TRANSPORT-COMMUNICATIONS

MONTHLY REVIEW

JUNE 1958—No. 134

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TABLE OF CONTENTS

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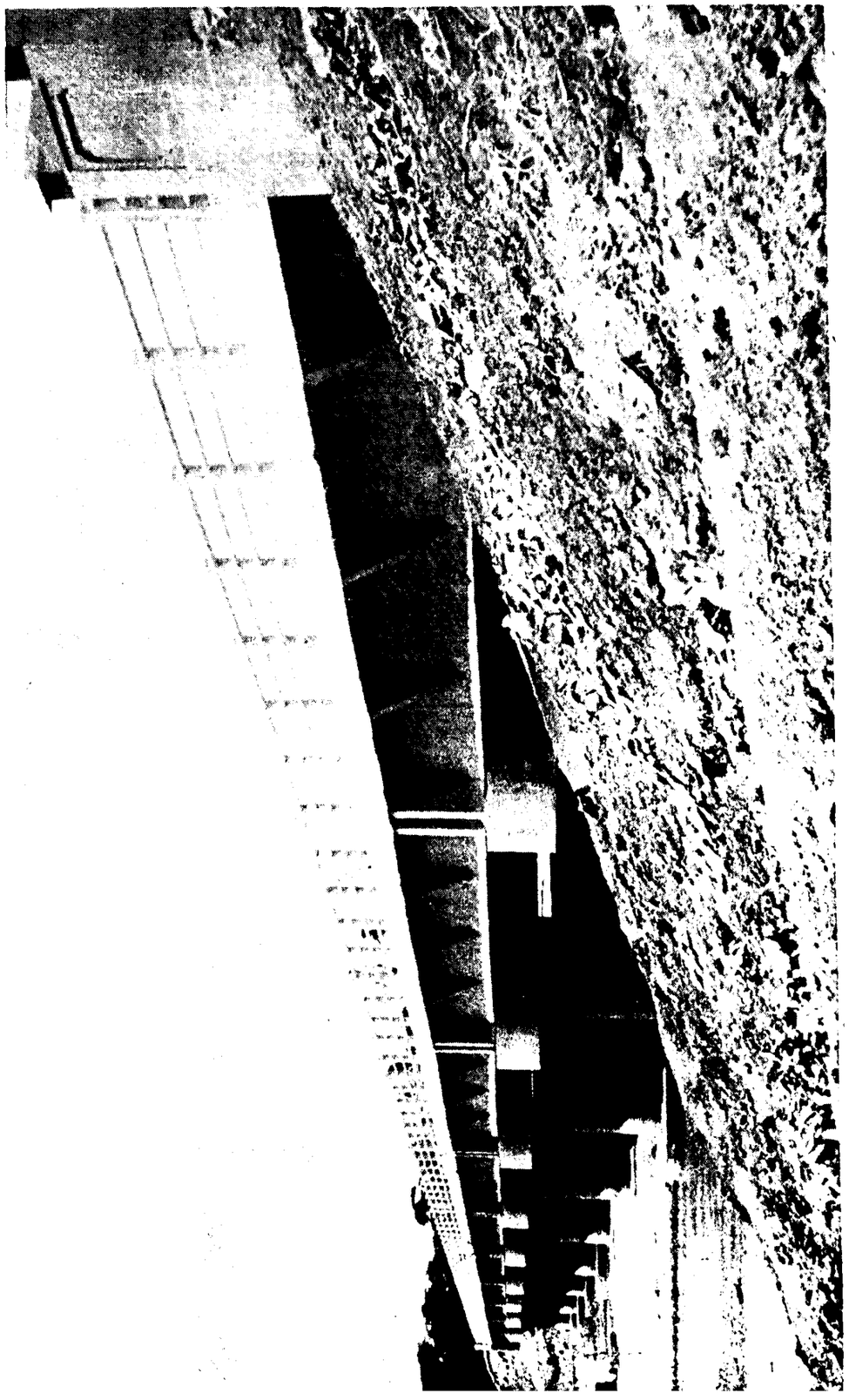


GENERAL VIEW OF THE COMPLETED BRIDGE ACROSS YELERU RIVER ON NATIONAL HIGHWAY No. 5—MADRAS-CALCUTTA ROAD (ANDHRA PRADESH)

TRANSPORT-COMMUNICATIONS MONTHLY REVIEW

A REVIEW OF
ROAD ENGINEERING, DEVELOPMENT & TRANSPORT

JUNE 1958 24

EFFECTIVE ROLE

THE country today is seething with many technical problems both big and small. The engineer is concerned in varying degrees with all of them irrespective of their magnitude. As examples of big problems may be quoted the gigantic multi-purpose hydro-electric schemes and other huge undertakings of national development on an unprecedented scale. The engineer is contributing his might to these problems, but by the very nature of the work and processes involved, the results are generally slow and not readily perceptible to the common man. To him, the small problems are more pressing as they influence his day-to-day life and are, therefore, his constant concern—problems like food, housing, communications, transport, industries, employment, etc.

The engineer has been concerned with the common problem since very early days all over the world. His function primarily has been that of preservation and fostering of the constructional crafts, many of these crafts being themselves much older than science and their practice more conducive to the development of human character and happiness than any scientific pursuit.* "Thus, for example, the engineers' business is to provide water, to dispose of sewage and rubbish, to attend to heating and lighting, to erect buildings; they have to assist in all those processes whereby goods, including industrial and agricultural produce, are obtained and manufactured; and they have to make the apparatus whereby goods, messages and passengers can be transported by land, by water, and by air".

In the past, the contribution of the engineer to the common problems in India has been outstanding and there is no field of public service where the imprint of his work is not visible. Yet, today, he has probably not come to occupy a place of cherished esteem in the hearts of the people. Why is it so? It would be difficult to answer this question, but a probable explanation may be that his contribution

* Maunsell on "Some Unsolved Problems in Civil Engineering"—James Forrest Lecture (1951).

has been slow, particularly in recent times when science and technology have advanced by gigantic strides. It is a truism that anything that is not timely is not effective. In this context it is felt that the effort of the engineer in many directions today goes unnoticed simply because the reform or relief is trying to bring about is long overdue. The remedy seems to lie in greater efforts on the part of engineers. This applies not only to engineers in Government service but also to those in private practice whose contribution, it may be stressed, is direct and can be more effective. Engineering Institutions in the country also have a notable part to play in this direction. Study of the problems, evolution of remedies and quick implementation by bringing unhindered collective opinion to bear on the problems can result in their effective and practical solution.

There are also several other considerations relevant to the issue to which a reference may be made. So far the engineer in India was content to do what he, according to his professional standards, thought was the correct thing and to do his work well and let the work speak for itself. In addition to that, he has now to raise his sights to see how he can fit himself and the profession into the conditions prevailing in the country at large, consequent to the general mass awakening and the urge towards better living. The engineer cannot remain detached from this surging current of life but has to strive for a full knowledge and understanding of the needs of the people. He has also to make his ideas persuasive to the common man and thereby succeed in influencing him to see and appreciate his viewpoint—a scientific one—in a co-operative effort which has to benefit the community and the nation as a whole. In this connection the role of public relations cannot be minimized. For creating a favourable public opinion recourse has increasingly to be made to agencies like the press, the radio, and the screen. The engineer cannot afford to feel shy of them any longer.

Further, the engineer has to be prepared to take an increasing share in activities outside the narrow confines of his speciality. His detailed analytical and scientific approach to problems can be an asset in matters pertaining, for example, to administration (technical) and management. Experince of other countries removes beyond a shadow of doubt any misgivings in this direction. In fact, the engineer has always come to be relied upon whenever balance between theory and practice is to be secured and practical results produced and goods delivered. Shortage of technical personnel cannot be an excuse for confining engineering talent to strictly technical tasks, some of them purely of a routine nature which can be performed by lesser qualified persons. Whenever feasible, engineering training and experience can be profitably utilized in other directions also. This will open up new vistas and opportunities for technical men who will be encouraged to give of their best to the service of the country instead of being confined to be merely "hewers of wood and drawers of water". Recognition of status of engineers will also aid in the same direction and remove the feeling of inferiority complex and frustration to which they are now subject. Old prejudices and out-of-date practices have to go away if we are to progress. Fortunately engineering education in India now provides for the study of general

subjects in the curricula. Where there are any shortcomings they can be remedied, but the charge of lack of broad vision and liberal education is certainly unfounded.

Remuneration of engineers is a question which requires serious attention. This has to be commensurate with work and responsibilities. There is no doubt that the engineers' work is hard and his responsibilities are heavy as he has to deal not only with problems of money and materials but also with those concerned with human beings. It is said that the engineer cannot bury his mistakes but the mistakes can bury him. Taking all considerations into account, there is reason to believe that the engineer in India is inadequately paid for his work as a result of which all sorts of complications arise. Financial amelioration of his prospects will result in raising his morale and also lead to greater efficiency.

The recent nomination of a distinguished Indian engineer to the Upper House of Parliament has been welcome news to the engineering profession. It is wished and hoped that such cases will be more frequent in future. Thus can matured engineering knowledge and experience be harnessed to the service of the nation not only in the direction of legislation but also towards more enlightened interest and pursuit of technical affairs and a scientific order and outlook. As far as the latter are concerned, the contribution of an old and tested profession can be valuable and significant. We all know the old story of a doctor, an engineer and a lawyer discussing as to which was the oldest profession. The doctor started first: "When Eve was created from Adam's rib, the first surgical operation was performed". The engineer spoke next: "But before that God created the world out of chaos". The lawyer turned round and said: "But who created the chaos?" Leaving aside the claim of antiquity, creating order out of chaos is certainly a commendable task.

DEFINITIONS OF HIGHWAY ENGINEERING TERMS

SAND: A cohesionless soil composed of granular, gritty and loose grains of siliceous origin of sizes ranging between 2.00 m.m. and 0.02 m.m.

SAND, COARSE: Sand of grain size varying from 2.00 m.m. to 0.20 m.m.

SAND, FINE: Sand of grain size varying from 0.20 m.m. to 0.02 m.m.

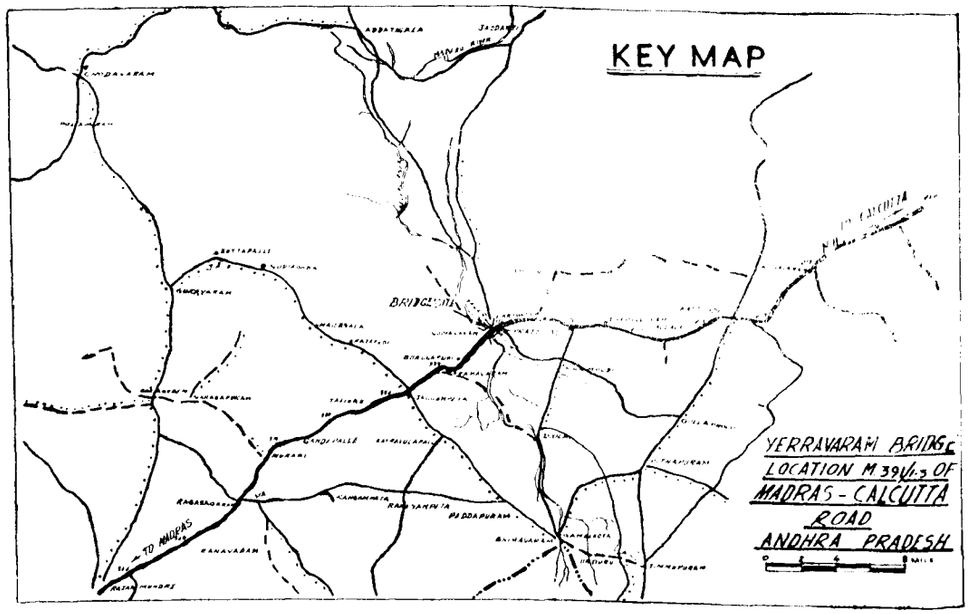
BRIDGING INDIA'S RIVERS

THE BRIDGE ACROSS YELERU RIVER

(By courtesy of Highways Department, Andhra Pradesh)

Introduction

THE river Yeleru, taking origin in the upper agency region in East Godavari District, crosses National Highway No. 5 (Madras-Calcutta Road) at Mile 391/1-3 near Yerravaram. It drains an area of 932 square miles at the bridge site. The maximum flood discharge passed by the river is estimated as 90,000 cusecs and the highest flood level recorded is 13.5 feet above the average bed level.



In the year 1888, a masonry arched bridge consisting of 15 vents of 30'-0" each with piers resting on shallow well foundations and protected by masonry flooring was constructed at this crossing. During the extraordinary floods in October 1949, five spans in the centre of the bridge collapsed. A link bund connecting the broken ends of the bridge was immediately formed and protected with rough stone pitching and traffic was thus restored.

Various alternatives were considered to afford permanent relief and reconstruction of the 5 collapsed spans and the sixth weak span on the Madras side on existing foundations with R. C. C. T-beams and slab decking was decided upon and work accordingly taken up. On opening the old foundations it was however found that the masonry wells were hardly 7'-0" and not 30'-0" as was originally expected. Moreover, they were all cracked and displaced. As such, the idea to restore the middle spans on the old foundations was

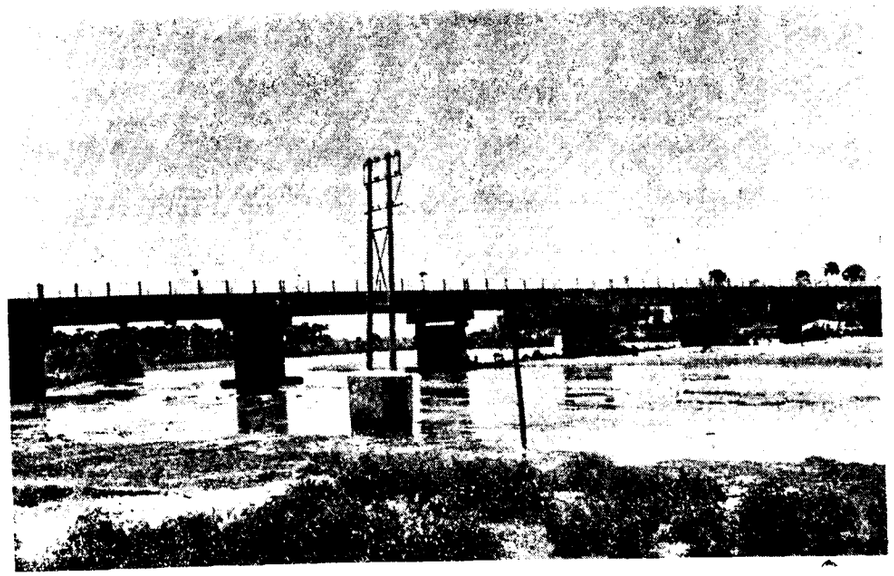


Photo 1. **A view of the newly completed bridge showing the location with reference to the river regime.**

Photo 2. **Showing the old bridge with its central spans washed away during October 1949 floods.**

given up and the construction of a new bridge on deep foundations was decided upon.

For the new bridge, a new site 280′ downstream of the collapsed bridge was selected. This was the best site as judged from local ground conditions and also from the point of view of easy approaches.

General description

The bridge as constructed consists of 10 spans of 60′–0″ each with prestresssd concrete superstructure and R. C. C. piers and abutments resting on well foundations. Wings were dispensed with on both sides and open abutments with rough stone revetment and launching aprons were provided.

Foundations

Few trial bores taken in the vicinity of the collapsed bridge showed moist red clay with about 90 per cent of fine sand for the major part. The well foundations for the bridge to be reconstructed were tentatively proposed to be taken to R. L. 49.50, i.e., to a depth of 43.50′ below H.F.L. (R. L. 93.00) for adequate grip and safety against highest anticipated scour and resting on moist red earth. Fresh borings were contemplated to be taken during execution to decide upon the final depths of foundations. Borings were taken subsequently for all the positions of piers and it was found that medium sand suitable for foundations was available at a deeper level. Accordingly the bottom of foundation was fixed at R. L. 36.00 for all the wells except the abutment pier and the pier adjacent to it on Madras side where the levels finally adopted were R.L. 31.50 and R. L. 24.50 respectively.

The two wells under each pier and abutment are circular in shape 11′–0″ outer diameter with a two feet thick steining in C. C. 1 : 3 : 6. The wells were provided with curbs of 4′–6″ height and fitted with 4″ × 4″ × ½″ M. S. angle iron shoes. The wells were plugged with cement concrete 1 : 2 : 4 at bottom for a depth of 5′–6″ and with sand upto the top. Twelve mild steel rods of 1″ diameter bars per well provided a rigid connection between the well and the cap slab 2′–6″ thick laid in R. C. C. 1 : 2 : 4

Well sinking

Sinking of wells below the original contemplated level of 43.50 was done departmentally as a reasonable rate for the sinking could not be agreed to with the contractors. The sinking of these small 11′–0″ external diameter wells at these low depths was found to be very difficult. The wells passed through a thick layer of clay. The sinking in the sand layers below clay was a very slow process. Sand blows for very little sinking was a regular feature and sand blows as high as 20′–0″ were not uncommon—whenever a well descended. The wells had to be invariably loaded with a kentledge of 2000 sand bags giving about 75 tons weight every time a pit was made for sinking the well. On an average about 15 attempts were required for each well to sink to its final depth.

There was interruption in the work due to floods and rainy season from June to November 1956 leaving about seven working months in which 184 feet of sinking at these lower depths was done. The average rate of this difficult sinking was about 10½″ per day.

Substructure

The R. C. C. piers and abutments consist of 2 Nos. 3′–0″ diameter columns spaced at 17′–0″ centres and rigidly connected at top by a pier cap of size 27′–0″ × 5′–6″ × 3′–0″ thick. The columns are reinforced with 18 nos. 1½″ diameter rods as main reinforcement with 3/8″ diameter spiral distributors at 2½″ pitch. The pier cap is provided with 1¼″ diameter rods at top and 1½″ rods at bottom as main reinforcement with 5/8″ diameter 8-legged stirrups.

For the piers, a 6″ thick diaphragm connecting the two columns is provided upto the flood level to prevent floating debris getting stuck up in between the two columns. The reinforcements for the diaphragms consist of ½″ diameter rods on both faces at 12″ crs. in the vertical direction and at 5″ crs. in the horizontal direction.

Bearings

Movable bearings of the sliding plate type (6″ × 12″ × 1¼″ thick) are fitted flush with the surfaces of the bottom of the beam and top of pier bent with a cross bar of 12″ × 2″ × 1¼″ in between (welded to bottom plate and with top contact surface machined). Fixed bearings of grout pad 1½″ thick are provided with ¾″ diameter ‘J’ shape anchor rods.

Superstructure

The superstructure consists of precast prestressed beams 5 Nos. per span spaced at 5′ – 1″ centres 4′ – 8″ deep and with a flange width of 4′ – 0″ at top and 5½″ web thickness. The thickness of the flange varies from 5″ at end to 7″ at the junction with the web. The beams are prestressed with 7 cables of 12 wires 5 m.m. in diameter for the end and intermediate beams and 6 cables for the central beams.

Each span is provided with 5 cross beams at 15′ – 0″ centre. The concrete for the cross beams and the slab portion between the beams was laid in situ, after the beams were launched in position. The deck was transversely prestressed in each span with 35 cables consisting of 12 wires of 5 m.m. diameter (25 Nos. in the slab at 2′ – 6″ crs. and 10 Nos. in the cross beams at 2 Nos. each). Freyssinet method of prestressing was adopted.

System of prestressing

The beams were cast on beds in a specially prepared casting yard, prestressed, and then launched on to the spans by the aid of a launching girder.

A working stress of 1,14,000 lb per sq. in. was allowed for H.T. steel in the design, after all losses were taken into account. The stress for the design of concrete was 1145 lb per sq in. in the extreme case. The concrete for the prestressed concrete work was of 1 : 1½ : 3 proportion and vibrated to give a cube strength of not less than 5000 lb per sq. in. at 28 days. The cubes were made in steel moulds from the concrete actually used on the work and tested at site by a 100-ton testing machine.

The kerbs are of vibrated C.C. 1 : 1½ : 3, 14″ × 9″ with a clear roadway of 22′ – 0″ between their faces.

The wearing coat consists of cement concrete 1 : 1½ : 3 vibrated and laid for a thickness of 3″ average. Kerbs and wearing coat were laid after the beams were transversely prestressed.

G.I. pipe hand rails 2½″ dia. for the topmost rail and 2″ dia. for the bottom 3 rails are provided. The rails are fixed in R.C.C. posts 6″ × 6″ × 3′ – 0″ spaced at 7′ – 6″ crs.

Approaches

The Madras side approach was taken straight to join the existing road. The Calcutta side approach was taken on a 900′ radius curve to join the existing road in M. 391/6. Four R.C.C. slab culverts of span 6′, 10′, 6′ and 3′ across irrigation channels on the Calcutta side approach road have been provided.

Cost

The total cost of the bridge including the approaches comes to Rs 9.62 lakhs.

The salient features of the bridge are tabulated below:

(1)	Catchment of the river	932 sq. miles
(2)	Max. flood discharge	90,000 cusecs
(3)	M. F. L.	... R.L. 93.00 (130.85 M.S.L.)
(4)	No. of spans	... 10
(5)	Spans	... 60′ – 0″ each
(6)	Length between abutments	... 627′ – 0″
(7)	Levels	
(a)	Road level	... R. L. 102.02 (M.S.L. 139.89)
(b)	Top of pier	... R. L. 97.00 (M.S.L. 134.85)
(c)	Top of capping slabs	R. L. 81.50 (M.S.L. 119.35)

This does not mean, however, the exclusion of the use of a small vibratory roller in restricted areas not suitable for the heavier roller, as this is the only method of obtaining a reasonable state of compaction.

The care on the control of water added for mixing when limestone aggregate is used is a very important factor in the four months November to February, as, should the water content exceed the 'optimum' due to inclement weather when being laid, there is little chance of natural air drying to reduce the water content and, coupled with the possibility of frost action, the material becomes spongy, there is risk of failure from traffic action.

On recent work carried out over 4 in. thick, with material graded 2½ in. down, it has been found that incorporating the larger size stone does tend to greater segregation and preference is now given to using the smaller grading 2 in. down.

General Conclusions :

With the experience gained in Lancashire by the use of 'wet mix' over the last few years, the conclusions reached are as follows :

(1) As a base to a road in place of pitching, it fulfils the requirements. The dry densities obtained are approaching that of concrete but density when using slag is dependent on the quality of the slag, i.e., whether mainly good, sound slag or containing excess of honeycomb material.

(2) Suitable aggregates are slag, blue or white limestone (granite has not been used).

(3) The water content for mixing in the case of limestone is critical. For winter working and in inclement weather 2½ per cent to 3 per cent should be used ; for summer working, not more than 4 per cent. Additional water if required can always be applied by sprinklers from the roller.

(4) Segregation does occur but is mainly caused on loading into the lorry at the mixer rather than during transit.

(5) Back blinding behind the Barber-Greene is not normally necessary, rolling will effectively produce the required finish.

(6) It can be laid by hand successfully in places not accessible to the Barber-Greene, but has a tendency to segregate. It should be mechanically laid wherever possible.

(7) Speed of laying is dependent on supplies. Maximum laid by one machine in one day to date is 482 tons.

(8) Traffic can be allowed on new work immediately after rolling and scatter will not normally occur except under very rapid drying conditions.

(9) To prevent wet conditions affecting limestone 'wet mix' the roller should be kept close up to the Barber-Greene to compact the material as soon as laid.

(10) The base course of tar macadam or bitumen macadam can be laid immediately after the 'wet mix' has been laid and rolled.

(11) The effect on the grading of the material due to rolling is less severe on limestone than slag, limestone showing an increase of 5 per cent due to crushing on the middle range of the stone size and slag 6 per cent, but in both cases this is not detrimental to stability.

(12) On trunk and Class I road, it should be laid 8 in. thick, in two 4-in. layers, on other roads 6 in. thick.

For the Preston By-pass motorway, 9 in. is specified in two 4½ in. layers. (All these dimensions are after consolidation.)

(*From* : *"The Surveyor and Municipal and County Engineer," April 12, 1958*).

BETTER ROAD TRANSPORT

HOW CENTRE PLANS TO FORCE VITAL IMPROVEMENT

By

D. D. SURI

(Member, Inter-State Transport Commission)

THOUGH the formation of the Inter-State Transport Commission has been generally welcomed, doubts have been expressed in certain quarters as to its capacity to eliminate obstacles to the development of road transport.

The maladies that infect the industry are deep-rooted and call for drastic action: but the concept of the Commission is revolutionary. For the first time the Centre has assumed powers not merely to advise the States how best to develop inter-State road transport, but also to take over administration of the subject should the need arise.

The manner in which the Commission will operate will depend on the degree of co-operation it receives from the States. The task before the Commission is enormous. It has to help to increase the road transport industry's capacity to lift an additional 60 to 70 million tons of goods, which is even more than the Railways' expansion programme envisages. The present capacity of road transport, with about 130,000 goods vehicles in the country, is a little over 20 million tons, but that is because of the under-utilization of vehicles. Our estimate is that the utilization of vehicles today is generally from 40 to 50 per cent.

Carrying More

With proper organization of the industry—and in this direction the Commission must exert full pressure—the percentage can be raised to almost double the present figure. At any rate, we hope to lift 15 million additional tons, using only the present number of vehicles. In addition, it is planned to put on the road another 110,000 to 120,000 vehicles by 1961, which with adequate organization will be able to lift 35 to 40 million tons. This will be possible as the new vehicles can carry greater loads.

Moreover, we are also trying to persuade State Governments to permit heavier loads on the roads wherever possible. By this means we can increase the total capacity by about 50 to 55 million tons. That will still be short of the target by 10 to 15 million tons. This capacity is not uncovered, however, for it is planned to encourage the use of trailers and put on the road 40,000 to 50,000 such vehicles by the end of the Second Plan period. It is through the agency of the Inter-State Commission that these targets will have to be achieved so the earlier the Commission begins functioning the better.

The development of road transport has yet another important aspect. It is the only means of opening up the country and thus promoting that unity among the people which is essential for achieving the second Plan's targets. Road transport can reach places which railways will not for years; because of the cost of new construction, it may never be feasible to extend rail transport to thinly-populated and remote areas: it is cheaper to approach these places by road. Road transport can also connect railway termini with markets and provide door-to-door delivery. In fact, for the successful operation of railways, there must be adequate road transport to bring traffic to them.

How it Will Work

The question has often been asked how the Commission proposed to proceed with its work. I shall give in detail below the functions the Commission can perform under the three main heads—development, co-ordination and regulation.

In regard to development, the Commission will (i) Determine what are inter-State routes (ii) Survey the needs of each inter-State route. (The Commission may find it necessary to have a separate Research Wing for this work) (iii) Examine how best the increased requirements can be met, whether by increasing the number of vehicles or by making fuller use of existing vehicles (iv) Draw up schemes for operation of these routes by large units (v) Persuade the interests concerned to work the schemes (vi) Watch the development of the automobile industry, and offer suggestions for improving its products (vii) Assist Governments in formulating policies regarding motor fuel, including the incidence of taxation.

On the subject of co-ordination, the Commission will: (i) Co-ordinate the operation of transport vehicles with other means of transport in each area and thereby ensure that (a) there is no uneconomic competition and (b) that there is no duplication or waste of transport capacity. (ii) Regulate road services so that passengers who have to catch a train or another bus will not have to wait for long.

Reluctant States

As for regulation, many States have not yet been able to reach agreement with neighbouring States for the operation of transport vehicles on inter-State routes. To encourage such agreements, certain principles were approved by the Transport Advisory Council at its last meeting in February 1956. These principles were later circulated to State Governments, but progress towards agreement has been unsatisfactory. The States which have not yet come to any agreement are Madras—Andhra Pradeash: Andhra Pradesh—Mysore;

Mysore; Orissa-Bihar; Orissa-Andhra Pradesh; Rajasthan-U.P.; Delhi-U.P.; Delhi-Punjab; Madhya Pradesh-Bombay; Madhya Pradesh-U.P.; Madhya Pradesh-Rajasthan; and Bengal-Bihar.

It will be one of the first tasks of the Commission to assist these States to enter into satisfactory reciprocal arrangements for the operation of transport vehicles on inter-State routes. If in spite of its efforts the results are not encouraging, the Commission will itself have to enter the field and regulate the operation of transport vehicles on such routes by fixing, from time to time, the number of vehicles that should ply on each route, and by allocating a quota from that to each State concerned, it will also settle disputes in connexion with inter-State traffic.

I visualize two major obstacles to the Commission's success—the reluctance of States to part with power, and an even greater reluctance to surrender any revenue. The Centre certainly has a strong case for pushing its schemes through so as to create the required transport capacity in the national interest, but a great deal of patience and persuasion will be needed to ensure dividends in this great venture.

Going Too Far

It has been urged in some quarters that, inter-State trade and commerce being a Central responsibility, transport must necessarily fall in the same sphere and, therefore, road transport should be controlled directly by the Centre. The Commission, according to these quarters, should not act merely as an advisory or planning body, but should take over the functions of RTAs and STAs in respect of the inter-State operation of vehicles.

That is easier said than done. Imagine the huge set-up needed to perform these functions. The commission will need to have dozens of offices all over the country to receive and scrutinize applications, grant permits and administer the operation of vehicles once permits have been granted. There will have to be an organization parallal to existing RTAs which, of course, must continue for the purposes of transport operations within the States. Will the cost involved in such a set-up be justified, and even so, from where would the money come?

At present, taxes on motor vehicles are collected by the States, and from the revenue thus derived they finance the administration and the construction and maintenance of roads. Once the Centre takes over the administration, it must

(*Contd. on page 10*)

DISCUSSIONS AND CONCLUSIONS OF THE XITH ITALIAN ROADS CONGRESS—MAY 1957

(*Continued from May 1958 T.C.M.R.*)

Intersections

INTERSECTIONS constitute particularly dangerous areas for road traffic and this is well attested by the statistics.

To such an extent is this true, that one of the basic characteristics of the most important roads consist precisely of the type of control employed for crossing the road at intersections.

In the United States, for example, the following definitions are employed:

Expressway: This term relates to a road (with the streams of traffic moving in opposite directions separated from one another) for through traffic, to which entry is restricted or is not allowed, and, in the majority of cases, with intersections at different levels.

Freeway: This is an expressway with full control of access.

Similarly, in Italy, one of the characteristics of motorways is the absence of intersections at the same level, as is evident from the definition of a motorway laid down in the Highway Code now in course of preparation.

In the same way, the setting up of "Stop" signals on side roads, which has a tendency to become widespread, is based on the idea that particular care must be exercised when entering main roads.

In Germany, a good practice for motorways where there is no control system at the intersections, is the use of accelerating and decelerating lanes, to enable vehicles to enter and leave the motorway without disturbing the flow of traffic moving along it.

If, in practice, certain rules for motorways do exist, nothing has so far been carefully defined; particular care must be taken to ensure that there is good visibility for a sufficient distance at the approaches to intersections, and the lay-out should be so designed that it compels a driver who wishes to enter a road which is carrying heavy traffic to move at a slow speed and not enter the main road at right angles.

At this point, attention should be drawn to the fact that although in the case of newly constructed roads it is possible to prescribe standards which must be complied with immediately, for roads already in existence it is necessary to carry out a gradual improvement, giving priority to the "Black spots".

These arrangements should examine the construction or the reconstruction of houses in the vicinity of the intersections, the construction whenever possible of channelising islands, the establishment of roundabouts, the construction of underground or overhead passages when the traffic density is too great, the establishment whenever possible of lanes for traffic moving at different speeds, those reserved for slow moving traffic being at the edge of the road (for example, the Viale Zala at Milan), etc. In addition, particular attention should be paid to traffic signals. Lastly, it must not be overlooked that in regard to traffic on urban thoroughfares the greatest importance attaches to pedestrian crossings and the maximum care should be devoted to providing signals for these crossings.

Surfacings

The design of surfacings should be closely associated with the study of the soil.

It is advisable to emphasise that a careful study of the composition of the soils and of the characteristics to be required of the soils after they have been compacted, is a matter which concerns all sur-

facings, whether made of earth which has been given a simple surface treatment or of bituminous compositions or of concrete.

The question of the thickness to be adopted for certain types of surfacings must be given careful study and form the subject of standard specifications which are open to revision as a result of progress made in researches in this field.

It is advisable to point out that there is not a single set of criteria to be followed in the calculation of the thickness of surfacings, but that the criteria vary with the type of surfacing. In particular, they are different for rigid pavements and for flexible pavements.

In this connection, it should be recalled that standards are already in existence in various countries for the surfacings of aerodrome runways; the I.C.A.O. was desirous of giving suitable indications to enable standardisation to be effected at international level and asked the P. I. A. R. C. to study this problem; this question is being investigated at the present time by a special Technical Committee.

While awaiting for final conclusions to be reached, this Committee has suggested that for the moment the formulas which refer to the "modulus of reaction" should be retained for the determination of the thickness of rigid pavements, while the suggestions of the U. S. Corps of Engineers, which are based on the measurement of the C. B. R., should be employed for flexible pavements.

It is readily understandable that, even if they are confined to the superstructures, care must be exercised in publishing standards, which should be in the nature of guides and, in any event, liable to periodical revision.

In addition to the thicknesses, attention must, of course, be given to the composition of the mixtures to be adopted for the construction of the superstructures. As far as these are concerned, it is not a difficult matter to draw sufficient data from current experience and the technical literature to enable useful standards to be published. In this connection, it should be recalled that specifications have already been drafted and approved by the Roads Committee of the T. C. I. containing suggestions regarding the construction of ordinary water-bound macadams or surface-dressed water-bound macadams, as well as macadams consisting of mixtures (open, semi-open and closed) and those prepared with asphaltic powder.

Furthermore, a number of large American organizations such as the Asphalt Institute, the American Concrete Institute and the A. A. S. H. O., etc., have given information on this subject, in addition to those that are valid in several States, and it is possible to extract useful material from these recommendations.

In studying surfacings, consideration must also be given to the suitability of the surface for obviating slipperiness and for reducing the cost per veh/km of the distance covered. All the various aspects of traffic dangers must, of course, be considered, as well as the colour of the layers; similarly, whatever contributes to good visibility in daylight and during the hours of darkness must be taken into consideration.

Finally, in any standard specifications relating to surfacings, a reminder should be included on the need to have regard for the choice of the surfacing to be adopted, to the "cost of the road", understood as the present value of the road, that is to say, as the capitalisation of the cost of contruction, the cost of repairs and the cost of reconstruction at the end of the useful life of the road.

All the variables that have been mentioned must naturally be related to the present traffic density and that forecast for future years, as well as to the design speed it is deemed advisable to adopt for each road.

Engineering Structures

Two fundamental aspects must be considered as far as engineering structures are concerned, that is to say, the dimensions that must be given to such structures in order to avoid bottlenecks in the traffic and the calculation criteria which should be followed in drawing up the plans.

In view of the fact that this National Congress should deal with problems on a general level, and not with exact numerical details, since such matters will be investigated, if necessary, by the Drafting Committee which is to prepare the draft of the standards, it is deemed advisable to restrict our remarks to an indication of the directives on which these standards should be based.

In substance, these directives should be as follows:

(a) to maintain the width of the carriage-way;

(b) to reduce the width of the central reserve separating the streams of traffic—without, however, eliminating it altogether—on roads constructed with uni-directional traffic lanes.

If this reduction results in the elimination of the hedge, the dazzle which makes driving dangerous should be obviated by arranging for a system of lighting to be installed on the bridge and on the sections of the road forming the approaches to it; if such an installation should present any difficulties, the central reserve separating the lines of traffic should only be reduced to the limit necessary in order to retain the hedge;

(c) the width of the side verges might be reduced by ceasing to regard them as a parking space for vehicles; if a widening of the carriage-way in the distant future is to be anticipated, the width of the verges remaining must be such as to enable that widening to be made;

(d) consideration of the possibility of a subsequent widening of the road must also serve as a guide in the planning of other engineering structures (retaining walls, culverts, etc.). These engineering structures must not make such widening too difficult or expensive.

As regards the loading conditions to be taken into consideration when calculating bridges, two standards (No. 6018 and 772 dating from 1945 and 1946, respectively) published by the Ministry of Public Works are still in force at the present time; these standards specify loads which vary in accordance with the type of traffic (heavy, medium and light). A similar circular letter from the Ministry of Defence fixes in the same way various loads for main roads, secondary roads and minor roads.

The criterion of a distinction between different types of roads is a logical one, and it is advisable to retain it, but the criteria on which such distinction is based must be clearly defined. This should be explicitly stated in the Highway Code now in course of publication. Attention should be drawn to the importance that military vehicles present for engineering structures, and that the forecasts by the Ministry of Defence, regarding the vehicles it is anticipated will be constructed in the near future, should be taken into consideration.

As regards roads which are not of interest to the military authorities and over which it is predicted that no army convoys are likely to pass, save in exceptional circumstances, plans could be drawn up, taking care to check that the loads specified by the Ministry of Defence, without imposing stresses below the safety limits, could not cause breaking of the structure.

At the conclusion of the Conference, the general meeting of the members of the Italian Committee was held at which M. Rumpler was present and kindly consented to address the meeting.

(*Concluded*)

(*From*: "*Bulletin DeL' Association Internationale Permanente Des Congres De La Route*" *No. 148*).

'WET MIX' SPECIFICATION USED IN LANCASHIRE PREMIXED WATER-BOUND MACADAM

DETAILS of the premixed water-bound macadam ('wet mix') used by the Lancashire County Council were given at an Institution of Highway Engineers' symposium by Mr. James Drake, B. Sc., M.I.C.E., M.I.MUN.E., F.INST.H.E., the county surveyor and bridge-master.

The following is the specification adopted:

'Where shown on the drawings or directed by the engineer the foundations of the carriageways shall consist of premixed water-bound macadam, as specified below, laid with an approved mechanical finisher in layers not exceeding 4½ in. thick after compaction. It shall be well compacted with an 8-10-ton steel-tyred roller or, where directed by the engineer, a 2½-ton vibrating smooth-wheeled roller, to the satisfaction of the engineer.

'The material shall be loaded into lorries at the mixing plant by means of a chute and not dropped into the lorry from the hopper, the lorry shall be uniformly loaded in height for its full length and width to prevent segregation, and material shall be sheeted over immediately after loading and during transport to prevent any variation in moisture content.

'The aggregate shall be either limestone or slag and shall comply with the requirements as defined in B. S. 802; paragraph 3.

'The material shall conform to the following gradings: for thicknesses over 4 in. compacted thickness grading "A" and for thicknesses not exceeding 4 in. compacted thickness grading "B".

Sieve size (B. S. 410)		Percentage by weight passing "A"	"B"
2½ in.	...	100	100
2 in.	...	95–100	100
1½ in.	...	80– 95	95–100
1 in.	...	60– 80	80– 95
3/4 in.	...	50– 70	60– 80
1/2 in.	...	40– 60	50– 70
3/8 in	...	35– 50	40– 60
3/16 in	...	20– 35	25– 40
No. 7 mesh	...	10– 25	15– 30
No. 36 mesh	...	6– 15	6– 18
No. 200 mesh	...	3– 7	3– 3

'The percentage passing a No. 200 mesh sieve shall not exceed half the amount passing a No. 36 mesh sieve.

'Water shall be obtained from approved source and shall be free from organic or other impurities.

'Mixing shall be carried out in suitable paddle mixers.

'The amount of water to be added is dependent upon the climatic conditions and the time of the year the material is laid and will be varied only on the direction of the engineer. For slag this shall not be more than 5 per cent by weight of mixed material and for limestone it shall be between 2½ and 4 per cent.'

Mr. Drake commented: 'wet mix' has been used successfully as a road base in place of pitching by the county council since 1952. Aggregates used have been blue and white limestone and slag. Dry densities obtained, after compaction, are in the order of 135 lb cu. ft. to 150 lb cu. ft.

Rate of spread in 6 in. compacted layers is 3.3 yds to 3.4 yds per ton.

Considerable experimental work has been carried out on 'wet mix' prior to and since its use as a road base, this being confined to limestone aggregates.

The findings from such work and from practical use of this material are given under the sub-heading of 'General Conclusions' at the end of this Paper.

A recent comprehensive test carried out which is of interest was the comparison of the compactive effort of a plate type of vibrator and a nine-ton three-point smooth-wheeled road roller, when it was found that better results were obtained with the nine-ton road roller. The reason for this is that to achieve satisfactory compaction of 'wet mix' a compressive rather than a vibratory action is required, as the fines are already distributed throughout the mix, and the vibratory action tends to disturb this distribution upsetting the balance of the mix.

This does not mean, however, the exclusion of the use of a small vibratory roller in restricted areas not suitable for the heavier roller, as this is the only method of obtaining a reasonable state of compaction.

The care on the control of water added for mixing when limestone aggregate is used is a very important factor in the four months November to February, as, should the water content exceed the 'optimum' due to inclement weather when being laid, there is little chance of natural air drying to reduce the water content and, coupled with the possibility of frost action, the material becomes spongy, there is risk of failure from traffic action.

On recent work carried out over 4 in. thick, with material graded 2½ in. down, it has been found that incorporating the larger size stone does tend to greater segregation and preference is now given to using the smaller grading 2 in. down.

General Conclusions:

With the experience gained in Lancashire by the use of 'wet mix' over the last few years, the conclusions reached are as follows:

(1) As a base to a road in place of pitching, it fulfils the requirements. The dry densities obtained are approaching that of concrete but density when using slag is dependent on the quality of the slag, i.e., whether mainly good, sound slag or containing excess of honeycomb material.

(2) Suitable aggregates are slag, blue or white limestone (granite has not been used).

(3) The water content for mixing in the case of limestone is critical. For winter working and in inclement weather 2½ per cent to 3 per cent should be used; for summer working, not more than 4 per cent. Additional water if required can always be applied by sprinklers from the roller.

(4) Segregation does occur but is mainly caused on loading into the lorry at the mixer rather than during transit.

(5) Back blinding behind the Barber-Greene is not normally necessary, rolling will effectively produce the required finish.

(6) It can be laid by hand successfully in places not accessible to the Barber-Greene, but has a tendency to segregate. It should be mechanically laid wherever possible.

(7) Speed of laying is dependent on supplies. Maximum laid by one machine in one day to date is 482 tons.

(8) Traffic can be allowed on new work immediately after rolling and scatter will not normally occur except under very rapid drying conditions.

(9) To prevent wet conditions affecting limestone 'wet mix' the roller should be kept close up to the Barber-Greene to compact the material as soon as laid.

(10) The base course of tar macadam or bitumen macadam can be laid immediately after the 'wet mix' has been laid and rolled.

(11) The effect on the grading of the material due to rolling is less severe on limestone than slag, limestone showing an increase of 5 per cent due to crushing on the middle range of the stone size and slag 6 per cent, but in both cases this is not detrimental to stability.

(12) On trunk and Class I road, it should be laid 8 in. thick, in two 4-in. layers, on other roads 6 in. thick.

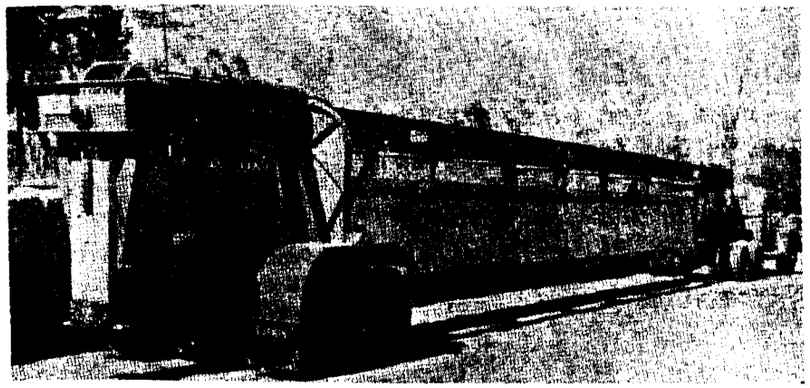
For the Preston By-pass motorway, 9 in. is specified in two 4½ in. layers. (All these dimensions are after consolidation.)

(*From*: "*The Surveyor and Municipal and County Engineer*," *April 12, 1958*).

HERE AND THERE

1. TRAILER FOR CONCRETE BEAMS SELF-LOADS

● A straddle trailer has been designed to haul large concrete beams from plant to projects. The trailer is built to load, carry and unload (without additional equipment) up to 70 ft lengths of prestressed concrete beams. Each beam can



be 4½ ft high by 16 in. wide with a weight of about 20 tons.

Since the prestressed beams must be handled delicately, dual rubber-tired wheels actually straddle the concrete beams. After pins are inserted in each end, the hydraulic lift loads the sensitive cargo automatically.

The trailer is about 80 ft long and weighs 10 tons. The outstanding feature claimed for the machine is its ability to self load and self unload. Neither the hauler nor the manufacturer needs to maintain any other beam loading equipment in the casting yard or at the delivery site.

(*From*: "*Engineering News-Record*," *March 27, 1958.*)

2. ADVANCED PERMANENT WAY TRAINING SCHOOL AT POONA RAILWAY BOARD DECISION

● THE Railway Board has decided to set up an advanced Permanent Way Training School at Poona and the Central Railway has been authorised to make the necessary arrangements.

The school is being set up to provide advanced training in the maintenance and construction of railway track to engineers and senior inspectors of the Indian Railways and also engineering officers and inspectors of other countries in the E. C. A. F. E. region.

The training is expected to lead to greater safety, efficiency and economy and result in high level track maintenance, which is becoming very essential with the fast speed and increasing density of traffic on the Indian Railways in the future.

An instructional film on the proper maintenance of railway track is also under production, and when completed it will be used widely for training purposes.

("*Press Note*," *May 22, 1958.*)

3. FINDING THE RADIUS OF AN EXISTING HORIZONTAL CIRCULAR CURVE

● PHILIP A. Latimer* — The article, "Interpretation of Deed Words," Surveying and Mapping, April-June 1957, pages 159-161, is very interesting reading to me.

Beginning at point B the above deed reads: "due West 1320 feet; thence, due North 2640 feet; thence due East 1320 feet; thence, due South 2640 feet....." Hasn't the engineer forgotten to allow for the convergence of meridians? I realize that the problem, as to point B being 11 feet out, is a question of the difference between the azimuth brought in from the line C 31-C 32 and the true north.

Now, I would like to offer a suggestion as to the solution of a problem which is apt to occur more and more frequently as new highways are built on new locations.

Suppose that we are running out on the ground an old deed line which now crosses a curve of a new highway, and it is desired to ascertain the degree of curvature or the radius of curvature of the new centerline. (See Fig. 1.)

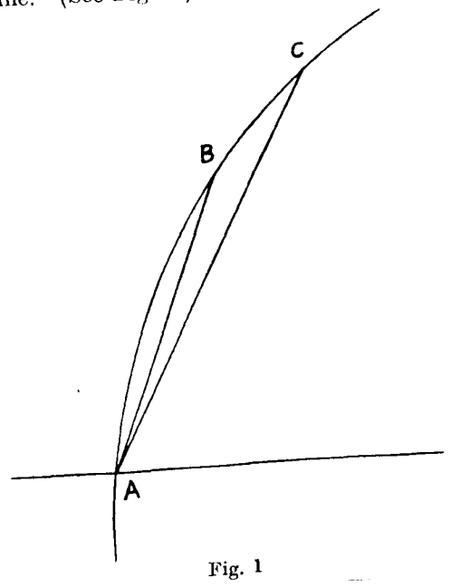


Fig. 1

Lay off a chord (AB) of length 67.70 feet and measure the middle ordinate. The degree of curvature will then be 10 times the measured middle ordinate. As a check, lay off the chord (AC) of length 95.75 feet and measure the middle ordinate. The degree of curvature will then be 5 times the measured middle ordinate.

Editor's Note:—When this letter was received, in July 1957, the editor became curious as to the relationship between this method and the one published in Surveying and Mapping, January-March 1956, Vol. XVI, No. 1, page 82, and undertook to experiment a bit. He kept coming up with certain small discrepancies—so small as to be of little practical importance, but disturbing nevertheless—and wrote to Mr. Latimer and requested a clue as to how the formulas had been derived.

It then developed that this is an approximate method, close enough for many practical purposes, to be sure, but becoming increasingly loose as the degree of curvature increases, or the radius of curvature decreases.

The derivation of the formulas** is given below. (See Fig. 2).

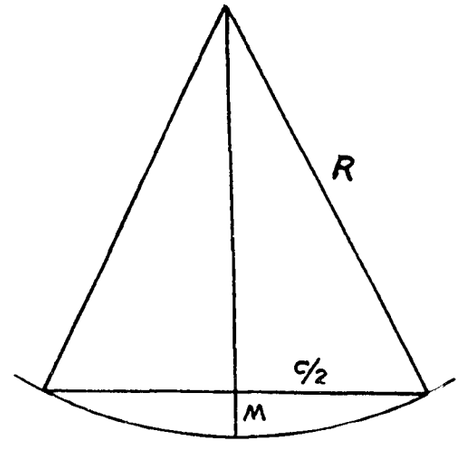


Fig. 2

*Route 2, Box 3, Edgewater, Md.

** This derivation was checked by Cecil F. Ellingwood, Coast and Geodetic Survey, who is also an instructor in Route Surveying at the U. S. Department of Agriculture Graduate School.

From Figure 2 it is obvious that

$$R^2 = (R-M)^2 + (C/2)^2$$
$$= R^2 - 2RM + M^2 + C^2/4$$
$$2RM = M^2 + C^2/4$$
$$R = M/2 + C^2/8M$$

Neglecting the small term, we have

$$R = C^2/8M \text{ (Approx.)}$$

$$D \text{ arc} = 5729.578/R = (5729.578 \times 8M)/C^2 = 45836.624\ M/C^2$$

If $45836.624/C^2 = 10$, $C = 67.70$, and if $45836.624/C^2 = 5$, $C = 95.75$.

(From: "Surveying and Mapping", January-March 1958).

4. MARRIED CONDUCTRESSES TO GO

● MARRIED women will no longer be employed as conductresses on Dundee Corporation buses after the holiday period, which ends in September. This was unanimously agreed by the Transport Committee on April 15. The decision affects 20 of the 86 conductresses. At a subsequent sub-committee meeting the transport manager, Mr. W. L. Russell, explained that from information supplied by the Ministry of Labour there was a potential supply of 1,000 men suitable for recruitment by the department. In 1953 it was decided that the number of women employed should depend on the availability of suitable male labour.

(From: "Modern Transport," April 26, 1958).

5. ECONOMICAL BEAM TESTING MACHINE

● BUILT for Lloyds British Testing Company, Limited, Low Walker, Newcastle upon Tyne, by J. Samuel White and Company, Limited, Cowes, Isle of Wight, the beam testing machine shown in the accompanying illustration has the double advantage of being economical in first cost, and simple to use and maintain. It will apply loads of up to 200 tons to beams with maximum dimensions of 39 ft long, 5 ft deep and 4 ft wide.

The machine is based on a fabricated steel box girder 46 ft 6 in. long, made from two 40 in. by 12 in. broad-flange rolled steel joists, with 1 in. thick steel plates welded to the top and bottom flanges. This girder which is supported at one end by a hinged pivot and at the other by a hinged and sliding pivot, is partly sunk in a pit for convenience of access to the beam under test. No load other than the deadweight of the machine —about 30 tons, without the specimen—is carried by two simple foundation pads.

Test loads are applied by two 100 ton hydraulic jacks mounted in cast-steel bolsters below the main girder, the bolsters being fitted with small wheels running on the upper side of the girder flange, so that the jacks can be positioned to apply the load as required. When the jacks have been moved to their loading position, the bolsters are clamped, and the jacks, acting vertically downwards, transmit a load to cross beams lying at right angles to the main girder. Tension bars working in slots in the ends of the cross beams connect them to similar beams resting on the specimen to be tested. Loads are thus applied to the specimen, and hydraulic capsules between the jacks and the lower cross beams give direct readings in tons of their magnitude. A variable-delivery pump supplies hydraulic fluid at a maximum working pressure of 6,000 lb per sq. in.

Two hydraulic jacks, two load capsules, and a simple arrangement of beams enable a load of 200 tons to be applied to a specimen beam of any length up to 39 ft, and up to 5 ft deep.

For loading beams at the neutral axis special trunnions are mounted on the main loading girder and on the underside of the top cross beam. These engage with pins attached at the neutral axis of the specimen.

(From: "Engineering", April 18, 1958.)

6. NEWCASTLE PROPOSES TRAFFIC ENGINEER

● A special committee set up by Newcastle upon Tyne City Council to deal with traffic problems in the city, has issued a report on its findings. The committee recommends the appointment of a special traffic engineer; the abolition of right-hand turns in the city centre; the provisions of light-controlled pedestrian crossings; all car parks to be made free; extension of "No waiting" and "One way street" orders; and the formation of a new traffic committee with wider powers. Another recommendation is that the Cowen Monument in Westgate Road should be moved to facilitate the re-siting of bus stops.

(From: "Modern Transport," April 26, 1958).

7. PLAIN WORDS

● IF you are an engineer, are you one of those who first set foot on the path to your career by wanting to be an engine-driver? Or, were you so good at mathematics and physics that a friend of your father said you would make a good engineer? Or, perhaps you were so hopeless at everything that your father said "He'll have to go in for engineering." As all three types seem to be able to do well, provided they have the human qualities and character which are essential to success in the profession, it really does'nt matter now how you started. What does matter to-day, I am sure, is whether future engineers of all three types should be given practical training in the shops.

There seems to be a sharp division of opinion between those who hold that some practical training is essential for every engineer, and those who believe that the young engineer of high academic qualifications who will probably go in for research should not waste time on the shop floor. The Conway Committee's report to the Institution of Mechanical Engineers on this subject of practical training, which was reported in last week's issue of Engineering, makes a definite recommendation in favour of such training. The only concession they would allow is for the trainee to specialise towards the end of his training; the future research engineer, for example, would spend little time in the shops and more in the test and research departments.

I have yet to meet someone who would allow the research engineer to dispense entirely with practical training. May be there are such people, but they must be in a minority. In any case, I cannot agree

with them. Engineering is a practical art; it is the economic application of scientific research, and if the engineers who do the research haven't the faintest idea how the research has to be applied, they will be only partly effective. No one is asking them to become skilled mechanics, but they ought to know what the mechanic does and how he does it. It is lack of practical experience, I think, which has reduced the contribution made by architects of this country. Why don't architects lay a few thousand bricks, mix concrete, and practise the art of building for a short time in their youth? They would be much better architects if they did.

In some shops, I hear, there are difficulties in arranging for apprentice engineers to have practical training. Separate training schools help to get round these difficulties, but we ought to resist this trend. Only in the production shops can the engineer in training gain an understanding of the chief function of his profession. He will have plenty of time after that to wash his hands and scrub his finger nails.

(*From*: "*Engineering*", *April 25, 1958*).

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8. BACK TO THE BICYCLE

● THE growth in the number of privately owned cars, motor cycles, and scooters, reflects the rise in the standard of living to some extent, but persistently rising bus fares have driven more people, who would otherwise never have thought of it, to investigate other modes of travel, even down to the humble push bicycle. On this point, I myself enter the witness box. Until the present bus strike, I had accepted rising fares with fatalistic groans, but the diappearance of the buses from the roads has induced me to get out my old bicycle which I have never before used in London. The experience has not been painful. It has been exhilarating. It has led me to discover that bicycling is not only infinitely cheaper than buses (and taxis!) but is, at least in central London, quicker because, while traffic blocks slow buses and taxis to a crawl, with a bicycle you weave your way to the head of the traffic jam and are off at the first green light. For bicycling in winter's rains and snows I propose to buy one of those zip-fastened suits, and ten gallon hats, affected by Winston Churchill during the war. Nor do I expect to be an object of curiosity. I anticipate that thousands will do the same, to the profit of their purses and their waist lines.

(*From*: "*The Eastern Economist*," *May 23, 1958*).

INGENUITY

Elderly lady: "*Isn't it wonderful how these service station people know where to set up their pumps to get gas!*"

AMBITIOUS

Wanted: *A secretary who looks like a girl, thinks like a man, acts like a lady and works like a dog.*

CURRENT LITERATURE

ABSTRACTS

IN-SITU MEASUREMENT OF THE DYNAMIC PROPERTIES OF SOIL BY VIBRATION METHODS: Ronald Jones, Geotechnique, The International Journal of Soil Mechanics, Vol. VIII, March 1958, The Institution of Civil Engineers, Great George Street, London, S. W. 1.

THE Paper describes vibration methods which have been used to obtain the dynamic properties of soil in situ from measurements made at the surface.

Part I of the Paper considers the propagation of surface vibrations over test lengths of about 50 ft. It is shown that the dynamic shear modulus, and the form if its variation with depth, can be ascertained from measurements of the phase velocity of the surface vibrations within the frequency range of 35 to 400 c/s. The relation between phase velocity and frequency enables the depth to be found at which there is a marked change in elastic properties such as at a transition between clay and gravel.

In Part II of the Paper, a method is described for obtaining the dynamic shear modulus of the soil from the resonant frequency of a mass vibrating perpendicularly to the surface. This method enables localized measurements to be made which may be used to supplement the average data derived from the method described in Part I.

ON THE PRACTICAL CALCULATION FOR BOX GIRDER BRIDGE, Transactions of the Japan Society of Civil Engineers, No. 49, October 1957.

A method is presented for the practical calculation of box girder bridge having two main box girders. The important characteristic in such structure is, moreover, made clear.

Considering on common action between sway bracing and deck in order to define its equivalent rigidity, two kinds of useful formulas corresponding to different loading conditions are introduced.

According to above consideration, we can give a criterion for applying the bending torsion theory to the box girder bridge wherein the cross-sectional shape is assumed to be invariable; and then it is sufficiently concluded that general composite box girder bridge with narrow width such as King County can satisfy this condition.

EXPERIMENTAL STUDIES ON PRESTRESSED CONCRETE PAVEMENT: Transactions of the Japan Society of Civil Engineers, No. 49, October 1957.

A prestresssed concrete pavement slab of $10 \times 300 \times 1200$ cm was fabricated to obtain detailed informations useful for building the prestressed pavements in fields.

The slab was prestressed up to 17 kg/cm^2 only in longitudinal direction by four high strength bars of diameter 17.4 mm.

The stress distributions in the slab after the transfer of prestress were measured by SR-4 gauges and whittemore strain-meter and compared with the theoretical analysis. A small-scale of loading test was also carried out. The subgrade friction test was made by using the precast slabs of $8 \times 80 \times 80$ cm and the theoretical consideration of the effect of subgrade friction on the loss of prestress was presented.

LATERITE SOILS AND THEIR ENGINEERING CHARACTERISTICS; K. S. Bawa, Journal of the Soil Mechanics and Foundations Division, Proceedings of the American Society of Civil Engineers, Paper No. 1428, November 1957.

LATERITE soils are tropical deposits occurring generally as residual surface deposits. This Paper gives a review

of existing literature concerning the origin, distribution and physical properties of these soils and in addition includes an evaluation from a civil engineering point of view. The information presented is of considerable importance for the preliminary planning and design of engineering structures in laterite soil regions.

AERIAL ROPEWAY DEVELOPMENT: R. H. T. Mackenzie, The Overseas Engineer, May 1958.

THIS article gives a few instances of the many applications of aerial ropeway transport. Agricultural produce, refuse, packaged cement and bulk minerals have been referred to, but oil in drums, logs, explosives, tools and implements, manufactured goods of every kind and passengers are being increasingly transported in almost every country at haulage costs considerably below those of any other system.

Over 75 per cent of the British industry's turnover is export business. This high percentage has been reached because manufacturers realize that every ropeway, whatever its length or capacity, must be tailor-made for the job and must include all the ancillary equipment necessary for it to function as a completely integrated installation. Thus, means may be required for collection of the material to be carried, for weighing it, storing, screening, loading, unloading, or distributing it from the main unloading terminal to various points. All this necessitates complete data, close liaison with suppliers of ancillary equipment and meticulously accurate design.

UNDERESTIMATION

Nurse: *"Congratulations, you are the father of triplets."*

Building contractor: *"Good! Heavens! I've exceeded my engineering estimate again."*

PERSONAL & MISCELLANEOUS

Shri P. V. Divatia has taken over as Chief Engineer of Madhya Pradesh on 25-5-58 *Vice* Shri H. R. Gupta who has proceeded on leave preparatory to retirement.

* * * * *

An Organising Committee for making necessary arrangements for holding the 'Study Week' on Highway Safety in Bombay under the auspices of ECAFE towards the end of this year held its first meeting at Bombay on the 18th June, 1958. Shri J. M. Trehan, Deputy Standards Officer, Government of India, Ministry of Transport & Communications attended this meeting on behalf of the Indian Roads Congress.

* * * * *

The next Council meeting of the Indian Roads Congress will be held at Bombay towards the end of July 1958.

SELECTED RECENT LITERATURE IN ENGINEERING JOURNALS

BRIDGES & OTHER STRUCTURES

1. **Prefabrication of Bridges in Prestressed Concrete**: P. XERCASINS, *The Indian Concrete Journal, Vol. 31, No. 12*, December 1957, pp. 399-403.
2. **The Design of Prestressed Concrete Rectangular Beams**; B. A. CHOWDHARY, *The Indian Concrete Journal, Vol. 31, No. 12*, December 1957, pp. 414-418 & 413.
3. **New Ways to cut Bridge Weight lead to Record Spans**; JOHN G. HOTCHKINS, *Engineering News Record, Vol. 159, No. 19*, November 7, 1957, pp. 36-38 & 40-51.
4. **Earthquake Resistant Construction in Mexico City**; J. H. THORNBY and PEDRO ALBIN, *Civil Engineering*, November 1957, pp. 71-75.
5. **Ultimate Shear Strength of Reinforced Concrete Flat Slabs Footings, beams and Frame Members without Shear Reinforcement**: C. S. WITNEY, *Journal of the American Concrete Institute, Vol. 29, No. 4*, October 1957, pp. 265-298.
6. **Ultimate Torsional Properties of Rectangular Reinforced Concrete Beams**; G. C. ERNST, *Journal of the American Concrete Institute, Vol. 29, No. 4*, October 1957, pp. 341-356.
7. **A Critical Look at Slab Design Methods**; K. E. MCKEE and E. I. FIESENHEISER, *Journal of the American Concrete Institute, Vol. 29, No. 5*, November 1957, pp. 397-404.
8. **Temperature Stresses in Continuous Frames**: SAN HARRID, *Journal of the American Concrete Institute, Vol. 29, No. 5*, November 1957, pp. 415-420.
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10. **Prestressed Footbridge Cantilevered from an Existing Bridge**; N. A. DEWS, *Concrete and Constructional Engineering, Vol. LII, No. 11*, November 1957, pp. 373-376.
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BUDGETS AND ADMINISTRATION REPORTS

GOVERNMENT OF BOMBAY BUDGET FOR 1958-59

The following extracts have been taken from the Civil Works Budget of the Government of Bombay for the year 1958-59.

Revenue (Civil Works)

Heads		Revised estimate (Rupees in lakhs)	Budget estimate (Rupees in lakhs)
Rents		20.21	23.38
Ferry receipts		0.44	0.64
Tolls on roads		0.40	0.54
Receipts from self-supporting workshops		0.65	0.50
Recoveries of expenditure		7.90	23.97
Miscellaneous		29.66	21.65
Receipts		...	0.21
Deduct - refunds		- 0.55	- 0.18
	Total	59.71	70.71

Expenditure (Civil Works)

Heads			
Buildings			
Original Works		48.01	57.74
Repairs		*	89.80
Communications			
Original Works	*	423.47	352.72
Repairs	325.19 (Total repairs)	*	172.84
		*	2.82
Miscellaneous (Repairs)			
Establishment		218.02	210.18
Tools and Plant		52.95	53.85
Grant-in-aid		12.97	3.57
Suspense-Debit		550.00	800.00
Charges in England		...	0.06
Repayment to contingency fund		1.07	...
Deduct—recoveries adjusted in the accounts in reduction of expenditure		- 1192.61	- 1275.58
	Total	439.07	468.00

* Break-up not available.

Capital account of Civil Works outside the Revenue account

Head	Revised Estimate 1957-58 (Rupees in lakhs)	Budget Estimate 1958-59 (Rupees in lakhs)
A-Original Works		
(a) Buildings	528.07	700.99
(b) (i) Communications-ordinary	192.86	284.72
(ii) Communications-Central Aid Road Development Programme works	71.14	57.84
(iii) Add-Expenditure transferred from State Road Fund, Public Works Department	186.37	...
Establishment charges	55.14	72.18
Tools and Plant charges	15.75	20.63
Repayment to contingency fund	5.05	...
Recoveries adjusted in the accounts in reduction of expenditure	- 98.36	- 88.98
Total	956.02	1047.38
Revenue from Roads:		
Receipts under the Indian Motor Vehicles Act	31.68	20.67
Receipts under the State Motor Vehicles Taxation Act	350.00	353.19
Fees and other receipts	0.75	0.55
Collection of payments for services rendered	0.04	...
Sales tax of Motor spirit	228.00	227.65
Deduct—refunds	- 3.54	- 5.10
Total	606.93	596.96

GOVERNMENT OF BOMBAY BUDGET 1958 - 59

(A brief review with reference to Civil Works)

TOTAL revenue receipts of the Government of Bombay for the year 1958-59 are estimated at Rs 12,000.15 lakhs and revenue expenditure at Rs 12201.10 lakhs, indicating a deficit of Rs 200.95 lakhs.

Revenue expenditure on Civil Works is estimated at Rs 468.00 lakhs. Expenditure on communications (original works) comes to Rs 352.72 lakhs. The important provision included under this head are Rs 102.54 lakhs for Central Road Fund works, Rs 76.63 lakhs for road works under the West Coast Road Programme, Rs 26.57 lakhs for State roads of economic and inter-state importance. All these works form part of Central Plan for Roads expenditure. An amount of Rs 4 lakhs for roads is also being financed jointly by the Central and the State Governments. An amount of Rs 73.33 lakhs has been provided for Express Highways and an amount of Rs 60.00 lakhs for communications is being financed from State sugarcane cess fund.

Expenditure on Capital account of Civil Works outside the revenue account is estimated at Rs 1047.38 lakhs. Buildigs and communications form the main items of expenditure.

LIST OF APPROVED WORKS ON NATIONAL HIGHWAYS

Sr. No.	Job No.	Name of work	Amount (Rs in lakhs)
		KERALA	
1.	1880 KR 47	Constructing a bridge across Walayar River on Salem Cochin Road, National Highway No. 47.	0.38
		BOMBAY	
2.	1881 BM 3	Land acquisition for constructing a diversion outside Dhulia Town on the Bombay-Agra Road, National Highway No. 3.	0.78
3.	1882 BM 4	(1) Land acquisition for constructing a diversion in mile 80 of Poona-Bangalore Road, National Highway No. 4.	
		(2) Widening of the road width of the bridge across Urmadi river in mile 79 of National Highway No. 4.	0.33
		BIHAR	
4.	1883 BR 31	Earth work on the south approach in about 10 to 11 chains to the Ganga bridge near Mokameh.	8.60
		ASSAM	
5.	1884 AS 37	Metalling and Surfacing of the diversion road in miles 258 and 259 of Assam Trunk Road, National Highway No. 37 near Khowang in Silesagar Sub-Division.	1.25
		PUNJAB	
6.	1885 PB 1	Improving Geometric standards of curves in miles 198/1 and 238/1-2 of G. T. Road, National Highway No. 1.	0.36
		WEST BENGAL	
7.	1886 BG 31	Construction of a permanent bridge over the Sukhajhord on the Bagrakote-Chalsa Section of National Highway No. 31.	7.01