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TRANSPORT- COMMUNICATIONS

MONTHLY REVIEW

AUGUST 1955—No. 100

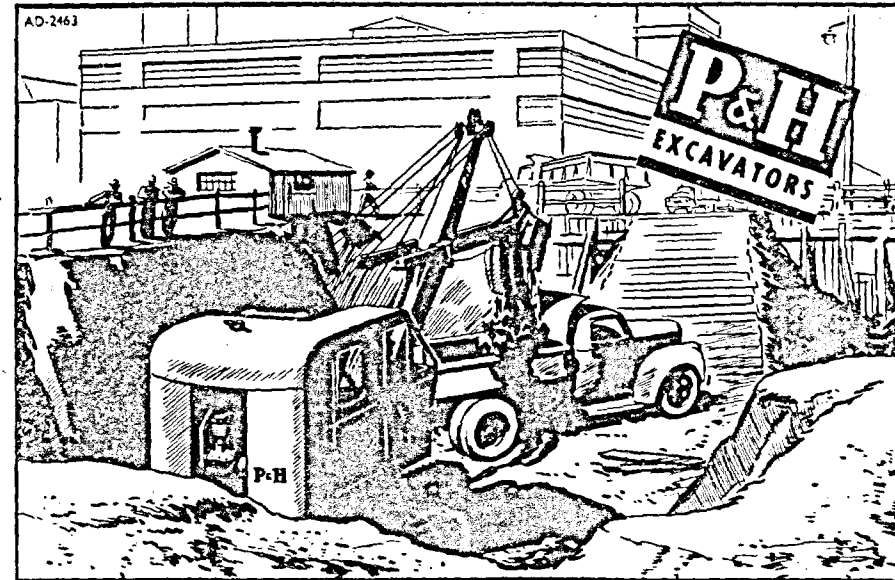
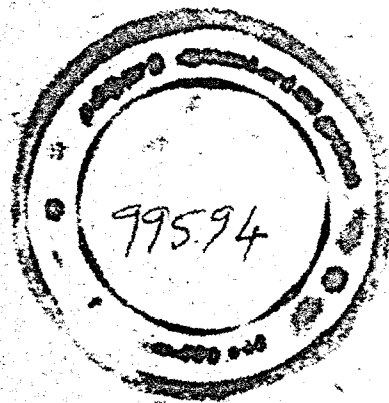
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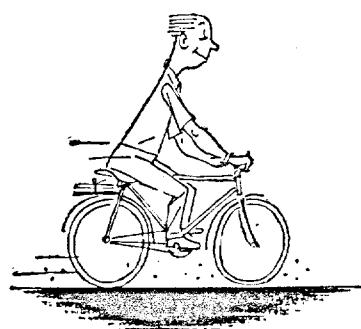
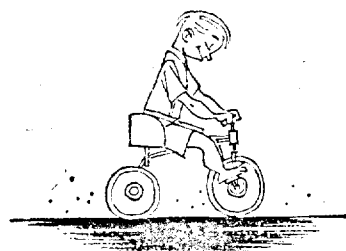
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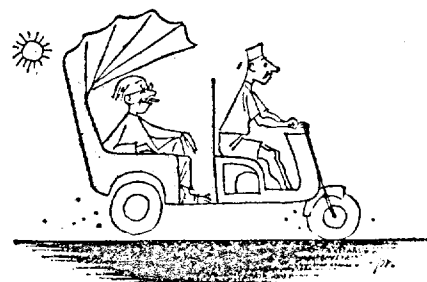
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AUGUST 1955—No. 100

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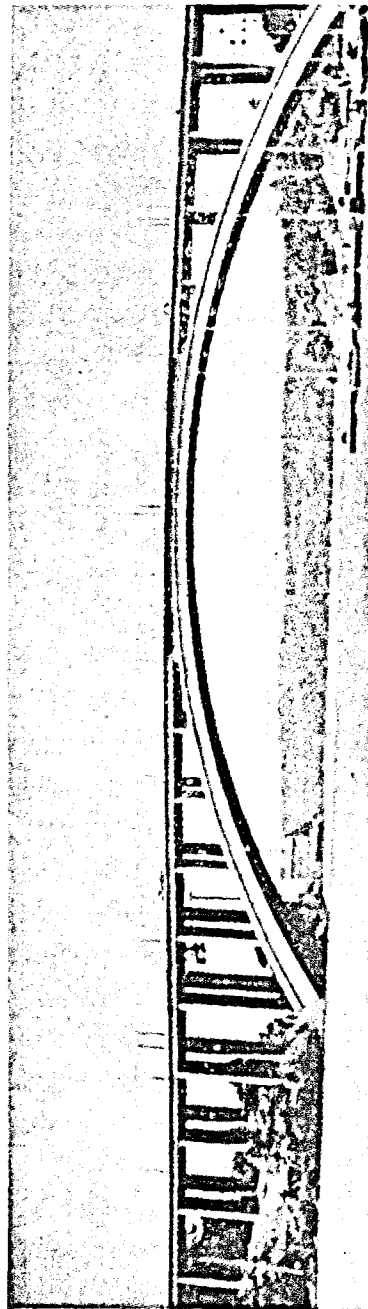
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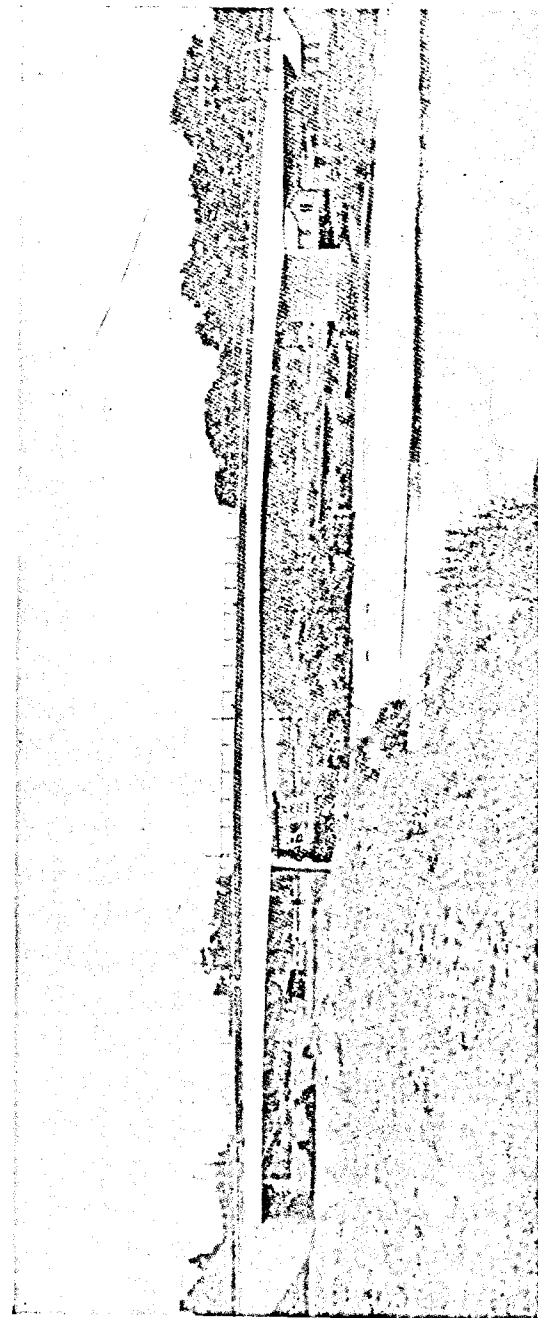
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Traneberg Bridge, Stockholm, Sweden. The roadway is carried on two rectangular box section arch ribs. Span 181 meters (594 feet).



Ring Canal Bridge at Ghent, Belgium. The thin diaphragm piers are hinged at bottom. All expansion is at one abutment, the other being fixed.

From "Main Roads", June 1955.

TRANSPORT-COMMUNICATIONS MONTHLY REVIEW

A REVIEW OF
ROAD ENGINEERING, DEVELOPMENT & TRANSPORT

AUGUST 1955

ROADS IN ASSAM

(Contributed)

ASSAM, the north-east border State of India, has an area of 50,200 square miles, of which 23,200 square miles are plains and 27,000 square miles hills. According to the census of 1951 the total population is 89,75,000, of whom 78,02,000 live in the plains and 11,73,000 in the hills. The hill areas of Assam are divided into five autonomous districts under the Sixth Schedule of the Constitution, four of which form a continuous belt from east to west and one district stretches towards the south. The plain area is divided into seven districts, six of which lie north of the hill belt and one isolated district lies south of the belt.

The State had only 2586.4 miles of motorable roads before independence. Of this, 2016.4 miles were in the plains and 570 miles in the hills. From 1947 to 1952 the mileage of motorable roads constructed was 1286.8 and in 1953 the mileage under construction was 1583. By the end of the year 1953, there were 6456.2 miles of motorable State roads of the following classes, inclusive of 803.9 miles of National Highways.

Black topped	968.5 miles
Water-bound	67.7 "
Gravelled	2097.6 "
Earth	2322.4 "

Of these, 4221.3 miles fell in the plains and 1234.9 miles in the hills. Besides

motorable roads, there were 1827.7 miles of bridle paths in the hills maintained by the State.

After 1953, till March 1955, construction of about 850 miles of roads have been taken up in the plains and 150 miles in the hills. Assam then will have 6456.2 miles of motorable roads on completion of the works in hand, of which 5071.3 miles will be in the plains and 1384.9 miles in the hills.

As per grid and star formula evolved at Nagpur Conference of the Chief Engineers in 1943, the target for Assam is 13,200 miles including National Highways. So, Assam still falls short of 6743.8 miles or roughly by half the target fixed.

NATIONAL HIGHWAYS

Length of National Highways maintained by the Assam P. W. D. is 899.8 miles. Of this, 803.9 miles are in Assam and 95.9 miles in Manipur State. 770.5 miles are black topped, 5.1 miles water-bound and 124.2 miles gravelled.

The amounts spent for improvements of National Highways during the last four financial years were :

1951-52	9.98 lakhs
1952-53	19.12 "
1953-54	19.74 "
1954-55	15.86 "

In addition the Government of India have approved projects costing about Rs 128 lakhs, of which projects costing Rs 54 lakhs have been sanctioned during 1954-55. In addition, a major bridge over Kullong river at Nowgong Town costing Rs 10 lakhs is in progress and is expected to be completed next winter.

The annual maintenance charges of National Highways for the last four years has been :

1951-52	Rs 33.50 lakhs
1952-53	Rs 31.99 „
1953-54	Rs 32.90 „
1954-55	Rs 38.00 „

There had been heavy flood damages last year and about Rs 15 lakhs had to be spent for flood damage works in addition to the normal annual repairs.

FIVE-YEAR PLAN FOR ROADS OTHER THAN NATIONAL HIGHWAYS

Originally construction of 736 miles of roads and 4,000 rft of major bridging has been taken up at an estimated cost of Rs 265 lakhs. The original plan has been revised and an additional road programme for 637 miles of roads at an estimated cost of Rs 158 lakhs has been included. The expenditure target reached so far is :

1951-52	Rs 2,41,000
1952-53	Rs 15,87,000
1953-54	Rs 55,82,000
1954-55	Rs 77,47,000 (approx.)
	<u>Rs 151,57,000</u>

Out of the balance of Rs 271.43 lakhs of which Rs 130.58 lakhs is proposed to be spent during 1955-56 and the rest, i.e., Rs 140.85 lakhs will be carried over to the Second Five-Year Plan.

In addition, 475 miles of hill roads at an estimated cost of Rs 256 lakhs under Article 275 of the Constitution had been taken up under the First Five-Year Plan. This plan has since been revised and an additional length of 152 miles of hill roads, at an estimated cost of Rs 86 lakhs, has been included in the Plan. Total work

taken up in autonomous districts under Article 275 is 627 miles of road at an estimated cost of Rs 342 lakhs.

The expenditure target reached so far is :

1951-52	Rs 9 lakhs
1952-53	Rs 16 „
1953-54	Rs 28 „
1954-55	Rs 50 „

Total Rs 103 lakhs

It is expected that Rs 110 lakhs will be spent during the current year. The balance of Rs 129 lakhs is proposed to be carried over to the Second Five-Year Plan.

Apart from these roads, a length of 82 miles has been taken up under Article 275 in the Tribal areas in the plains (not included in the Autonomous Districts) at an estimated cost of Rs 26.8 lakhs. Major portions of these works are likely to be completed within the First Five-Year Plan.

IMPORTANT WORKS OUTSIDE FIVE-YEAR PLAN

82 miles of hill roads, connecting Jowai with Badarpur, are nearing completion. This road, when completed, will connect the isolated plain district of Cachar, as also Tripura State, with the other plain districts of Assam through the hill belt via Shillong. The road has already been made jeepable. The estimated cost of this road is Rs 110 lakhs (approx.) and amount spent so far is Rs 56 lakhs. The project is financed out of Central Road Fund Special Reserve.

Immediately after partition, construction of a road from Shillong to Silchar via Jowai-Garampani and Haflong was started in 1947. The road was 210 miles in length, of which 165 miles were entirely new construction through sparsely populated and difficult hilly terrain, covered with dense tropical forests and infested with wild animals and pests. A kutcha road was cut within 18 months under trying circumstances and made fit for jeeps but the idea of connecting Silchar via Haflong was subsequently modified resulting in the construction of Jowai-Badarpur Road, retaining first 48 miles

(Continued on page 8)

EDITORIAL COMMENTS ON THE 19TH SESSION OF THE INDIAN ROADS CONGRESS, SRINAGAR

The Times of India, 21-6-1955

Missing Links

"SINCE the proposals for the development of roads under the Second Five-Year Plan are under discussion, there is a special timeliness about the deliberations of the nineteenth session of the Indian Roads Congress..... Whether it is the network of national highways or the approach roads to the villages, the missing links are many and serious enough to throttle if not block the nation's economic arteries. This is not to minimise the vital role of the railways in the system of communications. But with the increased traffic during the years of the Second Plan, more and better roads must provide an increasingly complementary rather than competitive service. The absence of an integrated approach to this problem and the slow progress made so far do not suggest that road development is getting the attention it badly deserves. The comparative neglect of road development and the delays inherent in making various and independent authorities responsible for their construction and maintenance can be removed effectively if the State Governments agree to set up a high power roads authority vested with the necessary powers. It may then also be possible to set aside a proportion of the proceeds from the taxes on vehicles for road development. This is no new demand. But it has now received the fresh and forceful support of the Taxation Enquiry Commission. Government must give it earnest thought if its proposals for road development under the second plan are not to go the half-hearted way of those under the first plan."

The Tribune, 22-6-1955

"The supreme importance of a network of roads connecting all parts of the country has not hitherto been sufficiently realized. Though in the last few decades

some progress has been made in the matter of road construction, India still seriously lags behind other countries in respect of roads. If our economy is to be organized on the basis of decentralization, road development has to assume greater importance. The remarkable pace at which Japan was industrialized was due to two factors—cheap hydro-electric power and a network of roads which linked every Japanese village with the industrial centres and markets.... The progress of road development in this country will depend to a considerable extent upon the ability of the States to raise funds for this purpose. The burden of development will have to be partly shared between the road users and the general community. The problem of financing road development is admittedly very complicated and difficult.

"The Motor Vehicle Taxation Enquiry Committee thoroughly investigated this problem and made a number of recommendations on this subject. The Taxation Enquiry Commission has also made a useful contribution on the problem of road development finance. The suggestion for the creation of Road Funds in every State in addition to the Central Road Fund is thoroughly sound. The Taxation Enquiry Commission has approved the principle of earmarking revenues for road development. It is particularly important that funds should be earmarked for the expansion of rural communications. We do not think that there will be much opposition to the proposal of levying a cess of one anna per rupee of land revenue if substantial funds are earmarked by the Central and State Governments for the development of rural roads. The financial hardships involved in the expansion of rural communications can be partially overcome if our public authorities and social workers can enlist voluntary labour and the co-operation of the public in the construction of new roads. The building of rural roads should be assigned the

highest priority in the plans of rural reconstruction. Without these roads it will not be possible to provide proper marketing facilities for the cultivators or to encourage village industries or to make technical and other facilities available in the countryside. In considering the problem of road finance the essential point which should be borne in mind is that the community cannot have more and better roads without paying for them.

"Road development is a responsibility of the Government, the local bodies, social workers and the road engineers alike. The engineer, as the technical expert, has to ensure that efficiency and economy are fully achieved."

Indian Express, 20-6-1955

More and Better Roads

"In his presidential address to the Indian Roads Congress, Mr. H. P. Mathrani has expounded the problems of road development in India with the approach of an expert but in terms intelligible to everybody. For nearly three decades, it has been accepted that the key to progress in backward countries lies in the development of transport..... In India today delay in transport development may well hold up the plan or deprive the nation of a large part of its benefits. As Mr. Nehru has pointed out in his message to the Roads Congress, "there is grave danger that while we produce goods we cannot transport them easily"..... The Nagpur plan is approaching fulfilment except in the matter of bridges, which, we are told, will have to wait for the third Plan. It is interesting, however, to note that there has been no lack of courage in tackling the problems of completing the national highways scheme.....

"Powers to prevent the ribbon development which mars their good work are being sought by the authorities and it may be hoped that before long the aesthetic value of our highways will be fully equal to their economic value."

The Hindu, 21-6-1955

"The Roads Congress performs a useful function in reviewing the progress made in India as a whole in road construction.

The Nagpur plan of 1943 set the targets for ten years and much has been done to fulfil the plan, though as Mr. Mathrani, the President of the Congress, showed bridge building over India's rivers presents very difficult problems..... A great deal remains to be done in linking up the interior villages. This can be done to some extent through the community project schemes but the making of rough earth roads will not mean lasting improvement..... Most of the existing village roads are fair weather roads which when the monsoon arrives are turned into mud, slush, pools of dirty water and become unusable. Moreover, there are few culverts and each nallah becomes an impassable obstacle in the rainy season. In the absence of reliable communications there is no incentive for farmers to grow vegetables, fruit or dairy produce which are perishable. He is cut off from the outside world and his life is consequently impoverished. Since earth roads are not permanent and macadam roads are worn through by the wheels of bullock carts, it has been suggested that concrete trackways be laid over earth roads. This has proved very useful in some parts of the country. Road-making is, however, a very expensive process and it is rendered still more so by the contract system. One method of lowering costs may be for the State to maintain permanent road making labour teams composed of skilled workers supervised by Government engineers. Much has also to be done in studying various types of soil. Here the Road Research Institute at Delhi has already made a beginning. It is expected that the targets set by the Nagpur Plan will be fulfilled by the end of the Second Five-Year Plan. But it is now clear that the country cannot stop there. If every village with a population of 500 is to be adequately linked with its neighbours another plan as far-reaching as the Nagpur Plan will become necessary."

National Herald, 22-6-1955

"Roads have been described as the lifelines of civilisation and in any system of planning, development of roads and other communications is essential. India is a country of vast distances but her road mileage is one of the lowest in the world...

In the matter of village roads we are still farther behind and a large part of rural India remains to be opened up... The task waiting to be accomplished, therefore, is immense and if, as the Union Deputy Minister for Transport and Railways, Mr. Alagesan, has stressed, no village in the country is to be left without a road at the end of the Second Five-Year Plan, there will have to be mobilization of voluntary labour on a large scale, besides what Governmental effort can do. And roads built by Shramdan cannot survive unless the Public Works Department or the district board accept responsibility for their maintenance. The Prime Minister in his message to the Srinagar session of the Indian Roads Congress has stressed the importance of developing communications in the hill areas which have so far been badly neglected. Road building in the hills is beset with difficulties, but these difficulties are not bigger than those which the Chinese had to overcome in building the great highways linking Tibet with Sikiang and Tsinghai.

"It has been said, and rightly, that the development of highways is linked with the development of the automobile industry and the manufacture and processing of fuels within the country. India's automobile industry is still in its infancy and her own oil production being small compared to her consumption, the new oil refineries cannot bring down fuel prices to levels obtaining in countries like the United States. But as the tempo of industrial development increases under the Second Five-Year Plan, road transport is bound to increase rapidly, and that underlines the need for more and better roads."

Amrit Bazar Patrika, 21-6-1955

"The British, for reasons of their own, neglected the development of roads and concentrated their attention on the construction of railways, mainly for strategic reasons. It was of little concern to them that the railway system could not be extended to all corners of the country. As a matter of fact, even at this distance of time the railways are hardly able to carry the requisite number of passengers and goods. Even our Government was long under the impression that the road transport of goods would compete with the railways. The

Motor Vehicles Act was passed in 1940 in order to protect the railways from unhealthy competition from road transport. The railways, however, are no longer in need of that protection. Road transport will perform a complementary job and at the same time very greatly facilitate internal trade. Far more trucks than are in service now would be required to carry goods. This will be one of the greatest factors contributing to the economic development of the country..... It has to be noted with regret that road transport, particularly goods transport, has been making little progress. Far from expanding, it is rather contracting..... One great hurdle is in regard to bridges, many more of which will have to be built if road transport has to be effective. The problem, therefore, is essentially one of finance. But it has to be tackled by all means..... The State Governments will have to be alive to the important role they are to play in this regard. They have to take immediate steps for provincializing District Board roads and draw up a comprehensive road development plan, particularly for the rural areas. Rural communications must get a larger share of the Government attention and resources, so that at the end of the second Plan period no village is found without a road."

The Leader, 24-6-1955

"The network of roads which can be used throughout the year to carry food-grains and other industrial raw materials from the villages to the consuming centres and manufactured goods from factories to markets is essential for the proper development of India's agriculture and industry as well as to the security of India. In spite of definite progress under the first Five-Year Plan, India has only a little more than 2½ lakh miles of roads, of which a very small proportion is of roads classified as National Highways and State Roads. According to the estimate of the Planning Commission, the National Highways are expected to increase from 11,900 miles in 1950-51 to 12,500 miles in 1955-56, while over this period the State Roads are expected to increase from 17,600 miles to 20,000 miles. This length of National Highways and State Roads is absolutely inadequate for our country.

"An equally important problem is the construction and maintenance of feeder and village roads which have not received due attention. In the case of national highways and State roads the main difficulty is the shortage of building material but in the case of village and feeder roads the main difficulty is the inadequate finances at the disposal of municipalities, district boards and the panchayats which are expected to keep these roads in good condition. The finances of these local bodies should be adequately augmented by grants from the State Governments to enable them to maintain and construct roads in areas under their charge.

"In his address Mr. H. P. Mathrani, President of the Indian Roads Congress, pointed out that the increase in the mileage of roads by itself would not suffice to solve the problem. The main deficiency in India is the lack of bridges especially across major rivers. Thousands of culverts and small bridges and scores of very big bridges varying in length from 500 ft to 7,000 ft have to be constructed to give

the country an all-weather road system. It is estimated that it will be necessary to construct some 200 big and small bridges on roads at a cost of Rs 22 crores in order to make them available in all kinds of weather. In the first Five-Year Plan it was proposed to construct 75 bridges but unfortunately progress has been slow and only 25 major bridges costing nearly Rs 3 crores have so far been constructed and work is in progress on 10 other bridges which will cost about Rs 1 crore. Mr. Mathrani told the Congress that 'considering the difficulties that we have met, this is not a small achievement.' It is to be hoped that every possible effort will be made to speed up the work of constructing bridges and to reduce the costs of construction which at present are high compared to the costs of similar construction in other countries. A proud achievement of the road engineers in India will be the construction of the mile and a half long Bannihal Tunnel through the Pir Panjal range at an altitude of 7,300 feet. It will be one of the longest road tunnels in the world costing nearly Rs 3 crores.

(Continued from page 4)

of Shillong-Silchar road. The amount spent was about Rs 129 lakhs, 2/3rds of which was borne by the Government of India. The road is, however, maintained as a cold weather road and is likely to be improved to all-weather standard during the Second Five-Year Plan.

The following expenditure was incurred during the last five years for the maintenance of the State Roads:

1950-51	Rs 52,09,100
1951-52	Rs 64,13,963
1952-53	Rs 79,55,785
1953-54	Rs 91,44,380
1954-55	Rs 112,87,401 (approx.)

Floods are a regular feature, particularly after the great earthquake of 1950 when topographical changes have taken place in the upper reaches of the Brahma-

putra Basin. Last year, flood damage repairs estimates amounted to Rs 49 lakhs.

FERRIES

In Assam there are 105 boat ferries, of which 10 are major and power driven, 15 minor and power driven, 4 major hand driven, and 76 minor hand driven. These ferries are expected to yield a revenue of Rs 4,57,214 in the year 1955-56.

Besides, there are three steam ferries over the river Brahmaputra which will fetch Rs 14,500 as revenue this year.

SECOND FIVE-YEAR PLAN

The provision proposed to be made in the Second Five-Year Plan for development of State roads is likely to be of the order of Rs 1,500 lakhs.

TRANSPORT IN U. P. HILLS

ROADS and Railways are the veins and arteries of a country through which the life-blood of its economic activity circulates. They create place utilities by joining the centres of production with the centres of consumption and promote division of labour as between regions of countries. The National Planning Committee Report, 1939-40, says, "Transport is an important ingredient or adjunct in the growth and ramifications of modern commerce, both internal and foreign, and through that of the entire economic organisation and activity today."

Systems of Transport in the Hills:—In the primitive stage man carried his own burden on his own broad shoulders but gradually his ingenuity and intelligence wrought a complete metamorphosis and transformation in the domain of transport, so that he is a superman today with complete mastery over the seas, air and land. But in the hills even at this stage of civilisation man's burden has not been much lightened and the hill-man himself carries on his burden on a very large scale.

Railway lines touch the district of Garhwal at Kotdwara and of Naini Tal at Haldwani, Kathgodam and Ramnagar, which are great trade and transport centres for the export of hill produce and import of food-grains, cloth and other consumer goods from the plains.

There is a system of arterial roads connecting Kumaon with the plains. These roads are metalled and motorable. One of the trunk roads leads from Rishikesh to Narendranagar, Tehri and Dharasu on way to Gangotri and another from Rishikesh to Srinagar via Deo Prayag and Kirtinagar on way to Badrinath in Tehri-Garhwal District. In the district of Pauri Garhwal there is one arterial road leading from Kotdwara to Pipalkoti on way to Badrinath with bifurcation from Dogadda to Lansdowne. In the districts of Almora and Naini Tal one road leads from Haldwani to Almora via

Ranikhet with a bifurcation at Jeonkote for Naini Tal and another trunk road from Tanakpur to Pithoragarh on way to Lipulekh Pass to Tibet. There are some other minor motorable roads. All these roads have zigzag steep curves forming 'Ws' and 'Zs' as we move.

Road Milage

Road construction in the hills is an arduous task and involves considerable cutting of mountain side and rocks and is a very laborious and expensive process. The road milage throughout the region is 335 miles of metalled and motorable and 436 miles of motorable but not metalled roads thus giving a total of 771 miles of motorable roads in a territory of 18,252 sq. miles. The road milage per square mile is thus only .04 whereas it is .3 for U.P.

Wheeled traffic is to be seen only along these trunk roads and in the higher regions there is a complete blackout of automobile traffic which has yet to penetrate these parts with its discordant note. In these northernmost parganas there are no roads but tracks and trails of the roughest kind with the most dangerous and precipitous ascents and descents. Sometimes a man has to crawl to ascend the steep hill and pass the treacherous screes. Here transport is carried on by sheep and goats, horses and jebus. The jebu is a cross breed of the yak and a hill cow. They ascend these perilous paths in such nimble fashion that they may well be called the ship of the Higher Himalayas. The sheep and goats with a load of about two seers each in hundreds of numbers are the goods trains of these highest regions. The Bhotiyas, Marchas and Folchas inhabiting these parts are matchless in fortitude, endurance, courage and nimbleness of feet and body. They are the toilers of snow, the conquerors of the heights. There are several passes, all above 16,750 feet in height, leading from the Bhotiya zone to Western Tibet. But these conquerors of heights and hazards with their goods train and ships have

conquered them to carry on barter trade with Tibet which is their principal means of sustenance.

Problem in Hills

The Governments have realised the strategic position of the hill districts and are extending the arterial roads on to Tibet. They are also developing and extending the pilgrim routes to Gangotri, Badrinath and Kailash Mansarovar. But these highways are just like railway trunk lines laid by the British to join the country to the ports for the export of raw materials to feed British Industries. So these roads carry the raw materials and forest produce of the hills to the plains but have not helped in developing the hills internally.

There is need to have transverse roads and transport should become an auxiliary agency for the development of trade and industry. Today a person from Almora has to go through Bareilly, Moradabad and Kotdwara to go to any place in Garhwal district though both the districts are adjoining. A sound road policy demands that besides the arterial roads there should be transverse feeder roads joining them at several angles and places collecting the exports and distributing the imports.

High Fares

Another problem of transport in the hills is the monopolistic nature of the service rendered. This has resulted in high and increasing motor-fares. There are two principles on which transport rates are fixed viz., the cost of service to the carriers and the value of service to the consumers. The cost of service to the carriers is the lower limit below which rates cannot be fixed, though there is always scope for economies in the cost of service by the carriers. The value of service rendered to the consumers is the maximum limit beyond which the rates should not move, i.e., the rates should be such that the traffic would be able to bear them.

A wise transport authority makes a wise choice between these two limits by fixing

discriminating rates, i.e. by discriminating between localities, between commodities and between persons and thus distributing the burden according to the strength of the shoulders that bear it. Due to their monopolistic nature these transport agencies, irrespective of the principle involved, are pursuing a policy of increasing the rates little realising that the hillman has little purchasing power and that throughout the year it is not the question of making hay in the sunshine of tourist traffic or official exodus or even at that it would have a discouraging effect on them.

It is for the Government to provide the benefits of cheap transport for its people. But transport by itself is purposeless if it does not feed industries, trade and commerce and does not get itself fed by them. The automobile transport has so far only made inroads in the economy of the hillman. The people of Garhwal used to earn Rs 20 to 40 lakhs a year from the pilgrims to the famous shrines of Badri and Kedar by working as porters, carriers, roadside shopkeepers, coolies, etc. The motor transport has ousted them lock, stock and barrel and the money has fattened the pockets of a few persons and foreign manufacturers. Thus considered the automobile transport becomes a curse causing unemployment on a gigantic scale.

That the key to the economic ills of the U. P. hills lies in the development of a sound system of transport goes without saying. But the transport policy should be well planned bringing in it wake an all-round industrial and commercial development otherwise the new lines of transport may bring in misery, discontent and unemployment. Government can ill-afford a hotch potch policy in this matter as the seeds of discontent are already being scattered by a swift-moving hill breeze, and Kumaon is now borderland with Tibet.

(By Dr. Shankarlal Shah, M.A., Ph. D.,
From 'The Pioneer,' May 29, 1955)

TESTING THE STRENGTH OF CONCRETE BY THE ULTRASONIC-PULSE METHOD

THIS article describes the use of the Ultrasonic-pulse method to assess the strength of precast units to form sections of primary and secondary beams which were to be assembled and prestressed on the site to form the beams in a new school building. The tests were undertaken at the request of the Ministry of Education and with the co-operation of Messrs. Gilbert-Ash, Ltd., the Prestressed Concrete Co., Ltd., and the Mono Concrete Co.,

the velocity of an ultrasonic pulse in the concrete and to infer the corresponding compressive strength from ancillary data relating to the compressive strengths and pulse velocities of cubes made of concrete of the same ingredients and composition. These data are obtained by testing cubes at different ages. Fig. 1 shows this relationship for the concrete used in making the units which were the subject of the tests described.

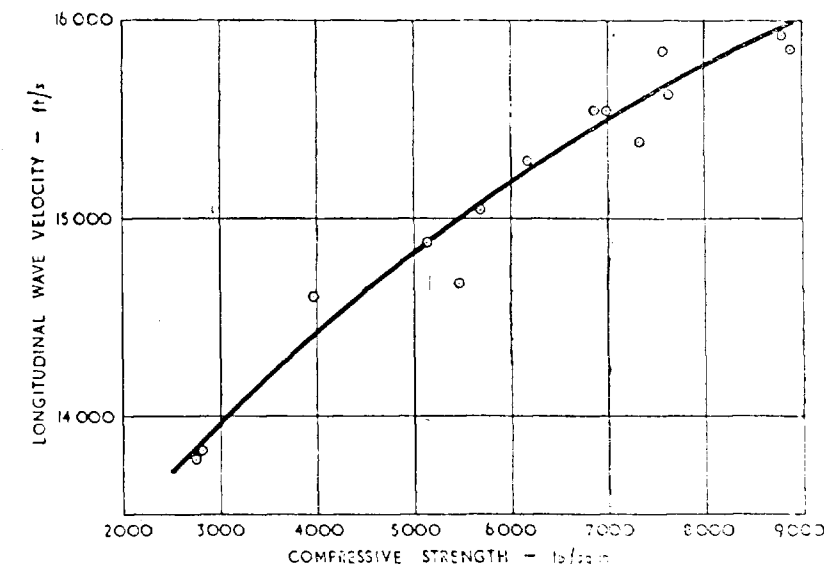


Fig. 1. Relation between longitudinal wave velocity and compressive strength.

Ltd. The testing was done at the works where the units were made, and 10 per cent of the total number produced were tested. By this means a stricter control of quality was achieved than would have been possible by usual methods of testing.

The Ultrasonic-pulse Method

For any concrete there is a simple relationship between the velocity of an ultrasonic pulse in the concrete and its compressive strength ⁽¹⁾, ⁽²⁾. Therefore, if it is required to know the compressive strength, the procedure is to determine

By testing cubes at different ages and made from different batches of concrete, allowance is automatically made for slight variations in proportions which may occur from day to day. If, however, the average proportions of the mixtures are changed, or another type of aggregate is used, a further series of test cubes would be required ⁽¹⁾, ⁽²⁾.

Method of Testing

The testing apparatus is fully described elsewhere ⁽³⁾. The velocity of the ultrasonic pulse, that is the longitudinal

wave velocity, is calculated from the time taken for the leading edge of the pulse to traverse a known length of concrete. The pulse is sent out 50 times per second from a piezo electric-crystal transducer held in contact with one face of the concrete. After passing through the concrete, the pulse is received by a second crystal transducer which converts the mechanical pulse into a corresponding electrical signal. This is amplified and produces a visual image of the pulse on the trace of a cathode-ray tube. The image passes across the screen in synchronism with the transmitted pulse. Timing marks also appear on the trace at intervals of ten microseconds. The time of propagation of the pulse is measured by the displacement of the pulse when the transducers are respectively (1) in contact with each other and (2) separated by the concrete. An interpolation device enables the time to be measured to ± 0.1 microsecond, and reading is facilitated by expanding the part of the time-scale in which the signal lies. The thickness of the concrete at each measuring position is determined with the aid of calipers.

The units were 3 ft 3 in. long and $7\frac{1}{8}$ in. wide across the bottom flange. The concrete in the bottom flange required

mission. A standard procedure of test was therefore adopted, consisting of taking three measurements directly across the $7\frac{1}{8}$ in. dimension (one measurement near each end and one at the middle).

Initially it was desired that every unit be tested, but as a result of extensive preliminary measurements it was found that sampling methods could be employed. The decision to test 10 per cent of all the units produced proved satisfactory both from a practical and from an experimental point of view.

In order to keep handling costs low the testing apparatus had to be as near as possible to the stacking area, and the instrument was therefore housed in a small weatherproof building close to the casting shop. Access was by double doors on opposite sides of the building, which enabled a roller conveyor carrying the units to pass through. The apparatus was operated by the staff of the Mono Concrete Co., Ltd., and Messrs. Gilbert-Ash, Ltd., and the testing was fitted into normal factory routine.

One unit from each batch was set aside when it was removed from the mould and placed close to the testing machine. As the units attained the necessary age they

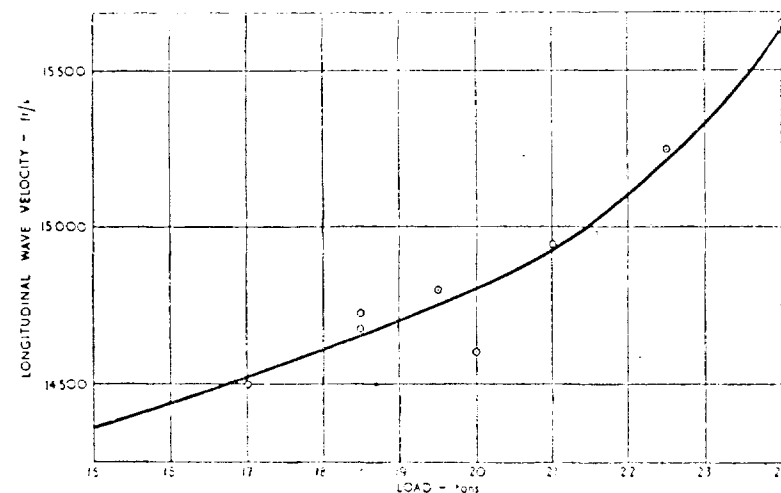


Fig. 2. Results of Compressive Tests.

the most careful examination since this part sustains the highest initial stresses. Analysis of a large number of measurements showed that the mean result from three standard positions was within ± 1 per cent of the true mean time of trans-

were prepared for testing in batches of about a dozen. Preparation consisted of numbering the units for record purposes, cleaning, and applying soap-jelly to the surface in the positions at which the transducers were to be applied. Particles of

grit and air bubbles, if allowed to come between the transducers and the concrete, tend to cause distortion of the cathode-ray trace; carborundum stone and a clean rag ensure the necessary smooth surface. The soap-jelly provides a coupling between the transducer and the concrete; this was as effective as the oil normally used and did not stain the concrete.

Before each day's testing a measurement was made on an aluminium proving-block through which the time of transmission of the ultrasonic pulse was accurately known. This enabled the operator to ensure that the apparatus was working satisfactorily. An assistant holds the transducers in firm contact with the concrete while the operator observes the cathode-ray trace and records the reading. The rate of progress was governed more by the time required for handling and preparing the units than by the time taken in actual testing. The average rate was about twenty units per hour.

The specification required the cube strength of the concrete to be at least 6500 lb per square inch at 28 days. The first measurements of pulse velocity showed that some of the units would have a somewhat lower equivalent cube strength at this age. The units were designed for a total load of 18 tons on the flange, including the factor of safety. Compression tests showed that units failing under this load would have strengths corresponding to a pulse velocity in the flange of 14,600 ft per second (Fig. 2). To provide a

slight additional margin, 14,800 ft per second, corresponding to an equivalent cube strength of 5000 lb per square inch, was chosen as the acceptance figure.

Test Results

The first 200 units tested were cast and cured between July and December, 1953, when the weather was relatively mild. Subsequent units were cast and cured in January, 1954, when severe frosts occurred. The apparatus was not available until late in November, 1953, so that some of the first 200 units were considerably over-age at the time of test. The results from these units were adjusted to relate to an age of 28 days by using additional data obtained from ageing tests on cubes.

The distribution of the longitudinal wave velocities in the units tested before 1st January, 1954, is given in Fig. 3. The results are on a normal distribution curve except for ten units which gave abnormally low values between 14,500 and 14,700 ft per second. These were all cast, although not necessarily tested, on the same day. For the normal part of the distribution the mean value of the equivalent cube strength was 6300 lb per square inch and the standard deviation ± 500 lb per square inch. Analysis of results obtained on cubes during the same period gave a mean strength of 7750 lb per square inch and a standard deviation of ± 750 lb per square inch. As expected, the strength of the concrete in the flange of the unit was slightly inferior to that in

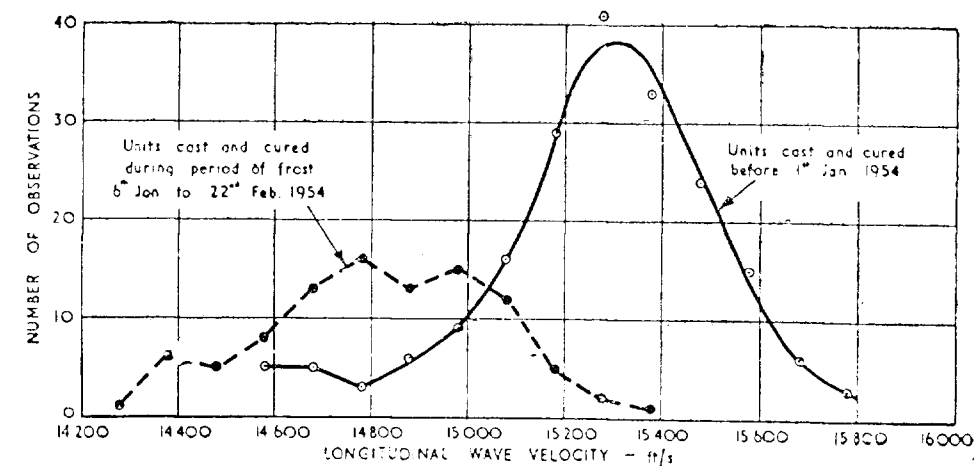


Fig. 3. Distribution Curve of mean results.

the corresponding test cube, but generally much higher than the acceptance strength. The variability, however, was similar and it is concluded that the main fluctuations in strength were due to variations between the different batches of concrete.

Results obtained from a further 87 units cast and cured during the intermittent frosts of January and February, 1954, are also given in Fig. 4. The strength of this concrete was appreciably less than that of previous batch and there was wider variation. The difference is almost certainly due to the low temperatures, which delayed the hydration of the cement and reduced the rate of increase of strength. Subsequent tests on these units, following a period of thaw, showed when the required strength had been attained. Under favourable curing conditions the specified strength (the strength required before applying the prestressing force) can be attained at an age much less than 28 days.

Thus, when an early delivery was required, ultrasonic tests showed whether units of an age less than 28 days could be used.

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—From "Concrete and Constructional Engineering November, 1954. No. 11".

DEFINITIONS OF HIGHWAY ENGINEERING TERMS

- EMBANKMENT:** An earthwork raised above the natural ground by the deposition of material to support construction at a higher level.
- FILLING:** Material used for raising the earthwork to a desired level.

SOME HOWLERS

Roger Bacon was a fryer.

Becket was found preying on the altar steps.

HERE AND THERE

1. FOAMED CEMENT AS INSULATION

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

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

From "Concrete and Constructional Engineering, May, 1955."

2. STEAM CURING ON THE SITE

● BY THE USE OF steam curing it was possible to lift some large prestressed beams for a bridge at Den Helder, Holland, the day after the concrete was cast. The beams are tee-shape with a top flange 3 ft 4 in. wide by 8 in. thick, a web 6 in. wide at the top increasing to 1 ft 2 in. at the bottom, a total depth of 5 ft and a length of 90 ft. The ends were precast and fully cured in advance. When the concrete for the intermediate part of the beam was cast a wooden cover was placed over it and steam at a temperature of about 130 deg. F.

admitted for a period of six hours. The steam was provided by a railway locomotive. Next morning the concrete had a compressive strength of about 2500 lb per sq. in. and sufficient of the prestressing cables were tensioned to permit the beam to be lifted off the casting bed and taken by a crane to the storage area. This bridge is fully described in "Polytechnisch Tijdschrift" for November, 1954.

—From "Concrete & Constructional Engineering" - June 1955.

3. DESIGN OF ROAD FOUNDATIONS

● DESIGN of foundations for concrete roads. In the design of a concrete road the basic aim is to provide enough structural strength to enable the slabs to remain reasonably free from cracks. Cracking is usually due to the concrete failing under tensile stresses resulting from the combined effects of traffic loads and temperature gradients through the slab and theories have been developed by Westergaard and others to enable the maximum stress to be calculated for various conditions of loading and temperature. In the calculation of the tensile stresses due to traffic loading it is assumed that

the support given to the slab by the foundation is uniformly distributed over the whole area of the slab, and the effect of the strength of the foundation is allowed for by a factor known as the modulus of subgrade reaction, which is a measure of the resistance of the foundation to deformation under a loaded steel plate 30 in. in dia.

The present view is that Westergaard's theory under-estimates the tensile stresses associated with the degree of support provided by the foundation, since it is rarely likely in practice that uniformity

of support is obtained over the whole area of the slab, as is postulated by the theory. This alternative concept of the factors affecting the stresses in concrete road slabs leads to two conclusions:

- (1) The thickness of the concrete slab and the tensile strength of the concrete should be based on the assumption that tensile stresses will occur in the concrete considerably in excess of those estimated by the Westergaard theory.
- (2) Since it is not possible at present to estimate the effect of non-uniformity of foundation support on the stresses in concrete, and since most soils are likely to be subject to a similar order of magnitude of non-uniform vertical movement under normal practical conditions, no proper allowance can yet be made in the design of the concrete for the type of soil existing in the foundation. The principal exceptions to this rule are highly compressible soils such as peat and soft organic clays for which some increase in the thickness of the concrete should be allowed as compared with that constructed on normal soils.
- (3) All practical measures should be taken to ensure that non-uniformity of support of the concrete slabs is kept to a minimum by creating foundation conditions that will result in only small vertical movements after the slabs have been constructed.

Practical measures:

The principal practical measures that can be taken to provide a stable foundation for a concrete road comprise:

- (a) All highly compressible soils should be avoided wherever possible.

4. TEMPERATURE GRADIENTS IN CONCRETE SLABS

THE two main features of the temperature distribution in a concrete slab causing large stresses are the variation of the temperature gradient, which causes warping, and the variation of the mean

Where the road is to be constructed in a cutting, such soils should be excavated if this is practical, and they should never be employed to construct embankments.

- (b) All embankment fills, subgrade soils, trench backfills and base materials should be thoroughly compacted in order to minimise subsequent settlements.
- (c) The conditions during the preparation of the soil formation of the road should be controlled so that the soil is maintained at a moisture content close to the average it will possess during the life of the road. This measure will minimise vertical movements resulting from volume changes, particularly with clay soils. (The control of the moisture content of soil formations is considered later in the paper).

Most concrete roads are provided with a base, usually composed of a granular material. The structural strength of a concrete road depends principally on the rigidity of the slab, and a base is therefore not a useful way of providing additional structural strength. Its main uses are:

- (1) To form a working surface on cohesive soils which will enable construction to proceed in wet weather.
- (2) To provide a levelling course on an uneven soil formation.
- (3) To prevent mud-pumping on cohesive soils.
- (4) To insulate frost-susceptible subgrades from frost.

From the Journal, The Surveyor, and Municipal and County Engineer 14th August, 1954.

temperature, which causes expansion and contraction of the concrete.

Previous experiments have shown that the temperature gradient in a slab covered with a bituminous surfacing, 2 in. thick,

was about the same as that in an exposed slab (i.e., with no surfacing). Thinner surfacings caused an increase in the gradient. Experimental slabs (8 and 10 in. thick) have been laid to measure the reduction in temperature gradient when using thicker bituminous surfacings (up to 6 in.) and also, at the request of the Air Ministry, a study has been made of the effect of a layer of dry stone of various thicknesses from 3 to 12 in. covered by a rolled-asphalt surfacing 3-in. thick.

The temperature difference between the top and bottom surfaces of the slab was taken as a measure of the temperature gradient. From the results obtained during the summer and autumn, it was found that the maximum temperature difference was decreased by the thicker bituminous surfacings; 6 in. of bituminous macadam reduced the temperature difference to about 50 per cent of its value in a bare concrete slab and was slightly more effective than 3 in. of rolled asphalt

overlying a 3-in. layer of limestone. Twelve inches of dry limestone covered with 3 in. of rolled asphalt reduced the temperature gradient in the concrete to 25 per cent of its value in the bare slab.

During the period of the tests, the changes induced by these surfacings in the mean temperatures of the concrete were not large. The highest mean temperature in the slab covered with 3 in. of asphalt and 12 in. of limestone was 23°C when the highest mean temperature in the bare slab was 30°C; the corresponding lowest mean temperatures were 9° and 5°C.

From the limited number of observations studied, the maximum and minimum temperatures of the surfaces of the bituminous carpets and of the concrete were linearly related to the corresponding air temperatures.

(From 'Road Research 1954' Department of Scientific and Industrial Research, U.K.).

5. ALABAMA COURT UPHOLDS AUTHORITY OF STATE HIGHWAY DEPARTMENT TO CONSTRUCT BY-PASS

IN denying an injunction to prevent the construction of a bypass around the City of Montgomery, Alabama, the state supreme court held that because construction of the bypass would result in economic loss to a hotel owner and others similarly situated would not be sufficient ground on which to base such action.

The Las Vegas Corporation had recently constructed a hotel within the corporate limits of Montgomery. Located on US 31, south of the city, the hotel was not far from the point where US 31 south of Montgomery is connected with US 31 north of the city by a state road, in itself a bypass route affording the travelling public a means of continuing on US 31 without going over the heavily travelled streets of Montgomery. The new bypass, located almost entirely outside the corporate limits of Montgomery, would also connect US 31 south of Montgomery with US 31 north of Montgomery. The Circuit Court of Montgomery County granted a temporary injunction enjoining the state highway director from proceeding with the new bypass. The state highway director appealed to the state supreme court.

Before considering the reasons advanced by the hotel owners as to why the court should enjoin the highway department from constructing a public road, the supreme court pointed out that the location, construction and maintenance of highways had been committed to the state highway department by the legislature and were not a function of the courts. A previous decision was cited in which the court had stated: "A court of equity is without jurisdiction to determine the question of the public need for a highway."

The hotel corporation asserted that if the proposed bypass were constructed, they as well as other business establishments on or near the existing bypass would suffer serious economic loss. The court agreed that this was so, but did not consider this sufficient ground for enjoining the highway department from constructing the bypass. Private inducements or considerations, said the court, could not rightly enter into the question as to whether a highway should be constructed. The controlling factor must always be the good of the general public

and not the convenience or financial gain of the people who lived along any particular way.

The point was also raised that construction of the proposed bypass would result in an economic loss to the city, depriving it of a considerable amount of gasoline and license taxes. The court found no merit in this contention, holding that the construction of a state road could not be made to depend upon the motel owners' concern as to the resulting economic effect on a city of the state.

The Las Vegas Corporation also contended that construction of the bypass would be violative of provisions of the state constitution and of the laws of the State and contrary to its public policy.

The first amendment to the Alabama State Constitution, and subsequent amendments, Articles XX and XX-A, authorize the State to engage in the construction and maintenance of highways and bridges, and to appropriate monies for such purposes. Both of these amendments provide for the issuance of bonds. Both contain language substantially as follows:

"The State Highway Commission or highway department shall locate, construct and maintain highways and State trunk roads so as to connect each county with the county seat of the adjoining county by the most direct or feasible route or by a permanent road, having due regard to the public welfare;..... It shall be the duty of the highway department to equitably apportion among the several counties of the State the expenditure of both money and labour and the times or times of making such investment."

It was asserted by the hotel owners that the proposed bypass would not connect a county seat with the county seat of an adjoining county by the most direct or feasible route, having due regard to the public welfare. Furthermore, to use the money needed to construct the proposed bypass would result in an inequitable apportionment of highway funds, giving to Montgomery County more than it was entitled to.

The court pointed out that none of the funds derived from the sale of bonds is-

sued under authority of Amendments XX and XX-A were available for use in the construction of the bypass, such funds having been expended long ago. The court had definitely concluded that the restrictions of these two amendments had application only to the use of funds derived from the bond issues therein provided for.

The court considered a similar statutory provision, directing the highway department to provide roads connecting county seats, (Code of Alabama, 1940, Title 23, Sec. 34) in the nature of a directive, which, however, was not intended to restrict the highway department in the construction of other state roads. "Certain it is that such provisions were not intended to prevent the use of state funds in the construction of a bypass such as here proposed, which is to be constructed for the purpose of forming a part of a belt line road or highway around the third largest city in the State of Alabama."

The hotel owners also took exception to the acquisition of right-of-way by the State highway department, although the county had neither failed nor refused to acquire the necessary property. A statutory provision, Title 23, Sec. 25, of the Code, provides that rights-of-way deemed necessary by the highway department for the construction of a state road are to be acquired by the county or municipality, at the expense of the state. If the county or municipality fails or refuses to acquire such rights-of-way, then the highway director is authorized to acquire them. The court, however, was of the opinion that the manner of acquiring right-of-way was of no concern to the hotel corporation. No court of equity, according to the court, would, at the instance of one situated as was the present property owner, order a highway director not to build a road because he or the employees of the department which he headed had obtained rights-of-way directly from the landowners across whose lands the road was to be constructed.

Having given careful consideration to the record, the court concluded that the temporary injunction should not have been issued by the lower court.

(From Highway Research Board Bulletin Circular 272, April 1955.)

CURRENT LITERATURE

ABSTRACTS

TESTS ON A LARGE CULVERT PIPE. Bulletin 102. Highway Research Board, Washington, D.C.

THE Bulletin contains two Papers. The first one is "Tests of Large-Diameter Reinforced Concrete Pipe" by John C. Hendrickson, Jr., and covers a number of tests on pipe 84 inches in diameter. The standard test in general use for concrete pipe of all sizes is the three-edge bearing test. This test is used to determine two values, generally accepted as indicative of the quality and strength of concrete pipe: the load to produce a 0.01 in. crack and the load to produce ultimate failure.

It is common practice to use this test on both plain and reinforced-concrete pipe in sizes ranging from 4 in. to 72 in. in diameter. Relatively few three-edge bearing tests have been performed on pipe larger than 72-in. in diameter. This was partly due to the lack of equipment with sufficient capacity to handle the larger pipe as well as the cost of manufacturing and testing the pipe to destruction.

In addition, there was some feeling that the three-edge bearing test was not applicable to large-diameter pipe. Depending to some degree on the size of the pipe and the amount of steel reinforcement, test results on large pipe did not appear to be consistent with either theory or tests on pipe of smaller sizes. It was found that increasing the steel area beyond a certain amount had little or no effect on either the 0.01-in.-crack load or the ultimate load which the pipe would support.

A number of tests have been run on pipe 84 in. in diameter. The three-edge bearing test was selected as the easiest method of loading the pipe. Various systems for reinforcing the pipes were used

including standard types normally used in pipe production.

As a result of these tests, it is believed that the major factor causing the discrepancy between test results and expected theoretical results has been the failure to consider shearing stresses set up in the wall of the pipe. Failure due to shearing stresses occurs before the tension reinforcement has begun to carry its design load, particularly in heavily reinforced pipe. If special reinforcement is provided to take care of shearing stresses, the strength of the tension reinforcement can be used more efficiently. It is possible to greatly increase the crushing strength of large diameter pipe without an increase in the wall thickness.

The second Paper on "Deflections of Timber-Strutted Corrugated-Metal Pipe Culverts Under Earth Fills," by M. G. Spangler and Donald L. Phillips, presents an analysis and development of a formula for predicting the vertical and horizontal deflection, or change in diameter, of timber-strutted corrugated-metal-pipe culverts.

STRENGTH OF SOIL-CEMENT AS A FUNCTION OF DEGREE OF MIXING by C. N. Baker, Jr., Highway Research Board Bulletin 98-Stabilization of Soils.

THIS Paper describes a laboratory investigation of the following variations involved in mixing portland cement into a clayey silt: (1) uniformity of soil and cement mixture, (2) compressive strength of the resultant soil-cement, (3) time of mixing, and (4) accumulative energy required for mixing.

Mixing was performed in a pugmill-type mixer and the energy required for

mixing was automatically recorded. Specimens were compacted in the Harvard miniature compaction mould and, after curing seven days, were tested in unconfined compression. Cement concentration throughout the soil-cement mixture was determined by means of a radio active tracer that was incorporated uniformly in the cement. This method of measuring cement content proved to be rapid and reasonably reliable. Degree of mixing was measured by the mixing uniformity coefficient. It was calculated that:

1. The relationship between uniformity of mix and strength of soil-cement is a logarithmic one; i.e., a straight line is obtained on a plot of strength versus $\log_{10}$ of I. Thus, when the cement and soil are poorly mixed, a small increase in mixing uniformity results in an even smaller increase in strength; whereas for a well mixed sample, a small increase in mixing uniformity results in a large increase in strength.

2. The strength of soil-cement varies directly with the $\log_{10}$ of the accumulative energy required for mixing. This relationship holds within the limits tested, but it is apparent that there is a point beyond which further increases in mixing energy would have little effect on the strength of the soil-cement.

3. The relationship between mixing energy and uniformity of mix (I) appears as a curve on a plot of $\log_{10}$ I versus mixing energy, so that a small decrease in I (increase in mixing uniformity) requires a very large increase in the amount of mixing energy.

4. Other things being equal, accumulative mixing energy is approximately proportional to mixing time.—*Author's summary.*

INVESTIGATION ON THE EFFECT OF PLACING TEMPERATURE UPON THE STRENGTH OF MASS CONCRETE by Dr. Eng. Shun-suke Takano, C.E. Member, Transactions of the Japan Society of Civil Engineers, No. 26.

THIS paper describes the results of investigation on the relations between placing temperature and strength of mass concrete. Firstly, the Author investigated chemically and physically the relations among the temperature at the time of making cement paste, curing temperature and properties of paste. He observed the fact that the rate of strength development of cement paste made at low temperature was remarkably greater than that of cement paste made at high temperature and tried to explain reason. Secondly, he examined the relations between placing temperature and strength of concrete. The Author reached the conclusion that (1) placing of concrete at the lowest possible temperature above freezing point produces favourable effect on the development of strength, (2) placing of mass concrete at low temperature not only reduces maximum temperature in the interior but also develops high strength at a later age, which consequently creates a more favourable condition for avoiding temperature cracking. *In Japanese—Author's summary.*

PLASTIC ANALYSIS AND DESIGN OF MILD STEEL VIERENDEEL GIRDERS by A. W. Hendry—The Structural Engineer, July 1955.

THIS paper discusses the application of the simple plastic theory to the design of mild steel Vierendeel girders. Three modes of failure are described and equations are derived for calculating the collapse load of a girder in each of these modes. Experimental results are quoted in confirmation and the application of the analysis to the design of parallel and inclined chord girders is illustrated by calculations for the design of a five panel bridge girder.

SOME HOWLERS

*Henry II asked for the Church to have taxis.
The horse was the main means of travail.
The Prince Regent gambolled and drank.*

SELECTED RECENT LITERATURE IN ENGINEERING JOURNALS

BRIDGES AND OTHER STRUCTURES

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BUDGETS AND ADMINISTRATION REPORTS

GOVERNMENT OF PEPSU BUDGET FOR 1955-56

CIVIL WORKS

	(In lakhs of rupees)		
	Actuals 1953-54	Revised Estimates 1954-55	Budget Estimates 1955-56
Revenue			
Rents	2.60	5.46	3.96
Recoveries of Expenditure	0.03	0.04	0.22
Transfer from Central Road Fund	6.71	17.51	19.50
Miscellaneous	4.44	5.23	6.54
Deduct-refunds	-0.06	-0.04	-0.01
Total	13.72	28.20	30.21
Expenditure			
Buildings			
Original Works	13.14	14.83	42.63
Repairs	8.08	10.00	10.00
Communications			
Original Works	17.33	14.56	5.92
Repairs	12.90	13.20	14.00
Miscellaneous			
Original Works	6.87	7.00	5.28
Repairs	2.27	2.50	2.30
Establishments	13.85	19.62	13.70
Tools and Plant	0.33	0.45	0.71
Suspense	-2.55	0.34	-2.45
Development Schemes			
Buildings	25.04	6.21	24.73
Communications	16.03	49.90	103.45
Tools and Plant	0.29	—	—
Total	113.58	138.61	220.27

Capital Expenditure on Civil Works outside the Revenue Account

(In lakhs of rupees)			
	Actuals 1953-54	Revised Estimates 1954-55	Budget Estimates 1955-56
Original Works—Buildings	—	39.00	59.82
Miscellaneous	—	—	5.10
Tools and Plant	—	—	0.14
Development Schemes Buildings	—	19.00	4.46
Establishments	—	—	4.10
Deduct-receipts and recoveries on Capital account	-4.13	—	—
Total	-4.13	58.00	73.62
Receipt from Roads			
Receipts under Indian Motor Vehicles Act	5.18	5.20	5.20
Sales tax on Motor Spirit (goods)	4.75	5.00	5.00
Total	9.93	10.20	10.20

GOVERNMENT OF PEPSU-BUDGET FOR THE YEAR 1955-56

(A brief review with reference to Civil Works)

THE total revenue of the State, including grants-in-aid from the Central Government, is estimated at Rs 824.28 lakhs for 1955-56 as against at Rs 779.74 lakhs (Revised estimate) for 1954-55 and Rs 698.44 lakhs (actuals) for 1953-54. The corresponding revenue expenditure figures are Rs 1028.85 lakhs for 1955-56 (Budget Estimate), Rs 813.27 lakhs for 1954-55 (Revised estimate) and Rs 682.81 lakhs for 1953-54 (actuals). The anticipated expenditure met from revenue for the year 1955-56 includes expenditure connected with 5 years' Plan schemes also, this expenditure amounting to Rs 318.75 lakhs.

The revenue Expenditure on Civil Works is placed at Rs 220.27 lakhs for 1955-56, while the revised estimate for 1954-55 and the actuals for 1953-54

amount to Rs 138.61 lakhs and Rs 113.58 lakhs respectively. In terms of total State revenue, the expenditure amounts to 26.7 per cent in 1955-56, 17.8 per cent in 1954-55 and 16.3 per cent in 1953-54. The provision for communications including development expenditure under "Original Works and Repairs" for the year 1955-56 is Rs 123.37 lakhs, which forms 15.0 per cent of the total State Revenue. In 1954-55 and 1953-54 the corresponding ratios were 10.0 per cent and 6.6 per cent respectively.

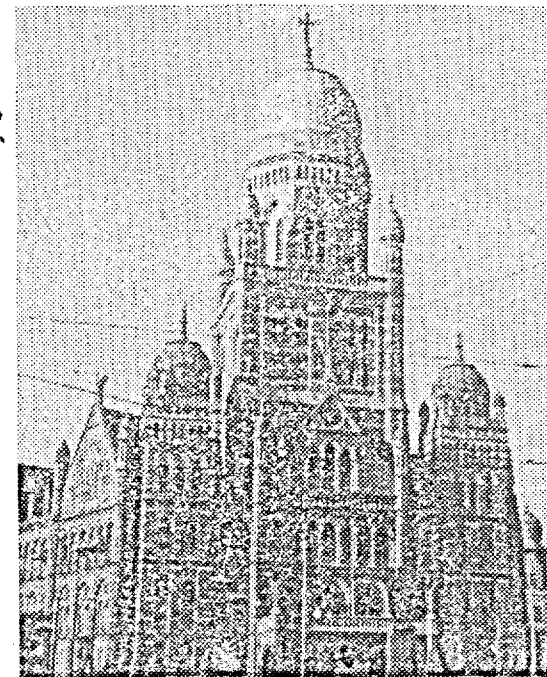
The Capital expenditure on Civil Works outside the revenue account is estimated at Rs 73.62 lakhs for the current year, while the revised provision for the previous year amounts to Rs 58.00 lakhs.

LIST OF APPROVED WORKS ON NATIONAL HIGHWAYS

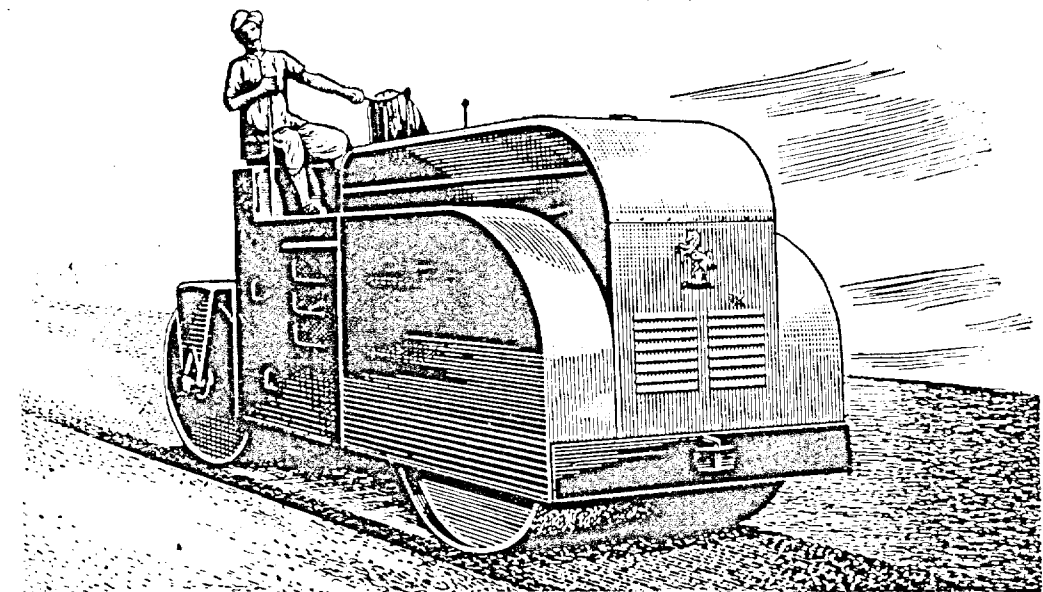
S. No.	Job No.	Name of work	Amount (Rs in Lakhs)
MYSORE			
1.	1263 MY 4	Widening the existing B. T. surface from M. 17/4 to 28/4 of Madras-Cannanore Section of N. H. No. 4.	2.32
2.	1277 MY 4	Black topping miles 88/4 to 146/0 of Bangalore-Dharwar Section of N. H. No. 4 in Chitaldrug Division.	7.04
3.		Eighteen works each costing less than Rs 2 lakhs.	16.24
BOMBAY			
4.	1246 BM 8	Bridge across the Kaveri river in mile No. 163/2-3 of the Bombay-Ahmedabad Road, N. H. No. 8.	4.14
5.	1278 BM 7	Black topping miles 89/5 to 149/4 and 154 to 167/3½ of the Poona-Sholapur Road, N. H. No. 9.	17.91
6.	1286 BM 9	Black topping miles 40 to 89/5 of the Poona-Sholapur Road, N. H. No. 9.	9.45
7.	1292 BM 8	Construction of a bridge across Khorera river in mile No. 161/5 Bombay-Ahmedabad Road, N. H. No. 8.	2.60
8.	1315 BM 8	Constructing a bridge across Baleshwar Khadi with approaches on Bombay-Ahmedabad Road, N. H. No. 8.	3.48
9.		Ten Works each costing less than Rs 2 lakhs.	9.25
MADRAS			
10.	1182 MD 47	Construction of a bridge across the Walayar river and from culverts on the diversion road in M. 343/1 to 344/5 of the Salem-Cochin road, N. H. No. 47 - necessitated by the Walayar Reservoir Project.	2.00
11.		Two works each costing less than Rs 2 lakhs.	1.54
BIHAR			
12.	1158 BR 31	Widening Crust to 12 ft from Bihar to Rajauli (40 miles) - N. H. No. 31 (Patna Division).	3.39
13.		Three works each costing less than Rs 2 lakhs.	1.67

S. No.	Job No.	Name of work	Amount (Rs in Lakhs)
MADHYA PRADESH			
14.	1190 CP 6	Constructing missing links of N. H. No. 6 between Loni and Murtizapur.	11.28
15.	1198 CP 43	Improvement of Abhanpur-Dhamtari section of N. H. No. 43 from mile 19 to 48/3.	14.13
16.		Two works each costing less than Rs 2 lakhs.	1.06
ANDHRA			
17.	1193 AH 7	Providing metalled shoulders to the Kurnool Gooty section of N. H. No. 7-M. 0/6 to 52/2.	6.24
18.	1194 AH 7	Black topping Kurnool Gooty section N. H. No. 7 from M. 0/6 to 52/2.	8.04
19.	1195 AH 7	Providing black top surface and metalled shoulders to M. 52/2 to 60/0 of Kurnool Gooty Section of N. H. No. 7	2.25
20.		Four works each costing less than Rs 2 lakhs.	5.13
RAJASTHAN			
21.	1237 RJ 29	Painting miles 28-35 of Allahabad-Gorakhpur road, N. H. No. 29 (local milage 132-139).	3.56
22.	1239 RJ 8	Construction of a metalled and Black topped road from Baggar to Bhim via Barar on N. H. No. 8.	7.51
23.	1240 RJ 8	Construction of a high level bridge over Banas river near Nathdwara in mile 32 of Udaipur-Kankroli road, N. H. No. 8.	12.22
24.	1255 RJ 8	Consolidation and carpetting of Udaipur-Khorwara section of N. H. No. 8 between miles 25 & 40.	3.20
25.	1256 RJ 8	Regrading, painting and widening of Udaipur-Nathdwara road (portion of miles 6/0-10/0).	2.26
26.		Eight works each costing less than Rs 2 lakhs.	6.81
HYDERABAD			
27.		Two works each costing less than Rs 2 lakhs.	1.73

S. No.	Job No.	Name of work	Amount (Rs in Lakhs)
HIMACHAL PRADESH			
28.	1247 HP 22	Widening of 6 ft track to full width of 2nd five miles portion of Luri-Rampur Section of Hindustan-Tibet Road, N. H. No. 22.	5.60
29.	1281 HP 22	Widening 6 ft track to full width in the last 3 miles (60/0 to 63/0) of Narkanda-Luri Section of Hindustan-Tibet Road, N. H. No. 22.	4.59
30.	1291 HP 22	Widening of 6 ft track to full width in miles 55/0 to 60/0 of Narkanda-Luri section of N. H. No. 22.	4.28
31.	1305 HP 22	Widening 6 ft track to full width from miles 10 to 15 of Narkanda-Luri section of Hindustan-Tibet Road, N. H. No. 22.	4.23
32.	1308 HP 22	Widening of 6 ft track to full width from Gaura towards Wangtoo miles 111/0 to 116/0, part of Hindustan-Tibet Road, N.H. No. 22.	9.70
33.		Four works each costing less than Rs 2 lakhs.	1.70
AJMER			
34.		Two works each costing less than Rs 2 lakhs.	0.80
SIKKIM			
35.		Two works each costing less than Rs 2 lakhs.	0.37
MADHYA BHARAT			
36.	1301 MB 3	Applying seal coat to 46 miles between miles 110 and 165 of N. H. No. 3 in Shivpuri Division.	2.72
37.	1302 MB 3	Applying seal coat to miles 166-235 of N. H. No. 3 in Guna Division.	3.79
38.		Six works each costing less than Rs 2 lakhs.	4.67
VINDHYA PRADESH			
39.	1165 VP 7	Widening and black topping 10 miles of N. H. No. 7.	2.25



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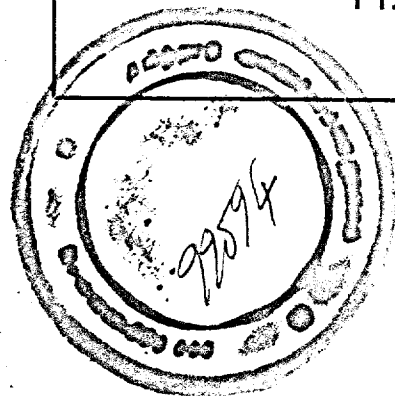
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