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In this issue

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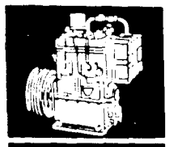

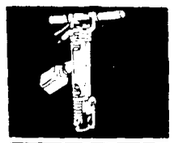

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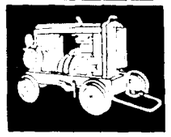

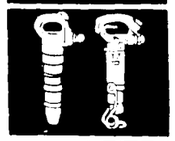

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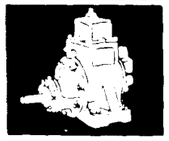

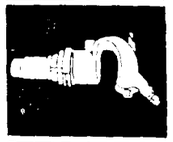

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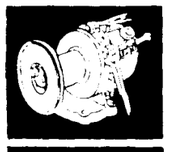

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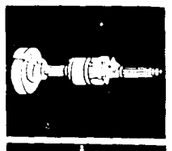

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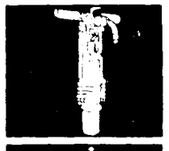

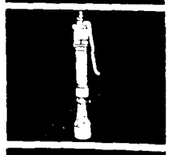

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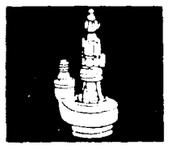

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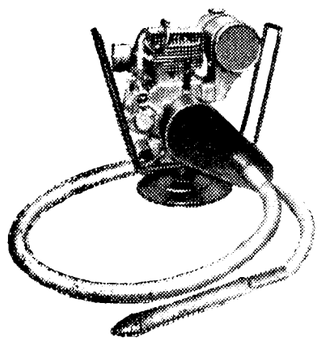

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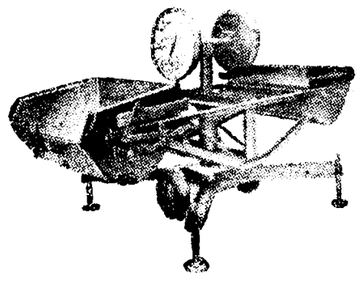

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Editorial

THE Transport-Communications Monthly Review came out timorously as a cyclostyled brochure in May 1947. One of the original intentions behind the venture was to utilise some of its sheets to convey information on interesting technical matters to the road-engineer.

Incidentally, it was hoped that in the course of time, these sheets would become repositories of useful information which would be easily accessible for future reference in the Roads Organization of the Government of India and in road-engineers' offices throughout the country.

The publication soon became popular and by February 1948 the demand for copies was so great that it could not be met from a cyclostyled edition. The Indian Roads Congress stepped in at this stage and offered to finance printing the magazine until such time as it was self-supporting.

We are glad to say that, financially speaking, we have now definitely found our feet. Since, as a matter of policy, we seek no profits, we propose now on to widen the scope of our services to the road-engineer profession. Further to impress on our layman readers the importance of Transport-Communications, we also intend to expand in other directions.

Our New-Year's Good Resolutions

Beginning with this issue we propose to publish a series of interesting articles on highway engineering, the first article in this series being on **"Reconnaissances for Bridge Sites."**

Then will follow brief summaries on highway standards recommended by the Indian Roads Congress from time to time. Most of our engineer-readers will have seen these standards and the Codes of Practice set forth in severely technical language in the Indian Roads Congress journals. Many readers may have put the abstruse dissertations aside for careful study when opportunity affords.

In these busy days, however, opportunity to do real, hard, thought-provoking work is difficult to find. We have therefore conceived the idea of publishing every month some reviews in simple language (and not in great detail) of Standards and Codes published recently by the Indian Roads Congress. We hope that our engineer-readers on finding how really interesting and useful these Standards

together, producing a mixture practically as strong as concrete.

Selling an Idea

The next thing was to "sell" the idea to the right people. "I went to Chequers," he said, "arriving at about the time Mr. Churchill was getting ready for dinner, and I was told that he was in his bath. I said, 'Good, that is exactly where I want him to be'. I nipped up to his dressing-room and called out to him that I had a block of new material which I would like him to put in his bath. I gave him a block of Pykerete."

One of the curious properties of that material was that, after the surface had melted, the melting practically stopped, because the ingredients formed a furry insulating coating on the outside. The fact that the block did not melt appreciably in a hot bath impressed the Prime Minister so much that he backed further investigation.

Details were worked out, including building sites in Newfoundland, where the material would freeze on being poured on.

Disagreement gives Opportunity

At the suggestion of Mr. Churchill, he had arranged to submit the Habakkuk Project to the Quebec Conference in August 1943, when there was a meeting of the Combined Chiefs of Staff. The difficulty was to sell the idea to the Americans. But an opportunity occurred when, quite early in the conference, a disagreement had arisen between the British and American Chiefs of Staff.

At those conferences the Principals of the two Chiefs of Staff Committees sat around the table, and behind them the members of the Staffs, very senior officers, looked on with stoney eyes when they felt their seniors were selling the pass.

Bosses Left Alone

The Chief of the Imperial General Staff, Field Marshal Lord Alanbrooke, had suggested that the members of the Staffs should leave the room, and that the Principals should sit around the table and continue their talk alone. The Staff did leave, wondering what their bosses would do in their absence; but it was not long before harmony was restored.

It was then that Lord Mountbatten had asked permission to introduce "Habakkuk." He had a sample of Pykerete available to compare with a sample of ice, and he asked that he might bring it in. Permission was given, and in came a member of his staff with a dumb-waiter, on which he wheeled a large block of ordinary ice and a large block of Pykerete, plus a kitchen chopper.

The Strong Man in Pain

Earl Mountbatten asked which of the Chiefs of Staff was the strongest, and General Arnold (then Chief of the United States Army Air Forces), took off his coat, seized the chopper and brought it down on the block of ice, which was satisfactorily split. Then he spat on his hands, seized the chopper again and advanced on the Pykerete, little knowing what he was in for. He brought the chopper down, but did not even dent the Pykerete; instead, he jarred his elbows and gave a shriek of pain. The members of the staffs outside had heard the blow and had recognised the the voice of one of their Chiefs in pain, and they became rather worried.

My God, They've Started Shooting

Then Lord Mountbatten drew his Service revolver and fired a shot at the ice, which was shattered. To demonstrate that Pykerete would stand up to gun fire, he fired a shot at that. The bullet bounced off and nearly hit Sir Charles Portal (then Chief of the air staff); and outside, the white-faced staff were heard to say, "My God, they've started shooting!"

However, the idea of landing on the Biscay coast was turned down in favour of a landing between Cherbourg and Le Havre, and so the idea of using Pykerete platforms was not taken up, although it had appeared not nearly so far-fetched as some of those that were taken up later.

—o—

Hints on Preparing
RECONNAISSANCE REPORTS ON BRIDGE SITES

DURING every road-engineer's professional career it will probably fall to his lot on many occasions to carry out reconnaissance surveys for bridge sites. The bigger and more important the bridge, the higher will be the responsibility devolving upon the reconnoitering officer, for on his reports will mainly depend the final selection of the site. It is, therefore, important that the engineer should have a good grasp of the fundamental factors which help him arrive at correct decisions. It is the purpose of this article to provide the engineer with an **aide-memoire** on what to look for and what to include in his report so as to make it useful.

What is a Good Site?

2. The characteristics of an ideal site for a bridge are:—

(1) A straight reach of the river;

(2) Steady regimen of the river and absence of serious whirls or cross currents;

(3) A narrow and well defined channel;

(4) Suitable high banks above high flood level on each side;

(5) Rock or other compact and fairly unerodable foundations close to the bed level;

(6) Secure and economical approaches which should not be very high, long, or liable to flank attacks of the river and its spills during floods; nor should the approaches involve obstacles, e.g., hills, frequent drainage crossings, sacred places, graveyards, congested or built-up areas needing viaducts, or troublesome land acquisition;

(7) Reasonable proximity to a direct alignment of the road to be served, i.e., avoidance of long detours;

(8) Absence of sharp curves in the approaches;

(9) If it is unavoidably necessary for the approaches of a bridge to cross the spill-zone of a river, they should, while proceeding through the spill zone towards the river, face downstream and not upstream, facing upstreams will cause heading up, pocket formation, and danger to the approaches.

(10) Absence of costly training works and, where such works are unavoidable, the possibility of executing them largely in the dry;

(11) Avoidance of excessive construction work under water;

It is hardly necessary to mention that the "ideal" site never exists in reality. At every site, one or more of the ideal conditions is lacking and the object of a reconnaissance ("recce" for short) is to select the least objectional site.

3. In making this selection, the relative importance to be attached to any one factor may vary considerably according to the nature of the bridging problem. The best compromise is a matter of judgement but that judgement can only be applied after careful study of relevant data. It is the business of the "recce" officer to collect that data and to **record it**.

"Rejection" Precedes Selection.

4. The officer deputed to reconnoitre for a bridge site should first study at home the largest available map of the area. He should tentatively fix the limits of the terrain within which his examination is to be conducted and make a tentative selection, on the map, of the sites and locations that seem to warrant inspection. The best method of doing this is by a process of "rejection", i.e., by considering the topography of the reach of the river as a whole and rejecting such stretches where the chances of finding a suitable site for a bridge are negligible.

5. After eliminating unsuitable sites the "Recce" Officer should concentrate

upon the remainder, giving prior attention to the 'probable' site nearest to the line along which, other things being favourable, the proposed road would run.

6. Having decided the site or sites to which reconnaissance activities should be directed, the Recce Officer should calculate the catchment areas at the probable sites from maps in his possession and get together any other information readily available with him about flood levels, discharges, waterways, etc., relating to the sites and to any bridges on the same river in the vicinity.

7 He should also take steps to collect meteorological information like annual rainfall and seasonal distribution, storm data, direction of prevailing and strongest winds, range of temperature (seasonal and daily), and humidity conditions.

If there are existing road or railway bridges not very far upstream or downstream of the site he is to examine, he should write and ask for particulars of these bridges.

Field work

8. Now the Recce Officer is ready to start his field work. His party should include, if possible, the officer who is to be responsible for carrying out the subsquent detailed investigation and preparation of the project.

9. **Equipment**:—The equipment which the party will need during field work includes—

(1) Tapes and survey chains with plenty of arrows;

(2) Half a dozen bamboo poles, each shod with steel, marked in black and white for feet, and carrying flags at the top;

(3) A clinometer or Abney level;

(4) A dumpy level with staff or, alternatively, a straight edge, and an ordinary mason's level;

(5) A prismatic compass or sextant;

(6) A stop watch or, in its absence, an ordinary watch with a second-hand;

(7) A crowbar and a one-inch diameter steel rod, about 12 ft long, with one end pointed, and a sledge hammer;

(8) Pegs and mallets.

Data to be Collected.

10. The field examination of the site should be rapid but sufficiently thorough to enable the officer to include in his reconnaissance report all the information indicated in the following paragraphs—or at least, most of this information.

Preliminaries.

11. The officer should first write down the following:—

(1) Name of the river he is to examine, of the highway requiring the bridge, and the milage of the probable bridge site from the nearest town or identifiable village.

(2) The name of the State and the District;

(3) Map reference of the crossing point or the approximate latitude and longitude scaleable from maps;

(4) Location of the nearest G. T. S. Bench Marks with their levels;

(5) Nature of the river (perennial, tidal, snow-fed, or rain-fed, etc.). In the case of perennial rivers, indicate low water level and its greatest depth.

(6) Description (with dimensioned sketch showing foundations) of any existing bridge or causeway over the same river in the vicinity, giving reason if the work is unsatisfactory.

(a) For an existing causeway, indicate the maximum depth of submersion, the height of the lowest point on the causeway above the lowest bed level, ventage if any, frequency and duration of interruptions to traffic.

(b) For an existing bridge, give the known clearance above the low water level, lowest bed level, and H. F. L. If any trouble has been caused by scour or flank attacks on approaches, give particulars.

(c) When a bridge is to replace a causeway and is sited close to it, other things being equal, a site upstream of the causeway is generally to be preferred;

(d) If the proposed bridge is to be near another existing bridge on the same river, the piers of one should not cause difficulties for the piers of the other by giving rise to cross currents or scour.

He should accompany this preliminary note with a sketch showing on the sketch itself the information listed above. He should also show the north point and the direction of flow of all streams. (See para 21 below).

Hydraulic Data

12. The following hydraulic data should be collected:—

(1) **Catchment**—(a) A traced index map showing the catchment area (suitable scale 1 in. to a mile or smaller) indicating, if possible, rough boundaries of hilly country, plains, forest, cultivated or barren land, etc. and the general nature of the soil in the area.

(b) The worked-out catchment are in square miles from 1 in. or $\frac{1}{4}$ in. G. T. S. maps at (roughly) the site envisaged for the new crossing.

(2) **H. F. L.**—(a) High floods generally leave water-marks on tree trunks and these are visible for a number of years after the floods. The marks consist of rings of silt (with or without twigs sticking to them) round the trunks of trees. Carefully examine old trees and look for these marks.

(b) Also ascertain by local enquiry (by individual, and **not** collective interrogation, of old inhabitants) the points on the ground (or on trees or structures) scattered over a wide area, that has been reached by the highest flood level in living memory. Show these points on sketch plans and cross sections, not necessarily to scale. Then link the levels of all these points to a common datum. Where there is a considerable difference in the levels reported by the local people, a difference that cannot be explained by afflux calculations, let the people argue the matter out and then use judgement.

(3) **Velocities and Discharge.** Record any information available from local enquiry as regards velocity of flow, slopes of bed or water surface, and floating debits.

(a) If there is a nearby existing causeway, the extent of the afflux caused by it should be ascertained, if possible. Rough discharge figures can often be estimated from this data.

(b) If the reconnaissance is done while the river is carrying an appreciable discharge, the time taken by a log thrown into the centre of the stream to float down a measured distance gives a rough indication of the velocity at that level which should be stated.

(c) If constants of any of the catchment and discharge formulae are known for the area, give figures for discharge based on these.

Siting.

13. Prepare a sketch map, not necessarily to scale, showing the position of the sites examined and assess the advantages and disadvantages of each site and give reasoned preferences for the sites in the order of merit.

DETAILED EXAMINATION

14. Sites not definitely rejected must all be examined and assessed for their merits. If any one site is unmistakably superior to the others, detailed examination may be confined to that site only.

Classify information as below:—

(1) Give a sketch, preferably to scale, of the cross section of the river at the site considered. A dumpy level can be used for this but on "recce" work it is preferable to use an Abney level or a clinometer or even a ghat-tracer. Even without these instruments, much useful information can be obtained by eye observation alone with the help of marked bamboo poles, a tape, and a mason's level. Cross-sections can be roughly gauged from temporary siting-flags erected on each bank.

(2) Mention whether the reach is straight or curved; give the length of the "straight" and the approximate position of the site on the "straight".

(3) Show in the sketch all tributary streams entering the river within a reasonable distance (say 5 to 10 times the width of the river) upstream of the site being examined. Give the approximate discharge of these tributaries as ascertained from the catchment area map.

(4) Ascertain, if possible, the depth of the deepest scour hole below H. F. L. and mention whether the hole is in the normal channel, against a hard bank obstruction, at a curve, or "local", caused by a whirlpool.

(5) In wide, meandering, alluvial rivers, indicate the width between stable banks, the position and widths of "nodes", i.e. the points at which the stable banks come closest to each other, and the width and depth of the channel during "dry" weather, ordinary floods, and high floods. Also indicate roughly the radii of the larger, meanders taken from the map.

(6) Show in the sketch plan the conditions of the approaches for 1000 ft on each side of the site being examined and sketch-in the alignment of the proposed approach road. Run a line of levels with an Abney level, clinometer dumpy level, or by boring rods to eye measurement, along this alignment and use a compass to show roughly the tangents of curves.

15. **Bed Material and Foundation**:—Indicate on the cross-section the bed material on the surface, and also a little below it as ascertained by probing with an iron rod, and say whether the bed is fairly homogeneous.

(1) If rock is exposed in the bed, indicate its position.

(2) In the case of sand, record whether it is quartzy, very micacious, very coarse, coarse medium, fine, or very fine.

(3) In the case of clay, record whether it is sticky, stiff, loamy, loose, or soft.

(4) In the case of boulders, record whether they are large or small, angular or rounded, and give their approximate size.

Note—State also the nature of the soil surface in the approaches.

(5) Then, probe deeper into the (dry) bed of the river with a steel bar (1 in. diameter is usually enough), using a sledge hammer and note the movement per blow, or the number of blows per foot sinkage. If the bed material alters within the range of the bar (12 ft length is convenient), the fact can usually be recognized and sometimes samples remain attached to the point of the bar. Aim at finding rock.

16. **Banks**:—State whether the material of the banks is rock, clay, loam, very sandy soil, or pure sand, etc.

If any rock projects from a bank into the river in such a manner as to deflect the current or cause serious whirls, give its position. If any bank is seriously eroded, or silted, indicate the position.

17. **Supplies of Materials**:—State what building materials can be made available, their quantity if limited, quality, source of supply, distance and means of communication, and methods of transport.

Specially mention the following:—

(1) earth for embankments;

(2) puddle clay:

(3) building stone, hard filling, pitching stone;

(4) stone suitable for concrete aggregate;

(5) bricks, brick-clay for local manufactures;

(6) lime; specially mention kankar lime, if available, and its quality;

(7) sand:

(8) timber.

18. **Labour, Staff, Amenities**. Classify the required information as follows:—

(1) Skilled or unskilled labour; available locally or to be imported and if to be imported, from where;

(2) Existing facilities for housing labour and staff at or close to the site of work; need for building such accommodation. Mention building facilities especially what kind of roofing can be provided.

(3) Nearest village or market from which supplies can be obtained;

(4) Healthiness of the site; quality and quantity of drinking water supply;

(5) Any special services obtainable, e.g., medical facilities, piped water supply, post and telegraph office, and electricity for domestic or power use (state A. C., or D. C., voltage, phases, frequency).

WRITING THE REPORT

19. The report should be brief and to the point but must not omit anything relevant. Clear, brief, and crisp reports, accompanied by sketch maps, give a far better picture than do long narratives.

(1) The Recce Officer will have to apply a broad vision and commonsense to the problem taken as a whole.

(2) If only one site is predominently superior to all others, the Recce Officer should recommend that any subsequent investigations be confined to that site only.

(3) If several sites merit consideration, he should give his own order of their respective merits.

(4) In either case he should recommend the scope of the subsequent detailed investigations and surveys needed to obtain the full data required for the design of the bridge.

(5) The scope of the detailed investigation may vary from a very brief local survey for determining locations, reduced levels, and sections in the simpler cases, to fairly comprehensive investigation of topographical, hydrological, and geological data including exploratory borings of the subsoil, in the more complicated cases.

(6) For economy as well as speed it is necessary that the scope should be limited to actual requirements and intelligently drawn up reconnaissance reports are a great help in this.

(7) **Sketches**. The most important parts of the Report should be the sketches. These should give not only information about the site under consideration but of the

(i) configuration of the river and its tributaries, for a distance of from five to ten times its width, upstream and downstream of the site.

(ii) rough levels upstream and downstream of the whole length shown in the sketch;

(iii) alignment and levels of the approaches to each site;

(iv) position of nallahs, hills, tanks, lakes, temples, and all obstructions that would lie in the way of locating alternative approach roads to the site.

(8) **Points the Recce officer should remember**.

(i) He is concerned with selecting the best possible bridge site but this does **NOT** always mean the place where the cheapest bridge can be built. The best site is generally the one where the cheapest bridge **with its approaches** can be built.

(ii) He must think of the road and avoid long diversions if possible.

(iii) He must also think of the road-needs of the traffic that is going to use the road for the next thousand years and avoid sharp curves, steep gradients, blind approaches etc.

(iv) He must also think of the origin and destination of traffic that will cross the river after the bridge is built and locate his site as far as possible to suit the needs of present, and more important, future needs of traffic.

(v) But he must not be influenced in his decisions by local vested interests either in land, or in traffic.

(vi) In brief, the recce officer is to select the best site, not only the best site technically, but the best site having in view the long-term prosperity of the country. The recce officer has a difficult and important task to perform.

Mistakes.

20. It may help the recce officer in his work and in writing his report to think of mistakes that have been made in the past by some of his predecessors. A few of the worst mistakes are listed below:—

(1) Bridge sited immediately downstream of a junction of two big rivers. [This mistake comes of looking only at a site and not upstream.]

(2) Bridge undermined after construction owing to regression of soft rock in the river bed. [This mistake comes through the recce and survey officers not looking immediately downstream where there were a series of waterfalls rapidly travelling up the soft-rock bed of a river.]

(3) The designs of two bridges were interchanged and each was built over the stream for which the other was intended. [This extraordinary mistake occurred because the recce and survey officers did not take enough trouble to show the exact sites of the bridges on their plans with reference to neighbouring villages, the streams themselves, and the approaches. The construction officer, of course, also acted without intelligence.]

(4) Site involving deep foundations selected when there was a site with rock at no great depth only 700 ft downstream. [This mistake would not have occurred had the recce officer sketched the course of the river downstream because there were surface indications (configuration of the banks and rocks on the banks on each side) that indicated the probable presence of rock at no great depth below the bed.]

(5) Bridge much longer than necessary was built. [This mistake occurred because the recce officer did not notice that the widespread of the river from bank to bank at the selected site was due to the presence of an old causeway which had frequently been outflanked and extended in the past. Half a mile upstream and half a mile downstream the river had accepted a much narrower bed.]

(6) Afflux caused by guide banks flooded some villages. [This mistake occurred because the recce, survey, and construction officers did not calculate probable affluxes and did not examine the levels of the country in the immediate neighbourhood of the site.]

(7) More money was spent on the approaches to a bridge than on the bridge itself. Had the bridge been built 200 ft upstream, the total cost would have been halved.

The mistakes quoted are mistakes that have actually occurred in the past. The list could be made much longer. In nearly every case the mistake arose because, first the recce officer. and then the survey and construction officers, had their noses glued to a particular site and neither looked upstream nor downstream, nor did they look to the right or the left hand approaches to the bridge. They were obsessed with a particular BRIDGE SITE.

21. This aricle is headed "Reconnaissance Reports on Bridge Sites". Let the recce officer observe the plural in the word "sites" and look upstream and downstream of the river and to his right and left on the banks. Let him then **make sketches of what he sees**, putting in names of villages, a north point, direction of flow of his river, sketches of hills and nallahs, temples and graveyards, in fact of obstructions of all kinds. Let him

(1) Use his eyes, and

(2) Record what his eyes have seen.

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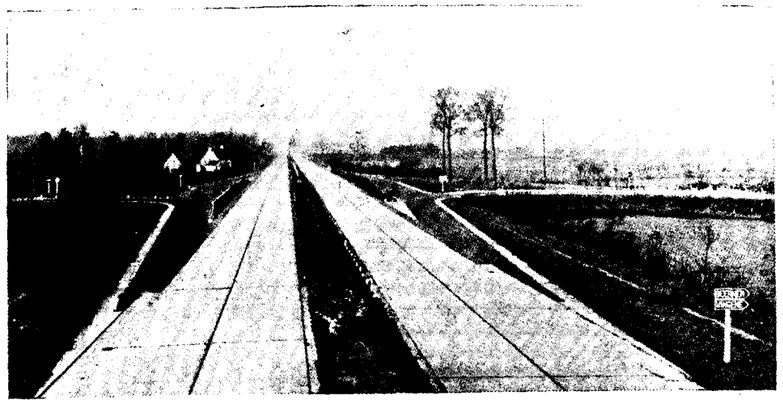
WHAT'S IN A NAME?

The "Irish Times" reports that after approving an increase of eleven shillings in the wages of scavengers (to £5 6s. weekly), Athlone Urban District Council has decided to call them scubadoirs in future.

[*Does it mean "Harijans"?—Ed.*]

[*From 'The Surveyor'—Nov. 17, 1951*]



CONCRETE ROAD CONSTRUCTION BELGIAN PRACTICE*

ENGINEERS, contractors, and public works officials will be interested in the Belgian concrete road-building technique. It is the purpose of this article to give some information on this subject.

Concrete Mix.—The specifications of the Belgian Highway Department are as follows:—

21 cu. ft crushed stone $\frac{3}{4}$" to $1\frac{1}{2}$"
11 cu. ft crushed stone $\frac{1}{4}$" to $\frac{3}{4}$"
11 cu. ft crushed stone 1/8" to $\frac{1}{4}$"
11 cu. ft sand
1,000 lb high resistance portland cement.

The crushed stone may consist of porphyry, hard limestone, hard sandstone, or crushed slag.

Water Content.—The water content, i.e., the water-cement ratio, is not specified, but one of the most important requirements is that the concrete must be as dry as possible; this means that no slump is allowed, which is quite a contrast with the American practice.

High Strength.—The only requirement is the following one: the compressive strength, measured on cubes (8" × 8" × 8") at 56 days must reach a minimum of 8,500 lb per sq. inch. This high figure can be obtained thanks to the rather high cement content and to the dryness of the concrete.

Slab Thickness.—On an average road paving project, the thickness of the slab is 8 in. On ordinary roads no reinforcement is ever used, nor any load transfer device. The general use of a 6-in. granular base makes it unnecessary and no pumping action is observed under the normal traffic. A waterproof paper sheet between the slabs and the base is a general requirement.

Carriageway.—The usual width of a 3-lane pavement is 30 ft or 35 ft Such a width is used on the main highways. The pavement is constructed either in 2 lines of slabs (15 ft or $17\frac{1}{2}$ ft) or 3 slabs (10 ft or 11 ft 8 in.)

On 2 lane roads, the pavement width is usually 23 ft and it is made up of two slabs, with a longitudinal joint. The thickness is uniformly 8 in.; no thickened edge is ever built.

Freeways.—Four-lane divided freeways are now under construction in Belgium. These are composed of two 23 ft wide pavements. This width is distributed as follows:

* Abstracted from an article in '*World Construction*' – September-October 1951.

two 2 ft wide edge slabs, 7 in. thick, used as rail supports for the movement of the equipment. After completion of the pavement, the two edge slabs are surfaced with a 1 in. thick asphalt concrete.

a 19 ft wide pour, with two 9½ ft. slabs and a central longitudinal joint. This part is built either in (a) two layers 5 in. and 4 in. depth, respectively, where there is no reinforcement, i.e. on hard sub-bases; or (b) in three layers: 2 in., plus reinforcement, plus 3 in., plus 4 in. when the sub-base is soft and deflection may tend to occur under traffic.

Equipment "Train" on Freeway Construction.

The equipment used on the freeways differ widely from that used on ordinary highways. In the former case there is a succession of equipment, actually an electric powered train supplied from a bridge-mounted diesel power unit.

After completion and curing of the two 2-ft edge slabs, and compaction of a 6-in. granular base, a 1-in. layer of sand is spread and the "train" may start. The "train" is as follows:—

- a tamping machine
- waterproof paper, rolled on the compacted base
- the electrical plant (2 diesel groups, operating 2 generators totalling 64 KVA)
- first concrete mixer, supplied by a narrow-gauge railway (the wagons are divided in 5 bins: 4 aggregates, plus cement)
- first distributing machine
- first vibrating machine (15-h.p., 3,600 r.p.m.)

Needed only where reinforcement is used:
- laying the reinforcement, when needed (12 ft × 8 ft panels of welded wire)
- second concrete mixer
- second distributing machine
- second vibrating machine (15 h.p., 3,600 r.p.m.), with finisher
- a repair shop, also used as shelter for the workers
- the protecting and mobile sheds above the fresh laid concrete.

The usual performance of the equipment is 650 ft per day with a 19 ft width.

The Highway Department is now contemplating to abandon the use of reinforcement and replacing it by sub-base stabilization; it is not to be forgotten that a very dry concrete is used, and the presence of reinforcement between two layers of such concrete can somewhat be compared to a horizontal joint, which is in no way favourable for the structural unity of the slab. This is why additional vibration is used to help the interlocking of the two layers through the reinforcement.

Equipment on Ordinary Roads

The equipment used on highways other than freeways is much simpler; instead of a "train," only one machine (with a 15 h.p. diesel engine) is used. The mixing of concrete is done in a fixed installation, near a railway station, and the mixed concrete is hauled by trucks to the field. The usual capacity of the mixers is 36 to 40 cu. ft. The former practice of using a smoothing device has been abandoned, in favour of a certain roughness of surface texture. The performance of machine can reach 600 ft. per day, with 10 to 12 ft width and 8 in. slab thickness.

The main reason for the use of a spreading machine on ordinary highway work is the need for counteracting the segregation of the components of concrete caused by long haulage of mixed concrete, the practice of dropping the concrete between the forms from a 3- to 5-ft height, and the practice of distributing the concrete by hand, with rakes, from the truck load.

Joints.—The usual practice is to build a transverse joint every 40 to 50 ft and a longitudinal joint at the centre-line. The transverse joint is composed of a 6-in. high compressed cork plate impregnated with asphalt, placed upon the base, and capped with a removeable steel plate. After curing of concrete, the steel plate is removed and the upper part of the joint filled with bitumen.

When the pavement is composed of 2 or 3 adjacent lines of slabs, built separately, the longitudinal joint consists merely of a bituminous coating on the vertical face of the contiguous slab.

In order to improve the construction of transverse joints, a new machine was built recently. It consists of a long, sturdy steel plate or knife, which is vibrated and forced 4 in. down into the concrete, about one hour after its completion. Two horizontal plates are pressed simultaneously upon the concrete, on each side of the knife, to prevent any deflection of the surface. After the knife has been taken out, the removable joint, takes its place, and bituminous material is poured in it after curing. The result is a dummy joint, but its construction gives better results than the usual practice as no discontinuity occurs in the compaction.

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I would like to tell you a little story of a young lieutenant who found himself in charge at Tobruk, in the course of the North African Campaign with refugees, troops, prisoners and, a thousand and one other people crowding in upon him. Rations were reaching a somewhat parlous condition, so parlous indeed that he felt impelled to send out a signal setting out the situation in which he found himself, and requesting advice and help. Judge of his astonishment when the return signal came back in just these few words: "Over to you: Take care you do not get eaten.".

(From 'The Structural Engineer'—June, 1951)

THE OLD PIONEER SPIRIT

An old American farmer of pioneer stock received a Government form to fill in. Slowly and painfully he filled in the answers to the many questions asked by some chair-borne bureaucrat in Washington, getting angrier and angrier as he went along.

Then he came to a ruled-in blank rectangle marked "Do not write here."

Angrily he scrawled across it,

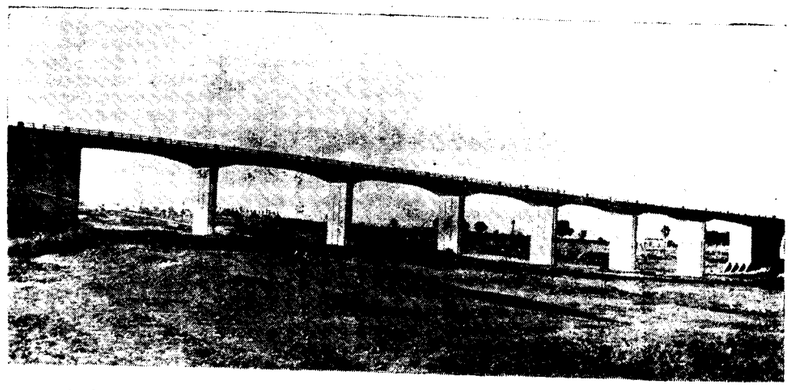
"I'll write where I damned well please."

BRIDGING INDIA'S RIVERS

THE BARAKAR BRIDGE

NEARLY exactly two hundred and fifty miles from Calcutta, the Grand Trunk Road (National Highway No. 2) crosses the Barakar river in Bihar over a brand new bridge which came into use only last year. Travelling over it the motorist will be tempted to stop and get out to have a close look at this imposing concrete structure. Outwardly there will not be much to see of the intricate pattern of mighty steel rods that have been woven into the hard concrete to form the graceful superstructure that is so pleasing to the eye. He may, however, possibly feel that the approaches are on very high embankments and that the piers are high and lanky and rather thinner than usual.

If he enquires he will learn the reason why—a few years hence, he will be told, the road and the bridge will be in the middle of a lake which will flood the surrounding country when a dam under construction a few miles away is completed. Then the piers will show only a few feet above the lake waters When this happens it will be worth the motorist's while to go again and stand on the bridge in the middle of the lake.



A view of the completed bridge. In the background the remaining two spans of the screw-pile bridge are still seen. [*Photo: B. B. & Jessop Const. Co. Ltd.*]

The new bridge lies between the ruins of two old bridges. A few hundred feet downstream stand the remains of the abutments of a masonry bridge-9 arches of 50 ft - which collapsed at the age of 71 years in 1911 after a week of incessant rain which brought an "unprecedented" flood (H.F.L. 1212.7 ft)

Remains of a collapsed abutment.

A screw-pile bridge (5 spans of 105 ft) was built in 1914 just before the first World War. History repeated itself in September 1946 when a wet week culminated in 10 inches of rain in one day and another "unprecedented" flood (H.F.L. 1216.3 ft this time), accompanied by a cyclonic wind. Three out of the five spans disappeared overnight. Two spans are still there.

The new bridge is of the cantilever-cum-suspended span type in reinforced concrete designed to the specifications of the Indian Roads Congress for 2 lanes of Class A loading and, alternatively, one lane of Class AA loading. This particular type of span was adopted as it does away with the possibility of unknown stresses occurring on account of slight movements of the supports. Moreover, materials required for this type of construction were easily available for this bridge within economical distances.

The main dimensions of the bridge are:

Overall length face to face of abutments, 607 ft; distance apart of centres of piers, 92 ft; height of pier shafts from plinth level to bearing seat, 44 ft; width of pier shaft, 5 ft; length of pier shaft, 28 ft 4 in.; width of roadway, 24 ft; maximum depth of main girders, 10 ft at piers: minimum depth of main girders and suspended span at the centre of the span, 4 ft; present maximum high flood level, 1219.56; new high water level after the Tilaya Dam is built, 1230.00 (this accounts for the extra height—10 ft 6 in.—of the piers); catchment area above the bridge site, 276 sq. miles.

Costs

The bridge has cost Rs 1,62,000/- for foundations, Rs 4,88,700/- for substructure, and Rs 4,59,500/- for superstructure. The approaches (embankment and shore spans) have cost Rs 17,86,000/-. The earthwork was done entirely by manual labour. As a measure of economy eleven shore spans (six arches of 46 ft span on the Calcutta side and five on the Delhi side) were introduced on either side of the main bridge where the lake waters will be deep.

The total cost of the bridge was Rs 29,62,205/- which works out to Rs 1,753/- per running foot, leaving out the cost of the approaches, or Rs 73/- per sq. ft of the roadway.

A portion of the Screw-pile bridge

Calcutta side span under construction.

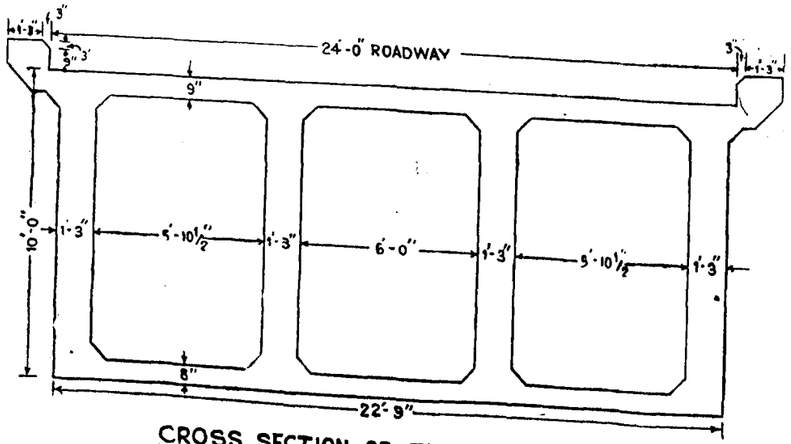
Cellular Construction.—With the exception of the suspended span, the entire bridge, i.e., piers, abutments, and superstructure are built in cellular construction. The pier shaft which looks solid is, in reality, a 3-cell vertical cantilever beam with high-grade concrete walls only 8 in. thick, reinforced with vertical bars, one inch square, at 14½ in. centres. For stability the hollow cells are plugged with plum concrete to various heights to suit design requirements. Because of the great height exposed to the water current, the piers have been made very slim so as to offer the minimum obstruction to the flood waters.

The abutment walls vary from 8 in. to 17 in. in thickness. The abutment cells were plugged solid with sand.

Very careful calculations were made in the case of the piers and abutments for "silo" stresses which might be caused by the bursting action of the wet concrete or granular sand plugs.

One abutment and two piers were constructed with open foundations, the other foundations being designed for cofferdam construction. Taking advantage of the lessons of the two previous bridge failures, the designers took all foundations down to solid, hard rock. Up to plinth level the foundations are in reinforced mass concrete.

Superstructure.—The main spans are fully cellular, the top slab being 9 in. thick (with 3 in. extra wearing coat), the bottom slab 5 in. to 8 in. thick, and the



CROSS SECTION OF THE MAIN SPAN AT PIER SUPPORT.

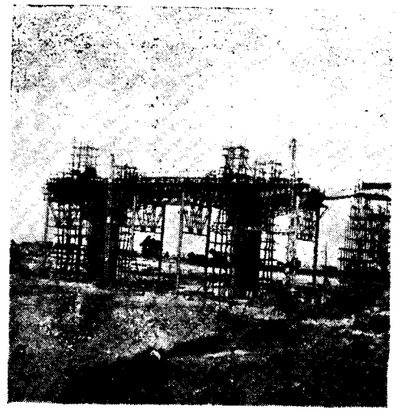
four webs 9 in. to 15 in. thick with diaphragms so arranged that the whole span acts as one large beam. The gross steel area near the centre of the span is 135 square inches and the design provides for the shear to be taken either by the concrete alone or by the web reinforcement alone.

The expansion bearings of the main spans consist of a row of four Meehanite high duty cast iron bearings of a design specially developed for this bridge.

The suspended span (25 ft) is non-cellular, designed as a standard, straightforward beam, the only special feature being its closely machined, pressure lubricated, phosphor-bronze-plate, expansion bearings.

The railing is pre-cast with a few main uprights monolithic with the slab.

Lifting Shuttering.—The pier shafts were constructed by means of specially designed lifting shuttering operated inside guide frames. If rapid-hardening cement had become available the building of the shafts would have been one continuous pour from the plinth to the bearings.



A view of the main centring.

The shuttering for the main span was supported on specially designed steel framing and centering adjustable for the varying levels of the river bank.

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PALE MR. PALING

In the House of Commons an excited Labour Member, a Mr. Paling, called the Conservatives "dogs."

There were loud cries of "Withdraw," "Withdraw" from the Conservative benches.

Before the Speaker could intervene, Mr. Churchill stood up and said:

"I do not want Mr. Paling to withdraw. Mr. Paling has called the Conservatives dogs. Does Mr. Paling know what dogs do to palings?"

[*We are reliably informed that it is* **not** *true that Mr. Churchill illustrated his point by standing on one leg and lifting the other slightly.—Ed.*]

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BOMBAY ROADS

(Extracted from 'The Times of India'—November 30, 1951).

ROAD planners will share the regret expressed by Dr. F. P. Antia that the Planning Commission should have driven the last nail into the coffin of the Nagpur Plan for roads, and provided over the next quinquennium less than one-third of the expenditure proposed in that project. However, the Indian Roads and Transport Development Association has shown a tenacity worthy of the cause it sponsors and the legions who suffer from want of communications and neglected roads have reason to be grateful to this body. Some day one hopes, its pleas will fall on receptive ears, now obsessed with nothing but the reverberations of the general elections.

Separate Road Departments

Meanwhile, it is of the utmost importance that such funds as have been provided should be properly utilised. This is being done in States like Uttar Pradesh, West Bengal and Madras, which have separate Roads Departments manned with their own personnel. The President of the Bombay branch of the I.R.T.D.A. urges emulation of this example by Bombay, a Stats once notable for its pioneering efforts in all good causes. Unhappily, those who rule Bombay to-day are more concerned with the propagation of their own narrow ideologies than with the maintenance of the premier status of this once proud province.

Lapses

In Bombay road grants lapse for lack of use, the reason being the absence of a separate roads organization and the diversion of the P.W.D.'s energies to buildings and irrigation. Bombay also lacks road experts since these can come only with the development of a special roads section and it has happened that engineers returning from abroad with special qualifications for road building are posted to other branches of the Public Works Department.

THE TRANSITION FROM BOMBAY TO HYDERABAD ROADS
(With apologies to Messrs Shalimar Tar Products (1935) Limited.)

Visitors and wayfarers cannot but note the unflattering contrast presented by Bombay's pit-studded roads with the smooth-surfaced arteries which run through the neighbouring State of Hyderabad. Even if new highways are not laid, much comfort will accrue to travellers and considerable savings to State transport if existing roads are maintained in good condition.

The Bombay Government did well to appoint recently a special Deputy Chief Engineer charged with the care of roads, but results will ensure only if such specialisation filters down from the highest to the lowest administrative levels. What is true of Bombay is true of other States.

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DIFFICULTIES

Difficulties of bidding farewell are accentuated by the introduction between Frankfurt and Dortmund, Germany, of trains with accommodation at three levels.

(From Modern Transport' August, 11, 1951.)

HERE AND THERE

1. ROADS FOR QUICK & DEPENDABLE TRANSPORT

BECAUSE highway transport is quicker and more dependable than rail transport, the higher-tariff products are generally carried by truck.

Milk is hauled four to five hundred miles by road truck to New York City. Seventy-nine metropolitan areas having a combined population of 25 million people receive their entire milk supply by highway.

Citrus fruits are carried from Florida to New York by truck.

Cattle are transported more quickly and often more cheaply by truck than by train.

The highway is part of the assembly line for certain motor cars that are built in the south and that receive parts from the west.

During the war one industrial concern had four plants located in three cities: forgings were made in Plant A, heat treated in Plant B, machined in Plant C, and assembled in Plant D. Trucks hauled the material 100, 100 and 15 miles successively for these processes.

(*From Road Research Technical Paper No. 22*)

(*Bituminous Roads in North America*)

2. AMERICAN TRAFFIC

THE concentration of traffic varies so much throughout the country that the average figure of 1,500 vehicles per day on all roads has little significance. Traffic concentration varies from a few hundred vehicles per day in the southern middle country to 100,000 vehicles per day on highways in New Jersey: 70,000 vehicles travel each day over the Oakland-Bay Bridge between San Francisco and Oakland.

(*From Road Research Technical Paper No. 22*)

(*Bituminous Roads in North America*)

3. SIZE OF LETTERING ON SIGNS

A motorist is supposed to be able to read a motor-car number-plate in good light at a distance of 25 yds., and these numbers are 3½ in. in height. The information on a road sign cannot be very useful to a passing motorist when he is within say 9 ft of the sign, owing to the skew angle at which the sign is then seen and the relative movement of sign and driver.

For 3½ in. letters, therefore there is a distance of 75 less 9 = 66 ft along the road at which the words can be read, and the reading takes two seconds. Therefore, if the vehicle is travelling at more than 66 ft in two seconds, or 33 ft per second, the information cannot be absorbed. It should be noted that the above is true no matter how far away from the junction the approach direction sign may be located.

The figure of two seconds which I have used is only a rough one for purposes of illustration, but if it is correct the conclusion is that for

Trunk Roads (Standard speed, 70 m.p.h.)

lettering of a size 3½ in. by 70/22½ = approx. 10½ in. letters are required.

For other Class I roads (Standard speed, 60 m.p.h.)

lettering 3½ in. by 60/22½ = approx. 9 in. letters are required.

For Class II roads (Standard speed, 50 m.p.h.)

lettering 3½ in. by 50/22½ = approx. 7 in. letters are required, and so on.

For a sign of less than average complexity (e.g., one second reading time) the size of letters can be correspondingly reduced. Also, in those cases where the junction cannot be approached at the standard speed, the size of letters could correspond with the highest speed at which the junction could be approached.

(*Extracted from 'The Surveyor'—Aug., 25, 1951*).

4. UNFAIR COMPARISONS

AT the anniversary luncheon of the Institute of Transport, Lord Brabazon drew comparisons between the safety of experiences of different forms of transport. Not one single fare-paying passenger in a British ship during 1950, he emphasised, lost his life in an accident. On the railways only three passengers were killed per thousand million passenger-miles. The comparable rate for passengers in motor transport was 12 and in the air as high as 62, although the latter was a worldwide figure and much higher than the United Kingdom average. It was even more surprising, he said, that as many as 7,000 people a year were killed by accidents in their homes, and **in any event, he concluded, he knew of no means whereby a man could leave this world alive.**

(*Extracted from 'The Shipping World'—Nov. 21, 1951*)

5. FAST DRIVING INCREASES TYRE WEAR

The table on the right using 30 m.p.h. as normal, shows the effect of higher speeds on the mileage expectancy of car tyres (correctly inflated).

Average speed	Mileage Expectancy
30 m.p.h.	Normal
40 m.p.h.	76% of normal.
50 m.p.h.	59% of normal
60 m.p.h.	43% of normal
70 m.p.h.	30% of normal

(*From 'State Transport Review' Bombay—Nov 1951*)

6. WORLD MOTOR TRAFFIC

ACCORDING to the latest figures published by 'The American Automobiles' there were, in January 1951, 6,90,45,408 motor vehicles in circulation in the world, an increase of about six millions as compared with the preceding year. The distribution was:

Africa	12,22,502
America	1,26,45,656
Asia	10,56,929
Europe	1,22,64,598
Oceana	18,55,723

(*From "Revue Generale des Routes et des Aerodromes"—October 1951*).

7. DRIVER Vs. DROVER

WHAT is the position concerning motor vehicles when meeting cattle on the road? If the driver stops his vehicle and waits for the cattle to pass can he sue the cattle owner for any damage done to his vehicle by the cows which sometimes stampede?

In overtaking cattle the noise of the engine appears sometimes to frighten them. If they then cause damage to the vehicle who would be held responsible? If the cattle drover indicates to the driver that he may pass is the driver then responsible for anything?

Are cattle drovers under any obligation to keep their herd to one side of the road, and what is the position with regard to the movement of cattle during the hours of darkness?

The courts are very tender of the rights of those who drive cattle on roads and of the rights of their owners. You do not say whether there is a drover with the cattle If there is, he and his employer might be held liable for negligence if the cattle stampede—the negligence being that the drover failed to control his herd. If there were no drover, then we think that the motorist is bound to look out for the chance of the cattle stampeding. An action at common law for merely permitting cattle to lie about or walk about on a road will not succeed unless their presence amounts to a common law obstruction.

The same answer must be given to the first question in the second paragraph. A driver is bound to anticipate that his engine may frighten cattle, and we do not think he could recover for damage caused by cattle which he himself had frightened. If the drover signals the motorist on, that is a signal to pass. Even so, the motorist must pass with due care. The driver would in this case not be responsible unless it could be shown by the cattle owner that the motorist was careless, and the motorist, if he proved that he was not careless, could recover.

There is no rule that cattle drovers must keep their herds to one side of the road. In the dark drovers must certainly be careful, and a motorist may be able to prove that the drover was not so. If the drover has another man with him, he is bound to send the extra man forward.

(*Extracted from "Motor Transport" Nov. 3, 1951*)

8. *EVERY THIRD CAR IN U. S. A. NEEDS SERVICING FOR SAFETY

APPROXIMATELY one out of every three cars checked in a recent nation-wide sampling of vehicle condition was found in need of "servicing for safety." Of the 10 items checked, brakes and lights stood out as parts most frequently in need of service attention.

A sample safety-check of nearly 360,000 vehicles was made by 1,165 automobile, truck, and tyre dealers in all States and the District of Columbia. In an over-all analysis, one out of 10 brakes; one out of 12 rear lights; one out of 13 headlights, and one out of 15 windshield wipers led the list of 10 items checked and were found to be in need of maintenance attention for safe vehicle operation.

Included in the sample safety-check were 311,350 passenger cars and 47,800 trucks. On the basis of the highest check of each item, the following estimates of vehicles needing maintenance attention were derived: total cars, 95,366 or 30.6 per cent; total trucks, 12,906 or 27.2 per cent; total vehicles, 108,272 or 30.2 per cent.

Items checked, by type and the percentage of each to the total number of parts in need of maintenance attention are shown in the Table.

Items Checked:	Passenger Cars		Trucks		All Vehicles	
brakes	31,412	19.8%	4,629	13.2%	36,041	18.7%
rear lights	24,335	15.3%	7,144	20.3%	31,479	16.2%
headlights	23,904	15.0%	4.945	14.1%	28,849	14.9%
windshield wipers	20,490	12.9%	3,276	9.3%	23,766	12.2%
steering	16,625	10.5%	2,667	7.6%	19,292	9.9%
exhaust system	12,869	8.1%	3,194	9.1%	16,063	8.3%
tyres	12,545	7.9%	1,700	4.8%	14,245	7.3%
glass	8,461	5.3%	2,486	7.1%	10,947	5.6%
horn	6,389	4.0%	2,519	7.2%	8,908	4.6%
rear view mirror	1,958	1.2%	2,581	7.3%	4,539	2.3%
TOTALS	158,988	100.0%	35,141	100.0%	194,129	100.0%

* From Highway Research Abstracts, September 1951.

9. AN IDEAL COMBINATION

DIFFERENT approaches to planning are made by engineers and architects. The former count the cost, feasibility and probability of execution. Architects plan for ideals regardless of cost and sometimes of probability of execution. It seems as though a combination of architect and engineer produces the best results, as in the City of Westminster Plan, 1946.

(*From 'Roads and Road Construction'—July, 1951*).

10. A TIP TO AUTHORS

THE Authors of various papers found it difficult to realise that it is better on such occasions to lay aside their manuscripts and to use their personalities in an attempt to convey a "message," which will not only arouse the immediate interest of their listeners, but leave them with something upon which to ponder. As a result, they may be led to a further study of the papers, so that its intrinsic value and the reputation of the author may both be increased. As it was, it is not going too far to say that very little of value was contributed in the discussions, and the impression left on many of those present was soporific rather than stimulating.

(*Extracted from 'Engineering'—June 29, 1951*).

11. OUTSIDERS ALL

IS it not a curious thing that unmistakable advances in arts, in thought, and in craft are brought about so frequently, not by properly equipped and properly instructed people, but by outsiders?

Einstein was in his youth an employee in the Swiss Patent Office; Marconi spoke of himself as an amateur; the use of reinforced concrete was first demonstrated by a French gardener; Henry Ford was a garage man; the designer of the Great Eastern, a steamship 50 years ahead of her time, was Isambard Kingdom Brunel, a civil engineer with no training in naval architecture; and his assistant, Froude, also a civil engineer, was the man who established the empirical laws of ship propulsion.

It is curious, too. that Colonel Crompton, who achieved so much for electrical development, started life as a naval cadet in the Crimean war, afterwards went into the Army, and only acquired a kind of accidental interest in electricity and engineering. Bessemer attacked the steel problem as an outsider who broke away from the traditions of the steel trade. Parsons, the inventor of the steam turbine, broke right away from established steam-engine practice, with which he could scarcely have been fully conversant.

(*Extracted from 'Engineering'—June 22, 1951*).

12. ROAD SYSTEMS OF EUROPEAN COUNTRIES

THE Permanent International Association of Road Congresses has decided to start republishing its report which has not appeared since the war.

Before coming to regular publication and in view of the coming Congress in Lisbon in September, 1951, the Committee of the Association has brought out two bi-lingual issues (English-French) which include, over and above circulars giving comprehensive information about the Congress, a series of articles summing up the road situation in a certain number of European countries: Portugal, Belgium, Denmark, Spain, France, Italy, Holland, Luxembourg, Norway, United Kingdom, Sweden and Switzerland.

These accounts make it possible to compare the various solutions that have been applied to different administrative,

financial and technical problems regarding the maintenance and development of road systems and to draw useful conclusions.

The two issues in question are prefaced by the President of the Permanent International Association of Road Congresses: M. Daniel Boutet, Inspecteur General des Ponts & Chaussees, Vice-President du Conseil General des Ponts & Chaussees, in Paris.

[*Both issues are available in the library of the Roads Organization and members of the Indian Roads Congress can obtain them on loan on request to the Secretary.....Ed.*]

(*Extracted from 'World Construction'—May-June 1951*).

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13. UNFETTERED SELECTION

MR. Barnes, the British Minister of Transport, said in the Parliament on the 18th June 1951 that he was informing the Edmonton Borough Council that he would regard the requirement that candidates (for the post of borough engineer) be members of a trade union affiliated to the Trades Union Congress as incompatible with the conditions on which he made Road Fund grants, particularly the established principle that councils should make their choice from as wide as possible a field of candidates having appropriate professional qualifications.

(*From 'The Engineer'—June 22, 1951.*)

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14. FINESSE IN PRESTRESSING

A number of years ago, even a small amount of prestress was thought to be valuable. Therefore, ordinary steel was used, with the result that the possible prestress was so small that it was soon lost through plastic flow of the concrete. Then, high strength steel was introduced, and prestressing went to the other extreme—the higher the better. Now it is beginning to be recognized that there is an optimum prestress—in other words by varying the amount of prestress the behaviour and the safety margin of a prestressed member can be pre-determined.

(*From 'Engineering News-Record'—July 5, 1951*).

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MILKING THE CLOUDS

Man's efforts to make rain have had the expected results. A rancher near Reno, Nevada, submitted documents to the state engineer's office claiming water in all clouds passing over his land: and the Salt Lake City, Utah, Chamber of Commerce threatened suit against Nevada on the ground that Nevada had no right to "milk" clouds that would normally drop their water on Utah's mountain ranges.

(*Engineering News-Record, January 15, 1948.*)

INTERNATIONAL CONFERENCE ON S OIL MECHANICS AND FOUNDATION ENGINEERING

The Third International Conference on Soil Mechanics and Foundation Engineering will be held in **Switzerland in 1953**. The tentative dates are the 16th to the 26th August 1953.

PARTICIPANTS.—The main participants of the Conference will be the members of National Societies*, but all engineers or groups of engineers interested in soil mechanics and foundation engineering will be welcome to participate in the Conference. Such engineers, whether practical engineers, research workers, or teachers, may register as guest-Participants and may join in discussions by previous arrangement with the National Society.

PROGRAMME.—The first part of the Conference, from the 16th to the 20th August 1953, is to take place in Zurich and includes the opening of the Conference, eight technical sessions of about two to three hours each, lectures on general and specific (Swiss) problems, one or two short excursions, and daily visits to the soil mechanics laboratory. From August 21 to 24 the Conference will conduct an excursion through the Alps. The closing session will take place in Lausanne on the 25th August.

PAPERS.-Only those Papers will be printed which—

(a) are a real contribution to knowledge of the fundamental properties of soils, or

(b) indicate new methods of application of soil mechanics which have proved satisfactory in practice, or

(c) contain case records and measurements in connection with a detailed description of the soil, and include comparisons between measurements and calculations.

TECHNICAL SESSIONS.- The titles of the sections under which Papers will be accepted and discussed during the eight sessions are:-

Session No.	Subject
1	Theory and hypotheses of general character, soil properties, classification, engineering geology.
2	Laboratory investigation (including compaction tests and improvement of soil properties).
3	Field investigations, compaction control, soil stabilization, technique of field observations.
4	Foundations of buildings and dams, bearing capacity, settlement observations, regional subsidences.
5	Piles and pile foundations, settlement of pile foundations.
6	Roads and runways, airports (flexible and rigid pavements and their foundations).
7	Earth pressure, retaining walls, earth tunnels, and pits.
8	Stability and deformation of slopes and earth dams, research on pore pressure measurements, groundwater problems.

SUBMISSION OF PAPERS-All Papers from members in India must first be submitted to the Secretary of the National Society.* Preliminary selection of papers will be made by the National Committee. Final Selection, however, rests with the General Reporters.

SUBMISSION DATES.—Three copies of the summary (not exceeding 300 words) of each proposed Paper should be submitted to the National Society not later than the 30th April 1952.

Detailed information about the last date for submitting complete Papers, the length of Papers, sizes of figures and photographs accompanying them, addresess of General Reporters, etc., etc., my be had from the Secretary of the National Society.

*For India, the Indian National Society of Soil Mechanics and Foundation Engineering, Curzon Road Barracks, New Delhi.

TECHNICAL INFORMATION

(i) LABORATORY TEST SIEVES

MECHANICAL VIBRATION

WHEREVER much sieving has to be done, the advantage of stacking the sieves in tiers, pouring the material on to the top sieve, and agitating them mechanically, as compared with using each sieve by hand separately, is obvious.

A machine has been developed by the Western Region of British Railways for use in all regions in soil size distribution analyses. The machine is designed to take up to eight 8-in. or six 12-in. diameter sieves, together with cover and bottom collecting pan, its important features being simplicity of construction, a minimum of moving parts, quick and efficient action and cheapness. It has been in operation for a year, and has proved entirely satisfactory.

It is operated by a 37-volt, 160-watt electric motor, of the type used for concrete vibrators. At either end of the motor shaft is mounted an eccentric weight, the weights being out of phase with each other by 90 deg. The speed of the motor can be controlled. The eccentric weights set up a compound vibration, the result of which is to shake particles of a sample round the sieves in a circular motion. The sieves undergo a vertical and horizontal motion, both simple harmonic, the maximum amplitude being approximately 2 mm., and due to the effect of the phase difference at the end of the motor shaft a rocking motion takes place in both the vertical and horizontal planes. The results at the end of 5 min. sieving differ negligibly from those achieved after 20 min., sieving differ negligibly from those achieved after 20 min., and could not be attained in less than 45 min. if manual methods by a skilled operator were followed.

(Extracted from 'Modern Transport'—Nov. 17, 1951).

(ii) CLIMBING SHUTTERING

A NOVEL DESIGN

THE shuttering for the main walls and the sides of culverts comprises triangular steel soldiers and plywood panels, both of which are rotatable and are of a patented design. Each soldier, which is an isosceles triangle in shape, is made of five double-channel 4-ft links (Nos. 1 to 5 in the Figure). each of which has a hinged connection with adjoining links. At the bottom of a wall concrete is placed to a depth of 4 ft behind ordinary shuttering, a bolt being embedded near the top of the lift. For the next lift the soldiers are placed so that the bolt projects through link (4) and is secured to it by a plate, link (4) being against the hardened concrete. The shape of the soldier is maintained by the tie-rods T1 and T2, adjustment of the length of which by turnbuckles keeps link (5) in its proper position. Link (5) is fixed to lean slightly inwards so that small outward movement under pressure of the wet concrete results in it being vertical. A bolt fixed near the top of the link (5) becomes embedded in the concrete.

The panels comprise a steel-channel frame on both faces of which plywood is attached. The panels fit between the

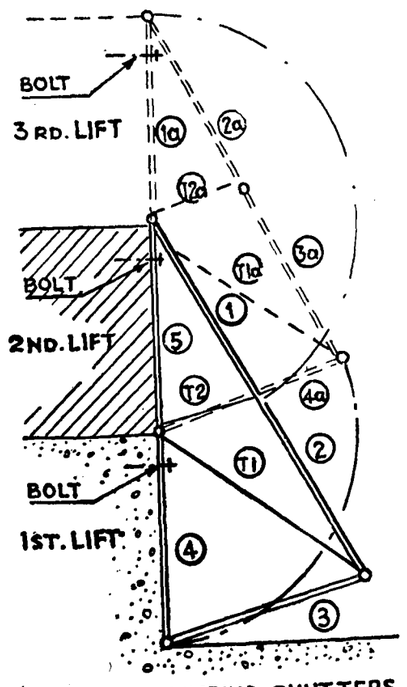

DIAGRAM OF CLIMBING SHUTTERS.

soldiers, which are at 4 ft 6 in. centres, and are clamped in position by a short length of angle extending across the outer face of a soldier and overlapping the panels on either side. The angle is held against the soldier by wing-bolts screwed into a plate behind the flanges of the channels of the soldiers.

When it is necessary to lift the shuttering, the bolt through link (4) and the panel clamps are removed and the tie-rods released. Rotation about the hinges between links (4) and (5) and links (1) and (5) permits the soldier to take up the position shown by broken lines in the Figure without disturbing link (5), that is (4) goes to (4a), (1) to (1a), (2)to (2a), and (3) to (3a), the soldier being held in position by the bolt through link (5). Link (1a) is held in position by fixing the tie-rods. The panels have vertical lugs at each corner which engage pins on the soldiers, so that each panel can be rotated about its upper lugs into position in the lift above, where it is secured by clamps as before. This process of removal and re-erection in one operation is repeated for subsequent lifts.

(Extracted from 'Concrete & Constructional Engineering'—November 1951).

(iii) EFFECT OF COARSE AGGREGATE ON CONCRETE PAVEMENT PERFORMANCE*

Previous surveys of concrete pavements in Indiana have established a definite correlation of the coarse aggregate source with the concrete durability. This paper reports the results of performance surveys of 12 projects, in which 15 sources of coarse aggregate were used. In several instances, more than one coarse aggregate was used in a single project with all other factors remaining constant. These projects form excellent illustrations of the change in performance with change in coarse of aggregate.

When the comparisons are restricted to single projects in which all factors except coarse aggregate are identical, the performance ranges are from slight D-line cracking at five per cent of the transverse cracks to severe D-lining at 80 per cent, from 2.1 to 7.2 blowups per mi. and from a transverse crack interval of 18·2 to 103.5 ft. In these cases, the coarse aggregate is the only possible cause of the variations in performance since a difference in source of the aggregate is the only variation between the sections compared.

The results of the surveys substantiate the conclusion that the **coarse aggregate is a major factor in the performance of concrete pavements in this area.** Dif-

* This paper was presented at the Thirtieth Annual Meeting of the Highway Research Board Jan, 9-12, 1951, Washington, D. C.

ferences in the prevalence of blowups and D-line cracking and in the transverse crack interval are attributed to the coarse aggregate used in the concrete.

The effect of coarse aggregates on the durability of concrete pavements in Indiana has been recognized for a number of years, and has been the subject of a large amount of research and investigation, both in the laboratory and in the field.

The problem was first pointed out by Woods, Sweet, and Shelburne in 1945, when they reported the results of very extensive field performance surveys. All of the concrete pavements built before 1935, totalling more than 2,600 miles, were included in the survey. Statistical analyses of the data collected showed a positive correlation between the source of coarse aggregate and the frequency of pavement blowups. It was noted that the pavements that were the most susceptible to blowups also showed the deterioration by D-line cracking. No correlation could be established between the fine aggregates or the cements and the pavement performance.

Although only about ten per cent of the pavement milage surveyed was found to have significantly bad performance, the problem is one of considerable economic importance. A later paper by Sweet and Woods (1946) showed the correlation of soil textures with the severity of D-line cracking and blowups. The subgrade soil texture is a major factor in determining the moisture conditions to which the pavement is subjected.

An extensive laboratory research programme has been underway for several years to develop information and data about the role of aggregates in concrete pavement durability.

Since the majority of the laboratory tests were conducted on crushed stone aggregates, the correlations of the test results with field performance are chiefly applicable to those materials. However either good or bad field performance may be found with gravels as well as with crushed stones, and current laboratory work is being directed primarily toward gravels.

The results of field and laboratory studies are very briefly summarized below.

1. The standard acceptance tests for aggregates are not adequate to differentiate between the materials with good performance records and those with poor records.

2. Freezing and thawing of some coarse aggregates, when saturated, is the major factor in lack of durability of the concrete in which they are used. The pore or void characteristics of these materials determine their water absorption and retention characteristics and, therefore, their susceptibility to damage by freezing and thawing. The topographic position of the pavement and the nature of the subgrade soil would influence the durability through their effect on the amount of moisture available.

3. The fine aggregates and cements have had little effect on the durability of the concrete in field use.

4. The field performance records have been correlated with: (a) laboratory freezing and thawing tests of concrete in which the aggregates are used, (b) the absorption and degree of saturation of the aggregates under vacuum, and (c) the percentage of voids less than 000.5 mm. in diameter in the aggregates.

5. The durability of concrete made with inferior aggregates apparently may be improved by: (a) the use of air entertainment, (b) drying the aggregate before use, (c) use of construction practices that will aid in keeping the concrete dry, and (d) restraint of expansion of the concrete slabs.

(*Highway Research Abstracts, June 1951.*)

WEST BENGAL CIVIL WORKS BUDGET 1951—52

The following extracts pertaining to Civil Works Budget have been taken from the Government of West Bengal Budget for the year 1951-52.

	(In Lakhs of Rs)		
	Actuals 1949-50	Revised Estimates 1950-51	Budget Estimates 1951-52
I. Revenue (Civil Works).			
i. Rents	4.46	5.00	5.00
ii. Tolls on Roads	1.75	1.75	1.75
iii. Recoveries of expenditure	1.30	4.83	11.05
iv. Transfer from Central Road Development A/c.	51.04	81.06	73.92
v. Transfer from Capital Account of grain purchase schemes of surcharge levied for improvement of village roads in heavy procurement areas.	9.81	14.26	
vi. Miscellaneous	1.90	7.03	2.53
vii. Deduct — Refunds	-.02	-.02	-.02
Total	70.24	113.91	94.23
II. Expenditure (Civil Works).			
i. Original Works	83.98	151.63	177.54
ii. Repairs	106.69	137.40	130.00
iii. Establishment	15.77	25.05	27.00
iv. Tools & Plants	4.08	8.55	5.55
v. Grants-in-Aid	23.40	26.36	15.11
vi. Suspense	.96	.57	.57
vii. Development Programme	34.47	66.84	65.01
Total	269.35	416.40	420.78
III. Expenditure (Communications only).			
i. Original Works	54.47	92.79	105.95
ii. Repairs	52.93	74.98	68.90
Total	107.40	167.77	174.85
IV. Receipts from Roads.			
i. Tolls on Roads	1.75	1.75	1.75
ii. Receipts under Motor Vehicles Acts.	46.17	48.07	48.82
iii. Receipts under Motor Spirit Sales Taxation Act.	90.12	90.00	100.00
Total	138.04	139.82	150.57

In addition to the above an expenditure of Rs 255.03 lakhs has been provided in the Capital Budget (Outside Revenue) Account in 1951-52 against Rs 239.11 lakhs in 1950-51 (revised estimates).

A BRIEF REVIEW OF THE WEST BENGAL BUDGET
(with special reference to Civil Works)

THE total revenue receipts of West Bengal for 1951—52 are estimated at Rs 34.04.54 lakhs and revenue expenditure at Rs 38.9 80,71 lakhs leaving at deficit of Rs 476 20 lakhs. The revised estimates for 1950—51 indicate a slightly bigger deficit of Rs. 498.72 lakhs with the revenue receipts amounting to Rs 34,67.93 lakhs and expenditure to Rs 39,66,65 lakhs. The budget estimates of revenue and expenditure for 1951—52 are lower than the revised estimates for 1950—51.

Revenue expenditure on Civil Works for 1951—52 estimated at Rs 420.78 lakhs forms 10.8 % of the total state expenditure in the year, the corresponding percentage for the previous year being slightly less i.e. 10. 5 % Revenue Expenditure on communications (original works and repairs) in 1951—52 is estimated at Rs 174.85 lakhs against Rs. 167.77 lakhs indicated in the revised estimates for 1950-51. As a proportion of the total state expenditure, the expenditure on communications in the two years 1951-52 (Estimates) and 1950-51 (revised estimates) forms 4.5 % and 4 2.% respectively.

Besides the expenditure charged to revenue a capital expendiure of Rs 255,03 lakhs is provided for communications in the 1951-52 Budget. It forms 17.6% of the total budgetted capital expenditure of the State against 27.4 % in the previous year.

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List of Approved Works on National Highways

S. No.	Job No.	Name of work	Amount Rs	Remaks
		MADRAS		
1.	510 MD 49	Providing a wearing surface to Ramnad-Mandapam National Highway No. 49.	9,81,000/-	
		BOMBAY		
2.	512 BM 8	Construction of a bridge over Dhol-Dhara Khadi in mile 171/2 of Bomby-Ahmedabad NH.	2,82,300/-	
3.	513 BM 8	Land acquisition, fixing boundary stones and constructing service roads on the Kathor to Pardi Section of the Bombay-Ahmedabad National Highway.	54,600/-	
4.	514 BM 8	Land acquisition, fixing boundary stones and constructing service roads on the Kim junction to Kharod Section of the Bombay-Ahemdabad NH.	2,85,400/-	

S. No.	Job No.	Name of work	Amount Rs	Remarks.
	(*Continued*)			
5.	515 BM 8	Land acquisition, fixing boundary stones and constructing service roads on the Kharod to Ankleshwar section of the Bombay-Ahmedabad National Highway.	86,900/-	
6.	516 BM 8	Land acquisition, fixing boundary stones and constructing service roads on the Broach-Wareria Section of the Bombay-Ahmedabad NH.	2,56,000/-	
7.	519 BM 8	Acquisition of land for the construction of North approach road to the Narmada Bridge at Broach (N.H. No.8)	13,000/-	
8.	522 BM 8	Improvements to the Palsara Balesar-Kadodra lengths of the Navsari-Kathor Section of National Highway No. 8.	2,87,200/-	
		BIHAR		
9.	518 BR 31	Providing pavement in flanks in mile 48 of the Bihar-Bakhtiarpur Road in the Distt. of Patna (N.H. No 31).	30,200/-	
10.	521 BR 28	Improvements to Muffarpur-Border-Motihari-Sagauli Road.	22,01,600/-	
		ORISSA		
11.	511 RS 42	Realignment of National Highway No. 42 between Chowduar and Nuapatna near Cuttack length $4\frac{5}{8}$ miles.	2,61,000/-	
12.	517 RS 6	Construction of National Highway No. 6 from Tangrapali to Kalapara in the District of Sambalpur, length 6.41 miles.	3,32,000/-	
		DELHI		
13.	520 DLH 2	Widening miles 6/0 to 10/2 of Rohtak Road.	1,12,000/-	

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List of Books added to the Roads Organization Library during November 1951

1. **Bulletin of the International Association of Road Congresses Bulletin No. 128.** (International Association of Road Congresses, Paris) 3 Copies

2. **50 Ans de Technique Reutiere Francaise (Fifty Years of Highway Engineering in France) – Special number of 'Revue Generale des Routeset des Aerodromes'** (Revue Generale des Routes at Aerodromes, 91 Boverored Bethiere Paris 7)

3. **Journal of the Institute of Actuaries Vol. LXXVI, Part III, No. 344,** (Cambridge University Press, Bentley House, London, N. W. 1., 1951).

Manager of Publications, Delhi.

4. **Statistical Abstract India, 1949, Vol I.** (2 Copies)

5. **Statistical Abstract India, 1949, Vol. II.** (2 Copies)

6. **Programme of Proceedings Part II-Technical - Twenty-second Annual Meeting of the Central Board of Irrigation and Power (India, 1950.** 3 Copies)

Publications of the Superintendent of Documents, U. S. Govt. Printing Office, Washington, 25, D. C.

7. **A bibliography of Highway Planning Reports -** compiled in the Liby. of the Bureau of Public Roads.

8. **Quarterly Report of Revenues, Expenses and Statistics - Class 1 - Motor Carriers of Property Budget Bureau No. 60-RO51. 3** (2 Copies)

9. **Monthly Report of Revenues and Statistics Class I Motor Carriers of Passengers-Budget Bureau No. 60. RO49 I.** (2 Copies)

10. **Classified List and Distribution Return of Establishment corrected upto 1st Jany., 1951.** (The Assam Govt. Press, Shillong).

11. **Roads and Road Construction Year Book and Directory 1950-51.** (The Limmer and Trinidad Lake Asphalt Co. Ltd., Steel House, Tothill Street, Westminster, London. S. W. 1.)

12. **Significance of Tests for Apshaltic Materials–Bulletin No. 119,** by Marshall Brown and Fred J. Benson. (Agricultural and Mechanical College of Texas, Texas Engineering Experiment Station, Texas).

13. **Tests of Admixtures for Concrete-Misc. Publication No. 28, by, Stanton Walker and Delmar L. Beloem** (National Ready Mixed Concrete Association, 1325, E. Street N. W., Washington 4, D,C., 1950)

14. **The Industrial Economy of India.** (Employer's Association, 15, Park Street, Calcutta.)

15. **Thirty-Seventh Annual Report of the Country Roads Board for Year ended 30th June 1950, 1951-52.** (The Government Printer, Melbourne, Victoria, 19)

The Institution of Civil Engineers, Great George St., Westminster, London S. W. 1.

16. **Chartered Civil Engineer, December 1950, Bulletin of the Institution of Civil Engineers.**

17. **Full-scale Experiments in Road Research with Special Reference to surface Dressings and Thin Carpets. Session 1949-50,** by Alfred Robert Lee.

British Standards Insitution, 24, Victoria Street, London, S W. I.

18. **B. S. 1000 : Vol I Part I - Universal Decimal Classification General Introduction Auxiliary Tables, Class O Generalities.**

19. **B. S. 1000: Vol. II Part I- Universal Decimal Classification-Clauses 50 General Works on pure Science.**

    51. Mathematics,
    52. Astronomy, Geodesy,
    53. Physics.

20. **B. S. 1000: Vol. 2-Part 2-Universal Decimal Classification - Class 54 Chemistry.**

21. **B. S. 1000, Vol. 2 Part 3, Universal Decimal Classification - clauses 55 Geology. Geophysics 56, Palaeoutology 57-Biology, 58-Botany, 59-Zoology**

22. **B S 1000 Vol. 4, Part 2- Universal Decimal Classification, Clause 621. 3-Electrical Engineering.**

23 **B. S 1000 (669): 1949. Universal Decimal Classification-669–Metallurgy.**

24. **C. A. I. Structural Information Series Nos. 1-7, 18-19, 21-24, and 26-27. (Bound in one cover)** (The Concrete Association of India, 83-84, Queensway, New Delhi.)

25. **Laboratory Design- National Research Council Report on Design construction and Experiment of Laboratories, by H. S. Coleman.** (Reinhold Publishing Corporation, 330, West 42nd Street, New York).

26. **SKAYANNIS TABLES- System of Tables for quick and accurate solving of any continuous Beam** by Athansios P. Skayannis. (2nd edition) 1949. (A. Skayannis, 56 Sokratous Street, Athens, Greece)

John Wiley and Sons Inc., New York.

27. **Structural Theory** by Hale Sutherland and Harry Lake Bowman (4th edition.)

28. **Some Theory of Sampling, by William Edwards Deming.**

29. **Standard Methods of Analysis of Iron, Steel and Ferro-Alloys.** (The United Steel Companies Ltd., Sheffield 1951).

30. **Turn Controls in Urban Traffic. Prepared by the Staff of the Eno Foundations.** (The Eno Foundations for Highway Traffic Control, Sangatuck, Connecticut, 1951.)

31. **Portland Cement Concrete-Bulletin No. 12. (R. C. De Hert).** (Montana State College of Engineering Experiment Station, Bozeman, Montana).

32. **Rapid Sample Preparation Method for Soil Selection in Earthwork Construction Research Report No. 21, by Bob M. Gallaway.** (Texas Engineering Experiment Station. The Texas A & M College System, College Station, Texas).

33. **Texas Engineering Experiment Station NEWS, Vol. 2, No 1, March 1951.** (Texas Engineering Experiment Station, Texas).

34. **The classification and Mechanical Testing of Roadmaking Aggregates-Reprint from the July, 1950 issue of the Quarry Manager's Journal.** (Paper read at a meeting of the Midlands Branch of the Institute of Quarring on June, 13th, 1950 by F. A. Shergold (Times Printing Co., Ltd., Mexborough).

35. **Prestressed Concrete Bridges, A paper presented at a meeting held at the Institution of Structural Engineers, by A. J. Harris. at 5-30 P. M. on Friday, 1-12-50.** (The Institution of Highway Engineers, 11, Upper Belgrave Street, London, S. W. I.)

36. **The Predetermination of Water Requirement and Optimum Grading under Various Conditions - Building Research Studies No. 3. by Nills M. Plum.** (The Danish National Institute of Building Research, Copenhagen, 1950).

37. **Proceedings of the Meeting of the Board of Communications, Madras held on the 20th April, 1951.** (The Supdt., Govt. Press, Madras, 1951.)

Publications of the H. M. Stationery Office, London.

38. **Offences Relating to motor Vehicles** by J. Chuter Ede.

39. **Granolithic Concrete Floors- Building Research Station Digest No. 24, November 1950-**(Reprinted 1951.)

40. **The Selection of Clay Building Bricks - Building Station Digest No.**

24, December 1950-(Reprinted March 1951).

41. **Aerated Concrete-Part I - Building Station Digest No. 28**-March 1951.

42. **Bitumen - Fiillstoff-gemische Die Bedeutung Von Fiillstoffen fiirdeu Aufbau bituminoser Massen und deren Bestanddigkeit** by Dr. Anton W. Rick Rerotender, Chemiker, Bad Godesberg. (Stra - Ben Und Tieffau - Verlags gesellschaft m. b. h., Berlin Pankow.)

43. **Prestressed Concrete and the Defence Programme - Prestressed Concrete Development Group**. (Cement & Concrete - Association, 52, Grosvenor Gardens, London, S. W. I.)

The Institution of Engineers (India,) Hyderabad Centre, Hyderabad.

44. **Experimental Investigations regarding the Nature of Flow in the Arched Vents of Deep Submersible Bridges during Floods. - A lecture delivered at the 3rd Annual Session of the Institution of Engineers (India) Hyderabad Centre on 15-12-1940**, by Dr. S. P. Raju.

45. **Recent Researches regarding Design of some Hydraulic Structures - A Lecture, by Dr.** S. P. Raju

46. **Report on Experimental Investgations regarding Causeways with Special Reference to Causeways wi Pipe Vents on Sand Foundations, 'by Dr.** S. P. Raju (The Hydraulic Laboratory, Osmania Engineering College, Hyderabad).

Publications of the Government Press, Hyderabad, Deccan.

47. **Hyderabad Engineering Research Laboratories Annual Repert for 1948 - Research Publication** by Dr. S. P. Raju.

48. **Hyderabad Engineering Research Laboratories Annual Report (Technical) for 1949** by Dr. S. P. Raju.

49 **Effects of Causeways (or Submersible Bridges on the Regime of Rivers)** by Dr. S. P. Raju. (Cyclostyled).

50. **Report on the Testing of Soils for Research Filling of Bhemanpali Tank (Nalgoda Distt)** by Dr. S. P. Raju -(Typed).

Publications of the Automotive Safety Foundation, 700 Hill Building, Washington. 6, D. C.

51. **An Engineering Study of Ohio's Highways, Roads and Street - A Report.**

52. **Summary of Principal findings and recommendation of the Engineering and management studies of Ohio's Highways Roads and Streets.**

Publications of the International Meehanite Metal Co., td., 66, Victoria Street, London.

53. **Better Castings- Bulletin B. 3.**
54. **The Specification of Meehanite Metal.**

55. **Prestressed Concrete** by Gustav Magnel, 2nd edition. (Concrete Publications Ltd., 14, Dartmouth London, S. W. I. 1950.)

56. **Report of the Finalising Committee with the Report of the Hindustani Shorthand and Hindi Typewriter Standardization Committee,** (Parliament Secretariat, New Delhi)

57. **Structural Engineers Handbook by Milos,** Ketchum. McGraw Hill Book Company, Inc., New York). 2 copies.

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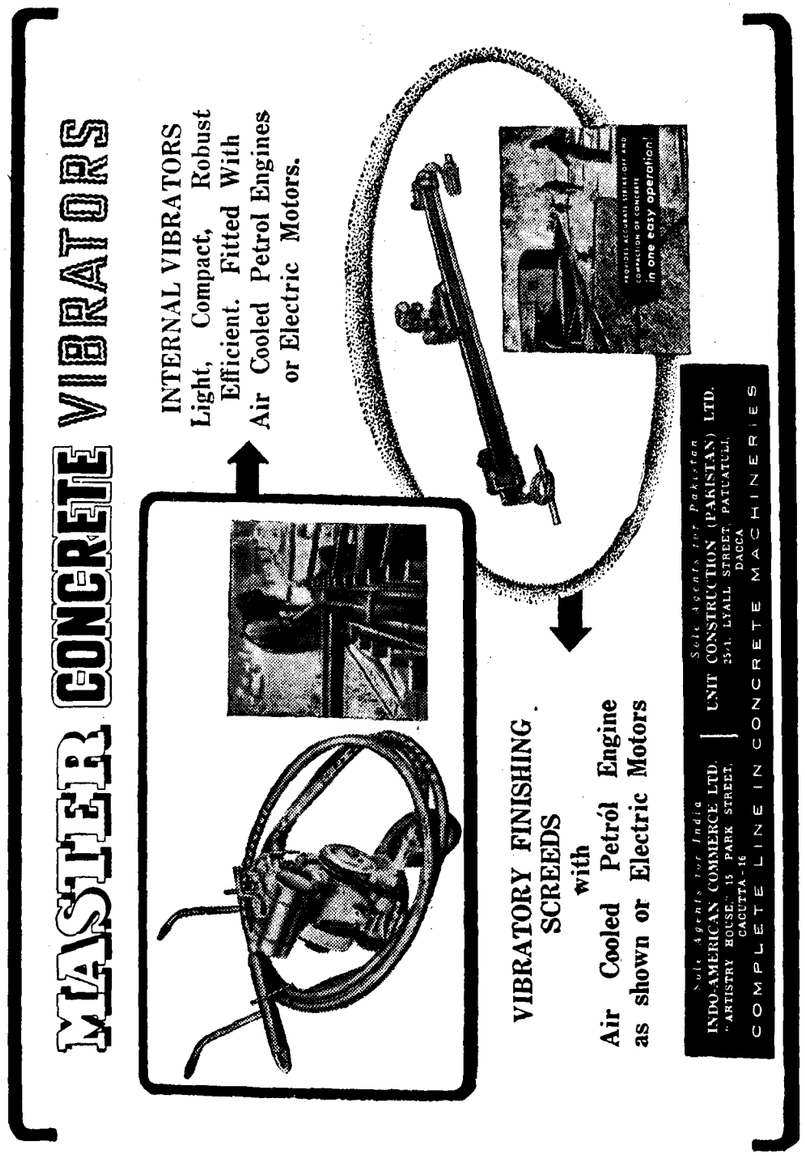
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