Transport-Communications

MONTHLY REVIEW

No. 53 September 1951

In this issue

Annual Subscription: Rs Fourteen Including Postage. PRICE RUPEE ONE
For Members of the I.R.C.: Rs Eight.
Copies can be had from the Secretary, Indian Roads Congress, Jamnagar House, Shahjahan Road, New Delhi-2.

SOME TRANSPORT PROBLEMS

(Extracted from 'The Journal of the Institute of Transport'—November 1950).

What is Integration?

IT is said that there are fashions in words, and that there is magic in words. The fashions I cannot deny, but the magic I distrust. In my time the fashionable words, in the transport industry and in other industries too—have included co-ordination, rationalisation, unification, nationalisation and, most recently of all, integration, and I suspect that we have not always been perfectly clear exactly what they mean.

Let us examine the latest word—"integration."

A dictionary definition is "the making up of a whole by adding together or combining the separate parts or elements."

What does this mean in relation to transport? Several leading officials of the British Transport Commission have publicly (and, may I say, courageously?) ventured to give their answers to this question.

Mr. R. H. Wilson, Comptroller of the British Transport Commission said, in evidence given before the permanent Members of the Transport Tribunal sitting as a Consultative Committee, on the 20th January, 1950:—

> "Integration has various aspects. There is what I call The Integration of the High Command. That has happened, with certain reservations, already. Then there is The Integration of OWNERSHIP, which is proceeding. The integration of ownership is not always absolutely essential. There is The Integration of The GENERAL PLAN. That involves experiments of various kinds, and the Charges Scheme is one of the elements there. There is The Integration of the ACTUAL OPERATION: the physical operating can begin in a very minor way already. You can have the common repair depots, but actually to begin to get the integrated system which I think is conceived under the Act I have always regarded as at least a ten-year operation. It is a fantastically large operation."

Mr. J. R. Pike, Chief Rates and Charges Officer of the Railway Executive, in a paper read before the Northern Ireland Section of the Institute of Transport, searched his chemistry books for a definition and produced that of a compound which, as he says, is a substance produced by the union of two or more substances, in such a way that the individual properties of the constituents have disappeared. One may perhaps be forgiven for wondering how useful to society would be a chemical fusion between, say, rail coaches and road coaches and whether this is really the sort of integration our Lords and Masters have in mind!

The opinion of Mr. A. B. B. Valentine, who is a Member of the London Transport Executive and has the special responsibility of the work of the commercial department which deals with fares and charges, emerges through question and answer, on the 1st June 1950, in the course of the Hearing of the London Area (Interim) Passenger Charges Scheme Application before the Transport Tribunal:—

> "Q. Would you say that you have to have equalisation of fares to get a properly integrated system?
>
> "A. Yes.
>
> "Q. In the ordinary meaning of the word 'integrated'?
>
> "A. 'Integrated' is a word which has been much abused but what I understand by it is the provision of complementary services where required. That is one of the cases where equalisation of fares is most essential."

So here is fine opportunity for controversy. If no man really knows what is meant by an integrated system of transport, how is it to be achieved?

* * *

How is Efficiency to Accompany Nationalisation?

Prior to nationalisation there were certain powerful incentives towards efficiency which developed gradually and yet so firmly that we came to regard them as natural incentives. Basically, we have had, in competition with other purveyors of transport, to satisfy our customers in order to pay our way, and we have had to pay our way in order to live. As we have wanted to live, and to live as well as we can, we have made ourselves efficient.

If we are now to adopt a new basic concept, we must also study the means by which efficiency shall be maintained. The Transport Act of 1947 has gone far to abolish this age-old incentive of competition but has not gone far enough to inflict complete regimentation upon the passenger or the sender of goods.

A certain Member of Parliament has more than once expressed in the House of Commons his view that the British Transport Commission ought to have an overriding power of direction of traffic in the national interest and that it is not in the national interest to send by road, traffic which could go by rail. One can understand his opinion, even if one does not agree with it.

Looked at in the same way, it is not in the national interest for citizens to smoke tobacco or to waste their time and money seeing films. It is not necessary for any man to have more than two suits of clothes. Water is all that is needed to quench the thirst. The operation of private cars involves waste of petrol and oil and rubber, unnecessary wear and tear of roads; many of the journeys are made solely for pleasure and could well be forbidden—most of the balance could easily be diverted to rail.

But do the inhabitants of this country wish to live on a basis of bare necessity? Do they desire the war-time "is-your journey-really-necessary?" mentality to remain a permanent feature of life in peace? My personal opinion is that it is our job as transport operators to sell the public what they want when they want it.

If a man wants to travel, encourage him. If he wants to travel by train, let him. If he wants to travel by road, let him. Wasteful? Yes, of course it is wasteful. **But what incentive would a man have to work if he were never allowed to do more than absorb enough calories to keep alive?**

* * * *

Standardisation

But beyond the mere machinery we have a further problem of ever greater significance: the human element. We owe the present quality of our transport very largely to individualism. The men who have built the structure knew on the one hand, that if they failed they lost their livelihood and, on the other hand, that if they succeeded, they would be rewarded.

Very many of them started from very modest beginnings and fought with all their might along the upward path. This applied throughout the industry but, since my own interests have been concerned most directly with road passenger transport, I would like to take as an example of the effect of highly competitive individualism, the evolution of the present-day road passenger vehicle—the motor coach.

By 1939 we had evolved a coach, which for strength, reliability, safety, endurance, and passenger comfort was the best of its kind in the world. Then we suffered a total suspension of normal advancement which lasted for nearly ten years, and we need feel no shame if American manufacturers got ahead of us.

Already, however, and despite the grandmotherly restraint of government authority in matters such as overall dimensions, we have, judging by the outstanding successes of our coaches in Continental competitions, retaken the lead in Europe. We shall retain it, so long as the powerful stimulus of competition remains.

Competition, or "the action of endeavouring to gain what another endeavours to gain at the same time," leads to much individual effort. For example, in transport, there is an urge to furnish the public with something better than is provided by any other undertaking—a more comfortable or nicer looking vehicle, a reputation for not being delayed by fog, a better laid track, a more presentable station.

* * * *

Machines, Minds, and Methods

To my mind, standardisation has great dangers. One of them is that the advantages are obvious and the disadvantages are not. There is more to be said for the standardisation of machines than of minds and methods but even then the standardisation should not go so far as to stultify progress or even to ignore local variations of conditions.

Once a widespread standard is established, whether it be material or abstract, it needs many minds and much courage to procure a change and therein lies one of its greatest weaknesses. The protagonists of standardisation of machines have a tendency to establish as a standard a machine which either suits the average conditions of usage or the worst conditions. The economics of this require the most careful investigation.

* * * *

The Personal Incentive

The question of personal incentive is one of particular difficulty in the case of such administrative workers as are included in the membership of our Institute. Leaving out of account the noble (and much to be envied) individuals who work without thought of self, there are, I suggest, four mainsprings of personal endeavour:—

(1) Fear - of punishment or want.

(2) Love of the job; a personal satisfaction in accomplishment.

(3) A desire for power.

(4) A desire for wealth.

The first applies less to-day in Great Britain than ever before and even less to our membership.

The second — the satisfaction in accomplishment - appeals to what Confucius called "the higher type of man."

The increase in the size of the operating unit carries with it, for a smaller number of people, the opportunity of greater power.

It is when we come to wealth that the difficulty arises and it is a difficulty which is common to all forms of enterprise in this country to-day. It is caused by a combination first, of the "levelling" process, secondly, the continuing reduction in the value of the pound sterling and, thirdly, the penal level of taxation.

The easiest way to explain what I mean is to take the example of the British Transport Commission—not because it is a nationalised enterprise but because of its size. Here we have an employer of no less than nine hundred and six thousand men and women.

It is probable that the man appointed to be the Head of this vast undertaking will always have accumulated a private income by the time he has reached such an exalted position. But let us assume he has not. Even in that case his gross income of £8,500 (and, remember, there is only one chance in a million of getting such a figure) is, by taxation, reduced to a net income of £3,336.

This, according to **The Economist**, had, in 1949, approximately the same purchasing value as a net pre-war income of £1,643. **The standard of living which accompanied a net pre-war income of £3,336 (or £5,130 gross, as it would then have been) would to-day necessitate a gross annual income of no less than £117,950.**

With the constantly increasing wages of the manual and routine-clerical workers, it is clear that the confiscation of up to 19s. 6d. in the pound by the State from the incomes of the higher paid brain workers is bringing about a constant reduction of possible monetary incentive. It is, in fact, becoming increasingly difficult to give any reward to those, who by hard and real effort, and the willingness to bear the burden of responsibility, desire to raise themselves above their fellows.

It is, accordingly, becoming increasingly difficult to persuade a man to accept promotion to a position which involves him in removal from one part of the country to another and in all the worry andstrain of increased responsibility.

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INDIAN STANDARD

RULES FOR ROUNDING OFF NUMERICAL VALUES

One of the earliest standards issued by the Indian Standards Institution laid down rules for rounding off numerical values. Apart from the popular practice of rounding off such values, a simple rule has been suggested for treating ambiguous cases like 1.8500, 1.4500. As the Standard deserves to be widely known extracts* are given below here with the permission of the Institution

1. Problem of Rounding.

1.1 In calculations involving numbers expressed to several decimal places it is usually necessary to follow a definite rule in "rounding off".

1.2 The rule usually followed in rounding off decimals is to keep unchanged the last figure retained when the first figure discarded is less than 5, and to increase by 1 the last figure retained when the first figure discarded is more than 5. There is diversity of practice when the first figure discarded is 5. In such cases some computers "round up", that is, increase by 1, the last figure retained; others "round down", that is, discard everything beyond the last figure retained. Obviously, if the retained value is always "rounded up", the sum and the average of a series of values so rounded will be too large; while if always "rounded down", the sum and the average of a series of rounded values will be too small.

2. Recommended Rules

2.1 In setting up rules for rounding off decimals there are three general cases that should be considered. They may be stated as follows:

2.1.1 When the figure next beyond the last figure or place to be retained is less than 5, the figure in the last place retained should be kept unchanged.

Example

1.2342	1.234	1.23	1.2

2.1.2 When the figure next beyond the last figure or place to be retained is more than 5, the figure in the last place retained should be increased by 1.

Example

1.6789	1.679	1.68	1.7

2.1.3 When the figure next beyond the last figure or place to be retained is 5, and

(a) there are no figures, or only zeros, beyond this 5, if the figure in the last place to be retained is odd, it should be increased by 1; if even, it should be kept unchanged.;

Example

1.35	1.4
1.3500	1.4
1.45	1.4
1.4500	1.4

(b) If the 5 next beyond the figure in the last place to be retained is followed by any figures other than zero, the figure in the last place retained should be increased by 1, whether odd or even.

Example

1.3501	1.4
1.3590	1.4
1.4501	1 5
1.4599	1.5

2.2 The above rules for rounding off decimals may be retained as follows:

2.2.1 The figure in the last place to be retained should be kept unchanged:

(a) when the figure in the next place is less than 5;

(b) when the figure in the next place is 5 followed by no other figures or only by zeros, and the figure in the last place retained is even.

Continued on page 17

*Copies of the complete Standard can be had from the Indian Standards Institution, 19 University Road, Delhi-8, at eight annas per copy.

INDIA'S DELEGATES IN CANADA

Montreal, August 29. Four members of a technical mission representing India's Ministry of Transport arrived in Montreal last night aboard a Trans-Canada Air Lines North Star. They were enroute to Edmonton where they will attend Colombo Plan conferences for the next two months. The group will study construction, maintenance, and snow clearance operations on Canada's roads and bridges. Delegations are also attending these conferences from Ceylon, New Zealand and Australia. Mr. Goverdhan Lall, heading the party, expressed his gratitude to the Canadian Government for the fine opportunity afforded his group to study conditions here and was very hopeful that their stay in this country would be exceptionally valuable. Seen here from left to right are: **G. H. Khan, S. L. Bazaz, M. N. Bhuyan and Goverdhan Lall.**

—*T. C. A. Photo.*

AND NOW

PRE-TENSIONED CONCRETE*

* * * * * *

UP to the present, the essential characteristics and purpose of prestressed concrete have been reasoned and defined in the following way. Concrete is a material of high compressive strength, but of low tensile strength and poor ductility. In reinforced concrete construction, the steel bars reinforce the concrete in tension and thus improve its tensile resistance. The ductility of concrete, however, remains poor. Hair cracks appear in the tensile zones of reinforced concrete structures under loads smaller than the specified working loads. In prestressed concrete, the tensile resistance **and** the ductility of the concrete are improved by the application of a **preliminary compression** to the concrete.

Prestressed concrete is generally defined as concrete in which preliminary compression is introduced in such a manner and to such a degree as to anticipate, counteract, and cancel all tensile stresses to be caused by the specified external loads. The emphasis is always laid on the improvement in the low inherent tensile resistance and ductility of the concrete obtained by prestressing process. As a secondary effect of the prestressing process it is pointed out that the steel members may be used with much higher working stresses than in ordinary concrete construction. Hence the economy in steel weight. **According to the accepted definition, theory and practice, prestresses in the steel are tensile, and prestresses in the concrete are compressive.** This process is, therefore, applied to best advantage to structural concrete members which by the specified external loads are stressed in tension, no matter whether this is due to axial loads or due to bending moments. According to the generally recognised conception, it is of no use to apply this process to structural members which have to carry loads causing compressive stresses.

* * *

In contrast to this, the novel method of construction described in this article deals with a prestressing process which applies **preliminary tension** to the concrete.

This method consists in the application of the prestressing principle to compression members, such as columns, walls, etc. According to this new process, the concrete is pre-tensioned during the application of the dead weight carried by the compressive member, to a degree which cancels all compressive stresses due to dead weight. Consequently, pre-tensioned concrete columns will carry the dead weight of heavy structures, while the concrete in the columns is not compressed. At this stage, its stress and strain oscillate round the zero mark. The whole load of the structure is taken by high-strength steel members which are stressed in compression to 40 tons per sq. in or more.

With regard to methods of production, pre-compression of the concrete, as known today, is mostly attained by the concrete taking the reaction of highly stretched steel wires. The newly proposed pre-tension of concrete is attained by the concrete taking the reaction of highly compressed steel struts, such as tubes, R.S.J.'s, box sections, or similar rigid units of high-quality material.

* * *

Pre-tensioned concrete according to this proposal may be used for :—columns and (bridge) piers, arched structures, the compression zones of beams, joists and slabs, the compression booms of trusses, compressive members cast in-situ, especially those carrying heavy dead loads.

* * *

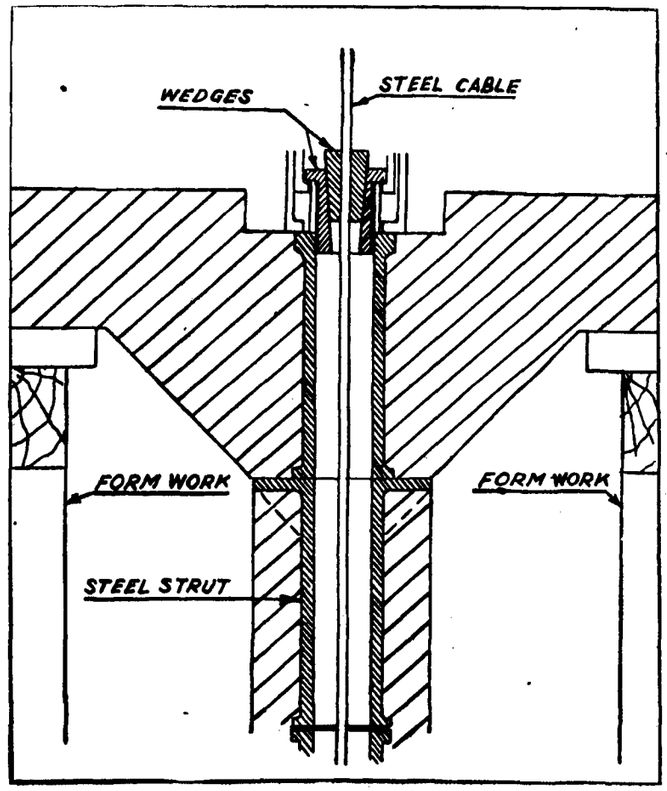
The prestressing member consists of a pre-tensioned steel cable which is the temporary carrier of the prestressing force, and a pre-compressed steel strut which is its permanent carrier. Spacers are provided between cable and strut at frequent intervals to avoid buckling of the steel strut. Both cable and strut are held in equilibrium by a locking device consisting of wedges, a sliding collar and distance pieces. The compound prestressing member may be produced in a workshop and brought to the site as a stressed unit, or it may be made up on the site. The prestressing member is embedded in the

* Extracts from an article entitled "Pre-tensioned Concrete" by Dr. K. Billig, Professor of Engineering, Hong Kong University in "Civil Engineering and Public Works Review," February 1951.

concrete column and remains in the locked position in the column during the whole process of hardening. (See Figure).

* * *

After the concrete has attained the specified strength the locking device is disengaged and the cable released. To release the cable a hydraulic jack which engages the unit is extended to take over the reaction to the prestressing force from the distance pieces which are removed. Then the jack is slowly telescoped, gradually releasing the prestressing force from the cable. The pre-compressed steel strut expands slightly, and by this movement it raises the newly-constructed concrete floor from the formwork and the scaffolding. To the same degree as the release takes place, the super-imposed dead weight of the floor becomes effective and is transferred from the formwork to the column.



By releasing the cable the floor structure is automatically stripped and the pre-compression force in the steel strut is replaced by the effect of the dead weight of the floor. The cable and end fittings are removed for re-use.

A similar arrangement of end attachments is provided in the foundation of the column and there is access to it to remove the fittings after the release of the cable. The slight expansion of the strut is transferred by bond to the surrounding concrete of the column which is thus pre-tensioned.

Finally, the hollow space inside the strut and the recess in the top face of the floor slab are filled with cement mortar or fine concrete.

This description illustrates the fact that although the concrete of the column is very highly pre-tensioned by the full prestressing force, the major part of this pre-

tension never becomes apparent as real tension. **The pre-tension is induced into the concrete simultaneously with, and to the same degree as the compression caused by the superimposed dead weight.** The resultant stress remains, therefore, at or around zero.

* * *

Arched Structures

Over thirty years ago, Prof. Melan suggested a method of pre-loading arched reinforced concrete structures for the purpose of keeping the concrete stresses low. His system specifies the use of rigid reinforcement made of structural steel which carry not only the formwork of the arch but also an amount of ballast equal to the dead weight of the arch to be erected. While the structure is erected section by section, the ballast is removed and replaced by an equal weight of concrete. Thus all stresses due to dead weight are taken by the steel and the permissible stress in the concrete may be fully used to carry the external loads. If the present method of construction is applied to arched structures it is possible to avoid the cumbersome method of applying and removing a great quantity of ballast by the introduction of preliminary loads into the steel skeleton. The working stress in the steel skeleton can be a multiple of the stress permitted previously, and in addition, the concrete obtains a specified pre-tension which also extends the useful range of working stresses in the concrete.

To construct a pre-tensioned concrete arch, a light arch skeleton of high-grade steel is erected. High tensile steel cables are placed co-axially in the structural steel skeleton with frequent distance pieces at short intervals to prevent buckling. The cables and the steel arch are pre-stressed against each other, and again the preliminary force is slightly greater than the arch pressure to be expected as a result of the concrete weight. As the casting of the concrete and the construction of the arch structure progresses, the tension in the cable is gradually reduced by releasing the jacking devices and the compression in the steel skeleton is kept constant by the increase in dead weight. When the casting of the arch is completed, 90-95 per cent of the pre-tension of the cables has been released, and the equivalent pre-compression in the steel arch has been replaced by the effect of the dead weight. After the concrete has hardened, the remaining pre-tension of the cables is released and the cables themselves withdrawn. Due to this least release—which is not balanced by the application of dead weight or super loads—the compression in the steel arch is slightly reduced and the concrete of the arch is put under tension. By a suitable design of the prestressing force this residuary tension in the concrete is limited to a safe value of, say, 150 pounds per square in.

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SUCCESS AT LAST

A year after the applications were submitted, K. W. Williamson (Coaches) Ltd., of Manchester, has been granted road service licences for five express services for workmen at Handforth R. A. F. Station.

(From "Motor Transport" May 4, 1951.)

INSPECTION OF BRIDGES

(Continued from the last issue)

Inspecting of Masonry and Brickwork Structures

THE mediaeval masonry arches are usually built of rugged and robust stones, roughly dressed with rather wide joints and not of smoothly and accurately dressed stones with thin joints which are described as ashlar masonry. Some of the elegant, neatly finished and ornamented bridges of the Adam period, mid-18th century, give the appearance at a distance of being faced with natural stone but a closer scrutiny reveals plaster work on a brick backing. A bridge inspector on making his rounds for the first time, must be prepared for surprises, since just as stonework has been most skilfully imitated in hard plaster, so have other materials been disguised to look like something else.

Probably the weakest parts of an old arch are the spandrel walls. They tend to slide outwards on the extrados of the arch vault owing to the pressure of the filling under the effect of heavy wheel loads or alternatively, if they are firmly adherent to the vault, they generate an annular crack in the latter in the plane of the back of the spandrel wall.

Wrought iron tie bolts with curiously shaped washer plates are to be seen clamping the two spandrels together. Owing to their antique appearance, one almost suspects that some of these have been inserted under the roadway at the time the bridge was built.

As to the annular cracks one is filled with wonderment at the great forces which must have been exerted in order to split so many of the bricks or stones as the case may be. They must surely be in excess of any calculated values!

The number of rings of brickwork visible on the face of an arch vault is not always indicative of the thickness of the vault since an extra ring is sometimes provided on the faces only to give an impression of great strength.

Importance of Adequate Waterproofing

Just as in the case of concrete structures, so in the case of brick and, in fact, structures of any kind whatsoever the control of water is a primary consideration.

Water in the wrong place is certain to do harm

There is often a temptation to economise on or dispense with waterproofing. Nothing could be a bigger mistake from the maintenance aspect. Water will freeze and expand, it will take into solution all kinds of destructive substances which it will distribute, it will foster the processes of decay, providing oxygen is also present. It seemingly defies gravity by climbing upwards, that is to say, by capillary action.

The drainage system of a bridge and its accompanying waterproofing should not only be correctly designed and specified but the workmanship should be beyond reproach because of the great cost of putting right any defects subsequent to construction. The inspector should therefore satisfy himself that the drainage system, were provided, is in good working order and where not provided he should consider making suggestions for remedying the deficiency.

It would appear that foreign rock asphalte applied hot in two 3/8 in. layers is still the most reliable waterproofing membrane when laid by specialist labour. It is expensive but in the long run is probably as cheap as any other variety of waterproofer.

Before applying remedial waterproofing to the outside of the wall, which is usually the work of specialists, the wall must first be pierced by pipes, known as bleeders, to free the hydrostatic pressure. It is standard practice to build weep pipes through

a retaining wall at the time of its construction and the inspector should make sure that these are free from obstruction and that any water which does issue from them can drain freely away.

Deterioration of Brickwork

Brick in bridges and particularly in tunnels is severely taxed by some such harmful influences as dampness, impurities, vegetation or heavy stressing. For buildings bricks last well but for the heavier types of engineering work they tend to deteriorate rapidly in the sense that the skins slough off and expose the granular interiors which speedily crumble. Even in parapet walls these bricks quickly disintegrate leaving honeycombs of cement mortar.

The structures examiner will find much interest in his observations of the way the various types of bricks stand up to varying conditions. There are indeed many variables in the environment which cause materials to react differently, for instance the aspect and the direction of the prevailing winds. It is frequently noticed that paint on steelwork facing south perishes more rapidly than that which faces north and the south-west or weather side of a bridge shows extensive wasting of the brickwork whereas on the opposite side there is excellent preservation.

Maintenance of Brickwork

The myriads of culverts under our roads and railways have had an almost staggeringly long life and these are built from locally produced bricks of unpretentious but durable characteristics. These culverts and small arches may have lost their original geometrical profile and their ends may be ragged, but they seldom manifest serious decay of the fabric, perhaps because the earth fill surrounding them keeps them warm and blanketed against the weather. Even when they are taken apart the bricks are available for refuse after the lime mortar is cleaned off.

Brickwork has the advantage of being easily repairable provided skilled men are employed for the job. So far as possible the new bricks should match the old remaining ones, and lime mortar should preferably be used if the old work is in lime mortar. Complete refacing is practicable in cases where the majority of the bricks have hollowed out or perished. Cavities can be repaired with new bricks and should not be filled with concrete or compo as plugs of these materials will probably fall out in course of time.

Before ordering bricks for repairs, the thickness of the existing ones should be checked.

Cement mortar rendering is a favourite treatment for spalling brickwork or for a skirting at the base of walls. Unless very skilfully done, frost gets behind the rendering and splits it off or detaches it in large sheets. In damp situations this treatment is not satisfactory, especially on old surfaces as the preliminary cleaning is virtually impossible.

Vegetation is highly destructive of brick structures. Saplings take root in the fabric or so close to it that their roots penetrate and dislodge it. Ivy does the same thing and even if rooted in the ground clear of a wall, it keeps the brickwork in a moist condition and its tendrils play havoc with the surface of the bricks by pulling pieces off it. Brambles, nettles, grasses, mosses, and other growths flourish in crevices and hold moisture in contact with the bricks with harmful effects. Lichons are not objectionable and by virtue of their various tints have a mellowing and embellishing effect.

Sociology and Bridges

It is a sure thing that if an accessible brick wall sheds some of its bricks either through damage or other causes it will not be long before many other bricks will follow them. Hence there is always a sense of urgency about running repairs so far as brickwork is concerned and they should not be postponed any longer than can be helped. Pulling out loose bricks and pitching them into a river is a distraction which cannot be resisted by many of the younger members of our civilisation and as deportation is no longer the prescribed penalty the authorities have difficulty in putting a stop to this kind of vandalism. *(Continued on page 17)*

ROADS IN THE PARLIAMENT

15th May, 1951.
Starred question No. 4145 by
Shri Jangde.

(a) Will the Minister of Transport be pleased to state how far the Great Eastern Road running between Nagpur and Sambalpur has been made a metalled road and how much of it will be metalled during this year?

(b) Is it a fact that a bridge across Mahanadi is being constructed on the road at Arang?

(c) If the answer to part (b) above be in the affirmative, how long will it take to complete the construction of that bridge?

Replyby
The Honourable
Shri K. Santhanam.

(a) The entire section of the Great Eastern Road (National Highway No. 6) between Nagpur and Sambalpur is already metalled.

(b) Yes.

(c) About 2 years.

18th May 1951.
Starred Question No. 4272 by
Shri Jangde.

Will the Minister of Transport be pleased to state whether the Government of India have constructed any national highway, roads and bridges etc., within the boundaries of the states that were merged in Madhya Pradesh?

Reply by
The Honourable
Shri K. Santhanam.

About 181 miles of the National Highways lie in these States and are being maintained at the cost of the Central Government. Such improvements as are necessary will be taken up as funds become available.

25th May, 1951.
Starred Question No. 4535 by
Shri Kala Venkata Rao.

(a) Will the Minister of Transport be pleased to state whether the scheme to divert the Madras-Calcutta National Highway in East and West Godavary districts and construct Bridges on the Gautami and Vasista branches of the river Godavari has been sanctioned?

(b) What is the estimated cost?

(c) Have the detailed estimates for the Bridge at Alamur been sanctioned and approved?

(d) Are tenders being called?

(e) What is the present stage of the work?

Reply by
The Honourable
Shri K. Santhanam

(a) Yes.

(b) About Rs. 215 lakhs.

(c) The detailed estimates have been technically approved.

(d) Tenders will be called for by the Madras Government.

(e) Preliminary Protective and training works are in progress.

29th May, 1951
Starred Question No. 4665 by
Shri G. S. Guha.

Will the Minister of Transport be pleased to state:

(a) How many miles of the projected road between Churaibari (Assam) and Agartala have been completed?

(b) What length of the road has been metalled or gravelled?

(c) How many bridges have been constructed out of the number proposed?

(d) How much money has been sent out of the total estimated cost; and

(e) How long it is expected to take to complete the road for regular motor traffic between Agartala and Assam?

Reply by
The Honourable
Shri K. Santhanam

(a) The formation has been completed in more than half of a total length of 134 miles, including 5 miles of an approach road from Dharmanagar.

(b) Seven miles from the Agartala and have been gravelled.

(c) Semi-permanent timber bridges have been constructed in the Teliamura Valley, i e., between miles 24 and 32, and ARMCO culverts in several miles at the Churaibari end. Service bridges have been constructed across streams in other parts of the road, with ferries across rivers. These service bridges are being replaced by semi-permanent timber bridges or ARMCO culverts. If the Honourable Member still wishes to know the exact number of bridges and culverts constructed by any particular date, I shall call for the information from the Assam Public Works Department.

(d) About Rs 165 lakhs upto March 1951.

(e) It is hoped that regular motor traffic will be able to use the road by the rains of 1952. It will, however, not be possible to complete all the estimated work before 1953.

29th May 1951.

Starred Question No. 4666 by
Shri G. S. Guha

Will the Minister of Transport be pleased to state :

(a) Whether it is proposed to connect the various Divisional Headquarters of Tripura State with its capital Agartala by roads running within the state ;

(b) If so, has a beginning been made ; and

(c) How long it is expected to take to complete the main roads of an internal communication system and at what estimated cost ?

Reply by
The Honourable
Shri K. Santhanam

(a) and (b) The answer is in the affirmative.

(c) Subject to availability of funds, it is proposed to construct nine internal roads estimated to cost Rs 137 lakhs roughly in a period of about five years.

13th August, 1951

Unstarred Question No. 37 by
Shri A. C. Guha.

Will the Minister of Transport be pleased to state :

(a) the amount so far spent on the Tripura-Assam road ;

(b) the staff maintained for the construction with the total monthly expenses thereon ;

(c) the length of the road so far constructed and the total length to be constructed ;

(d) when the construction was first undertaken and when it is likely to be completed ; and

(e) the total amount likely to be required ?

Reply by
The Honourable
Shri K. Santhanam

(a) About Rs 170 lakhs upto June 1951

(b) One Superintending Engineer in charge of the project with two Divisions, each under an Executive Engineer. The total monthly expenditure on staff excluding work—charged establishment, is about Rs 24,000.

(c) Formation of the road, which is 134 miles long, including 5 miles of an approach road from Dharamnagar, is nearing completion. Seven miles from the Agartala end have also been gravelled.

(d) The work was commenced in 1948. The road is likely to be fit for regular motor traffic by the rains of 1952. It will, however, not be possible to complete all the estimated work before 1953.

(e) About Rs 3.0 crores.

FIRST PRESTRESSED CONCRETE HIGHWAY BRIDGE IN INDIA

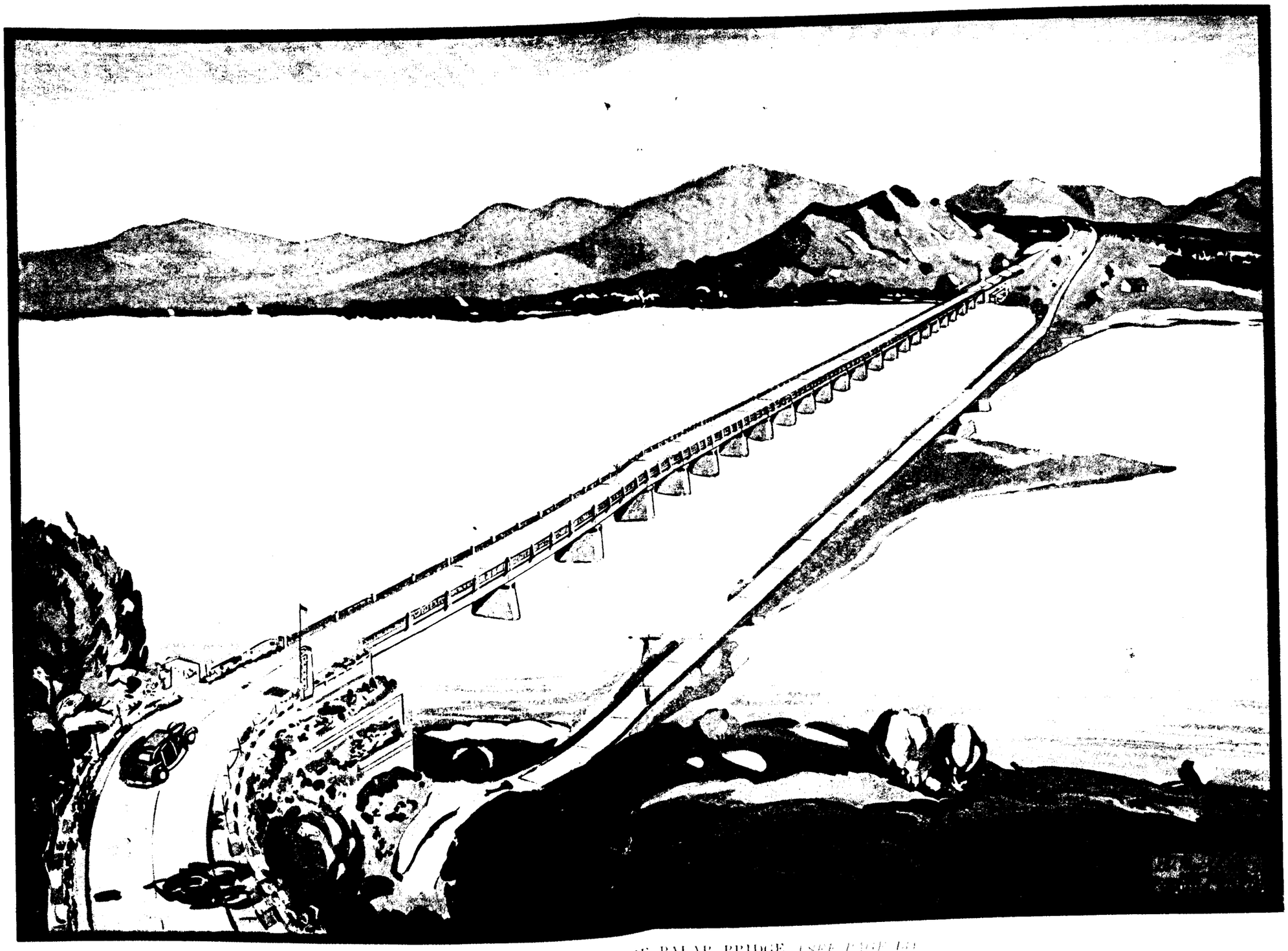
[*2,200 ft. long; Under construction*]

THE foundation stone of the first prestressed concrete highway bridge in India was laid by the Hon'ble Shri Bhaktavatsalam, Minister of Public Works, Madras on the 9th May 1951. The bridge will take National Highway 45 across the Palar river in the Chingleput District.

In requesting the Minister to lay the foundation, the Madras Chief Engineer of Highways, Shri M. S. Thirumale Iyengar, said that building of bridges across rivers and streams in India specially in the South was an ancient art. The earliest reference to this was the bridging of the gulf of Mannar for Rama and his army to cross the sea and reach Lanka (Ceylon). That was perhaps legendary, but there was historical evidence of great bridge-building activities in the last 3,000 years. Great Hindu kings had built several fine bridges and some of them still existed and were in use to this day.

A great many archmasonry bridges were constructed during the nineteenth century which might truly be denominated the "Arch Bridge" era. One of the earliest important long bridges constructed in India was across the Tambaraparni river in the South (Tinnevelly District) in the year 1843 (Palak-Kottah Bridge). This bridge consists of 11 spans of 60 ft. each. Another bridge was over the Vaigai river in Madurai built in 1889 consisting of 15 spans of 60 ft. each. This 60 ft. span was quite a large one for masonry arch work. Also, throughout the main routes in South India, there were many elliptical arches in brick with spans of 32 ft. to 38 ft. They had not only stood but were also found fit to take the modern heavy traffic. The City of Madras abounded with these old arch-bridges built in the last century across the Cooum and the Buckingham Canal. The use of masonry arch bridges had to be restricted to comparatively smaller spans, so arose the necessity for using materials of greater strength than stone and brick. This brought in the use of iron and steel for bridge structures. The impetus for this type of bridging also came from the construction of railways. The South Contributed to the development of a larger number of such steel bridges. Many different types of steel structures such as R. S. Js. plate girders, and trusses of various types with masonry as well as steel foundations were constructed. Some of these were very fine structures indeed. The limited steel production in this country and the increasing costs of imported steel, naturally, made engineers look for more economical methods of construction. Scientific advance in the search for and discovery of new techniques in the use of building materials for economy and strength led to the development of the use of concrete for bridge-building. Reinforced concrete structures used much less steel than all-steel structures. Reinforced concrete bridge construction therefore greatly developed between the two World Wars. There were many such bridges in Madras, built since 1920, for example the Tadpatri Bridge-simple T beam and slab and bow-string girder bridges across the Eluru Canal, and the Cooum, the Murat, and the Korapuzha rivers in the Malabar region. Shri Thirumale Iyengar reminded the audience that a remarkable feature of R. C. C. construction was that it was moulded at site and shaped to attain whatever architectural features were desired.

After the close of the Second World War large development programmes were undertaken throughout the World. The rapid advance of scientific research during recent years led to further economies in the use of the two building materials of the day, viz., cement and steel. Prestressed concrete design was thus developed. This was largely practised in France



ARTIST'S IMPRESSION OF THE PALAR BRIDGE (SEE PAGE 15)

and the continent of Europe during recent years, but its adoption in other countries had been slow. Though the basic idea of pre-stressed concrete was old, it was only Freyssinet of France who gave a clear conception and analysis of the technique of pre-stressed concrete in 1930 and proved the success of practical application of this principle to large structures. The adoption of pre-stressed concrete resulted in a saving of 40 per cent in concrete and 70 per cent in steel. The steel in pre-stressed concrete was used only to stress the concrete section before the live loads come into play. In consequence, steel did not undergo any deformation during the action of additional loads. Thus, the various indeterminate and erratic factors like bond and shear stresses due to the composite action of concrete and steel that developed in R. C. structures were eliminated in pre-stressed concrete. The evaluation of stresses was therefore nearer to actuals in pre-stressed than in ordinary reinforced concrete design.

Quite a few remarkable bridges had already been built in Europe. In India, two Railway bridges were recently constructed in pre-stressed concrete on the Assam rail-link.

The bridge across the Palar, whose foundation stone was being laid that day, would be the first pre-stressed highway bridge in India and one of the longest of its kind in the world.

Shri Thirumale Iyengar expressed the hope that Tatas would soon undertake to manufacture the high-tensile steel required for use in pre-stressed concrete construction and thus it would be possible to make more and more bridges of the new type in the large bridge-building programme of India.

A few salient particulars of the bridge were then outlined by the speaker. The design of the superstructure had been made in accordance with the Belgian Magnal Blaton system of pre-stressing. The bridge would consist of 23 spans of 90 ft. (clear) each. Expansion joints would be provided at 96 ft. intervals. The cross section of the four main spans girders had been designed to be 5 ft. 6 in. deep U-shape. This type of cross-section lent itself to the economical application of pre-stressing methods. The girders would rest on piers 6 ft. thick at the top and 7 ft. at the bottom, on well-foundations, which would be taken down to an average depth of 32 ft. below the river bed. The cost of the bridge had been estimated to be 21 lakhs of rupees and the work would be financed by the Government of India.

The bridge had been designed for I.R.C. Class 'AA' loading (70 tons). **The Contractors had agreed to test one girder to destruction free of cost.** This test was intended to demonstrate the margin of safety and the behaviour of the girder under working and failure loads.

—o—

HOPE ON THE ROADS

The speed with which British roads are improved in order to keep up with twentieth century progress has evoked humorous comment from a well-known overseas visitor. After travelling down the Great North Road, A. 1, Mr. Bob Hope has said, "The English have done a lot of work on it during the last 2,000 years and now it is a couple of inches wider." B. R. F. Monthly Bulletin—July 2, 1951.

(The Bulletin thinks this estimate of improvement is an exaggeration ——Ed.)

—o—

FAMOUS LAST WORDS

"If you brake carefully, worn tyres do not matter a bit".

(Continued from page 10)

Bridges, of course, exercise a peculiar fascination on people of all ages. The oldest inhabitants like to lean on the parapets and exchange reminiscences whilst the children love to climb all over and under them. The old people cause no anxiety to the custodian of the bridges but the same cannot be said of the young ones. All bridges should be made as safe as possible by providing reasonable devices to guard against accidents. Parapet copings should be shaped so as to make walking on them difficult and sheer drops should be protected by guard fences. Deep scour holes should be filled up both for the safety of the foundations and so as not to provide facilities for drowning.

Apertures in which the heads of small children are liable to become wedged should not be left open.

Barbed wire must not be used on or alongside a public highway.

The conclusion emerges that the structures examiner must be a man of ideas and imagination and should not content himself merely with a factual report on existing condition but suggestions should flow from his pen as to how the condition and conditions might be improved without great financial outlay.

—o—

(Continued from page 4)

2.2.2 The figure in the last place to be retained should be increased by 1.

(a) when the figure in the next place is more than 5;

(b) when the figure in the next place is 5 followed by no other figures or only by zeros, and the figure in the last place retained is odd;

(c) when the figure in the next place is 5 followed by any figure or figures other than zero.

2.3 The final rounded value should be obtained from the most precise value available, and not from a series of successive roundings. For example, 0·5499 should be rounded off successively to 0.550, 0·55 and 0.5 (not 0·6), since the most precise value available is less than 0.55. Similarly, 0.5501 should be rounded off as 0.550, 0.55 and 0.6, since the most precise value available is more than 0.55.

3. Explanation of Rules

3.1 Justification of the recommended method of rounding off decimals can be obtained from consideration of any large group of decimal values in which random distribution of figures occurs. It will be found that, on the average, the number of values "rounded up" and the number "rounded down" will be nearly equal.

Therefore, the sum and the average of the rounded values will be more nearly correct than would be the case if all were rounded in the same direction; that is, either all up or all down.

HERE AND THERE

1. TEN COMMANDMENTS FOR TECHNICAL MEN

1 THOU shall not follow in the dust of progressing operations, but shalt run ahead with a lantern in thy hand to reveal the way.

2. Thou shalt seek and respect the opinions of operators even unto the third helpers, for theirs is a wisdom unknown to technocrats.

3. Thou shalt determine what should be done and do it, without the necessity of others holding thy hand.

4. Thou shalt not be too dignified to shoot the bull; neither shalt thou shoot it entirely, for so is its productivity destroyed.

5. Thou shalt not forsake the ways of thy technical training, so that to thee CHO_2 cease to be formaldehyde and become sea water.

6. Thou shalt not take thy grievances and ideas first to the top, lest the bottom remove its support from under thee, saying, "We knew nothing of it."

7. Thou shalt remember that refining processes change not because of reasoning and meditation, however profound, but only by the turning of valves.

8. Thou shalt study thy conclusions, from all sides through many viewpoints, for verily, undiscovered claws may rip thy rear.

8. Thou shalt strive to make thy judgment as good as man's by experimenting, observing, recording, calculating, studying, and thinking: and having done so.

10. Thou shalt use it.

(*From "Traffic Engineering", May, 1951*).

2. ROAD TRANSPORT OF HEAVY PLANT

THE Road Haulage Association, Ltd., has issued particulars of the transport by road from Stafford to London of a very large hydrogen-cooled turbo-alternator. For this job two separate vehicles were used to carry the stator and the frame. Each of the sixteen-wheel, double-bogie well wagons used to carry these units was drawn by a heavy diesel-engined tractor.

The frame, weighing 80 tons, was 25 ft 5 in. long, and 15 ft 6 in. high when prepared for transport. The wagon on which it was carried is the only one of its kind in the country having a loading line sufficiently low to transport such a large and heavy unit by road.

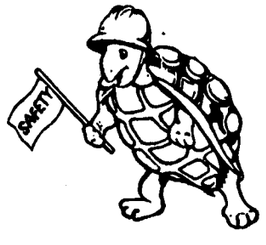
The transport of the stator, **which weighed 108 tons,** was thought to be the first occasion on which a vehicle fitted with pneumatic tyres carried a load exceeding 100 tons in weight.

(*Extracted from 'The Engineer' Nov. 24, 1950*).

3. AN UNUSUAL CLUB

A LIFE SAVING club of an unusual nature was formed in British Columbia recently. Known as the "Turtle Club", its purpose is to encourage the wearing of head protection among all workers exposed to falling objects. Motto of the club explains the name: "Shell on Head, We're Not Dead."

The only requirement for active membership is proof in the form of a



printed application completed and signed by responsible people that the applicant's life was definitely saved by wearing a hard hat. Those qualifying will be presented with a lapel pin in the form of a turtle, and a scroll setting forth the history of their case.

Eventually, the Turtle Club will become international in its scope of operations and memberships.

(*Extracted from "Western Construction" July 1950*).

4. PRIVATE CONTRACTORS CAN PAY BY RESULTS

* * *

THE critical phase of the scheme is the assessment of the target and bonus figure. The target must enable the average man to earn a bonus with reasonable effort, but too harsh a target or too small a bonus would result either in shoddy workmanship or the loss of the man's co-operation.

When a target for slab paving was first fixed, the labour costs of earlier schemes were examined, and it was found that the average output had been 1.56 sq. yds. per man-hour. The first target figure was set at 200 sq. yds. per gang per week, which is equivalent to 2.16 sq. yds. per man-hour. It was found that this target could be doubled by more than one gang, and for subsequent jobs the target has been advanced to 230 and 250 sq. yds. per week, but account is always taken of any difficulty, such as extensive cutting particular to the job in hand.

The target assessed for fixing 10 in. by 6 in. kerbs has been 80 lin. yds. per gang per day, with a bonus of 3 pence for each lin. yd. above that figure. Again it has been found that a good kerb-layer can very nearly double this target. It is interesting to note that this target itself is almost twice that laid down by the Ministry of Works in their memorandum on payment by results.

It is most important that no deterioration in workmanship should result from the operation of an incentive scheme. This has been dealt with by instructing the workmen that any shoddy work will have to be taken up and put right in the time on which the bonus is calculated. The knowledge that the correction of defective work will reduce their output has been effective in preventing any deterioration in the normal standards, and it has not once been necessary to condemn any workmanship during the operation of the scheme.

The results of the scheme have been as follows:—

Output of slab paving prior to bonussing: 1.56 sq. yds./man-hr.

Output of slab paving on bonus schemes: 4.22 sq yds./man-hr

(Total area, 6,963 sq. yds.)

i.e., output under incentive conditions is 2.7 times the output obtained without bonussing.

Labour cost of slab paving prior to bonussing including on cost) 26.07 d. per sq. yd.

-ditto- on bonus scheme (wages, bonus and on-cost) 12.96 d. per sq. yd.

Average saving on labour cost 50.3 per cent

(The cost quoted for bonus work includes no on-cost on bonus payments).

* * *

(*Extracted from 'The Journal of the Institution of Municipal Engineers— March 6, 1951.*)

[*Will a Ministry of Finance ever agree to bonuses on departmental work—Ed.*]

5. STOP PROGRESSING

ADDRESSING the Birmingham Rotary club on Monday, Mr. H. J. Manzoni, the city engineer, said the road system of this country would never be up-to-date unless the country was prepared to stop the progress of the construction of vehicles. When front-wheel brakes and balloon tyres were introduced the life of roads was reduced from 12 to two years, and when the width of lorries was increased to 8 ft. from 7 ft. 6 in., the value of double carriageways was considerably reduced. * * *

(From the "Surveyor," 16th February 1951)

6. PUNCTURE-PROOF TYRE MAKES DRIVING SAFER

A tubeless tyre which is puncture proof and eliminates danger of blow-outs is being put into production by the Firestone Tyre and Rubber Company in Akron, Ohio. The Company said the tyre removes "all hazards from any kinds of tyre failure."

Instead of a tube the tyre has an inner diaphragm which retains air even when the casing is damaged, allowing the driver to keep control of the vehicle.

(U. S. A. IN REVIEW; 16. 2. 1951)

7. ROAD SIGN DESTRUCTION

A survey by highway engineers reveals that 1,400,000 dollars (£ 500,000) is spent annually in the United States in the replacement of road signs maliciously defaced or destroyed.

Some maintenance engineers report that signs last, on the average, no longer than one or two years. A few reported sign-life in some regions as short as two or three months. States hardest hit are generally west of the Mississippi, and the damage rate is higher in areas where firearms are more commonly carried—as in much of the far west and south-west. Many state highway departments have abandoned reflectorised signs—especially those with glass buttons—because these seem to be favourite targets.

Practically all states using wooden signposts report more damage than those using steel posts. Some far western states said Indians uprooted wooden posts for firewood, and that reflectors were especially popular for saddle and belt decorations.

(From 'The Surveyor'— March 2, 1951).

8. SITING LONDON BUS STOPS

TEN Officials to Decide on Moving One Stop.

Details of the powers and composition of the Committee were given by Mr. Barnes, Minister of Transport, in answer to M. Vaughan-Morgan.

Mr. Barnes said that the Committee was appointed informally by the London and Home Counties Traffic Advisory Committee constituted under Section I of the London Traffic Act, 1924. It was composed of representatives of the Licensing Authority, the Police, London Transport, the Transport and General Workers' Union and the Ministry of Transport. Its main function was to advise on the provision and siting of stopping places for the trams and buses of London Transport in the Special Area as defined in the London Passenger Transport Act, 1933.

Mr. Vaughan-Morgan then gave the case of a bus stop in Reigate, which it was required to move 100 yards. For this, he said, the Stopping Places Advisory Committee met, three local officials were called in and seven officials from London. Was this necessary in order to move one stop only 100 yards?

Mr. Barnes said he was not aware of the particular instance but the Committee, of course, gave their advice in such cases.

9. MULTUM IN PARVO

DURING 1935-37 the construction of autobahnen resulted in decreases in ths number of persons killed on all types of roads of 34 per cent; despite an increase in the number of motor vehicles of 32 per cent. The number of accidents per million motor vehicles kms. on the new autobahnen was only 17 per cent of those which occurred on the old State roads.

On a flyover in Oregon the rate for all types of accidents fell from 6.97 per million vehicles on the original single level cross roads to 2.58 per million vehicles on the multi-level intersection.

On the Chicago Outer Drive the accident rate is 0.8 per million vehicle miles, compared with 18.9 on ordinary roads in the area.

More than half the world's lorries and buses and over three-quarters of all passenger cars are registered in the U.S.A. where there are one motor vehicle for every 3.3 inhabitants.

In China the ratio of motor vehicles to population is estimated at 9,000 to 1.

(From London Bulletin of the International Road Federation Limited, February, 1951.)

10. CONCRETE ROADWAY LAID ON SWAMP

POURED directly on the surface of a swampy bog, a cellular-concrete roadway supported a 5750-pound truck only six hours after pouring was completed. The bog was soft enough so that it could not be walked on without sinking to the waist. No attempt was made to drain the land under the roadway or to build it up with fill. Wire mesh was laid over the marsh and two rows of logs served as forms for the shoulders. The cellular concrete, which expands 2½ times as it sets, was mixed and pumped into the form through a hose to make a slab about eight inches thick. The roadway was poured as an experiment by Higgins Resources, Inc., developers of the lightweight cellular concrete.

(From 'Popular Mechanics," February 1951).

11. VILLAGE ROAD DEVELOPMENT SCHEME

THE Government of India has drawn up a model scheme for the development and improvement of village roads with the co-operation of villagers themselves. It is proposed to set apart Rs. 15 lakhs for the scheme from the Central Road Fund (ordinary) reserve.

Outlining the scheme in Parliament on 30th May, Mr. Satyanarain Sinha said it was proposed to form village road development co-operatives in all States. Grants would be made to State Governments towards village road development schemes as soon as development plans were ready in each State.

The proposal is that, to start with, the Central Government will contribute one-third of the cost of certain approved village road development schemes subject to the limit of Rs 15 lakhs, provided the State Governments find one-third of the cost and the villagers meet the remainder. It is anticipated that the States and the villagers will provide more than the minimum suggested and that the Central grant will be regarded merely as a token to indicate Government's interest in village development.

* * *

(From "Capital", July 5, 1951)

MADRAS CIVIL WORKS BUDGET, 1951-52

The following extracts have been taken from the Madras Civil Works Budget for the year 1951–52 in respect of expenditure on Civil Works.

Head of Expenditure	Expenditure		
	Accounts 1949-50	Revised Estimates 1950-51	Budget Estimates 1951-52
1. Original Works	1,70,04,090	1,79,15,200	1,90,65,100
2. Repairs	3,16,60,393	3,38,49,700	3,51,74,500
3. Suspense	- 11,75,153	- 12,49,900	- 14,04,400
4. Lump deductions for probable savings	—	—	- 8,82,200
5. Lump addition for regrant of lapses	—	—	10,000
6. Lump provision for merged areas	—	—	—
7. Establishment	69,20,955	68,41,900	67,38,700
8. Tools & Plants	85,73,267	82,03,900	81,69,500
9. Grants-in-Aid	1,00,27,974	1,02,86,000	69,79,300
Total	7,30,11,526	7,58,46,800	7,38,50,500
Expenditure on Communications only :—			
I. Original works (Excluding Post-War Reconstruction)			
(a) National Highways		57,300	—
(b) Provincial Highways		4,62,500	4,50,200
(c) Major Distt. Roads		21,51,200	22,71,500
(d) Other Distt. Roads		35,600	33,500
Total		27,06,600	27,55,200
II. Original works (Post-War Reconstructions)			
(a) National Highways		51,57,900	93,35,700
(b) Provincial Highways		36,85,500	46,74,900
(c) Major Distt. Roads		53,17,900	58,61,000
(d) Other Distt. Roads		47,000	8,900
(e) Miscellaneous Works		75,300	1,05,000
Expenditure on National Highways recoverable from the Government of India		- 51,57,900	- 93,35,700
Total		91,25,700	1,06,49,800
III. Repairs (excluding Post-War Reconstruction)	2,87,19,306	3,07,94,500	3,20,02,500
IV. Repairs (Post-War Reconstruction)	1,39,866	1,00,000	—
V. Suspense (Highways Department)	- 10,06,888	- 20,80,000	- 13,71,000
VI. Establishment (Highway Deptt.)	50,71,276	49,02,800	49,89,900
VII. Tools & Plants (Highways Deptt.)	84,64,631	81,44,000	81,31,000
VIII. Grants-in-aid to Local Bodies	88,98,265	75 40,400	77,08,300
Deduct-Amount met from famine Relief Fund			- 30,00,000
Grand Total		6,12,34,000	6,18,65,700

Capital outlay on Civil Works outside the Revenue Account during the three years was as follows:—

1949—50	Rs. 61,08,770
1950—51 (Revised Estimates)	1,10,44,100
1951—52 (Budget Estimates)	2,05,73,700

A BRIEF REVIEW OF THE MADRAS BUDGET

(With special reference to Civil Works)

The total revenue receipts of Madras for 1951-52 are estimated at Rs 59,63 lakhs and revenue expenditure at Rs 60,30 lakhs showing a net deficit of Rs 67 lakhs.

The revised estimate for 1950-51 shows the total revenue figure as Rs 59,70 lakhs as against Rs 55,21 lakhs in the Budget, the corresponding expenditure figures having also similarly gone up to Rs 59,07 lakhs as against Rs 55,57 lakhs in the last year's budget, this indicating a surplus of Rs. 63 lakhs as against the estimated deficit of Rs 36 lakhs last year.

Revenue expenditure on Civil Works for 1951-52 estimated at Rs 7,39 lakhs forms 12.3% of total estimated expenditure in the State during the year as against 12.8% in 1950-51 (Revised Estimates).

Expenditure on Communications (Original Works and Repairs) in 1951-52 is estimated to be Rs 4,54 lakhs which forms about 83.7% of expenditure on Civil Works (Original Works and Repairs). The corresponding figure for 1950-51 (revised Estimates) is 82.5%. The expenditure on the establishment of Highways Department forms nearly 8% of total expenditure on Communications in both the budgeted figure for 1951-52 and the revised estimated figure for 1950-51: on Tools and Plants in the Highways Department 13.1% as against 13.3% in 1950-51 (Revised).

The Communications expenditure as a whole forms 10.3% of the total budget expenditure as against roughly 10.4% in 1950-51 (Revised).

—•—

BRICKS WITHOUT MORTAR

Berlin. A brick that stays in place without mortar has been developed in East Germany, the Russian-licensed news agency A. D. N. reported recently.

It gave no details, but said that the new brick saves time and labour.

ROAD TO PROSPERITY – HARDER WORK

"There is no royal road to prosperity. The only road is by greater effort on the part of all of us. There is not the slightest chance of improving or maintaining our existing standard of living unless every one succeeds in producing more with the same labour force that we have at the present time and with the same effort. It does not matter who makes the effort - men paid £ 6 to £ 7 per week or men paid a great deal more - **we should have a 20 per cent greater output from everybody.**–" *Mr. R. R. Stokes, M. P., Minister of Works.*

TECHNICAL INFORMATION

1. BRAKING PERFORMANCE OF VEHICLES *

* * *

THE braking performance of a vehicle is fundamentally dependent on the adhesion between the tyres and the road. Even with excellent brakes, adequate braking is not possible where reasonably high adhesion cannot be obtained.

The degree of adhesion depends mainly on the texture and condition of the road surface and to a smaller extent on the properties of the tyre, such as the hardness of the tread rubber, the nature and condition of the tread and the inflation pressure. If the brakes are poor and the road surface good, the maximum degree of adhesion is not attained and the retardation is governed by the efficiency of the brakes rather than by the properties of the road surface and of the tyres.

Coefficients of Friction

The frictional properties of road surfaces are expressed in terms of certain coefficients, the two in common use being the braking force coefficient, and the sideway force coefficient...............

Measurements of these coefficients under varying conditions of speed, road surface texture and condition (wet, icy, muddy etc.), tyre size and inflation pressure, temperature, etc., had yielded interesting results. It had been found that the coefficients were high for all clean, dry surfaces, but were generally lower when the road surface was wet. Also, on many wet surfaces the coefficients fell, sometimes rapidly, with increasing speed. One explanation of this decrease was that a high resistance to skidding depended upon the tyre making direct contact with the road surface and in wet weather the liquid, which acted as a lubricant, had to be expelled before this could occur. It took time to expel the liquid film and at any instant, a wheel would be supported partly by the film and partly by the road surface; the friction thus depended upon how much of the load on the wheel was carried by portions of the tyre in contact with the road surface. At higher speeds there was less time for the liquid film to be expelled and the coefficient would thus decrease with increasing speed.

When a Wheel Locks on a Dry Surface

As the brakes are applied, the frictional coefficient rises to a peak value and during this stage the kinetic energy is dissipated as heat mainly at the brake drums. When a wheel locks, the same portion of tyre remains in contact with the road and the dissipation of energy takes place in the area of contact resulting in an increase in the temperature of the tread rubber and a corresponding decrease in the frictional coefficient. As the wheel continues to slide the temperature rises until melting point is reached, when a visible skid mark appears on the road surface and the coefficient becomes sensibly constant at its minimum value.

On some surfaces the melting point of the binder might be reached before that of the tread rubber, in which case the slipping coefficient would have a different value from that of a surface on which the rubber melts first.

It was generally accepted that the minimum distance in which a vehicle could be stopped by braking was obtained when the wheels were just on the point of locking. As road surfaces differed widely in their constitution and texture the frictional properties varied. The specification and construction of non-skid surfaces are problems which greatly concern road engineers.

Vehicle Characteristics

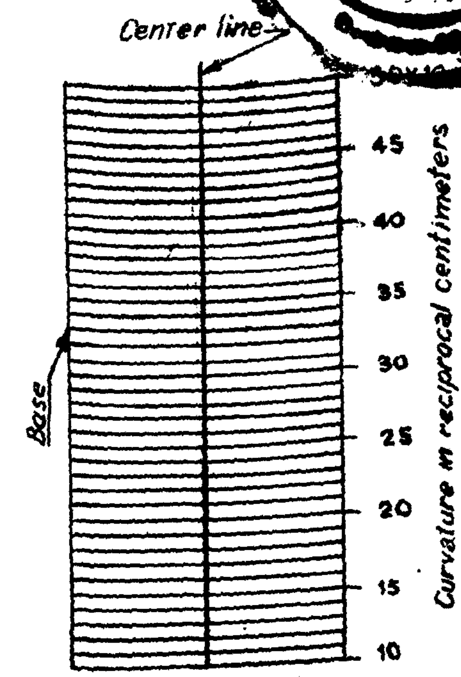
The load transfer from rear to front when braking, is generally small on private cars except at high decelerations, but in the case of commercial vehicles it may

* From an article 'Motor Transport' dated 24—2—1951 based on a Paper entitled "The Factors which Influence the Banking Performance of Vehicles" by H. J. H. Starks, Ph. D., B.Sc., D. I. C.; published by the Road Research Laboratory, Harmondsworth.

be large even at moderate decelerations. One authority instances the case of an American truck where the load transfer under a deceleration of 0·5 g. results in an increase of load on the front pair of wheels of 72 per cent. * * *

A larger proportion of the total braking effort on the front wheels would introduce the possibility of front-wheel locking on surfaces of low coefficient with consequent loss of steering control. Further difficulties were introduced by brake unbalance between the wheels and which could be attributed to a number of factors related to the design, lack of maintenance or wear. Load distribution, transfer and brake unbalance were all subject to variations of uncertain amounts and made it difficult to predict the exact motion of a braked vehicle. It was, however, generally accepted that when front wheels only locked, a vehicle tended to proceed in a straight line, the driver having little or no control over the direction of the vehicle. With the rear wheels alone locked there was a tendency to deviate laterally, but the driver had some control, depending on the amount of deviation and on his skill in counteracting it.

* * *



On Curves

When a vehicle was travelling round a curve or when it deviated from a linear path during braking its behaviour was dependent not only on braking forces applied and on other vehicle characteristics, but also on factors associated with the design of the steering and suspension and with the road layout and surface properties. Little has been published on the behaviour of a vehicle braked while travelling round a curve and this was a field in which work was required.

Braking Systems ; Time Lag

When new or in good adjustment there appeared to be little to choose between the various brake actuation systems as regards the retardation they produce, but there was no evidence as to how they were affected by wear or lack of attention. One feature in particular which did not seem to have received proper attention in heavier vehicles and on commercial vehicles with trailers was time lag in operation. Coupled with the time lag in the actuation system was the time taken to press the brake pedal sufficiently to obtain full braking effort. One authority quoted instances of typical American six-wheelers with trailers fitted with rear brakes in which the time taken to reach full braking action was 0·35 secs. One pre-war models full application of the rear brakes on the trailer was not obtained until an interval of approximately 0·25 secs. after that on the rear brakes of the six-wheeler itself, but on recent models this time interval had been reduced to about 0·05 secs.

From the viewpoint of road safety the most desirable characteristic of the brake was a uniform, adequate and constant response at each wheel to the effort applied at the brake pedal. Factors which tended to upset this and produce brake instability included changes in the friction properties of the linings, the presence of oil, water and road grit and loose abraded material in the brake drums and changes in the dimensions of the drum and shoes such as those due to temperature changes, distortion of the drum and the like.

* * *

Physical Reactions

It has been shown that, owing to the toggle action of the human leg, it is usually possible for a driver to exert an effort of about twice his own weight on the brake pedal at least for a few seconds, but the age, sex and physique of drivers has a profound influence on the maximum and comfortable braking effort they are capable of maintaining.

Power Brakes

On the heavier commercial vehicles power assistance was essential, and in some forms of power-assisted brakes the pedal effort was small and practically constant over the whole range of deceleration, the amount of brake application being determined by the amount of movement of the pedal and not by the effort applied by the driver. * * *

The maximum effort which the driver could exert on the hand brake had been quoted as 120 lb. This might be sufficient for private cars or light commercial vehicles, but it would not be sufficient to apply satisfactory braking forces on the heavier commercial vehicles unless the hand brake was regarded as a parking brake only. If, however, it were to be regarded as an emergency brake then it should be provided with power assistance on the heavier vehicles. A hand brake on the transmission was widely used in America, and although there were some objections to its use it could provide adequate braking without power assistance.

As regards physical reactions of driver and passengers to braking, the maximum brake deceleration regarded permissible in public service vehicles was about 0·5 g. Higher decelerations were considered likely to cause serious injury to the passengers.

Finally, the reaction time of drivers is of importance in considering the braking performance of vehicles on the roads. Tests in the laboratory and in stationary vehicles show reaction times of the order of 0·5 secs., but under normal driving conditions this time may be considerably increased depending on the nature of the stimulus, visibility and road conditions.

* * * *

2. GRAPHICAL METHODS OF CURVATURE MEASUREMENT

A new graphical method determines the curvature and second derivative at any point on a plotted curve. This method utilizes a piece of transparent material containing acres of known curvature. The corresponding second derivative is then obtained by a simple calculation.

A point on the curve is chosen. The transparent guide is laid so that the center line is normal to the curve at the given point, while the curve lies exactly under one of the instrument arcs. Curvature is read directly while slope is found by measuring the angle θ between the instrument base and the positive direction of the x-axis. The second derivative is computed from

$$d^2y/dt^2 = c \sec^3 \theta$$

The simplest form of instrument is illustrated. A series of black circular lines, with uniformly increasing curvature, are spaced at intervals. Arcs may also be made as clear lines on opaque or semi-opaque sheet or they may be a series of dashes on a clear surface. Two arcs, to bound the unknown curve have also been tried.

[*From Technical Report 1445, National Bureau of Standards, Washington, D. C.— 'Product Engineering', January 1951*].

3. BINDING OLD AND NEW CONCRETE

I. Treat the old concrete with dilute hydrochloric acid—two parts of water to one of acid—or dilute muriatic acid—3 parts of water to one of acid. Clean the old surface as well as possible with brooms and water and then apply the dilute acid. The solution should be left for two or three minutes and then washed off with clean water. It should, however, be ensured that the aggregate is not such that will react with the acid.

II. Placing a film of grout on top of the old concrete has often been used in an effort to insure a good bond at the point of contact. However, this method seems to have the objection that it leaves a film of water on the surface of the old concrete, which tends to keep the cement particles from adhering to the old surface.

Two methods of overcoming this difficulty have been found. One of these is to saturate the old concrete and then sweep off all the excess water, after which the top is sprinkled with dry cement powder. The suction of the dry cement as it absorbs the water tends to draw the cement into the pores of the old concrete and eliminate water and air pockets. The new concrete is then placed directly upon the dry cement.

The second method is equally successful and, as is the case when the first method is used, permits the joining of a thin slab of concrete tapered to a feather edge to the old surface. This method consists of scrubbing the cement into the old concrete surface with a steel wire or fiber brush. The rubbing of the cement into the pores of the old concrete insures intimate contact between the two surfaces.

From Civil Engineering Aug. Sept and Nov. 1943).

4. ALUMINIUM IN ROAD TRANSPORT

THE Northern Aluminium Company, Ltd., of Banbury, Oxfordshire, has just published a brochure entitled "Aluminium in Road Transport." Pictorial illustrations graphically show the wide application of aluminium to the various forms of road Transport. The advantages of the material are discussed and the construction of goods vehicles dealt with, while a chapter treats with passenger vehicles, where a weight-saving of over 25 per cent is shown in figures given for a tramcar. To short sections review the applications to private cars, caravans, and the mobile business vehicles, followed by the uses of the material for power units and general fittings. To assist users, a chapter is devoted to designing; the aluminium alloys are described; mechanical and other properties given, and isometric views of typical bodies shown. All the various methods of working aluminium are discussed and illustrated and general information given concerning machinery, forming, spinning, riveting, welding, and other methods of joining. At the end of the brochure useful tables give the bulk weight in pounds per cubic foot, of a wide range of materials; the die numbers of channel cross bearers and the bend radii for several alloys in various tempers over a range of thicknesses.

(*Extracted from 'The Engineer'—Nov. 24, 1950*).

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RIGHT OF WAY

"It's a dangerous practice to debate the right of way on the highway. A better habit is to **GIVE** *the right of way and debate it later. It may save your life."*

List of Approved Works on National Highways

S. No.	Job No.	Name of work	Amount approved Rs.	Remarks.
		UTTAR PRADESH.		
1.	486 UP 24	Painting miles 179-187 of National Highway No. 24 (miles 127-119 of Lucknow Bareilly Road).	3,57,000/-	
		BOMBAY.		
2.	487 BM 8	Survey and preparing detailed plans and estimate for Broach-Vasad Section for the alignment of National Highway No. 8 between Ankleshwar and Nadiad **via** Baroda.	27,168/-	
3.	488 BM 8	Survey and preparing detailed plans and estimate for Vasad-Boriavi Section for the alignment of National Highway No. 8 between Ankleshwar and Nadiad **via** Baroda.	3,119/-	
4.	489 BM 8	Survey of miles 129/2 to 203/0 of Bombay-Ahmedabad Road, National Highway No. 8.	18,600/-	
5.	491 BM 8	Reconstruction and improvement of National Highway No. 8. between miles 2/1 to 10/2 (State miles 185 to 206/4) within the limits of the late Baroda State).	1,32,300/-	
		MADHYA PRADESH.		
6.	490 CP 6	Black-topping miles 12/3 to 26 of Akola-Murtizapur Section of Bombay-Calcutta National Highway No. 6.	1,56,190/-	

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List of Books added to the Roads Organization Library during July, 1951

1. **Planned Seeing-Air Ministry-Air Publication No 3139-B.** (His Majesty's Stationery Office, London).
2. **Architects' Builders' and Civil Engineers' Reference Book, 1950** by Evelyn Drury, F. E. Drury and A. C. Pallot. (George Newnes Ltd., South Hampton Street, stand London, W. C. 2).
3. **Standards Methods for Testing Tar and its Products (Third edition).** (Standardization of Tar Products Committee, 166 Picadilly, London, W. I.).

   Publications of the Road Research Laboratories, Middlesex.
4. **The Factors which Influence the Breaking Performance of Vehicles** (by H. J. H. Starks).
5. **Notes on the Work of the Road Research Laboratory.**
6. **Creating Better Cities-A complete report on the 3rd Businessmen's Conference on Urban Problems.** (Chamber of Commerce of the United States, Washington 6, D. C.).
7. **Proceedings of the Ohio Highway Conference 1950, held at the Ohio State University, Columbus, Ohio-April 3-6, 1950.** (Engineering Experiment Station, Columbus, Ohio, May, 1950).
8. **Heat Treatment and Properties of Iron and Steel—U. S. Bureau of Standard Circular No 495.** by S. J. Rosenberg and Thomas G. Digges (The Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.).
9. **Hand Book of Information to Students regarding the courses of study available at the Institute of Sciences.** (Indian Institute of Sciences, Bangalore).
10. **Report of the Reviewing Committee of the Indian Institute of Sciences Bangalore 1948.**
11. **Contractors Record and Municipal Engineering, Vol. 2, No. 12, June 1951.** (The Proprietors, the Contractors Record Ltd., Lammox House, London, W.C. 2).
12. **Draft Report of meetings ISO Technical Committee 17-Iron and Steel held in London from June 13 to 16th June 1951.** (British Standards Institute, London).
13. **Problems in Drafting Traffic Laws.** (Traffic Institute North Western University Evaston, Illinois).

    Publications of the Deptt. of Highways, Pennsylvania, 1950.
14. **Design of Portland Cement Concrete Mixtures—Bulletin No. 5 (Revised).**
15. **Aerial Photography.**
16. **Dynamic Design of bituminous Pavements-The journal "Trend" in Engineering January 1950, Vol. 2 No. 1).** (University of Washington, Seattle 5, Washington).
17. **Punjab on the March, edited by L R Nair.** (The Director of Public Relations Department, Punjab Govt., Simla, March 1951).

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Printed by K. S. Krishnan at The Progressive Printers, 17, Coral Merchant Street, Madras 1, & Published by J. M. Trehan, Hony. Secretary, Indian Roads Congress, Jamnagar House, Shahjahan Road, New Delhi-2—850.