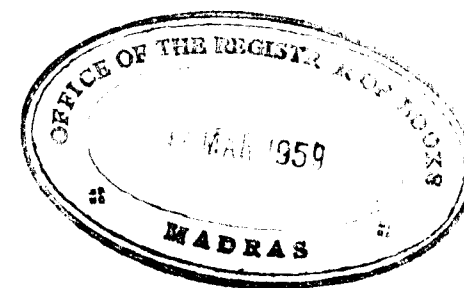


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MONTHLY REVIEW

FEBRUARY 1959—No. 142

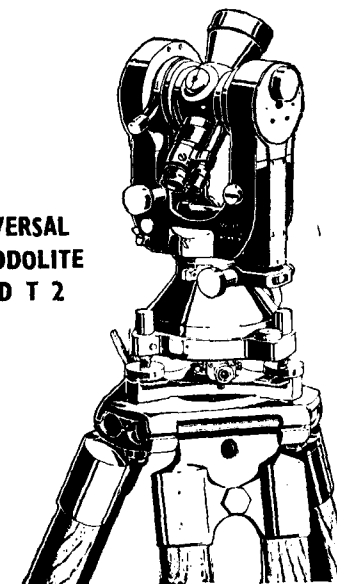


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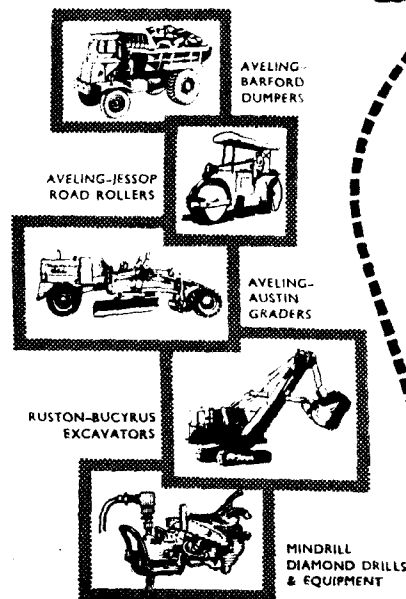
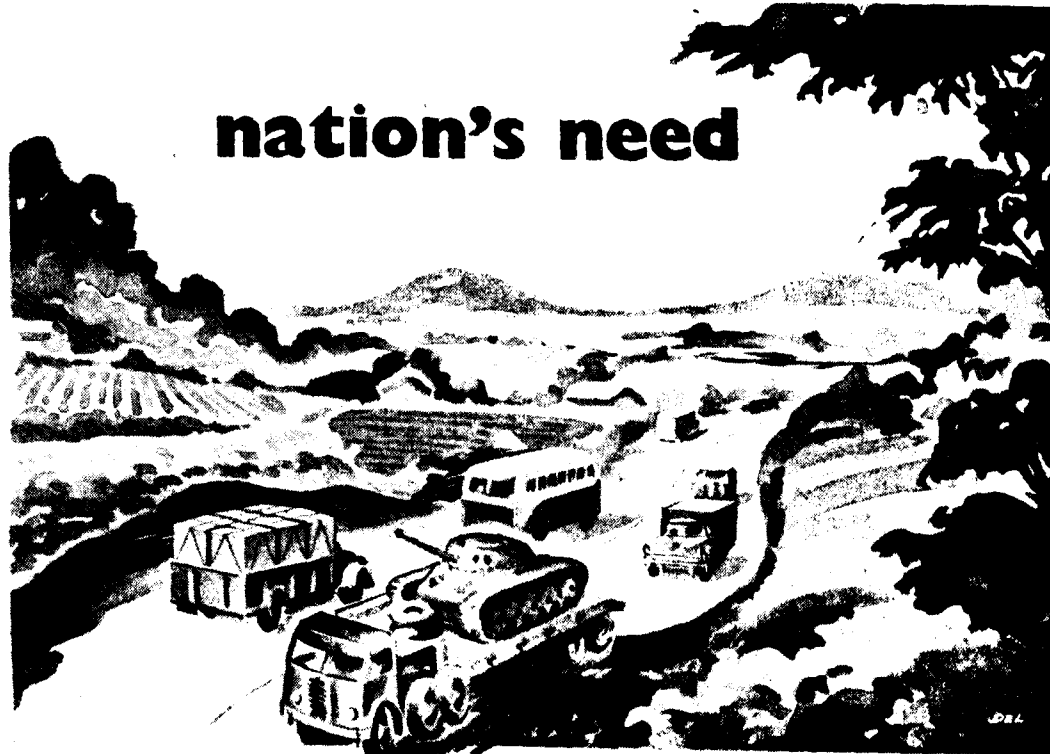
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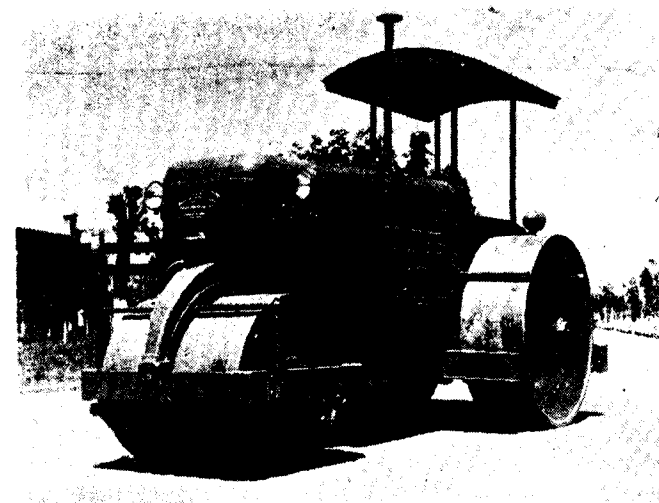
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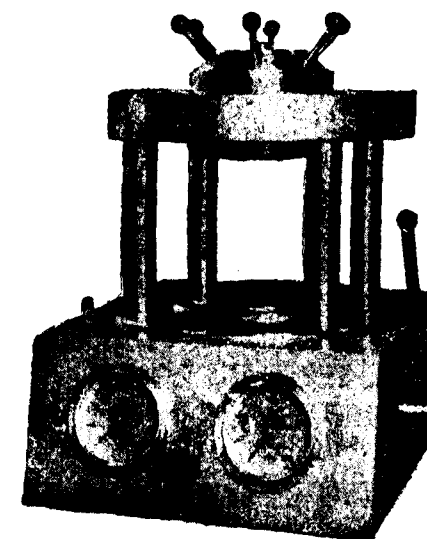
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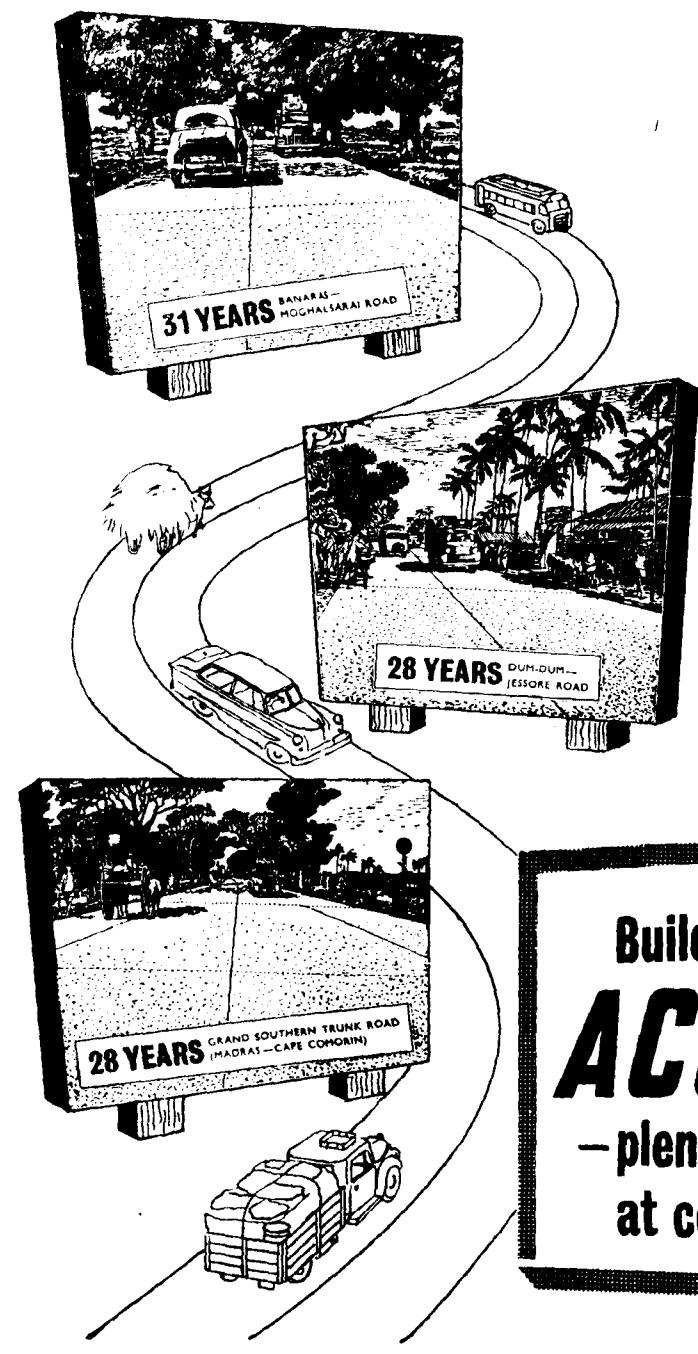
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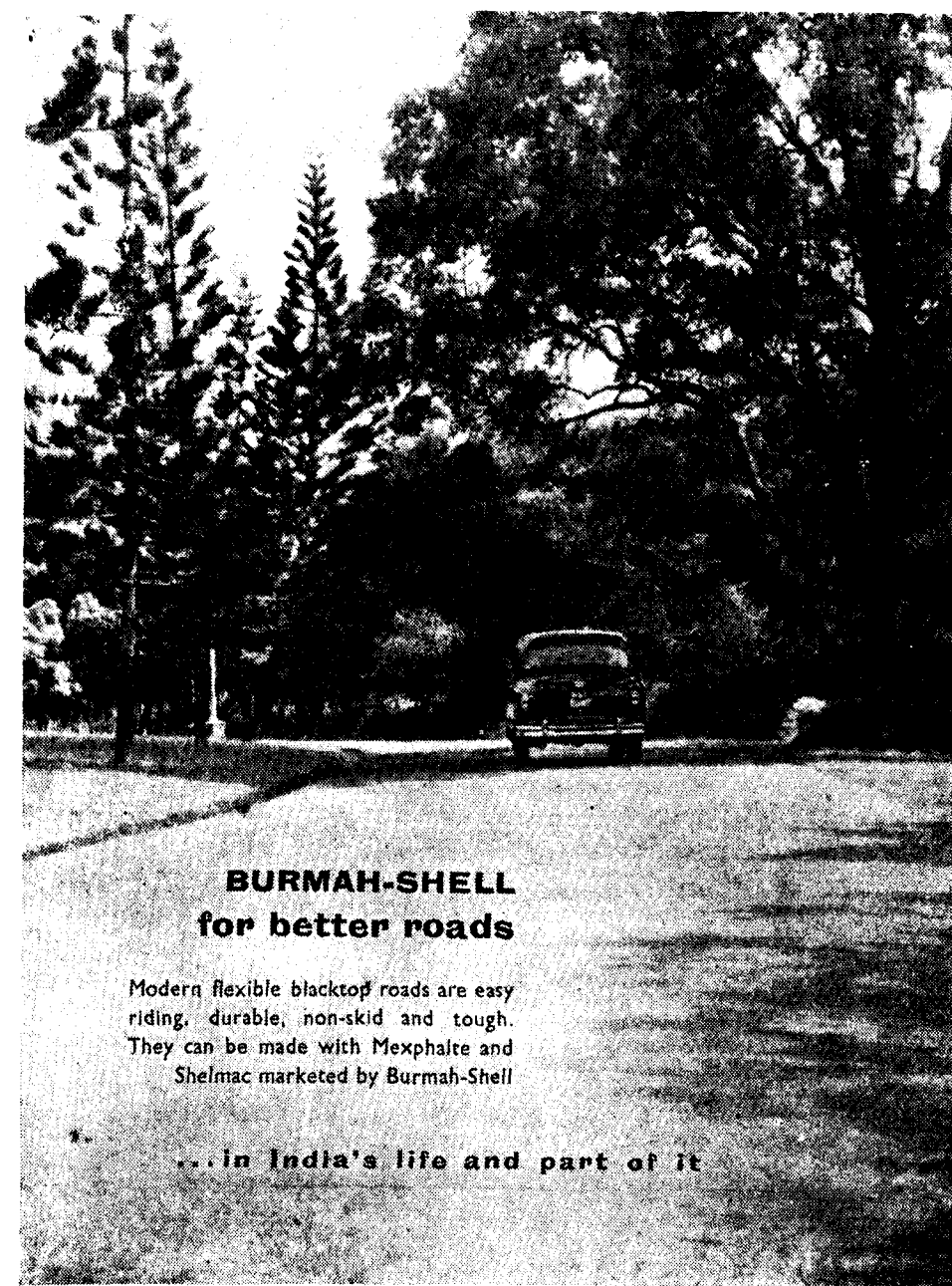
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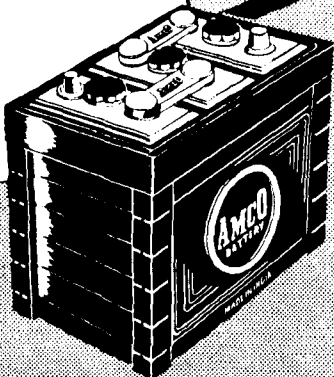
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FEBRUARY 1959—No. 142

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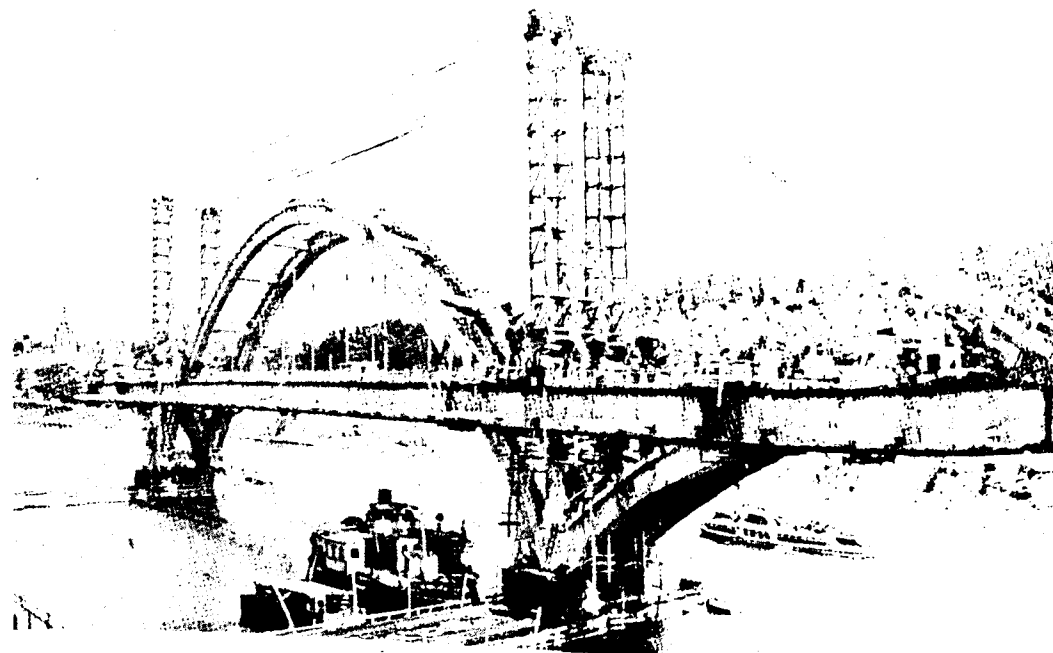
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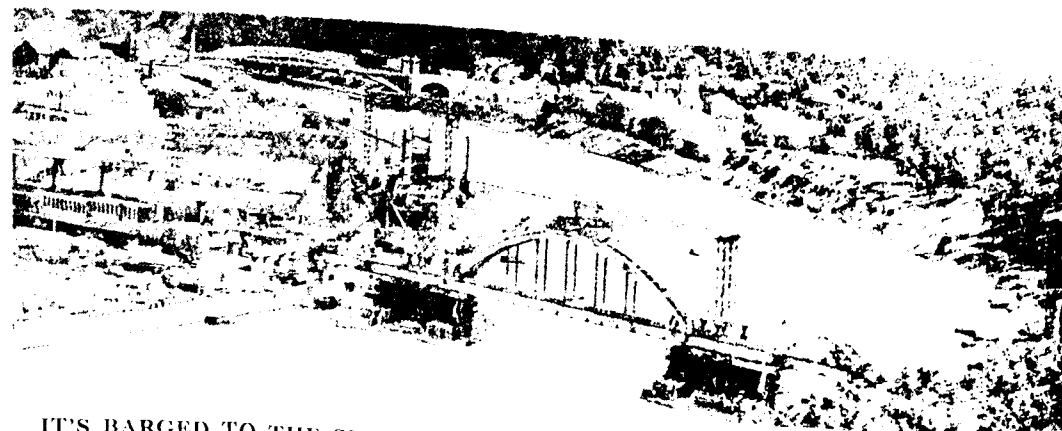
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MOSCOW BRIDGE ROLLED TO MIDSTREAM AND FLOATED TO FOUNDATION



HALF A PRECAST CONCRETE BRIDGE, WITH TEMPORARY GUYS,
GOES OUT ON TRESTLES EXTENDING FROM SHORE. (See page 13)



IT'S BARGED TO THE SITE. SECOND HALF (ON SHORE BEHIND THE FIRST)
IS MOVED ALONGSIDE THE SAME WAY

TRANSPORT-COMMUNICATIONS MONTHLY REVIEW

A REVIEW OF
ROAD ENGINEERING, DEVELOPMENT & TRANSPORT

FEBRUARY 1959

A MOMENTOUS SESSION

THE Hyderabad Session of the Indian Roads Congress was a momentous one as it was held soon after the finalization of the Second Road Development Plan for India (1961-81) which has now been submitted to Government for consideration. This Plan synthesises "the country's hopes and aspirations in the matter of road development" during the next 20 years and is a worthy successor to the well-known Nagpur Plan of hallowed memory. In his Presidential Address to the Session, which is reproduced in full elsewhere in this issue, Shri W. X. Mascarenhas highlighted the salient features of the new plan which envisages a total road length of 6,57,000 miles, of which about 2/5 will be surfaced. The objective of the plan is to bring every village in a developed and agricultural area within 4 miles of a metalled road and 1 1/2 miles of any road; in a semi-agricultural area within about 8 miles of a metalled road and 3 miles of any road; and in a non-agricultural area within 12 miles of a metalled road and 5 miles of any road. The implementation of the Plan will involve an expenditure of about Rs 5,200 crores.

Appropriate to the occasion, Shri Mascarenhas dwelt at length on the implementation of the Plan in respect of both financial and organizational aspects. From a consideration of the direct and indirect benefits accruing from an adequate road system he argued that the original construction of a general utility system should properly be paid for largely from general revenues and the cost of maintenance and renewal should fall on road users. However, as a modification, he suggested that half the road bills, i.e., both construction and maintenance costs, expressed in terms of an annual charge reflecting both elements, be paid from general revenues and the remaining half by road users. At present, in practical effect nearly all road expenditure is financed by the road users and it is high time that a more equitable and progressive fiscal policy in regard to road communications is adopted. In this connection it is pertinent to point out that in a democratic set up the most important things are those which concern the welfare of the largest number of people. A public utility service like road communications which promotes this object in ample measure can, therefore, rightly lay claim to a larger share of the country's general revenues than at present. Other means of increasing road revenues could also be found by way of small

scale taxation of cart traffic, levy of betterment charges, greater measures for promotion and manufacture of motor vehicles in the country, rationalisation of production and distribution costs of motor fuel, etc.

As regards organisation, Shri Mascarenhas suggested several measures for streamlining the highway administration in the country, measures like establishment of Communications Departments in the State covering highways, inland waterways, minor ports, etc., creation of a single authority for dealing with roads and Road Transport, introduction of a separate cadre for road engineers and use of better methods of planning and execution of road works. By far the most important measure suggested is no doubt that concerning the status of the engineer himself who is responsible for spending anything between half and two-thirds of the financial appropriations under the Plans. It is imperative that the lot and the prospects of the engineers should be improved with a view to make them contented and enthusiastic workers capable of playing their part with all the skill and courage and fortitude of which they are capable. The relation between the Engineer organisation and the Secretariat also requires to be reviewed in the context of the present day needs of the country. The engineers should be regarded not as mere tools in the hands of administrators but as active partners in the mighty venture of building up the national fabric. They should have full authority for dealing with their subjects and tendering advice direct instead of through devious means. It is our fervent hope that this plea coming as it does from one who has himself a distinguished record of both technical and administrative service will not remain unheeded.

The part played by roads in the economic development of a country hardly needs emphasis. In spite of all the high-bound effects of jet age and space travel there will still be a need for more and better roads and particularly so in our country with its woefully inadequate road system. As pointed out by His Excellency Shri Bhimsen Sachar, Governor of Andhra Pradesh, in his Inaugural Address to the Session it is obvious that if we have to make full use of our national resources in a balanced and co-ordinated manner and derive maximum benefits, the future road pattern of the country must not only meet the requirements of the towns and cities but also subserve the needs of the growing economy of our countryside. This sentiment was voiced unanimously in all the messages received on the occasion from many well-wishers of the Indian Roads Congress including the President of India and the Prime Minister. We have great pleasure in reproducing elsewhere in this issue the full text of these messages which provide so much inspiration and encouragement to the road engineers in their humble calling. The dominant idea pervading all the messages is economy in road construction. It may be mentioned in this connection that economy has been a constant pre-occupation of the road engineers as evidenced in all the activities of the Indian Roads Congress since its inception. It has never been lost sight of in facing the problems peculiar to our country particularly in rural areas where the bullock-cart presents the greatest conundrum to road builders. In spite of this probably nowhere in the world has it been possible to build cheaper roads than in India. With recent advances in the techniques of design and construction of roads and great strides in the field of soil science, utilisation of indigenous resources to the maximum advantage has increasingly come to be more effective and road engineers are thereby in a better position to tackle the problem of low-cost roads for rural India.

INDIAN ROADS CONGRESS

TWENTY-THIRD SESSION -HYDERABAD, JANUARY 1959

HYDERABAD also called Bhagayanagar, the Capital of Andhra Pradesh gave a most hospitable welcome to the delegates who attended the 23rd Session of the Indian Roads Congress held from the 6th to the 13th January 1959. The delegates were very much touched by the hospitality and courteousness of the host Government and they will remember this Session with warm feelings for many years to come.

Hyderabad is a city of glittering lakes, beautiful gardens, architecturally impressive buildings and inspiring monuments. Its fine, wide and clean roads provided an excellent setting for the Session of the I.R.C. This is not the first time the Congress held its Session in Hyderabad: the previous Session was held there in January 1938. It was really a matter of coincidence that in the year 1938 when the Congress held its 4th Session at Hyderabad, the Nizam Government launched their programme of road development and now in the year 1959, Andhra Pradesh along with other States has approved of an All-India Road Development Plan which will be much bigger in size and volume and would cover the whole of the country.

Two hundred ninety nine delegates from various parts of India including some representatives of institutions from abroad attended the Session. The delegates had the privilege of meeting some of the old engineers of Hyderabad who had a hand in



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

making Hyderabad what it is to-day. All meetings were held in the beautiful Jubilee Hall, Public Gardens, Hyderabad.

Shri W. N. Mascarenhas, Retd. Chief Engineer, P.W.D., Bombay and now Chief Engineer and Executive Director (Engg.), Life Insurance Corporation of India

in his Presidential Address suggested the creation of an All-India Transportation Board, consisting of Officials, and other experts, to advise the Central and State Governments on transport questions, such as the development of highways, waterways and minor ports. He said communications should be viewed as a whole. Each State should have a unified Transport and Communications department especially in view of the rapid nationalization of motor transport.

Shri Mascarenhas suggested that all taxes on road users should be levied by the Centre and the amount collected on account of what were now purely State taxes re-distributed among the States on the basis of vehicles registered and operating in each State, for expenditure solely on road construction and maintenance. The States should be required to match the share thus received by equal allocation from their own general revenues.

Among other points dwelt upon by Shri Mascarenhas were the suggestion for taxing the bullock-cart to the tune of Rs 12 per annum, the revival of the Indian Service of Engineers and improvement in the status and prospects of engineers. All these measures were necessary for successful implementation of the Second All-India Road Development Plan (1961-81) which had now been finalised.

His Excellency Shri Bhimsen Sachar, Governor of Andhra Pradesh inaugurating the Session said that in the past "our road system was built to meet the needs of strategy and administration rather than to promote the economic development of our rural areas." In a predominantly agricultural country like India, he said "trunk roads spanning its length and breadth and feeder roads interlacing the districts and providing an outlet for the produce of the villagers were major economic factors."



The Secretary, I.R.C. reads the messages

Messages of goodwill from the President of India, the Prime Minister, the Minister of Transport and Communications, the Minister for Shipping, the Minister of Scientific Research and Cultural Affairs, the Governor of Bombay, the Chief Minister of Punjab and several others were read. The messages referred to the good work already done by the Indian Roads Congress and stressed the need for evolving further and less expensive methods of road building with a view to utilising indigenous resources of the country to the maximum and keeping in view the needs of the rural areas.



Delegates listen to the speeches with rapt attention

"The I.R.C. Medal" was awarded to Messrs S. R. Mehra and H. L. Uppal for their Paper No. 205—"The Importance of Subgrade Compaction in the Economic Design of Flexible Pavement". Paper No. 200—"Asphalt Paving Mixtures" by N. H. Taylor was highly commended.



Messrs S. R. Mehra and H. L. Uppal receive the award

Seven Papers were discussed at the Session and about eighty speakers took part in the discussion. A Panel Discussion on "Construction of Roads in Water-logged Areas" was arranged. Water-logging is unfortunately spreading fast in certain areas. Besides damage to agriculture, it is causing progressive deformation of roads which have so far carried the traffic successfully. This problem having become important and urgent, was discussed in great detail. The delegates also discussed a Report on Road Research work carried out in the various Road Research Laboratories of the Country for the period ending the 31st March 1958. The discussion was very stimulating and useful. Engineers as well as research workers took part in the discussion.



Shri C. G. Swaminathan introduces his Paper

Shri S. R. Mehra, Director, C.R.R.I., gave a very useful and informative lecture on his impressions about Russia which he visited recently as a member of the team of Indian Scientists and Engineers. Another lecture on prestressed concrete bridges in foreign countries was given by Shri R. N. Joshi. This was explained with slides. A demonstration of "Earthmaster Manual Rammer" was arranged by Messrs Voltas Ltd. for the delegates.

Various Committees of the Congress also met during the Session. A Subcommittee of the Specifications and Standards Committee held a meeting to draft Specifications for bituminous pavements. The Research Organisation Committee which is responsible for the co-ordination of road research work being done in the



Research Organisation Committee Meeting



Another Committee in Session

country at its meeting reviewed the progress made on its earlier recommendations and discussed the points arising out of the discussions on the Second General Road Research Report in India.

The Community Projects Road Maintenance Committee also held a meeting. The consensus of opinion of this Committee was that the condition of community project roads was not satisfactory and to make this mileage of roads a permanent addition to our road system considerable improvement in the standards as well as responsibilities of agencies for execution and maintenance was necessary.

The Bridges Committee discussed the various comments on Section III of the Indian Roads Congress Standards Specifications and Code of Practice dealing with Plain and Reinforced Cement Concrete. The Committee decided to compile a pamphlet giving permissible stresses in concrete, mild steel, high tensile steel, prestressed concrete and other materials. Other subjects discussed by the Committee were (1) the possibilities and advantages of adopting prefabrication and composite construction for road culverts for medium span bridges and (2) the preparation of design standards and construction requirements of the prefabricated and composite construction units for culverts and bridges of medium span. Various Subcommittees were also appointed to finalise some of the remaining Sections of the I.R.C. Bridge Code. The finalised Section II of the Bridge Code was issued at the Session.

The Education Committee discussed the Syllabus for Diploma Courses in Highway Engineering and the Syllabus for B.E. Degree Examination for Civil Engineering. The Committee also discussed the question of institution of Refresher Courses for practising engineers in Highway Engineering.

The Road Transport Operation Cost Committee at its meeting reviewed the progress made in the implementation of its recommendations, and examined the results of the analysis of the data of the experiments being conducted by various State Transport Undertakings.

The Traffic Engineering Committee discussed the Nomenclature for Traffic Engineering Terms and Standards on Road Signs and Indication boards.

The Prevention of Ribbon Development Committee also held a meeting. The Committee recommended that the Central and State Govts. should immediately take steps to enact Bills to deal with the prevention of ribbon development. As this was likely to take time, it was decided that the Central and State Govts. should, pending enactment of such legislations, give priority to the acquisition of lands adjoining various roads. It was also emphasised that high priority should be given to the preparation of up-to-date and correct land plans for the roads and for this purpose it would be necessary to appoint special revenue officers to deal with this matter in an expeditious manner. In order to limit the access to main highways it was desirable that the future development of villages and towns should be done on group development basis. This would mitigate the chances of future ribbon development.

The Road Transport Development Committee which is charged with the work of carrying out scientific studies of road transport problems discussed a suggestion that on account of the pressing need to strengthen bridges, culverts and road surfaces to carry the growing traffic, very high priority has to be accorded to strengthen the existing traffic bearing roads. As regards the increased assistance to the States from the Centre in respect of financial outlay on the development of roads, the Committee felt that diversion of 2½ annas only to the Central Road Fund from petrol duty is now inadequate. In the opinion of the Committee the contribution to the Central Road Fund should increase and the proportion of fuel tax to be credited to the Central Road Fund should be restored to the same value as originally envisaged by the Jayakar Committee. The Committee also noted that there has been a substantial increase in the duty of high speed diesel oil in the recent past. The non-lapsing Central Road Fund should not be deprived of the contribution received from high speed diesel oil in respect of which the Committee recommended that an

equal amount of share as decided in the case of motor spirit should also be diverted to the Central Road Fund which is likely to provide an additional source of revenue for road development to a considerable extent.

The Committee agreed that greater emphasis is necessary on the maintenance of existing roads as experience had shown that in many States the maintenance of roads was lagging behind although the traffic on them was increasing by leaps and bounds. The construction of earth roads should not be undertaken unless specific financial provision for their maintenance has been made and the authority who will maintain them has been prescribed.

The Local Bodies Engineering Services Committee discussed the progress made in regard to the Provincialisation of Local Bodies Engineering Services and made certain suggestions towards this end.

The Soil Research Committee discussed the specifications for road construction in sandy areas. Other subjects discussed by the Committee were the specifications for soil-cement pavements, specifications for road construction in water-logged areas and the classification and identification of soils for general engineering purposes and classification of black cotton soils in India. The application of results of research carried out in various road research laboratories was also discussed and various suggestions were made.

The Council at their 53rd meeting apart from transacting the ordinary business of the Congress discussed the Draft Design for Kilometer Stones and approved of an amendment to the Recommended Practice for Location and Layout of Roadside Motor-Fuel Filling Stations. The Council at their 54th meeting decided to hold the next Session of the Congress in Bangalore next year. Shri U. J. Bhatt, Chief Engineer, P.W.D., B & R., Bombay State was elected the new President of the Indian Roads Congress. Messrs N. Durrani, B. Prasad and L. R. Patel were elected as Vice-Presidents. Shri A. J. D'Costa was re-elected as Honorary Secretary.

Other highlights of the Session were the "At Homes" by the Govt. of Andhra Pradesh, the Corporations of Hyderabad and Secunderabad and the Highway Engineers' Association, entertainment to Cultural Shows and the Indian Roads Congress Dinner which was also attended by many distinguished guests.



At Home by the Andhra Pradesh Engineers' Association



At Home by the Corporation of Hyderabad and Secunderabad

An Engineering Exhibition which formed part of the All-India Industrial Exhibition was arranged for the benefit of delegates. The exhibition showed the various techniques used in road construction. Road statistics were displayed to show the importance of roads to the community. Various firms dealing with road building

materials and machinery, the State P.W.Ds., the Central Road Research Institute, the Army Headquarters, etc., took part in the exhibition. The exhibition was formally opened by Shri N. Narsing Rao, Minister for Communications, Andhra Pradesh on the 7th January 1959.



Another view of the At Home by the Corporation of Hyderabad and Secunderabad

On the 12th January the delegates inspected the Nagarjunasagar Dam, work on which is in progress. They also visited the Nagarjunakonda relics. Extensive excavations are being carried out by the Archeological Department near the dam site to salvage the relics of a Buddhist City said to have been founded by Nagarjuna a Buddhist some 2200 years ago. The area is going to be submerged when the Nagarjunasagar Dam is completed. The relics will be preserved on the top of a nearby hill in a museum.

On the 13th the delegates made local visits to the Salarjung Museum, Osman Sagar Dam, etc. With these visits the Session came to an end.

TIT FOR TAT

An actress at a party, seeing an authoress whom she disliked, went over to congratulate her on her latest book.

"I enjoyed it, my dear," she said. "Who wrote it for you?"

"I'm glad you like it," replied the authoress. "Who read it to you?"

OPINIONS

Bar fly to neighbour at bar: "My wife is the most wonderful woman in the world, and that's not just my opinion — it's hers".

— Kirk in the Saturday Evening Post.

PRESIDENTIAL ADDRESS
TO THE
TWENTY-THIRD SESSION
OF THE
INDIAN ROADS CONGRESS

By
SHRI W. N. MASCARENHAS

Hyderabad, January 7, 1959.

Shri Rajyapal, Ladies & Gentlemen,

On behalf of the Indian Roads Congress and on my own behalf I extend to you all a most cordial welcome. I am particularly grateful to you, Sir, for your kindness in agreeing to inaugurate this our 23rd Session and to your Government and your Chief Engineer, Mr. Durrani, and his Officers for the excellent arrangements made for our accommodation and comfort. As head of the State, you, Shri Rajyapal, can help the State Government to make a correct appraisal of the importance of roads in the country's programme of national development and together with your colleagues, the Governors of the other States of the Union, can promote the evolution and energetic implementation of a country-wide and continuing programme of road development carried out according to a carefully conceived plan under competent and imaginative technical direction and with adequate and assured funds.

You, too, Ladies and Gentlemen, can play a useful part even if you are not Road Engineers or Road Transport Operators. After all, all of you are road users and in a democratic set-up an enlightened public opinion is an important force in determining the scope, content and priorities of any programme of national reconstruction to which good roads can make a significant and indeed striking contribution.

The Indian Roads Congress is the only forum for discussion and the only clearing house for information open to Road Engineers throughout the country. Though not a purely official body, it has worked in the closest co-operation with Government since its inception. By its excellent work and responsible and constructive criticism, it has helped in shaping Government's policy in the introduction of various measures designed to standardise and improve highway engineering practice and promote highway expansion.

We do not confine ourselves merely to an Annual Session such as this one with all the pomp and panoply that a distinguished Chief Guest such as you, Sir, can confer on its proceedings. Serious work is done behind the scenes and no less than 17 Committees are at work throughout the year, as well as of course during the Annual Session itself, dealing with various aspects and problems of Road Finance, Construction and Administration.

A unified road plan for the whole country, based on 9 years' continuous study of road problems by the Indian Roads Congress, was first conceived at its Gwalior

Session in 1943 and proved most useful to the Chief Engineers in framing the famed Nagpur Plan which now holds the field. It was largely the insistent urging of the I.R.C. that led to the establishment of a Central Road Research Laboratory at New Delhi, and it was at its suggestion that several delegations of Road Engineers were sent abroad to acquaint themselves with the latest theories and techniques of road design and construction. The work of some of its Committees has already led to uniformity of practice and procedure in many important respects throughout the country and the good work is continuing.

This Session of the Indian Roads Congress is a momentous one because a new long term Road Plan of the country has just been finalized and is under submission to the Government for their consideration. This new Road Plan, prepared by the Chief Engineers of States, was carefully scrutinized at a Special Session of the Council of the I. R. C.—which the Union Minister for Transport & Communications, Shri S. K. Patil, himself inaugurated—and valuable suggestions were offered as a result of this scrutiny. The Indian Roads Congress therefore is an organisation that rightly enjoys a very special position of prestige and even privilege among the technical associations in this country and can make its voice heard in the councils of the nation. It is therefore a matter of regret that its membership should after 25 years of existence still be some 1,700 only. Considering that there are some 4,700 graduates and a much larger number of senior diploma holders in the country engaged directly in road construction and maintenance as members of the Central and State Road Administrations, Municipalities and D.L.Bs. and of business organizations and contractors' firms connected therewith, this is a very disappointing membership. To make the Indian Roads Congress even more effective, I would appeal for a wider membership and would therefore urge the Central and State Governments, Municipalities and D.L.Bs. to offer to pay half the membership fees of any of their engineers who join up. Business firms dealing in road materials, plant and machinery, etc., should also encourage their engineer employees and other staff connected with transport and road development to become members or associate members. Further, it is my fervent plea to the Central and State Governments that they send larger delegations than they do now to the Annual Session as well as to the Meetings of the various Committees which do all the indispensable spadework.

I understand that the Government of India makes a grant of Rs 10,000 towards the I.R.C.'s Annual Budget. This is a pathetically low figure and the Central Government should have no hesitation in doubling or quadrupling it, thereby enabling the Congress to enlarge and intensify its activities. One reason for this meagre financial assistance of course has been that the I. R. C. has so far contented itself with a very modest and balanced budget. The magnitude and tempo of the road development programme demands a much more ambitious outlay, and I can assure the Ministry of Transport and Communications and the State Governments who should, I suggest, also extend enhanced financial assistance to the Congress that it will be money well spent and bring in handsome dividends.

I have referred to the New Road Plan, which was first foreshadowed in Bombay at a special Meeting of the I.R.C. Council held on 11th August 1958 and finalized after informal discussions between the I.R.C. Council and the Chief Engineers at that Meeting and another convened at Delhi some two months later.

The salient features of this New Plan are as follows:

It is proposed to increase by the end of 1980-81 the total road length from 3,31,000 miles to 6,57,000 miles, of which about 2/5th will be surfaced. This will give a net-work of 52 miles per 100 sq. miles. The objective is to bring every village:

- (i) in a developed and agricultural area within 4 miles of a metalled road and 1.5 miles of any road;

- (ii) in a semi-agricultural area within about 8 miles of a metalled road and 3 miles of any road; and
- (iii) in a non-agricultural area within 12 miles of a metalled road and 5 miles of any road.

The implementation of the plan will involve an expenditure of about Rs 5,200 crores as indicated below.

The Nagpur Plan targets and anticipated actuals by the end of 1960-61 are also shown for purposes of comparison.

	Nagpur Plan Targets (Miles)	Anticipated Actuals by 1960-61 (Miles)	New Plan Targets (Miles)	Cost of New Plan in Crores Rs
National Highways	20,000	13,800	32,000	980
State Highways	53,000	35,000	70,000	1,580
Major Dist. Roads	50,000	95,200	1,50,000	1,360
Other Dist. Roads	70,000	78,300	1,80,000	650
Village Roads	1,38,000	1,56,700	2,25,000	630
Total	3,31,000	3,79,000	6,57,000	5,200

The most important thing about a Plan is obviously its implementation, and implementation as you know, is a matter of (a) financial resources, and (b) the organisation for carrying out the construction programme.

In determining the share of the national resources that may legitimately be applied to road construction and improvement, we must not only consider the services rendered by the roads to the national economy, but also assess their direct and indirect contribution to the national well-being.

As every primer on Highway Engineering tells us, highway value consists of 2 factors: (i) the indirect general benefits expressed in terms of higher standards of living and (ii) the direct reduction in the cost of vehicle operation. While it is impossible to make a precise monetary evaluation of the indirect general benefits, it is agreed among all authorities that they are much more important than the item of reduced vehicle operation cost; all authorities are equally agreed that the indirect benefits alone more than justify the construction of a complete system of modern highways usable the year round for adequate loads with moderate comfort and safety.

The late Lord Wavell said at the end of the last World War—

“Among the social services, I put communications first, since I do not see how it is possible to effect any great improvement in health and education in the villages of India until they can be reached surely and quickly at all times.”

A few years ago our own Prime Minister made the following announcement: “I have come to the conclusion that one thing to which we must give top-most priority is roads, roads of all kinds, not only very up-to-date, bituminized or cement roads, but roads of any kind to open out the vast areas of this country which are

closed today and which cannot be reached unless you walk or ride. I give roads the first priority.”

Our national leaders have dedicated themselves to the formidable and challenging task of raising the standard of living in the country by increasing production in field and factory, and ensuring a more equitable distribution of the national income and a fair deal for the common man. The immediate task is self-sufficiency in food and rapid industrialization, the latter preferably through the setting up of small and medium scale industries dispersed throughout the length and breadth of the land. If this task is to be fulfilled and further if the Socialistic Pattern of Society, which is the declared national objective, is to have any real meaning, the vast mass of our people living in the villages—some 86 per cent of the total population—must be enabled to share in the new ways of life and rising levels of prosperity. How can all the social services that are now planned or are already in operation, and all our schemes for establishing rural schools and dispensaries, and cottage hospitals and regulated markets with their godowns for storing grains and other primary produce ever operate successfully, how can all our much publicised plans for rural uplift, including the creation of Community Development and N.E.S. Blocks, ever come to anything tangible and permanent without an adequate and well-planned network of roads?

Some social workers never cease from exhorting young people from the villages to stay in the villages and urging educated young people from the towns such as doctors, nurses and others to go to villages and enrich them with their skills. Indeed the more idealistically inclined among them become quite lyrical about the countryside and talk with great feeling about the great open spaces and the simple life.

But the only way to arrest this steady gravitational pull of the cities on the more enterprising and ambitious young men and women of the villages and the only way to redress the growing imbalance between town and country is not through pious exhortations or emotional appeals, but through the creation of conditions that will make life in the villages sufficiently attractive or at least worth while to young people of spirit.

A well-planned, well-built and adequate net-work of roads would create these conditions, and city and country would be brought closer to each other both literally and metaphorically. Townsmen would seek the country more readily for rest and recreation; it might be possible for many to live in the country and travel to their work in the town every morning thereby helping to relieve the housing shortage prevailing in the major urban centres or at least preventing it from becoming more acute. Conversely, the social, agricultural and medical facilities in the town would be more easily available to the villagers and their life and outlook brought nearer the urban level.

Even in the matter of mere self-sufficiency in food, such a net-work of good roads would increase the mobility of agricultural produce and of materials and goods entering into agricultural practice; and agricultural prosperity would make a great leap forward. The range of marketing of perishable goods especially, like fish, fruit, vegetables and milk, in all of which our diet is woefully deficient, would be extended in respect of both distance and favourable selling period—to the advantage of both producers and consumers. Marginal lands which now lie fallow because of transport difficulties would also come into production.

In my Address at the Inauguration of the 52nd Indian Roads Congress Council in Bombay last August, I made the point that for every rupee spent on the construction and maintenance of roads the return to the villages served exceeded three rupees, besides creating several other additional sources of revenue to Government. This was demonstrated over 15 years ago by a pilot survey in Bombay State made by the Indian Roads and Transport Development Association and other studies in the same field both in this country and elsewhere confirm this finding.

I would like to make a further point, viz., that road construction and maintenance activity as also road transport operation employs something like 3 million people today throughout the country. The significance of this figure is not in its absolute value but in the clear indication it affords that road development and road transport have perhaps the highest employment potential of all our economic activities.

All the abovementioned general benefits cannot, as I have already observed, be evaluated in purely monetary terms. As regards direct highway benefits, viz., those resulting in a reduction of vehicle operation costs, perhaps a better appreciation of these benefits can be arrived at by considering the waste and economic loss caused by the lack of a good road system. This waste and loss can be classified under the following heads:

- (a) waste of time through reduced vehicle speed and stoppages;
- (b) high fuel consumption;
- (c) heavy wear on tyres;
- (d) avoidable accidents reflected in cost of insurance; and
- (e) wear and tear of vehicles, leading to increased cost of repairs and maintenance.

In an interesting paper read by Mr. Cristopher T. Brunner before the Institute of Highway Engineers on 17th January 1947, the possible savings under the above heads, that would accrue if the British road system were modernized, were indicated. With a total estimated expenditure of £ 648 million on the operation of mechanically-propelled road vehicles in the U.K. it was calculated, on the basis of the considerations advanced in the Paper, that the possible savings would be something as follows:

	£ per annum
Saving of time	26,000,000
Saving of fuel	12,000,000
Saving of tyres	3,000,000
Saving of repairs to vehicles	9,000,000
Saving of accidents (insurance)	10,000,000
	<u>£ 60,000,000</u>

The direct saving in the vehicle operation costs was thus estimated by Mr. Brunner to be something like 10 per cent for the conditions prevailing in the U.K. in 1947. It is scarcely necessary to add that the road system of the U.K. in 1947 was far better planned, better constructed and better maintained than the Indian road system of even today, and that the big saving was largely the result of refinements in an already excellent system, excellent at any rate according to Indian standards.

Mr. N. D. Daftary, General Manager, Bombay State Road Transport Corporation, in a Paper read before the Indian Institute of Road Transport in Bombay on 13th September 1954, showed how a planned programme of surface upgrading of some extensively used roads would bring down the cost of operation of motor vehicles on these roads very substantially. His experience on the Nadiad-Dakor Road showed that the cement concreting of that road had resulted in a total saving of about 17 per cent in operation costs. Shri Daftary concluded:

“State Transport cost of operation on average bad and kachha roads in 1953-54 amounted to Rs 5.80 crores. If all our vehicles were operating on modernized roads our saving in operating cost would have been Rs 98 lakhs approximately.

“If the vehicles in the entire State are considered, the amount will be approximately Rs 9 crores.

“In Bombay State we have 21,988 miles of metalled (W.B.M.) and kachha roads and the cost of concreting the entire surface would come to approximately Rs 130 crores.

“Thus if Government decides to float a loan for the amount the saving in operation cost will not only cover the interest but sinking fund charges also. Resulting benefits due to comfortable travel, etc., are not taken into consideration in computing this.”

One of my predecessors in office, Shri R. K. Batra, President of the Indian Roads Congress in 1954, estimated that the loss to motor transport on account of bad and inadequate roads in this country was of the order of Rs 38 crores per annum.

In view of the fact that road vehicles in this country are the most highly taxed in the world, as another of my predecessors, Shri M. S. Bisht, pointed out at the last Annual Session, this extra burden on the transport industry is a crushing handicap which it is the duty of the State to eliminate by providing the funds necessary for an adequate and modernized road system.

From a consideration of the direct as well as indirect benefits accruing from an adequate road system, it could be argued, as in fact it has been argued, particularly in America, that the original construction of a general utility system of roads should properly be paid for largely from general revenues and the cost of maintenance and renewal should fall on road users.

The Salter Commission took a more conservative view in the U.K. in 1932 and laid down the principle that road users should pay for two-thirds of all road bills and the remaining one-third should come from the general revenues. In this country nearly all road expenditure is financed by the road users—in fact it is only recently that road expenditure has equalled the aggregate of the user taxes collected by the Centre and the States—actually the Centre spends less than it collects and the States more than they collect—and it is high time that a more equitable and progressive fiscal policy in regard to road communications is adopted. As a mean between American theory and the Salter Commission's principle mentioned above, I would suggest that half the road bills, i.e., both construction and maintenance costs, expressed in terms of an annual charge reflecting both elements, be paid from general revenues and the remaining half by road users.

Incidentally there is such a wide variation in the States of the Union in regard to securing road development funds and such imperative need for a co-ordinated policy of road finance, that I would suggest that all taxes on road users whether in the form of licensing or registration fees, customs and excise duties, as well as sales taxes on motor fuel, oils, lubricants, spare parts, tyres, etc., should be levied by the Centre and the amount collected on account of what are now purely State taxes redistributed to the States, on the basis of the vehicles registered and operating in each State, for expenditure solely on road construction and maintenance and that the States should be required to match the share thus received by equal allocations from their own general revenues.

The taxing of cart traffic is also long overdue. Bullock carts, as we all know, cause heavy damage to roads but do not contribute anything towards their cost. A small tax, say Rs 12 per annum, on each cart is fully justified, specially in view of the fact that there is a large programme of development of rural roads. This will bring something like Rs 10 crores to the national exchequer and might be devoted exclusively to the construction and maintenance of rural roads to the great benefit of draught-animals as well as monetary gain to their owners.

The number of motor vehicles in this country is extremely limited and it is obvious that we must greatly increase it, if road transport is to play its legitimate share in moving the progressively increasing traffic resulting from our steadily expanding economy.

Railway capacity has already nearly reached saturation point on many lines and further development can only be in the form of additional route mileage, doubling of lines, electrification or dieselization of traction, better yard-marshalling arrangements, etc., all of which will involve an enormous capital outlay. The I.R.T.D.A. has estimated that by 1961 the total traffic to be moved will be of the order of 185 to 190 million tons and that the short-fall in railway capacity may well be as high as 20 to 25 million tons. The present temporary set-back to traffic resulting from foreign exchange restrictions and the consequent fall in imports will, it is hoped, soon be overcome and in any case we are envisaging road requirements over the 20 years next after 1961, and the continued expansion in developmental activity and increased production born of it, of which road transport will have to carry its fair share.

Restrictions on the import and manufacture of motor vehicles in this country must therefore be reconsidered against this background. The astonishing fact is that in spite of heavy taxation—the highest in the world, as I have said—the high cost of automobile manufacture in the country and the high custom duties on imported vehicles and spare parts, motor traffic has expanded enormously since the Second World War and we may be sure it will do so at an even greater pace, if these high costs and duties are lowered somewhat or at any rate not increased, provided of course, that an adequate number of vehicles is readily available to meet the rising demand for them. In this matter the correct fiscal policy would appear to be the lowest duties and costs consistent with the highest return and therefore highest volume of traffic. Incidentally fuel at nearly Rs 3/- a gallon for petrol and Rs 1.63 a gallon for h.s.d. oil is also a big factor in vehicle operation costs—the largest in fact after wages—and any reduction in production and distribution costs will have a marked effect on the growth of motor traffic. I was amazed to read in a recent despatch of the “Times of India” correspondent in the Middle East that the cost of crude oil in Qatar, Kuwait and other adjacent producing centres of the Arabian Peninsula varied from 3 sh. 9 d. to 4 sh. 3 d. per ton over the last 5 years and that during this period the average selling price at the shore terminals was more than £ 5 per ton. If this information is correct the large difference is apparently accounted for by overall prospecting charges, royalties and profits.

Now that oil has been struck also at Cambay and Lunej—let us all hope in commercially exploitable quantities—the Indian Government will have a new source of income which might be utilized largely for road development, though it is to be hoped that part of the profits will also be made available to the consumer in the form of reduced fuel prices. The price structure of motor fuel is already under investigation by Government and as a result something like a saving of Rs 10 crores is likely to accrue to the Central exchequer at the present level of taxation and retail prices. Further economies may be possible but half the money equivalent of the savings should, it is suggested, be paid into the Central Road Fund and the remaining half used to write down retail prices.

So much for road finance. I now come to the second and, to my mind, more important factor in the implementation of the road plan, because it is a factor much more within our control than finance, namely, the organization for carrying out the construction programme.

It is hardly necessary to add that efficiency and economy—to say nothing of revolutionary thinking on the subject which, in my opinion, is urgently called for—are only possible in a specialist Department. Many of my predecessors have pressed

for a separate Highways Department in each State and I would reiterate their plea with one small but significant amendment. Communications must be viewed as an integrated whole and accordingly all means of transport such as highways, inland waterways, minor ports and—to the extent that the State Government are concerned with them—also airways and railways should vest in one authority. Moreover since it is illogical to separate the track from the vehicle using it, road transport and all other transport—to the extent that it falls within a State's jurisdiction—should also be vested in the same authority. This means that each State should have a Department of Transport and Communications analogous with the Ministry of Transport and Communications at the Centre, each such State Department having 2 Wings: (1) Communications and (2) Transport. This is particularly important and urgent in view of the fact that the principle of nationalisation of motor transport has been accepted in the country and is being rapidly acted up to in most States, as is evidenced by the setting up by them of their own Transport Corporations.

A unified Transport and Communications Department would be able to understand the relationship between track and vehicle better than two separate Transport and Communications Departments and ensure the development of both transport and communications to their mutual advantage. Incidentally any profits accruing from the Transport Wing could be ploughed back into the development of both track and vehicle.

The need for a unified Transport and Communications Department is so obvious that it is with something of a feeling of shock that we remind ourselves that very few States have a separate Highways Department. Most of them combine roads with buildings exactly as they did more than 100 years ago when the P.W. Departments were first instituted.

Even in such an important and progressive State as Bombay there is not only no separate Highway Department, but there still continues a combined cadre for the Irrigation Wing and the Roads and Buildings Wing. Even when there are separate cadres for the two Wings linking up buildings with roads is linking up two highly specialized fields, in only one of which the average engineer can hope to be proficient. It is also a mistaken notion that any real economy is achieved by such a combination, for, the savings, in any case slight, in establishment charges will be more than counterbalanced by the loss on the workside resulting from unspecialized technical handling.

Real economy can only be said to have been achieved when for the attainment of any given engineering objective, the establishment costs plus works expenditure are a minimum. This is the only criterion which should be applied, and judging by this criterion I have no hesitation in saying that the separation of roads from buildings would be more than justified. May I suggest in passing that the prevailing housing shortage everywhere, not only in respect of Government housing but also of general housing, can be satisfactorily dealt with only by a special buildings organization in every State vested with the responsibility for the construction and maintenance of all administrative buildings required for Government purposes and residential housing for Government servants, and also for industrial and subsidized public housing now being administered in some States by a separate Housing Department. In short, let all buildings for which Government is in anyway responsible go together. In any case let us separate roads from buildings.

I would like to make it clear that the road component of the Communications Wing should cover all roads, down to and including minor district roads and excluding only village roads, which should be left to the Gram Panchayats, Taluka Local Boards and other local authorities. All major district and other district roads now vesting in the District Local Boards should be immediately provincialized, if

is our uniform experience that with few exceptions District Local Boards are utterly incapable of maintaining—leave alone expanding—the roads in their charge, and the provincial roads previously vesting in the State P.W.Ds, and later transferred to the District Local Boards in pursuance of the principle of decentralization have generally speaking deteriorated and in some cases been virtually destroyed. To insist on such decentralization of road administration when we are aware of its disastrous consequences is to confuse means with ends, and to make decentralization an end in itself.

With a view to evolving and ensuring the vigorous implementation of a national policy relating to Transport and Communications, I would urge that an All-India Transportation Board be set up comprising officials and expert non-officials who will deal continuously and competently with the problems arising from the needs of transportation as an integrated whole, i.e., from the standpoint of the highway, inland waterway, minor port, etc., and of the vehicles and craft using them. This body would advise the Central and State Governments with regard to all matters connected with the development of highways, waterways, minor ports, etc., as well as transport development and secure as far as possible co-ordination and uniformity of policy between the various States in regard to these crucial and inter-related matters. Such a Board should exercise primarily advisory functions, but in order that it should be really effective a certain amount of executive authority would also have to be vested in it—as for instance, the authority to fix priorities in regard to construction or development schemes financed wholly or partly from Central Funds. I am glad to note that a step in this direction has recently been taken by the Government of India by forming—

- (1) Transport Development Council.
- (2) Road and Inland Water Transport Committee.
- (3) Central Transport Co-ordination Committee.

The States might also profitably set up similar Transportation Boards within their own boundaries to exercise the same or related functions.

I have dealt so far with departmental organization and road administration. Considering next, the question of the actual planning and execution of a road programme, an essential requirement of economy is that the dimensions and details of this programme must be carefully determined well in advance and preferably fitted into the State's overall Five-Year Plan. There should then be no departure from this programme except for the gravest reasons. It is a matter of common knowledge that road works are often budgetted for which have not been properly investigated and in respect of which no plans and estimates exist; and engineers are often pressurized into executing such projects at breakneck speed merely to ensure that the financial appropriations are expended. Any surrenders of funds are regarded as a catastrophe and the engineers who make them with the laudable intention of avoiding waste through frantic haste, instead of being commended for their good stewardship of public funds are often viewed with disfavour, if not branded as incompetent.

The attainment of fixed targets either of expenditure or of road mileage should not be at the sacrifice of the quality and cost of the amenity provided. Real progress in road development must, in our country, always mean getting maximum value for money. Incidentally parochial and regional rivalries should be resolved once and for all, when the programme is framed, at the highest level—Cabinet level if necessary—and should not thereafter be allowed to obtrude themselves, since any change during the actual execution of the programme, even of priorities only, usually leads to serious dislocation of the engineer's plans, infructuous expenditure and general waste of funds. The engineers are also, to their dismay, often embroiled in local disputes and jealousies and their morale can be seriously affected in consequence.

But even when a programme is framed after due investigations and proper field surveys and the preparation of detailed plans and estimates and after all conflicting regional claims have been reconciled, there still remain other causes of waste and inefficiency. The first is the still widely prevailing practice of basing road design, particularly the design of subgrades and wearing surfaces, on purely empirical rules, some of them dating to the time of Telford and Macadam! There is no room for rule-of-thumb and empiricism in modern engineering. Subgrades, pavements and all other parts of a highway are susceptible of being scientifically designed and should be so designed. When even small countries like Italy, Turkey, Greece, Israel, Syria and Egypt adopt rational methods of design and the most up-to-date technique of construction we should not allow a big one like India to lag so hopelessly behind.

Another prolific source of waste is the primitive methods generally adopted in the construction of modernized road surfaces. A reasonably efficient method is adopted in the construction of cement concrete pavements, but asphaltic carpets and asphaltic grouts are even today laid by such antiquated techniques, involving the use of the crudest and most rudimentary plant and machinery, that it is my belief that it is never possible to derive full value for the money spent. Quality control, which is an essential in dealing with asphalt as it is in dealing with cement, is only possible by the mechanization of the whole process of carpet making, from crushing of metal down to mixing, laying and finishing of the road surface. This is one clear case where capital-intensive methods must be preferred to labour-intensive methods.

Finally I come to the most important factor in the efficiency equation, viz., the engineer, the man on whom falls the responsibility and burden of planning, constructing and maintaining our road system. Considering the engineer's pivotal position in the country's struggle to pull itself out of the morass of stark poverty and want in which the bulk of our population is engulfed, it should be abundantly clear that we must attract some of the best talent in the country to the engineering profession. It should be equally clear that after recruitment, Government should endeavour to make its engineers contented and enthusiastic workers determined to keep their "appointment with destiny" and play their part with all the skill and courage and fortitude of which they are capable. But what do we find? The Indian Service of Engineers, to which all recruitment ceased after 1932, has practically died out, and both in the States and the Centre we have the so-called Class I cadres showing wide disparities in emoluments and conditions of service between themselves and given pay-scales and a status incomparably lower than the pay-scales and status enjoyed by the Indian Administrative Service and the Indian Police Service.

The inequalities in emoluments, status, and prospects are startling. As an example, in one of the larger States, there are 43 Collectorates and 6 Commissioners' Divisions. The number of posts available to the members of the I.C.S. and I.A.S. as Heads of Departments, Secretaries to Govt., etc., is 36. In the case of the P.W.D. which comprises 161 Divisions and 23 Circles, the number of higher posts, none of which goes beyond the status of Head of a Department, is only 4.

It has been repeatedly urged from this platform that the time is overdue for reviving the Indian Service of Engineers and putting it in all important respects on a par with the I.A.S. and I.P.S. It is only the prestige and the prospects attaching to such a Service that will provide the needed attraction to the best talent; moreover it is only an All-India Service which might be expected to ensure continuity of policy and enable its members to exhibit greater independence of technical opinion than is possible with men belonging to the State Services—an important consideration if we bear in mind the possibility, in fact the probability, in the near future of different political parties holding power in different States or in the States on the one hand and the Centre on the other.

In the First Five-Year Plan as also in the Second Plan now under way and undoubtedly also in all future Plans, the engineer has been, is and will be responsible for spending anything between half and two-thirds of the financial appropriations made under them. On more than one occasion, the Prime Minister has stressed the pre-eminent importance of the engineer and scientist in the context of these Plans. Speaking to a meeting of the General Services at Kurnool some years ago, he said:

"The person who is important today is the engineer, the scientist and the technical man. The fact remains that the type of specialised work like that of the engineer or scientist is becoming more and more important.....the future of the country will depend more and more on them rather than on the administrators." More recently, he mentioned that in Russia the scientist and technician are "treated as demi-gods".

The present Union Minister of Transport and Communications, Shri S. K. Patil, has paid frequent and handsome public tribute to the engineer and during his Inaugural Address on the occasion of the 52nd Meeting of the Indian Roads Congress Council held in Bombay last August, he announced Government's decision to institute four additional All-India Services, including an Indian Service of Engineers.

At the same Meeting of the Council I urged the adoption of Mr. Paul Appleby's suggestion that there should be only one Civil Service for the whole country, and that administrators, police officers, engineers and others should all belong to different branches of it. This will automatically ensure that the best talent in the country will find its appropriate field freely, without differences in pay and status tending to restrict them in their choice that they often do at present. I would urge Shri Patil to press for such a combined Civil Service based on egalitarian principles relating to status and emoluments governing all its branches.

Another important measure for securing efficiency and speed is the organisation of charges. To begin with the workload and responsibility devolving on each Officer must be such as he can carry without blunting his capacity to think out newer and newer organization and methods. Judged by this standard we shall have to increase very considerably the number of Superintending Engineers and Chief Engineers now employed in the different States.

At the instance of the I.R.C. a special Committee of Chief Engineers has examined the question of workload and suggested norms for the different charges and I would urge the Centre and the States to apply those norms to their engineering organizations. It can never pay to drive these men beyond their capacity in the name of economy.

Then the old basic structure and pattern of P.W.D. organization, namely, territorial charges, is outmoded and outdated, and should now be restricted purely to maintenance work. All planning and construction should be organised on a functional or specialist basis.

Lastly I come to the question of the relations between the Engineer organization and the Secretariat or Ministry. Not long ago the Chief Engineer of a State used to be the Secretary to the Government also and thus had the opportunity to co-ordinate both the technical and administrative aspects of the work for which he was responsible. The position has altogether changed today. The Chief Engineer is now completely disassociated from the Secretariat and his place there has been taken up by non-technical Officers. At a time when our entire energy should be directed towards the rapid development of the country, it is absolutely essential to give the fullest encouragement and support to scientists and technical personnel. **The Secre-**

tariat being the fountain head of authority, must include suitable scientists and technical men who have a flair for administration. An administrator without an appropriate technical back-ground will suffer from the serious handicap of not being able to appreciate fully the finer points of a technical proposal, and this is bound in the long run to hamper seriously the country's progress. The Secretariat must, therefore, have suitable scientists and technical persons for all the main branches concerning developmental activities, who should be vested with full authority for dealing with their subjects and for tendering advice direct to the Ministers.

Before requesting you, Shri Rajyapalji, to inaugurate the Session, permit me to pay a well-deserved tribute to all those official and non-official associations and individuals who have done so much to advance the cause of road and transport development. All my predecessors in their Presidential Addresses have made out well-reasoned cases for greater Government interest in road development. Though it is somewhat invidious to single out any, I must commend the Addresses of two immediate predecessors, Sarvshri P. L. Varma and M.S. Bisht, to Government's special attention. In Shri Bisht's Address particularly will be found a masterly analysis of all the factors affecting the problem.

I would also like to pay my homage to the I.R.T.D.A. for the yeoman service rendered by it for more than a quarter of a century in keeping road problems and transport development prominently before the public eye and jogging Government's elbow repeatedly. The time and attention devoted to the good cause by men like Shri B.V. Vagh and Dr. F.P. Antia have been invaluable. I am sure that there are other men equally willing and capable who would gladly follow in their footsteps and further the same cause in an official or non-official capacity, if only Government knows how to enlist their co-operation. The present Union Minister for Transport and Communications has the perspicacity to view the problem steadily and view it as a whole and the dynamic personality to provide the inspired leadership that road and transport engineers are impatiently awaiting.

DEFINITIONS OF HIGHWAY ENGINEERING TERMS

- DITCH:** A trench cut in the ground for the purpose of receiving and conducting drainage water.
- DRAIN:** A conduit or channel, either artificial or natural, for carrying off surplus ground water or surface water.

INAUGURAL ADDRESS

By

His Excellency

SRI BHIM SEN SACHAR

Governor of Andhra Pradesh,

Hyderabad, 7th January, 1959.

Mr President, Ladies and Gentlemen,

[T gives me great pleasure to be here this morning in the midst of distinguished engineers from all over India and to inaugurate the Twenty-third Session of the Indian Roads Congress. It is gratifying to learn that, during the 23 years of its life, your Congress has discussed as many as 205 technical papers at its general session on subjects of road development in India, fixed many road standards relating to geometric and other features of road construction and maintenance, published a code of practice on bridges and bridge specifications, and appointed many committees to study detailed aspects of various technical problems. I am glad to know that the Sub-Committee appointed by the Roads Congress to consider the subject of evolving an improved design for bullock-cart wheels so as to improve the pay-loads of the carts without increasing the tractive effort of the bullocks, and at the same time to decrease the destructive effect of the bullock-cart wheels on the roads, has evolved a design which has been accepted by the Transport Advisory Council of the Government of India.

India in general, and Andhra Pradesh in particular, is under-developed in the matter of communications. While the average density of road system is as high as 3.00 miles per square mile in all Western countries, it is only 0.25 mile in this State. The part played by roads in the economic development of a country hardly needs emphasis. In a predominantly agricultural country like ours, trunk roads spanning its length and breadth, and feeder roads interlacing the districts and providing an outlet for the produce of the villages, are factors of inestimable economic value. In the past our road systems were built to meet the needs of strategy and administration rather than to promote the economic development of our rural areas. It is obvious that if we have to make full use of our national resources in a balanced and co-ordinated manner and derive maximum benefits, it is necessary that road development is planned so as to extend transport facilities to the remotest villages. With the launching of the Five-Year Plans, road development plans have necessarily to take into account the great industrial and agricultural development taking place in the country and the increasing volume of internal traffic.

The necessity for the expansion of routes on a nation-wide scale brings in its train the necessity for the pooling of experience of engineers from all over the country, the setting up of standards for roads, and for evolving cheap and durable methods of road construction. Much as we may desire that the development of our country should proceed rapidly, there are limiting factors, particularly our inadequate financial resources, and there is, therefore, great need for economy. It is also essential that there is no wasteful expenditure and no delay in execution at any stage. Economy in construction and design and use of available local materials without detriment to quality, would help considerably in bringing down costs.

In your illuminating address, Mr. President, you have rightly stressed the need for a well-planned, well-built and adequate net-work of roads connecting the villages with towns and cities. India is a land of villages, and about 86 per cent of our population live there. If the economy of our country is to be stabilised, the future road pattern of the country must not only meet the requirements of the towns and cities, but also subserve the needs of the growing economy of our countryside. It is essential that the initial and maintenance cost of these roads is well within the resources of the local authorities, the more so because under the Community Development Programme vast lengths of village roads are being constructed with contributions from the public in the shape of materials and "Shramdan". While drawing up road plans to link the villages, it is, therefore, necessary to remember that our bullock-cart will continue to play an important role in the rural economy of the country. I trust that the Roads Congress would pay special attention to this aspect of the problem.

From the papers given to me I find that the Indian Roads Congress has been continuously urging the Government of India to accept the proposals for the establishment of non-lapsing funds for highways, both in the State and Central budgets, and for the establishment of an independent Roads Board to co-ordinate road development activities in the country. I hope these proposals would receive sympathetic consideration from the Government of India.

I am glad many of your Sub-Committees are actively engaged in research studies relating to economy in designs of various structures, tourist traffic, etc. I hope the Congress, which has over 1,700 road engineers as its members, will grow from strength to strength and continue its useful work.

I now have great pleasure to declare this Conference open, and wish its deliberations every success.

JAI HIND!

MESSAGES

Dr. RAJENDRA PRASAD,
PRESIDENT OF THE REPUBLIC OF INDIA

THE Indian Roads Congress deserves to be congratulated on its achievements in improving the network of road communications in India. It has also met with considerable success in evolving better and less expensive methods of road building with a view to utilising indigenous resources to the maximum. I need hardly say what good roads and reliable means of transport mean for a vast country like India. Therefore the task with which the Indian Roads Congress is grappling is of great national importance.

On the occasion of the 23rd annual session of the Indian Roads Congress, I send it my greetings and the best wishes for the successful conclusion of the forthcoming Session.

SHRI JAWAHAR LAL NEHRU,
PRIME MINISTER OF INDIA

I SEND my good wishes to the Annual Session of the Indian Roads Congress to be held in Hyderabad.

Roads are of obvious importance in any scheme of development of a country. But in India we have not only to make good roads but also cheap roads. That does not mean that there should be a conflict between the two. We have to devise means to use local material which is good enough for the innumerable village roads that we have to make. I hope the Roads Congress will consider this aspect of the matter.

A very great part of our expenditure on development goes towards construction work, whether it is roads or buildings. Any saving on this would help us to enlarge our development programme.

SHRI S. K. PATIL,
MINISTER OF TRANSPORT & COMMUNICATIONS,
GOVERNMENT OF INDIA

I am very happy to learn that the Indian Roads Congress is holding its next annual session at Hyderabad. Although I may not be with you, I shall watch your deliberations with keen interest.

I had the opportunity to inaugurate the meeting of your Council in Bombay where All-India Road Development Plan was discussed and which, I am glad, has now been finalised. Let us hope that this plan will be a successor to the well-known Nagpur Plan and will see the country's hopes and aspirations in the matter of road development fulfilled in the course of the next 20 years.

No country in this modern era can afford to neglect its roads. India, standing as it does on the threshold of a great industrial revolution, needs the development of roads all the more—not only to link up towns and cities but also to provide access to the far-flung villages in the remote country-side.

I am glad that your Congress is devoting attention to evolving a scientific approach to the problem of road development in the light of recent advances made in the techniques of design and construction of roads.

I wish the Session a great success.

SHRI RAJ BAHADUR,
MINISTER OF STATE FOR TRANSPORT & COMMUNICATIONS,
GOVERNMENT OF INDIA

I HAVE great pleasure in sending my greetings and good wishes to the Twenty-third Annual Session of the Indian Roads Congress which is now meeting in Hyderabad.

The Road System of a country is a safe index of the level of its development. The expansion and improvement of Roads are the surest key to all progress. Roads are symbols of civilization and harbingers of prosperity. It is impossible to conceive of any programme of economic development of a country without an adequate provision of road-communications and transport. The question of expansion of the existing network of our roads in our country has, therefore, assumed a vital importance in the context of our growing economy. The answer to this question has to be furnished by our Road Engineers. Development of roads has to keep pace with the expanding needs of transport, both for industrial development and rural economy. Roads are also essential to promote cultural and social bonds between various parts of our country.

I note with pleasure the great contribution already made by the Indian Roads Congress in promoting the growth and development of all types of roads in the country and in disseminating the know-how on the subject. I wish the delegates attending the Session of the Congress the best of success in their deliberations.

SHRI HUMAYUN KABIR,
MINISTER, SCIENTIFIC RESEARCH AND CULTURAL AFFAIRS

ROADS are not merely necessary for movement of men and goods but they have also proved one of the greatest factors for civilisation by promoting quick movement of ideas. They help to unify the country by bringing different regions into closer contacts with one another and simultaneously they offer each region the opportunity to develop along its own lines.

The Indian Roads Congress will be rendering real service to new India if it can devise methods for construction of cheap and durable roads. A good deal of scientific work has been done in the Central Road Research Institute and it is my hope that the engineers and road builders assembled at Hyderabad will give proper attention to the results of such work and utilise them at first on an experimental basis and then increasingly on a national scale.

**SHRI SRI PRAKASA,
GOVERNOR OF BOMBAY**

I am very glad to learn that the 23rd Annual Session of the Indian Roads Congress is to be held at Hyderabad during the coming month, and that a large number of highway engineers are likely to attend the same.

The problem of communications is a very important one for any country; and with our developing economy, it has acquired still greater importance for us. We are not at all satisfactorily served by roads, and the lack of them hinders the quick movement of men and goods from place to place. There are many difficulties in the way, but these have to be overcome; and engineers can best help us to do so.

I earnestly hope that the engineers assembled in the Congress will be able to take decisions of a practical nature, so that regard being had both to the means and needs of our people, we might have a larger and still larger network of roads, bringing peace and prosperity to our people, and helping in the strengthening and the consolidating of our national unity.

I send my warmest good wishes for the success of the Congress, and all health and happiness to those who are participating in the same.

**SARDAR PARTAP SINGH KAIRON,
CHIEF MINISTER, PUNJAB**

I am very pleased to convey my good wishes for the success of the 23rd Session of the Indian Roads Congress.

I understand that you will consider 20-year Road Plan during this Session, which will be the basis of Third-Five Year Plan for roads.

Roads are of vital importance in the opening and development of the country, and I hope that a comprehensive and balanced programme to serve urban and rural areas will be framed.

I lay particular emphasis on village roads, as our villagers are very enthusiastic about road development and are even prepared to share the cost by "Shram-Dan" and free gift of land. It is hoped that greater allocation will be made for construction of village roads, in which Central Government, State Government and villagers are co-sharers. Whenever my Ministers or I go on tour in rural areas, pressing demands are made by villagers for more and better roads, and their completion at faster pace.

I trust you will pay earnest consideration to these matters, and evolve an integrated and balanced programme which will serve the future transport needs of the country.

VOTE OF THANKS

By
SHRI SUJAN SINGH,
Vice-President, Indian Roads Congress

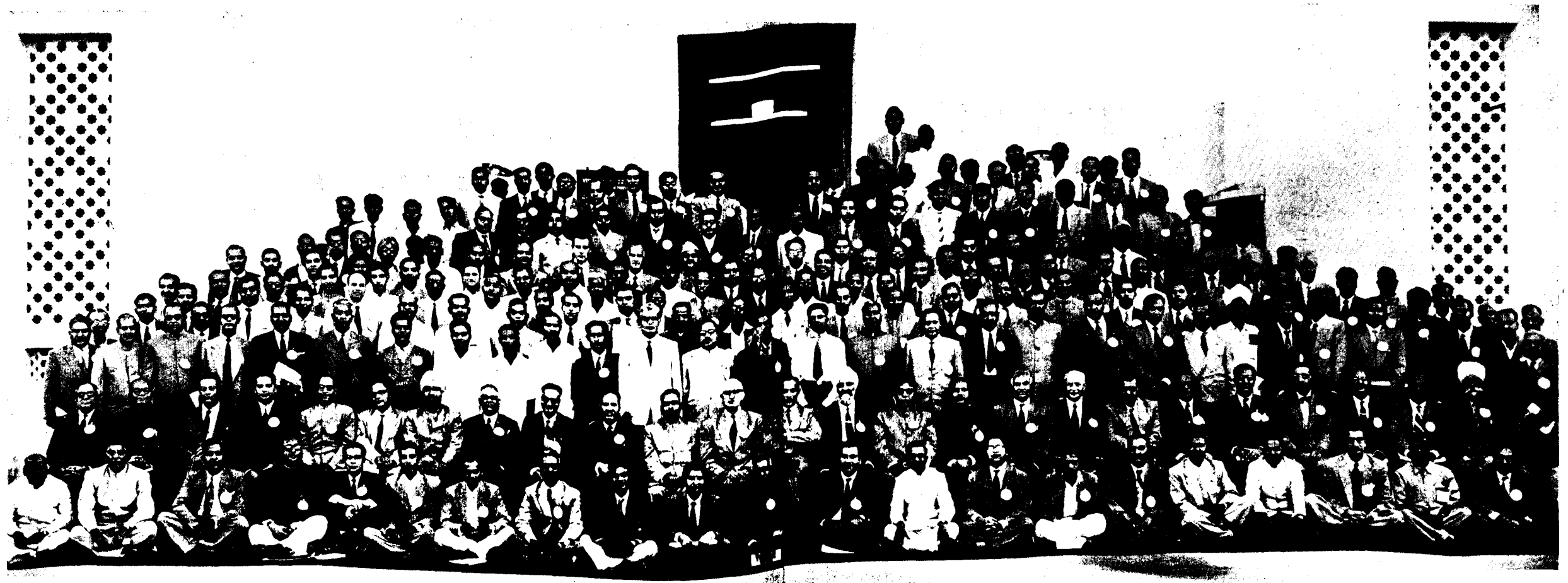
Your Excellency, Ladies and Gentlemen,

It gives me great pleasure to propose a vote of thanks to His Excellency, the Governor of Andhra Pradesh who in the midst of his multifarious affairs and duties of the State has been kind enough to spare time to be present in our midst to inaugurate the 23rd Session of the Congress. It also gives me great pleasure to welcome amongst us Her Excellency Shrimati Lalita Sachar and thank her for her kindness in gracing the occasion with her presence.



Vote of thanks by Shri Sujan Singh, Vice-President, I.R.C.

We are singularly fortunate in having the Heads of the States to inaugurate our Sessions and this gives so much grace and brilliance to our functions in addition to the encouragement and inspiration we get. You, Sir, have been at one time at the helm of affairs in one of our northern most States which under your guidance has seen tremendous progress particularly in the shape of great engineering works like the gigantic Bhakra Nangal project and in the building of the new city of



INDIAN ROADS CONGRESS, TWENTY-THIRD SESSION, HYDERABAD, JANUARY 1959.

making this exhibition a great success. The Minister accompanied by the President, IRC then went round the exhibition.

The exhibition which was tastefully laid out depicted the various techniques used in road construction and included maps and charts pertaining to roads and bridges, models of bridges and machinery used in road construction.

Various Government Departments and firms dealing with road building materials and machinery, scientific instruments, etc. participated in the exhibition. The Andhra Pradesh State show with a chain of stalls dominated the exhibition. In brief the participants in the exhibition were:

STATE AND OTHER GOVT. DEPARTMENTS

Andhra Pradesh, Highways Department
Bihar, PWD
Bombay, PWD
Madras, Highways Department
Mysore, PWD
West Bengal, Road Development Department
Army Headquarters, E-in-C's Branch
Central Road Research Institute.

FIRMS

Associated Instrument Manufacturers (India) Ltd.
Burmah Shell Oil Co.
Gannon Dunkerley and Co. Ltd.
Larsen and Toubro Ltd.
Marshall and Sons (India) Ltd.
Millars' Timber Trading Co. Ltd.
Standard Vacuum Oil Co. Ltd.
William Jacks and Co. Ltd.

OTHERS

Concrete Association of India

THE VOICE OF THE PRESS

We publish below extracts from leading articles regarding the 23rd Indian Roads Congress Session which appeared recently in newspapers all over India.

“The Mail”, Madras, January 9, 1959.

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Some of the other suggestions made by the President of the Congress, are worthy of consideration by the Government, as steps towards co-ordination of an important aspect of the country's development. The proposal for an All-India Transport Board and State Committee is a variation of an earlier suggestion for a department at the Centre exclusively for transport, with each State having its Transport Ministry handling all its aspects. With such a set-up, at the Centre and in the States, it is felt that there should be greater co-ordination and uniformity in development, and it is natural that communications should be viewed as a whole rather than as separate problems for each State. In regard to taxation, and the collection of taxes, and centralisation, there is likely to be strong opposition from the States, where the levies vary so tremendously, and different levels of dependence are laid on the taxes which are levied. In Madras, for instance, the rate of taxation is very high, and could reasonably be reduced, to help in the development of road transport. Yet it is reasonable to suggest that even in this respect there should be some uniformity. The issue of the taxation of cart traffic is an old one also, which has resulted in the past in many acrimonious differences of opinion, but yet it is not unreasonable to say that the benefits which are bestowed on this form of traffic by the improvements made from payments made by other forms should be, in some way, paid for. That there is need for more and better roads cannot be denied, that these are to play an increasingly important part in the development of the country is accepted, and yet it will be incongruous to spend so many more crores on roadways and not make provision, amply and in time, for the production of the vehicles which are to use them, to carry the largely increased volume of produce of agriculture and industry. It is essential that a high and continuingly advancing level must be maintained, and a proper balance retained.

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“The Times of India”, Bombay, January 9, 1959.

Mr. Mascarenhas has very dutifully fulfilled this ritual of deploring the failure to reduce the gap between achievement and objective and has in addition offered some provocative suggestions. All of these might not be acceptable but certainly deserve careful consideration. He very pertinently asks why bullock carts which use the roads as frequently as other vehicles and damage them to a greater degree are exempt from even a token contribution towards the construction and maintenance of roads. The owners of bullock carts are admittedly far from affluent but the same might be said of the farmer and the average consumer both of whom are subject to a variety of taxes. Bihar has imposed a registration fee on bullock carts ranging from Rs 2 to Rs 12 per year according to the area of operation and there is no reason why other States should not follow this example.

The cost of the new plan is estimated at Rs 5,200 crores which involves an annual outlay of Rs 260 crores against an expenditure of Rs 50 crores per year in the current Five Year Plan. The gap of more than Rs 200 crores is a formidable one but the advantages of a network of good roads throughout the country are such that an allocation from the general revenues would be fully justified. Once a beginning has been made in developing roads and road transport it is possible that road construction projects might become self-financing and to this extent contribute towards reducing the gap between the current outlay and what is required under the new plan. The necessary degree of efficiency can be maintained if each State administration is given the services of a roadways authority as has been repeatedly recommended by road experts.

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“The Deccan Chronicle”, Secunderabad, January 9, 1959.

We have in India four categories of roads, national highways, state highways, district roads and village roads. The national highways are the responsibility of the Centre and others that of the State Governments. When all these roads are put together one is staggered by the fact that there are nearly two thousand miles of missing links and over a hundred missing bridges on the highways. So mere lengthening of highways and by-ways without making them all-weather roads and their surface enduring will be of little advantage. The community which is expected to pay for good and bad roads would want every missing mile of road laid and every missing bridge built before making fresh plans for expansion. The Roads Congress, which is an important body of experts should be taken into confidence by the Central Government, and its advice availed of in these matters.

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“The Statesman”, New Delhi, January 9, 1959.

The harsh fact is that for two decades now the development of roads and road transport has been hindered by Governments. At first railways were the reason, now, inescapably, it is shortsightedness and inertia. There is always much talk, little action. Taxation is not only prohibitive but uneven and the proceeds are diverted to other ends; roads are built but bridges frequently overlooked; administrative reforms are delineated in detail, then shelved; the freer movement of trucks is recommended but not permitted; commissions and committees are announced but years may pass before they are appointed. In 1943 one of them emphasized that buses should penetrate to the villages. Today, 15 years later, more than 62 per cent of road-mileage is unbridged, unsurfaced and unfit for heavy vehicles. The problem involves not only roads, but vehicles. It has been estimated that to lift the goods traffic likely to be available. Passenger vehicles are similarly below needs. At the present rate of production 11,000 buses are likely to be added to the existing fleet by 1960-61. But 40,000 are required.

None will dispute the contention of Madhya Pradesh's Governor that in an agricultural country like India road transport “is of inestimable economic value”. Even today despite every discouragement, almost as many people travel by road as by rail and pay more for it. The appalling conditions to which they submit stamp them as patient, hardy and courageous people. They deserve better treatment.

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THE TESTING METHODS IN VOGUE FOR EVALUATING THE BEARING VALUES OF SUBGRADE SOILS—A REVIEW

By

H. L. UPPAL & BHUPINDER SINGH*

(Continued from previous Issue)

North Dakota Cone Test

General

THE test was originally developed in North Dakota and was used along with CBR test in the design of flexible pavements. When a solid cone is loaded, it gets imbedded in the material. The bearing value of the material by this method shall be obtained by dividing the total load by the cross-sectional area of the cone at the surface level.

Brief Description of the Test⁽¹⁷⁾

Briefly the test consists of measuring the penetration of a steel cone (half angle, 7° 45') into the soil under a set of increments of load. The test is made directly on the soil layer, of which the bearing value is needed after trimming the test area to level. Loads are applied in increments such that the total loads on the penetrating cone are 10, 20, 40 and 80 lb successively.

The North Dakota Cone method of design is also an empirical method. In evolving this method Boyd⁽¹⁷⁾ has tested a number of roads both good and failed ones in North Dakota under the existing conditions of climate and traffic. After thus testing several roads, the results of bearing values obtained for various roads were plotted versus their thickness and from the plot on log-log basis, the curve separating most of the failed roads from good roads was expressed as

$$T = \frac{65.7}{b^{0.388}}$$

* Central Road Research Institute, New Delhi.

Where T = thickness of construction in (ins.)

and b = cone bearing value in (lbs/sq. in).

The prevailing traffic in North Dakota was of the order of 5000 lbs wheel load with a tyre inflation pressure of 70 lbs per sq. inch. This method also provides means of converting the thickness of construction given by the formula to a thickness for other wheel loads and contact pressures. To a limited scale this method has also been used in the State of Madras⁽¹⁸⁾ in India.

General Limitations of the Test

1. Due to being easily portable, less time consuming, less expensive and having more of the simplicity, this method enables more frequent tests to be made.

2. This test gives good results only on fine grained cohesive soils. A little piece of stone may give rise to erratic results. Many tests have to be carried out to find the average result.

3. Using this method with the existing information, it is not possible to predict the bearing capacity of the soil at saturated conditions, unless the tests are done in the same moisture conditions in the field which may not be possible in most of the cases.

4. Under the conditions and limitations when tests were conducted by Baker and Drake,⁽¹⁸⁾ it was found that designs based on this method were successful with 83 per cent probability.

Shear Tests (^{1,2,3}) to determine the structural strength of soils

General

The three common methods of shear testing are Direct Shear Test, Cylindrical or Triaxial Compression Test and Torsion Shear.

The principle of all these tests is that the structural strength of any soil depends upon its value of cohesion and angle of internal friction. The shear strength of a soil is its maximum resistance to shearing stresses and when this resistance is exceeded, failure occurs. These tests are made to determine the values of C & ϕ to be used in an empirical formula proposed by Coulomb.

$S = C + N \tan \phi$; in which

S = shearing strength in lbs/sq. ft.

C = cohesion in lbs/sq. ft.

N = pressure normal to shear plane, in lbs/sq. ft.

ϕ = friction angle of soil

$\tan \phi = \mu$ = coefficient of friction.

The use of such tests as Direct Shear, and Triaxial Compression is an indirect method of determining the bearing strength of sub-grades. The results of such tests are substituted in a theoretical or semi-empirical expression for the supporting power of soil.

Hawthorn (²²), Housel (²³), Palmer and Barber (²⁴), Barber (²⁵), Spangler (²⁶), Glossop and Golder (²⁷) have used the shear tests to determine the bearing values of sub-grade soils, consequently to be used in the design of the flexible road pavements.

General Limitations of these tests

The shortcoming of all Laboratory Shear tests is that none of them gives true information on the effective strength of soils in the field, because in the laboratory it is very difficult to simulate true field conditions. Further work is needed to explore methods to simulate true field conditions in the laboratory; otherwise sometimes the results may prove to be very deceptive in their application.

A Brief Description and Limitations of each test are as follows

Direct Shear test

General

This test enjoys the widest acceptance in the U.S.A. Shear Box tests are divided into two parts, i.e., undrained and completely drained according to the drainage permitted during shearing of the specimen.

In a Direct Shear test the failure is caused in a predetermined plane of the soil, the shear strength or shearing resistance and the normal stress both being measured directly. The apparatus used is a rectangular box, divided horizontally into two halves and containing a rectangular prism of the soil. While the prism is subjected to a constant vertical compressive force, an increasing horizontal force is applied to the upper half of the box, thus causing the prism to shear along the dividing plane of the box. The test is made on a number of identical specimens using different vertical stresses so that a graph of shearing resistance against vertical stress can be plotted. From the graph the values of C and ϕ are obtained.

The test is generally used for soils ranging from clays to coarse sands. It may be used for gravels too, but for that purpose the dimensions of the shear box will have to be increased.

General Limitations

(i) Immediate or consolidated quick test in the shear box when constant volume conditions are required can be made only on saturated clays, but with other soils it is usually impossible to prevent consolidation occurring during shearing. There is a possibility of progressive failure due to non-uniform distribution of stress on the plane of failure. It is not possible to measure modulus of deformation or elasticity or to measure the pore water pressure within the specimens.

(ii) Exact reproduction of the field conditions such as rate of loading, density, moisture content, and drainage are not

possible in the laboratory testing, because the conditions in the field cannot always be fully predicted or are not fully known and on the other hand the range of technique at present available with the shear box is limited.

Triaxial Compression Test

General

All three types of tests, i.e., immediate test, consolidation quick test, and slow test in all soils can be carried out with the triaxial apparatus. The measurement of the modulus of deformation or elasticity, the measurement of pore water pressure and the measurement of volume changes are usually possible.

Brief Description of the Test

To describe briefly, the triaxial testing provides lateral support to a specimen which at the same time is subjected to a vertical load. It also allows expulsion of water from the specimen as the test progresses. A value of total stress corresponding with strain is obtained at regular intervals. From these data a stress strain curve is drawn, which in turn is used for the determination of the modulus of deformation. At failure the value of both the stresses is known. The values of C & ϕ are determined by the use of Mohr's (¹⁰) circles.

Relative Merits of the Triaxial Test over the Direct Shear Test

Though the Direct Shear Test machine is simpler and faster to operate and the use of a thinner soil sample facilitates rapid drainage of the pore water from the saturated specimen, yet the Triaxial Test received preference over it because of the reasons that:—

1. Progressive effects are smaller.
2. The measurement of volume-changes in the specimen are more accurate.
3. The complete state of stress is known at all stages during the test, whereas only the stresses at failure are known in direct shear test.
4. The triaxial machine is more adaptable to special requirements.

5. While both types of shear tests do not exactly simulate field conditions, the Triaxial shear test with its better control approximates more closely to field conditions than does the Direct shear test.

Torsional Shear Tests

General

These tests are occasionally used as alternatives to the shear box and triaxial tests in the U.S.A. A field Torsional shear test for clays which is likely to gain increasing importance is the vane test. In this a Vane, usually consisting of two blades at right angles is attached to the end of a rod and pushed into the soil at the bottom of a bore-hole. The torque required to shear the soil along a cylindrical surface passing through the outer edges of the vane is then measured. The shear strength C of the clay is given by the expression (²⁸)

$$\tau = c \pi \left(\frac{d^2 h}{2} + \frac{d^3}{6} \right)$$

Where τ is the torque, d the diameter of the vane, and h the height of the vane. The test is particularly suited for very soft clays and for sensitive clays for which suitable compression specimens cannot easily be prepared.

It has an advantage over the unconfined compression test, in that the strength of clay at considerable depths can be determined without obtaining undisturbed samples. The results obtained by the vane test are regarded as being more reliable because unconfined compression specimens taken from great depths are unlikely to be truly undisturbed.

Unconfined Compression Test

General

This is suitable only for cohesive soils and for measuring the shear strength under zero lateral pressure. The apparatus is portable and can be used in the field as a measure of in situ strength. In addition, it is the simplest and the quickest of the laboratory methods com-

monly used to measure the shear strength of cohesive soils. The test is advantageous over the Direct Shear Test because more uniform stresses and strains are imposed, and unlike the Direct Shear Test where the failure is made to occur along the predetermined surface, which may not be the weakest one, the failure occurs in the weakest portion of the specimen.

Brief Description of the Test (¹⁰, ¹⁹, ²⁰)

The test requires an undisturbed sample of cylindrical form, usually of 3 in. effective length and 1.5 in. diameter. It is loaded in compression until failure takes place, either by shearing on a diagonal plane or by lateral bulging. The compressive stress (load per unit area) is then the greatest principal stress, and the other two principal stresses are zero. The test is mainly used for undrained tests on cohesive soils whose angle of shearing resistance is zero or very small.

If ϕ (the angle of shearing resistance of the soil) is 0 then the plane of failure makes an angle of $45^\circ + \frac{\phi}{2}$ with the plane from which the maximum principal stress acts. The shear stress at failure is therefore equal to half of the maximum principal stress, and can be written as $S = 1/2$ unconfined compression value.

General Limitations of the Test

The test is only applicable to very cohesive and homogenous soils, since the cohesionless soils do not form unsupported cylinders. Moreover it is very difficult to simulate field conditions in the laboratory.

Acknowledgments

The Authors wish to express their deep sense of gratitude to Shri S. R. Mehra,

Director, Central Road Research Institute under whose initiative and valuable guidance this study was conducted.

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TRAFFIC AND SAFETY

THE WORK OF THE HARMONDSWORTH ROAD RESEARCH LABORATORY

(Continued from previous Issue)

APPARATUS FOR TRAFFIC STUDIES

Measurements of journey times and stopped times. Measurements of 'journey times' along sections of a route and 'stopped times' (i.e. from first stop to last start) at intersections on the route are frequently made by filtering a car into the traffic and timing its progress. An instrument has been developed to simplify the observer's task in recording times. The observer presses push-buttons at each stop and start of the vehicle whilst queueing and operates a changeover switch when the vehicle enters each new section of the route. The instrument incorporates an automatic summing feature which enables the required 'stopped times' and 'journey times' to be displayed on electrical digital counters. These times are simply copied on to log sheets and no intermediate stop and start times during queueing need to be recorded.

Measurement of speeds. A compact timing apparatus has been developed in co-operation with a manufacturer of transistorised plug-in counting units. Pulses at $2\frac{1}{2}$ kc/s from a crystal controlled source are counted on three decade stages, the whole equipment being powered by a pair of 6-volt dry batteries.

Speeds are measured by timing vehicles as they pass between accurately spaced pneumatic detectors approximately 6 ft apart on the road. The supply of pulses to the counter is started by the passing of a vehicle over the first detector and stopped by its passage over the second detector. Accurate sampling from high traffic flows is simplified by push-button control, enabling the speed of the selected vehicle to be obtained as it passes over either of two pairs of detectors.

SAFETY SKIDDING

Use of accident reports. Further detailed studies of skidding accidents

occurring in wet weather have confirmed the usefulness of using police reports as a guide to slippery sites in need of treatment. In one area studied, nearly 400 personal-injury and damage accidents were reported in 1956 as involving skidding vehicles. In more than one-quarter of these accidents skidding was given as the sole cause, there being no report of any emergency which had caused the driver to take action by braking or swerving. One-third of the skids occurred on bends, and one-quarter were located in clusters at 29 sites. Measurements with the portable tester have confirmed that the skidding resistance of 24 of these sites when wet was lower than the appropriate values suggested in "Road Research, 1955"; the other five sites had recently been resurfaced for surface dressed and no measurements could be made. Of these 24 sites, 22 had rough looking surfaces, but individual stones had become round and polished by the traffic. On the other two sites the surfaces were smooth and slippery due to excessive 'fetting up'. All the sites involved some difficult feature of road layout, most of them being bends on gradients. These findings confirm the results of previous studies of other sites where skidding was frequently reported.

Standards of skidding resistance. In 1956 a survey was made of 133 lengths of road in different parts of the country to assess the suitability of the suggested standards of skidding resistance put forward in "Road Research, 1955" and elsewhere in more detail²; the results obtained have shown that the chosen values of sideways force coefficient are of the right order. Thus at 28 sites the accident records showed a significantly high frequency of skidding in wet weather, and with one exception these sites had sideways force coefficients below the suggested standards. At many other sites, the suggested values of coefficient are already being obtained: 17 per cent of

ordinary Group A installations were provided in place of very poor lighting. The results showed good agreement with those obtained in previous studies, and the old and new data combined gave the following percentage reductions in night accidents.

Pedestrian accidents ...	45 per cent
Other injury accidents...	23 per cent
All injury accidents ...	50 per cent

There was no firm evidence that the benefits differed with accidents of different severities, although fatal and serious accidents showed the greatest apparent reductions. There was no evidence that any one type of lighting (mercury, sodium, etc.) provided greater benefit than any other.

Accident Statistics

Halt and slow signs. Accident data were obtained for 30 junctions before and after the provision of halt or slow signs. For halt signs, the average reduction in injury accidents involving a vehicle emerging from the main road was about 80 per cent; this compares with 75 per cent for injury accidents found in a previous more limited investigation. Similar reductions were found for serious accidents and for damage accidents. For slow signs the reduction in injury accidents of all types averaged about 70 per cent; there were too few accidents involving serious injury or damage at these junctions to permit any deductions being made from the figures.

These signs were thus very effective in reducing accidents at the 30 junctions studied and could be more widely used. The general position would need to be watched, however, since the installation of too many signs might reduce the respect paid to them and lessen their safety value.

Roundabouts. Results are now available for 22 crossroads where roundabouts have been provided.

At those roundabouts which were provided with a circular island at least 100 ft in diameter, the average reduction in injury accidents was 70 per cent.

At all other roundabouts, where the site either did not permit or did not require the use of standard designs, the average reduction was 40 per cent. In neither case was there any evidence of a change in the proportion of serious accidents.

The average capital cost where a large circular island was provided was 15,000 pounds; that of the other roundabouts was 6,000 pounds. The annual rate of return represented by the economic saving on accident costs was 6 per cent for the first group and 12 per cent for the second group.

Staggered junctions. Results for 16 crossroads are now available. At each, a simple crossroad was changed into a staggered junction, usually a right-left stagger, i.e., one that requires a vehicle crossing the major road to turn right into it and then left out of it.

At the 16 crossroads taken together, the average reduction in injury accidents was 60 per cent. For fatal and serious accidents it was 90 per cent.

The average cost of the schemes was 5,000 pounds; the monetary cost of the accidents saved thus represents a return of about 15 per cent on the capital invested.

Dual carriageways. A study has been made of accidents before and after the provision of dual carriageways on 13 lengths of road. On the average, personal-injury accidents as a whole were 30 per cent fewer following the changes. Fatal and serious accidents appeared to decrease by about 10 per cent, but there were too few of these to give a reliable assessment.

At several junctions on new dual carriageways marked increases in accident frequencies have occurred. Although in some of these cases further changes in the layout have now caused the accident figure to fall again, it appears that special care is required in the design of junctions on dual carriageways if increases in accident frequency at them are to be avoided.

Traffic Signs

An investigation has been put in hand during the year with the object of im-

proving the legibility of traffic signs; this matter is becoming increasingly important in view of the construction of motor roads and the higher speeds of traffic.

The experiments so far carried out have been limited to a study of the problem of providing signs for a simple crossroads; they have involved determining the distances at which an unfamiliar sign could be read by the driver of a vehicle travelling on a straight road at speeds of 30 and 50 mile/h. The test signs were formed by scrambling the word "Stoke"; in each test the driver was asked to state

6 in. and five sizes of letter ranging from 2 in. high to 6 in. high were studied in various combinations. The results obtained are shown in Fig. 7. It was found that, without making the whole sign any bigger and therefore more expensive, it was possible to convert a conventional sign carrying 3-in. letters into a continental type sign carrying 5-in. letters or an American-type sign carrying 6-in. letters. These changes resulted in the first case in a three-fold increase, and in the second case, a four-fold increase in recognition distances.

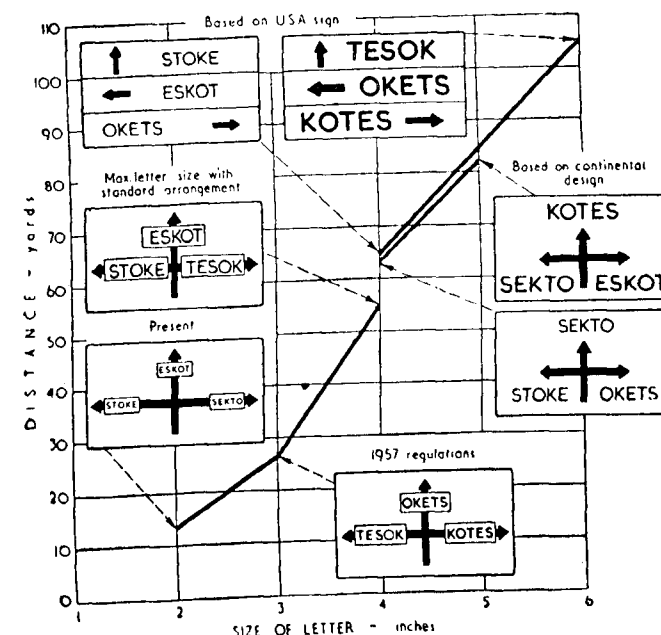


Fig. 7.

Distance away at which direction of chosen place was indicated at 50 m.p.h. All signs have exactly the same total area

the direction indicated by the sign bearing the word selected. His eye movements were recorded by a cine-camera during each test run, and the records were subsequently analysed to determine the periods of time during which his gaze was averted from the road ahead.

Three types of sign were studied, namely, the 'British' sign, the Continental 'map' sign, and the American 'list' sign; route numbers were excluded from the test signs. All the signs were the same size, namely, 4 ft 6 in. by 2 ft

For the same size of lettering there was no difference in recognition distance between the Continental 'map' and the American 'list' signs. The case studied was, however, a simple crossroads; where the layout of an intersection is more complicated, signs embodying the 'map' principle might have advantages.

The measurements of eye movements showed that in reading a sign the eyes were directed towards it for an average time of some 4 seconds. The distances from the sign at which its message was appreciated were much less at 50 mile/h than at 30 mile/h. This suggests that when high-speed motorways are built in Great Britain, special consideration will have to be given to the design and siting of the traffic signs. For signs of any

particular size it is clearly desirable for the layout of the sign to be such that the lettering is as large as space permits.

Reference

- Giles, C. G., The skidding resistance of roads and the requirements of modern traffic, Proc. Instn. Civ. Engrs., 1957, 6, 216-2; Discussion, 243-9.

(From "Roads and Road Construction", September, 1958.)

Category A sites (most difficult sites), 49 per cent of Category B sites (general sites) and 92 per cent of Category C sites (easy sites) were above the suggested values. The greatest problem is thus likely to arise in maintaining the required sideways force coefficient at Category A sites.

Treatment to increase the sideways force coefficient is being carried out at the 28 sites with high skidding rates to afford further checks on the standards and to show the effectiveness and durability of the different remedial measures taken.

Slipperiness measurements with towed wheel. Tests with the small braking-force trailer showed that the values of braking-force coefficient measured on different wet surfaces were 9 per cent to 33 per cent greater when the test wheel was towed in the track of the near or off-side wheels of the towing vehicle than when running clear of their tracks, because the wheels of the towing vehicle had pushed aside some of the water film. In the design of machines for measuring the resistance of a wet road surface to skidding it is thus important that the test wheel should run clear of the tracks of the towing vehicles; at the same time a better resistance to skidding in wet weather may be obtained for vehicles where the successive pairs of wheels run in the same tracks.

Portable 'skid-resistance' tester. The manufacture of a further 13 skid testers, brings the total number made to 17. All have been independently calibrated and cross-checked. The cross-check covered the widest possible range of both surface texture and skidding resistance. The agreement between the laboratory models and the production models is excellent.

A number of these testers are now in constant use on the roads, ten of them being tried out by highway authorities. After six months' use reports from high-

way engineers indicate that with a few minor modifications to mechanical details the instrument is satisfactory.

By comparing distributions of 'skid-resistance' measured with the portable tester at skidding accident sites and at a random selection of sites, standards of 'skid-resistance', as measured by the portable tester, to ensure freedom from skidding in wet weather have been suggested, in the same way as for sideways force coefficient. The distributions and suggested values are indicated in Fig. 5: values of skid-resistance below 45 indicate potentially slippery sites; between 45 and 55 the demands of the traffic and

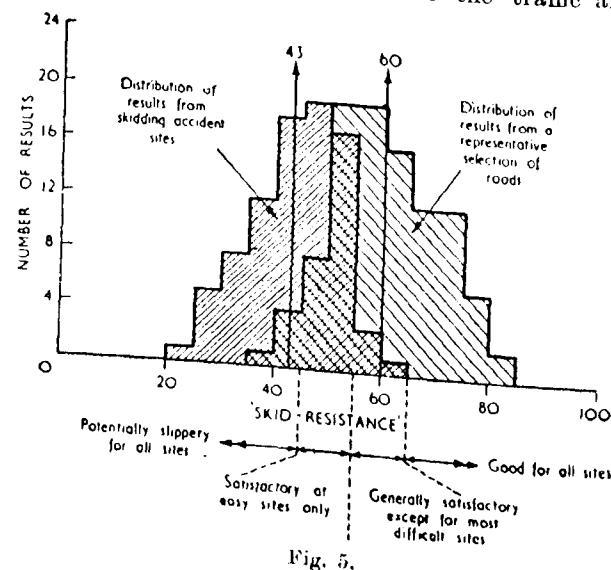


Fig. 5. "Skid-resistance" measured with portable tester at skidding accident sites and on a representative selection of roads

road layout will determine whether the skid-resistance is adequate; values above 55 should be satisfactory for most conditions of road layout except at the most hazardous sites where values up to 65 may be required to ensure freedom from skidding.

Seasonal variation. The seasonal variation in the resistance to skidding of wet roads has been studied in more detail by making tests with the portable tester at fortnightly intervals on twelve roads, covering a range of materials and aggregates. The results for all the sites

followed similar patterns. The difference in skid-resistance between the summer minimum and the winter maximum ranged from 13 to 31, about a mean of 18; neither the summer (1956) nor the winter (1956/57) were extremes. If the summer had been hotter and drier the gradual lowering of the resistance to skidding to a minimum in May-June might well have continued further into July and August; likewise a more severe winter (winter 1956-57 was particularly mild) might have resulted in a rise in skidding resistance beyond the existing peak in December-January.

These trends in resistance to skidding recorded in 1956 are closely followed by corresponding seasonal trends in the frequency of skidding in accidents on wet roads. Fig. 6 shows the percentage of accidents involving skidding month by month during 1956; superimposed on it (on an inverted scale) is the mean 'skid-resistance' measured by the portable tester at the 12 experimental sites.

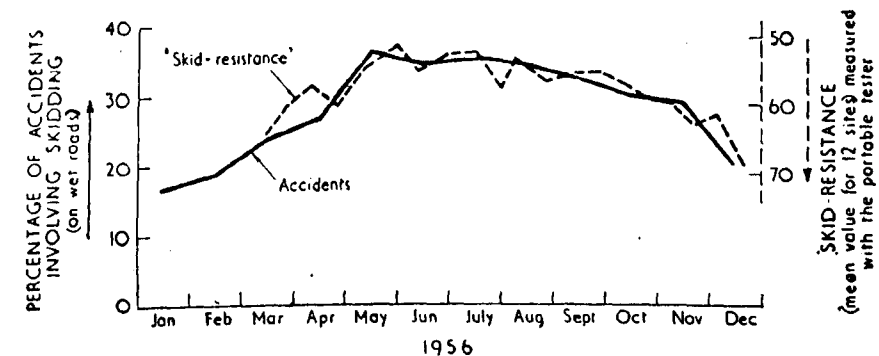


Fig. 6. Seasonal variation in skidding accidents as compared with measurements of resistance to skidding in 1956

A preliminary analysis indicates that both temperature changes and the proportion of time that the road is wet play important parts in determining the seasonal changes in resistance to skidding. In seeking an explanation of these seasonal changes, records have been taken of the condition of both tyre and road at a series of pre-arranged stops on similar journeys in winter and summer. Samples of the dust present on the tyre, and on the road, were collected on adhesive tape pressed on to the surfaces. These prints showed that in the wheel tracks the roads themselves are fairly

clean; most dust (which appears to be about 80 per cent tread rubber) adheres to the tyres. In dry weather quite large particles of rubber dust are found on the tyre, but in wet weather the dust is washed away leaving only fine-grained dirt on both tyre and road. Thus, whilst particles of dust may be the polishing agent for stones in dry weather, there is no such simple explanation for the roughening in winter.

Changes in the small-scale texture of the surface of stones, similar to those observed on stones in the road in summer and winter, have been produced by laboratory tests, in which polished road-stones saturated with water were exposed to the atmosphere. This suggests that the observed improvement in the resistance to skidding of roads every winter could come about from a weathering action of the stones in the surface of the road, and may not require the action of traffic. The mechanism of this weather-

ing is not fully understood and tests are continuing in order to investigate it further.

Street Lighting

Accidents. Evidence that the provision of modern street lighting tends to reduce the frequency of night accidents has hitherto been obtained mainly from a limited number of sites in the London area (see "Road Research, 1955"). This conclusion has now been considerably strengthened by the results arising from a study of a further 52 sites spread over all parts of the country. In most cases,

HERE AND THERE

1. MOSCOW BRIDGE ROLLED TO MIDSTREAM AND FLOATED ON TO FOUNDATIONS

● RUSSIAN bridge builders used unusual methods to build a combination subway and four-lane highway bridge across the Moscow River.

Workers assembled two complete precast concrete arch structures on shore. While the first was being rolled to midstream and floated into place on barges, the second was being constructed. Then it too was rolled and floated to its place along side the first. The parallel sections have 354 ft center spans.

While crews on shore built half the super-structure at a time, foundation work went ahead in midstream.

The first assembly was rolled out into midstream on tracks laid over timberpile trestles. Steel towers and suspension cables supported the cantilevered ends of the span temporarily. These supports

were later removed after the bridge section finally rested on its foundations.

The 5,600-ton section was floated into position on 248 water-ballasted pontoons and lowered into place by pumping water into the pontoons.

The second section of the bridge was floated into place in the same way.

The two sections from a double-level bridge connecting the growing south-west part of Moscow with the center of the city (ENR Aug. 14, p. 54). A four-lane, high-level roadway will cross the top of the bridge arches. A subway will run on the lower level. Pedestrian walks are cantilevered from both sides of the bridge.

(From: "Engineering News-Record", December 11, 1958)

2. DATA ON RUBBER BRIDGE BEARINGS

● THOUGH neoprene, a synthetic rubber, has been used for bearings in short-span bridges in the U.S., few tests have been made to produce sufficient data to set up design criteria. Data were needed on the resistance of elastomers to shear loads while under compression.

To remedy this shortcoming, evaluation tests of elastomeric bridge bearings were conducted by Charles A. Maguire and associates, consulting engineers of Providence and Boston, in co-operation with the Division of Roads and Bridges of the Rhode Island Department of Public Works.

Measurements of vertical deflections in the tests indicate:

Deflection increases inversely with durometer (hardness) ratings.

The ratio of deflection to thickness increases with bearing thickness.

Shape has little effect on compressive resistance.

Deflection increases with time and dynamic loading.

Horizontal shear tests lead to these conclusions:

Compressive load has little effect on shear resistance.

Resistance to angular shear distortion increases with thickness.

Resistance to shear distortion increases with stiffness.

Dynamic creep of vertical deflections resulted from an alternating horizontal loading. A test indicated that an addi-

tional 50 per cent deflection is maximum for an indefinite period.

The researchers recommend additional tests for fatigue creep and temperature effects on compressive and shear distortions.

Elastomeric bearings are being tried as a low-cost way of supporting short-

span bridge beams. They not only provide uniform transfer of beam reaction to the substructure but also permit rotation of beam ends and expansion and contraction with temperature change (ENR May 16, 1957, p. 67).

(From: "Engineering News-Record", December 11, 1958.)

3. MENDING THEIR WAYS

(From the speech of the Prime Minister, U. K. delivered on the occasion of the opening of the Preston by-pass.)

● 'IT is perhaps one of the happiest features of road planning and construction that it requires co-operation from all who work on it, and that it is not approached in any political or partisan spirit. This is as it should be.'

Robert Burns once wrote:

"I'm now arrived —

thanks to the Gods!

Through pathways rough and muddy.

A certain sign that making roads

Is no this people's study.

Yet though I'm no wi'scripture
crammed,

I'm sure the Bible says

That heedless sinners shall be damned

Unless they mend their ways."

Having quoted this to a Lancashire audience, the Prime Minister concluded by saying: "This road is a sign—not the first sign, but the most striking so far—that we are no longer heedless sinners and that we are determined to mend our ways."

(From: "The Surrey and Municipal and County Engineer", December 13, 1958.)

4. ELECTRONIC SLANDER

● A STORY directly designed to appeal to the engineers, scientists and research men present was told by R. F. Newman, of Thornycrofts, at this week's luncheon of the Motor Industry Research Association. It concerned a company which had installed an electronic computer. As an experiment with the memory element of the machine, the scientist in charge had fed it a lot of personal data about the staff. He was then required to demonstrate to the managing director.

"Where is my father now?" the m. d. asked the machine.

"He is in Montreal" came the reply from the machine.

"That's nonsense," the m. d. told the scientist. "My father died two years ago. Check it."

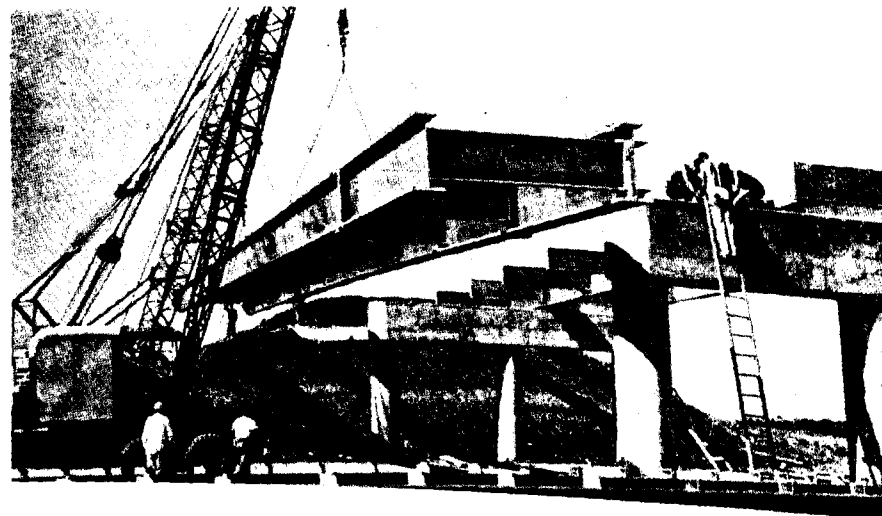
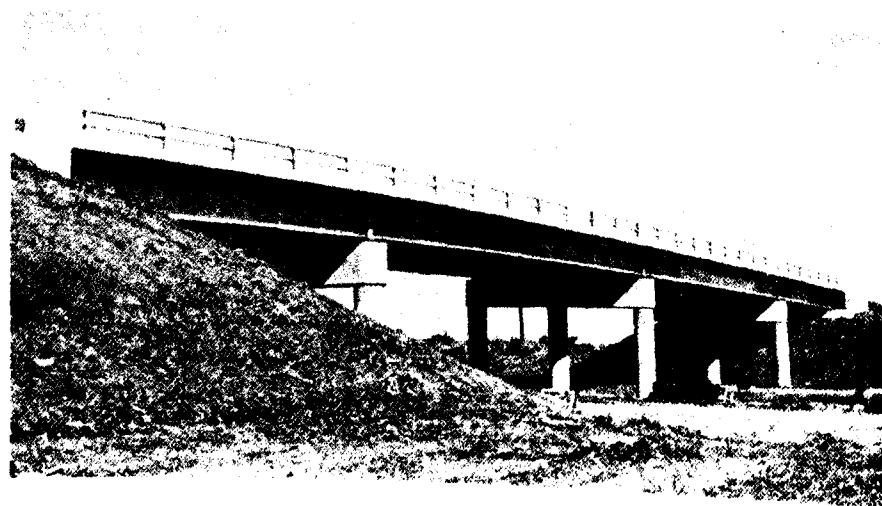
The scientist did so and got a confirmation from the machine: "It is correct that your father is in Montreal. Your mother's husband died two years ago."

(From: "Motor Transport", December 19, 1958.)

5. ALUMINUM-GIRDER HIGHWAY BRIDGE OPENS

● THE FIRST aluminum girder-type highway bridge in the world was dedicated Sept. 24 at Des Moines, Iowa. The bridge was built after an extensive research and development program sponsored jointly by the state of Iowa and Aluminum Co. of America, Kaiser Aluminum & Chemical Corp., and Reynolds Metals Co.

The 22-ft long welded structure was officially opened to Traffic with the cutting of a ribbon made appropriately of aluminum foil. In attendance were state and city dignitaries members of the Iowa State Highway Commission and the Des Moines Chamber of Commerce, highway administrators and engineers from all over the nation and represen-



The completed aluminum-girder highway bridge carrying Clive Road across an interstate highway near Des Moines, Iowa, is shown in the top photograph. Below, a giant subassembly of aluminum structural members is elevated into position during construction of the Iowa bridge. Quick and easy field erection was made possible by prefabrication of members.

tatives of the three sponsoring companies.

A two-lane, four-span continuous girder structure with a reinforced-concrete deck, the bridge is located on Clive Road and crosses Inter-state 35 and 80, a four-lane expressway. The bridge is 36 ft wide, with a 30-ft roadway.

The aluminum bridge is a developmental project to demonstrate structural and fabrication advantages of aluminum and to stimulate broader use of the metal in the nation's huge highway-construction program. It was designed by Ned L. Ashton, consulting Engineer of Iowa City, Iowa, under the direction of the Iowa Highway Research Board and the Iowa State Highway Commission.

The aluminum structural members were shipped in four giant sub-assemblies by railroad from Chicago, Ill., to a point near the site and then completed the journey by truck-trailer. The sub-assemblies, each consisting of an exterior and interior girder with connecting diaphragms, were approximately 12 ft wide and ranged from approximately 95 to 126 ft in length.

The big sections were then quickly and easily elevated to concrete piers by crane and bolted in place, thus demonstrating

the simplicity of field erection made possible by the prefabrication of the relatively light-weight members. Casting of the concrete deck and installation of railings completed the project.

A further important advantage expected to be demonstrated by the bridge is elimination of maintenance costs for painting. A similar bridge of conventional materials requires repainting from time to time to protect it from corrosion.

Four continuous longitudinal girders are used under the roadway, spaced 9½ ft apart. The girder and diaphragm system is primarily of welded-plate construction, taking full advantage of high-strength weldable aluminum alloys. The plate ranges in thickness from ½ in. to 1¾ in. A typical main girder has a web ½ × 36 in., a lower flange 1½ × 18 in. and an upper flange ¾ × 12 in. A typical diaphragm has a ½ by 23-in. web and 1 × 10 in. flanges. The concrete deck is tied rigidly to the aluminum girders with aluminum shear connectors to achieve composite action. Aluminum offers certain structural advantages when used for members designed for composite action with the concrete road slab, permitting a reduction in aluminum weight.

(From: "Better Roads," October, 1958.)

6. COMMUNICATION SKILLS

● THE attitude of mind displayed by engineers towards management and administration is in large measure paralleled by their attitude towards the necessity to express themselves clearly and effectively. Little solace may be derived from the fact that similar deficiencies are displayed by members of other scientific professions.

The vital arteries through which pulsate the life-blood of human progress, technical advancement and social development are the means by which we communicate with one another.

It is essential, therefore, to bring home to engineers the importance of writing and speaking clearly and effectively.

An ideal arrangement would be for the curriculum to include at least a full course in either English or Afrikaans. This, however, is not essential. It will suffice if the course in management and/or administration covers briefly but adequately the essentials of effective expression, with particular emphasis on the writing of reports, letters, memoranda, instructions, directives, general correspondence and public speaking.

Engineering technology—no less than any other professional science—is not static. New procedures and new techniques are being evolved all over the world. Progress involves change, and what applies to the practice of engineering applies equally well to its teaching. If

therefore, the deficiencies outlined earlier are to be eliminated, engineering training must be adapted to meet the needs of changing circumstances.

The university training of civil engineers—a problem whose principal features are the same whether in South Africa or in any other country—was discussed, with particular emphasis on the viewpoints of the practising engineer and the employers of engineers, by Mr. S. S. Morris, B.Sc. (Eng.), M.I.C.E., M. ASCE, M.I.MUN. E., M.I. (S.A.), C.E., M.T.P.I., F.R.S.H., city engineer of Cape Town in a paper entitled **Keep Pace with Progress**: which he presented to a convention of the South African Institution of Civil Engineers held in Johannesburg this week.

(From: "The Surveyor and Municipal and County Engineer", November 1, 1958.)

7. DESIGN FOR BRIDGE WITH 'SAG IN THE MIDDLE'

● A reinforced concrete bridge 500 ft long will carry the A.1 100 ft over the Wentbridge Valley some 10 miles north of Doncaster. The structure is part of the 1½ mile Wentbridge by-pass. It is described by the county surveyor, Col. S. M. Lovell, as a 'modified portal frame'. The bridge, designed in the county surveyor's department, will have a slight sag in the middle as the road slopes down into the valley and up the other side.

The Wentbridge by-pass bridge will be the highest on the Great North Road in

the West Riding and is believed to be the largest of its type in Europe. The design has been approved by the Royal Fine Art Commission.

Another design produced by the county surveyor's department is for a bridge on the Doncaster motorway by-pass. This will be 680 ft long and 70 ft high, carried on five pairs of vertical pillars.

(From: "The Surveyor and Municipal and County Engineer", November 1, 1958.)

8. TRUCKS HANDLE EMERGENCIES

● A New Service of the highway maintenance division of the department of public works of Cincinnati, Ohio, is an emergency truck service. Such problems



(Continued on page 60)

CURRENT LITERATURE

ABSTRACTS

TESTING OF STEEL—A SERIES OF INDIAN STANDARDS.

THE Indian Standards Institution New Delhi has drafted the following 11 Indian Standard Specifications which are being circulated widely for eliciting comments by 20th March, 1959.

- (i) Indian Standard Specification for Tensile Testing of Steel Wire [Doc: SMDC (118)]. This standard prescribes the method of conducting tensile test on steel wire of constant cross section and mainly characterized by this section, in particular its form and dimensions.
- (ii) Indian Standard Specification for Brinell Hardness Test for Steel [Doc: SMDC 3(119)], which prescribes the method of conducting Brinell hardness test on steel.
- (iii) Indian Standard Specification for Rockwell Hardness Test (B and C scales) for Steel [Doc: SMDC 3(120)]. The standard prescribes the method of conducting Rockwell hardness test (B and C scales) on steel.
- (iv) Indian Standard Specification for Vickers Hardness Test for Steel [Doc: SMDC 3(121)]. The Standard prescribes the method of conducting Vickers hardness test on steel.
- (v) Indian Standard Specification for Tensile Testing of Steel Sheet and Strip less than 3mm and not less than 0.5 mm thick [Doc: SMDC 3(130)], which prescribes the method of conducting tensile test on steel sheet and strip less than 3 mm and not less than 0.5 mm thick.
- (vi) Indian Standard Specification for Simple Bend Testing of Steel Sheet and Strip less than 3 mm

and not less than 0.5 mm thick [Doc: SMDC 3(131)]. The Standard prescribes the method of conducting simple bend test on steel sheet and strip less than 3 mm thick.

- (vii) Indian Standard Specification for Reverse Bend Testing of Steel Sheet and Strip less than 3 mm thick [Doc: SMDC 3 (132)]. The Standard prescribes the method of conducting reverse bend test on steel sheet and strip less than 3mm thick.
- (viii) Indian Standard Specification for Tensile Testing of Steel [Doc: SMDC 3(133)]. The Standard prescribes the method of conducting tensile test on steel products.
- (ix) Indian Standard Specification for Charpy Impact Test (U Notch) for Steel [Doc: SMDC 3 (134)]. The Standard prescribes the method of conducting charpy impact test (U Notch) on steel.
- (x) Indian Standard Specification for Izod Impact Test for Steel [Doc: SMDC 3(135)], which prescribes the method of conducting Izod impact test on steel.
- (xi) Indian Standard Specification for Bend Test for Steel [Doc: SMDC 3 (136)]. The Standard prescribes the method of conducting bend test on steel products.

CODE OF PRACTICE FOR STEEL BRIDGES—AN INDIAN STANDARD

THE Indian Standard Institution New Delhi has prepared a draft Indian Standard Code of Practice for Steel Bridges [Doc: BDC 14 (297)], which is being circulated to all interested parties for eliciting comments by 15th March,

DH/m2, N48



1959. This code of practice is primarily intended to apply to the superstructure of simply supported steel bridges of spans (effective) upto 125 mm (or 400 ft). Where appropriate, the requirements of the code can be adopted for larger spans or other types of steel bridges.

The provisions of this code apply mainly to the design fabrication and erection of new bridges. When the existing railway bridges are checked for permissible loads, or while alterations are being undertaken; the designer may check them according to the I.R.S. Steel Bridge Code. While it is not obligatory for the designer to adopt the stresses or details specified in this code in checking existing railway bridges where the code is adopted, the bridge shall be required to comply with all the provisions of this code.

Most steel bridges in India have been constructed by the Indian Railways and the Steel Bridge Code of the Indian Railways together with Bridge Rules and other publications have governed the design and construction of steel bridges in this country generally. The Roads Wing of the Ministry of Transport and Communications has been following hitherto a Draft Code prepared by the Indian Roads Congress. Except for the requirements for approaches, design of the pavements or decking and such other considerations which distinguish railways from roadways, practices in the design and construction of steel bridges have been to a substantial extent similar. This draft code on Steel Bridges unifies fully the practices followed by the Indian Railways and the Indian Roads Congress and takes into consideration the requirements of other departments such as Defence etc.

PAVEMENT SLIPPERINESS FACTORS AND THEIR MEASUREMENT; Bulletin 186, Highway Research Correlation Service, Highway Research Board of the National Academy of Sciences—National Research Council, 2101 Constitution, Washington, D. C.

THIS bulletin presents information on some promising new methods for measuring the resistance to slipping of rubber tires on pavement surfacing

materials. The results of both field and laboratory tests are reported.

Six of the reports describe how and to what extent the skidding of locked wheels was influenced by different compositions and conditions (wet and dry) of the pavements.

Another paper describes the development of equipment and a method for determining, by means of pretesting, the potential slipperiness of various road surfaces. Still another paper gives results of the tests made to show the polishing characteristics of certain kinds of aggregates commonly used in pavements.

During the time these studies and developments were in progress in the United States much research on this problem of skidding was being done in great Britain and some other European countries. A knowledge of this situation brought about the planning of the First International Skid-Prevention Conference for the Second week in September 1958, at the University of Virginia.

PAVEMENT PERFORMANCE—METHODS FOR EVALUATION; Bulletin No. 187, Highway Research Correlation Service, Highway Research Board of the National Academy of Sciences—National Research Council, 2101 Constitution, Washington, D. C.

THE several papers and discussions published in this bulletin were presented at the 37th Annual Meeting as a Symposium. It was programmed to bring together everything significant that is known about identifying and explaining all kinds of defects and failures in paved highways.

"Types and Causes of Failure," by F. N. Hveem, gives charts outlining classification of failures for bituminous road surfaces and for portland cement concrete pavements. Thirty-six photographs are included as aids in describing various kinds and stages of pavement distress.

The second paper deals with warning signs of distress in airport pavements as

(Continued on page 56)

SELECTED RECENT LITERATURE IN ENGINEERING JOURNALS

X. BRIDGES AND OTHER STRUCTURES

1. Automatic Tunnel Unlocks New Orleans Traffic Maze; SHU-TIEN LI, *Engineering News Record*, Vol. 159, No. 24, December 12, 1957, pp. 60-66.
2. A Very Cheap, Easily Transported and Erected Footbridge for a Difficult Site; GEORGE A. TAYLOR, *Proceedings, The Institution of Civil Engineers*, Vol. 9, Session 1957-58, January 1958, pp. N6-N8.
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(Continued on page 59)

Capital Account of Civil Works outside the Revenue Account

Heads	Actuals 1956-57	Revised Estimate 1957-58	Budget Estimate 1958-59
(In lakhs of Rupees)			
Original works			
Buildings	95.32	229.90	256.87
Communications	30.32	55.77	72.92
Development works under the Nizamsagar etc. Projects and the City Improvement Board	1.24	13.85	17.00
Establishment	5.63	6.44	5.56
Tools and Plant	...	...	5.00
Outlay in connection with the formation of Andhra State	19.62	3.92	0.70
Suspense	0.32	...	...
Add—			
(i) Amount transferred from the Major Head "50, Civil Works" (State's share on National Highway No. 5)	...	5.85	9.70
(ii) Establishment and Tools & Plant charges transferred from '50-Civil Works' on pro rata basis	11.81	9.74	10.58
(iii) Lump for regrant of lapses	...	0.10	0.10
Deduct—Central Assistance for schemes sponsored by the Govt. of India	...	...	-12.70
Total	164.26	325.57	365.73
Revenue from Roads			
Receipts under the Indian Motor Vehicles Act	34.37	37.65	37.65
Receipts under the Madras Motor Vehicles Taxation Acts	163.51	182.52	201.42
Other Receipts	3.97	4.25	4.25
Receipts under the Motor Spirit Tax	68.62	84.79	86.92
Deduct—refunds	-0.89	-0.88	-0.88
Total	269.58	308.33	329.36

ANDHRA STATE GOVERNMENT BUDGET FOR THE YEAR 1958-59

(A brief review with reference to Civil Works)

THE total revenue of the State for the year 1958-59 is estimated at Rs 6,365.88 lakhs against Rs 6,108.14 lakhs (revised estimate) for the year 1957-58. The corresponding figures of revenue expenditure for the years '58-59 and '57-58 are Rs 6,287.34 lakhs and Rs 5,796.24 lakhs respectively, leading to an estimated surplus of Rs 78.54 lakhs in the current year and Rs 311.90 lakhs (revised estimate) for 1957-58.

Revenue expenditure on civil works is estimated at Rs 385.58 lakhs for 1958-59 while the revised estimate for 1957-58 is placed at Rs 328.01 lakhs. In terms of total State revenue it works out to 6.1 per cent for 1958-59 (Budget estimate) and 5.4

per cent for 1957-58 (revised estimate).

There is a provision of Rs 418.39 lakhs (original works and repairs) on communications in the current year from the revenue account and the corresponding figure for the year 1957-58 (revised estimate) is Rs 356.99 lakhs.

The provision for capital expenditure on civil works outside the revenue account amounts to Rs 365.73 lakhs for 1958-59 (Budget estimate) Rs 325.57 lakhs for the year 1957-58 (revised estimate) Rs 72.92 have been earmarked for communications under this account for the year 1958-59 and the corresponding figure for the year 1957-58 (revised) is Rs 55.77 lakhs.

(Continued from page 55)

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LIST OF APPROVED WORKS ON NATIONAL HIGHWAYS

S. No.	Job No.	Name of Work	Amount (Rs in Lakhs)
ANDHRA PRADESH			
1.	1941 AH 5	Forming North approach road to the Regulator-Cum-road bridge across the Krishna river at Vijayawada on National Highway No. 5.	8.10
BOMBAY			
2.	1940 BM 4	Land acquisition for constructing a diversion outside the Chowk village in miles 55 and 56 of the Bombay-Poona road, National Highway No. 4.	0.14
JAMMU & KASHMIR			
3.		Five works each costing less than Rs two lakhs.	4.58
MADRAS			
4.	1935 MD 47	Construction of a bridge in place of the existing dip at mile 320/6 of Salem Cochin Road, National Highway No. 47.	0.91
ORISSA			
5.	1939 RS 43	Improvement of the portion of National Highway No. 43, Boriguma and Madhya Pradesh border.	5.47

(Continued from page 50)

as potholes in streets, demolitions, defective curbs, fallen trees, clogged street inlets, barricading red lights and so on are now handled in a matter of minutes.

The service consists of two specially designed trucks, like the one above, carrying a supply of paving materials, rope, chain, lanterns, shovels, mattocks, axes, picks, and so on. The drivers are skilled employees with wide experience in street maintenance.

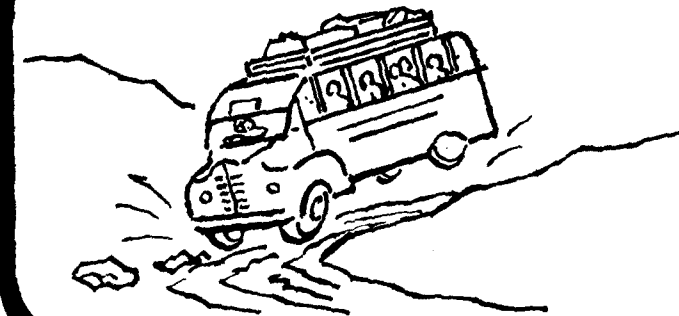
Emergency calls are now channelled to the highway maintenance radio dispatcher by employees, firemen, police and

city-hall telephone operators and relayed by two-way radio to the trucks. The service is in operation from 6 a.m. to 10 p.m. When motor-vehicle and pedestrian traffic are lightest the night-street-cleaning force takes over, giving 24-hour coverage.

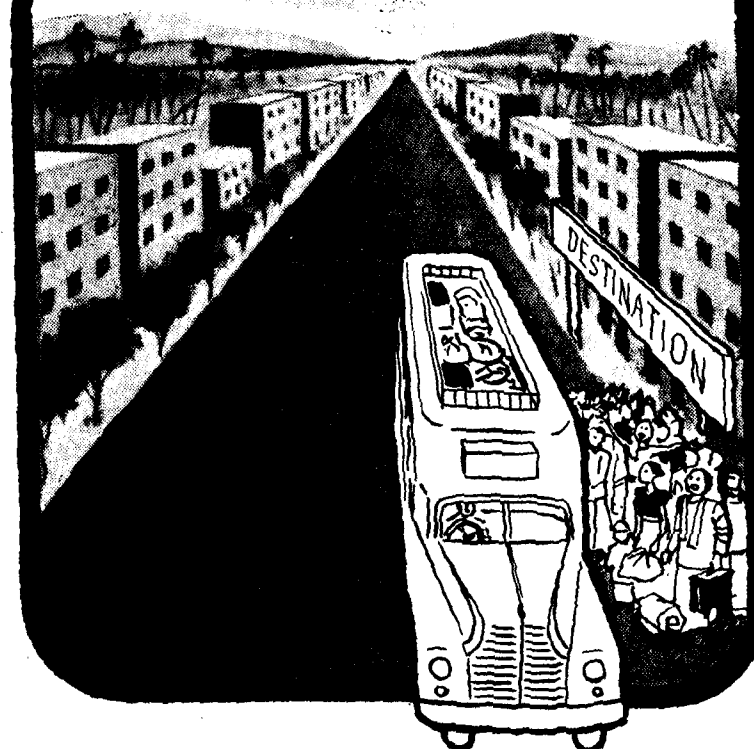
The emergency service as a rule that is followed at all times: any hazard on streets, bridges, viaducts and walkways must be taken care of at once, or protected by barricades and red lights until the hazard can be removed.

(From: "Better Roads", November, 1958.)

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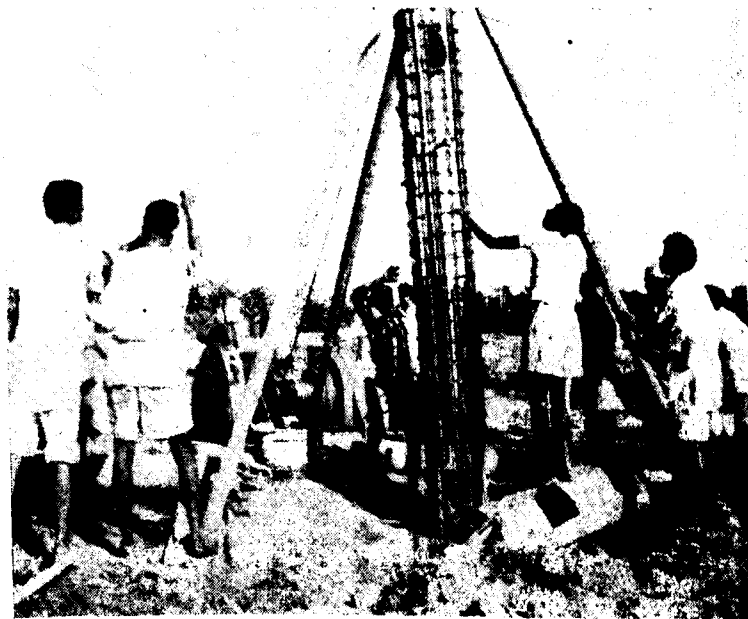
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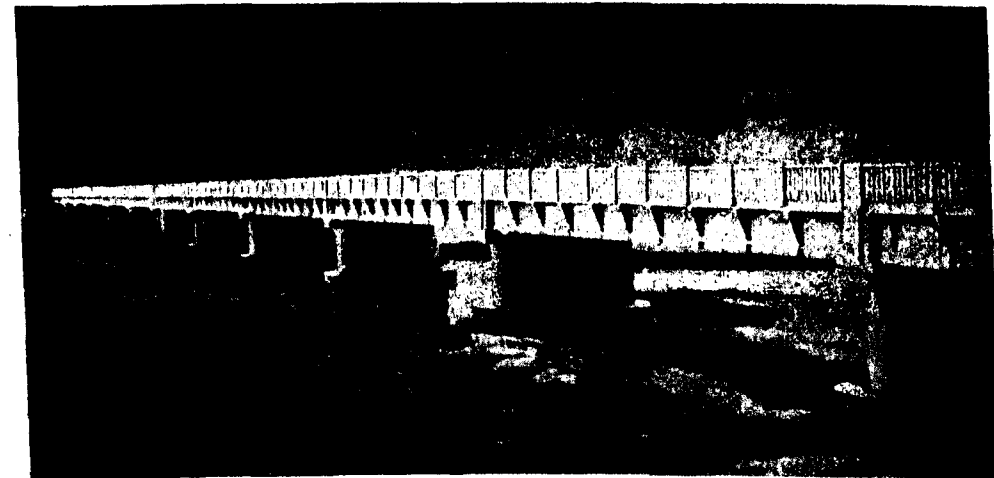
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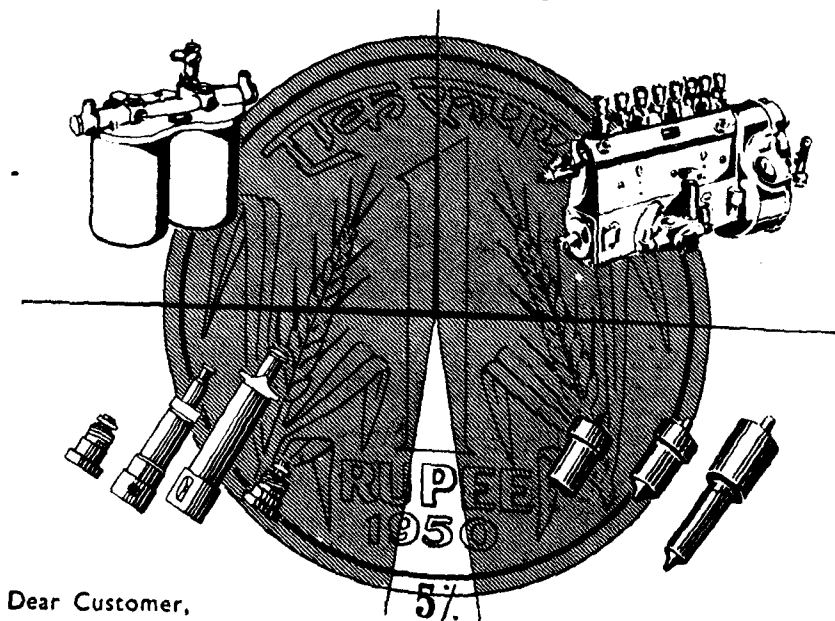
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