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We wish all our
Readers, Contributors, and Advertisers
A Happy and Prosperous
New Year.

THE SWISS HIGHWAY SYSTEM

Dimensions, Technical Standards, and Guiding Rules*

(Extracted from the "Bulletin Congres de la Route," 1952)

Dimensions

AS a basis for calculation, the number of motor vehicles for which provision is to be made is taken at 75 per cent above the accepted figure for the year 1942.

Traffic peaks are no longer to be taken as the absolute peaks. Instead, and in accordance with the indications of the United Nations Organization, **the peaks reached or exceeded during 30 hours throughout the year are to be employed**.

Standards

The Standards characteristics are given below in the report of the Public Works Inspection Department.

Guiding Rules

The main points of the guiding rules, the detailed application of which is also given in the report of the Public Works Inspection Department, are as follows :

(a) avoidance of built-up areas which hinder traffic and make only a slight contribution to its volume.

(b) restriction of the right of access to new roads by limiting the points of connection and by the construction of parallel service roads.

(c) choice between the improvement of an existing road and duplicating it by the construction of a new road.

* * *

REPORT OF THE INSPECTOR OF PUBLIC WORKS

Capacity of the Highways, or the Permissible Volume of Traffic

This capacity has been determined as follows :

Type of road	A.C.F. 3/12/43		UN O 16 Sept. 1950	
	Without lorries	with lorries	All types of vehicle	Motor-ways.
	No. of motor vehicles per hour			
2 lanes width 7 m.	700	600	600	Much more than 600 vehicles per hour
3 lanes width 9 m (UNO : 9 m. – 10.5 m)	1000	900		
4 lanes width 12 m. (UNO : 2 × 7 m.)	more than 1000	900		
Motorways 2 lanes each 7 m. wide	900 motor vehicles per hour (traffic practically uniform)			

*An article entitled "The Swiss Highway System : Programme for improvement" has appeared in our last issue.

The indications given above refer to roads which have cycle tracks or strips, and on which there are very few horse-drawn vehicles.

If the carriageways are used by cyclists, the road capacity falls to 500 motor vehicles per hour for 50 bicycles per hour, and to 400 motor vehicles per hour for 200 bicycles per hour (corresponding to an average of 300 to 500 bicycles per day). On most of the main roads the cycle traffic amounts to 50 bicycles per hour, so that if the volume of traffic reaches 500 vehicles per hour, cycle tracks must be provided. If the bicycle traffic is less than 500 per day and the motor traffic peak is less than 400 motor vehicles per hour, cycle tracks are not necessary. On the other hand if there are more than 500 bicycles per day, cycle tracks are absolutely essential. Safety requirements may provide a reason for the construction of cycle tracks even where there is a smaller volume of traffic.

* * *

It was found, in 1948–49, that the annual average of daily traffic included 11 per cent of motor-cycles and that this average rose to 20 per cent at the peak hours. If it is assumed that, from the traffic standpoint, 2 motor-cycles are equivalent to one motorcar, it may be said that 100 theoretical vehicles at the peak hour comprise 90 motorcars and 20 motor-cycles, so that 1,170 motor cars per day thus correspond to 1,300 vehicles per day. It has therefore been concluded that, for roads where the daily traffic observed in 1948–49 was less than 1,300 vehicles, two traffic lanes would be adequate for future requirements, if other conditions remain the same.

* * *

Guiding rules for the Improvement of Main Roads

Intersections and road forks

Level-crossings.—No level-crossing should be constructed on new roads. Where improvements are made to existing roads, level-crossings should be abolished whenever possible.

By-passing built-up areas.– By-pass and ring roads should be provided, particularly where the built-up areas contribute little to the volume of traffic on the road.

Limitation of the right of access from side roads.—The presence of slow local traffic on a road intended for through traffic constitutes a danger and increases the wear and tear on the road. It is therefore advisable to segregate these two types of traffic by the provision, within the framework of the local town-planning scheme, of parallel service roads to adjoining properties which are separated from the main carriageway by grass verges and are connected to it at only a few carefully selected points. The necessary legal basis should be provided by the cantons where this is lacking.

* * *

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WORDS OF WISDOM

If we were all given by magic the power to read each other's thoughts, I suppose the first effect would be dissolve all friendships. The second effect, however, might be excellent, for the world without friends would be intolerable, and we should learn to like each other without needing a veil of illusion to conceal from ourselves that we did not think our friends absolutely perfect.

—Bertrand Russell.

BRIDGING INDIA'S RIVERS

TEST TO DESTRUCTION OF A 96-ft PRESTRESSED-CONCRETE BRIDGE GIRDER

THE importance of scale model tests of engineering structures is realized by most civil engineers who can gain by such tests much valuable information on the performance of structures. A full-size test is a rare opportunity for verifying the truth of design theories and formulae. Such an event, of considerable importance to bridge designers in India, occurred last June when a full size 96-ft prestressed bridge girder was tested to destruction near Madras. Of such importance was the test considered that the Consulting Engineer to the Govt. of India (Roads) wrote to all States and many engineering firms commending them to depute some of their engineers to witness the test. No fewer than 600 engineers from all parts of India responded.

Elaborate arrangements were made to measure the stresses at various points of the structure. The test was a great success and a note of increased confidence in prestressed concrete work was evident among the engineers who saw the test. This, in turn, will lead to considerable economies in bridge design in cases **where prestressed work is suitable**. Engineers are, however, reminded that in their enthusiasm for a new technique they should not overlook the competitive claims of alternative though conventional, designs.

Photo No. 1.—Some prominent Engineers who saw the test.

L. to R. **K. F. Antia, M. L. Bahl, S. L. Bazaz, K. L. Rao, F. R. Coales, H. P. Mathrani, K. K. Nambiar, D. P. Nayar, H. P. Sinha, K. V Thadani.**

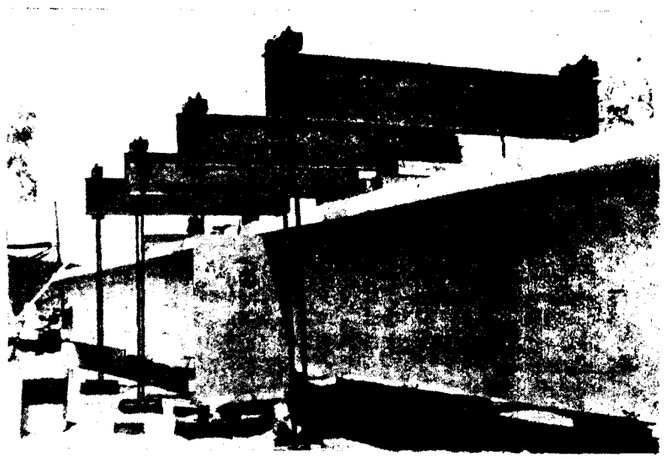


Photo No. 2 (above)—How the load was applied.

Photo No. 3 (left)—Shri H. P. Mathrani inaugurates the test.

[All photos by courtesy of the Chief Engineer (Highways), Madras.]

Photo No 4—(Right) The beam is U-Shaped with diaphgrams connecting the two webs.

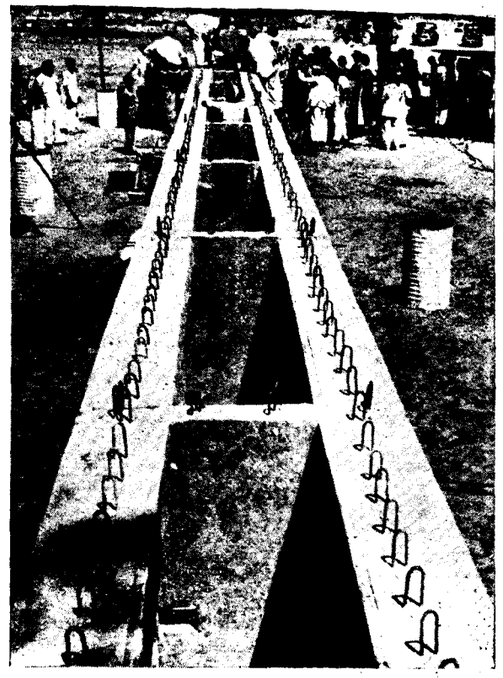
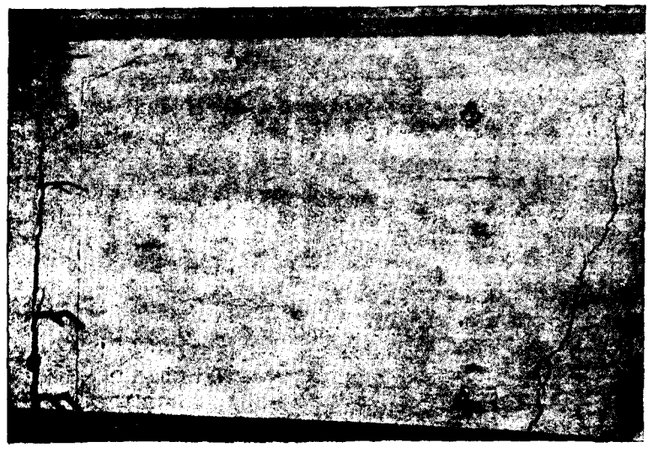
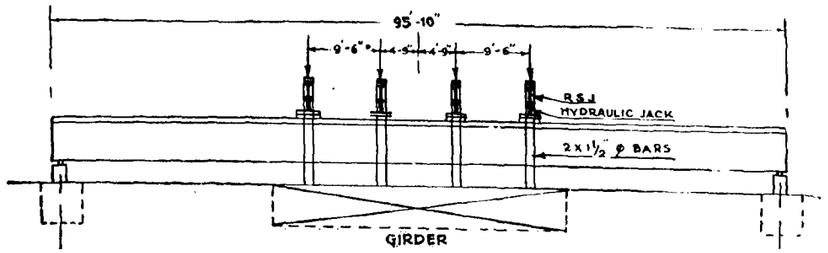


Photo No. 5—(Below) The prestressed concrete beam developed cracks as the load on it went on increasing. Photo shows cracks when there was a load of about 140 tons.



The test described here was the first of its kind in India, and perhaps the second of this magnitude in the world. The bridge, when completed, will be one of the longest prestressed concrete bridges in the world.

The bridge is across the Palar river, about 30 miles from Madras, on National Highway No. 45 (locally known as the Great Southern Trunk Road). At the bridge site the river is 2,200 ft wide between well defined banks. Twenty-three



90-ft clear girder spans with 6-ft thick piers, will bridge the full width of the river. The foundations under each pier will consist of two 12-ft diameter circular wells, spaced 17 feet centre to centre, resting on hard moorum or soft rock. The average depth of foundation is 30 ft below the bed.

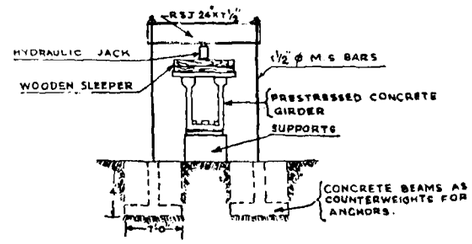
The deck is to consist of four precast, prestressed, 'U'-shaped beams, with a 6-in. cast-in-situ R. C. deck slab. The beams are to be 5 ft 1 in. deep, prestressed with 256 wires of high tensile steel, 0.2 in. in diameter and anchored with the Magnel-Blaton system of anchorages.

The estimated cost of foundation and substructure is Rs 9 lakhs and that of the deck Rs 10 lakhs. With other items amounting to about Rs 3 lakhs, the total cost is estimated to be Rs 22 lakhs, which works out to Rs 1,000 per foot run. The work was started on the 20th July 1951 and about 60 per cent of the foundation work has been completed. The general contractors for the work are Messrs Associated Engineering Syndicate, and the prestressed concrete work is being done by Messrs Rayalaseema Constructions, the licencees in India for the Magnel-Blaton system.

It was a condition of the contract that before commencing work on the superstructure, one beam would be constructed and load-tested to destruction.

The Test Procedure

The general layout of the beam and the loading arrangements for the test are shown in the sketch. The load was applied at four points, 9 ft 6 in. apart, through reaction jacks, operating against a framework of rolled steel joists. These joists were anchored down by means of 1¼ in. diameter bars embedded in two concrete beams, cast below ground level, one on each side of the test beam.



First of all, the proportionate share on the beam of the dead load due to the kerb, hand rails, wearing coat, and diaphragms (which worked out to 10.2 tons) was applied gradually and the readings of the various strain gauges were taken. Then the equivalent design (live) load which corresponded to 27.55 tons for each beam was applied gradually in eight equal stages, the readings of the dial gauges being taken at each stage. The actual deflection at the centre of the beam for this design load (27.55 tons live and 10.2 dead load) was 0.282 in. against the calculated deflection of 0.4766 inch. This loading was maintained overnight till about 10 a. m. next morning and the final readings of deflection taken. The central deflection had increased to 0.346 inch.

The load was then removed gradually and the readings of the dial gauges were taken without any live load. The residual deflection was found to be 0.0975 inch.

Loading intended to test the beam to destruction was then started and was increased in stages of about 6 tons the deflections being noted at each stage. The first slight crack appeared at a load of 62.75 tons, on the underside of the beam adjacent to the fifth diaphragm at its junction with the fifth bay. The crack was so fine that it was visible only with the aid of a magnifying glass. With further increase of the load, clearly visible cracks developed, but whenever the load was released the cracks closed up fully.

At 109.25 tons there were numerous cracks and, at that stage, the loading was released to verify whether the beam still retained its elasticity. The beam regained its original shape and the cracks closed perfectly but there was a residual deflection of 1.1 inch.

of the Central Water & Power Commission on prestressed concrete with special reference to the test.

Betting

When the load on the beam was approaching 100 tons, with the cracks increasing in size and number, several enthusiasts began betting on the probable load of destruction. The forecasts on the ultimate load at which the beam would collapse altogether ranged from 105 tons to 145 tons. But the test beam proved its strength beyond all expectations, and all the punters lost their bets. The nearest guess was that of Mr. Mathrani, who put the probable ultimate load at 145 tons, against the actual figure of 155 (later calibrated to 142.75) tons.

Photo 6—Another view of cracks extending from the bottom to the top.

The loading was again resumed and carried on up to 142.75 tons, when the deflection became mechanical, without any addition in the loading. The beam was declared to have failed under this load.

Although the test lasted over two days interest never flagged. Mr. F. R. Coales, the engineer of Rayalaseema Constructions, gave a running commentary throughout the test. There was also an interesting technical discourse by Dr. K. L. Rao

At the end of the test Mr. Mathrani remarked that the test was the best witnessed by him in his professional career and would create confidence in the new form of construction which the test had proved to be sound. He was glad that the results of the test had proved that the beam had attained a higher strength than they had expected. It was a great thing and was to the credit of the contractors as well as the Madras Highways Department, who were in charge of the work.

OUR ROAD PLAN

as seen

THROUGH FRENCH EYES

"AT a time when similar programmes are being conceived and executed in our Overseas Territories it will possibly be interesting to compare the principles which have the same objectives: that is, to bring very backward regions into easy contact with the modern world, the essential difference in favour of India being the size of the working class population which still remains to be served," writes M. Paul Darnault, Director of Public Works and Transport, the Cameroons, in an article in the November 1951 issue of the French journal 'Revue Generale des ROUTES et des Aerodromes'. M. Darnault visited India as a French delegate to the International Congress on High Dams held in Delhi in January 1951.

A peculiar feature of the Indian road problem, according to M. Darnault, is that "the number of motor vehicles in India is about 270,000 against more than 8 million bullock-carts.

"The present system of roads and particularly (cart) tracks has a length of 400,000 kilometres (250,000 miles) but is to go up to 646,000 kilometres (400,000 miles) according to the development plan elaborated at Nagpur in 1943.

"The regular rise in prices has already taken the initial estimate of 392 milliard francs* in 1943 to 1200 milliard francs in 1950 and it is beyond doubt that big and important modifications will be made in the programme by way of reduction in the volume of work.

"At that stage will come in the principles of co-ordination for the choice of the main highway routes between regions already served by railways and air communications.

"In other respects the decision about the order of priority of the secondary and village roads will depend only on States and will give rise to numerous local controversies.

"If we compare what we have done, it can be stated that, in the Cameroons for example, the initial objectives of the plan have been, proportionately speaking, much more modest:

Utilization of all the old tracks already constructed,

Construction of only two main axial routes connecting the only big port with the interior of the country,

Programme of definite works for crossing rivers,

Carrying into effect some of the new economic considerations."

The writer then goes on to describe the basis of the Nagpur Plan, the celebrated grid-and-star formula designed to give roads so that ultimately "no village will find itself at a distance of more than 8 kilometres (5 miles) from a main road, the average distance being less than 3.2. kilometres (2 miles) in most cases."

The author had contacts with provincial engineers and found that "they had been left free to undertake work on simple projects.

Specifications

"As regards formation work and surfacing of roads, economy and utilization of local material is aimed at under all circumstances. For example, in the State of Bihar where stone‡ and burnt brick are

(Continued on page 21)

* 78.5 francs = one rupee.
one million francs = Rs 19605.6
one milliard francs = Rs 1860500
392 " " = Rs 583 crores
1200 " " = Rs 1632 crores

‡ By Indian standards stone is not cheap in Bihar; possibly the French writer did not consider the price high...Ed.

THE LOGICAL STAGE DEVELOPMENT OF ROADS IN UNDER-DEVELOPED COUNTRIES

By

Sir Kenneth Mitchell

(Reprinted from the Winter 1951 issue of Road International, the journal of the International Road Federation.)

[*Conitnued from our last Issue*]

Traffic Considerations

IN densely populated India, the bulk of third-class passenger traffic by rail is within the zone of 0-50 miles. If in the under-developed countries much passenger traffic over 100 miles offered, there would have to be staging accommodation as also for the drivers of long-distance goods services. Industrial concentrations of population needing long-distance express services for perishables would be exceptional.

Dealing with propositions (c) and (d) together, it follows that the types of vehicle evolved for the advanced countries are unsuitable for use in the manner proposed. Their reserve of power, axle and gear ratios allow for speeds of 35 m.p.h., and more. Laws can be made restricting their speeds, but they are quite inoperative. Governors can be fitted, but no one in his senses would attempt to govern a standard 3-ton lorry down to 10 m.p.h. What then is required?

As long ago as the Colonial Conference of 1927, the need was stressed of finding some way for backward territories to have the benefit of mechanical transport without the, even then, crippling initial cost of high-duty roads. A body was then set up called, "The Overseas Mechanical Transport Directing Committee", which set itself to design a transport unit that could be used economically on rough tracks or no roads at all. It produced two prototypes of a 15 ton pay-load unit, consisting of an articulated tractor-trailer and two load trailers, capable of going almost anywhere and with a top speed of 8 to 10 m.p.h. One of these was tried in the Gold Coast and later in Tanganyika; the other in Queensland. Their performance was good, but they were expensive. *Circa* 1930, each unit cost about £ 4,000. Operating costs were a little under four pence a ton-mile, including depreciation and overheads. These figures would be very much higher to-day.

In overseas or "backwoods" vehicle maintenance, the crux is immediate availability of replacement parts or unit assemblies, which, for special vehicles, is an expense and source of trouble and delay. The need for such vehicles would, to some extent, be transient in each country and there would never be large fleets. Backward areas probably could not depart so far from standard vehicles and expect to get good service. Moreover, roads of a sort are needed for the cars and light trucks of the administration and its police, postal, and medical services. These prototypes were not followed up and it seems that the low "combined cost" must be looked for along more conventional lines than roadless vehicles.

In recent years, heavy duty rubber-tyred tractors have been developed to a pitch where slow-moving units would be available almost ready-made from standard production. Clearly, without trial and evolution it is difficult to specify precisely, but the general idea is of a tractor-unit towing two or three trailers, whether for passengers or goods, or both, with a goods pay-load of 10 tons and a speed of about 10 m.p.h. The tractor would need a good cab and seat. Seating and weather protection in the passenger trailers could be simple and removeable.

Tractor-Trailers

The tractor should have large driving wheels and the trailers a laden axle weight perhaps not exceeding 2½ tons. All wheels should have large pneumatic tyres. The trailers should be sprung and their laden weight might be, say, 15 tons for the 10-ton pay-load, so that six axles would be needed. That would mean two 6-wheeled, 5-ton capacity trailers or three 4-wheeled 3½ tonners. As the unit might have to use "stripway" roads tractor and trailer wheels should nearly track. Efficient brakes would be needed on all wheels, operated from the cab, for descending gradients with a slippery surface. Those would be the main non-standard feature.

The use of such units for all general transport purposes would enable a new approach to be made to the problem of low-cost roads, by way of rational stage-development. In that way one of the obstacles at present in the way of building up the economy of the backward countries would be overcome and the time would be shortened, which must in any case elapse, before they could afford modern roads and transport. In short, it is a way round what seems to be, otherwise, an approaching stalemate.

The evolution of such a transport unit would of course have to be worked out. It has been pointed out that a tractor and train of trailers may be very dangerous in hilly country on slippery surfaces, and that, brake-maintenance being difficult, "jack-knifing" is always a possibility. Brake design would be most important for such conditions. There is the further difficulty that, for loads of over, say, 200 miles, such low speeds may even be uneconomic. Indeed, the natural evolution of the road system would be to develop first to a higher standard, permitting higher load-speed combinations, the backbone or trunk roads.

This raises the question either of transhipment at feeder and main road junctions, or of a dual-purpose vehicle. Close policing and traffic control are a nuisance to all concerned and, in backward countries, probably an impossible expense. Were it not so, and were drivers completely reliable, a standard lorry with supplementary gearbox would possibly be the answer. Or it might be possible to make and supply with each vehicle a separate low-speed back axle. It is not suggested that back axles could be changed under load at road junctions, but by this change vehicles would be made interchangeable between different classes of road.

The Primary Need

Clearly, the sooner the backward countries can have an extensive system of good roads and modern transport the better. If their economy is to be built up quickly, the first need is an extensive system of serviceable roads fully serving all areas capable of producing money crops for export. Such a system will be economically impossible in most cases, unless a start can be made with really low-cost roads relying mainly on local materials. Even for that, labour conditions may be such that mechanised construction will be necessary; so that there is the paradox of the economy based initially on "the men with a hoe" having to build its roads with machines made by the man on ten pounds a week. It would appear that the disparity in wealth between the backward and advanced countries is growing and the less the former have to import of machinery and materials from the latter, in the earlier stages, the quicker they will get on.

A Delusion

As a general rule, the stage-development system advocated would apply wholly to the surface, partly to the bridges, but not at all to the location or alignment of the roads. The latter should from the start be to strict specifications. It is disastrous to chance the alignment merely in order to start with a cheap surface, in the hope that location faults can be corrected later. That is a delusion: it can seldom be done. For one thing, all the important bridges must be located, if not built. Moreover, stage-development is never static. Almost from the start there may be stretches of bad ground that cannot be avoided. These may have to be given a foundation and some surface in the first year or two. Where sharp bends, or steep gradients in slippery material, must be made, these, too, may have to be surfaced very early; and soon so much will be invested in an alignment that it cannot be abandoned. Indeed, the last stage of that loss of the initiative is much in evidence in this country.

There would appear to be no golden rule for the stage-development of bridges. Where timber abounds, the stream is sluggish and piles can be driven, cheap timber may suffice for, say, 20 years. Elsewhere fords may serve for a time. In certain cases submersible bridges may be necessary as a quasi-permanent feature, but low masonry causeways are a bad investment where solid building has to be done from the start. Part of the cost can sometimes be usefully saved by building at first a narrow bridge on full-width foundations with additions later. Each case is its own problem.

Haste makes Waste

All this means that the most important phase in stage-development is that of preliminary investigation, detailed survey and design, before a sod is turned. Indeed, to the extent that low-cost roads must avoid bad ground, and study availability of useful materials, locations need more careful planning in their case than in that of expensive roads. Julius Caesar could afford to go straight from point to point—the slaves taking the consequences—but we to-day have not his resources. At the present time this important first stage is often neglected, because the engineers are not allowed the necessary time and facilities. They are driven to ill-considered decisions on alignment, and, it may be, to chancing a relatively expensive surface on an ill-prepared sub-grade and foundation.

Finally, road transport is the prime need in the development of under-developed countries. In order to avoid a crippling road debt at the outset, with consequent high combined costs of transport, and the approaching stalemate, it is necessary to get back to the practice of stage-development. The road and the vehicles are parts of a whole; the one cannot be developed by stages and not the other. Low-cost beginning will be possible only if speeds of transport vehicles are much less than those prevalent in advanced countries. But the ultimate objective is the provision of modern highways to be used by fast modern vehicles. With this and low cost beginnings as the aim, the first and most important stage in all but plain open country is the careful determination of the alignment and thoughtful design of the whole road. Where this is rushed, waste of money is inevitable. The more difficult and blind the country the more likely is impatience to prevail and the more serious is the waste of money sure to be.

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FIRST PRIORITY

After a tour of India's north-eastern border **Shri Jawaharlal Nehru** *said in a press conference at Delhi on the 2nd November:*

"The tribal folk are a very fine lot, very attractive, hard working and intelligent. What they want is,

FIRST OF ALL, COMMUNICATIONS,
SECONDLY, SCHOOLS,
and THIRDLY, HOSPITALS AND DISPENSARIES."

ROADS IN THE PARLIAMENT

IN the current session of the Parliament **Shri K. Subrahmanyam** (Vizianagram) asked whether it was a fact that the foundation stone of a road bridge over the Godavari at Alamuru was laid two years ago; and if so how far the bridge work had progressed. **Shri O. V. Alagesan**, Deputy Minister for Railways and Transport, replied in the affirmative and stated that protective works (stone pitching and guide bank) were in progress and tenders had been invited for the main bridge work.

Bridge at Vijayawada

In reply to a question by the same Member, the Deputy Minister stated that the work of constructing a road bridge on the Krishna at Vijayawada was included in the current 5-year programme and was proposed to be taken up in 1953–54. Surveys were in progress.

Shri M. Islamuddin (Purnea North-East) wanted to know about—

(a) the roads, if any, in Bihar maintained from the Central Road Fund; and

(b) the amount incurred on the maintenance of each of them separately during the last three years.

Shri Alagesan replied that no road in Bihar or in any other State was maintained from the Central Road Fund.*

In reply to a question by **Shri Dasratha Deb** (Tripura East), **Shri Shah Nawaz**, Parliamentary Secretary to the Minister of Railways and Transport, stated that during August and September 1952 two accidents had occured on the Agartala-Udaipur and Agartala-Sidhai Roads in Tripura — one on each road. These roads were not certified for heavy vehicular traffic. They were classed as fair-weather roads suitable for Class 9 traffic which included the ordinary 5-ton lorry. The roads were existing roads and were not in the process of being constructed.

In reply to another question by the same Member, **Shri Alagesan** stated that up to the end of October 1952 about Rs 1.9 crores had been spent on the construction of Agartala-Kurti (Dharma Nagara) Road. The formation of the road with temporary bridges had been completed, but metalling and construction of permanent bridges were still in progress. Co-operation was sought from the local people for the construction of this road, but the response was poor.

Bridle paths in Manipur

In reply to **Shri Rishang Keishing** (Outer Manipur-Reserved-Sch. Tribes), the **Deputy Minister** stated that the total length of bridle paths in the hills of Manipur was about 1,100 miles.

When asked wheather it was a fact that the hill villagers living near the bridle paths were required to clear the same twice a year for which they received Rs 20/- only per mile, and that if they refused to do so they were liable to heavy punishment, the **Deputy Minister** said that these bridle paths were similar to village roads in other parts of India, which were looked after by village panchayats and local bodies. As there were no panchayats or local bodies in Manipur, portions of the bridle paths were alloted for maintenance and repairs to tribal villages according to their size. The work consisted mainly of clearing undergrowth and weeds and removing slips, if any, during the rainy season, and occasionally building and repairing small wooden bridges. The rate of payment varied from Rs 7/- to Rs 25/- per mile according

(Continued on page 19)

*A detailed article on the Central Road Fund appeared in our issue for May 1951. Allocations to States from the fund are meant for "expenditure on road construction or improvement as distinct from ordinary road maintenance or repairs".. Ed.

HERE AND THERE

1. PLASTIC ROAD MARKS

An Experiment in New Delhi

AN experiment with plastic central lines and "stop" marks was made on some black-topped roads in New Delhi. The results did not turn out to be satisfactory.

The patent plastic material was heated in a boiler and poured on to the pavement in situ in 3 ft x 4 in. x 1/8 in. moulds. On cooling the material dried up and hardened. The edges of these lines were then dressed and trued up with chisel and hammer.

Unsatisfactory

The lines broke up under normal traffic within a very short time. It may be that the material used in this particular case was not suitable for the purpose, or perhaps the process of using it on the road should have been different. For instance, the material might have been poured into a groove cut in the road surface instead of standing proud of the road level.

(*If plastic materials have been successfully used elsewhere in India for road marking, we would like to hear of the process and costs. Ed.*)

2. "NINE OUT OF TEN HEAVIES BREAK THE SPEED LIMIT"

DR. R. J. Smeed, of the Road Research Laboratory, in a paper to the psychology section of the British Association analysed the percentage of commercial vehicles that break their speed limit. More than 90 per cent of heavy vehicles break their speed limit of 20 miles an hour and 58 per cent of light goods vehicle break their speed limit of 30 miles an hour, he said.

Drivers appeared to vary their degree of compliance with the law in accordance with the safety and traffic conditions prevailing at the time.

[*From 'Motor Transport'—Sept. 13, 1952.*]

3. BRITAIN'S RAINS AND FLOODS

HIGH annual or monthly falls in Britain are not in themselves damaging to property other than bringing economic burdens to the farmer and an unpleasant inconvenience to the holiday maker. By contrast, the excessive spring rains of the Mississippi in 1927, inundated an area about one half that of England and Wales and rendered homeless over half a million people. In the same year, 2,000 people were drowned when a dam burst in Algeria. The world flood list is beset with consecutive tragedies of mass slaughter, the Krakatoa tidal wave, 1883, 36,000 lives; the Ganges flood, 1864, 45,000 lives but figures convey nothing of the stark fury of nature. By comparison, however, these natural forces are much more temperate in Britain than elsewhere. The equivalent of the monsoon arrives on these shores rarely, and then only on to a very small part.

Largest Daily Rainfalls: Great Britain.

9.56 in.	Bruton, Somerset, June 28th, 1917.
9.40 in.	Cannington, Somerset, August 18th, 1924.
8.31 in.	Rhondda, Glamorgan, Nov. 11th, 1929.

8.20 in. Loch Quoch, Inverness, October 11th, 1916.

8.03 in. Borrowdale (Seathwaite), Nov. 12th, 1897.

The recent catastrophe of Devon raises this measured total to six, a small number for over half-a-century, yet six too many. Not more than 20 of the 5,000 rainfall stations have recorded as much as 7 in. in a day. In the 13 years ending 1947, 12 years failed to deliver one record of this amount. Floods are inevitable with such great falls; they become greatly accentuated when the daily fall includes a cloudburst, an intense peak of short duration. The numerous records from automatic gauges which register the rate of fall suggest that a fall of 2 in. in 30 minutes may be excepted once about every two centuries. The highest rates recorded are more intense. 1.1 in. in 10 minutes, 2.1 in. in 20 minutes, 2.9 in. in 30 minutes and 3.64 in. in one hour. Portobello in Scotland holds the world record with 2.47 in. in 3 minutes on May 1st, 1908. It is such as these which create the sudden floods of dramatic intensity.

[*From 'The Surveyor'—Sept. 6, 1952.*]

4. WORLD OUTPUT OF CEMENT

"CEMENT and concrete are major constructional materials which have revolutionised civil engineering construction and radically affect all branches of building. The world output of cement is now at least 120 million tons per annum. If we convert this into concrete it means something approaching 500 million cu.yds. or enough to girdle the equator with a road 150 ft wide. 8 in. thick.

—Sir Ben Lockspeiser, Secretary of the Department of Scientific and Industrial Research.

[*Extracted from 'The Surveyor'—September 20, 1952.*]

5. SOUTH AFRICAN NATIONAL ROAD PROGRAMME

THE total expenditure from the National Road Fund between 1936 and 1952 amounts to some £ 60 million. The gross over-all expenditure on the raising of the complete system of 5,000 miles of National Roads to bitumen standard will, it is estimated, amount to over £ 100 million. Since 1945 the National Road Board and the Road Transport Commission have followed the policy of concentrating all construction resources on roads of national importance. These routes include the 1,250 mile Cape Town to Beit Bridge road, of which only 50 miles remains to be brought up to standard, the Cape Town—Mossel Bay—Port Elizabeth—Maritzburg—Durban road, the Durban to Johannesburg road, the Kingwilliamstown to Bloemfontein road, the Pretoria to Komatipoort road.

Expenditure from all sources on rural roads amounts to some £ 15 million per annum.

With the finishing of the tarred National Road between Cape Town and Colesberg some 1,500 miles of the projected 2,800 miles National Road network in Cape Province will have been completed. The longest road—known as the coastal route, from Cape Town, through Port Elizabeth, East London, Umtata and Kokstad to the Natal border, is some seven-eighths tarred.

[*From 'World Highway Report, No. 19/20, Oct. 1952.*]

6. JET AIRCRAFT Vs. AIRFIELD PAVEMENTS

* * *

THE asphaltic pavement was described as presenting a problem whenever jet planes remain stationary with engines running. After a very few minutes the exhaust from the tail-pipe tends to soften the bitumen and then the force of the blast begins to blow out pieces of aggregate from the heated area. Angle of the blast and time are controlling factors. While planes are in motion during take-off the speed eliminates jet problems.

Thus, damage is concentrated on three relatively small areas used for (1) warm-up, (2) final run-up prior to take-off and (3) maintenance areas where engines are tested or checked.

Under present jet operations portland cement concrete pavement is not affected by this action of heat or blast, with the exception of the expansion joint filler which softens and tends to blow out onto the surface. Fuel spillage, with its softening action on asphalt, was considered not so much a technical problem as one of better "housekeeping" in the Air Force.

A possible solution for the immediate problem would be to pave those areas where jets are tested, run up or maintained, with rigid type pavement, together with possibly the first short section of the runway. Otherwise present design could continue. This change would still involve the problem of softened expansion joints, but new materials were announced which would be less vulnerable. With this modification in airfield design the problems discussed would be on the way to a solution.

(*Extracted from 'Western Construction'—June, 1952*).

7. "GLULAM" BRIDGE FOR 100-TON LOADS

RAPID advance in utilizing the unusual properties of glued laminated timber is again demonstrated by the 180-ft clear span logging bridge recently designed and fabricated by timber Structures, Inc., for the Kosmos Timber Co. of Kosmos, Wash. This bridge consists of two 180-ft camelback trusses constructed entirely of glued laminated members and glued laminated deck beams suspended at panel points 15 ft on center, extending beyond trusses to provide outrigger bracing to truss web members. The roadway is laid with 2 × 12-in. laminated pieces on edge, spanning between deck beams.

Data on this bridge are as follows:

Clear span—180 ft

Height of trusses at center line—25 ft

Roadway width between wheel guards —16 ft

Clearance between trusses —19 ft

Vertical clearance—unlimited

Load capacity —2 logging trucks, each with a 100-ton gross weight.

(*Extracted from 'Western Construction'—June, 1952.*)

8. PAKISTAN CENTRAL ROAD FUND

AN extensive road building programme in Pakistan is to be financed from the Central Road Fund. The Ministry of Communications has allocated over Rs 5½ million (approximately £ 613,900) during the financial year 1951/52. This compares with under Rs 3½ million (approximately £ 359,000 allocated in 1950-51.) The amounts allocated to date total Rs 18 million (approximately £ 1.9 million).

The Central Road Fund was created in 1949 and financed from the 2½ annas (4d.) Excise and Customs Duty on petrol. The Fund is administered by the Central Government. 85 per cent of the monies available are distributed among the Provinces and Cities and the balance spent on research and administration.

(*Extracted from 'World Highway Report' No. 17/18, September 1952.*)

9. SAFE SHOES

A 2-oz toe-cap of specially hardened steel which, it is claimed, supports a weight of 3 tons was demonstrated in a safety shoe in London last week, when a London Transport double-decker ran a wheel over the foot of a man wearing such a shoe without ill-effect.

The shoe was made to the British Standards Institution's specification. Urging the maximum use of safety boots and shoes built to this standard, Mr. Harold Watkinson, M. P., Parliamentary Secretary, Ministry of Labour, said it was estimated their adoption would reduce by two-thirds some of the present 29,000 foot injuries a year.

(Extracted from 'Motor Transport,' September 20, 1952.)

10. COST OF ROAD ACCIDENTS

ADDRESSING the National Safety Congress in London on Tuesday, Maj.-Gen. B. K. Young, director-general of the Royal Society for the Prevention of Accidents, said that it had been estimated that during 1951 road accidents cost the community £146,000,000 equivalent to £3 per head of the population.

(From 'The Surveyor'—October 11, 1952)

11. SIGN-SPLASHING TESTS

HIGHWAY warning signs and markers in Missouri will be about 2 ft farther from the pavement, and 2 ft higher off the ground than most of the signs are at the present time, when a moving job can be completed. The new location is expected to keep the signs cleaner and more legible. Traffic engineers of the state highway department conducted splashing tests during the first half of this year, and the results showed that the moving of the signs would save in maintenance costs.

Test panels were set up in each of the 10 highway divisions. They consisted of sets of four black-and-white-stripped boards, each 10 in. wide and 5 ft long. They were installed to stand 7 ft. above the highway shoulder, and were set 18 in. apart in line, at right angles with the pavement edge. Maintenance personnel kept a close check on the test panels, measuring to determine how far out and how high muddy water was splashed by passing vehicles. It is believed that sufficient information has been obtained to permit a conclusive finding. The Missouri splash test is believed to be the first undertaken by any highway department.

(From 'Better Roads'—August, 1952).

12. REPORTS: HOW TO WRITE THEM

REPORTS issued by the operational research department require very careful thought. They must always be read by the production or other departmental heads affected before issue. They may or may not agree with the findings, but they are in the picture. Reports must be written in a form useful to the recipient. He has asked certain questions; he is interested both in the actual results and in the actions suggested.

The report, therefore, must start by stating the problem, setting out the answers, and giving recommendations for future executive action. The experimental and analytical methods should then be given as being of general interest, but mathematical and statistical techniques are interesting only to the operational research worker and his brethren, and should be included only as an appendix.

The language used should be straightforward, and such technical language as is used should be that of the men to whom the report is addressed, not that of the man who writes the report.

Some years ago a certain managing director said to the writer, "I have people who will read your reports in detail, but if you wish me to see anything in any of them put it on page 1: if it is on page 2 I shall not see it."

(Extracted from 'The Engineer'—July 25, 1952).

A GREAT PHILANTHROPIST
Donations Applied to
BRIDGE BUILDING IN RHODESIA

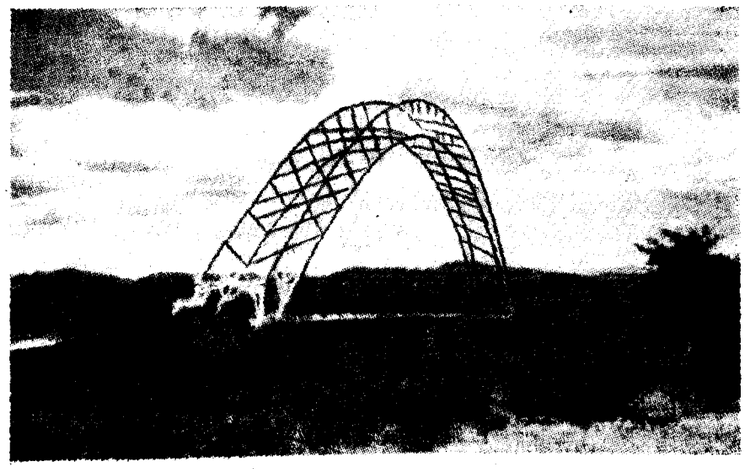
(Extracted from 'Contractors Record'—September, 1952).

SOME magnificent bridges have been erected in the Northern and Southern Rhodesias since the turn of the century. In present times, as one speeds along over these, little thought is given to the perils and delays which the pioneers and early settlers experienced when moving from one part of the country to the other. During the rainy season the swiftly-flowing rivers constituted great danger to man and beast alike as the heavily laden ox wagons and herds of cattle had to ford them. Even the drought years presented their problems as the sandy river beds were deep and treacherous. Time and patience had to be expended in cutting young saplings to form corduroy crossings in drifts.

To-day there are six major steel constructions spanning great rivers. They are the Victoria Falls Bridge and the Alfred Beit, Luangwa, Brichenough, Otto Beit, and the Kafue River Bridges. With the exception of over the Victoria Falls, **the other bridges have been financed by the trustees of the late Sir Alfred Beit.** When he died in 1906, he left £1,200,000 for the furtherance of Rhodesia's internal development, this sum was so prudently invested that it had increased to £2,700,000 by 1932.

The Alfred Beit Bridge

As far back as 1910, investigations were afoot to find a suitable bridge site over the Limpopo River which would connect Rhodesia with the Union of South Africa, but the site was not definitely selected until 1926. Both Governments agreed to build a road and rail bridge over the river,



'A Poem in Steel'

the cost to be jointly shared. The Beit Trustees recognised the importance of this connection and offered to finance the project on **condition that the bridge was to remain free of toll for all time.** This was the first bridge to be erected through the medium of the Beit Trustees in 1928.

It is a deck bridge of fourteen spans approximately 1,550 ft long. The girders are 20 ft deep and the deck is 68 ft above the river bed. As a monument to Alfred Beit the seventh pier has been raised in Pietersburg granite 20 ft above the deck level and into this a memorial plaque has been inserted to commemorate his memory.

The Luangwa Bridge

This is the **second bridge** to be financed by the Beit Trustees. Situated in Northern Rhodesia it spans the Luangwa River and is a connecting link between Lusaka, the capital of the colony, and Fort Jameson, in the eastern districts. It was built at a cost of £ 67,000 and was opened on May 12, 1934.

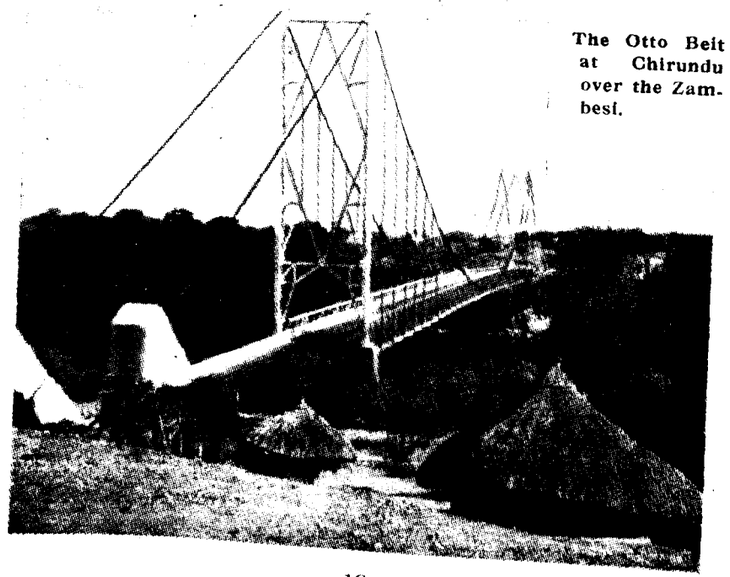
The Birchenough Bridge

The news that the Beit Trustees proposed building a third great bridge was announced by the late Duke of Kent when he visited Southern Rhodesia in 1934. Built by Messrs Dorman Long and Company, the entire construction cost approximately £ 165,000, and was opened on December 20, 1935. Of its type it was at the time of completion the largest in Africa and the third largest in the world. It spans the Sabi River and is of extreme importance to the eastern districts of Rhodesia as it affords a direct link with the southern half of the country.

Approximately 1,500 tons of chromodor steel were utilised in its construction, the single arch rises 280 ft above the river and is 1,080 ft in length. The existing suspension cables are those actually used during the erection of the Sydney Harbour Bridge.

Named after Sir Henry Birchenough, at that time Chairman of the Beit Railway Trust, there is an embossed plaque in bronze of him in the east and west abutments. His ashes and those of his wife are sealed up in the north-east pylon of the bridge.

It is, undoubtedly, one of the finest examples of engineering construction in the colony: it stands clearly silhouetted



The Otto Beit at Chirundu over the Zambesi.

against the skyline, the delicately interlaced silvery arch shimmers in the brilliant sunshine. It has been aptly described as a "poem in steel."

The Otto Beit Bridge

One of the longest bridges in Africa, it forms an important link between Northern and Southern Rhodesia. It crosses the Zambesi River at Chirundu. The bridge is named after Sir Otto Beit, brother of Alfred, and was opened in 1939. This was **the fourth bridge** to be presented to the people of Rhodesia by the trustees.

Kafue River Bridge

Northern Rhodesia and its communication problems never escaped the attention of the Beit Trustees. Across the Kafue River the Great North Road (Cape to Cairo) was linked by means of a temporary cable operated ferry. Unreliable, irritating to travellers during the monsoons, this method of crossing proved totally inadequate for a rapidly expanding colony. Sponsored by the trustees, preliminary investigations for a permanent road bridge were made on the site in 1937, but as a result of the Second World War the project was interrupted and a floating pontoon bridge had to continue to meet the demands of transport.

At the end of the war, when steel was at a premium, a decision was arrived at to use war surplus material. In February 1948, the London County Council accepted the tender for the purchase of the emergency steel bridge which was then in position over the River Thames.

The site had to be adapted to the structure rather than the design to suit the site. The width of the river at low water level was 330 ft with the south bank low and marshy. The Thames emergency bridge of three spans with a total length of 420 ft is carried on piers, each pier made up of three steel cylinders of 6 ft diameter sunk 21 ft below the river bed and filled with concrete.

Commenced in December 1948, the steel erection was completed in 1949.

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(*Continued from page 12*)—**ROADS IN THE PARLIAMENT.**

to the amount of work actually done. As the maintenance of the paths was for the benefit of the villagers themselves, they were expected to do the work. There had so far been no instance of defaulting villagers being punished. Sometimes some defaulters had been warned that they might be punished.

So far as the Government were aware the hill people did not consider this action of Government as amounting to forced labour. The Government, however, understood that there was complaint from some quarters against the arrangements mentioned above.

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THE RETORT COURTEOUS

A spinster who was the self-appointed supervisor of village morals accused a man of being a drunkard because she had seen his car parked outside a tavern. The accused man made no comment, but the same evening parked his car outside his accuser's door—and left it there all night.

THE DEVELOPMENT OF THE UNIVERSITY SYSTEM*

(Extracted from 'Engineering'–September 7, 1951).

HIGH authorities claim that the foundations of the modern university system were laid long before the Christian era, at Athens and Alexandria. Athens came first with Plato's Academy, Aristotle's Lyceum, Zeno's Stoa, and the Garden of Epicurus. Next came the Mouseion of Alexandria, which was founded by Soter, the first of the Egyptian Ptolemies (323–283 B. C.) on the model of the Athenian Mouseion, a philosophic establishment that had housed the library of Aristotle. Although the Mouseion of Alexandria did not neglect the humanities its pre-eminence was in science.

On the science side at Alexandria, Euclid composed his **Elements** and founded a mathematical school that lasted 700 years; Apollonius wrote on conic sections; and Eratosthenes the geographer measured the earth and came within 50 miles of the correct diameter.

In astronomy, the calendar we now use was worked out; and in medicine, anatomy was taught and vivisection practised on animals and even on condemned criminals.

It was to the Mouseion of Alexandria, with its famous scientists, lecture halls, laboratories, huge and well organized library, zoological gardens, park and dining hall, that the youth of the ancient world (after primary and sometimes secondary education in Government-supported schools) flocked for scientific and technical training and education.

Dangers of Government Control

From that fascinating episode there is one important lesson to be drawn. Unlike the Athenian schools whose income was derived from private sources, the Mouseion of Alexandria was supported by the State, the funds being administered by a priest who was appointed by the King—a prototype, we can imagine, of the Chairman of the University Grants Committee. But "he who pays the piper calls the tune" and, under control of the palace, which included both the Court and the Government Offices, the University experienced both the advantages and the disadvantages of Government control.

In less than a hundred years from its foundation, the scientific energy of Alexandria had lapsed. To-day when Governments are, quite rightly, spending large sums on science in their own establishments and in universities, technical colleges and the like, there is a latent danger than pure science, the basis of applied science, may be starved, and that insistence may be too great on immediate and practical results.

"Limitless Desires"

I do not suggest that it has happened or is likely to happen here in the near future under the present enlightened system, but, on a long view, universities are right to be on their guard against the risk. As was well said by Mr. Gladstone in the first Romanes Lecture, delivered in 1892, with specific reference to our own Universities: "The chief dangers before them are probably two: one that in research, considered as apart from their teaching office, they should relax and consequently dwindle. The other that, under pressure from without, they should lean, if ever so little, to that theory of education which would have it to construct machines of so many horse-power, rather than to form character, and to rear into true excellence the marvellous creature we call man; which gloats upon success in life, instead of studying to secure that the man shall ever be greater than his work, and never bounded by it, but that his eye shall boldly run (in the language of Wordsworth) 'Along the line of limitless desires.''

Some of the mediaeval universities were founded by the State, notably the University of Naples, by the Emperor Frederick II in 1222 B.C.; others, like Bologna, by the Popes, and many were associated with monastic orders. The contribution of these early universities to science was limited to a few, like Salerno, which specialised in medicine. Three that tower above the rest are Paris, Oxford and Cambridge, all founded in the Twelfth Century A. D.

British Universities.

It was not until after the Restoration that, through the agency of societies in London and Oxford, the Royal Society for the promotion of Natural Science was founded (in 1662) and that, through the earlier stimulus of men like Lord Bacon (1561–1626) and Newton (1642–1727) science began to come into its own. In Great Britain, after Oxford and Cambridge the oldest universities are in Scotland—St. Andrews (1411), Glasgow (1451), Aberdeen (1494) and Edinburgh (1583). Glasgow and Aberdeen were established by Papal Bulls, in Glasgow's case on the model of Bologna, to which University Scotch students had been wont to resort.

The other British Universities are of modern origin. They comprise Durham (1832), London (1836), Manchester (1880), Wales (1893), Birmingham (1900), Liverpool (1903), Leeds (1904), Sheffield (1905), Bristol (1909), Reading (1926), Nottingham (1948) and a number of important university colleges. The remarkable features are, firstly, the extent to which University development in England has advanced since the Great Exhibition of 1851; secondly, the important place that the newer universities occupy in British scientific prestige; and thirdly, the reassuring fact that the older universities whose world-wide reputation was built on the "humanities," while retaining their status in that respect, have also achieved high distinction in science and technology.

* From a Lecture delivered at the Home Office Industrial Museum, London, S. W. 1, under the auspices of the Ministry of Labour and National Service, on August, 29, 1951.

(*Continued from page 8*)—**OUR ROAD PLAN AS SEEN THROUGH FRENCH EYES**

very cheaply obtained, the following surface type is adopted:

"Foundations in burnt brick without bond; on top, stone macadam of 6 cm gauge rolled in two layers of 9 cm thickness; tar 1.5 kg. per sq. metre, with coarse sand in place of shingle—this in a region not very humid and not wooded. The cost of such a road is 1½ million francs per kilometre. If traffic attains a figure of 500 tons per day, the formation is stabilized and the cost is of the order of 3 million francs per kilometre.

"It is to be noted that bricks and stone are extremely cheap."

Concentric Brick Walls

"The technique of making well foundations for bridges attracted the attention of the author and he writes: "Most of the foundations of the big bridges in this region are built by sinking concentric brick walls down to the necessary depth; concrete is poured between these two walls and reinforcement assures the rigidity of the whole. A concrete shoe (plug) is poured at the bottom of the big-diameter column thus formed, the remaining portion is filled with sand, and another layer of concrete is poured at the surface."

BOOK REVIEW

"Indian Standard Practice for Alphabetical Arrangements"

IS : 382-1952; Indian Standards Institution, 19, University Road, Civil Lines, Delhi-8, 4 pages, Rs 1-8-0.

THE standard is of importance not only to documentalists, bibliographers and librarians, but also to users and producers of bibliographies, catalogues, indexes to books, directories, such as telephone directories and lists of a similar nature.

Alphabetical arrangement means arrangement of letters or their combinations according to the traditional ordinal values of letters which increase as we proceed from the first to the last letter of the alphabet. While usage fixes a unique arrangement among the letters of an alphabet, groups of letters with different spacings, punctuations and other marks, and the introduction of alien characters, give rise to the possibility of several alternative arrangements.

The basis for alphabetical arrangement prescribed by the standard ignores the presence of space, punctuation marks, apostrophies, brackets, etc. In one of the examples given in the standard to illustrate the rules, the terms 'Electrode-holder' 'Electrode, Metal' 'Electro-deposits', 'Electrodes' and Electrode (wire), have been arranged in this order.

The rule for numerals is that they shall precede letters of the alphabet. Thus the entries '6 books'. '8 books', '100 books' shall be in this order.

Symbols, by which is meant non-alphabetical, non-numeral, internationally accepted characters, marks and signs, have been prescribed to precede numerals just as the latter are to precede letters of the alphabet. Mathematical symbols have been listed in an appendix according to the proposed order of arrangement for them.

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A BLESSING

Fortunately no regulations or code of practice have yet been issued for prestressed concrete and the way is clear for the exercise of originality in its development.

From 'Roads & Road Construction'—Aug. 1952.

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HUMAN PARCELS

It is amusing in these days of well ordered air travel to recollect that the engineer in charge of the construction of the Luangwa River bridge travelled by air to Lusaka, in Rhodesia, consigned and labelled as a parcel at the rate of one shilling per ounce.

TECHNICAL INFORMATION

1. COMBINED TIMBER AND CONCRETE PILES

(Extracted from 'Concrete'—July & September 1952).

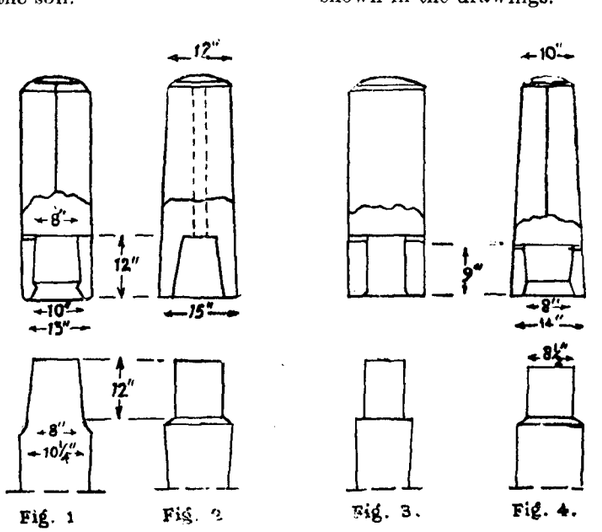
IT is necessary for their preservation that timber piles be kept at a constant moisture content, and in Holland they are frequently driven below low water level with in-situ concrete extensions above them.

Figs. 1 to 4 show a type of concrete pile, known as "oplangers," which are used to extend and to continue the driving of wooden piles. These are of various patented types.

Their advantages are: (a) Long piles to carry light loads are cheaper in a wood-concrete combination than in all-concrete construction; (b) the pile-driver can be lighter and shorter; (c) wood is less affected than Portland cement concrete by chemicals in the soil.

the wooden piles. The shapes shown in Figs. 1 and 4 are designed to lock the concrete and wood together. The concrete extension in Fig. 1 is driven so that it locks on the tapered head of the wooden pile while in Fig. 4 the head of the pile is cylindrical so that the wood is slightly compressed when the extension is driven on it. When the ground water reaches the joint, the wood expands and fills the dovetail shape in the extension shown in Fig. 4. Figs. 2 and 3 are similar designs; the wood is compressed in Fig. 2 resulting in a slightly stronger joint, although this may stop the circulation of water through the wood.

To prevent the formation of an air-cushion in the joint, vents are provided as shown in the drawings.



The shapes of the bottoms of some types of these extensions are shown in Figs. 1 to 4, together with the shapes of the tops of

These concrete extensions are hexagonal, octagonal, or circular in cross section. They are generally made in lengths of 3

ft to 12 ft, but sometimes up to 18 ft. Other common dimensions are given in the illustrations. The concrete extensions cannot be used for sloping piles.

The reinforcement is often welded and consists of eight or more bars of 3/8 in. or ½ in. diameter. The helical binding is in most cases ¼ in. in diameter and is very closely-spaced around the joint at the bottom, where there are often two helices of 3/8-in. or ½-in. bars.

Another method which may be used where extensions up to 5 ft long are required has been suggested. A watertight bag of bituminized paper is made, strengthened by wires circumferentially and by wooden ribs vertically, and this is placed on the timber pile after the latter has been driven to its final set. A cage of reinforcement is placed in the bag and concrete poured through a tremie, the paper serving to form shuttering and to protect the newly-placed concrete from damage by ground water. After placing the concrete the space around the paper mould is filled with earth.

Two types of bag are used. The first, for use where only vertical pressure occurs, has a rebated seating 2½ in. deep on the timber pile and is without circumferential reinforcement; it may be strengthened by driving a rag-bolt in the centre of the timber pile. The second type has an 8-in. deep rebated seating and has helical reinforcement. The bags are made in six lengths with a diameter at the top of 11 in. for the first type and 12½ in. for the second type.

It is claimed that this method is cheaper than the method (illustrated in Figs. 1 to 4) of driving concrete piles on top of wooden piles.

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2. SIMPLIFIED GRAPHICAL METHOD WORKS BLENDING AGGREGATES

(Extracted from 'Engineering News-Record'—June 19, 1952)

ANYONE blending three differently sized aggregates to make a specified mixture will find this method simple and practical.

It is an outgrowth of a more involved graphical solution of the aggregate blending problem presented in ENR Jan. 5, 1950, p. 45.

Why Triangular co-ordinates?—Triangular co-ordinate paper is used, since the sum of the distances of any point within an equilateral triangle from the three sides is constant and equals the length of one side—in this case, 100 per cent.

Selecting any point within the triangle (above) the proportion of Aggregate A is the distance from the base BC (measured along the line aA); the proportion of Aggregate B is the distance from the base AC (measured along bB); and Aggregate C is similarly measured along cC. It is helpful to remember that the point labeled A represents 100 per cent Aggregate A, B represents 100 per cent Aggregate B, and C represents 100 per cent Aggregate C.

Table I gives the sizing of the three aggregates, A, B, and C which are to be combined in a blend to meet the specification limits shown. In Fig. 1, three vertical lines are erected for each aggregate upon which are represented the grading of the particular aggregate. The vertical line representing Aggregate B is completely marked showing it is composed of 42 per cent of No. 4—No. 40, 55 per cent of No. 40—No. 200, and 3 per cent passing No. 200.

Using the No. 4—No. 40 fraction (designated as J) as an example, the percentages of Aggregates A, B and C which can be combined to yield exactly 25 per cent of the No. 4—No. 40 fraction will be determined. This will be done by making a satisfactory blend of Aggregates A and B, another satisfactory blend of Aggregates B and C, and then combining the two blends to obtain a mixture with a constant 25 per cent No. 4—No. 40 fraction although

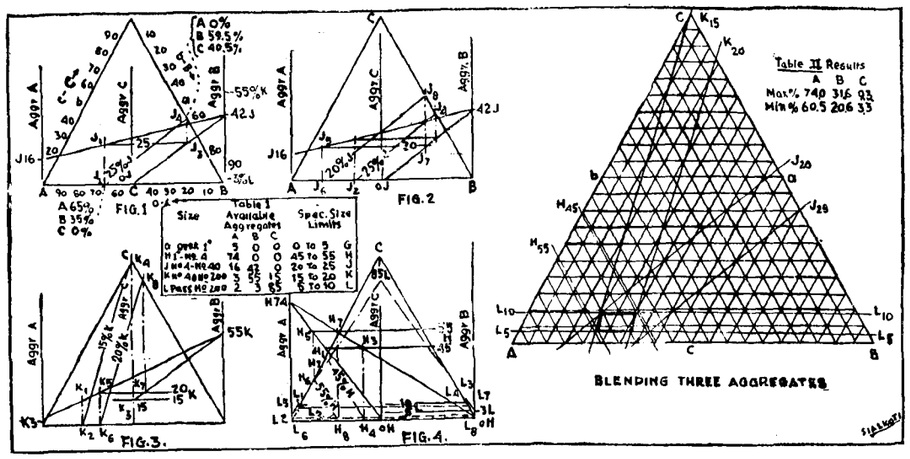
the percentages of Aggregates A, B and C may vary.

Mechanics of solution:—On Aggr. A line locate J at 16 per cent on Aggr. B line locate J at 42 per cent and on Aggr. C line locate J at 0 per cent. Draw lines J16, J42 and J0 J42. Draw the horizontal 25 per cent line to obtain J_1, which is projected to J_2, which represents a blend of 65 per cent A and 35 per cent B (0 per cent C). Extend the horizontal 25 per cent line to its intersection with the line J0 J42 at J_3. J_3 is projected to the CA line of J_4, which represents a blend of 59.5 per cent B and 40.5 per cent C (0 per cent A). The proportion of Aggregates A, B and C represented by points J2, J4, or any points on the line J2J4 will make a composite in which the No. 4—No. 40 fraction will equal 25 per cent.

Refer to Fig. 2 where the very same procedure is followed to establish the 20 per cent proportion limit line J6J8. The proportions of Aggregates A, B and C represented by any point in the area between the two lines J2J4 and J6J8 will yield a percentage of No. 4—No. 40 which will be between the specification limits of 20 per cent and 25 per cent.

Fig. 3 illustrates the solution of the K fraction and Fig. 4 represents the solution of the H and L fractions. Fraction G is not represented.

As the various limit lines of each fraction are determined, they are transferred



to the graph. Area enclosed by the heavy lines, common to all limits, represents all possible proportions of the three aggregates A, B and C which can be used to obtain a blend within specification limits. Thus, Aggregate A can vary from 60.5 per cent to 74 per cent, Aggregate B, from 20.6 per cent to 31.6 per cent and Aggregate C can vary from 3.3 per cent to 9.3 per cent. If the common area does not lie between each pair of limit lines, it is impossible to meet all [illegible] with the three aggregate[illegible]

ADMINISTRATION REPORTS AND BUDGETS

1. PUNJAB CIVIL WORKS BUDGET 1952-53.

The following extracts relating to Civil Works have been taken from the Punjab Budget for the year 1952–53.

	(In Lakhs of Rupees).		
	Actuals 1950–51	Revised Estimates 1951–52	Budget Estimates 1952–53
I. Revenue (Civil Works)			
(i) Rent	7.63	7.19	7.18
(ii) Ferry receipts	.02	—	—
(iii) Recoveries of expenditure	.23	.31	.30
(iv) Transfer from Central Road Fund	23.69	42.64	31.20
(v) Miscellaneous	17.60	22.85	29.17
(vi) Deduct refunds	−1.38	−0.34	−.24
TOTAL REVENUE	47.79	72.65	67.61
II. Expenditure (Civil Works)			
(i) Original Works	72.45	106.25	119.29
(ii) Repairs	67.77	65.26	60.80
(iii) Tools and plant	—	.66	.68
(iv) Grants-in-aid	3.91	4.38	5.49
(v) Suspense	—	−3.06	4.00
(vi) Deductions (amounts transferred to other heads)	−32.60	−13.66	−18.43
(vii) Establishment	16.93	14.04	12.48
Total	128.46	173.87	184.31
III. Expenditure (Communications only)			
(i) Original Works			
(a) Provincial	2.90	8.02	25.37
(b) Financed from Central Road Fund	2.40	—	—
(c) Punjab Govt.'s Ordinary share	20.18	6.35	14.20
(d) Govt. of India Reserve Original works	—	36.29	17.00
Total	25.48	50.66	56.57
(ii) Repairs	34.58	35.00	35.00
Communications Total	60.06	85.66	91.57
IV. Expenditure on Communications from Capital Account (Outside Revenue A/Cs)			
Original works	8.03	18.26	25.25
V. Revenue from Roads.			
(i) Receipts under motor Vehicles Acts.	15.95	16.12	18.60
(ii) Receipts under Punjab Motor spirit (Taxation of Sales) Act.	15.22	18.96	19.01
TOTAL	31.17	35.08	36 1

A BRIEF REVIEW OF THE PUNJAB BUDGET

THE Punjab Budget for 1952–53 provides for revenue receipts of Rs 1704.77 lakhs and expenditure chargeable to revenue of Rs 1748.12 lakhs leaving a deficit of Rs 43.35 lakhs. The revised estimates for 1951–52 indicate a surplus of Rs 38.58 lakhs with the revenue receipts amounting to Rs. 1738.83 lakhs and expenditure to Rs. 1700.25 lakhs.

Revenue expenditure on Civil works for 1952–53 estimated at Rs 184 31 lakhs forms 10.8 per cent of total state revenues. The corresponding percentage figures for the previous two years 1951–52 (revised estimates) and 1950–51 (actuals) are 10.0 and 7.6 respectively.

Expenditure on Communications chargeable to revenues under the heads Original Works and Repairs during 1952–53 is estimated at Rs 91.57 lakhs. This is exclusive of charges on establishment and tools and plant and of Rs 25.25 lakhs earmarked for expenditure on communications from capital account (outside revenue account). The revenue expenditure (Rs 91.57 lakhs) forms 5.4 per cent of total state revenue in 1952–53, the corresponding percentages for the previous two years being 4.9 and 3.6 respectively.

2. KUTCH P.W.D. ADMINISTRATION REPORTS 1948-51

KUTCH became a centrally administered area as a 'Part C' State from the 1st June, 1948 and the period beginning from this date up to the 31st March, 1949 is covered by the Administration Report of the P. W. D. of the State for the year 1948–49.

The salient features of the Reports for the two years **1948–49** and **1949–50** are as follows:—

1. EXPENDITURE ON BUILDINGS & ROADS

	1948–49	1949–50
	(Lakhs of Rupees).	
(1) **Original Works.**		
Buildings (Major Works)	1.59	1.44
Buildings (Minor Works)	0.13	0.20
Roads	—	—
(2) **Repairs.**		
Buildings	1.45	1.54
Roads	1.08	1.34
(3) **Famine Road-Works**	2.76	8.95
Total Expenditure	7.01	13.47

Establishment expenditure during the two years 1948–49 and 1949–50 amounted to Rs. 0.47 lakhs and Rs 0.78 lakhs respectively, representing 6.5 per cent and 5.8 percent of total works expenditure in the two years.

2. ROAD MILAGE

Public Works Department held charge of 257 miles of water-bound macadam roads from the beginning of 1948–49 and no rew roads were constructed during the two years under review. In addition, however, there were seven miles of road maintained from the privy purse, not under the charge of the P.W.D.

3. RECEIPTS OF THE DEPARTMENT

Receipts of the P.W.D amounted to Rs 15,029 during 1948-49 and Rs 65,149 during 1949-50. Both the Roads and Buildings Sections and the Aviation Section contributed to these receipts. Tolls on roads figured as one of the new revenue yielding items during the year 1949-50.

1950-51 : Kutch had 266 miles of water-bound macadam roads during 1950-51. Roads in the State which are under the executive charge of the State P. W. D. have been administratively controlled by the Government of India since April 1950.

The revenue of the Public Works Department during the year under review amounted to Rs 86,432 against Rs 65,149 during 1949-50. Expenditure incurred on roads and buildings during 1950-51 was as follows :—

(In lakhs of Rupees)

	Roads	Buildings	Total
Original Works	3.93	1.89	5.82
Repairs	4.19	1.82	6.01
Total	8.12	3.71	11.83

It will be seen that of the total expenditure of Rs 11.83 lakhs on roads and buildings, nearly 70 per cent was provided for roads only.

Expenditure on tools and plant for road works during the year amounted to Rs 97,659.

Establishment expenditure during the year was Rs. 87,140 which works out to 7.3 per cent of the total works expenditure. The corresponding percentage for 1949-50 was 5.8.

—o—

NO COMPROMISE

The fundamental principle of scientific work is unbending integrity of thought, following the evidence of fact wherever it may lead, within the limits of experimental error and honest mistake. On this there can be no compromise.

(Prof. A. V. Hill)

He had " borrowed " father's car and bent the mudguard. He took it to the repair man and said : " Can you fix this so Dad won't know it was bent ? "

The repair man replied : " No, but I can fix it so that in a few days you can ask Dad how he bent it. "

List of Approved Works on National Highways

S.No.	Job No.	Name of work	Estimated cost	Remarks
		ORISSA		
1.	642 RS 7	Construction of culverts falling on the approach road to bridge over Kola Nallah from mile 136 to 139 on National Highway 6.	76,700/-	
2.	648 RS 6	Extension of metal surface from 9 ft to 12 ft width in miles 155 to 159 of the Bargarh-Sambalpur section of National Highway No. 6.	26,100/-	
		BOMBAY		
3.	643 BM 8	Providing hume pipe culverts in the Kharod-Ankleshwar section of the Bombay-Ahmedabad National Highway No. 8.	40,500/-	
4.	644 BM 8	Land acquisition for the Pirojpur-Prantij section of the Bombay-Ahmedabad National Highway No. 8.	1,42,300/-	
5.	645 BM 8	Land acquisition for Prantij-Himmatnagar section of the Bombay Ahmedabad National Highway No. 8.	1,29,300/-	
6.	647 BM 8	Improvement to the Ahmedabad-Naroda sub-section of the Ahmedabad-Pirojpur section of the Bombay-Ahmedabad National Highway No. 8.	1,67,500/-	
7.	656 BM 8	Construction of the Karjan-Makarpura sub-section of the Karjan-Baroda section of the Bombay-Ahmedabad National Highway No. 8.	5,00,800/-	
8.	657 BM 8	Land acquisition, fixing boundary stones and constructing service paths in the Boriavi-Vasad Section of the Bombay-Ahmedabad National Highway No. 8.	6,84,600/-	
		ASSAM		
9.	646 AS 31	Purchase of special tools and plant equipment required for the ferries on Assam Access Road, National Highway No. 31 — for permanent and and emergent use in Dhubri Division.	53,800/-	

10.	649 AS 31	Carrying out detailed survey of longter alignment of National Highway No. 31 *via* proposed Gangadhar bridge crossing at Simulbari.	14,800/-
		KUTCH	
11.	650 KH 8A	Surveying the Kandla-Chirai section (11 miles) of the Kandla-Ahmedabad, National Highway No. 8A.	2,400/-
		MADRAS	
12.	601 MD 5	Construction of a bridge across the Eluru canal near Badampuri on Madras Calcutta Road	1,45,000/-
		WEST BENGAL	
13.	652 BG 6	Providing ferry boat with approaches for the ferry on Dulong river at Fekoeghat on National Highway No. 6	10,120/-
14.	653 BG 31	Construction of approach roads to the New Geesh Bridge on National Highway No. 31 in Jalpaiguri District.	1,30,000/-
		RAJASTHAN	
15.	654 RJ 8	Surface painting Jaipur-Delhi road (N.H.No. 8) in miles 37—39, 41/$\frac{1}{5}$, 44—9, 50$\frac{1}{2}$, 52—55 and 56$\frac{3}{4}$.	1,51,500/-

The first dated postmark in Holland was used in 1829, not for the cancellation of stamps—which were then not even thought of —but for the control of prompt delivery. The postage was paid by the addressee.

Books added to the Roads Organisation Library during November 1952

The British Standards Institution, 24, Victoria Street, London, S.W.I.

1. **B. S. Code of Practice C. P. 1004: Part 1 : 1952, Street Lighting, Part I, Traffic Routes.**
2. **B. S. 497 : 1952 Cast Manhole Covers Road Gully Gratings and Frames for Drainage Purposes.**
3. **B. S. 1881 : 1952 Methods of Testing Concrete.**
4. **B. S. 1856 : 1952 General Requirements for the Metal Arc Welding of Mild Steel.**
5. **The Popular English-Hindi Dictionary with Sundry useful Appendices and Tables.** (The Indian Press Ltd., Allahabad, 1950).

The British Road Federation Ltd., 4-a, Bloomsbury Square, London, WC. I.

6. **Road Way to Safety.**
7. **Basic Road Statistics, Great Britain 1952.** 2 copies.
8. **Facts and Figures about the Govt. Transport (Madras).** (The Directory of Information and Publicity, Government of Madras).

H. M. S. O., London.

9. **Road Research 1950 with the report of the Director of Road Research for the year 1950.**
10. **The Suction of Moisture held in Soil and other Porous Materials—Road Research Technical Paper No. 14,** by D. Croney, J. D. Coleman and Pamela M. Bridge.
11. **Report on the Collapse of a Foot bridge which occurred on 19th January 1952 at Knowsley Street Station, Bury in the London Midland Region, British Railways.**
12. **Coloured Treatment for Bituminous Surfaces—Building Research Station Digest No. 43.**
13. **Committee on Road Safety—Report to the Minister of Transport on the Highway Code.**
14. **Schedule of Suggested Minimum Street Widths for Carriageways and Footways of New Streets.**
15. **Progressive Uttar Pradesh-Town Planning** (The Publications Bureau, Information Directorate, U. P. Govt., Lucknow).
16. **More about Rubber in Roads** by L. Mullins and A. R. Smee (The British Rubber Development Board, Market Buildings, Mark Lane, London, E.C. 3. 1952).
17. **Highway Survey and Design Manual, 1950** by Charles M. Ziegler (Michigan State Highway Department, Lansing, Michigan).
18. **The Analytic Mechanical Testing of Bituminous Mixes-Shell Bitumen Reprint**—No. 5 by A. V. Endersby (Burmah-Shell Oil Storage and Distributing Co. of India, Ltd. (Incorporated in England) Burmah Shell House, Connaught Circus, New Delhi.
19. **Highway Definitions-Part I—Types of Highways Part II—Additions to "Types of Highways" Part III Traffic Terms. Part IV—Right-of-Way Terms** Prepared by Special Committee on Nomenclature (Adopted by the American Association of State Highway Officials, June 25, 1949, Washington).

Central Board of Irrigation and Power, Curzon Road; New Delhi.

20. **Proceedings of the 22nd Annual meeting of the Research Committee of the Central Board of Irrigation and Power-Programme and Preli-**

minary Notes Sections A, B, and C (Cyclostyled) 7-12, July, 1952.

21 -do-Preliminary Notes Sections, D. E. F.

22. -do-Preliminary Notes Sections G. H. I. and J.

23. **Annual Report of the Hirakud Research Station 1951** by R. C. Hoon.

24. **The displacement method of Frame analysis** by G. P. Manning (Concrete Publications Ltd., 14, Dartmouth Street, London, S.W.I., 1952).

25. **Strain Gauges, Theory and Application** by J. J. Kotch and others. (Cleaver Hume Press Ltd., 42-A, South Audley Street, London, W.I., 1952).

26. **The Hardy Cross Method and its Simplification (La Methode De Hardy Cross Et Ses Simlifications Systemes Rectilignes a moments, D'inertie Constants** by Serge Zaytzeff (DUNOD. 92, Rue Bonaparte (Vie), Paris 1952.)

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31. **Tables for rapid Calculation of deep web girder beams. (Tableaux Pour Le Calcul rapide des POUTRES A AME PLEINE RIVEES ET SOUNDEES)** by Omer Hoatrechts.

32. **Composite Concrete Steel Structures (LE CALCUL DES CONSTRUCTIONS MIXTES ACIER BETON)** by Victor Forestier.

33. **Design of hyperstatic (indeterminate) Systems : Continuous Frames-Vierandal girders LE CALCUL DES SYSTEMES HYPERSTATIQUES (PORTIQUES CONTINUSPOUTRE VIERENDEEL)** by E. Roland.

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35. **Brihat Hindi Kosh** by Kalika Prashad (Gyan Mandal Ltd., Kabirchaura, Banaras, I.)

36. **Comprehensive Bibliography of Cement and Concrete 1925-1947** by Floyd O. Slate (Joint Highway Research Project, Engineering Experiment Station, Purdue University).

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40. **Introductory Soil Mechanics and Foundations** by George B. Somers and George F. Somers.

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McGraw Hill Book Co. Inc., New York, 1951.

46. **Engineering and Western Civilization (1st edition)** by James Kip Finch.

47. **Pile Foundations-Theory-Design-Practice** by Robert D. Chellis.

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John Wiley & Sons, Inc., New York.

49. **Data Book for Civil Engineers-Design. Vol. I (2nd revised edn.)** by Elwyn E. Seelye. 2 copies

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51. **Punched Card Methods in Scientific Computation** by W. J. Eckert (The Thomas J. Watson Astronomical Computing Bureau, Columbia University, 1940).

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53. **Indian Railways 1950-51** (Ministry of Railways).

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