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CAPITAL EXPENDITURE ON ROADS IS HIGHLY PRODUCTIVE*

THE second field for increasing the efficiency of transport which it seems opportune to explore at this time is that of capital expenditure — a field outside the industry's control, although, of course, it is the duty of the industry to put Governments in possession of the facts.

No responsible person today will approach this problem solely on the basis that capital expenditure is justified if it shows an attractive commercial return to the industry in which it is incurred. The needs of the rearmament programme, of export and home consumption including capital investment, are not to be denied. We may doubt whether the slice of capital expenditure allowed to transport is as large as it should be — not merely in the industry's interest, but in the national interest.

A Glaring Misconception

The simplified test is to determine in what sectors of the economy capital expenditure will increase national productivity to the greatest extent as soon as it has been spent, or at least very quickly. It is impossible to escape the suspicion that those who allocate the resources of materials and manpower which are available for capital improvement and development between different industries and purposes are inclined to regard expenditure on improved transport as if it were largely unproductive, and in the passenger field as if it were merely designed to increase the amenities of life for which the nation in its present circumstances must wait. But this is a glaring misconception.

I am convinced that some of the most urgently needed capital expenditure on roads, of benefit to the movement of both passengers and freight, could be shown to be highly productive, and (what is all-important in the present situation) more productive than much other capital investment now being allowed to take place in other industries. I believe it could be proved that the expenditure of, say, £10,000,000 on road improvements would produce a bigger and quicker dividend in the saving of man-hours, equipment and resources than an equal expenditure by almost any of the major industrial users of capital today. One well known authority has expressed privately the conviction that such an investment on roads could be shown, if the facts were all properly established and marshalled, to yield a return in increased national productivity perhaps three times greater than the return obtained from the same capital spent on oil or steel or even electricity and about equal to the return from similar expenditure on coal mining.

Road Improvement

In cities and on busy main roads all over the country there must be scores of opportunities for road improvements which would amply and immediately repay their cost, by eliminating delays and other forms of waste due to bottlenecks, level crossings, congested intersections, and the like. It is a sad reflection that in this country fly-over road junctions can be numbered on the fingers of one hand compared with many hundreds in the U. S. A. and in Germany. Yet in 1950 the density of motor vehicles per mile of road in the country was second only to Belgium among the countries of the world. It is a matter of common observation that we must be spending hardly enough to keep our roads in repair, let alone undertake improvements. It might come as a surprise to many outside this Institute that we can only find it possible to spend about two-thirds of one per cent of the national income on road improvements and maintenance. The United States and Canada spend twice as

* Extracts from Presidential Address of A. B. B. Valentine (Member, London Transport Executive) before the Institute of Transport, delivered on 15th October 1951.

much. We ourselves spend a little bit more of the national income on newspapers or in the total amount staked in a year on football pools, and twenty times more on drink and tobacco, than we do on our roads.

There must be many cases, too, where uneconomic use of single-deck omnibuses and lengthy diversion of freight vehicles enforced by low bridges would be found to cost the country more in one year than the all-time cure.

Future Planning

In all the cases I have mentioned, and many others not necessarily confined to road transport — it is for the economists and statisticians in the industry, collaborating as required with bodies such as the Road Research Laboratory, (to whose pioneer work in the field of road enineering and safety I should like to pay a tribute), to measure more thoroughly the benefits, both direct and indirect, accruing to the national economy from capital expenditure on specific schemes, whether for new works or re-equipment, designed to increase the efficiency of transport. Whitehall must not be blamed for blue-pencilling claims not adequately substantiated by the claimants. Yet nothing today is impairing the efficiency of transport more seriously than capital starvation.

KEEP PROJECTS READY

I should like to add one footnote to this train of thought. Whatever success may attend our more determined efforts to secure in the national interest that a larger share of the nation's capital investment is devoted to transport, many of the most worthy projects, because of their very size will still have to wait. Let us, however, not be induced by this knowledge to set them on one side for later study when prospects are more favourable. An unforeseen easement of international tension or a sharp change in our economic climate may come upon us suddenly—that has happened before. Let us bring the plans for the bigger schemes that matter most far enough forward so that we may be ready—with parliamentary powers in our pockets, if required—to start work upon them at once, if the opportunity comes unexpectedly upon us. Otherwise resources may be frittered away upon lesser projects that happen to be ready, instead of upon those that are most deserving and will ultimately benefit the country most, and the opportunity may pass—that, too, has happened before.

—o—

HOOLIGAN DRIVERS

DURBAN (South Africa):—"Road courtesy and road safety can only be taught to decent people," said South Africa's Minister of Education, Mr. J. H. Viljoen, addressing the Road Safety Council here.

"The hooligan driver's mind is insensitive. All he can understand is fear of jail, of losing his car, of a heavy fine. The way to make him conform is through law enforcement."

(From 'State Transport Review' Bombay—Oct. 1951).

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BRIDGING INDIA'S RIVERS

THE PENNAR BRIDGE

RECENTLY a Frenchman who had lived in Calcutta for about five years asked us when it would be possible for motorists to drive down from Calcutta to Madras. The questioner had in mind the numerous unbridged rivers between these two cities. We have counted on a map these obstructions to motor traffic and find that the two new bridges over the Kathjuri and the Kuakhai on this highway hardly touch the fringe of the problem. There are still another eleven major rivers left unbridged. The Pennar is one of these and work on a bridge across this river is now in progress.

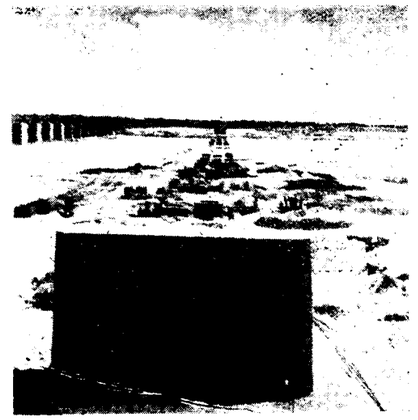
The need for all these bridges is self-evident; the only question is of priorities. Many considerations go to decide this question, the main being the volume of traffic on any particular section of the highway, and the cost of providing a river crossing.

In this particular case the traffic across the river is catered for by a weir-cum-causeway over the Pennar. Traffic here is heavy as this causeway is the only link between the two heavily populated parts of the Nellore district. The river divides this fertile deltaic district into two almost equal halves and the main market towns are on opposite sides of the river.

A Death Trap

Traffic over the weir is, however, unsafe as there is always a liklihood of some flow over it. Interruptions to traffic are frequent and traffic may be held up on 30 to 90 days in a year. The presence of the weir-causeway therefore became worse than no river crossing at all, for it had lured many a traveller to his death. Under these circumstances the Madras Government gave a very high priority to this bridge.

The site and the span length were almost fixed by circumstances for the designers who were not left with much discretion. As would be expected, for many miles upstream of the weir, the river

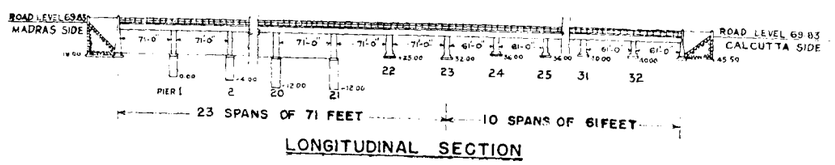


View from the Madras side Abutment.

Railway Bridge is seen on the left.

is very wide. Three furlongs below the weir there is a railway bridge and the irrigation engineers did not agree to another bridge being put up between these two works. The only course open to the highway engineers was to build downstream of the railway bridge and as near to it as possible so as to take advantage of the existing river training works. Further, the railway engineers insisted that the road bridge piers should be so sited that no cross-currents were set up between the two bridges. Consequently, each pier of the highway bridge was located exactly in line with the corresponding pier of the existing railway bridge. Both bridges have the same number of spans and the same length between abutments. The highway bridge is sited 300 ft below the railway bridge

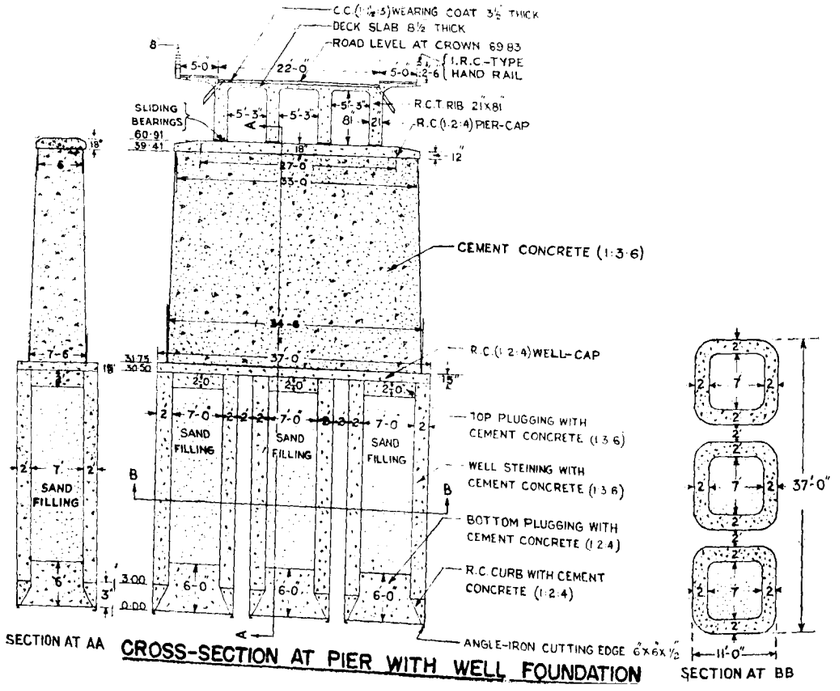
As most of the piers are founded on clay, a reinforced concrete T-beam design with simply supported free ends was adopted for the superstructure. Commencing from the south side the bridge has 23 spans of 71 ft and 10 spans of 61 ft each (clear). The first 21 piers have well foundations, but in the two abutments and the last 11 piers open foundations were adopted as laterite rock was found at a depth of 3 to 5 ft below the bed in most of these cases. The bridge is designed for two lanes of 1. R. C. class A loading.



LONGITUDINAL SECTION

The main dimensions of the bridge are :—

Overall length face to face of abutments, 2,426 ft; distance apart of centres of piers : 23 spans, 77 ft and 10 spans, 66 ft; width of pier shaft, 6 ft in the longer spans and 5 ft in the shorter spans; length of pier shaft in plan 33 ft for longer spans and 32 ft for shorter spans width of carriageway, 22 ft with two 5-ft footphats; T-beam web, 81 in. by 21 in. (62 in. by 20 in. in the shorter spans); deck slab thickness, 8½ in.; high flood level, 58.00 (assumed the same as that at the railway bridge); freeboard, 5 ft over high flood level to the bottom of the T-beam at the centre of the span : maximum discharge, 6,63,548 cusecs observed on the 6th December 1946 at the weir. The catchment area is 5000 sq. miles.

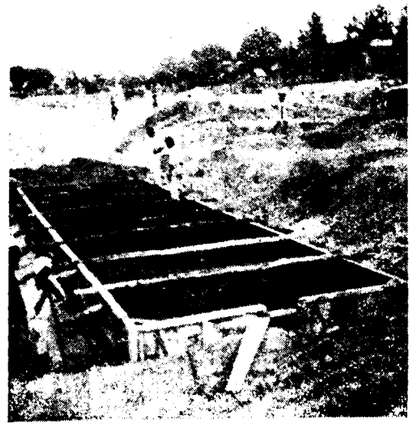


SECTION AT AA CROSS-SECTION AT PIER WITH WELL FOUNDATION SECTION AT BB

COSTS

The bridge, work on which is in progress, is expected to cost Rs 8,23,000 for the foundations, Rs 2,95,700 for the substructure and Rs 10,77,000 for the superstructure. The approaches will cost about Rs 2,00,000. The total cost of the work is estimated to be about Rs 25,00,000.

The expected rate per lineal foot is estimated to be Rs 910.5, and per square foot of roadway excluding foot-paths Rs 41.4 and including footpaths Rs 28.5.


Reinforcement for Well Cap (Pier No. 1)

FOUNDATIONS

Piers Nos. 1 to 21 where the subtratum is clay are founded on wells with three separate wells under each pier. Each well is square in shape (7 ft by 7 ft inside) with rounded corners. The steining walls, in 1 : 3 : 6 cement concrete, are 2 ft to 2·5 ft thick with bond rods and plate ties. The wells are plugged at the bottom with 6-ft deep cement concrete plugs (1 : 2 : 4) filled with well-rammed sand, and sealed at the top with 2-ft thick plugs of 1 : 3 : 6 cement concrete. The pressure under the well foundations is calculated to be 7·3 tons per sq. ft. A 15 in. thick continuous capping slab of reinforced concrete is laid over the top of the three wells. The remaining 11 piers and the two abutments, under which there is laterite rock, are founded on mass cement concrete (1 : 3 : 6) carried into rock to a suitable depth (varying from one foot to two feet).

The piers and abutments, originally intended to be of coarse rubble masonry in 1 : 5 cement mortar, have actually been built in mass concrete (1 : 3 : 6). The piers will be capped with reinforced concrete slabs, 18 in. thick, which serve also as bed blocks under the T-beams.

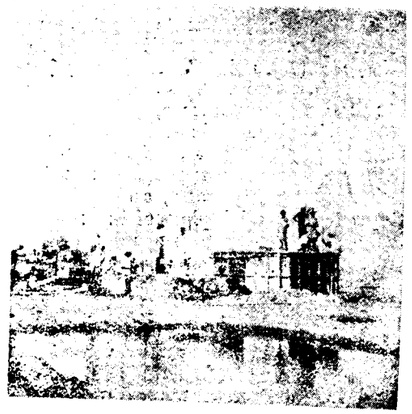
SUPERSTRUCTURE

The superstructure is very simple in design and consists of four T-beams with a 8½-in. deck slab and a 3-in. wearing surface (1 : 1½ : 3). The footpaths, raised 9 in. above the level of the road crown, have been designed hollow to save on dead load and to accommodate the services.

The reinforced concrete handrail will stand 2½ ft high above the footpath.

BEARINGS

Quotations were invited for roller and rocker bearings and it was found that such bearings under all the 132 beams would cost no less than Rs 2,50,000/-, that is, almost 20 per cent of the cost of the superstructure. The design was modified to provide sliding plate bearings at the expansion ends and concrete necks at the stationary ends.



Well sinking in Progress.

EXPANSION JOINTS

For a range of temperature of 60 deg. F. and a coefficient of expansion for reinforced concrete of 0.0000065 gaps of $\frac{3}{4}$ in. are to be provided between consecutive spans.

EXECUTION

Before commencement, work totalling about Rs 20,00,000 was put to tender and the bids which came in ranged from Rs 24,60,000 to Rs 41,30,000. As even the lowest tender (20.1 per cent above the estimate) was outside the permissible margin of 10 per cent, work was taken in hand departmentally.

Later on, well foundation work was given out on contract at 12.3 per cent above the estimated rates. Open foundations have been completed departmentally.

Recently tenders were again invited for the superstructure work and bids ranging from 12.2 to 33.3 per cent above the estimates were received. The work has been let out to the lowest bidder.

This experience has shown that though direct working may not always be as economical as work done on contract, **readiness to execute works departmentally helps to keep the contractor's bids down.**

PRESENT STAGE OF THE CONSTRUCTION

According to the latest reports, the two abutments and all the piers in the shorter spans have beem completed. In the longer spans, well foundations have been completed under six piers and are in progress under other piers. Superstructure has not yet started. The work which commenced in February 1950 is progressing according to schedule and is expected to be completed in June 1953.

CUL-DE-SAC

A Cul-de-sac is that street in Aberdeen which hath a Seller of flags at one end.

STRONGER

There was a young lady of Siam,
Who said to her lover called Priam
I dont want to be kissed
But if you insist
God knows you are stronger than I am.

—o—

FOOD SUPPLIES
A CHALLENGE TO THE ENGINEER

(Extracted from 'The Engineer' — May 25, 1951)

THE world is faced with a crisis. It is one which has come creeping up upon nations distracted by politics. The root cause of the crisis is the extraordinary increase in world population.

Having regard to all the circumstances, and pending the establishment of some kind of world order to regulate population, there seems to be approaching a period of none can say how many years but certainly a good many decades during which the pressure of population upon the sources of food supply throughout the whole world is likely to bear rather heavily.

One of the ways whereby this demand can be met is by bringing into cultivation some of those vast areas of the world's surface which cannot now be made use of.

Anyone who has had to take transcontinental journeys by air is bound to be impressed by the limited areas of the earth's land surface which are under cultivation and the comparatively large areas which are not. There are, for example, mountainous areas where there is little or no soil and where it is too barren for crops to grow. There are other immense tracts where it is too cold, where there is almost perpetual snow and ice; then there are other desert areas where there is plenty of sunshine and a suitable temperature, but insufficient rainfall, and then there are yet other areas, also very large in extent, where Nature seems to be too exuberant, where there is too much of everything, too much sunshine, too much heat and too much rainfall, areas which are now covered by the tropical rain forests.

Great potentialities for food production could be created in some of the desert areas and in the tropical rain forest areas but, before these territories can produce very much, they require more or less intensive preparation and a great part of that preparatory work is of a kind which must be done by civil engineers. Developments at present inconceivable will doubtless have to be embarked upon. Much could be achieved, for example, if by some process sea-water could be made suitable for irrigation. Methods of inducing rainfall by charging the atmosphere with water vapour have also been suggested. *** ***

You will, no doubt, agree that the immense undevoloped areas of land surface in temperate and tropical zones, both jungle and desert, at present unused or unusable, constitute a challenge to the engineer and that the rapidly increasing population of the world plus the demand for an improved standard of living in the backward areas, makes this challenge an urgent one.

—o—

CAUSE AND EFFECT

The Great King Solomon had several hundred wives. When he came to record what he had learnt, he said "Vanity of vanities, all is vanity and vexation of the spirit."

divided into suitable sections. Where a project is of considerable length the Index Map should show the whole project with the sub-divided sections duly numbered.

The Index Map should be the first drawing prepared and on it should be marked the scope of each survey sheet. It will enable the detail to be well placed on the sheets and form a guide for fixing the bearing of each sheet in its relation to the next.

Scale:—Preferably 1 in. to 1 mile.

Difference between the Key Map and The Index Map

It would be helpful to emphasize here the difference between a **Key map** and an **Index map**. The Key map should give an overall picture in one sheet It would correspond to the "Political Map" of the Survey of India. The Index map should give more details of villages, salient features as hills, drainage slopes, etc., and may be in short sections where the project covers considerable length.

Preliminary Survey and Location Plans

Before the engineering survey of any road is taken in hand, tracings should be taken of village maps and the proposed alignment marked therein. (The village maps are generally to a scale of 8 in. to 1 mile or 16 in. to a mile). On these tracings should be shown all alternative routes, curves, village boundaries, built up areas etc. The proposed alignment of road should be indicated by a red line. The width of right of way existing and proposed should also be indicated.

Sizes of Sheets:—Sizes B to F indicated above should be suitable. Where the full length of project cannot be accommodated in one sheet the drawings should continue on other sheets. It is desirable to so adjust the size that all sheets are of same size for one project.

Scale:—8 in. to 1 mile or 16 in. to 1 mile.

Detailed Plan and Longitudinal Section

In this drawing should be shown **BOTH**

(a) The detailed ground plan, and

(b) The longitudinal section.

Note: The plan and section are often drawn separately. This is a mistake.

(a) The ground plan must show the following particulars:—

(i) The alignment with the boundaries of right of way marked; in the case of improvement to existing roads, the existing and proposed widths of roads;

(ii) Contours—in plain country 5 ft contours may be necessary, while in hilly country, 10 ft or even 20 ft contours may be more practicable;

(iii) all existing structures such as temples, mosques, graveyards, public and private buildings, wells, level crossings, cross roads etc., and drainage courses, tanks, ponds, etc.;

(iv) the location, (reduced distance) of the drainage crossings which should be serially numbered with information regarding the nature of bridging proposed. Names of rivers, drainage courses and important nullahs should also be noted;

(v) in case of bends, the deviation angle, tangent points, radius of curve etc. Separate particulars showing the details of the curves should be tabulated and in complicated cases separate drawings should be enclosed and referenced in the main plan;

(vi) the nature and description of soil, position of quarries etc.;

(vii) the positions of cross sections which are to be serially numbered and the reduced distances of such points;

(viii) Bench marks, with their position described and levels noted;

(ix) the north point;

(x) Key chart at bottom of plan showing the bearings of the sheet to other contiguous sheets in all directions,

(xi) reference to field book used as source for the plotting;

(xii) the centre line (cutting indicated by dotted lines and embankment by firm lines)

(b) **The longitudinal section** should be on the same sheet and be drawn to the same horizontal scale as the ground plan, the centre line of the road being considered as in a straight line (as opposed to direct projections of the road in alignment). The longitudinal section should give information on the following:—

(i) datum line;

(ii) ground or existing road surface levels;

(iii) formation levels;

(iv) height of bank;

(v) depth of cutting;

(vi) nature of surface soils;

(vii) gradient;

(viii) reduced distances and position of mile and furlong stones;

(ix) position of cross roads:

(x) vertical curves;

(xi) drainage crossings with their number and name corresponding to the plan, and with a rough indication of the H. F. L. and the nature of crossing proposed;

(xii) the field book reference from which the longitudinal section has been plotted;

(xiii) positions of cross-sections (with their numbers);

(xiv) formation line in dotted red in cutting and firm red in embankment;

Sizes of Plan and Longitudinal Section:- The size of the sheet should be 33 inches by 18 inches for convenience of handling in the field. Leaving 1½ inches margin on the left hand side for filing, and half an inch on the other three sides (this may be increased to one inch, if possible), the working space available will be 31 inches by 17 inches. This size will conveniently accommodate 1 mile length of road with a scale of one inch to 200 ft recommended for general adoption allowing sufficient space for overlap. (In the United Kingdom the size adopted by the Military Engineering Service for this drawing is 24 inches by 18 inches).

Scale:—The following scales are suggested for adoption:—

(a) In rolling open country 1 in. to 200 ft which corresponds to a scale of 1/2400.

(b) In close country or where greater details are required, a scale of 1 in. to 100 ft. corresponding to a scale of 1/1200.

(c) In the **longitudinal section**, the vertical scale largely used and also now recommended is 1 in. to 20 feet.

If surveys are carried out using Gunter's chain the drawings may be to a scale of 1 in. to 220 ft instead of 200 feet.

OTHER DRAWINGS

Detailed cross-sections:— Cross-sections should be taken at all places where there are abrupt changes of level. In plain country, it will normally suffice to have cross-sections at every 300 or 330 feet. In hill roads the cross-sections should be taken at closer intervals as may be decided by the Engineer-in-charge. The cross-section number, the reduced distance and the area of cutting or/and filling should be shown, as also the field book number from which the plotting has been made. The cross-sections should ordinarily be taken over a width equal at least to the width of the proposed right of way. In the case of improvement to existing roads, positions of lines of avenue trees should be indicated. Side drains, catch drains, etc., should also be shown.

Each cross-section sheet should be one of the standard sizes. The cross-section relating to one plan and longitudinal section sheet should as far as possible be accommodated on one sheet of cross-section provided, of course, that this sheet is one of the standard sizes.

Where the road is in open country with very few undulations and a few typical cross-sections will serve the purpose, it may be possible to incorporate the cross sections in the longitudinal section sheet. In such cases, detailed cross-section sheets are not necessary.

The scale generally adopted is 1 in. to 20 ft natural, and this scale is recommended.

Land acquisition plans and schedules:—For purpose of estimates, the land width schedules can usually be prepared from the survey drawings.

For land acquisition purposes, however, further detailed plans will be required usually to the scale followed in the preparation of the village, or settlement maps, say 1 inch to 330 feet or less. Local irregular patches of land will be shown separately to a larger scale on the same plan. The linear land plans should show wells, buildings, etc., and indicate the nature of crop, wet, dry, garden, etc., to help in assessing the value. Schedules for land acquisition should accompany the plans.

Similar land plans and schedules should be prepared for land to be acquired temporarily.

DETAILED DRAWINGS

Detailed designs for masonry works:- For masonry works, the working drawings are usually to a scale of 1/8 in. to a foot. For details of any complicated portions of the structure, larger scales of ¼ inch, ½ inch, or 1 inch, to a foot or alternatively, 1/8, ¼, or ½ full size may be used.

In every case, the size of drawing sheet should conform to one of the standard sizes indicated.

Ground plan, longitudinal and cross sections, and elevations should be accommodated in one sheet as far as possible.

Cross-sections of streams should be to a scale of not less than 1 in. to 100 feet. (For details of scales for bridge drawings see Clause 100 of Section I of the I.R.C. Bridge Code).

Plans for dak bungalows, rest houses, etc.—Separate plans should be prepared for dak bungalows, rest houses, etc., and the size of drawing and the scale will be the same as for masonry works. A site plan should also accompany the other plans for these houses and should preferably be to a scale of 1 inch to 50 feet, showing in detail the boundaries because these plans will have to show considerable detail and will also be permanently preserved to watch encroachments.

Land plans for quarries. - Where quarries for materials of construction have to be acquired for new projects, separate land plans and schedules should be prepared and should accompany the project estimates. The sizes of maps and scales suggested under land acquisition would apply in this case.

GENERAL

When carrying the plan detail forward from one sheet to another, the finished sheet should overlap the next to be used. In the case of road plans the overlap should include not less than the full width covered by the topography and should not be less than 1 inch. After pinning down both sheets, three black lines should be drawn extending into both the sheets to serve for matching. Sheets should be numbered consecutively

At the bottom of the sheet, a diagram showing the index of sheets should be given. This will indicate at a glance all the drawing sheets contiguous to the sheet under consideration.

When more than one sheet is required for a project, space should be provided in the upper right hand corner to show the number of sheets in the series and the number of the particular sheet.

Folding.—The method of folding drawings for storing in filing cases, attaching to correspondence files, or for binding in special reports, is illustrated in Plate 7 of the I.R.C. Paper referred to at the beginning of this note.

The method of folding advocated has been selected to embody the following principles:—

(i) All maps and plans must fold to a final size of 13 in. by 8 in. for convenience of record in office files.

(ii) It should NOT be necessary to open up a map to see what it refers to. For this reason full details of the maps or plans should be recorded on the *bottom right hand corner* so that after folding it is only necessary to flick over the plans, without fully opening a file, to select the plan required.

(iii) All folding should be done in the same way, *vertical folding first* and then *horizontal folding*. To open a plan, all that is necessary is to hold firmly the top *left hand* corner and pull out the bottom right hand corner.

[*The Roads Organization has brought out a Pamphlet on the uniform practice regarding the preparation and presentation of Highway Project Schemes. Copies have been distributed through Chief Engineers. However, salient features of this pamphlet will be reviewed in a future issue of this magazine in this series —Ed.*]

Continued from page 13.

passing places have a length of 50 to 70 feet and the pavement over this length has a width of 16 feet. All crossing places are marked by a white diamond-shaped sign of 9-inch sides, supported 6 feet above the road by a post painted with black and white bands. The passing manoeuvres are very easily carried out, but, of course, it is to be expected that on occasions in the tourist season some driving in reverse may be necessary where a motorist fails to see the on-coming vehicle and overruns a passing place.

LOW-COST ROADS IN SCOTLAND

(Extracted from 'Main Roads'—June, 1951).

FOR main roads in Scotland "road gravel" is no longer used in the construction of the pavements. The chief reason for this position is that suitable gravel is now scarce whereas good stone for crushing is available everywhere within easy reach of any job. Also, economical modern crushing plants of a portable type can be readily purchased or hired.

In the past, as an alternative to road gravel, broken stone "dry-macadam" pavements have been constructed using basalts or granites, 2 to 2½ inches nominal gauge, with screenings and selected gritty earth for a binder. Recently, however, the use of gritty earth has been discontinued and the normal so called low-cost roadway in the Highlands consists of a "bottoming" (base course) 6 inches thick of 4 inches-1½ inches crusher-run stone on which is laid a 2-inch course of precoated 1½-inch gauge crushed stone. After one year of traffic use a final top course of hot pre-mixed macadam upto 2½ inches thick is laid.

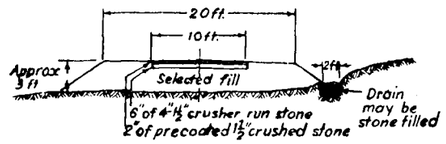
Where, however, some of the old surface treated gravel or dry macadam roads have to be strengthened and restored as to riding quality, the general method is to lay a carpet coat of hot premixed macadam 1 inch to 1¼ inches consolidated depth. This coat costs 1 s. 8d. to 2 s. 6 d. per square yard and it is made up of ¾-inch down to 1/8-inch crushed aggregate plant-mixed with 85-100 bitumen, or one of the many tar/bitumen binders on the British market. Carpet coats are spread by machines when there is sufficient length to justify bringing the spreader or spreader-tamper to the job.

If the old surface treated gravel or dry macadam road has good riding quality it may be resealed with bitumen or tar/bitumen compound, at 0.20 to 0.25 gallons per square yard with cover stone of ¾ to ½ inch gauge spread at the rate of 1 ton to 80-100 square yards.

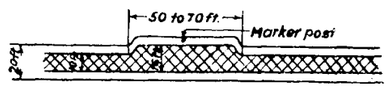
In the Highlands the lowest type of road now being constructed with assistance from the Ministry of Transport is the single-lane "Crofter" road, but at an average cost of £ 20,000 per mile (including the cost of small bridges) they can hardly be classed as low-cost roads by Australian standards.

These Crofter roads have a cross-section as indicated below and are intended to carry mixed traffic upto 300 vehicles per day in the summer. Where more than this volume of traffic is expected to arise following completion of the road, the width of pavement is increased to 16 feet, which is regarded as the minimum for two lanes in the Highlands.

ONE-WAY CROFTER ROAD
SCOTLAND



CROSS SECTION
ON EASY SIDE SLOPE



PLAN OF PASSING PLACE

The Crofter roads are designed for travel at 30 m.p.h. but where heavy rock work is required, the design speed is reduced to 25 m.p.h. Where it is necessary to adopt steep grades, i.e., over 8½ per cent. or where curves have necessarily to be very sharp, a length of two-lane road is inserted over the difficult sections.

The principal feature which makes these Crofter single-lane roads interesting to us is that the surprisingly high traffic capacity is achieved by the construction of vehicle passing places within sight of one another but at not less than 12 to the mile. These

(*Continued on page 12*)

In every case, the size of drawing sheet should conform to one of the standard sizes indicated.

Ground plan, longitudinal and cross sections, and elevations should be accommodated in one sheet as far as possible.

Cross-sections of streams should be to a scale of not less than 1 in. to 100 feet. (For details of scales for bridge drawings see Clause 100 of Section I. of the I.R.C. Bridge Code).

Plans for dak bungalows, rest houses, etc.—Separate plans should be prepared for dak bungalows, rest houses, etc., and the size of drawing and the scale will be the same as for masonry works. A site plan should also accompany the other plans for these houses and should preferably be to a scale of 1 inch to 50 feet, showing in detail the boundaries because these plans will have to show considerable detail and will also be permanently preserved to watch encroachments.

Land plans for quarries. - Where quarries for materials of construction have to be acquired for new projects, separate land plans and schedules should be prepared and should accompany the project estimates. The sizes of maps and scales suggested under land acquisition would apply in this case.

GENERAL

When carrying the plan detail forward from one sheet to another, the finished sheet should overlap the next to be used. In the case of road plans the overlap should include not less than the full width covered by the topography and should not be less than 1 inch. After pinning down both sheets, three black lines should be drawn extending into both the sheets to serve for matching. Sheets should be numbered consecutively

At the bottom of the sheet, a diagram showing the index of sheets should be given. This will indicate at a glance all the drawing sheets contiguous to the sheet under consideration.

When more than one sheet is required for a project, space should be provided in the upper right hand corner to show the number of sheets in the series and the number of the particular sheet.

Folding.—The method of folding drawings for storing in filing cases, attaching to correspondence files, or for binding in special reports, is illustrated in Plate 7 of the I.R.C. Paper referred to at the beginning of this note.

The method of folding advocated has been selected to embody the following principles:—

(i) All maps and plans must fold to a final size of 13 in. by 8 in. for convenience of record in office files.

(ii) It should NOT be necessary to open up a map to see what it refers to. For this reason full details of the maps or plans should be recorded on the *bottom right hand corner* so that after folding it is only necessary to flick over the plans, without fully opening a file, to select the plan required.

(iii) All folding should be done in the same way, *vertical folding first* and then *horizontal folding*. To open a plan, all that is necessary is to hold firmly the top *left hand* corner and pull out the bottom right hand corner.

[*The Roads Organization has brought out a Pamphlet on the uniform practice regarding the preparation and presentation of Highway Project Schemes. Copies have been distributed through Chief Engineers. However, salient features of this pamphlet will be reviewed in a future issue of this magazine in this series —Ed.*]

Continued from page 13.

passing places have a length of 50 to 70 feet and the pavement over this length has a width of 16 feet. All crossing places are marked by a white diamond-shaped sign of 9-inch sides, supported 6 feet above the road by a post painted with black and white bands. The passing manoeuvres are very easily carried out, but, of course, it is to be expected that on occasions in the tourist season some driving in reverse may be necessary where a motorist fails to see the on-coming vehicle and overruns a passing place.

LOW-COST ROADS IN SCOTLAND

(Extracted from 'Main Roads'—June, 1951).

FOR main roads in Scotland "road gravel" is no longer used in the construction of the pavements. The chief reason for this position is that suitable gravel is now scarce whereas good stone for crushing is available everywhere within easy reach of any job. Also, economical modern crushing plants of a portable type can be readily purchased or hired.

In the past, as an alternative to road gravel, broken stone "dry-macadam" pavements have been constructed using basalts or granites, 2 to 2½ inches nominal gauge, with screenings and selected gritty earth for a binder. Recently, however, the use of gritty earth has been discontinued and the normal so called low-cost roadway in the Highlands consists of a "bottoming" (base course) 6 inches thick of 4 inches-1½ inches crusher-run stone on which is laid a 2-inch course of precoated 1½-inch gauge crushed stone. After one year of traffic use a final top course of hot pre-mixed macadam upto 2½ inches thick is laid.

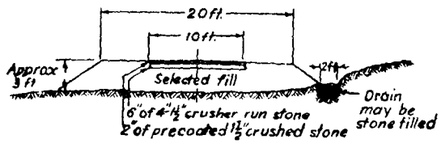
Where, however, some of the old surface treated gravel or dry macadam roads have to be strengthened and restored as to riding quality, the general method is to lay a carpet coat of hot premixed macadam 1 inch to 1¼ inches consolidated depth. This coat costs 1 s. 8d. to 2 s. 6 d. per square yard and it is made up of ¾-inch down to 1/8-inch crushed aggregate plant-mixed with 85-100 bitumen, or one of the many tar/bitumen binders on the British market. Carpet coats are spread by machines when there is sufficient length to justify bringing the spreader or spreader-tamper to the job.

If the old surface treated gravel or dry macadam road has good riding quality it may be resealed with bitumen or tar/bitumen compound, at 0.20 to 0.25 gallons per square yard with cover stone of ⅜ to ½ inch gauge spread at the rate of 1 ton to 80-100 square yards.

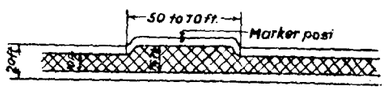
In the Highlands the lowest type of road now being constructed with assistance from the Ministry of Transport is the single-lane "Crofter" road, but at an average cost of £ 20,000 per mile (including the cost of small bridges) they can hardly be classed as low-cost roads by Australian standards.

These Crofter roads have a cross-section as indicated below and are intended to carry mixed traffic upto 300 vehicles per day in the summer. Where more than this volume of traffic is expected to arise following completion of the road, the width of pavement is increased to 16 feet, which is regarded as the minimum for two lanes in the Highlands.

ONE-WAY CROFTER ROAD
SCOTLAND



CROSS SECTION
ON EASY SIDE SLOPE



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(*Continued on page 12*)

HERE AND THERE

1. THE - FIVE YEAR PLAN

ON funds for the first year of the plan, Mr. Deshmukh said, Government had already Rs 75 crores from the American wheat deal and expected another Rs 15 crores from Canada and Australia under the Colombo Plan. He had no doubt that the first year's programme under the plan would be fully implemented. "Both from the point of view of our stability of internal finances and external finances and from the angle of foreign aid we will be able to carry through the 1951-52 part of the plan," he said. He hoped to have a surplus of Rs 25 crores to Rs. 26 crores in the revenue of the country during the current year. Out of that, he had already allotted an additional Rs 10 crores for river valley schemes.

(Speech by Shri C. D. Deshmukh at Bombay on 29-12-51, from the "Hindu" dt. 30-12-51)

2. WHAT IS A "FREEWAY"

A "freeway" is statutorily defined as "A highway in respect to which the owners of abutting lands have no right or easement of access to or from their abutting lands or in respect to which such owners have only limited or restricted right or easement of access."

It will be seen, therefore, that the only distinction between a freeway and an ordinary highway is in the matter of access to the freeway. The mileage of full freeways in the United States is, and necessarily will be, small in comparison with ordinary highways, for freeways are mainly required in urban areas, to carry heavy volumes of traffic.

In current practice, such freeways may have a total of four, six or even eight traffic lanes, each 12 ft wide, with divisions separating traffic flowing in opposite directions, and with all cross traffic passing over or under the freeway.

* * *

(Extracted from 'Engineering" — Aug. 17, 1951).

3. HOW THE CAR BEGAN

THE effects of the petrol engine were most revolutionary in the field of transport, first on the roads and then in the air; its lightness in relation to power made it pre-eminently suitable for this purpose. Daimler at first intended his engine to be used for stationary work and for the propulsion of boats, but in 1886 he fitted it to a bicycle. The results were so successful that, three years later, he built another engine for a road vehicle. This was the beginning of the great motor industry. The year 1896 saw the founding of the English Daimler Motor Company, and in the same year the Ford Motor Exhibition was held in the Crystal Palace, London.

These early cars were frequently unreliable, but the mechanical design was quickly improved as a result of practical experience on the road. Other improvements, such as better systems of ignition and cylinder cooling, pneumatic tyres, and streamline body construction have done much to popularise the motor car. By 1928, the output of high-speed internal-combustion engines exceeded by more than ten times the total horse-power of all power stations, ships and railways. Again, at the World Power Conference in Berlin in 1930, it was stated that the number of motor cars on the World's roads was some 30 millions, with an output of at least 600 million h.p. Today, self-propelled vehicles are used for practically all forms of transport.

* * *

(Extracted from an article "Two Thousand Years of Engineering" published in 'Engineering'—Aug. 17, 1951)

4. ROAD-BUILDING MACHINE

A machine that can travel through sand and leave a usable road behind it has resulted from research by the U. S. Naval Laboratory. Several models have now been built, consisting of a tractor and a mixer unit. The mixer, pulled by the tractor, picks up sand, combines it with chemicals and spreads it out in roadway widths. The system is known as the aniline-furfural method of beach stabilization. The latest tests, using a machine capable of travelling at 17 feet per minute, showed that the beach strip which had been stabilized could easily support a 19-ton truck about eight hours after it had been treated.

(Extracted from "Motor Transport"— December 22, 1951)

* * *

5. AMERICAN ROADS

A high proportion of the roads of the U.S.A. have no special surface or only one of a very elementary kind. Of the 3,000,000 miles of rural roadway, 1½ million miles are non-surfaced, their surface being simply the soil that forms the roadway; 1 million miles have just a gravel surface, consisting of a layer of loose gravel spread over the carriageway and kept in position by maintenance with a blade-grader. About half million miles have a bituminous or concrete surface, and of these ½ million about 200,000 miles may be considered as of the high-quality type.

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

(Bituminous Roads in North America)

6. BITUMINOUS ROADS IN AMERICA

THE bulk of bituminous surfacings on American roads are dense and impervious. In the eastern and middle states sand-asphalt is the normal material, in the western states asphaltic concrete is invariably used; the open-textured carpet, so popular in Great Britain, is rarely seen.

(From 'Road Research Technical Paper No. 22)

(Bituminous Roads In North America)

7. VOLUME OF ROAD TRANSPORT IN THE U. S. A.

THE total vehicle-miles estimated on main rural roads in the United States during 1949 was 125,602 million, and for local roads 43,267 million, or a grand total for that year of 168,867 million vehicle-miles including both public and private carriage. But public carriage is reported to represent only approximately 1 per cent of this total. The average number of persons per vehicle was two, so that the passenger-miles produced on United States highways that year amounted to roughly 337,734 million, of which only about 1 per cent resulted from public carriage.

In 1936 transportation by public carriers on the United States highways amounted to 11,911 million ton-miles. In that year private carriers were responsible for 16,094 million ton-miles. In 1949 the ton-miles produced by private carriers amounted to 43,231 million compared with 45,896 ton-miles accounted for by public carriers.

(From Transport & Communications Review, January–March 1951, U. N. Trans & Comm. Divn. "Some aspects of rail transport service" By Herbert Ashton, E, Ph.D)

8. HOW TO GET A GOOD SEAL COAT

TO get a good seal coat, first be sure that the surface to be treated is free of dirt and dust that would prevent the bitumen from adhering. The bitumen must be applied at a temperature that will allow adherence both to the surface and to the cover aggregate. The weather conditions must be such that the bitumen does not set before it is covered with aggregate. Also, the application of bituminous material should not be subjected to rain before it is covered with aggregate.

Bituminous spreading should proceed slowly enough for the covering operation to follow closely, so that aggregate can be imbedded into the asphalt. The colder the weather, the closer the two operations should be.

The application of bitumen must be sufficient to provide a mastic one-half the depth of the cover stone. The cover aggregate must be surface-clean when placed. It also must be dry. Cold, wet aggregate will not bond with the bitumen. Prompt rolling is required.

(*Extracted from 'The American City' -October 1951*).

9. METAL LAUNDRY

THE importance of a process which reconditions metal objects formerly regarded as only good for scrap cannot be overstressed, especially at a time when there is an increasing shortage of raw materials. The method consists of derusting metal by means of "electro-plating in reverse."

A current of 4,000 amps is passed through five 3,000-gallon vats filled with an alkali solution which froths and bubbles, and the rust and impurities are dissolved into hydrogen gas. It is claimed that any rusted or deteriorated object, from a "locomotive to a nut", can be treated in this way, leaving metal surfaces perfectly clean and without any chemical absorption even in the more porous types of metal. Porous or deeply pitted surfaces are cleaned as efficiently as bright surfaces, and with correct treatment no trace of corrosion is left in even the smallest interstices. Although the process entirely removes rust, it does not prevent it from recurring, and normal anti-rust precautions are then necessary.

Two of the most important advantages of the treatment are that it does not attack sound metal in any way whatever and complete machines and assemblies can often be derusted without any dismantling—an enormous saving in labour and possible damage, for the stripping of corroded machinery is usually difficult, expensive and laborious. The treatment can be safely applied to nearly all metals except certain magnesium and aluminium alloys, and when these are present in complete assemblies they can in most cases be fully protected by any of several methods of masking or painting over with insulators.

(*Extracted from 'Commonwealth Today No. 7'*)

10. ADVANCED TREES TRANSPLANTED IN AUSTRALIA

THE construction of kerb and gutter on State Highway No. 13 in the Shire of Baulkham Hills, New South Wales, necessitated the transplanting of a number of Brush Box (Tristania conferta) trees. The fourteen trees transplanted were part of an avenue of Brush Box trees, planted in 1940, and which by 1949 had reached a height of approximately 12 feet.

The trees were first "skeleton" pruned to reduce the weight and height as much as possible. A trench approximately 18 inches deep was dug around each tree, at a distance of 3 feet from the bole. From the bottom of the trench the tree was carefully undermined, care being taken to injure the roots as little as possible, and preferably without removing the soil surrounding the roots. Where damage to any roots was unavoidable, these were cut off cleanly and tar applied to prevent bleeding.

When the tree had been completely undermined, hessian was forced under the tree and brought up around the bole to hold firmly the ball of soil containing the roots. While this was going on, a trench 6 feet wide and to the same depth as the undermining was dug from the old to the new position for the tree. Wooden planks were then pushed under the hessian containing the ball of roots, and the tree skidded to its new position.

Fresh soil was packed in around the tree, water being sprinkled into the hole at the same time. Finally, the tree was securely staked so that support would be provided until the soil again held the roots firmly.

The trees were watered regularly for several weeks after being moved.

Of the fourteen trees moved eleven are now flourishing. The failure of the other three trees was not due to damage during removal but to interference to the root systems after the trees had been re-established.

(*From 'Main Roads' – September 1951.*)

11. EVALUATION OF DAMAGES CAUSED BY TRAFFIC ACCIDENTS IN THE NETHERLANDS

	Francs ('000)	
1. Corporal damage :	59,000	67%
Loss of Production :		
by death (1000 cases)	20,000	22·7%
by disability (2000 cases)	19,000	21·6%
by injury (100,000 cases)	14,000	15·9%
Expenditure of treatment at hospital or at home :	6,000	6.9%
2. Material damage :	16,000	18%
Damage to		
Tramway cars (including railway rolling stocks damaged at level crossings)	400	0·4%
Motor vehicles	12,500	14·1%
Bicycles (including carrier-tricycles)	600	0·7%
Wagons and carts	250	0·3%
Fixed objects (boundary marks), road signals, electric posts, bridges, buildings, etc.)	1,000	1·1%
Other damage to property (dress of the victims, charges and expenses of reserve vehicles)	1,250	1·4%
3. Accessory expenses :	13,000	15%
The expenses of the police (drawing up police reports etc.)	750	0·9%
justice (magistracy, advocates, prisons)	500	0·6%
settling accounts (valuation, general expenses of assurance companies)	11,750	13·5%
Grand Total	88,000	100%

The calculations have been based on damages caused to the community and not to individuals.

[*Translated from 'Transport Documentation' of the Netherlands Transport Institute.*]

12. BUS FARES

THE fares of Calcutta buses are by far the lowest in India, lower than those of Bombay, Madras and Delhi by 100 to 200 per cent. Comparative figures are there for anybody to see. In this respect the bus passengers of Calcutta are the most fortunate. To give the readers an idea :

I. Thakurpur to Shambazar
14 miles – fare 4 annas
Madras—the same distance 7½ annas
Bombay – do 6 annas
Delhi from station to Kutub Minar distance of 11 miles – 9 annas

II. Ballygunj to Elgin Road distance 3 miles – 1 anna
Madras – the same distance 2 annas
Bombay – ,, ,, ,, 2½ annas
Delhi – ,, ,, ,, 4½ annas

(*From 'Motor Transport' – November 1951.*)

BUSINESS AND GOVERNMENT COOPERATE IN BUILDING A MEXICAN BRIDGE

(From "Engineering News-Record" – September 13, 1951.)

BUSINESS and government have teamed up to do a job on Mexican roads. They work together with an enthusiasm that reminds U. S. highway people of the early days of the good roads movement in this country.

Their teamwork pays off. Just recently they opened up another region—heretofore almost inaccessible—by throwing a bridge across the Balsas River at Coyuca, capital of the Pacific Coast State of Guerrero, 110 airline miles south of Mexico City.

To Mexico, the bridge means much more than a safe and easy way to cross a difficult stream. It stands out as a symbol—the first bridge to be designed and partly paid for by the National Committee for Local Rural Roads.

Industry Volunteers Higher Taxes

Industry and government got together two years ago to produce the funds with which the committee does its work. In March 1949 the Mexican assembly plants of the automotive manufacturers entered into an agreement with the government by which each would supply half of the committee's funds. **The auto industry agreed to pay 10 per cent more in taxes**, the money to be matched by the government, with the whole sum to go into rural—or so-called auxiliary roads.

Purpose of the deal was to dig up cash for secondary highways. The national budget could not be stretched to cover these roads. Credit for the industry-government agreement goes to the Mexican Highway Association, an affiliate of the International Road Federation, headquartered in Washington, D. C. The Mexican good roads association sponsored the agreement and put it across.

In its first year, the National Rural Roads Committee had 1,150,000 dollars to spend. The committee's charter allows it to contribute no more than one-third to the cost of a local improvement, the rest to come from the state governments and private individuals in the area to be benefited. For the Coyuca bridge, however, the project was so important that the Committee and the Communications Ministry made contributions of slightly more than 48,000 dollars each to the 208,000 dollars total cost. Besides the bridge itself, the project called for special approaches and for initiation of city plans both for Coyuca (pop. 2,000) and for Cindad Altamirano, 4 miles northeast (pop. 4,000).

Local businessmen and the State of Guerrero contributed more than 23,000 dollars to the cost. A bank loan—to be paid off from bridge tolls—supplied the rest of the money, less than 90,000 dollars.

Noteworthy Structure

Aside from its business-government financing, the bridge is a noteworthy structure in its own right. The 773-ft crossing is bridged by nine 86-ft spans of twin reinforced concrete continuous girders on stone piers. The two girders support the concrete roadway and cantilever sidewalks.

Welded Reinforcing Rods

Steel reinforcing roads were welded—instead of merely lapped—over the intermediate piers of each continuous bridge section, thus saving 10 per cent in weight. Also, the builders used high-early-strength cement exclusively to cut construction time.

Construction speed was good. Despite the remote location and unusually heavy floods during the rainy season, the contractor completed the job on schedule in less than 13 months, Feb. 1, 1950 to March 25, 1951.

Water as Test Load

To test-load the structure, the engineers used water instead of trucks or other vehicles. They built low brick walls around the deck slab of the spans being tested and filled these brick-wall reservoirs with water pumped from the river. Under design loading, the spans deflected 4 mm instead of the 5 calculated, and they recovered completely when the load was released.

—o—

CORRESPONDENCE

INSPECTION OF BRIDGES

To, The Editor, Transport-Communications Monthly Review.

Sir,

THE Transport-Communications Monthly Review has performed a useful piece of service by publishing in the columns of its August, September and November issues articles and references on the subject of inspection of bridges.

The need for inspection of bridge structures has already been pointed out. Briefly, a regular bridge inspection programme will serve several useful purposes, viz :

(1) to ensure discovery of weaknesses before accidents occur ;

(2) to determine in advance the character and extent of necessary renewals or improvements, so that annual budget estimates may be prepared and funds authorised ; (This will allow for comparison of alternate methods, preparation of plans or sketches, and scheduling of work in the order of urgency.)

(3) to make it possible to assemble necessary equipment and order materials in advance (at a time that will take advantage of the best market prices) ;

(4) to enable State bridge crews to be maintained all the year round so as to be always available in emergencies, and to be kept at strategic points during times of high water and floods ;

(5) to provide a service record of bridges, valuable in determining the life expectancy of different types under various climatic and traffic conditions ; and

(6) to discover design defects and to correlate needed replacement with new construction programme.

It is not difficult to imagine the magnitude of the problem in India. One State alone, viz : the Punjab, had, before partition, 310 major bridges of 50 feet length and above. There are now about 186 such bridges in the State in India. In addition, there are several smaller bridges and culverts which should also come under the scope of our investigation. Viewed from the point of view of the whole country, the problem is, therefore, one of considerable magnitude.

As eminent an authority on science and technology as Sir Henry Tizard, addressing the British Association in 1948 remarked, *inter alia*, ".....What is of first importance is to apply what is already known". Advancing on the same argument, I think, we can rightly say that what is of equally great importance to-day is to maintain what we already have.

The problem is no doubt being presently tackled by each State in its own way. It is true that no absolute rules can be laid down for the inspection of a structure, but some sort of a systematic procedure in going about with the task seems to be called for. The Oregon State Highway Department of the U. S. A. has devised a a suitable form for recording inspection notes of bridge structures. The greatest advantage of such forms is that they aid the man on the spot to check all important items during the course of inspection, without missing any of them through oversight. The form is reproduced here with due acknowledgement to the source.

A blind adoption of the form is by no means suggested. It can be modified to suit the requirements of each case. Probably it is a subject for the Bridges Committee of the Indian Roads Congress to work upon before any recommendation is made. What is of primary importance is, to my mind, a recognition or conviction on our part of the usefulness of such a form for the purpose in view. Otherwise, it is feared, the form or the register may meet with the same fate as so many other useful forms or registers in our Departments which require Herculean efforts to be rescued from the oblivion to which they are confined.

Yours Truly

Simla, 12-12-51 HBC

—o—

BRIDGE INSPECTION AND MAINTENANCE REPORT.
OREGON STATE HIGHWAY COMMISSION—BRIDGE DEPARTMENT

FOR BRIDGE OVER ... TUALATIN RIVER ..... HWY NO. 3 SECTION NO. 34-23 BR. LOC. NO. 1298
COUNTY ... WASHINGTON ..... MILEAGE NUMBERING FROM ... PORTLAND. .....
GENERAL DESCRIPTION 4-40 RCDG; 1-150' STEEL DECK; 5-40 RCDG SPAN SHEET 1 OF 1 ...
INSPECTION MADE BY ... A.F. SMITH ..... DATE 10.29.37...

OBSERVATIONS

WATERWAY	PIERS AND ABUTMENTS TIMBER STEEL CONCRETE	CONCRETE STRUCTURES AND FLOORS	STEEL CONSTRUCTION	TIMBER SPANS AND FLOORS
ADEQUACY ...	✓ UNDER MINING ...	✓ CRACKING ...	(2) CONDITION OF PAINT	(4) CONDITION OF PAINT ...
SCOUR ...	✓ SETTLEMENT	✓ SCALING ...	✓ CORROSION ...	(1) DECAY ...
OBSTRUCTIONS ...	✓ CRACKING ...	✓ SCOUR ...	✓ JOINTS.	✓ WEAR (FLOORS) ...
UNDERGROWTH ...	(1) ... DISINTEGRATION	✓ SETTLEMENT ...	✓ LOOSE RIVETS ...	✓ STRUCTURAL DEFECTS ...
CHANNEL SHIFTING ...	✓ ... DECAY (LUMBER)	— DISINTEGRATION	✓ CAMBER ...	✓ CRUSHING AT JOINTS ...
REVETMENTS ...	✓ ... CORROSION (STEEL)	— WATER-PROOFING	(1) END SHOES ...	✓ SPLICES. ...
OTHER FEATURES	✓ OTHER DEFECTS PILING TO FOUNDATION YES	✓ OTHER DEFECTS	(2) ... OTHER DEFECTS	✓ CAMBER ... OTHER DEFECTS ...

MAKE ABOVE OBSERVATIONS FOR EACH PART OF STRUCTURE AND NOTE WITH (✓) MARK TO INDICATE OK OR NONE FOR ITEMS
NEEDING EXPLANATION MARK WITH A CIRCLE WITH A NUMBER INSERTED TO REFER TO THE CORRESPONDING REMARK LISTED BELOW. AMPLIFY.
REMARKS WITH SKETCHES ON SECOND SHEET WHEN NECESSARY.
"UNDER" STRUCTURAL DEFECTS" NOTE ANY TENDENCY TO WARP, SPLIT, CRACK: ETC.

REMARKS

USE SECOND SHEET WHEN SPACE BELOW IS NOT SUFFICIENT; ALSO, LIST CAUSE OF ALL DEFECTS SUCH AS (CRACKING AND SCALING OF CONCRETE WHENEVER POSSIBLE.)

(1) ... BRUSH AROUND PIER #1 GROWN UP TO BOTTOM CHORDS
OF STEEL TRUSS-CONDUCIVE TO RUSTING STEEL.
(1) ... SLIGHT CRACKING APPARENT IN SIDEWALK SLAB, DUE TO
CONTRACTION-WATER PROOFING NOT REQUIRED
(1) CATCH BASINS AT END OF BRIDGE CLOGGED
(2) PAINT ON STEEL WEATHERED AND SHOWS INDICATION OF
SCALING-WILL REQUIRE ONLY SLIGHT CLEANING IF REPAINTED NEXT YEAR.

MAINTENANCE AND BETTERMENT RECOMMENDATIONS

ITEM	ESTIMATED COST MAINTENANCE	BETTERMENT
CUT OUT BRUSH AROUND PIER #1	PATROL MAINTENANCE	
CLEAN OUT CATCH BASINS.	"	"
CLEAN, SPOT PAINT AND REPAINT STEEL		
WITH FULL COAT 110 TONS @ $35	$ 3850 00	

NOTE: LIST UNDER MAINTENANCE AND BETTERMENT RECOMMENDATIONS ALL NECESSARY CHANNEL CLEARING, REVETMENTS, BANK PROTECTION, CHANNEL CHANGES, STREAM BED PAVEMENTS, RIPRAP WORK, UNDERPINNING OR OTHER FOUNDATION PROTECTION, SHOULDER AND SLOPE PROTECTION, REPAIRS TO CONCRETE WORK, PAINTING, WATER-PROOFING, PRESERVATIVE TREATMENTS, REPAIRS TO ROADWAY SURFACES, REPAIRS AND RENEWALS TO TIMBER AND PILING, AND ALL OTHER MAINTENANCE AND REPAIR WORK OF WHATEVER CHARACTER. FILL OUT IN DUPLICATE AND SUBMIT ORIGINAL TO SALEM OFFICE.

TECHNICAL INFORMATION

(i) REPAIRING OLD BRIDGE PIERS IN FAST RUNNING WATER

PLENTY Bridge over the River Derwent, Tasmania, is sandstone-piereed and was built in the early days of the Colony. The river is fast flowing at about 6 ft a second. An investigation showed that the masonry blocks were in fair order but erosion by the water had left many of the mortar joints open. To make these joints good, and to protect the masonry at the pier bases, the whole of each pier base has been encased in concrete, which was wet-placed in stilled water.

General Method

Each pier called for separate detailed treatment because of their shape, variations of river bottom, water depth and velocity, but generally, the method used in concreting called for part or all of the following:—

1. Rough stone walling upstream of pier (where possible).
2. Sand bag walling around pier placed by winch and gear from decking.
3. Timber shuttering positively anchored to pier, to protect sand bagging.
4. Steel sheet shuttering, 18-gauge, inside sand bagging.
5. Timber or sheet steel formwork within the shuttering and bagging (not used in pier No. 2).
6. Placing of concrete by tremie from bridge deck.
7. Salvage of useful material.

Construction Details

Important features of the work on all piers are embodied in that done on No. 2 pier of which the following is a description. (See Fig. on next page.)

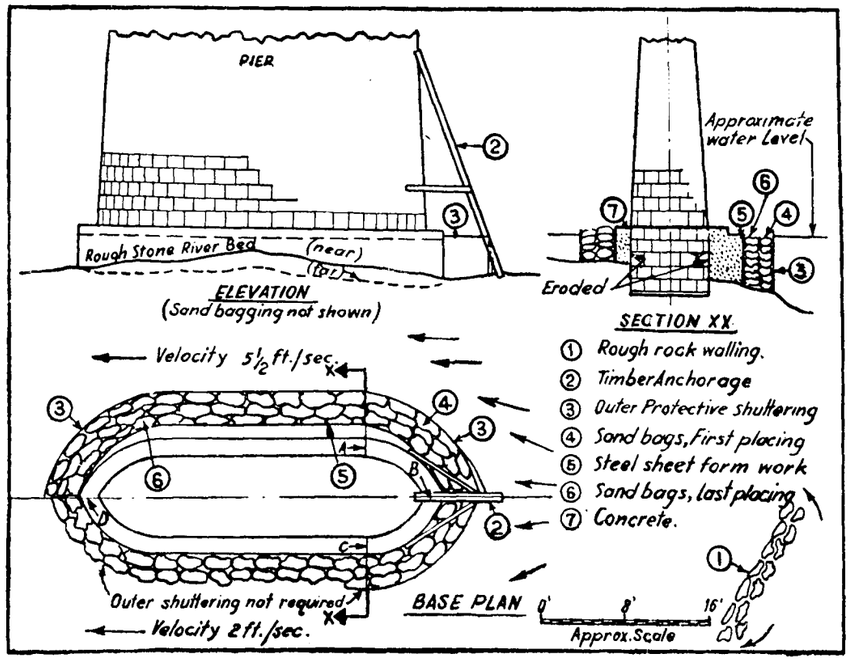
The first-placed unprotected sand bags were swept away, and a rough stonewall of heavy blocks was built upstream. This was effective in diverting the water flow and lessening the water velocity at the pier cutwater. Positive anchorage for 5/8 in. thick green timber shuttering was provided by placing a 6 in. by 6 in. sloping timber footed into a pocket in the rock bottom, approx. 7 ft upstream of the pier cutwater. This timber was fixed into the pier masonry high up. (see (2) in Fig.). The shuttering was fastened to the timber anchorage, then staked off and tied to the pier. This provided protection to the sand bags which were then placed inside, hard against the timber. The work of scouring the masonry to provide a good bond and of cleaning off the rock bottom was then done, and steel dowels fastened into the mortar joints.

Arrangement of Formwork

The concrete steel sheet formwork rising from bottom to above water level was placed in the calmed water and braced off the pier itself. A space of about 18 in. was provided between this formwork and the sand bagging already placed. This space was carefully packed with sand bags. Cut off formwork was placed at A, B & C and the space between A and B and later C and B was poured by tremie. The mix was 1 : 2 : 2 and the mortar of the mix was worked into the cleaned joints with tamping rods. With the placing of the new protective cutwater the procedure was repeated for the remainder of the pier base, pouring being carried from D towards A and later D towards C.

Test for Water Stillness

The test of water stillness was by dropping small quantities of dry cement into.



Pier No. 4 showing completed concreted "rings" around base.

the impounded water and noting the deposition. Complete impounding allowed the cement to settle directly and remain. Twenty-one cubic yards of concrete was placed around this last and most difficult pier and the result was satisfactory. Great care was required in placing the bags and controlling their content, and once in the water, the work on any pier was carried forward with all expedition to lessen risk of damage by sudden water rise.

(Extracted from "Commonwealth Engineer" July 2, 1951)

(ii) RUBBERISED BITUMEN AS SPRAY COAT

THE City of Leeds Highways Department has just completed resurfacing over one mile of main trunk roadway with a dressing of chippings and bitumen containing rubber.

This is the first full-scale work carried out with a rubberised bituminous material as a binder for spray-coat work anywhere in the world. The Leeds City Highways Engineer last year arranged to lay a small test section employing this material on the Selby Road in Leeds. The behaviour of this test section, compared with adjacent control area, has been so satisfactory that the Leeds highway authority felt justified in undertaking this present work.

The material used was a 60–70 penetration bitumen to which approximately 2 per cent of rubber powder had been added. This had been treated with a constant agitation for approximately three hours at a temperature of 300 deg. F., after which a light creosote oil was added as a flux. The spraying bitumen was delivered to the site in insulated road tanks at a viscosity of 300–323 secs., standard tar viscometer, and was applied at a temperature of 280–300 deg. F. The handling and application of the rubber-bitumen to the site was exactly the same as would have been occasioned by the use of normal bitumen.

The work was carried out with a rotary brush sprayer at a cover of 5–6 sq. yd. to the gallon, used in conjunction with a gritting machine using ⅜ in. whinstone chippings at approximately 70–80 sq. yd. per ton. The consolidation of the surface was by means of 10/12-ton rollers.

(Extracted from 'Highways and Bridges' —Aug. 15, 1951).

(iii) QUICK WAY TO FIND SCALE FOR PLANIMETER

IN measuring areas with a planimeter, the scale can easily be determined by laying out a one-inch square on the drawing. Without any adjustments to the planimeter, roll the square inch and read the planimeter dial. Dividing this reading into the actual area represented by the square inch gives a constant, which represents the area scale as measured by the planimeter.

For example, consider an earthwork cross section with a vertical scale of 1 in. =5 ft and a horizontal scale of 1 in. = 25ft. Suppose rolling a planimeter around a 1-in. square section produces a dial reading of 100. Then, since the 1-in. square represents 5 x 25 = 125 sq. ft the scale constant is 125/100 = 1.25.

If, after this, in measuring around the cross section, the dial on the planimeter reads, say 8,000, the area of the section is 8,000 x 1.25, or 10,000 sq. ft.

(Extracted from 'Engineering News-Record' - Oct. 11, '51).

UPLIFT?

We understand that manufacturers of a certain feminine garment are currently making only three kinds: the Russian type, the Salvation Army type, and the American type. The function of the Russian type is to uplift the masses; the function of the Salvation Army type is to raise the fallen; the function of the American type is to make mountains out of molehills.

ADVICE

My Son, if sinners entice thee, consent thou not..... *(Solomon).*

ASSAM P. W. D. BUDGET FOR 1951—52

REVENUE receipts anticipated for the year 1951–52 amount to Rs 962.40 lakhs and revenue expenditure Rs 10,60.24 lakhs, which indicate a deficit of Rs 97.84 lakhs. From 1949–50 onwards revenue receipts appear to be on the decline while expenditure does not show any fall.

Receipts on account of Civil Works are detailed below :—

Civil Works (Receipts).

	(In Lakhs of Rs)		
	Budget Estimates 1951–52	Revised Estimates 1950–51	Actuals 1949–50
Rents	1.65	1.59	1.87
Ferry Receipts	2.76	2.78	3.00
Tolls on Roads	0.50	0.50	0.03
Recoveries of expenditure	0.25	0.25	0.68
Transfers from Central Road Development Account.	10.87	10.50	7.15
Transfers from Post-War Reconstruction Fund	0.87	5.00	5.32
Contribution for improvement of village roads	0.02	0.02	0.01
Contribution from the Centre towards the construction of Shillong - Silchar Tripura Road	—	86.00	—
Receipts on account of Food bonus	12.00	—	—
Miscellaneous Receipts	0.89	0.93	1.92
Deductions and Refunds	-12.10	-0.16	-0.16
Total	17.71	107.41	19.82

The revised estimates of receipts for 1950–51 shows an abnormal increase but this is accounted for by the Central Contribution of Rs 86 lakhs for the construction of the Shillong Silchar Tripura Road.

Expenditure on account of Civil Works is as follows :—

Civil Works (Expenditure Rs in Lakhs)

Original Works	106.10	83.43	156.73
Repairs	77.42	57.36	60.04
Grants-in-Aid for Communications	8.17	12.83	4.13
Establishment-Charges, Tools and Plant	32.03	21.05	27.01
Stocks and Suspense A/cs.	3.28	-2.51	11.07
Total	227.07	172.16	258.98

Expenditure on Communications is separately shown below :—

(Communications - Expenditure)

	(In lakhs of Rs)		
	Budget Estimates 1951–52	Revised Estimates 1950–51	Actuals 1949–50
Original Works	56.54	42.65	116.02
Repairs	68.03	49.76	52.12

In 1949–50, expenditure under Original Works, on "ordinary roads" as well as st-war Development Schemes was unusually high. The budgeted expenditure for 51–52 is less than half the actual expenditure in 1949–50 while the provision for lepairs' is fairly higher than the corresponding figures for the two earlier years.

The position in regard to receipts under Motor Vehicles Acts as anticipated in budget may be now compared to the receipts (revised estimates) in 1950–51 and tuals) in 1949–50.

Receipts under the Motor Vehicles Acts

	(In lakhs of Rs)		
Receipts under the Indian Motor Vehicles Acts	5.00	5.00	2.95
Receipts under the Assam Provincial Motor Vehicles Taxation Act.	19.00	18.00	12.20
Fees and other receipts	1.75	1.75	2.77
Deduct refunds	-.04	-.06	-.07
Total	25.71	24.69	17.85

DEVICE TO CHECK RASH DRIVING

Motorists exceeding the speed limit in Berlin will be revealed to the police by a coloured light flashing from the car roof if a new invention is made compulsory, says the Berlin correspondent of the "Daily Express."

Connected to the speedometer, the roof light switches itself on whe[n] the car exceeds the speed limit—in Berlin 25 miles per hour. In d[e]trolled areas where the speed limit is higher a different colour l[ight] comes on at 50 miles per hour.

BOOK REVIEW

"**Quality Concrete**" published by the Concrete Association of India, 1, Queen's Road, Bombay, 218 pages, 172 illustrations and diagrams, 42 tables, size 9¾ x 7½, Price Rs 7/8/-.

THE Concrete Association of India are to be congratulated on the production of a well-conceived, profusely illustrated, comprehensively written, and exceedingly well got-up treatise on concrete.

The book deals with the properties of the materials used in concreting, their tests, and the methods of storing and handling them on the job.

The manufacture and chemistry of cement are only briefly touched upon but the various types of special cements, (such as 'rapid hardening' 'low-heat' 'air-entraining' and many others) and the conditions under which they are used, are described in detail. Results of research such as that on the expansive reaction between cement and aggregates are given. Under "aggregates" besides recounting what constitutes soundness, strength, resistance to abrasion etc., the book goes into detaisl about their geological characteristics and there is a most useful chapter on the classification of rocks for aggregates.

A complete chapter is devoted to the proper designing of concrete mixes. All steps in the making of concrete, from mixing and transporting to placing in the forms, compacting and curing are dealt with lucidly and fully. Modern machinery such as crushers, pavers, truck mixers, batching plants, buckets, hoists, chutes, belt conveyors, concrete pumps, and tremies (for placing concrete under water) which are coming more and more into use are described and illustrated with photographs.

The book is a valuable contribution to the production of quality concrete and should be a useful guide to engineers, students and contractors.

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THE ENGINEER'S PRIVILEGE

"The engineer has the fascination of watching a figment of his imagination emerge with the aid of science to a plan on paper. Then it moves to realization in cement, metal or energy. Then it brings new jobs and homes to men. Then it adds to the security and comfort of these homes. That is the engineer's high privilege among professions."—
Herbert Hoover.
(From 'Engineering News-Record'—Nov. 29, 1951).

List of Approved Development Schemes

S. No.	Job No.	Name of work	Amount Rs	Remarks
		MADRAS		
1.	523 MD 49	Widening six narrow culverts, and two minor bridges in the stretch of Madura-Dhanushkodi Road in Ramanathapuram Division (N. H. No. 49)	32,000/-	
2.	526 MD 5	Forming a road from Kaikram to Chebrolu along the right bank of Eluru Canal.	73,350/-	
		BOMBAY		
3.	529 BM 8	Earth work for road embankment on Kathor-Pardi and Kim-Khrod sections of Bombay-Ahmedabad National Highway No. 8 as a famine relief measure.	50,000/-	
4.	530 BM 8	Carrying out model experiments in connection with protection works to safeguard the south approach bank of the bridge over the Narmada river at Broach on National Highway No. 8.	10,960/-	
		HIMACHAL PRADESH		
5.	528 HP 22.	Construction of Arch Bridge over Panwi Khad, mile 114/7 on the Hindustan-Tibet Road.	68,941/-	
		HYDERABAD		
6.	527 HD 7 & 9	Development of National Highways in Hyderabad State (Dust proofing and widening of National Highways).	24,00,000/-	
		ASSAM		
7.	524 AS 37.	Surfacing miles 226 to 244 of the Assam Trunk Road—National Highway No. 37 in Lakhimpur Division.	9,49,000/-	
8.	525 AS 37.	Surfacing miles 245 to 256 of the Assam Trunk Road (National Highway No. 37) in Lakhimpur Division	5,99,000/-	

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

His Majesty's Stationery Office, London.

1. Pavement Design for Airfields-Road Research Technical Paper No. 20
2. Sources of Road Aggregates in Great Britain.
3. New Streets Act, 1951.
4. Public Utilities Works Act, 1950.
5. A bibliographical Survey of the development and use of substitute Materials for Non-Ferrous Metal and Alloy Steels in Germany-Report No. RMS—2.
6. Bituminous Roads in North America-Research & Construction Road Research Technical Report No. 22.
7. Painting New Plaster and Cement-National Building Studies Bulletin No. 2.
8. Concrete and Bricklaying in Cold Weather. Bulletin No. 3.
9. Sand-lime and Concrete Bricks Bulletin No. 4.
10. The laying of Linoleum on Concrete Floors. Bulletin No. 5.
11. Gypsum and Anhydrite Plasters-Bulletin No. 6.
12. Mortar for Brick-work Block Construction and Masonry-Bulletin No. 8.
13. Floor Finishes for houses & other non-industrial buildings-Bulletin No. 11.
14. Sand-lime Bricks-Special Report No. 3.
15. New Methods of House construction Second Report - Special Report No. 10.
16. New Methods of House Construction Special Report No. 4.
17. Investigation on Granulated Blast furnance for the manufacture of Portland Blast furnace cement-Technical Paper No. 3.
18. Sands for Plasters, Mortars and Renderings—Leaflet No. 15.
19. The Thermal Expansion of Concrete—Technical Paper No. 7.

Division of Building Statistics and Structural Engineering, Royal Institute of Technology, Stockholm.

20. Concrete Beams with Compression Reinforcement—Bulletin No. 4, 1950.
21. Concrete Slabs Reinforced in Two Directions—Bulletin No. 5, 1950.
22. Calculation of Deformations in Reinforced Concrete Structures after formation of Cracks—Bulletin No. 6, 1950.
23. Transfer of Moments and Deformations in Concrete Beams Submitted to Long-Time Loads—Bulletin No. 7, 1950.

American Society of Testing Materials, 1916, Race St., Philadelphia 3, Pa.

24. Symposium on Load Tests of Bearing Capacity of Soils-Special Technical publication No 79—5th annual meeting of A. S. T. M., June 16-20, 1947.
25. Symposium on the identification and classification of soils—Presented at the 43rd Annual Meeting of A. S. T. M., Atlantic City, N. J., June 29, 1950-Special Technical publication No. 113.
26. 1950-Supplement Book of A. S. T. M. Standards including Tentatives } Part I-Ferrous Metal.
27. — Part II-Non-Ferrous Metal.

28. 1950-Supplement Book of A. S. T. M. Standards including Tentatives } Part III-Cement Concrete, Ceramics, Thermal Insulation, Road Materials, Water proofing, Soils
29. 1950-Supplement Book of A. S. T. M. including Tentatives - Part 4-Paint, Naval Stores, Wood, Adhesives, Paper, Shipping Containers.
30. 1950-Supplement Book of A. S. T. M. including Tentatives - Part 5-Textiles, Soap, Aromatic, Hydrocarbons, Antifreezers, Water.
31. 1950-Supplement Book of A. S. T. M. including Tentatives - Part 6 - Electrical Insulation, Plastics, Rubber.
32. Highway Capacity Manual—Practical Applications of Research by the Committee on Highway Capacity Deptt. of Traffic and Operations Highway Research Board. (U. S. Government Printing Office, Washington, 1950).

Director of Publicity, Government of Bombay.

33. Bombay marches on—Peace, Justice and Security.
34. Bombay marches on-Forests, Parks and Gardens.

Highway Research Board, Washington 25, D. C.

35. Highway Research Board Proceeding of the 29th Annual Meeting held at Washington D. C., December 13-16, 1949-Vol. 29. 1949.
36. Controlled Access Expressways in Urban - A symposium - Highway Research Board Bulletin No. 25.
37. Stress Distribution in a Homogeneous Soil - Highway Research Board Report No. 12-F.
38. Bibliography on Durability of Concrete Physical Reactions—Bibliography No. 8.

Manager of Publications, Delhi. (Issued by Ministry of Railways, Railway Board).

39. Steel Bridge Code—Indian Railway Standard Code of Practice for the Design of Steel or wrought Iron Bridges carrying Rail Road or Pedestrian Traffic. 3 copies.
40. Indian Railway Standard Code of Practice for Design of Steel Structures other than Bridges (Steel Structure Code)-Revised 1948. 3 copies.
41. Indian Railway Standard Code of Practice for the Design of Bridge Pier and Abutment (Pier and Abutment Code) 3 copies.
42. Indian Railway Standard Code of Practice for the Construction of Reinforced concrete structures for the storage of Liquid—Liquid Retaining R. C. Structure Code. 3 copies.
43. Indian Railway Standard Code of Practice for the Design and Construction of Masonry and Plain Arch Buildings (Arch Brdige Code) 3 copies.
44. Indian Railway Standard Code of Practice for Reinforced Concrete Construction (Reinforced Concrete Code) 3 copies.
45. Indian Railway Standard Code of Practice for Electric Arc Welding of Mild Steel Structures (Welding Code) 3 copies.
46. Indian Railway Standard Code of Practice for Plain concrete construction (Plain concrete code) 3 copies.
47. Bridge Rules—Rules Specifying the Loads for Designing the Super and Sub-Structures of Bridges and Assessing the Strength of Existing Bridges.

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

48. B. S. 63 : 1951 - Single Sized Road Stone Chippings.
49. B. S. 812 : 1951 - Sampling and Testing of Mineral Aggregates Sands and Filers. 2 copies.
50. B. S. 1249: 1951—Cast iron Columns for Street Lighting.

51. **B. S. 1722 : Fencing : Part 1 : 1951– Chain Link Fences.**

52. **B. S. 1722: Fencing : Part II-1951 : Woven Wire Fences.**

53. **B. S. 1722: Fencing : Part III-1951: Strained Wire Fences.**

54. **B. S 1722 : Fencing : Part IV: 1951: Cleft Chestnut pale Fences.**

55. **The Romance of American Transportation** by Franklin M. Ruck (Thomas Crowell Company, New York).

56. **Tar in Road Making and Mending—An article in "The Times Review of Industry"–April 1951** (The Times Office, Printing House Square, London. E. C. 4)

57. **Principles of Quantity Surveying** by Reginald D. Wood. (The Estate Gazette Ltd., 47, Meseum Street, London, W. C. 1.)

58. **Manual of Highway Construction Practices and Method** (American Association of State Highway Official, 1220, National Press Building, Washington 4, D. C.)

59. **Elementary Theory of Structures** by J. C. Grassie. (Longmans Green and Co, Ltd., 6 & 7, Clifford Street, W. 1)

60. **Bamboo reinforcement in Portland Cement Concrete Bulletin No. 4, May 1950** by H. E. Glenn. (Engineering Experiment Station, South Carolina).

The Institution of Civil Engineers, Great George Street, Westminster, London, S. W. 1, 1951.

61. **Prestressed Concrete applied to the construction of Railway Bridges and other Works—Session 1950-51** by **Arthur Dean.**

62. **Discussion on the Relative Merits of Methods Sinking Foundations—Session 1950-51.**

63. **Engineering Factors influencing the Adoption of Rigid and Flexible Pavements** by Bernard Howard Knight—Session 1950-51.

64. **Discussion on the Pile driving in difficult conditions—Session 1950-51.**

65. **Recent Researches in Reinforced Concrete and its application to Design** by Prof. A. L. Baker.

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68. **Economics of the Maintenance Highway Bridges.**

(a) **Steel Bridges by** D. J. Davis.

(b) **Concrete and Masonry Bridges** by R. E. O. Malley.

69. **Transport Industry** by H. R. Caulfield (Sir Isaac Pitman and Sons Ltd., Pitman House, Parker Street, Kingsway, London, W. C. 2.)

70. **Transport Costs in Distribution** by A. Prentice. (A. Prentice at Cathbert's Co-operation Association Ltd., Transport Deptt., Gardens Crescent, Edinburgh).

71. **Photo-elasticity Principles and Methods** by H. T. Jessop and F. C. Harris. (Cleaver-Hume Press Ltd., 42-A, South Audley Street, London W.1.)

72. **Earthquake Resistance Design Building Structures and Tank Towers,** by H. M. Engle and John E. Shield. (Pacific Fire Rating Bureau, 465, California Street, San Francisco, California.)

73. **Lessons in Structural Safety Learned from the 1949 Northwest Earthquake by** Harlan H Edwards.

Chapman and Hall Ltd., 37 Essex Street, London. W. C. 2.

74. **Traffic Control and Road Accident Prevention by** Capt. Athelstan Popkees.

75. **Report Writing** by Carl G. Gaum Harold F. Graves and Lyne S. S. Haffman, 2nd edition.

76. **Welding Design & Process** by B. R. Hilton.

The Board of Economic Inquiry, East Punjab, Ludhiana.

77. **Economic Conditions of Displaced Persons settled in East Punjab Part I (Towns) –Publication No. 3** by V. P. Malhotra.

78. **Social and Economic Survey of Refugee Camps in East Punjab by** Om Prakash.

79. **Family Budgets 1948-49 of Eighteen Cultivators in the Punjab** by Arjan Singh and others.

80 **A Statistical Analysis of the Economic Conditions of Peasant in the Punjab,** by Om Prakash.

Gokhale Institute of Politics and Economics. Poona.

81. **The Social Process–R. R. Kale Memorial Lecture No. 1938,** by G. S. Ghurya.

82. **A Socio-Economic Survey of Weaving in Sholapur–Gokhale Institute publication No. 14,** by R. G. Karade.

83. **A Socio–Economic Survey,** by D. R. Gadgil, pnblication No. 12.

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84. **The Design of Prismatic Structures** by A. J. Ashdown.

85. **Construction with Moving Forms** by L. E. Hunter. 2 copies.

86. **A study of the Growth of Grass in "Surface Stabilized" Soil** by Martin A. Sutton. (Sutton and Sons Ltd., Reading, London)

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87. **A Simple Method of Measuring the Moisture Content of Coarse and Fine Aggregates—Research Note No. Rp. 1 (5/50).** by J. D. McIntosh.

88. **Principles Underlying the Steam Curing at Atmospheric Pressure** by A. G. A. Saul.

89. **Handbook of Welded Structural Work-October 1949** (4th edition) (The Institute of Welding, 2 Buckingham Palace Gardens, Buckingham Palace Road, London, S. W. 1.)

90. **Building Materials–Science and Practice** by Cecil C. Handisyde. (The Architectural Press, London).

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94. **Highway Engineering by L. J. Ritter and R. J. Poquette.** (The Ronald Press Company, New York).

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97. **Proceedings of the Twelfh Annual Highway Engineering Conference-Bulletin No. 41 No. 1-April 1951.** (University of Utah, School of Engineering Salt Lake City, Utah.)

98. **Cybernatic or Control and Communication in the Animal and the Machine** by Norbert Wiener. (John Wiley and Sons, Inc., New York)

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100. **The Revised Famine code, Ajmer-Merwara, 1918.** (Job Printing Press, Ajmer, 1939).

101. Survey Concerning the Control and Supervision of the erection or placing of advertisement in ancient towns and rural areas in various countries (The International Union of Local Authorities, Hague, May 1950).

102. The Population of India and Pakistan by Kingsley (Princeton University Press, Princeton, New Jersey, 1951.)

103. Vertical Curves for Roads—A textbook for Highway Engineering and Students by F. G. Royal Dawson. (F & F. N. Spon Ltd., 57 Haymarket, London, S. W. 1).

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