swing between the poles of a powerful magnet which acts as a damper. The angle between the entering and emergent rays, in this case, is again 100°.

When coincidence of the two images is obtained by adjusting the cross member of the staff the reference line of the staff lies on a horizontal line passing through the optical centre of the level, which is a fixed point.

In short, the principle of the instrument is based on the fact that a freely swinging pendulum assumes a position at right angles to the horizontal line defined, in the normal type of level, by the spirit level.

(From "Highways and Bridges", July 7th, 1954.)

HERE AND THERE

1. IDEAL SPECIFICATIONS

THE IDEAL SPECIFICATION, "would specify results only, and contain no requirements concerning equipment or methods to be used in attaining the results. Unfortunately, we are not always able to write an accurate description, or provide practical and adequate methods for measuring the results to be attained. Here we resort to specifying equipment and methods. Occasionally we make the serious mistake of specifying both the method to be used and the result to be attained. The wiser, more alert and more careful we are the more nearly can we approach the ideal. Too often we specify equipment and methods to the degree that contractors are precluded from the exercise of their ingenuity in developing better and cheaper methods to attain the results desired".

(From 'Better Roads', August, 1954).

2. CONTROL OF ACCESS

ON HEAVILY TRAVELLED ROUTES, control of access is of utmost importance to the life of the highway. Lack of this control has created problems impossible of solution. Where there is no control of access, roadside businesses develop. Traffic resulting from these roadside businesses interferes with through traffic. Consequently, the capacity of the highway is reduced and accident frequency is increased. As roadside businesses increase, accidents increase and capacity decreases; congestion develops. Widening is impracticable because these businesses have become so valuable that right-of-way costs are prohibitive. Thus, obsolescence increases until authorities are forced to re-locate the highway. This wasteful procedure may be avoided by control of access—an important item to be considered in the planning stage of the complete highway.

(From Engineering Bulletin G-3 of the College of Engineering, New Brunswick, New Jersey.)

3. T. V. VIEW OF TRAFFIC

DETROIT—THE Streets and Traffic Department is studying the possibility of TV control of expressway traffic jams.

If the plan becomes a reality, TV cameras will be located so as to view long distances of expressway traffic. The cameras would be monitored at a central location, allowing an observer electrically to trigger warning signs posted on the highways. Motorists then could leave the expressway before becoming involved in a jam-up.

Two other systems of traffic control also have been suggested: use of a larger police force, or erection of observation posts manned by observers.

(From "Engineering News-Record", March 3, 1955.)

4. FOAMED CEMENT AS INSULATION

A METHOD of producing foamed cement for insulation purposes is described in "Engineering News-Record" for February 24, 1955. Foam is generated at the rate of 60 to 120 gallons per minute by aerating by compressed air, in a tank, a compound with a protein base. Cement and water are stirred to form a slurry in a concrete mixer with a drum of 5 cu. yd. capacity; to this the foam is added through a pipe, and the rotation of the mixer drum is continued in order to distribute the air cells throughout the slurry. The foamed slurry is discharged from the mixer into a hopper from which it is taken to the site of the work by means of concrete carts.

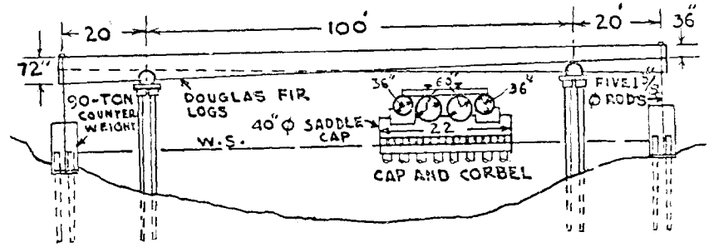
In the work described, the material was used to cover a roof of 60,000 sq. ft. The density was 40 lb per cubic foot, and it is stated that this can be varied between 10 lb. and 100 lb per cubic foot according to the proportion of cement and foam in the mixture. At a density of 40 lb per cubic foot, about 575 lb of cement per cubic yard of foamed material and about 105 gallons of foam were used per cubic yard. The foam cost about 5 shilling per cubic yard of concrete. The process is owned by National Foam System, Inc.

(From "Concrete and Constructional Engineering, Vol. L, No. 5, May, 1955".)

5. PRESTRESSED COUNTER BALANCE LOG SPAN PROVIDES WIDE OPENING FOR FLOODS

AN OLD TIMBER BRIDGE with short spans over the Hoko River was to be replaced at a point where driftwood during floods had frequently caused trouble in the past because of the small openings and low headroom at time of high water. The solution was the prestressed counterbalanced log bridge shown below.

Live load for the bridge was that created by a 160-ton locomotive and a 100-ton crane. Four log stringers were used, 142 ft long, with 72 in. butts and 36 in. tops.



All piles and timber except the log stringers were treated with creosote. The stringers are covered on the top half with 24 gauge galvanized sheets.

In this log bridge, 90 ton counterweights, given added stability against uplift by deeply driven piles, were used to develop a negative deflection of three inches at the centre of the main span.

The central span is 100 ft, and counterbalance arms at each end are 20 ft long. Each counterweight block is of concrete weighing 90 tons. Additional stability against uplift is provided by eight timber piles driven into the ground under each counterweight and extending 8 ft up into the block. Five steel rods, 1-5/8 in. dia. secured to plates in the bottom of each

(From "Engineering News-Record," Washington, dated Jany. 27, 1955).

6. ONE OF THE WORLD'S LARGEST STEEL ARCH BRIDGES

JAPAN'S New Single-Span steel arch bridge linking Nagasaki with Sasebo, Kyushu Island, is the fourth largest structure of its kind in the world. The bridge, costs about 1.5 million dollars (Rs 74 lakhs), is 712 ft high at the centre and 1,042 ft long. The world's largest steel arch bridge is the 1,652 ft long Kill Van Kull span in New York City. Second is Australia's Sydney Harbour Bridge, 1,650 ft long. Birchenough Bridge (Zambezi River in Southern Rhodesia) is third with 1,080 ft.

(From "Engineering News-Record", March 3, 1955.)

CURRENT LITERATURE

ABSTRACTS

Laboratory Analysis of Soils—Grain size and Liquid Limit—Highway Research Board—U.S.A. Bulletin No. 95.

THE Bulletin contains three Papers the following two of which are devoted to improvements in dispersion of soils in the measurement of grain size distribution.

1. Dispersing Agents for Particle-size Analysis of soils by A. M. Wintermyer and E. B. Kinter.

Nineteen chemical dispersing agents were listed to determine their effectiveness in the dispersion of soils and the stabilization of soil suspensions for particle size analysis. 14 soils and two clay minerals were tested. Principal findings and conclusions are :

1. Sodium metasilicate was among the less-satisfactory dispersants. Although it failed to stabilize the suspension of only one soil, many of its dispersion values were seriously low. Its use as a general soil dispersing agent should be discouraged.

2. Widely effective dispersing agents were found only among the phosphate materials. Two of these, sodium polyphos and sodium tripolyphosphate were highly effective with all soils except one, a laterite. Sodium hexametaphosphate and sodium tetraphosphate were only slightly less effective.

3. The highest dispersion values for a laterite soil were obtained from trisodium phosphate and tetrasodium pyrophosphate. For most other soils, however, the first was unsatisfactory and the second produced dispersion values that were only moderately high.

4. From the standpoint of special groupings, such as, podzolic, illitic, kaolinitic, and montmorillonitic soils, the four phosphates noted in Item 3 (above) were consistently highly effective, though their relative ratings varied somewhat among the groups. For general use, sodium polyphos is rated best and sodium tripolyphosphate is a close second. Their unsuitability for the dispersion of a true laterite soil does not extend to related, partially laterized soils.

2. Defloculating Agents for Mechanical Analysis of Soils, by T. Y. Chw and D. T. Davidson.

Among the three chemicals compared Sodium metaphosphate is the most promising. The age and amount of the defloculating solution used on the efficiency of dispersion is also reported. The third Paper is " Rapid methods for determining Liquid Limit of Soils " by F. R. Olmstead and C. M. Johnston.

Two Simplified methods of determining liquid limit of soils are discussed. Care is the short method developed by the Washington State and the other a modification of the chart method. Both the methods have good reproducibility and have sufficient accuracy, within limits, to be acceptable as alternate test procedures for the Standard method.

Flat Slab Solved by Model Analysis by GERALD BOWEN and R. W. Shaffer.

A practical model analysis procedure for determining elastic moments, shears, torsions and deflections in any plate structure under transverse loads is presented. This method, known as " photo reflective stress analysis " or the " Presan method," is described in some detail. A specific analysis and reinforcing steel design of a continuous square bay flat plate supported by columns of finit diameter is presented and compared to mathematical analysis of the same structure using ACI Building Code moment coefficient (M_o) and standard elastic analysis and design procedures. (Authors Summary).

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2. **A Coal Storage with Walls of an Unusual Type of Construction**; C. W. J. GROOTHOFF, *Cement, Vol 5, No. 11-12*, December 53, pp. 172-173 (in Dutch).
3. **Flat Slab Floors for the Construction of A Textile Warehouse at Goor**; H. H. TOETER – *Cement, Vol. 5, No. 11-12*, December 53, pp. 177-184 (in Dutch).
4. **The Influence of Vibration and Re-Vibration on the Bond of Concrete and Reinforcement**; P. C. KEIJGER, *Cement, Vol. 6, No. 13-14*, February, 54, p. 212.
5. **Testing of the Position of Reinforcement – Bars in Concrete**; H. C. DEN DAAS – *Cement, Vol. 6, No. 15-16*, April ,54, pp. 227-229 (in Dutch).
6. **From Concrete and Reinforced Concrete to Prestressed Concrete**; D. J. VAN DORP, *Cement, Vol 6, No. 15 16*, April 54, pp. 230-234 (in Dutch).
7. **Prestressed Concrete Shell-Roofs**; B. W. VAN DER VLUGT and J.J.B.J.J. BOUVY – *Cement, Vol 6, No. 15-16*, April 54, pp. 247-251 (in Dutch).
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BUDGETS AND ADMINISTRATION REPORTS

GOVERNMENT OF AJMER BUDGET FOR 1955-56

The following extracts relating to Civil Works have been taken from the Government of Ajmer budget for the year 1955-56.

CIVIL WORKS

	(In lakhs of rupees)		
	Accounts 1953–54	Revised Estimates 1954–55	Budget Estimates 1955–56
REVENUE			
Receipts from the Central Road fund	—	0.64	0.16
Rents	0.03	0.03	0.03
Miscellaneous	0.26	0.20	0.20
Total	0.29	0.87	0.39
EXPENDITURE			
Buildings			
Original Works	1.00	2.53	5.22
Repairs	0.21	0.40	3.50
Communications			
Original Works	3.46	4.62	3.36
Repairs	3.29	4.45	5.59
Establishment Charges	0.68	0.97	1.40
Tools & Plant	—	0.06	0.10
Development Schemes			
Local Development Works	0.15	0.16	—
Total	8.79	13.19	19.17

Capital Account of Civil Works outside the Revenue Account

	(In lakhs of rupees)		
	Accounts 1953–54	Revised Estimates 1954–55	Budget Estimates 1955–56
Original Works—Buildings	—	4.87	23.72
Construction roads other than National Highways	—	1.77	7.00
Establishment Charges	—	0.80	3.69
Tools & Plant Charges	—	0.07	0.31
Total	—	7.51	34.72

Revenue from Roads

Receipts under Indian and State Motor Vehicle Acts	0.54	1.85	1.85

Sales tax on petrol not separately available.

GOVERNMENT OF AJMER BUDGET FOR THE YEAR 1955-56

(A brief review with reference to Civil Works)

THE total revenue of the State for the year 1955–56 is estimated at Rs 274 21 lakhs as against Rs 195.10 lakhs (Revised Estimate) for 1954–55 and Rs 162.09 lakhs (Accounts) for 1953–54. The corresponding revenue expenditure figures are Rs 274.21 lakhs for 1955–56 (Budget Estimate) and Rs 206.10 lakhs for 1954–55 (Revised Estimate) and Rs 147.68 for 1953–54 (Accounts). The year 1955-56 is expected to end with a closing balance of Rs 5.96 lakhs which is equal to the opening balance brought forward from the preceding year.

Revenue expenditure on Civil Works (Original Works and Repairs only) is placed at Rs 17.67 lakhs while the Revised Estimate for 1954–55 and the Actuals for 1953–54 amount to Rs 12.16 lakhs and Rs 8.11 lakhs respectively. In terms of total State revenue, the expenditure works out to 6.4% in 1955–56, 6.2% in 1954–55 and 5.0% in 1953–54. The provision for Communications alone (Original Works and Repairs only) is Rs 8.95 lakhs for 1955–56 which forms 3.3% of the total estimate revenue of the State. For 1954–55 and 1953–54 the corresponding ratios are 4.6% and 4.2% respectively. (The percentage figures in respect of Communications do not take into account the expenditure under "Development Schemes" as it could not be readily apportioned between Buildings and Communications. The amount involved is, however, too small to affect the ratios appreciably.)

Capital Expenditure on Civil Works outside the revenue account amounts to Rs 34.72 lakhs for 1955–56 (Budget Estimates) as against Rs 7.51 lakhs for 1954–55 (Revised Estimates). No capital expenditure appears to have been incurred in 1953-54.

WRONG SOURCE

FRIEND: "*Did you get any replies to your advertisement that a lonely maiden sought light and warmth in her life?*"

Spinster: "*Yes, two from electric-light companies and one from a gas company.*"

LIST OF APPROVED WORKS ON NATIONAL HIGHWAYS

S. No.	Job No.	Name of work	Amount (Rs in Lakhs)
		UTTAR PRADESH	
1.	1231 UP 24	Construction of the Approach roads from Meerut side to the bridge over the Ganga at Garmukteshwar proposed on Lucknow-Bareilly N. H. 24.	5.06
2.	1235 UP 24	Widening the bridge over the river Hindan on Delhi-Lucknow N. H. 24 near Gaziabad.	4.34
3.	1237 UP 29	Painting miles 28-35 of Allahabad-Gorakhpur road, N. H. 29 (local milage 132-139).	3.56
4.	1252 UP 28	Painting Ms. 196-199 of Gorakhpur-Kasia Road, N. H. 28 (local miles 32-35).	2.27
5.	1275 UP 28	Painting Ms. 180-190 of Gorakhpur-Kasia Road, N. H. 28 (local Ms. 16-26).	6.39
6.	1304 UP 2	Diversion of Bombay-Delhi road N. H. 2 in miles 811-812 near Kosikalan.	4.00
7.		Three works each costing less than Rs 2 lakhs	3.54
		TRAVANCORE-COCHIN	
8.	1262 TC 47	Construction of a bridge across the back waters at Aroor on N. H. No. 47.	27.24
9.		Four Works each costing less than Rs 2 lakhs	3.94
		MYSORE	
10.	1175 MY 4	Improving to M. 146/0 to M. 173/0 of N. H. No. 4 in Davangere Division.	3.98
11.	1199 MY 4	Black topping M. 67 to M. 85 of N. H. No. 4 in Tumkur Division.	2.10
12.	1200 MY 4	Widening the B. T. surface from M. 28/4 to 43/0 of Madras-Cannanore Section of N. H. No. 4 in Kolar District.	2.90
13.	1228 MY 4	W. B. M. renewals over miles 92/2 to 146/0 of Bangalore-Dharwar Section of N. H. No. 4 in Chitaldrug District.	2.81
14.	1250 MY 4	Widening the B. T. surface in M. 43/0 to 71/2 of the Madras-Cannanore Section of N. H. No. 4 in Kolar District.	7.45

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