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Transport Communications

Monthly Review

No. 74

June 1953



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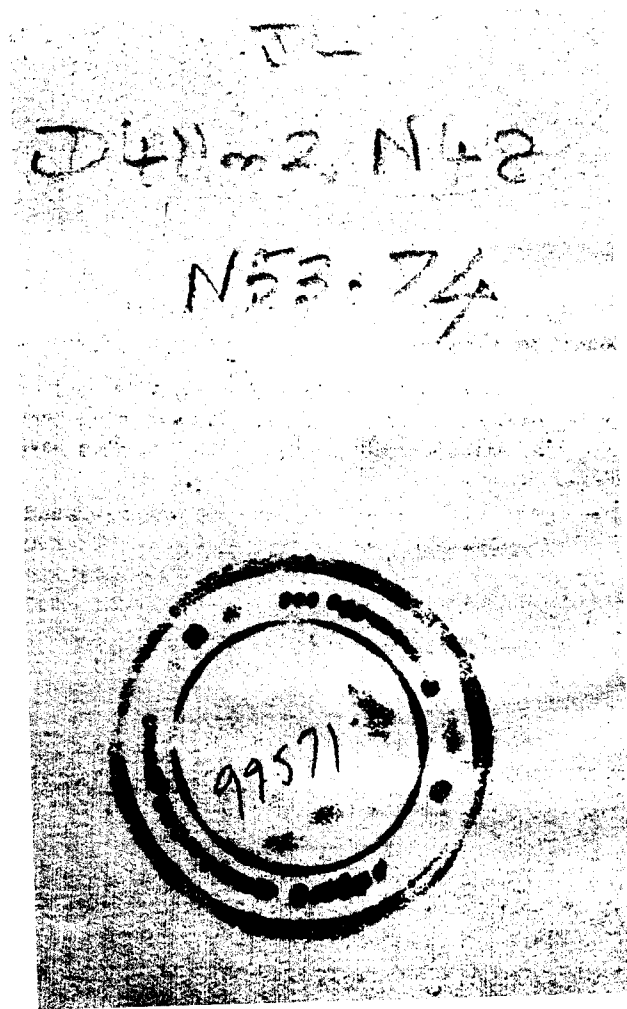


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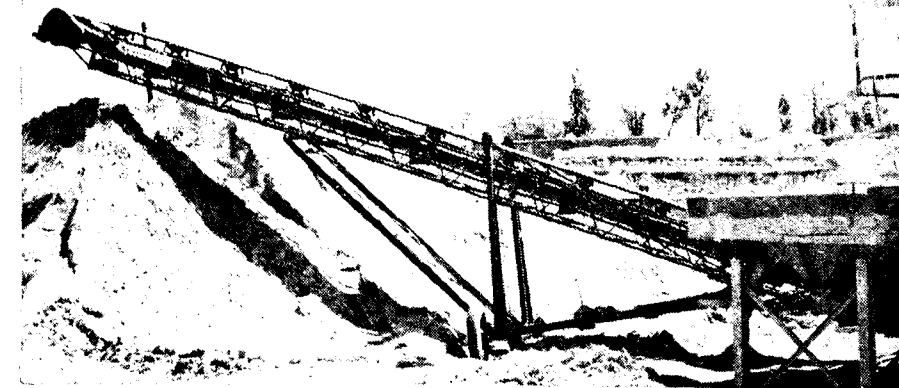
In this issue		Page
1. State Highway Organizations in the United States of America	...	1
2. Aluminium Alloy Bus Bodies	...	3
3. Report of the Roothing Investigation Committee, New Zealand, 1953	...	6
4. Organisation of Plant Maintenance and Repair in Australia	...	8
5. Liaison Arrangements between the Centre and the States in the U.S.A. in Road Matters	...	10
6. Mr. McKelvie Retires	...	17
7. HERE AND THERE—		
(i) Education and Engineering Art	...	14
(ii) Push Roads, Not Rails for South Africa Transport	...	14
(iii) Experimental Results on Road Safety	...	15
(iv) Road Engineering and Accidents	...	16
(v) Circumference of an Ellipse	...	16
(vi) Mobile Advertising Van Illegal	...	20
(vii) Story of a Society Manual	...	20
(viii) Concrete Curing Test	...	21
8. TECHNICAL INFORMATION—		
An Interesting Method of Repairing a Cast-Iron Bridge Girder	...	22
9. CORRESPONDENCE—		
Simplified Graphical Method Works Blending Aggregates	...	24
10. BUDGETS AND ADMINISTRATION REPORTS—		
Government of Mysore Civil Works Budget 1953-54	...	25
11. ABSTRACTS	...	26
12. Book Review	...	27
13. List of Approved Works on National Highways	...	29
14. List of Books added to the Roads Organisation Library during April 1953	...	31
Also:—Lessons of War and Peace are the same—"Cop" Courtesy—Lawyers and Accidents—Statistics and Swim Suits—Eisenhower on Roads—Definitions of Highway Engineering Terms.		

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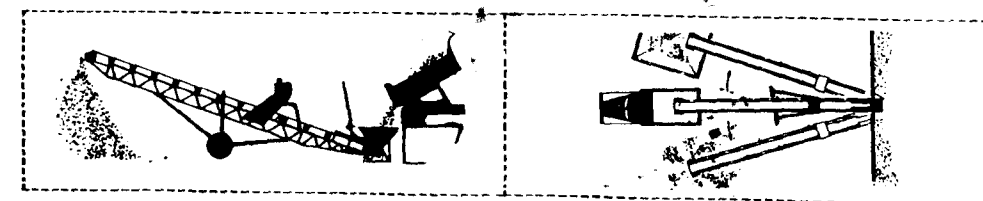
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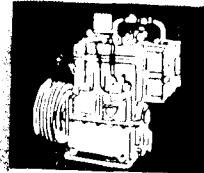
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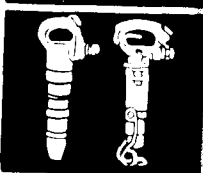
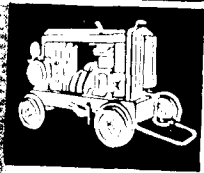
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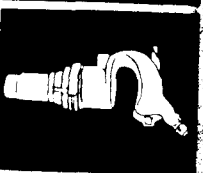
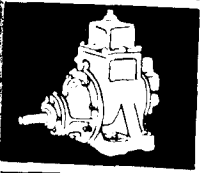
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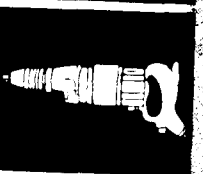
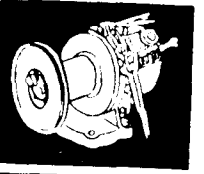
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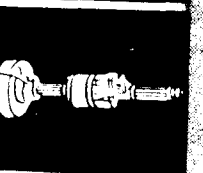
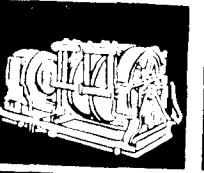
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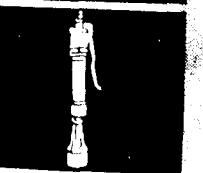
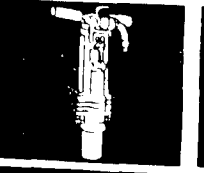
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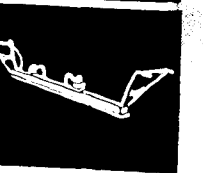
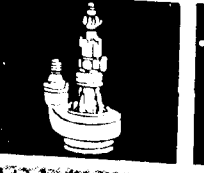
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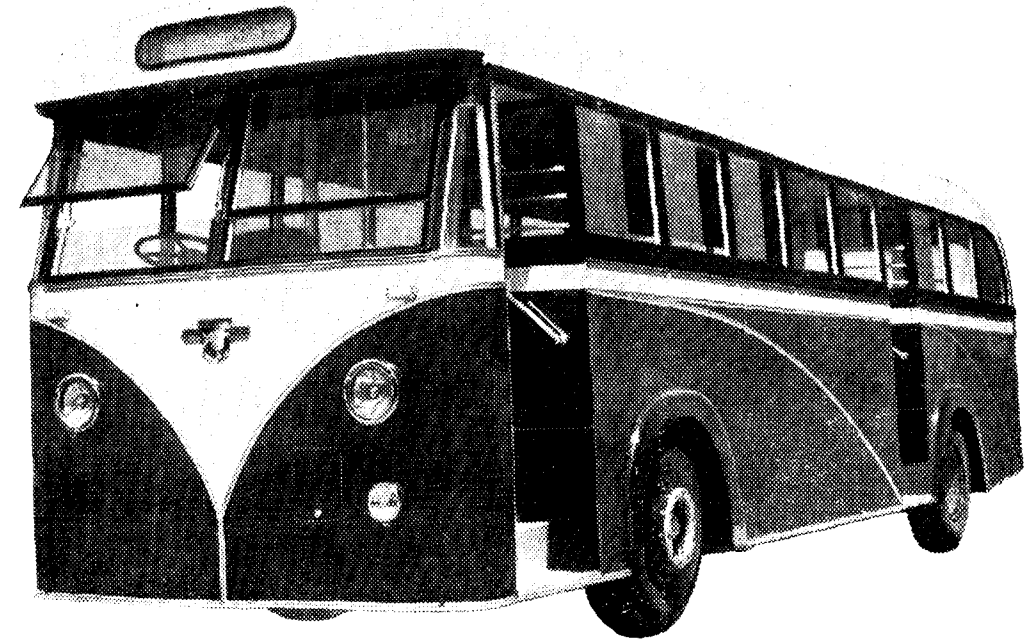
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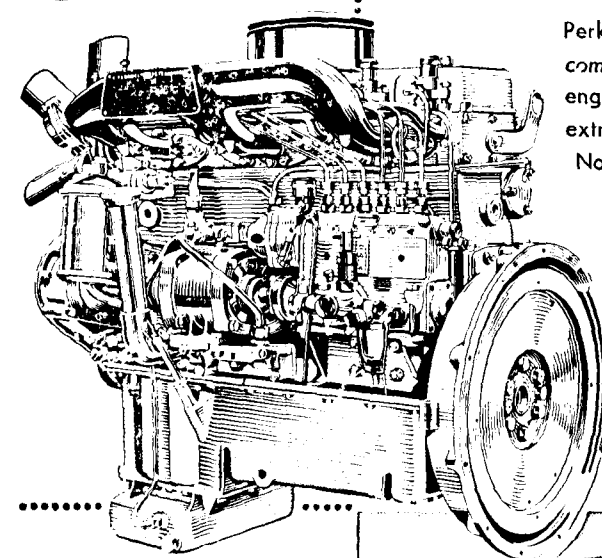
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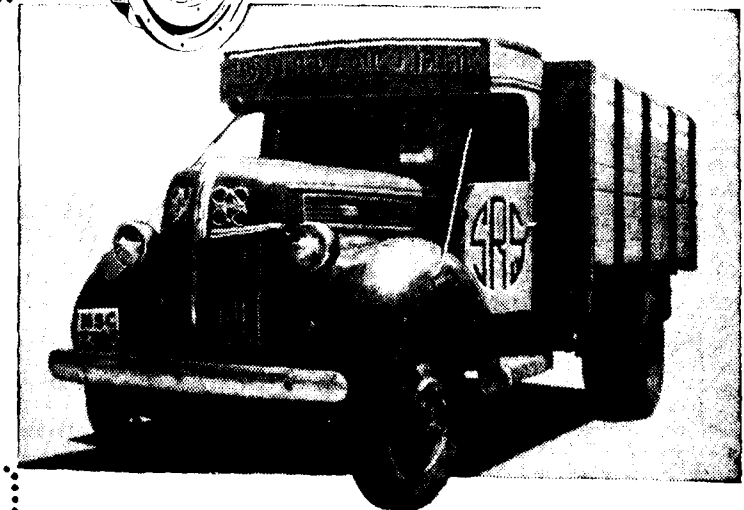


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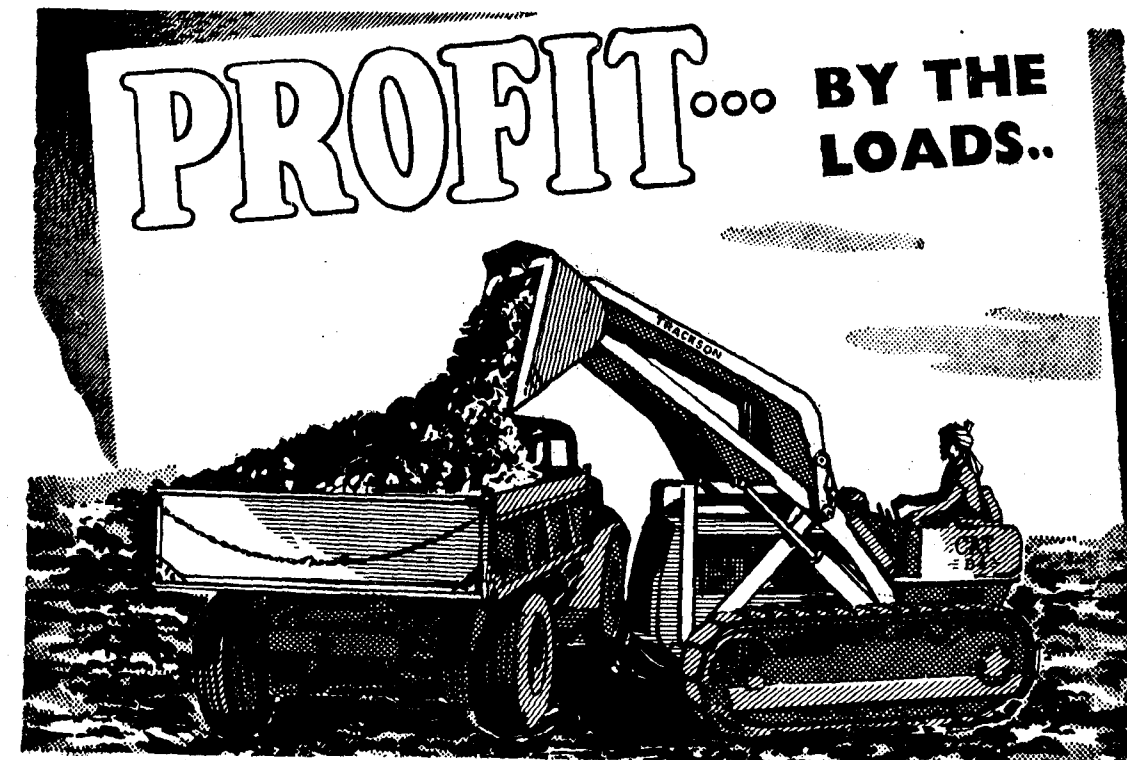
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STATE HIGHWAY ORGANIZATIONS IN THE UNITED STATES OF AMERICA

INTENSIVE study to find the best set-up for state highway administrations has been going on for some years in the U.S.A. The following quotations have been taken from an article on the subject appearing in the September 1952 issue of the magazine "Better Roads".

TRENDS

"If any general trend is apparent in the report, it is perhaps the tendency to take responsibility for administrative matters out of the hands of part-time boards. Creation of highway boards or commissions having purely advisory functions has been recommended in a number of States.

"In a large sense the trend is in the direction of insuring public responsibility and public responsiveness through elected officials. Recommendations are divergent relating to the alternatives of grouping highways and other public-works functions in a public-works department or isolating highway matters in a department concerned solely with highway development.

INDIVIDUAL RECOMMENDATIONS

"A report of a California legislative committee on governmental reorganization suggests limitations on the role of the part-time board in this way: "Boards and commissions composed of part-time appointees should be relieved of responsibility for administrative matters. Such matters as development of a departmental budget, designation of highway routes, release or exchange of rights-of-way, or purchase or condemnation of property constitute administrative matters for which the head of a department is responsible normally. A part-time board may be used to advise the department head and to determine, through rule-making, the broad outlines of policy.

"A commission on state government in Connecticut recommended that each state department, including the highway department, be headed by a single commissioner appointed by the governor. The study commission also recommended that there be established for each department a five-member citizens' advisory council, the members to serve 5-year overlapping terms."

"Fundamentally," the Arizona committee points out, "the management of an administrative department by a commission is much less desirable and less effective than by a single administrative head." The proposed reorganization is intended to eliminate some major existing defects and "provide for a clear chain of command." The present plan of administering highway affairs through two administrative officers—an executive secretary and a state highway engineer—is characterized as "unsound."

"Mississippi has a state highway commission of three members, elected to represent districts for 4-year terms. Under a proposal of a legislative fact-finding committee for reorganization of the state government, the elected commission would be retained; it would be charged "only with policy-making functions, and should have no line or operating responsibilities." A director, appointed by the commission for a 6-year term, would have full responsibility for management of the highway department."

"Iowa has a five-member state highway commission. Administrative work has for years been the responsibility of the chief engineer, who retired on September 1 of this year after 33 years of service in that capacity. A governmental reorganization commission recommended in 1950 that on retirement of the chief engineer there be appointed by the governor a superintendent of public roads, who would have full

charge of all executive matters pertaining to state highways."

CONCLUSIONS

"A few conclusions and observations are offered:

(1) There is majority support in the recommendations for the "clear chain of command" through a single executive at the head of the state highway department. This implies that good administration is finally a responsibility of the citizens, to be exercised in their choice of the head of the state government. The single-executive plan also fixes accountability; responsibility for poor highway management is not divided or diffused.

(2) There is very general support for the use of part-time advisory or policy-forming boards. Such boards introduce another channel for citizen participation. Advice "from a committee of broadly representative and public-spirited citizens," the Connecticut commission declared, "can be accommodated to the compelling need, in the interest of responsibility and good management, for single-headed

departments. We think the opportunity to study at first hand and influence through his advice the policies of a department in which he is interested is an honourable challenge and a satisfying reward for a citizen who may be called upon to volunteer in that capacity."

(3) Most of the reports favour the appointment of board or commission members at large, and not from geographical districts. This places emphasis on the welfare of the state as a whole.

(4) Opinion is mixed on whether highway and other public-works functions should be united in a single department or divorced, and on whether the highway department should have responsibility for the highway patrol, motor-vehicle registration and related matters. In a few states it is proposed that the highway department manage all state automotive equipment.

(5) In several states it is proposed that a division of business administration be organized within the highway or public-works department."

THE LESSONS OF WAR AND PEACE ARE THE SAME

In peace

"I have come to the conclusion that one thing to which we must give topmost priority is roads—roads of all kinds, not only very up-to-date bitumenized or cement roads, but roads of any kind, to open out vast areas of this country which are closed up today and which you cannot reach unless you walk or ride I give roads first priority."

Jawaharlal Nehru

"Among the social services, I put communications first since I do not see how it is possible to effect any great improvement in health and education in the villages of India unless they can be reached surely and quickly at all times."

In War

"The more experience I have had of both peace and war, the more I appreciate its general truth—after some years in high military command. I am inclined to put forward as a parallel dictum that 'War is Transportation.' Certainly it is the ruling factor in military operations; and no campaign has better illustrated this than that on the North-East frontier of India and in the north of Burma."

Lord Wavell

Lord Wavell.

ALUMINIUM ALLOY BUS BODIES

(CONTRIBUTED)

[Different types of bus body construction such as, all steel construction, composite steel and timber, etc., are being adopted in India. This article describes one method using aluminium alloy and enumerates the advantages claimed for such a construction.—Ed.]

THE use of aluminium alloys for construction of bus bodies results in considerable saving in weight. When built from extruded sections and sheets of aluminium alloy, the bus bodies are very sturdy, due to the durable nature of the alloys used, and have a long life. This is specially true in tropical and moist climates or where roads are below standard. Economies in running and maintenance costs more than justify a slightly higher initial cost of an aluminium alloy bus body.

Over two hundred bodies built during the last five years almost entirely with aluminium alloy sections and sheets are being used in Africa, the Middle East and India and are running on comparatively inferior roads. All the bodies after considerable mileage are reported to be in very good condition.

Lack of previous experience in building aluminium alloy bodies is not a bar to undertaking this type of construction. This is explained by the self-jigging feature of the sections used, which are specially extruded to suitable sizes and shapes. Little is required in the nature of equipment that is not already available in any body building workshops. Methods of handling and jointing of aluminium, although different from other materials, are easier.

The Advantages of Aluminium Bodies are:

1. Durability.
2. Saving in unladen weight.
3. Reduced fuel consumption.
4. Longer tyre life.

5. Reduced maintenance cost.
6. Ultimate scrap value.

DURABILITY. The modern tendency to use diesel engine chassis of sturdy designs has necessitated provision of a body which will have a life of approximately the same length as that of the chassis. Aluminium alloy bodies can be designed with this end in view. Tests made on bodies of some designs by the Motor Industries Research Association on their research track in the U. K. have given very satisfactory results. The bodies being used in the Middle East and Africa have been standing up to very hard usage and, although operation mileages in some cases have reached over 200,000, no structural failures have been reported. A similar body operating in South India on relatively bad roads has been reported to be in first class order after running 30,000 miles.

A hundred bodies on Fiat chassis, built almost entirely of aluminium alloys have been in use over rough roads in Bombay State for several years and reports on their durability are highly satisfactory.

SAVING IN UNLADEN WEIGHT. Typical examples of weight saving with aluminium bodies are: (1) a saving of about 22 cwt. in the unladen weight of a 33-seater body on a 190 in. wheel base Leyland-Comet chassis; and (2) a slightly greater saving on a 35-seater 210 in. wheel base Bristol chassis.

This saving in unladen weight results in reduced operating cost as compared with heavier timber and/or steel bodies and makes it possible to carry a larger

pay load with resulting improvement in operating profits.

A transport organization in the U. K. estimates that, on the basis of cost that was ruling in 1950, an additional capital cost of about £20 (Rs 270) can be justified for every cwt. saved in the unladen weight of the body. This is equivalent to about Rs 2-8-0 per lb of tare weight saved. From operating experience in India, it is estimated that each additional passenger that can be carried as a result of reduced body weight means an additional profit of Rs 1,000 per annum and that for every cwt. by which the weight of the body can be reduced, an additional cost of Rs 300 for the body can be justified.

Reduction in weight also means quicker acceleration and braking, enabling public transport vehicles to operate on schedule.

REDUCED FUEL CONSUMPTION. Ordinarily, with an aluminium body a 10 per cent increase in mileage per gallon can be expected. For transport authorities operating large fleets of buses this means a considerable saving in fuel costs.

IMPROVED TYRE LIFE. Improvement in tyre life also results from the lighter body, which again means lower operating cost.

REDUCED MAINTENANCE COST. The aluminium alloys used for making bus bodies have excellent corrosion resisting properties resulting in considerable reduced maintenance cost and longer life. The lower modulus of elasticity of aluminium results in the localisation of damage from impact with the consequent reduction in repair expenditure.

ULTIMATE SCRAP VALUE. The aluminium material has a considerable scrap value, which is of the order of 30 per cent of the original cost of the aluminium material used.

A typical specification for an aluminium alloy body is given below.

FRAMEWORK. The framework is to be built of units assembled from extruded sections of adequate dimensions made of

aluminium alloy to British Standard Specification BS 1476/HE 10-WP. (BA 25 WP)*. The sections after heat treatment should attain a minimum tensile strength of 18 tons per sq. in. Where bending or forming is required, sections in the solution heat-treated condition only are to be used, i.e., BS 1476/HE 10-W (BA 25 W.) Both standard and specially designed shapes may be used to simplify assembly and all are to be made to fit together as necessary. Extra thickness in the sections is to be provided for screw fittings or for local strength in a particular direction depending upon design considerations. Gusset plates are to be made from thick aluminium alloy to BS 1470/NS 4-½ H (BA 21 ½ H).

PANELLING. Both inside and outside panelling is to be made from aluminium alloy sheet to BS 1470/NS4-½ H (BA 21 ½ H) with a minimum ultimate tensile strength of 15 tons per sq. in. The thickness of panelling sheet recommended is .048 in. (18 S.W.G.). All panel joints are covered with a decorative moulding of pure aluminium.

FLOOR UNIT. For floor unit heavy aluminium alloy cross bearers and longitudinal angles (BA 25 WP), assembled by cleats with rivets and bolts as necessary, are to be used. Firm attachment of the floor unit to the chassis is to be effected by short mild steel bolts to mild steel cleats bolted to the chassis in accordance with the chassis makers' approved instructions. Fibre pads are to be inserted between cross bearers and chassis frames to absorb shocks. Access traps are to be provided where specified by the chassis manufacturers for approach to the differential, gear box and universal joints.

The actual floor could be in aluminium alloy treadplate (BA 25 WP Positive Grip Pattern plate) of 1/8 in. or 3/16 in. base thickness, or in extruded sections with provision for non-slip strips.

SIDE UNITS. The side units are to be constructed from U-type or "top hat" flanged channel section and special extruded shapes for the waist and cant rails. Thick sheet metal kickplates in 14 S.W.G. aluminium alloy (BA 21 ½ H) are to be pro-

vided from floor to seat rail and the inside panels from seat rail to waist rail are to be of 18 S.W.G. sheets of the same alloy. The seat rail is to be of "T" section. Access flaps for battery fuel tank and spare wheel are to be provided and a detachable lifeguard fitted below the skirt rail, if required.

The entrance and exit doorway is to be normally arranged at the forward end of the left or near side but central or rear entrance can also be arranged. Crush doors of the jack-knife type could be incorporated if required. The design should include provision for an emergency door. A heavy gauge aluminium stepway suitable for local conditions is to be provided.

Half sliding, half lifting or half drop type of windows can be made using suitable aluminium alloy sections.

ROOF UNIT. The roof is to be constructed from aluminium alloy (BA 25 W) inverted "top hat" section as roof sticks and stringers and channel and "top hat" sections (BA 25 WP) as roof rails. The anchor rail for attachment to the cant rail is to be of special shape. Both the inside and outside panelling is to be of 18 S.W.G. alloy sheet (BA 21 ½ H) and should provide "still air" insulation. Additional insulating material may also be inserted between the inner and outer panelling, if considered desirable.

FRONT AND REAR UNITS. These units are to be built up from "top hat" anchor and channel sections. Provision is to be made for built-in destination indicators and traffic indicators, and in the case of the rear unit, a built-in registration panel in which the rear and stop light may be incorporated. The windscreen may be constructed from special aluminium sections. Both front and rear views are to be catered for by large window spaces. A sliding door for the driver may be included, if preferred to a hinged door.

LUGGAGE GRID. For rural buses a luggage grid of tubular construction is to be included with an access ladder (pivoted to provide the space). In cases where a luggage grid is required, the roof is to be reinforced with 14 gauge alumi-

nium alloy sheet (BA 21 ½ H) with deep square corrugations for extra strength.

FASTENINGS. The recommended fastenings are cadmium plated mild steel aircraft type bolts, self-locking nuts, anchor plates and aluminium alloy rivets. Should the bolts and nuts of the above specification not be easily available and the plating become a problem, black mild steel British Standard bolts with spring and plain washers and ordinary nuts may be used instead after properly cleaning and painting them with zinc chromate base primer paint. "POP" rivets are recommended for panel fastenings.

Alternatively, panels may be fixed by "Sims" locking washer or "Rivnuts" where ease of removal for repair or reconstruction is a major consideration. Unplated brass or copper fastenings should never be used as the galvanic action between aluminium and copper or copper-base alloys in the presence of moisture will corrode the aluminium.

BI-METALLIC CONTACTS. Where aluminium comes in contact with wood, steel or any other metal it is necessary to insulate it by using zinc chromate primer as otherwise corrosion is likely to take place.

FINISH. For finishing, the use of synthetic paint is recommended. All concealed structures should be treated with a suitable primer or aluminium paint. Self-etching primer ensures the best adherence for paints.

WEIGHT OF ALUMINIUM REQUIRED. The weight of aluminium required for a body on the types of chassis used in India is about half a ton of sections and half a ton of sheets. This does not include provision for an aluminium floor for which about 370 lbs of 1/8 in. Positive Grip Pattern plate is required.

COST. The cost (based on 1952 prices) of the aluminium alloys required for the body framework and panel ranges from Rs 6,000/- to Rs 6,500/- per body. Using standard fittings, seats etc., the total cost of an aluminium body properly constructed should not exceed Rs 13,000/- to Rs 14,000/-.

* The specification numbers given in parenthesis refer to British Aluminium Co. alloys.

REPORT OF THE ROADING* INVESTIGATION COMMITTEE, NEW ZEALAND, 1953.

A copy of the above-mentioned Report on Roads and Road Finance, which was submitted to the Government of New Zealand on the 3rd March 1953, was recently received in the Ministry of Transport, Roads Organization. The Committee was asked to report on what standard of "roading" (road upkeep) was required in New Zealand to provide and maintain an efficient road-transport system in the country.

The Committee was also asked to report on motor-vehicle taxation and the allocation of tax proceeds for expenditure on roads and generally on "any matter, financial or otherwise considered relevant to the maintenance and improvement of the roading system".

INDIA AND NEW ZEALAND COMPARED

Motor Vehicles. New Zealand, which is about a tenth of the size of India, has over 480,000 motor vehicles as against India's 300,000.

The capital investment in motor vehicles is estimated at Rs 284 crores: and in roads, more than Rs 81 crores.

Roads. The annual expenditure on roads in New Zealand and India are compared below:

	New Zealand	India
	Rs Crores	
Total expenditure on roads (other than Municipal roads)	22.93	40.17
Expenditure on roads as a percentage of revenue from roads	128.6	63.5

* Roading = Road upkeep.

Milage of Roads. The milage of roads in New Zealand and India is as follows:

Milage	New Zealand	India
Modern Surface	8,432	11,851
Water-bound Macadam	38,781	79,584
Unmetalled	7,755	138,606

Motor Vehicle Taxation. The New Zealand and Indian figures are compared below:—

Tax	New Zealand	India
Year ending 31st March 1952		
	Rs Crores	
Customs Duties	3.923	12.5
Tyre Tax	0.054	6.1
Motor Spirit Duties	11.015	32.7
Vehicle Tax	2.558	9.7
Drivers Licence etc.	0.187	0.6
Miscellaneous	0.100	1.7
Total	17.837	63.3

Restrictions because of competition with the Railways.

Nil in New Zealand.

[The Indian restrictions are contained in the Code of Principles and Practice.]

ROAD FINANCE

The Committee's recommendations are as follows:—

A National Roads Fund shall be created and credited with funds from the following sources:

- (1) Petrol Tax.
- (2) Milage Tax.
- (3) Tyre Tax.
- (4) Heavy traffic tax.

(5) Registration and Annual licence fees.

(6) Such further funds as are voted by Parliament out of general revenues.

"It is recommended that statutory provision be made for the items relating to motor taxation to be paid direct into the National Roads Fund without the necessity for annual appropriation by Parliament."

The representative from the Treasury on the Committee dissented from this recommendation but the Committee said—

"Great importance is attached by roading authorities in other countries to the security of finance for roading purposes. It is claimed by these authorities that roading works cannot be properly planned if finance is dependent upon annual vote by Parliament".

The Committee goes on to discuss this question at length. The arguments of the Treasury representative and those of the Committee are familiar to us in India. The Committee were not impressed by the old ideas on financial orthodoxy voiced by the representative from the Treasury.

The Petrol Tax. The Committee say—

"While the Committee is strongly of the opinion that as a source of general revenue a tax on petrol is a bad tax, when it comes to a levy for roading purposes the same objections do not apply, or perhaps it would be more correct to say are heavily outweighed by those considerations which make it an appropriate source of revenue for roading purposes.

"A tax on transport of this kind, which is not a tax in the strict sense so much as a payment for an essential factor in the efficient operation of the transport service system, although it is added to general transport costs and is passed on to the ultimate user, is a necessary and legitimate charge on transport.

"The provision of good roads is as essential to the efficient operation of road transport as the provision of vehicles themselves, and it is the widespread recognition of this fact, particularly by

vehicle users, that accounts for the general acceptance of a tax on petrol for roading purposes as a fair proposition.

"It is agreed that petrol consumption bears some direct relationship to road usage, and while it is impossible to prove that petrol consumption is a completely accurate yardstick by which to measure road usage, it is the most readily available by which this can be done.

"There is today almost universal recognition of the principle of user payments for road usage, and the petrol tax is accepted as at least a rough and ready gauge by which to measure such usage. Arguments against petrol taxation so far as they persist today are directed almost exclusively against the use of this taxation for other purposes and not against the collection or roading revenue by this means".

ADMINISTRATION

The Committee "strongly" recommend the creation of a National Roads Board. They say—

"The relation of the Central authority to the local roading authorities is not visualized as one of control by the one and subordination by the other, but rather as one of co-operation as partners in a common undertaking."

The Board will administer the National Roads Fund and carry out the other duties envisaged for the Central Road Board for India in the Nagpur Report.

Research. The Committee recommended that £25,000 (Rs 3.37 lakhs) a year should be provided for Research.

RECOMMENDED RECEIPTS AND EXPENDITURE

National Roads Fund Revenue

	Rs Lakhs
1. From the Road User	
(a) Petrol tax	1,135
(b) Registration & Licences	203
(c) Heavy traffic fee	233
(d) Tyre and milage tax	33
2. From the Central Government	333
Total	1,937

(Continued on page 24)

ORGANISATION OF PLANT MAINTENANCE AND REPAIR IN AUSTRALIA.

(Extracted from *Main Roads, June, 1952.*)

IT is axiomatic that plant kept in good condition will operate at maximum efficiency and, to ensure this, it is essential to have adequate provision of plant maintenance and repair facilities and efficient supervision and planning so that such facilities are used to the best advantage.

The Department of Main Roads, New South Wales, Australia has local offices and depots, some permanent and some temporary located throughout the State and from these the various works, both major and minor, of road and bridge maintenance and construction are directly controlled by engineers or foremen. The local offices and depots form the centres of operation of groups of plant from small to large and facilities, varying in degree, are provided for plant maintenance and repair. In addition each plant item is supplied with service charts, operators' instruction books, a kit of tools and lubricants so that operators are able to undertake the lubrication, maintenance and running adjustments.

The equipment provided with each plant item and the facilities at each local office, together with service which may be available from other Government Department or private enterprise in certain areas, enable adequate maintenance and repairs, mainly of minor nature, to be undertaken in the field in close proximity to jobs on which the plant is engaged.

Plant items worked hard and continuously over long periods gradually deteriorate to such an extent that frequent breakdowns and resultant disorganisation in jobs are experienced and they require major overhauls which are beyond the resources of the field organisation to undertake.

Plant items requiring major overhaul are returned to the Department's Central Workshop at Granville, Sydney, where they are completely stripped down and rebuilt. A high standard of repair is aimed at so that each plant item is in near new condition on completion of the repairs and fit to give long service in the field before requiring another major overhaul, thus avoiding frequent costly transport charges from all parts of the State of Central Workshop.

Field Workshops. The types and numbers of field workshops established by Department are as follows:

- | | | |
|-------------------------|-----|----|
| 1. Minor Workshops | ... | 20 |
| 2. Travelling Workshops | ... | 4 |
| 3. Major Workshops | ... | 6 |

The type of workshop to be established in any particular area is determined by:

- (1) The number and types of plant items in operation,
- (2) Period the plant, will operate in the area to complete the job,
- (3) Distance from facilities of private enterprise or other Government Departments which have capacity to undertake repairs,
- (4) Whether plant is located in compact area or dispersed in groups of one or two units over very extensive areas,
- (5) Whether a moderately large group of plant is engaged on a fast moving roadwork necessitating frequent moving of the repair facilities, and

- (6) The number of fitters available for employment and the capacities of those engaged.

In practically all areas where plant is in use a field workshop of some description has been established by the Department. The only exceptions are where one or two plant items are engaged in a remote area on work of comparatively short duration. In these circumstances, new plant or plant which has been recently overhauled is selected for the work so that maintenance by the operator is sufficient to ensure efficient operation to completion of the work.

The conditions in each area have to be carefully considered before the most suitable type of workshop is determined. Even after the most suitable type of workshop has been selected it is still necessary to decide what equipment is to be supplied as it is not practicable to standardise the equipment for each type of workshop, as this must vary with local circumstances except in the case of travelling workshops for which equipment has been standardised. For instance, if a minor workshop is considered suitable for a particular area it will be necessary to provide hand-operated, engine operated or electric motor driven tools, according to the volume of work to be undertaken or the availability of local electric power supply. Again, the supply of some items may be not essential as local facilities already in the area can cater for some repair requirements. The same remarks apply to major workshop.

The majority of field works are provided with a **Minor Workshop** comprising a small building of sufficient size to accom-

modate the equipment and tools supplied and to permit of one or two fitters working on component parts of plant items. The dismantling and assembly of the plant item is undertaken under tarpaulins in the open.

Travelling workshops, each comprising a large steel body fitted on a 4 to 5 ton lorry, are provided when small plant groups are dispersed over a very wide area or when a large number of plant units is engaged on a fast moving road job. The body of the travelling workshop is sufficient to house the equipment and tools stores, and up to two fitters repairing component parts of plant.

Major workshops are provided when a large group of plant items will be in operation for a long period in a particular area and the work is remote from facilities of private enterprise or other Government Department having the capacity to undertake repairs. The building is larger than that for a minor workshop and will accommodate more machine and hand tools and room to house one or two major plant items as well as fitters engaged on repairing component parts.

Equipment for Field Workshops

The machine and hand tools, stores and sundry special equipment will, as explained previously, vary. Stores, comprising expendable materials and spare parts, will be located in the local office stores together with other roadwork stores when fixed minor and major workshops are established. In the case of travelling workshops a small supply of stores is carried with the workshop.

(To be continued)

"COP" COURTESY

The police should not humiliate the driver who is trying to leave his car under a "No Parking" sign by a rude "Notice nai dikhta kha."

Rather they imitate the example of the London bobby who came up and took a kindly interest: "I shouldn't park her if I were you," he said, "Very expensive site this is," he explained genially.

Adapted from 'Automobile Magazine of India'—April 1953

LIAISON ARRANGEMENTS BETWEEN THE CENTRE AND THE STATES IN THE U. S. A. IN ROAD MATTERS

THERE is much closer liaison in road matters in the U.S.A. than has yet been achieved in India between the Central Government and the Governments of the individual States. Although by their constitution the States in the U.S.A. are more independent of the Federal Government than the States in India are of the Union Government, the American States have already achieved the close association with their Central Government that was recommended as an ideal for India in the Nagpur Report.

In India the Roads Organization has posted a few Engineer Liaison Officers to the larger States. More will be posted as they become available. In the following paragraphs an American District Engineer employed by the Central Bureau of Public Roads and posted to one of the Districts (which embraces a group of States) tells us of his duties and the work he does.

Function of a District With Respect to Inspection of Constructions

"The State initiates the project by submission of a project statement, and then undertakes surveys and develops plans, specifications, and estimates. Through the effective co-operation of our branch office located within the State with the State Highway Department the plans are agreed to in detail before they are fully developed.

"An engineer from the branch office and an engineer from the State Highway Department go over the ground together and make a "plans in hand inspection," so that upon formal submission the plans can be quickly reviewed and transmitted to the district office.

Contracts Approved by the Centre

"When found satisfactory by the District Engineer (who consults the

Bureau of Public Roads as necessary), he authorizes the State to advertise for and receive bids, to award the contract, and upon his concurrence therein to start construction.

"Now, what is this contract between the State and the contractor? It is a bill of particulars of what the owner (the State) wants done and for which the owner will pay a stipulated sum of money. The contractor agrees to perform the work at the unit prices stated in the contract and in accordance with the plans and specifications. Under this contract for construction of a Federal-aid project it is the State that issues the notice to the contractor to proceed: it is the State that furnishes the necessary engineering in connection with the project, and it is the State that assumes the responsibility for paying the contractor.

"Since the contract is between the State and the contractor, question arises as to why we are on the job at all. How do we fit into the picture? Because ours is a continuing responsibility provided for in the requirement that each project shall be subject to Federal inspection and approval as a condition to a State's receiving Federal funds.

"Contractors are paid by the State, and the State then submits claims for reimbursement for the Federal pro rata share of the cost of work done. Under our regulations, payments to States are made only upon vouchers approved by the District Engineer. These vouchers may be submitted as often as once a month. An engineer from our branch office therefore visits the job as often as possible, but at least once a month, and records the progress of the work.

"As I have said, we are not a party to the contract for the construction of a Federal-aid project, and therefore we have no direct relationship with the contractor. It is with the State that we have our

agreement. In what is known as a Project Agreement it is mutually agreed that the project shall be constructed in accordance with the plans, specifications, and estimates which have been approved. The amounts of Federal funds applicable and the State funds available are set forth. It is important to keep the contract and the agreement separate in our minds as we proceed with the discussion of inspection of construction.

Inspections

"Perhaps at no other point are present so many intangible factors in the Federal-State relationship as in the inspection of construction. A thorough understanding of the principle of Federal aid and of the State-Federal and State-contractor relationships involved is of utmost importance, for friction and misunderstanding can easily occur. Our agreement is with the State and not the contractor. His contract is with the State, and he is responsible only to the State. The State alone is responsible for payment for work done under the contract.

"Although the engineer making an inspection should and does talk freely with the contractor as well as with the resident engineer, he must never tell the contractor that he may or may not do a particular thing. Nor should he tell the resident engineer that this yard of concrete must come out, that another yard must go in, and that the contractor must be paid for the second yard. That is outside our province. What lies within our province is that the yardage of concrete, when it is presented to us for payment, does meet the terms of the agreement executed between us and the State Highway Department.

"Because Federal funds are obligated for the construction of a project, there is a tendency sometimes to "cut across lots." But it must be firmly borne in mind that Federal funds are paid out only as reimbursement for work done—that our approval is a condition of payment.

"Our approach must be to advise the State Highway Department that this particular element is not being constructed in accordance with the terms of its agreement with us, and therefore will not be eligible for payment. If we are asked

to make suggestions we can then go ahead and our suggestions will be accepted in proper spirit. Advice proffered by representatives of the Federal Government to a State government always treads on the thin ice of "Federal interference" and must be handled with the utmost tact.

"Here, as in the approval of plans, specifications, and estimates, the core of our success is our personnel. The value of Federal inspection depends on the engineer who makes it.

Qualifications of a District Engineer

"Good judgment and a great deal of tact, as well as a sound technical background, are required of an engineer making inspection of construction. Not only must he be able to observe accurately but he must know how to ask questions. He must know his design and his specifications in order to recognise good construction, but he must be able to grasp essentials and to differentiate between what is important and what is not.

"For highway work, as all professional work deals with elements that are not measured by exact standards. If a crown width shown on the plans as 38 feet is built to 37 feet 11 inches, it is substantially correct. If it is a few inches over, we are not going back to have changes made. But anything that affects the integrity of the work must never be overlooked.

"In most cases the engineer who makes the inspection is the one who has followed the project through the development and submission of the plans, specifications, and estimates. He is thus thoroughly familiar with the ground and the individual problems of that particular project. And here I want to emphasise not only this man's responsibility but the importance of his conduct. To the State resident engineer, to the contractor, and to a large part of the public this man is Public Roads. He may be the only contact they have with Public Roads, and therefore his actions, in no small measure, determine the reputation we enjoy.

Contracts

"It is recognised that a contract is a serious matter, and should be made in

good faith and lived up to by all parties in spirit as well as in technicalities. But it is also recognised that no matter how carefully plans, specifications, and estimates are prepared, conditions will change and occasions will arise which make modifications or changes necessary. Such changes may concern materials used, methods of procedure, even design. When such emergencies arise, the thing to do is the thing that will produce the kind of work intended. And if that thing is outside the contract provisions, the contract must be modified by mutual consent.

"The State resident engineer, and to a lesser extent, our own engineer who visits the job must be alert for and recognise these conditions as they approach. Because Federal funds may not be spent retroactively, it is necessary to make provision before the act.

Rigidity of Outlook Harmful

"Naturally considerable latitude has to be given to the interpretation of a contract; but, if we keep the theory in mind, we cannot go too far afield in practice. Many kinds of situations arise. For example, notwithstanding the variance of the bridge foundation, it is sometimes necessary to go beyond the ground surface, to go into the unknown, and occasionally it is necessary to go much deeper than was originally expected or not as deep.

"Under the heading of 'liquidating damages,' most contracts contain the requirement that they be completed within a certain time limit. Provision is made for the State Highway Engineer, or some other specified authority, to extend the time limit under certain conditions, which are set forth in the contract. In general, we accept the State's judgment, provided that judgment is within the terms of the contract.

"But recently the following situation confronted us: One of the States in District 10 has this clause in its specifications, 'The State Highway Engineer shall collect liquidating damages when.....' The State Highway Department has no legal right, then, to do other than collect liquidating damages when certain things occur. In another part of that specifica-

tion there is a broad interpretation that permits the State Highway Engineer to extend the time limit for certain causes. The State Highway Department, however, submitted a request for approval of the extension of time for the reason that 'the State Highway Engineer has elected to waive liquidating damages.' Obviously we could not concur in that, for the State Highway Engineer did not have the right to waive the time limit.

Another more recent situation shows a condition we have to watch. The contract had among its elements a concrete sidewalk 4 in. deep, bid price of 20 cents a square foot. The design had failed to give consideration to a certain driveway and it was determined by the State, and properly so, during the course of construction that the concrete across the driveway should be 6 inches instead of 4 inches. But the State in submitting its voucher for reimbursement submitted it on the basis of claiming 50 per cent additional yardage at 20 cents per foot. Now I think it is quite clear that we cannot approve for payment a quantity that is non-existent. We can, and will of course, agree to an increase in price of 50 per cent for that item with a 50 per cent increase in depth. But it does make a difference whether you add the 50 per cent to the quantity or to the price.

Records of Inspections

"The records of inspections made by our engineers are the Construction Inspection Reports which are submitted at least once a month for every project under construction. Since vouchers are approved for payment on the basis of these construction reports, we must have confidence in them.

"These reports describe the project, give the name of the engineer who made the inspection and the date the inspection was made, together with a certain amount of statistical data showing the progress of the work, whether satisfactory or not, per cent complete, and so forth. These data are relatively easy to furnish.

But under the section 'Comments and Recommendations' the engineer has the opportunity to make more than a routine report. Here is the place for

recording the specific problems of the project, things of an unusual nature, things done in a different manner, things that could well be taken to other jobs, and things that should not be repeated. Thus a vast amount of data can be recorded, provided the engineer who is making the inspection has the ability to observe and the ability to interpret his observations in writing.

"I have here three types of construction reports. The first might be described as a minimum report. The comments are very brief, but we are still able to determine whether the amount of work done can be paid for. In the second we have what might be called an intermediate report. There is only a little more detail but we have the added advantage of pictures from which a great deal of information is available. The third is a really excellent report, concisely written but descriptive. When the voucher comes in we can approve it for payment with confidence, not merely because the amount claimed is within a given percentage, but because the description and pictures indicate that a really first-class job is being done. And at the end of the report is attached a description of something unusual in the way of consolidating fills which the engineer has observed on this particular job.

Repository of Information

"We are a clearing house for all kinds of highway information. Where do we get this information? We gather it from the places it grows. The engineer making the inspection has the opportunity to see whether there are any new methods of doing all kinds of construction, whether methods being used are not successful, and through the medium of the construction inspection report, to submit that information so that it can be digested and passed on to other parts of the country.

"As evidence of some of the major accomplishments that have come about through observations made in the field might be mentioned the disappearance of solid rubber tyres from the highways. A quarter of a century ago there were many solid rubber tyres on the market as well as pneumatics, but from our obser-

ventions facts were developed that resulted in solid tyres being taken off the highways.

"Again, in the early 20's a contractor who laid three or four hundred square yards of concrete a day thought he had done a good day's work. Then what happened? Through our time studies and related activities, the contractor was shown how to get away from lost motion and how to better organize his work, until the day came when a contractor was not in the bidding unless he could lay 2,000 yards a day. These are dividends given by our organization to highway transport through the medium of studies made in the field, analysed by our Washington office, and made available to the whole highway construction industry.

Good Will

"We have, as an organization, enjoyed, the good will of the public and the support of the Congress in a way few Federal bureaus have. We have earned that confidence because we have stayed within the fundamental principles of co-operation set forth in the Act. **Co-operation**, as defined in the dictionary, is the action of 'working together towards the same end.' In other words—joint effort. The Federal-aid law provided that the work should be performed under the direct supervision of the State Highway Departments, thus making the State the responsible operating unit in the Federal-State relationship.

"But provision was made for the approval of plans, specifications, and estimates by the Federal Government, and our problem, therefore, becomes one of seeing that Federal-aid projects meet Federal standards without interfering with State initiative. With the inspection of construction provided for as a condition payment of Federal funds, dual responsibility runs through the entire Federal-aid scheme.

"The effectiveness of any policy must rest on its application, and the applying of a policy in the field is not so simple as is sometimes imagined. In these talks together I have tried to show some of the everyday problems that arise and how they are solved through our working contacts with the State Highway Departments."

HERE AND THERE

1. EDUCATION AND ENGINEERING ART

WHAT Sir David Pye, who has himself had so much experience of teaching, said in his Presidential Address to the Institution of Mechanical Engineers in October last, was not new.

"All the theoretical training in which we teach 'a student' to manipulate formulae on paper and to record experiments in a laboratory," takes him only a small part of the way to becoming an engineer; in fact, before he can become truly an engineer he must learn to appreciate the art, the intuition and the experience of people with a more practical and less scientific turn of mind.

That art is found in many engineering places but nowhere probably is it more obviously apparent than in a design office. For though the simpler stresses in the separate parts of a complete new device, the rates of fluid flow, changes of pressure and temperature, and the effect of many other factors may be calculable, yet when it comes to the putting together of the whole there must, of necessity, be so much compromise that only intuitive skill of a high order allied with experience of the operation of similar machinery can produce a satisfactory result.

It can be remarked of scarcely any machine save the very simplest that all

the relevant factors upon which design calculations can be based have been completely elucidated scientifically. Just as Sir Charles Parsons, during the development of the steam turbine, had to devise on wholly insufficient aero-dynamic information a suitable form for a turbine blade—and how well he did it—so does many a designer today have to form judgments, intuitively as much as rationally, from the few and possibly irrelevant facts available to him upon certain matters and learn by subsequent experience—that is by trial and error—whether he is right or wrong.

It is those with scientific training and imaginations ready enough to conceive and bold enough to attempt alternative solutions to old problems or to attack new ones who are so valuable to industry and in such short supply. Yet their exuberance needs to be tempered by knowledge of practical limitations and the practical experience of the past.

Sir David, having stressed the importance of practice went on to ask "Can it be said that the creative mind is typical of the university graduate today?"

(Extracted from 'The Engineer'—October, 31, 1952).

2. PUSH ROADS, NOT RAILS FOR SOUTH AFRICA TRANSPORT

BECAUSE the industrial economy of the area apparently is not sufficiently developed to warrant a first-class railway service, South Africa governmental units should consider the construction of highways as a first means of improving communications, the British Government has been advised recently.

A survey of proposals for a railway to link the Rhodesian and East African rail

systems, and of possible lines of economic development for the area has just been completed by Sir Alexander Gibb and Partners of London, and Overseas Consultants Inc., of New York.

The engineers' report followed up a report made in 1949, which expressed the view that the cost of the rail link would not be justified unless steps were taken to develop the areas traversed. The new

survey concurred in this line of reasoning, adding that, since the development most likely in the area is agricultural, a road network would be essential before rail lines can be considered economically. (Extracted from 'Engineering News-Record'—January 22, 1953).

3. EXPERIMENTAL RESULTS ON ROAD SAFETY

(Experiments by Road Research Laboratory, London)

Braking Performance of Vehicles

Commercial Vehicles: Tests were made on a random sample of 250 commercial vehicles. The main conclusions are:

(1) The average braking distance from 20 miles per hour increased almost linearly with an increase in the gross vehicle weight, ranging from about 40 ft for vehicles having a gross weight of about 3 tons to 70 ft for vehicles of 20 tons. This relationship agreed closely with that observed for American commercial vehicles of similar types.

(2) The average braking distance from 20 m.p.h. for all the vehicles was 46 ft, corresponding to an overall deceleration of 0.29g.

(3) On the average, laden vehicles had a braking distance about 20 per cent longer than that of unladen vehicles.

(4) There was little difference between the braking distance of vehicles with non-assisted hydraulic brakes and those with non-assisted mechanical brakes. Vehicles with vacuum-assisted hydraulic brakes gave shorter braking distances than other types of assisted brakes, mainly because the maximum deceleration could be achieved more quickly.

Speed:

(5) Vehicles legally restricted to 20 m.p.h. had a mean speed of 27 m.p.h.; 70 per cent of them were exceeding the legal limit by more than 5 m.p.h.; Vehicles restricted to 30 m.p.h. had a mean speed of nearly 30 m.p.h. and 16 per cent of them were exceeding the limit by more than 5 m.p.h. These results which were borne out by measurements on other roads, are of interest in view of the

discussions on the speed limits for commercial vehicles.

(6) Observations were made on dry roads, of the speed of vehicles, and these were then grouped into types according to their gross weights. They showed that in general the heavier vehicles travelled more slowly and had poorer brakes than the lighter ones. The mean speed of each type of vehicle was such that the average vehicle of each type could stop in about the same distance; this was about the same as that for cars on the same road.

Motor Cycles:

Measurements were made of the braking performance of a single machine of each of six makes of Army Service motor cycles (either 350 cc. or 500 cc. capacity). Four experienced riders took part and each was instructed to stop as quickly as possible on a dry surface when using the foot brake or the hand brake only, or both brakes.

When the foot brake only was applied, so that the rear wheel was locked, the average braking distance observed for all the machines was about 88 ft for 30 m.p.h. corresponding to an overall deceleration of about 0.35g. This value agrees with that calculated from a knowledge of the load transfer on braking.

When both brakes were applied together, the minimum distance in which two of the machines could be stopped was only a little greater than that which can be obtained by cars with brakes in excellent adjustment; but to achieve this it was necessary to lock the rear wheel and to nearly lock the front wheel. If the front wheel actually locked, the rider lost

control of the machine. In the other four makes of machine, the front wheel could not be locked and the braking distances were much greater than those of cars with good brakes. Thus one of the motor

cycles needed 64 ft to stop from 30 m.p.h., the corresponding figure for one of the laboratory cars being 46 ft.

(From 'Road Research, 1951'.)

4. ROAD ENGINEERING AND ACCIDENTS

BRITISH Road Federation stipulates six fundamental requisites of a good road system: uniformity of all features in the planning and layout of roads; adequate road space; good visibility; the segregation of different types of traffic; clarity, simplicity and standardisation of all signals and roadside information; and amenity.

Comparison of the accident rates before and after the reconstruction of the Sawley cross-roads, south-east of Derby, where the trunk roads A6 and A453 intersect incorporating some of the above requisites, is striking. Originally the cross-roads were controlled by halt signs on one of the roads, but there were 29 accidents in seven years. The crossing was redesigned,

a roundabout was introduced, and during the 18 months following the completion of the work in June 1950, there were no accidents at all.

A right-angled triangle formed by three roads was the scene of eight accidents in five-years; the acute angles at two of the road junctions were the prime cause. By making one side of the triangle a one-way route, and by altering the layout slightly to ensure that traffic approached a road ahead at right-angles instead of obliquely, the accident rate was reduced to nil in two years.

(Extracted from 'Engineering'—January 23, 1953).

5. CIRCUMFERENCE OF AN ELLIPSE

A new formula for the circumference of an ellipse has been developed by a Norwegian engineer, J. B. Fergested. He gives the expression:

in which a and b are the semi-major and semi-minor axes. This formula has a maximum error of 0.392 per cent.

$$C = \pi [3(a + b) - \sqrt{(3a + b)(3b + a)}]$$

(From 'Engineering News-Record'—March 12, 1953.)

LAWYERS AND ACCIDENTS

Counsel: "How far were you from the scene of the accident?"

Witness: "Two yards, three inches."

Counsel: "Did you measure the distance?"

Witness: "Yes, I guessed some silly ass would ask that question."

MR. McKELVIE RETIRES

WITH the retirement of Mr. G. M. McKelvie from the Government of India last month we have lost the services of an able engineer, administrator and ardent champion of the cause of India's roads.

Mr. McKelvie was born in February 1896 and received his education at Allen Glen's School, and Glasgow University. For practical training he spent 2½ years,

this period he was responsible for the design and construction of many roads and bridges and acquired considerable experience in the construction of buildings and water-works and famine relief operations. He was responsible for the compilation of the Central Provinces Specifications for roads in 1927 and C. P. Scarcity Manual in 1932.

In 1938 he joined the Central Govern-



Mr. G. M. McKELVIE, C.I.E., I.S.E.

mostly with a bridge building firm in Glasgow. He served in the Army for more than 3 years during the first World War.

Beginning from 1920 the first 17 years of his service passed in the Central Provinces (now Madhya Pradesh). During

ment and was employed in the construction of buildings, roads and airfields throughout India. During the Second World War he organised large airfield construction programme in Eastern India. In 1943 he was appointed Consulting Engineer (Roads) and in 1950 as the Road Development Adviser and

Joint Secretary to the Government of India.

His contributions to the drafting of the post-war road development plan, popularly known as the Nagpur Plan, Motor Vehicles Taxation Enquiry Committee, and to the draft Highway Act are outstanding and will be land marks in the history of Indian Roads. During his term of office as Consulting Engineer (Roads), the Central Government assumed responsibility for the construction and maintenance of National Highways. Under his able

initiative and guidance the Indian Roads Congress undertook to lay down road standards and draft the Indian Roads Congress Bridge Code.

Mr. McKelvie was wedded to duty and his motto was "Work is Worship".

His broad vision, unselfish devotion, kindly firmness, and manifest honesty and integrity had a tremendous influence in every one of his undertakings.

He was always sympathetic and kind to his men.



Delivering his Presidential Speech
at the Simla Session
of the I.R.C.



At work in a Subcommittee.

guidance, happy co-operation was achieved between the Centre and States as partners to the common undertaking. The Roads Organisation which is the repository of information on all road matters in India grew up from his untiring energy.

He is a founder member of the Indian Roads Congress. Under his fostering care as the Treasurer and later as the President, the Society was able to stabilize its finances and serve the profession to a degree greater than before. He started the publication of 'Transport-Communications Monthly Review'. Under his

While solving problems intricate,
Amidst a file or a case,
We found behind occasional frowns,
He hides a smiling face.

At Hashimara aerodrome,
While on his touring round,
He gave his bed to a junior staff
And slept upon the ground.

He was awarded the title of O.B.E. in 1945 and C.I.E. in 1948.



At a Chief Engineers' Meeting.



Explaining Indian practice to Major General Fleming, the American Road Expert when he visited India in 1946,

6. MOBILE ADVERTISING VAN ILLEGAL

WHETHER a lorry prominently displaying advertisements in a car park could be regarded as exempt from the provisions of the Town and Country Planning Act was argued in a test case before the stipendiary magistrate at Liverpool recently. The Liverpool Corporation summoned a firm of advertising contractors in connection with the display of two advertisements on a lorry in a car park in the city centre for seven and a half hours, contrary to the Town and Country Planning (Control of Advertisements) Regulations, 1948. For the Corporation, it was contended that the advertisements were on boards attached to the lorry, and the submission was that it was a "mobile advertisement station." The regulations exempted vehicles and defined them as being normally employed as

a moving vehicle on the highway on railway.

The defence was that the lorry came under that definition as it had been used for the purpose of maintaining permanent sites. The whole tenor of the regulations, was aimed against permanent advertising. To say they were aimed against a three-ton lorry which was static for seven and a half hours made nonsense of them.

The stipendiary magistrate said he was satisfied this vehicle had been adapted or designed for the main purpose of displaying advertisements, and that was a breach of the regulations. He imposed a fine of £20.

(From 'Modern Transport', March 21, 1953.)

7. STORY OF A SOCIETY MANUAL

PRODUCTION of the blue-covered occasional publications of the American Society of Civil Engineers—"Manuals of Engineering Practice"—represents an entirely different process from that used in issuing a Society Paper. A Paper is the product of a single author, or the joint product of two or three men. After publication, the Paper may be followed by written discussion and an author's closure.

In contrast, a Manual is drafted by one or more individuals, reviewed and amended by a sponsoring committee, reviewed by a number of selected "experts", who furnish constructive criticisms and sugges-

tions, amended again by the committee, presented to the Board of Direction, which may make further suggestions or amendments, approved by the Board, and finally published together with a historical summary that recites the specific details of the procedure. Thus a Manual, as the product of many minds, represents the best available collective thought in its field. Incidentally, a Manual is authorized only if the material is considered to be "not readily available elsewhere" to practising members of the profession.

(Extracted from 'Civil Engineering'—December, 1952).

STATISTICS AND SWIM SUITS

Statistics are like a Bikini bathing suit. What they reveal is alluring; what they conceal is vital.

(From a speech in the Parliament).

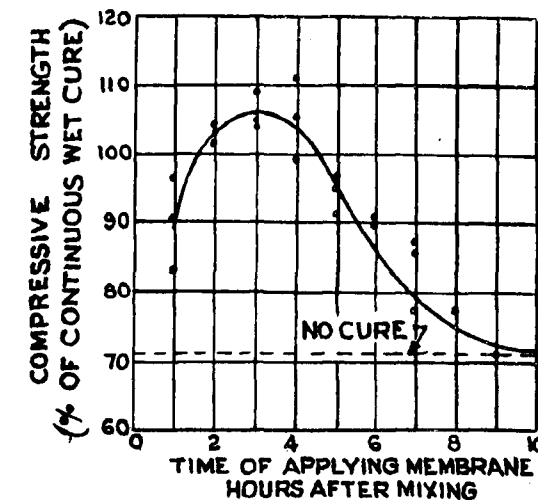
8. CONCRETE CURING TEST

A pilot study was conducted to determine the effect of withholding curing treatment under conditions that favour the rapid loss of contained moisture due to evaporation from the exposed surface of the concrete.

Specimens 6 in. in diameter and 6 in. high were cast in metal cans with soldered bottoms. The moulds were surrounded with sand and exposed outdoors away from shade during the summer. The weather was clear, relative humidity low, and afternoon temperatures reached 90° to 100° F. The temperature of the sand surrounding the test specimens was 65° F. in the morning at the start of one series and rose to 100° F. seven hours later. After 10 days exposure, the specimens were

removed from the moulds, placed in water for two days and then tested for compressive strength.

Two series each containing 24 specimens were run. In the first series 20 cylinders were cured with grey pigmented curing compound, two each at hourly intervals up to 10 hours; two specimens were covered immediately with cotton mats which were kept damp continuously and two received no curing treatment whatever. Half the specimens were tested for compressive strength, the others were sawed longitudinally, for observation. In the second series, seven cylinders were cured with grey and seven with white pigmented curing compound and seven with metal lids; one each by each method at hourly



STRENGTH IS HIGHEST WHEN CURING IS STARTED AT OPTIMUM TIME.

intervals up to 7 hours. Of the remaining three specimens, one was sealed immediately with a metal lid, one was covered immediately with a damp cotton mat, and one received no curing treatment.

The curve shows the principal results with respect to the strength of the concrete and illustrates the value of applying membrane cure at the proper time after concrete is mixed and placed. The strength of control specimens that were cured with

a water saturated blanket continuously from the time of casting is given a rating of 100 per cent. Other values are relative to this base. When no curing of any kind was applied the relative strength dropped to 71 per cent. The curve shows that evaporation of water is beneficial during the period that the concrete is plastic and is bleeding due to the settlement of the solid particles.

(Extracted from Highway Research Abstracts, February, 1953.)

TECHNICAL INFORMATION

AN INTERESTING METHOD OF REPAIRING
A CAST-IRON BRIDGE GIRDER*(Extracted from 'Engineering' November 7, 1952)*

REPAIRS of a cast-iron girder in a bridge carrying a busy road over the railway has been carried out recently at Northwich Station, Cheshire, by British Railways, London Midland Region. The bridge has two spans, one of 27 ft 1 in. over the up and down main lines, and one of 17 ft 8 in. over a loop line; it is 25 ft between parapets, and has a footpath 5 ft 5 in. wide on one side only. The deck of each span is supported by seven identical cast-iron girders placed longitudinally at 4 ft 6 in. centres with jack arches between them. The girders are of a familiar cast-iron type, hog-backed, with bottom flanges bowed in plan, and with cast stiffeners at intervals along their length.

One of the girders in the longer span, under the traffic lane and close to the kerb, was found to have a crack 1/8 in. wide, in the bottom flange, adjacent to the centre stiffener. After the road traffic had been restricted to one half of the bridge in order to relieve the defective girder of live load, the roadway surfacing was opened up in an attempt to ascertain whether the fracture could be traced in the top flange. This was found to be impracticable owing to the presence of a nest of nine Post Office cables in steel tubes embedded in concrete, which lay immediately over the girder and its adjacent jack arches. Detailed examination revealed that the girder had a sag of about 1 in., but no appreciable cracks were found in the jack arches.

It seemed certain that the crack extended right through the section of the girder and that it had been prevented from falling only by the combined action of the jack arches and surrounding backing.

The normal course would have been to replace the defective girder, but the cost

of such a repair would have been heavy, because not only would the Post Office cables have needed support and possibly some temporary diversion, but the demolition of the jack arch on the footpath side would have entailed temporary support being given to other services under the footpath. In addition, the footpath would have been so reduced in width during the occupation that it might have been necessary to provide a temporary footbridge. The only alternative method to offer substantial advantages was to restore the live load carrying capacity of the girder, by introducing a compressive force in the bottom flange by means of high-tensile steel rods stretched between anchorages attached to each end of the girder. Although it was realised that the design problem was not capable of precise solution, it was considered that there was a reasonable chance of success, and it was decided to proceed with this scheme.

It was evident that the dead load previously carried by the girder had been transferred to the jack arches surrounding material, and it was, therefore, clear that high-tensile steel rods would have to be sufficiently loaded to induce a compressive force in excess of that due to both dead and live loads. Four high-tensile steel rods 1-1/8 in. in diameter were placed with their centres 2 in. above the under-side of the bottom flange, two rods on each side of the girder. The rods were each jacked to 45 tons, the nuts tightened against welded headstocks and the jacks slackened. The residual load in each bar was then 42 tons, thus inducing a compressive force in the girder of 168 tons. Under this eccentrically-applied load, assuming a homogeneous section — which would be a reasonable assumption if the cracks

in the cast iron would be well below the usually accepted safe limit under dead load plus the Ministry of Transport live load. The crack did, in fact, appear to close, though it could not be established that it closed completely; therefore it would be reasonable to assume that the compressive stress in the cast iron under certain conditions of loading may be high, but it seems unlikely that it could reach unduly high proportions since some assistance would be offered by the jack arches and backing material. Moreover, the calculated extension of the roads under the jacking load, after making allowance for elastic shortening of the girder and steel headstocks, plus 1/4 in. for the width of the crack, was checked and found to be correct within ordinary limits of measurement.

The rods were connected at each end to stiff welded-steel headstocks bearing against the "closed" ends of the cast-iron girder. The headstocks were placed in position from the top without disturbing the tubes of the Post Office cables,

and the rods were threaded through the headstocks from under the bridge. Since the rods were delivered to the site by road, and might have sustained damage if each had been in one length, they were supplied in two lengths and coupled together on site before erection. The jacking operation was carried out from one end in two stages, the two inner rods being jacked simultaneously and then the two outer rods. It was considered advisable to build a small access chamber around each headstock to allow the anchorages to be inspected and adjustments made, if necessary. Furthermore, when the time comes for reconstructing the bridge, the demolition work will be rendered much easier than if they had been concreted in. The projecting screw threads and nuts were, of course, heavily coated with grease. Although the high-tensile steel rods are somewhat more resistant to corrosion than mild steel, they are in a vulnerable position where they are subjected to locomotive exhaust. They were, therefore, wrapped and coated with a bitumen compound.

EISENHOWER ON ROAD

"Next to the manufacture of the most modern implements of war as a guarantee of peace through strength, a network of modern roads is as necessary to defence as it is to our national economy and personal safety Roads to meet the requirements of today and the foreseeable future, instead of the era when automobiles were a luxury and roads were minor shipping lanes, will be a foundation for the progress ahead."

The bicycle was first used in the eighteenth century.

CORRESPONDENCE

SIMPLIFIED GRAPHICAL METHOD WORKS BLENDING AGGREGATES

To
The Editor,
"Transport-Communications
Monthly Review."

Sir,

In the article under the caption "Simplified Graphical Method Works Blending Aggregates" on page 24 of the January 1953 issue of "Transport-Communications Monthly Review" there is an error which might cause difficulties to some of your readers.

The article says that the sum of the distances of any point within an equilateral triangle from the three sides is constant and equals the length of one side. This is not correct. Actually, the sum is equal to the height of the triangle which is $\sqrt{\frac{3}{4}}$ times the length of a side. The sum can equal the length of one side only if distances are measured along lines parallel to the sides of the triangle.

Confusion would best be avoided by remembering that the distance of a point from any side is the same as the distance between that side and a line parallel to

that side drawn through that point. This distance can be entered against the intercepts which the parallel line makes on the other two sides. The use of the diagram would therefore find it useful to note that the numbers entered on a side of the triangle are indices of lengths measured not along that side but along a direction perpendicular to one of the other sides.

As the sum of the distances of any point from the three sides is constant (and taken as 100) the infinite number of possible points within the triangle represent all the possible combinations of the formula $x+y+z=100$ where x , y and z are all positive. If a straight line is drawn in the triangle parallel to one of the sides the region between that line and the apex opposite gives the restricted field within which one of the percentages is limited in its maximum value. By drawing similar lines parallel to the other two sides we can mark out regions within which limits are imposed on all the three percentages. Such regions would invariably be bounded by straight lines parallel to the sides of the triangle.

Yours faithfully,
A READER

Continued from page 7)

Expenditure	Rs Lakhs	(4) Payment to Municipalities in lieu of 8 per cent of petrol tax	Rs Lakhs
(1) Construction of motor-ways	40		67
(2) Construction of State & Main Highways	735	(5) Subsidies to local bodies at 33½ per cent	Counties 178 Boroughs 112
Less local bodies construction	37	698	(6) Administration 80
(3) Maintenance of State & Main Highways	666	(7) Research 3	
Less local bodies construction	47	619	(8) Miscellaneous 90
			(9) Revenue 50
			1,937

BUDGETS AND ADMINISTRATION REPORT

GOVERNMENT OF MYSORE CIVIL WORKS BUDGET 1953-1954

The following extracts relating to Civil Works have been taken from the Government of Mysore Budget for the year 1953-54

(In lakhs of rupees)			
	Actuals 1951-52	Revised Estimate 1952-53	Budget Estimates 1953-54
I. Revenue (Civil Works)			
1. Rents	1.82	1.34	1.37
2. Recoveries of expenditure	0.96	8.28	8.91
3. Transfer from Central Road Fund	...	22.83	24.24
4. Miscellaneous	7.24	5.32	3.35
5. Deduct-- Refunds	-0.05	-0.04	-0.04
Total	9.97	37.73	37.83
II. Expenditure (Civil Works)			
1. Original Works	21.81	69.87	67.97
2. Repairs	33.83	47.40	50.40
3. Establishment	14.55	18.89	21.75
4. Tools & Plant	5.51	4.35	5.00
5. Grants-in-Aid	4.32	20.37	4.10
6. Suspense	58.88	27.50	15.00
7. Development Schemes	74.33	58.11	72.37
Total	213.23	246.49	236.59
III. Expenditure (Communications)			
(a) Original Works	15.15	13.50	13.50
1. Ordinary	13.15	41.11	44.37
2. Development Schemes	26.53	39.03	42.03
(b) Repairs	13.46	13.00	20.00
2. Development Schemes	68.29	106.64	119.90
Total			
IV. Receipts From Roads			
1. Receipts under Motor Vehicle Acts	56.80	57.58	58.53
2. Tax on Petrol and Motor Spirit other than Petrol	18.24	17.51	18.00
Total	75.04	75.09	76.53

(Continued on page 30)

ABSTRACTS

625.858*—ROAD SURFACES OF TAR MACADAM.

Tar Macadam by A. R. Lee ('Road Tar', September 1951, pages 7-13).

The article deals with the types of tar macadam and tar carpets that are in use to meet present traffic in Great Britain, and the specifications adopted in their construction. The use of aggregates from soft stones as limestone, igneous rocks and rounded stones and the effects of oxidation of tar are also discussed. The importance of low volatility and oxidation of tar is stressed. Results of experiments on the use of tar-bitumen mixture are included. The essentials of a 'dense tar surfacing' are explained.

625.754—TREATMENT OF ROAD SURFACE WITH TAR.

The Mechanisation of Road Maintenance operations with particular reference to Hot Surface Dressing by C. R. Chadwick ('Road Tar', September 1951, pages 15-17).

How the use of machines results in increased outturn and how to match economically the general purpose and special plants on a job are briefly explained. The effects of site and weather conditions are also discussed.

625.754—TREATMENT OF ROAD SURFACE WITH TAR.

The Use of Precoated Chippings for Surface Dressing by L. F. Cantlay ('Road Tar', September 1951, pages 20 & 21).

An experimental surfacing with tar precoated chippings, carried out at a roundabout in September 1949 at the commencement of Croydon Bypass is described.

Type 'A' tar of 44 E.V.T. with wetted and unwetted stone chippings was used.

691—BUILDING MATERIALS.

'Economy of Steel in Building'—J. W. Roderick (The Journal of the Institution

of Engineers, Australia, Jan-Feb. 1952, pages 15 & 16).

Discusses the ways in which economy in steel material can be secured in design. Reference is made to the report of Steel Economy Committee by the U.K. Government which indicated the directions in which economies could be achieved. A number of cases where welding of steel was responsible for reduction in cost ranging between 10 and 50 per cent are quoted.

The Design of Aerodrome Pavements by R. H. A. Cochrane (The Journal of the Institution of Engineers, Australia, June 1952, pages 129 to 137).

Describes the current practices of the Commonwealth Department of Works and Housing in the design of aerodrome pavements in Australia. Design criteria under the various conditions such as wheel loads and tyre pressures, nature of surface suitable to the crafts, etc., are given. Flexible and non-flexible (or Rigid) types of pavements are discussed. Subgrade conditions, C.B.R. values and compaction of subgrades are also considered in preparing designs. Under rigid pavements, determination of modulus of subgrade reaction, the use of reinforcement, and provision of joints in concrete pavements are also briefly outlined.

518.6 : 624.624-SPECIAL METHOD, CALCULATION FOR R. C. ARCHES.

A Numerical Method for Analysis of Two-Hinged Elastic Arches by Deflection Theory—Dr. P. N. Chatterjee (Journal of the Institution of Engineers, India, December, 1952, pages 125-161).

Analyses the action of a two-hinged elastic arch by the deflection method. Formulae have been developed for calculating bending moment. The results of a model test on a two-hinged arch carried out at the Bengal Engineering College, Howrah are also included. This numerical procedure is recommended by the Author for use in designing arches

(Continued on page 28)

BOOK REVIEW

"Publication of the International Association for Bridge and Structural Engineering" Vol. XII, 1952, issued by the International Association for Bridge and Structural Engineering, Swiss Federal Institute of Technology, Zurich, pages 324; price not stated.

The publication contains 17 Papers, presented to the Association, on various subjects. Eight are in English, four in French, and five in German.

The following Papers are in English.

(1) **"Partially Prestressed Concrete Constructions, Built in the Eastern Region of British Railways 1948-52"** by P. W. Abeles.

The Paper deals with partial prestressing, its economy and usefulness. Routine tests to investigate the quality of prestressing are described and examples of practical application to 16 road bridges over railways of spans 20 to 50 ft built as composite partially prestressed slabs are given.

(2) **"The Design of Small Railway Underbridges with Special Reference to Erection and Maintenance under Traffic"** by P. S. A. Bridge.

The Paper explains the present practice in the design and maintenance of various types of railway bridges after discussing the design loadings and calculations for impact effects due to hammer blows, rail joints and lurching. The use of waterproofing layers between the ballast and the deck slab is discussed. Comparative costs of various types of construction, for a double deck of 40 ft span, are given. The choice between welding and riveting for fabrication is touched upon and reference is made to current practice in painting steelwork.

(3) **"Approximation Following from the Maximum Condition Applied in Theories of Plasticity and Earth Pressures"** by Hermann Craemer.

The Paper deals with the Plastic Theory as applied to beams, frames and plates in the higher ranges of stresses when the Elastic Theory has ceased to apply. The effects of movements in the critical sections are described and it is shown how approximations in computing the maximum stresses do not generally result in appreciable errors by the use of this Theory.

(4) **"Shear Deflections in Latticed Structures"** by Charles Doveton Crosthwaite.

(5) **"Statics of the Vierendeel Girder"** by Prof. I. A. el Demirdash.

(6) **"Model Verification of the Classical Flutter Theory as Adapted to the Suspension Bridge"** by Prof. F. B. Farquharson.

(7) **"The Fabrication and Erection of the 'Dome of Discovery'"** by J. D. Vaughan.

The Paper describes the fabrication and the erection of the Dome of Discovery built for the 1951 Festival of Britain. This structure has an overall diameter of 365 ft and is probably the largest dome in the world. The curved latticed girders, tubular struts, and bolts and nuts were of steel and the remaining parts of aluminium. Approximately 138 tons of steel and 234 tons of aluminium were used in the construction.

(8) **"Mathematical Prediction of Suspension Bridge Behaviour in Wind from Dynamic Section Model Tests"** by George S. Vincent.

The following Papers are in French :

(1) **"Corrosion problems of Concrete"** by Pierre Chevrier and Robert Houbas.

The Paper deals with the effects of pure water, salt water, and frost on concrete hydraulic structures in France.

(2) **"Tests concerning Creep and Shrinkage Losses in Prestressed Concrete"** by Guy Dawance.

* Refers to the Universal Decimal Classification Number.

The Paper describes the use of a simple testing device to ascertain the creep of steel and concrete, as shrinkage in concrete progresses as it occurs in prestressed concrete girders, and gives the results of a few tests.

(3) "The Sectional Method in Slab Theory" by R.L'Hermite.

In this Paper the Author describes a method of calculations for slabs and flat coverings with free edges from theory of intersectional slabs supported freely at the edges.

(4) "Adoption of Superelevation in Concrete Slabs of Mixed Constructions in Steel, and Concrete" by M. Oudotte and M. Guerin.

The design of bridges comprising the structural steel frame with concrete deck has been the subject for research for many years. When the beams are continuous there is a tendency for the slabs to crack over the supports. To prevent the slab from cracking, a compressive stress is produced in it by raising the inner supports of the continuous beam before casting the slab and lowering the beams to the original level after the concrete has

hardened. The slabs are bonded to the steel beams by means of bars in the form of helices welded to the flanges of the beams and embedded in concrete. The adoption of the method during reconstruction of three bridges in France is also given.

The following are in German :

(1) "Prefabrication in Steel-Concrete—Special Constructions" by Prof. Fr. Baravalle-Brackenburg.

(2) "Continuous Cylindrical Beams of Prismatic Cross-Section" by Ernst Gruber.

(3) "The Two-Dimensional Problem in the case of Periodically Altering Temperature Effects" by Prof. Pierre Lardy.

(4) "Regarding the Influence of Frictional Forces and Bearing Pressures in Connection with Prestressing in Steel-Concrete Structures" by W. Swida.

The volume has been well got up with numerous drawings, charts, and photographs. At the end of each of the Papers in French and German a summary of the Paper in English is included.

(Continued from page 26)

both by the ordinary and deflection theory.

624.6—INDETERMINATE FRAME ANALYSIS BY THE METHOD OF EQUIVALENTS—by M. R. Saha (Journal of the Institution of Engineers, India—March 1952, pages, 67-92).

Describes a method of dealing with frames consisting of members of uniform cross-section and fully restrained against lateral sway. It involves evaluation of

final rotation of joints under the influence of equilibrating moments and is known as the method of equivalents. The principle involved is based on replacement of complex frames by equivalent simple ones and is derived from the fundamental equilibrium equations of elastic joints.

The theory is dealt with first and then the practical aspect. Computation procedure with a summary of formulae is given. An example is also worked out.

List of Approved Works on National Highways

S. No.	Job No.	Name of work	Estimated Cost Rs (Lakhs)	Remarks.
MADRAS				
1.	718 MD 5	Forming a metalled road between Narayanapuram and Badampadi along the right bank of the Eluru canal in the West Godavari District (miles 4½).	2.46	
2.	723 MD 5	Forming metalled road from Gundaganu to Kurellegudam along the right bank of the Eluru canal in West Godavari District.	3.33	
WEST BENGAL				
3.	726 BG 34	Construction of a bridge over the Kulik river in the 2nd mile of Raiganj-Dalkhola section of N. H. No. 34.	3.07	
BOMBAY				
4.	727 BM 8	Improvements to Naroda-Pirojpur sub-section of the Pirojpur-Ahmedabad section of the Bombay-Ahmedabad National Highway.	6.19	
PUNJAB				
5.	717 PB 1-A	Construction of a high level bridge in mile 17/1-2 of the Jullundur-Tanda section of National Highway No. 1-A.	1.29	
6.	729 PB 1-A	Providing overhead line and lighting over the Beas Bridge.	0.46	
ORISSA				
7.	724 RS 5	Black topping N. H. No. 5 between Ganjam and Madras-Orissa border (length about 16½ miles).	2.38	
8.	731 RS 42	Land acquisition for straightening the curve from 94/1 to 94/3 qrs. on Cuttack-Sambalpur road—N.H. No. 42.	0.02	

S. No.	Job No.	Name of work	Estimated Cost Rs (Lakhs)	Remarks.
SAURASHTRA				
9.	725 SR 8-A	Improvement and construction of the Limbi-Sayla-Dolia section of the Ahmedabad-Kandla N. H. No. 8-A in Saurashtra (length 27.6 miles).	5.37	
RAJASTHAN				
10.	728 RJ 8	Improvement and widening of Jaipur-Ajmer road (N. H. No. 8) in miles 12/5-16 in Rajasthan.	0.43	
KUTCH				
11.	730 KH 8-A	Construction of the Kandla-Chirai section of the Kandla-Ahmedabad National Highway No. 8-A in Kutch (excluding cross drainage works).	5.21	

(Continued from page 25)

A BRIEF REVIEW OF THE MYSORE BUDGET FOR 1953-54.

THE budget estimates of the Government of Mysore for the year 1953-54 anticipate a revenue of Rs 2062.25 lakhs as against an expenditure of Rs 2219.58 lakhs indicating a deficit of Rs 157.33 lakhs.

The expected revenue during 1953-54 from Civil Works indicates a slight increase (Rs 0.10 lakhs) while the expenditure is less than the provision in the revised estimates for the previous year by about Rs 10 lakhs. The apparent fall in expenditure for the current year is due to the transfer of Grant-in-aid to Local Bodies to a different head of Account and also lower grant under Suspense—An additional amount of Rs 10 lakhs has been provided for Buildings, which will

be met from the Capital Account of 'Civil Works outside the Revenue Account.'

Expenditure on Civil Works forms 11.5 per cent of the total State revenue for 1953-54. For 1952-53 (Revised Estimates) and for 1951-52 (Accounts) the corresponding ratios are 12.5 per cent and 11.6 per cent. The percentage for 1953-54 becomes 11.8 if we take into account the contributions to Local Bodies previously included under "Expenditure on Civil Works" but now transferred to a different head of expenditure. The expenditure on Communications only works out to 5.8 per cent of the total revenue for 1953-54, 5.4 per cent for 1952-53 (Revised Estimates) and 3.7 per cent for 1951-52.

DEFINITIONS OF HIGHWAY ENGINEERING TERMS

ROADWAY :—That portion of road which is designed for and carries traffic—includes carriageways and shoulders.

TRAFFIC LANE :—The Longitudinal strip of the carriageway of a road, regarded as of unit width, to accommodate safely the forward movement of one line of traffic.

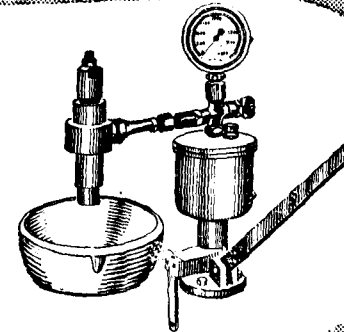
List of Books added to the Roads Organisation Library during April 1953

1. **The National Sample Survey General Report No. I on the first round (April, 1950-March 1951).** (Issued by the Department of Economic Affairs, Ministry of Finance, Government of India, 1952).
2. **Transactions of the British Ceramic Society, Vol. 51, No. 7, July, 1952, containing two articles:**
(i) Particle size analysis from Sedimentation curves by A. H. Nissan.
(ii) A Contribution to the determination of Plasticity by M. Linseis.
3. **The Indian Standards Institution (Certification Marks) Bill, 1952** (as passed by Parliament).
4. **Bulletin of the Permanent International Association of Road Congresses, Paris, Bulletin No. 131.** (Science Industries, 2, Rue Paul Cezanne, Paris (VIII))
5. **Report on the Lighting of Vehicles.** (The Standing Joint Committee of the R.A.C., A.A.—R.S.A.C., 66 Whitcomb Street, London, WC2, 1951).
6. **Street Lighting—The Road Maker's Library Vol. No. 12.** by J. W. Waldram (Edward, Arnold & Co., London).
Her Majesty's Stationery Office, London.
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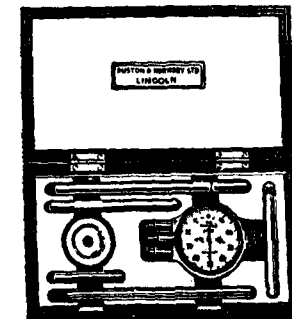
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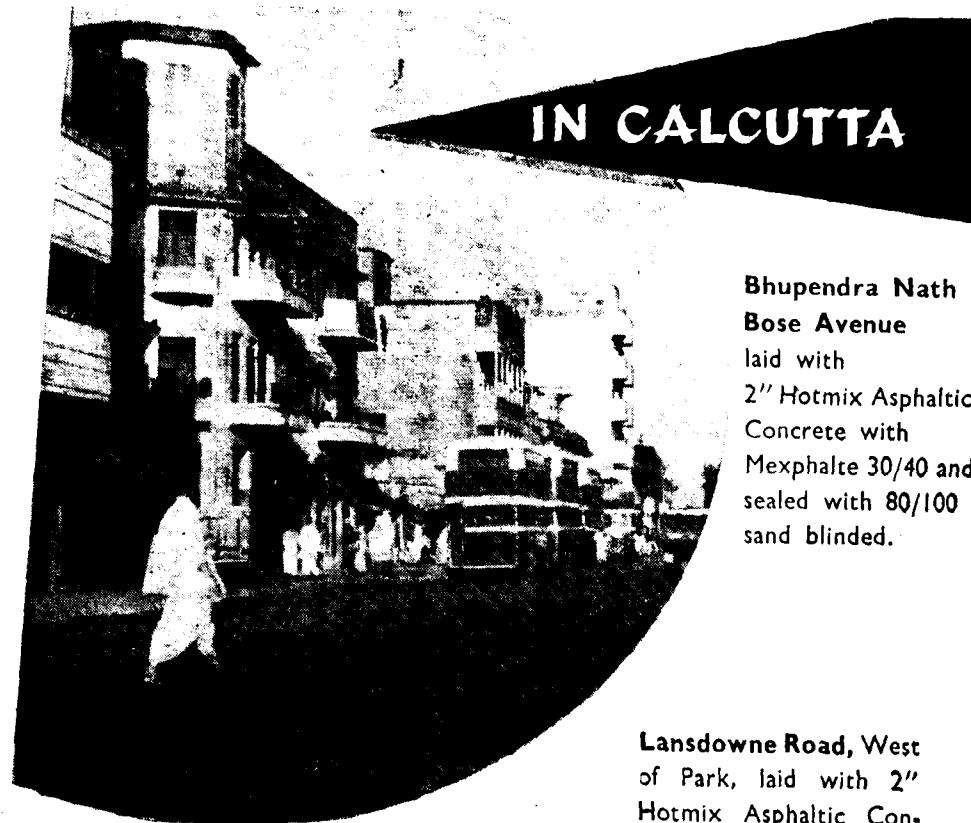
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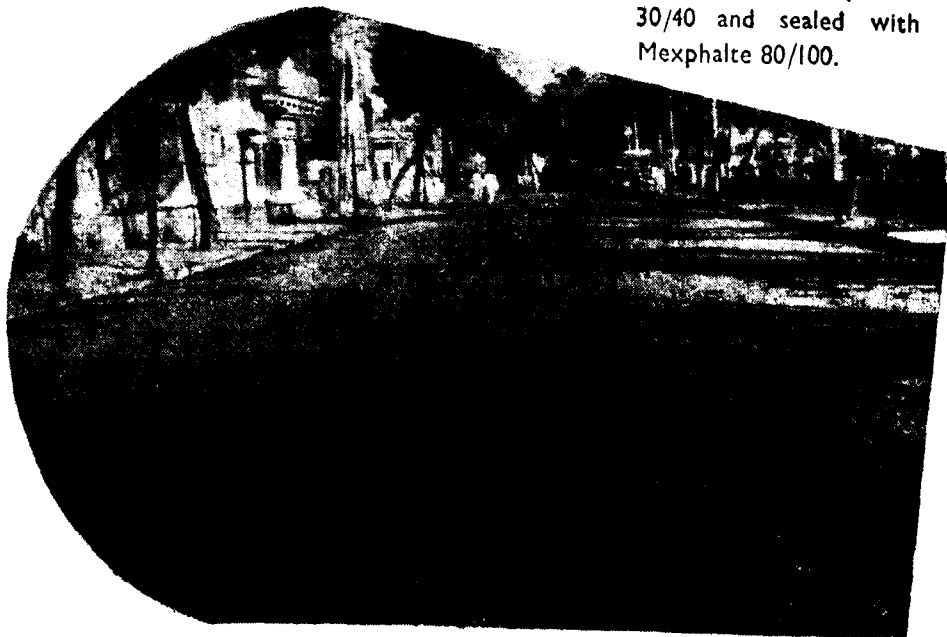
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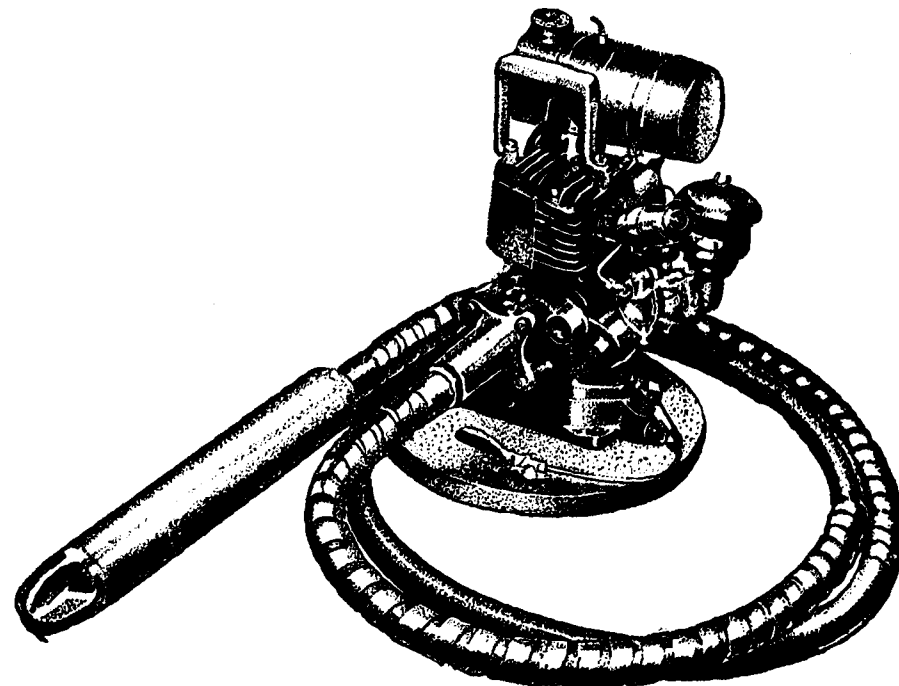
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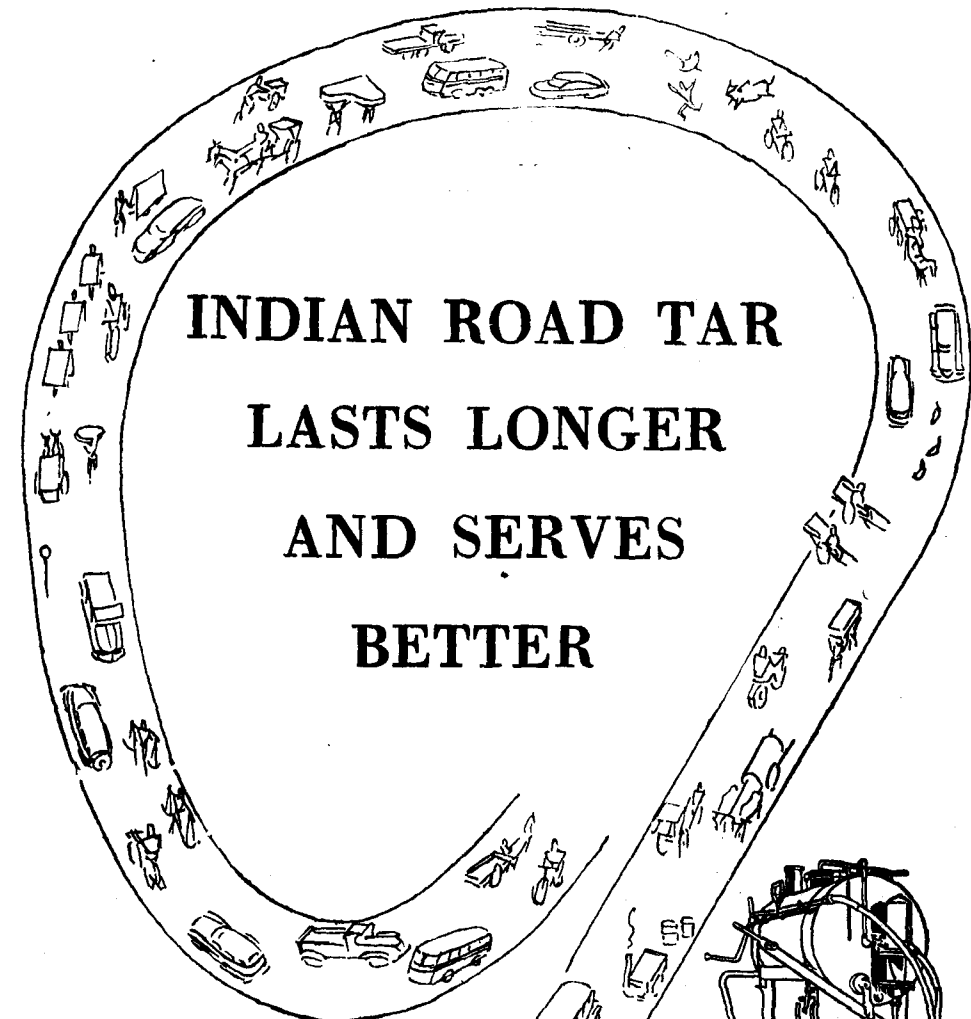
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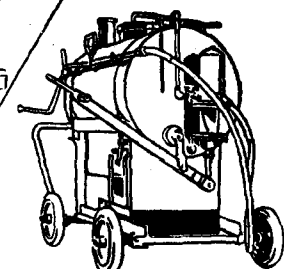
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