812

Transport-Communications

MONTHLY REVIEW

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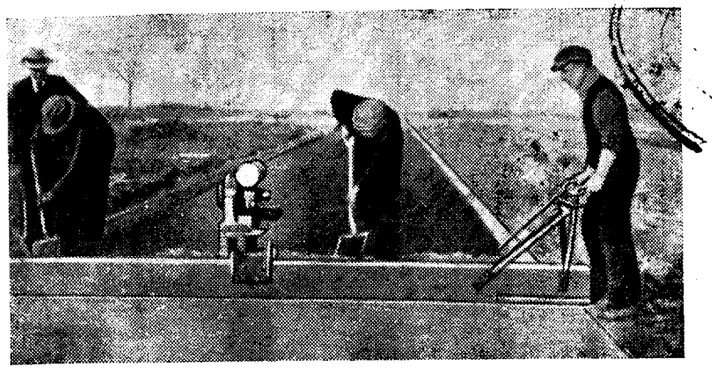

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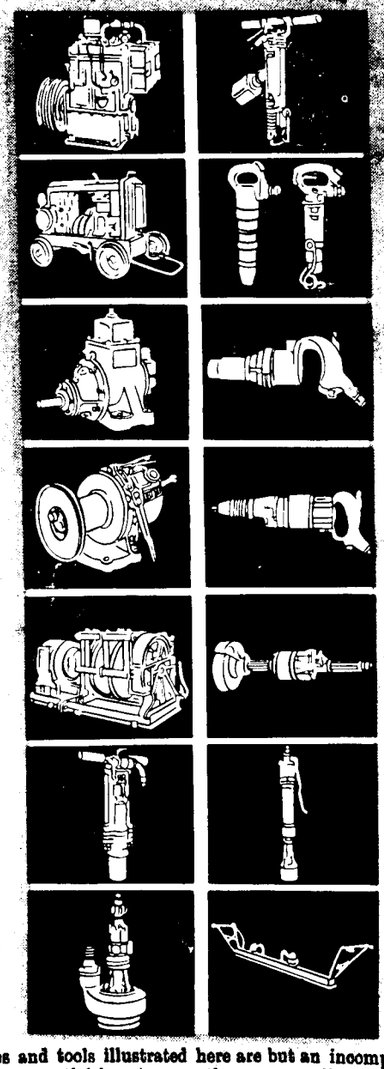

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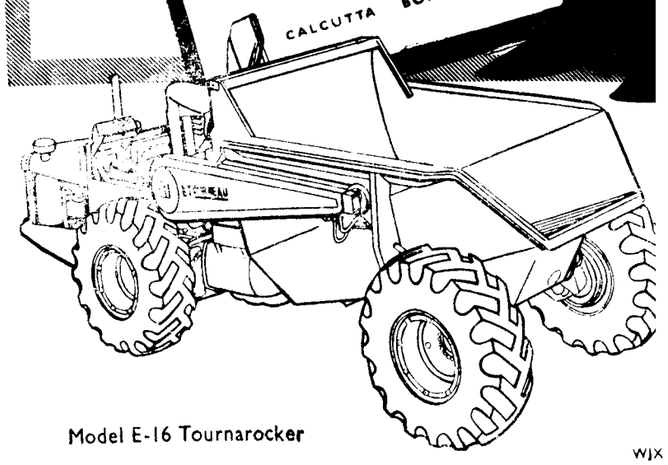

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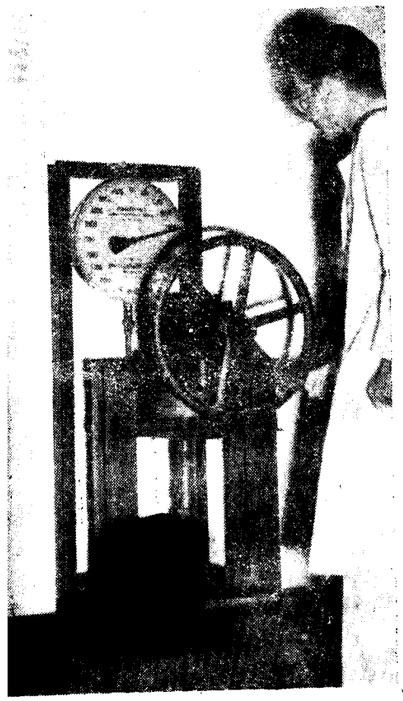

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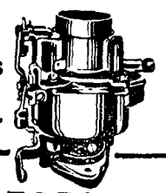

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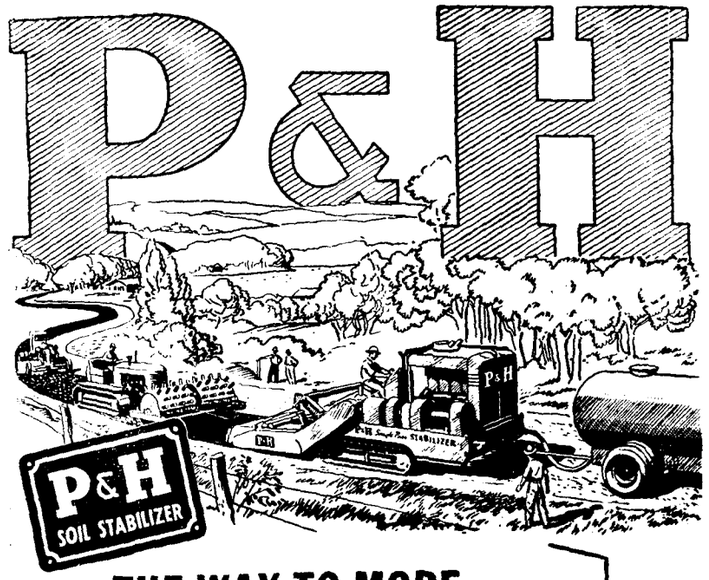

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ROAD SAFETY

THE ENGINEER'S ROLE

[From the Surveyor, November 17, 1950.]

IN a paper on "Road Safety and the Highway Engineer," presented at a joint conference under the auspices of the County Surveyors Society and the Institution of Municipal Engineers (U. K.), Mr. Edward Ogden, B.Sc., A.M.I.C.E., section engineer, Lancashire County Council, said that the problem of road safety and the part to be played in its solution by the highway engineer had only recently been seen in a true light, notably as a result of the stand taken in the U. K. by one or two authorities who maintained that road construction and layout were major factors affecting the incidence of road accidents. This fact was being proved at this moment by experience on motorways in various parts of the world where the frequency of accidents was appreciably less than on other roads.

The problem had been obscured by the irrefutable idea, which is demonstrable in most accidents, that some breach of human behaviour had occurred, whence it was argued that the sole responsibility for avoiding the accident rested with the driver or the victim.

A more faithful picture was obtained by considering the progress of a vehicle along the road and recognising that the road layout gave rise to a constantly recurring number of situations each of which embodied the possibility of an incident. This fact would be well-known to drivers who should have little difficulty in recalling potentially hazardous situations which had occurred during their last two or three trips.

For instance one often saw a driver overtake on a bend when, should anyone be attempting the same from the other direction, a critical situation would arise; or perhaps going down a hill paved with wet shining setts, one could feel the wheels of the car skidding and then could only trust it would not be necessary to apply the brakes suddenly.

The position was therefore that the road layout or construction was responsible for setting up numbers of situations of a greater or less degree of hazard and it was then the human factor which governed whether the situations were surmounted, a failure possibly occurring through recklessness, bad judgment, fatigue or inexperience.

The number of such hazardous situations depended upon the road layout, and the highway engineer by the reduction of this number would make his contribution to road safety.

The argument that the creation of a large number of hazards would result in a conditioning of a driver, so reducing the number of accidents, was not valid although one could accept that the chances of an accident for each incident were less.

Accepting that road layout was responsible for setting up hazardous situations it then remained to determine what were the factors involved and to demonstrate that these factors did give rise to accidents. Having isolated the hazards, their remedy could be attempted.

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KARNAL RESEARCH LABORATORY

WORK DONE IN 1950 - 51

AS a result of the partition of India the Lahore Soil Research Laboratory fell to the share of Pakistan. The East Punjab set up its own laboratory at Karnal and work has been going on there steadily ever since. The first problem which the Laboratory was called upon to tackle was to lay down specifications and methods for cheap and quick building construction. This was the burning need of the hour because millions of refugees from Pakistan had to be housed and rehabilitated. Not all could find shelter in houses vacated by the Muslims who went over to Pakistan.

This problem was solved admirably by the Laboratory which carried out research in the use of stabilised soils for house-building and devised suitable proportions and methods of construction. A series of research notes on this subject have appeared in the I. R. C. Journal, Volumes XIV and XV.

Lime to Stabilize Soil

The use of cement stabilised soil in road construction has also been studied first in the laboratory and then in the field. As cement, however, is costly, laboratory experiments were extended to the study of lime as a soil stabilizing agent in road construction. The aim was to find out the proportion of lime which would improve the various soils so that the resultant lime-soil mixtures should be able to resist the softening action of water and have low shrinkage and high compressive strength.

There are indications that stabilization with lime increases the strength and durability of most of the soils. The addition of lime to the base course soils is expected to check the capillary rise of water and prevent the softening of road foundations in areas of high subsoil water level.

Use of Waste Products

A soil properly graded so as to have the correct proportion of clay in it develops abrasive resistance, shear strength, and high density. But there may be situations when clay may not be obtainable economically while some other stabilizing agents might be more economically used.

In this connection some industrial wastes have been experimented with as stabilizing agents, viz., molasses, a waste product of the sugar industry, and "jharua", a waste product of the "Katha" industry.

Black Cotton Soil

Black cotton soil which occurs in many parts of India contains a large percentage of colloidal clay and sometimes 4 to 8 per cent humus too. This type of soil has great affinity for water which it soaks up by capillary action and absorbs even from the atmosphere.

In a very dry state this soil is very hard, has a compressive strength of 600 to 800 lb. per sq. inch, and will stand very heavy traffic. But when wet the soil loses all cohesion and bearing capacity. Moreover, on drying the soil shrinks considerably and develops big and deep fissures. On this account this variety of soil is unreliable for engineering construction. In highway construction particularly the soil presents difficult problems with very expensive solutions.

The Karnal Laboratory is attempting to find out the most economical method of stabilizing black cotton soil for road builders. On account of its high clay content the mechanical stabilization of this soil with sand is not always economical (particularly when sand has to be carted over long distances) because 60 to 70 per cent sand is required for proper grading.

Admixtures like lime, cement, molasses, plaster of Paris, or combinations of two or more of these ingredients, have been tried. Lime promises to be the best admixture encountered so far but experiments are in progress.

(Contd. on page 25)

CONTRACTORS' CLAIMS FOR "EXTRAS"

(Extrcted from 'The Surveyor'—March 2, 1951)

A matter apparently trivial yet of much importance was decided in the High Court a few years ago, and the effect should be kept in mind as an evergreen (unless and until, of course, it is reversed or over-ridden) All who have to handle the financial aspect of contracts for work done for local authorities know that difficulties arise from time to time regarding the contractor's claims for extras.

So customary is it for them to present a more or less lengthy bill for such items that the absence of a document of that description would almost imply that the final account had yet to come.

When one poses the question whether these claims ought to be admitted, one is apt to think that the querist is merely "leg-pulling" since the surveyor or engineer would hold that if the work which forms the basis of the claim for extras was properly ordered or authorized or even unavoidable in the circumstances, provided that charge is made on proper lines, the answer is a definite affirmative. Actually, it needs careful thought and the decision should depend on the full circumstances of the case.

Examples of Extras

As is known, extras (so-called) may consist of a number of things such as:

(1) work (including both labour and materials) not covered by the agreement;

(2) work done (including materials used) of a quality or description different from that originally specified and on which the contract price was based;

(3) alterations of the original plans not involving additional labour or goods, but which, being requested at a date when arrangements had been made to follow the lines first contemplated, the change occasioned additional cost;

(4) variations made by the contractor to suit his own convenience (though not so admitted by him) and for which he seeks to obtain payment over the contract price;

(5) increases in cost of labour and/or cost of materials in consequence of rising market prices;

(6) alleged additional cost of materials used, which may relate to goods that have actually cost the contractor more to acquire, but which additional cost he did not need to incur had he been careful and shrewd buyer, or which related to purchases not specified for the job in question; and

(7) claims for additional expenditure incurred by paying overtime rates of wages to workmen.

A private individual or firm can, of course, pay what is thought fit, challenging the claims or discharging them by payment without question, but a public body, before deciding what should be admitted for payment, must do two things:

(a) seek proof that the extras claimed for actually (not necessarily authoritatively) been incurred; and

(b) inspect the contract document along with a copy of the specifications and quantities.

* * *

It is generally found that in so far as the bill of extras relates to item (4), it must be rejected and similarly with Nos. (5), (6) and (7) unless there is a clause in the agreement authorising them.

The agreement may, of course, provide for additions and deductions to be made in respect of increases and/or decreases by reason of rises and falls in the market prices of labour and materials. That would cover in principle, the claim under No. (5). But No. (6) should not be allowed. No. (7) should be rejected unless authority has been given to incur the overtime on the understanding that the principle will meet the extra cost.

Extras Not Ordered in Writing

With regard to claims for extras of the type in Nos. (1), (2) and (3) important points arise. In this connection the decision in an action a few years ago in the King's Bench Division of the High Court is worth examining or re-examining. The case above alluded to is **S.C. Taverner and Co., Ltd., vs. Glamorgan County Council** (1940). It concerned a claim to recover a charge for extras to a contract which were not authorised by the defendants in the manner prescribed in the contract.

The plaintiffs were a firm of building contractors and claimed from the Glamorgan County Council the substantial sum of more than £ 10,000, which they alleged was for work done as per account delivered. The extras related, mainly, to the cost of stone facings. The plaintiffs contended that instructions for the extras were given to the managing director by the defendants' clerk of works. Whilst no price was expressly agreed, it was contended that there was an implied agreement to pay a reasonable figure for the extra works ordered.

The contract provided that:—

> "The contractor shall execute all alterations and additions which shall be ordered by the county surveyor, but if the contractor shall be of the opinion that any such alterations and additions will cause additional expense, he shall not be bound to execute the same without an order in writing signed by the clerk of the County Council, stating the price which is either agreed or certified by the county surveyor to be the proper sum to be allowed for the same....."

The agreement also contained provision for waiving that clause by notice in writing.

The local authority contended that so far as the materials were concerned, the items were not authorised by them in accordance with the provision in the agreement. And the court held that the parties had clearly contracted that extras were to be ordered by the employer in writing, and that as no such order had been obtained by the contractors, their claim for payment for the extras in question failed.

The problem raised is an important one, and it is interesting to note that the decision did not lay down any new principle; but it affirmed the law and thus cleared away a misapprehension that if extras were put into a contract and tacitly accepted by the employer (that is, the latter did not draw the attention of the contractor to the fact that he was doing something for which he had no proper instructions and therefore for which he would not be paid, as soon as practicable after it came to the proprietor's knowledge), they would have to be paid for.

The defendants, in the case quoted above, did not contend that no extras were done and/or that they were part of the original contract. The Court held that the parties were bound by the clear terms of the contract and that the claim for extras could not be maintained.

Fallacies

Prior to the present case, nobody doubted that no attention was paid by parties to the condition in a written contract that there was no liability for extras not ordered in writing. Plaintiffs' counsel expressed his astonishment that there should be expressed a contention that those terms of the contract were binding. And he quoted a passage from Hudson on "Building Contracts":—

> "When there is a condition in the contract that extras shall not be paid for unless ordered in writing by the architect.....and the employer orders work which he knows, or is told, will cause extra cost, a jury or an arbitrator may find that there was an implied promise by the employer that the work should be paid for as an extra, and specially so in cases where any other inference would be to attribute dishonesty to the employer," and "There would, it would seem, be strong evidence of fraud if an employer, desiring alterations and additions to be made by a builder, and knowing that they would cost more than the contract price, himself, or by his architect.....were to stand by and see the expenditure going on and then, taking the benefit, refuse to pay upon the ground that proper orders had not been obtained."

The judgment in the case embodies an intricate and interesting analysis in the law on the subject, including cases and judgments. Briefly stated, the position now is that where there is a stipulation in a building contract that extras are not to be paid for unless ordered in writing that requirement is fully effective and if a contractor executes extra work without the appropriate orders, he does so at his peril. The building owner may not, however, use the stipulation as a cloak for fraud. There could be circumstances that would render it dishonest not to pay for extras so performed and there may be conduct on his part that will constitute a waiver of his right. But clauses of the kind included in the contract concerning which action arose were not a mere formality: they are there for a purpose and that more than a mere acquiescence by the employing party is needed in the performance of the extras to entitle the contractor to recover his claim in the absence of written orders.

* * *

—o—

THE REDEEMING FEATURE

A Bilbao journal has been fined £ 60 for publishing a dialogue between a Spanish and a French soldier on the frontier. It went like this:

"How long do you think it would take Stalin to reach the Rhine?"
"One day" says the Spanish Soldier
"And to reach Paris?"
"Two days".
"And to reach the Pyrenees?".
"Three days", replies the Spaniard.
"And to get to Gibraltar?" asked the French.
"Four weeks" says the Spanish soldier.
"Why the difference?"
"Because of the state of the Spanish roads".
Says the Spanish soldier.

—

TYPES OF ROADS FOR TOWN AND COUNTRY*

(Continued from June, 1951)

Details of Design

THE following details constitute only a review of the average requirements of the different types of roads described under the foregoing headings; in practice many variations will occur.

(a) Traffic Roads

The axiom of road engineering that roads should be designed for the probable traffic should always be remembered. If an attempt is made to fit traffic to a road the result is disastrous; loss of time and frayed nerves at the best and loss of life at the worst.

In designing a new road or the widening of an existing one an attempt must be made to estimate the probable traffic load it will carry. This may be based on a traffic census taken on the road in question or on an "intelligent guess" of the amount of traffic from existing roads (for which census figures are available) which may be diverted to the new one.

* * *

The following design figures have been suggested:—

No. of vehicles per 16-hour day	No. of carriageways	Width of carriageway
Upto 3,000	1	22 feet
3,000–6,000	1	30 ,,
6,000–15,000	2	each 22 ,,
Over 15,000	2	each 30 ,,

Except in very hilly country or other exceptional circumstances the gradients should not exceed 1 in 30. Where much heavy traffic is probable and there is risk of other road users being obstructed by slow-moving traffic on gradients the American practice should be adopted and an additional lane width provided on the near side on up-gradients.

* * *

An ideal traffic road in a redevelopment scheme would be cut through property blocks so that the existing roads are retained at ground level to form service roads, the new road being sunk to such a level that it could be bridged over where required.

* * *

Curves should be of as large radius as possible and, in the case of single carriageways, must provide adequate sight distance for approaching vehicles. In most cases some super-elevation should be provided.

* * *

Where dual carriageways are necessary the central reservation should be sufficiently wide, if possible, to permit of horticultural treatment or—at the very least—turfing. * * *

The minimum width of reservation must not be less than *4 ft.* so that there is no risk of the overhanging chassis or loads of passing vehicles coming into contact. But in a heavily trafficked road there is difficulty, if the width is as narrow as this, if opening have to be provided for vehicular access between the two carriageways. Unless the width is between *15 ft. and 20 ft.* a vehicle standing in the opening will project into a carriageway and obstruct other traffic. To avoid delivery vehicles serving premises on both sides of a dual carriageway having to make the added journey to a roundabout an opening may be provided about 100 ft. from the end of the reservation.

(b) **Road junctions** require very careful consideration. Where the traffic is heavy the remedy is usually some form of roundabout with or without grade separation.

* * *

Care should be taken that traffic roundabouts are sited with regard to the levels. Roundabouts situated on land with a cross fall are very difficult to design to give easy transition from one road to another.

Where a traffic road also serves as an access road to shops or offices the theoretical carriageway widths already mentioned may have to be increased to form a waiting lane alongside the kerb. This waiting lane can also be used for accommodating omnibuses at stopping places. * * *

(c) **Industrial roads** require a strong foundation and a surface suitable for either horse-drawn or other vehicular traffic. Carriageways should be sufficient for the needs of traffic but, generally speaking, a waiting lane should not be necessary. The industrial buildings should have loading docks so designed that standing vehicles can be drawn clear of the highway in order that even the passage of pedestrians is not interfered with. If standing vehicles outside the building are going to be necessary then the firms concerned should provide service roads.

Kerb radii at road junctions should not be less than 40 ft.; large vehicles and trailers will then not require to swing out when turning the corner.

(d) **General business streets** will be those in office zones and where wholesale warehouses are concentrated. In these zones wide carriageways are desirable so that parking for limited periods may be allowed. The warehouses should, of course, provide loading docks.

(e) **Residential streets**—Apart from those carrying omnibus traffic—are in effect service roads carrying local traffic of a domestic nature; the milkman's lorry, the bread van, the doctor's car, the cleansing department vehicle. The main requirement of these roads, therefore, is that they shall provide frontage for houses. It follows that the combined layout of roads and houses should ensure that no lengths of road serve only as a traffic link.

The gradient is not so important as on a traffic road. Housing estate roads may be as steep as 1 in 15, although such slopes should be avoided if possible, as they cause difficulties in the treatment of roof and floor levels.

* * *

Footpaths should not be less than *5 ft.* in width to enable two parambulators to pass with ease. The footpaths should be paved; concrete flags are most satisfactory if the paving has to be disturbed to obtain access to services.

* * *

Where traffic is light, a 16 ft. wide carriageway may be sufficient but 18 ft. is preferable; in fact 12 ft. is adequate for a short cul-de-sac provided it has a proper turning place. Kerb radius should be not less than 20 ft. at junctions and turning places. At road junctions 20 ft. radius should be sufficient, otherwise the area of carriageway becomes unnecessarily large. For example, 30 ft. radius kerb at a right-angled intersection means an increase of nearly 50 sq. yards in the area of carriageway compared with a junction having 20 ft. radius returns.

(f) **Shopping streets** require adequate footway space and accommodation for waiting vehicles. The ideal treatment for shops is a service carriageway but this may not be always feasible. Where the traffic is heavy on a single carriageway street the carriageway should be 44 ft. wide with island refuges in the centre spaced about 40 yards apart. In new development where a service road is not provided, a back access road should be constructed so that goods can be delivered to the shops without interfering with customers' cars or with passers-by on the footway.

Where a row of shops fronts a residential street the carriagway should be widened to provide a waiting lane.

(g) **Pedestrian Ways** should be constructed in multiples of 21 ins. for each "traffic" lane, but with a minimum width of 7 ft. In residential areas they may be flanked with grass verges and a few seats might be provided. Where it enters a heavily trafficked road the end of the "way" should be stopped with a barrier on the kerb line so that children will be slowed up to prevent them running out on to the road. Where steps are necessary the risers should not be more than 5½ in., and a handrail should be provided down the centre.

If a pedestrian way—as in an arcade—is flanked with shops on both sides it should not be less than 20 ft. wide. This width will prevent any feeling of conges-

* Extracts from a Paper by Herbert J. Manzoni, CBE., MICE., MIMunE., MTPI., City Engineer and Surveyor, Birmingham at the Public Works and Municipal Services Congress, London, November 17, 1950.

tion and will provide space for window gazing and 4 rows of pedestrians on each half.

* * *

(h) **Rural roads** should not only be designed and sited to suit the traffic requirements of the district but also with an eye to the preservation of its amenities.

* * *

A Class I or Class II road or a trunk road passing through a hamlet or village should have footways constructed on the frontages to buildings. If the provision of footways will reduce the width of the carriageway to an undesirable extent then the village should be by-passed. Of course a heavily trafficked road should, if possible, always be diverted round villages. If there is an omnibus service "lay-byes" must be provided at omnibus stops.

In view of the permitted width of public service vehicles having been increased from 7 ft. 6 in. to 8 ft. carriageways of roads linking up villages should not be less than 20 ft.

Main Laying

Apart from being made wide enough to suit the pedestrian traffic, footways and verges should be wide enough to accommodate the mains expected. It is most undesirable for service mains to be laid under the carriageway.

Subways for mains are likely to prove expensive but they may be justified at road junctions to avoid having to open up the carriageway for repairs When new roads are constructed, ducts—of stoneware or steel tubing—may be laid under the carriageway at junctions to provide for future needs.

* * *

Safety

Vehicular safety is looked after by provision of dual carriageways, properly designed curves, adequate lighting, efficient signposting and provision of proper warning signs, and last but not least the provision of a non-skid surface.

The only efficient method of ensuring the safety of pedestrians is by their complete segregation from other forms of traffic. This can be done in the country by siting footways behind a hedge so that pedestrians cannot step directly into the path of an approaching vehicle.

In towns and villages guard rails along the edge of the footway will serve the same purpose but unfortunately the need to maintain access to frontage property causes complications.

* * *

Perhaps the greatest problem is to provide for pedestrians wishing to cross the carriageway. How can they do so with safety to themselves and without undue interference with vehicular traffic? The ideal method would be to ramp the footway down gradually to a level sufficient to permit a subway being constructed under the carriageway; or conversely, to lift the carriageway to a height sufficient to give the necessary headroom for a pedestrian under-pass.

The difficulties in this ideal are the length of the ramps required for gradients of, say, 1 in 15, and the difficulty in dealing with shops.

Where the distances between road junctions are comparatively short, ramped approaches to subways at each junction will mean that practically the whole footpath is sterilised against access from the carriageway, and goods and passengers must be unloaded elsewhere than directly opposite the shop door required.

To reduce the length of approaches, flights of steps can be provided but even with guard rails it is possible they will not be used. Much thought is still required to produce an attractive method of leading pedestrians to subways.

Bridges for pedestrians can only be practicable in open country unless they are incorporated with continuous verandahs to the buildings with access within the premises.

Conclusion

There have been probably fewer alterations in road layout during the past 15-20 years than there have been in the technique of construction.....New roads should be planned and designed so that in location and construction they will be economical in vehicle fuel, cheap in maintenance, and the initial cost and consequent loan charges kept as low as possible. In this the members of the town planning profession must play their part in collaboration with the highway engineers who will have to construct and maintain the new roads in town and country.

GAUTAMI BRIDGE AT ALAMURU*

Decisive Model Investigations

[*From the Central Board of Irrigation Journal, July 1950*]

THE Government of India have proposed construction of a road bridge on National Highway No. 5, Madras-Calcutta line, across the River Godavari in Madras State. Based on various economic and engineering considerations it is proposed to have two bridges on the Gautami and Vasista branches of Godavari River instead of having a single bridge across the Akhanda Godavari. Model experiments were conducted with a 1/330, 1/50 scale model of Gautami River to investigate the problem under the following terms of reference:—

(a) to finalise the bridge site within a furlong upstream or downstream of the proposed bridge site (12/6 mile 295 feet GLB) and (15,4 mile 495 feet GRB) at Alamuru, 12 miles downstream of Dowleshwaram anicut;

(b) to determine the exact orientation of the bridge;

(c) to determine the waterway through the bridge; and

(d) to design suitable protection works for the bridge.

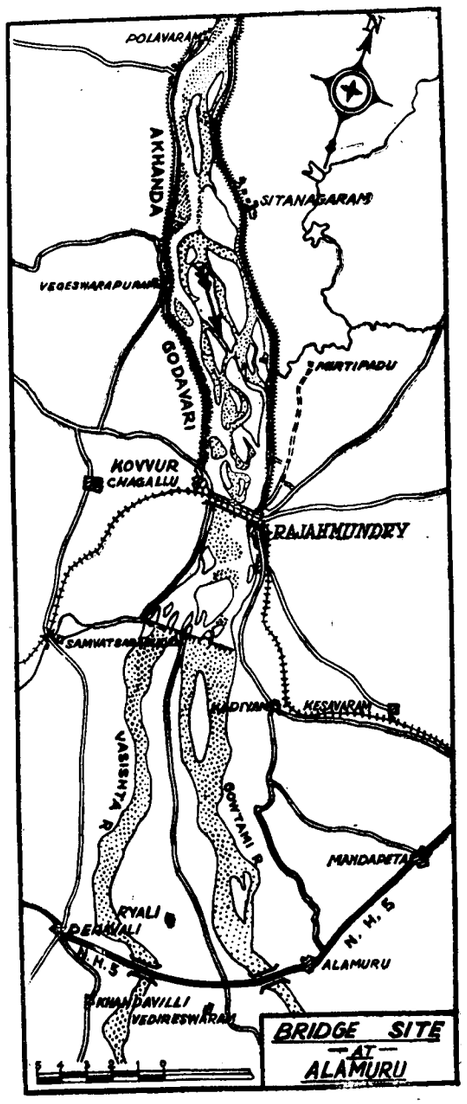
The River Godavari in its deltaic region assumes the peculiar features of an alluvial river and the various ways of solving bridge problems of alluvial rivers were, therefore, tried in the model. The model studies indicated the following solutions:

(a) There exists a better site upstream of the one proposed at Alamuru, but under the limited scope for choosing a site the proposed site at Alamuru was confirmed.

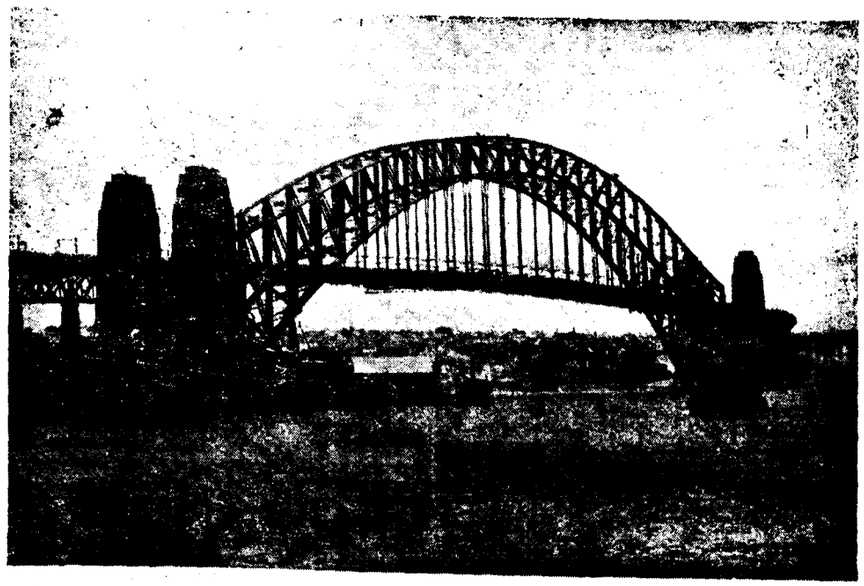
(b) The orientation of the bridge was changed to (12/6 mile 295 feet GLB) - (15/4 mile 495 feet GRB).

(c) The model investigations indicated in favour of constricting the waterway through the bridge which was the chief controversial aspect of the problem. As against the total flood width of 8,600 feet at the bridge site, only 4,040 feet of waterway through the bridge was recommended with the right abutment located near the present cutting edge of the right marginal bank.

(d) 3,000 feet long guide **bund** of Bell's type on the left flank and marginal stone revetment and a falling apron on the right marginal bank were recommended as bridge protection and river training measures. The design of additional protection works is being studied in the model.



* By courtesy of the Secretary, Central Board of Irrigation.



Sydney Harbour Bridge, South Wales the longest steel arch span in the world.

MAIN ROADS—NEW SOUTH WALES ORGANIZATION AND ADMINISTRATION

[Contributed by an officer who received a fellowship training in Australia in 1949—50]

Geography and the Roads

NEW South Wales is a State in the south-east of Australia. Topographically it consists of four well-defined belts, each parallel to the east coast :—

(a) A narrow coastal fringe consisting partly of river plains and partly of poorer tree covered hills; the principal rural industries are dairying and timber extraction ;

(b) A belt of table land averaging 2,000 to 3,000 ft. in height and largely devoted to sheep and cattle rearing ;

(c) A belt of undulating country or "slopes" with a moderate rainfall and devoted to growing wheat, rearing sheep, and, to some extent, raising cattle ;

(d) A vast area of semi-arid plains on the west covering almost half the State and devoted to sparse grazing of sheep.

The densest rural population is on the coastal belt specially in the nothern half. The population of this belt comprises nearly 75 per cent of that of the whole State. Here also are the cities of Sydney (the State capital), New Castle, Wollongong, and Port Kembla.

Considerable road development is required for connecting these cities in the coastal area with each other and for linking this area with the hinterland. This involves heavy work in rough county. The problem in the inner zones, specially beyond the wheat areas, is that of building roads over long distances to serve a sparse population.

Development of Roads

In 1858 the Government passed the "Main Roads Amendment Act" setting out a list of the main roads (mere tracks at that time) and accepted the reponsibility for maintaining them and providing funds from the Consolidated Revenues aided by tolls.

Upto 1910 the road system continued to be in an undeveloped state in the hilly parts and the arid regions of the west. Hard surface roads were little known. The roads were narrow tracks, consisting mainly of earth formation with steep grades and bad alignments. After the rains every year it was almost impossible to travel on these roads.

The total number of motor vehicles registered in New South Wales in 1910 was 4,478 (65 per cent cars and 35 per cent motor cycles). Till 1910 there were no commercial vehicles registered in New South Wales.

Slow Legislation

The realisation that the roads needed special attention came in 1909 and suggestions were made to set up an independent organization to deal with the Main Roads. The Main Roads Bill was drafted the same year but came up before the Parliament only in 1912. It took twelve long years to pass the bill which came into force on the 1st January 1925.

Organization of the Department of Main Roads

The Chief Engineer's office set up under the Act is divided into a number of sections which are located at the head office at Sydney and exercise control through the divisional offices which, in turn, have local offices under them.

The functions of the sections are described below :—

(1) Road Construction Section :

Organization and control of road construction works ; examination of new proposals ; and preparation of annual programme of work.

(2) Road Maintenance Section :

Similar functions with regard to maintenance.

(3) Bridge Section :

Design of bridges ; organization and control of bridge construction, and bridge and ferry maintenance ; examination of new proposals and programme of work.

(4) Road Design Section :

Examination of plans for road work after locations have been determined by the Investigation Section ; preparation of standard specifications.

(5) Road Investigation Section :

Investigation of immediate and long range proposals ; investigation of locations and capacities for particular roads.

(6) Plant Section :

Purchase, registration, insurance, numbering, hiring, inspection, transfer and repair of plant and vehicles ; design of certain items of plant and equipment and preparation of specification for the purchase and manufacture of new items ; central workshops.

(7) Material Section :

Testing of materials ; research.

(8) Survey and Property Section :

Surveys for the acquisition of land ; preparation of standard widening plans, plans for alignment or re-alignment, and resumption and transfer plans ; preparation of plans, specifications and estimates for new buildings, and the removal of existing buildings.

(9) Library and Plan Room :

Receipt, registration, and issue of plans, specifications, photographs, library books, and publications.

(10) Helio Room :

Photography, reproduction and mounting of plans, etc.; book binding.

(11) Film Section :

Production and exhibition of technical films ; taking photographs of works under execution for keeping a running record of various stages of progress.

(12) Clerical Section :

Correspondence ; general administration ; maintenance of statistics.

(13) Costs Section :

Examination of detailed estimates ; analysing progress and final costs of works.

Divisional Offices

Twelve divisional offices were established in 1928 for providing ready contact with councils (corresponding to our "District Boards", and their officers and for facilitating the supervision and control of works throughout the State. Contact with the Councils except on matters of policy, is maintained directly by the divisional engineers.

Day labour works are carried out through **the local offices** which are under the charge of assistant engineers just like P. W. D. Sub-divisions in India.

The Secretariat Wing

The **Legal Section** administers the legal machinery for the resumption or purchase of property ; prepares contracts for the sale or lease of land for carrying out works ; prepares cases involving legal proceedings by or against the department, and drafts new Main Roads legislation, ordinances, and regulations.

Survey and property Section initiates action for the purchase of land, controls property acquired in connection with road proposals ; negotiates the disposal of residences.

Purchasing Section deals with the sale and purchase of stores and materials and maintains a record of surplus items available for transfer from one work to another.

Industrial Section deals with industrial disputes ; interviews and appoints employees up to the status of a ganger (mate).

Staff Section corresponds to the administration branches in Government offices in India.

Central Records Branch receives, registers, and files inward correspondence ; routes all files between officers.

Heavy work in Rough Country

Head Office Garage where vehicles, with or without drivers, are kept for use by officers on duty.

Accountant's Branch :

Examination Section deals with claims for wages and for supplies and services rendered to the Department.

Bookkeeping Section maintains particulars of the Department's receipts and payments, the operation details of all units of plant and vehicles ; and particulars of the Department's assets and liabilities.

Stage Construction of Roads

The Department has adopted and follows a policy of stage construction of roads, beginning with only an earth road and developing gradually to higher types according to the needs of the traffic.

Twenty-five years experience has justified the adoption of this policy which applies not only to roads but also to bridge construction.

The Main Roads System

The Main Roads are classified into the following types :—

(1) **State highways** which are the main arterial roads on which the whole network of roads is based.

(2) **Trunk roads** which connect the State highways and complete the highway framework.

(3) **Ordinary Main Roads** which connect towns with state highways or trunk roads.

(4) **Secondary roads,** round about big towns (like Sydney) meant to relieve the Main Roads of heavy traffic.

(5) **Developmental roads** which are short lengths built to develop particular areas by connecting them to a railway, a port, or a Main Road.

Traffic Determines Standards

The design standards adopted for roads depend upon the volume and type of traffic

Long roads serving sparse population

and not on classification. Many miles of State highways in the western division are mere cart tracks, without any formation even, because traffic on these sections is quite insignificant.

The following table shows the growth of Main Roads mileage from 1925 to 1949 :—

Year.	Total Mileage.
1925	12,840
1928	13,490
1949	22,971

Relationship with Local Councils

The State of New South Wales is divided into shires which correspond to districts in India. Each shire is governed by an elected council. Similarly big towns have municipal councils. The roads lying within the area of a shire or municipality are looked after by the respective council. The main function of the Department of Main Roads is to assist and advise the Local Councils financially and technically in respect of Main Roads work. The Department will carry out a work directly only when the local authority shows its inability to do it and requests the Department to carry it out. This happens when a local authority does not have skilled staff or equipment to undertake the work. This system of distribution has worked very effectively so far.

In the case of State highways, however, the Department has direct control on a considerable length. For instance, on the 30th June 1948, 85 per cent of the Main Roads system was under the control of local authority and the remaining 15 per cent under the direct control of the Department (State highways formed 28 per cent of the Main Roads system).

An important feature of the system of partnership described above is the transfer of officers between the engineering services of the Department and the local authorities. Young engineers join the Department, gain experience in the office and in the field, and after a few years join the Councils as engineers.

"Needs of Traffic."

Courtesy, the Watchword

The authorities of the Department are very particular in maintaining good relations with the Councils. The Department's officers are advised to extend the utmost courtesy and assistance to the Council's officers and to deal promptly with all matters raised by the Councils by correspondence or otherwise.

According to one Department instruction "The officers of the Department are obliged in the discharge of their official duties to disregard any personal convictions, political or otherwise. They are required always to act with strict impartiality and at the same time in conformity with the Government's and Department's expressed policies.

"Officers should be courteous and patient in their dealings with the public and, above all, should display a cheerful readiness to assist on all occasions. It should always be remembered by the officers of the Department that they are working for the common good and that they are servants of the public, not in the sense of servility but rather in the sense of helpfulness. Any suggestion of superiority or condescension on the part of the officers in their dealings with others is to be serupulously avoided and, short of divulgence of confidential information, officers should explain the reasons for the Department's actions where that may be necessary."

Good Work: The Best Form of Publicity

"While it is not the policy of the Department to seek publicity it does not wish to give cause for criticism.

* * *

"To a large degree the goodwill of the public towards the Department must arise from the satisfactory condition of the Main Roads and the manner in which the works on those roads are carried out."

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POLITICIAN

Mr. Barnes speaks with an attractive half-smile on his face all the time, but his words are the fluent and rapid abstractions of the professional politician; he gave the impression that he could have spoken for several hours more, if necessary, **without adding anything to what he had already said**. *His ratio of abstract nouns to brasstack facts is too high.*

(Extracted from 'Motor Transport'—Nov. 18, 1950)

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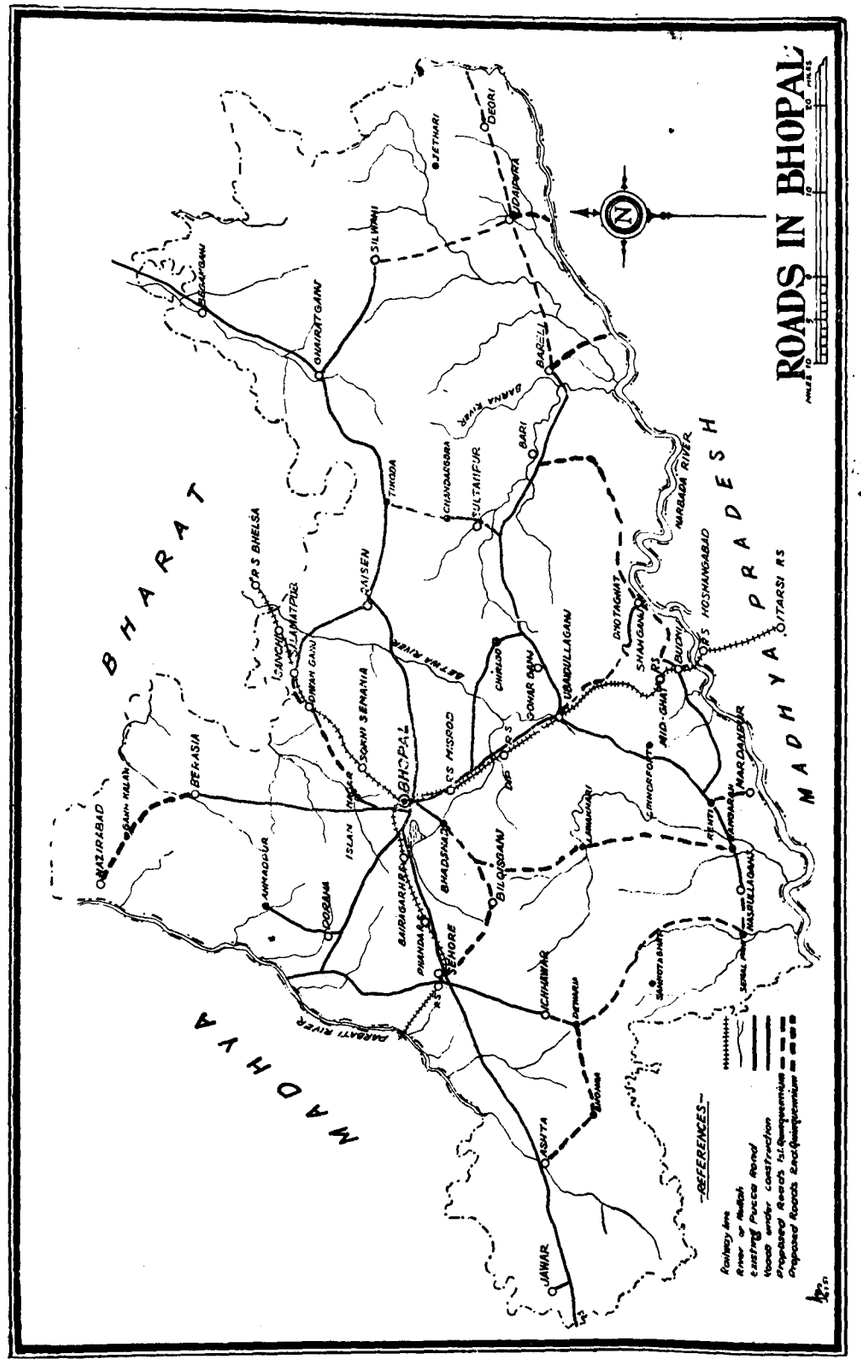

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ROADS IN PART 'C' STATES—BHOPAL

Formerly an Indian State in Central India, BHOPAL was integrated with the Indian Union in May, 1949 and has since been centrally administered by the Government of India through a Chief Commissioner. The capital town, Bhopal, is an important railway station on the G. I. P. Railway, midway between Delhi and Bombay.

Area and Contours

The area of the State of BHOPAL is 6,918 sqnare miles, two thirds of which is part of a wide table land with a mean elevation of about 2,600 feet above the sea level and the rest is hills. The table-land called the MALVA PLATEAU consists of vast rolling plains spotted with flat topped hillocks. The soil is black cotton. The land is very fertile and highly developed agriculturally. On the eastern side the rolling and undulating MALVA PLATEAU yields place to a level plain, not so fertile and generally of red colour. In the hilly tracts there are forests of tall trees and thick under-growth.

Hills and Rivers

A prominent range of the VINDHYAS runs right across the State, west to east, and forms the water-shed. From the northern slopes of it rise the BAITWA and the PARBATI rivers, which run ultimately into the GANGA. From the southern slopes several steep, swift and flashy torrents such as the Kolar and the Barna rise and after a short but vigorous career fall into the NARBADA.

Rainfall

The monsoon comes to BHOPAL in the middle of June. The annual rainfall is approximately 30 inches on the plateau and 50 inches on the hills.

Population

There are 17 towns and a little less than 3,000 villages in the State. The total population of the State is nearly 8 lakhs, more than 80 percent of which is rural. Agriculture is the principal occupation of the people.

Materials of Construction

The geology of BHOPAL yields good hard trap and fairly hard sandstone for road making. Red sandstone is used for masonry works and is popular for its ease of working and beauty of colour. Moorum is available everywhere and is used for surfacing metalled roads. Sand and bajri can be collected from the beds of rivers and streams. Lime is rather scarce and, therefore, cement is generally used instead. Cement comes from the BANMORE and KYMORE factories. "C. P. Teak" is in abundance. Average rates are :—

Road metal, Rs 25/- per 100 cubic feet;
Cement, Rs 5-8-0 per bag;
Lime (where available), Rs 50/- per 100 cu. feet.

Tools and Plant

Comparatively speaking BHOPAL is well-equipped with road making tools and plant. The P. W. D. possesses the following equipment in good working order :—

Road Rollers 17; Stone Crushers 3; Concrete Mixers 4; Tractors 2; Graders 2; Scraper 1; Lorries 3; Hand and Power Boring Plant 3 sets.

As regards new tools and plant to be purchased now the State requires, among other minor things, three rollers, a welding plant, a portable compressor and a few tar sprayers.

Existing Roads

No National Highway passes through the State of BHOPAL. The DEWAS-BHOPAL-SAUGOR road, however, is of inter-State importance. It is an important link between two National Highways, namely, No. 3 and No. 26. This road, stretching right across the State, in a length of 144 miles forms the back-bone of BHOPAL's road communications. Several other roads radiate from BHOPAL in all directions. The total length of hard surfaced roads in the State is 425 miles. Most of this milage is made up of water-bound macadam roads. About 35 miles are black-topped and further black-topping is in progress. There are

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largish tracts in the southern parts of the State i.e., in the fertile valley of the Narbada where all-weather roads do not exist.

Maintenance of Roads

The standard of maintenance of the existing roads has not been good in the past. Even the most important road, namely, DEWAS-BHOPAL-SAUGOR road, has badly suffered from neglect and long stretches of it are so rough and rutted that one wishes to drive on the berm rather than on the hard surface. There being a great deal of maintenance work in arrears, earnest attempts are required to catch up as quickly as possible. But hasty work, of which there has been some evidence recently, must be avoided. For instance, the consolidation of a mile is done in 10 days and this does not produce satisfactory results. The hard trap metal of BHOPAL requires prolonged rolling, i.e., 16 to 20 days per mile, for good consolidation.

The Chief Engineer has chalked out a programme of repairs somewhat as follows:—

Ordinary repairs during 1950–51, 1,015 miles (road gangs, moorum topping, berm filling, etc.)	Rs 3,34,476
Renewal, 56 miles	Rs 2,44,956
Collection of metal for the next year, 81 miles	Rs 2,43,000
Special repairs to bridges, culverts etc.	Rs 30,000
Total	Rs 8,52,432

With four years of work of such planned maintenance the roads of Bhopal may be expected to vie with those in many other States of India.

Inspection Houses

There are hardly any Inspection Houses in the State and facilities of staying out during inspections are lacking. Since officers have to return to the headquarters (Bhopal) on each occasion, inspection of works is done in a hurry. A start has been made by sanctioning the construction of a rest house at Ghairatganj on the DEWAS-BHOPAL-SAUGOR road. Several other rest houses will have to follow.

Bhopal's Road Development Plan

A first stage examination of the problem has shown that nearly 350 miles of new Roads are required to improve the State's economy. But the Five Years' Plan, which is now under consideration of the Planning Commission, envisages the construction of about 110 miles of new roads at an estimated cost of Rs 50 lakhs. Also, about 40 miles of new roads, estimated to cost about Rs 20 lakhs are already under construction. The average annual expenditure on roads during the next five years is expected to be of the order of Rs 8 lakhs on maintenance and Rs 10 to 15 lakhs on development works. The development works will, apart from the construction of new roads mentioned above, include the upgrading of surfaces of some of the existing roads as also the construction of some important bridges on them. The P. W. D. of BHOPAL is well staffed and equipped for this programme. A few temporary officers may have to be employed for the new projects.

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WORRYING

"Doctor, I've been losing my hair."

"But, my good man, I'm not a scalp specialist. I'm a dentist."

"I know it. I've been losing my hair worrying about losing my teeth."

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SOURCES OF ENERGY

[From "Civil Engineering"—September, 1950]

"At present rates of production the quantity of petroleum oil is sufficient for the world's needs for only about 25 years." This was said by Dr. A. Parker, C. B. E., Director of Fuel Research, D. S. I. R., during a British Association lecture at the Midland Institute, Birmingham. He was speaking on "Man's Use of Solar Energy" and he added that even with new resources which will almost certainly be discovered there will probably be difficulty within 50 or 100 years in meeting world demands for petroleum.

Dr. Parker said that the earth has received and is still receiving an enormous amount of energy from the sun. This energy is available in two forms, "capital" and "income." In the energy capital, there is the terrestrial heat with which the earth was originally endowed by the sun, and there is the store of fossil fuels-coal and lignite, petroleum and natural gas, oil shale, and peat. Of the known resources of fossil fuels, which are equivalent to six million tons of coal, 97 per cent occurs as coal and lignite, 1 per cent as peat, and less than 1 per cent as petroleum and oil-bearing shale. At present rates of production, the coal and lignite which can be produced economically are sufficient for the world as a whole for 2,000 years.

In the U. S. A. and the U. S. S. R., the reserves of fossil fuels are sufficient to maintain the rates of production in those countries at a reasonable price for 2,000 years. The position in Great Britain is not nearly so favourable. Already the most easily accessible seams of coal have been exploited to a considerable extent, and difficulties of mining are gradually increasing. Known reserves that can be won economically will provide coal at the present rate in Great Britain for 200 or 300 years. Our indigenous petroleum would meet our needs for only two or three weeks.

Income of energy being received by the earth from the sun, after allowing for that radiated and reflected back into space, is equivalent to 8,000 times the heat of combustion of the world's annual production of coal and petroleum at the present time. This income of energy is used by nature's methods to provide vegetation and animal life, and potential wind and water power. The food consumed by the population of 2,200 million has an energy value equal to more than 300 million tons of coal a year. It is not always realised that wood used as fuel is equivalent to 200 million tons of coal a year.

The coal equivalent of all the energy resources—capital and income—being harnessed and used by man to meet his needs is about 3,200 million tons a year, of which 10 to 20 per cent is as food for men and animals, 40 per cent as coal and lignite, nearly 30 per cent as oil and natural gas, 6 per cent as wood fuel, and 5 per cent as water power.

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HERE AND THERE

1. HIGHWAY CONSTRUCTION COSTS

REPLYING to the debate, Lord Lucas, Parliamentary Secretary to Ministry of Transport, gave some interesting figures of highway construction costs. Thus, a 22 ft. single carriageway costs anything from £ 50,000 to £ 100,000 a mile, and a dual carriageway from £ 100,000 to £250,000, or £ 300,000 a mile where substantial bridge works and fly-overs are concerned. The proposed new motor roads are estimated to cost from £ 150,000 to £ 160,000 a mile, the approximate total cost being £ 120 million for 809 miles of road.

Lord Lucas reminded the House that £ 300 million had been spent on roads since the war and they had "absorbed the money like so much blotting paper." What he termed commercial traffic had increased by 60 per cent and buses and coaches by 35 per cent compared with pre-war, although traffic as a whole had increased by only 7 per cent.

(Extracted from 'Modern Transport-' Feb. 10, 1950)

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2. DANGERS OF "THUMBING"

"HITCH-hiking" is now prohibited by law in 26 States and the District of Columbia. Generally, these laws specifically ban soliciting rides, or standing in a roadway for the purpose of soliciting a ride, although in Washington the state statute also prohibits drivers from picking up "hitch-hikers."

The purpose behind the passage of the anti-hitch-hike laws has been to protect the motorist as well as the "thumber." A motorist who carelessly picks up a hitch-hiker runs two very definite risks: (1) he may subsequently find himself sued for alleged "injury," or (2) he may wind up as the victim of robbery, physical violence or murder. The "thumbers" also run the risk of being robbed and assaulted by motorists who give them a lift, as well as of being picked up by a careless or drunken driver, and of being killed or injured in a traffic accident.

(Extracted from "Highway Research Abstracts" March, - '51)

3. PROGRESS OF BRITISH ROAD SERVICES

ACCORDING to a statement issued by Lord Hurcomb, G.C.B., K.B.E., Chairman of the British Transport Commission, the organisation of British Road Services is, in general, complete, and it is expected that this year will be one of consolidation. The work carried out so far is considerable as, during the last three years, some 2,900 separate road-haulage concerns have been merged into a national network comprising of 40,000 vehicles; these are based on 1,000 depots and sub-depots and, in all, employ approximately 75,000 persons. The units, of course, vary in size but usually consist of 100 to 200 vehicles, which is considerably greater than the fleets operated by the average haulier. During 1950, the total number of vehicles operated fell by 0.3 per cent but the total monthly tonnage lifted increased by 6 per cent to 3,700,000 tons in November, and the loaded miles run by 20 per cent. Furthermore, out of 59,000,000 miles run by the British Road Services lorries in November, only 10,000,000 miles were run empty.

The organization has now reached the stage when the Executive are confident that they can take over the 5,000 or more original permits and these will not be renewed when they terminate in the near future.

(Extracted from 'Engineering' - Jan. 19, 1951)

4. NO NEW STEEL FOR CERTAIN TYPES OF CONSTRUCTION

GOVERNMENT controls on the use of steel were announced last December by the Rt. Hon. C. D. Howe, Canada's Minister of Trade and Commerce.

The use of new steel is prohibited in construction for amusement or recreational purposes or for the manufacture of liquor, beer, wines, cigarettes, cigars, soft drinks or confectionary.

Under the heading of "amusement purposes" the new regulations include theatres, dance halls, amusement parks, recreation clubs, holiday camps, arenas, rings, stadia, race-tracks, bowling alleys and exhibitions. Outdoor advertising signs also come under the ban.

(Extracted from 'Roads & Engineering Construction' - December, 1950)

5. ENGINEERING AND THE ARTS

A study of the meaning of words is much needed in the engineering profession. Take, for example, the following definition from a recent British Standard Code prepared by a committee of engineers: "Folding wedges. Wedges used in pairs, folding over each other and driven in opposite directions in order to hold or force apart two parallel surfaces." First, it is not possible to fold wedges over each other, although it is a simple matter to fold (or place) one above another. Secondly, by the use of the word "over," the definition takes no account of folding wedges used between vertical surfaces, where they lie side by side. Thirdly, it is sometimes better to drive one of the wedges in one direction only. And, fourthly, there is no reason to restrict the number of wedges to two if, as is sometimes the case, three would be better.

In the same code a manhole cover is defined as a casting, although it is hardly likely that it is intended that pressed steel covers shall never be used. Such misuse and carelessness in the use of words are no doubt among the reasons that cause non-technical people to doubt the wisdom of engineers and scientists; for how, it may reasonably be asked, can wisdom be present in persons who cannot say and write what they mean?

(Extracted from 'Concrete & Construction Engineering'—October, 1950).

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6. LATERITES AND THEIR USE AS ROAD BUILDING MATERIALS

FROM a study of the properties, development, and occurrence of laterites, it is concluded that: (1) Lateritic clays are excellent binders for soil stabilized roads. (2) Bituminous binders adhere well to lateritic rocks and it is possible to obtain excellent bituminous macadam and bituminous stabilized soils. (3) Compact lateritic rocks are strong enough to be used as broken stone and chippings for road building purposes.

(Extracted from 'Highway Research Abstracts'—September 1950).

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7. WHAT IS A STANDARD?

A **Standard is**

a verbal (oral?) or written formulation, or a physical representation in the form of a graph or sample or model,

which serves to define, or designate, or specify certain features (or basis of measurement) of

a unit, an object, an action, a process, a method, a practice, a capacity, a function, a performance, a measure, a quantity, an arrangement, a condition, a duty, a right, a responsibility, a behaviour, an attitude, a concept or a conception, or a combination of any of these,

with the object of promoting economy and efficiency in

production, disposal and/or utilization of goods and services

by providing a common ground of understanding

among producers, dealers consumers and technologists.

(Extracted from 'ISI Bulletin', Delhi—April 1951)

8. WATER DIVINING

A very interesting series of tests was carried out in 1913 at Croyden to determine once and for all the true scientific value of water divining, seven water diviners being examined separately by seven leading authorities on water supply, three pieces of land being chosen for the experiments. The first was on water-bearing strata, a large sewer running through the plot and known only to the experts, the second was a lawn hiding a reservoir, through which water flowed, and the third was a field about 100 yards wide and 250 yards long, with a very strong spring 15 feet below the surface. This was discharging water at 50,000 gallons an hour, another fact known only to the expert.

On the first site no diviner spotted the sewer. On the second, only one diviner found water in the middle of the underground reservoir. On the third, only one diviner got near the hidden spring. The Committee wrote as follows :—

".....wherever sensitiveness to underground water may exist in certain persons, of which some evidence has been given, it is not sufficiently definite and trustworthy to be of much practical value. Moreover, the lack of agreement with each other shows that it is more a matter of personality than any direct influence of the water. Tbe diviners, as a rule, confine their attention to small streams of water and as there are few places where these cannot be found, they may well show a large percentage of success."

* * *

(From an article on "Modern Methods of Exploiting Water Resources"—'Machinery Lloyd', Jan. 6, 1951.)

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9. TRAFFIC IS BEING STRANGLED

" More Than Smooth Surfaces Wanted "

* * *

MAJ. Aldington said that the public had been blinded in the past by the excellence of the smooth, modern road surface but, he said, something more than smooth surfacing is required to obtain the fullest economic benefit and advantage from transport. "It is essential that our internal transport costs should be cut to the minimum," he said. "We have to export to live, and our transport system should be so organized to encourage goods to flow by the most efficient and economical form of transport, whether by road or rail, by permitting the overall economic factors to operate freely."

Dealing with traffic difficulties, Major Aldington said that in general the larger the town the larger was the proportion of converging traffic having business in it and, conversely, the smaller the town the larger the proportion of traffic wishing to by-pass it. It had been estimated, broadly speaking, that in the case of towns of upto 10,000 population on important through traffic routes, upto 75 per cent of the converging traffic was " by-passable," whilst in the case of large towns of 500,000 to 1,000,000 population or over, only 5 to per cent of the couverging traffic was by-passable. A by-pass was the solution in the one case and a ring road in the other.

(Extracted from 'Motor Transport'— January 6, 1951).

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10. pH MEASUREMENT OF SOIL, ETC.

(Patent No. 628,840
Marconi's Wireless Telegraph Co. Ltd. and C. P. Fagan).

THE usual delicate glass electrode is quite unsuitable for the direct measurement of pH of soil and samples must be taken from the field and tested in the aboratory. A suitable electrode structure has been designed, however, consisting of a stainless steel cylinder, inside which is fixed a central electrode rod composed of 97 per cent antimony and 3 per cent lead. The pointed end of this rod protrudes slightly from the sealing ring of the cylinder, which ring is made from sintered glass.

The circular space inside the cylinder is fitted with saturated potassium chloride electrolyte. The top of the cylinder is tapered off and is attached to a flexible copper tube, the other end of which is fixed to the instrument case. Inside the latter is the usual electrometer measuring apparatus and also a reference cell communicating with the electrolyte in the electrode cylinder by a rubber pipe passing down inside the flexible copper tube in which there is also located the insulated connection to the central electrode. Such an assembly, it is claimed, is sufficiently robust, to be used in the field and yet can be made with a total weight of only about 10 lb.

(From " Instrument Practice " Nov. '50)

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11. FRENCH ENGINEERING NEWS

THE Societe de Transport et de Manutention Industrielle has constructed a railway truck built entirely in light alloy. The total weight of the truck is 15 tons, and it will carry a load of 65 tons (i. e., four times the tare), compared with a load of 55 tons carried by steel trucks weighing 25 tons. The alloys used were as follows:— for cast parts "A-U 5 G T" (containing aluminium, copper, magnesium and titanium), with a density of 2.75 (against 7.8 for steel) ; for sheeting "A-U 4 G," and for the chassis, which was designed to avoid corrosion and to facilitate repairs, "A-G-5" (containing magnesium).

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

[*Why do railways not make lighter coaches and use rubber wheels ? .....Ed.*]

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MEMORY

Actors must have good memories. The following paragraph was used by the actor Foote to test the memory of brother actors. Many failed to commit the words to memory properly.

" So she went into the garden to cut a cabbage leaf to make an apple pie; and at the same time a great she-bear, coming up the street, popped his head into the shop. 'What! no soup?' So he died, and she very imprudently married the barber; and there were present Picninnies, and the Jobillilies, and the grand Panjandrum himself, with the little round button at top, and they all feel to playing the game of catch-as catch-can, till the gun powder ran out at the heel of his boots."

CHILD IS THE FATHER OF MAN

Customer: *I hear my son has owed you for a suit for three years.*
Tailor: *Yes, Sir; have you called to settle the account?*
Customer: *No, I'd like to have a suit myself on the same terms.*

CIVIL WORKS BUDGETS 1951-52

Madhya Bharat

THE following extracts relating to Civil Works Budget Estimates of the Madhya Bharat State for the year 1951–52 have been taken from the General Budget of the State for that year.

Particulars	Actuals 1949-50	Revised Estimate 1950-51	Budget Estimate 1951-52
I. Revenue (Civil Works)			
(i) Rents	1·32	1·76	2·00
(ii) Ferry Receipts	·26	0·9	.20
(iii Receipts from Workshops	·10	·39	·10
(iv) Recoveries of over payments	·14	·04	—
(v) Miscellaneous	4·03	3·05	3·45
(vi) Collection of payments for Services rendered	·26	·01	·20
(vii) Receipts from the Road Fund—Gwalior	—	2·61	2·00
(viii) Route Taxes	·26	—	—
(ix) Water Works Receipts	2·35	—	—
(x) Deduct Refunds	—	—	– ·05
Total Revenue	8·72	7·95	7·90
II. Expenditure (Civil Works)			
(i) Original works	26·34	31·92	68·80
(ii) Repairs	43·32	45·55	41·48
(iii) Establishment	8·72	10·77	11·16
(iv) Tools & plant	1·38	0·91	1·00
(v) Suspense	2·27	2·40	—
(vi) Furniture for the Residences of the Hon'ble Ministers and Contract Officers	—	·18	—
(vii) Deduct—Contributions from Indore Funds etc.	—	– 5·94	– 18·00
Total Expenditure	81·03	85·79	104·44
III. Expenditure (Communications only)			
(i) Original works	8·67	11 97	26·74
(ii) Repairs	31·92	32·39	31·27
Total Expenditure—Communications	40·59	44·36	58·01
IV. Receipts from Roads			
(i) Receipts under Motor Vehicles Act	11·66	14·03	16·68
(ii) Sales Tax on Motor Spirit	N. A.	N. A.	N. A.
(iii) Ferry Receipts	·26	0·9	·20
(iv) Receipts from the Road Fund—Gwalior	—	2·61	2·00

N. B. N. A. = not available

A Brief Review of the Madhya Bharat Budget

(With special reference to Civil Works)

THE total revenue receipts of Madhya Bharat for 1951–52 are estimated at Rs 11,31.00 lakhs and revenue expenditure at Rs 11,36.00 lakhs leaving a small deficit of Rs 5.00 lakhs. The revised estimates for 1950–51 indicate a much bigger deficit of Rs 103 lakhs with the revenue receipts amounting to Rs 10,80.62 lakhs and expenditure to Rs 11,83.62 lakhs.

Revenue expenditure on Civil Works for 1951–52 estimated at Rs 104.44 lakhs forms 9.2% of total estimated expenditure in the State during the year. The corresponding percentage for each of the two preceding years was a little lower i.e., 7.2%.

Expenditure on Communications (Original Works & Repairs) in 1951–52 is estimated to be Rs 58.01 lakhs which forms about 53% of expenditure on Civil Works (O. W. & Repairs). The corresponding percentage for the two preceding years 1950–51 (Revised Estimates) and 1949–50 (Actuals) stood a little higher at 57 and 58 respectively.

The Communications expenditure expressed as a fraction of total budget expenditure amounts to 5·1% which marks a little increase over the corresponding figure for each of the two previous years when it was 3·7%.

(*Contd. from page 2*)

Waterproofing Subgrade

Another problem under investigation is: how to check the capillary rise of water into the road subgrade, and thereby prevent its softening. The softening of the subgrade results in the corrugation and ultimate breaking up of the road surface under traffic.

Various bituminous primers have been tried on the subgrade with varying success. The most difficult case is presented by soils containing sodium sulphate ("kallar"). The experiments are yet to be tried out on a field scale.

A Useful Piece of Work

Another useful piece of work done at the Laboratory in 1950–51 is the development of an electrical method of rapidly determining the density of a stabilized soil base course and for estimating the cement content in a cement-stabilized soil road. The utility of the method should be obvious to highway engineers. The presence of salts like sodium sulphate in the soil introduces a disturbing factor. This has been taken into account in the newly developed electrical method.

TECHNICAL INFORMATION

1. BAMBOO REINFORCEMENT IN PORTLAND CEMENT CONCRETE*

DURING the war period when different materials were being considered as possible substitutes for steel, bamboo for use as reinforcement in concrete was investigated. It was first studied in the laboratory and later used and tested in actual construction.

In order to learn and develop design principles for the new type of structural members, numerous laboratory specimens including rectangular beams, tee beams and flat slabs of various cross sectional areas, each with various percentages of the bamboo reinforcement were prepared and tested. At the same time it was found necessary to study the physical properties of numerous varieties of bamboo and to compare them at different ages, stages of seasoning, and degrees of dryness. Twenty-five varieties of bamboo were investigated.

Field Experiments

To determine the practicability of the use of bamboo for reinforcement and to make cost comparisons between bamboo reinforced structures and standard steel reinforced construction applications of the laboratory findings were undertaken in the field. These applications to field construction included the following:

A. A building 32 feet square (designated unit 1), used as a workshop for later construction.

B. A building 60 ft. by 18 ft. with three levels (designated unit 2), constructed for a press box in Clemson College Memorial Stadium.

C. Two dwelling houses.

These structures, the test specimens, and all the various kinds of tests and observations that were made are presented and discussed in the original publication.

Regarding the physical properties of the bamboo the investigation brought out that the modulus of elasticity in tension varies between the limits of 2,000,000 and 4,500,000 lb. per sq. inch. The tensile strength of bamboo culm without a node is usually in the range of 26,000 to 50,000 lb per sq. inch calculated for the net section. Generally the node was found to be the weakest part of the culm in tension. Its minimum strength was established to be about 18,000 lb. per sq. in. calculated on the "net area alongside the node, not the increased sectional area at the node." Different species of bamboo showed marked variations in physical makeup and appearance of the nodes. Those with pronounced thickening and bulging at the nodes showed corresponding weakness in tension at those points.

Bond between bamboo and concrete

The series of tests, intended for study of bond between concrete and bamboo reinforcement, was not completed but was said to be sufficient to indicate the following: Bond stresses vary from a high value of 350 lb. per sq. in. to a low or zero stress. Shrinkage of the bamboo from green, to the seasoned stage, and from wet to dry depends upon the age of the bamboo, and on the season of the year in which it is cut. The values for bond appeared to be influenced by swelling of the culms due to absorption of mixing water and subsequent shrinkage after the concrete hardened.

Throughout the investigation it was apparent that load carrying members were more likely to develop cracks when green (unseasoned) bamboo was used.

High early strength cement seemed to have the merit of preventing cracks that would otherwise tend to result from the swelling of the bamboo.

Asphalt emulsion (a light brush coat) on seasoned culms showed a benefit in that it lessened the swelling of the bamboo from water absorption but an excess of asphalt tended to reduce bond.

* Abstract (appearing in Highway Research Abstracts, March 1951) from Engineering Experiment Station Bulletin No. 4, Clemson Agriculture College, South Carolina.

Recommendations

Some of the more outstanding conclusions and recommendations presented by the author are summarized below:

(a) Bamboo reinforcement in concrete beams does not prevent the failure of the concrete by cracking at loads materially in excess of those to be expected from an unreinforced member having the same dimension.

(b) Concrete beams with longitudinal bamboo reinforcement may be designed to carry safely loads from two to three times greater than that expected from concrete members having the same dimensions and no reinforcement.

(c) Members having the optimum percentage of bamboo reinforcement (between three and four per cent) are capable of producing tensile stresses in the bamboo of from 8,000 to 10,000 lb. per sq. inch.

(d) Increasing the strength of the concrete increases the load capacities of concrete members reinforced with bamboo.

(e) Ultimate failure of bamboo reinforced concrete members usually was caused by diagonal tension failures even though diagonal tension reinforcement was provided.

(f) Deflections of the beams followed a fairly accurate straight line variation until the appearance of the first crack in the concrete. Following this first crack, there was a flattening of the deflection curve (probably due to local bone slippage) followed by another fairly accurate straight line variation, but at a lesser slope, until ultimate failure of the member occurred. Flattening of the curve was more pronounced where the amount of the longitudinal reinforcement was small.

(g) When possible, the bamboo used in concrete, subject to flexure, should be cut and allowed to dry and season from three weeks to one month before using.

(h) Bamboo cut in the spring or early summer is not recommended.

(i) The use of vertical split sections of bamboo is recommended for diagonal tension stresses in members under flexure covering the portions where the vertical shear is high and where it is impractical to bend up the main longitudinal reinforcement.

(j) The design of structural members of bamboo reinforced concrete for flexural loads will be governed by the amount of deflection that can be allowed for the member. On account of this high deflection, failure of a bamboo reinforced concrete member usually occurs from other causes considerably before the bamboo reinforcement reaches its ultimate tensile strength. Design values, not in excess of from 300 to 4,000 lb. per sq. in. for the allowable tensile stress of the bamboo reinforcement, must usually be used if the deflection of the member is to be kept under 1/360 of the span length. When this low design value is used a high factor of safety against ultimate failure of the member usually results.

Design Procedure

In general the same procedure as used in designing conventional steel reinforced concrete members was recommended for use in designing bamboo reinforced units. One exception to this that was pointed out, however, was that when bamboo is used tee beams should be designed as rectangular sections ignoring the flange width in the calculations.

2. THE CAPACITY OF A HIGHWAY

[Extracted from "Traffic Engineering" August 1950]

IF cars are moving individually on a highway and even if no driver is allowed to change his lane (as for instance in tunnels or on bridges), it is clear that a safe space must be allowed between each car and the car ahead. This safe space naturally increases with the speed of each car.

Let me assume (ideal case) that each driver is instructed to maintain the same speed and to observe a certain safe distance between his car and the one ahead.

The 'safe' distance really consists of two parts. First, the distance a which would be covered within the so called 'reaction time' t (time interval between the stop signal observed visually and the moment the brakes are applied) and second the distance b covered while the brakes are acting i.e., 'braking time'.

The distance a is, naturally, proportional to the speed of the car v

$$a = vt$$

For instance, if we take—as an average—a reaction time of 0.75 sec., the car would roll on unchecked for a distance of 30 ft. if it is moving at a rate of 40 ft. per second.

The distance b covered during the 'braking time' is proportional to the square of the velocity of the car, depending very much on the surface of the road and the condition of the brakes. But generally we can assume $b = kv^2$, where k is a coefficient (friction) which may vary within wide limits.

The total 'safe distance' between two cars is, therefore, $a+b = tv+kv^2$

where coefficient k has to be found by experiment and by measuring the actual stopping distance at various speeds.

The actual distance to be allotted for each car in one lane is the sum of car length (L), the reaction time distance (vt), and braking distance (kv^2):

$$D = L+vt+kv^2.$$

If all cars are travelling at a speed v the time necessary to cover this distance D is $\frac{L+vt+kv^2}{v}$ and this is also the time interval between two successive cars passing at a chosen spot (for instance the entrance of a tunnel). The number of cars passing this spot per second is, therefore,

$$n = \frac{v}{L+vt+kv^2}$$

and the number of cars passing per hour (capacity of one lane of the road)

$$N = \frac{3600v}{L+vt+kv^2}$$

This formula allows us to compute the number of cars which can be handled by each lane of a highway, under favourable conditions, for any chosen speed.

It is of great interest to find out if there is an optimum speed, that is, if there is a speed at which the greatest number of cars can pass at a given spot.

Mathematically N is maximum when

$$v = \sqrt{\frac{L}{k}}$$

The optimum speed, therefore, depends only upon the average coefficient k and the length of a car and does not depend on the reaction time.

Taking $k = 0.115$ (a value derived from experiments)
and $L = 15$ feet.
We get $v = 14.8$ miles per hour.
Taking reaction time $= 0.75$ sec., $k = 0{\cdot}115$ and $L = 15$ feet, the following table gives the capacity of a road at various speeds :—

Speed (miles per hour)	n (number of cars per hour for each lane)
4.5	1034
9	1464
13.4	1584
14.8	1590
17.9	1570
22.4	1500
26.7	1415
33.6	1280
45	1080
56	854

Most motorists will not be pleased to travel at this optimum speed for any length of time.

It can be clearly seen that at about 15 m. p. h. the capacity is greatest (1590 cars per hour on each lane), but the decrease at greater velocities is not very noticeable at first so that up to 25 m. p. h. the road shows still a capacity of about 1450 cars per hour (90% of maximum capacity).

From the formula for the capacity of each lane, $N = \frac{v}{L+vt+kv^2}$, we see that the length of each car reduces this capacity quite effectively at lower speeds and becomes insignificant only at speeds of 45 m. p. h. and over.

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BREVITY IN LANGUAGE

The Americans have made sporadic efforts to improve English spelling. They write "honor" for "honour" and so on but they still talk of an "elevator" when the English say 'lift" an and "apartment" when the English say a "flat".

Voltair was very impressed with the English shortening of words such as "is n't" for "is not", "don't" for "do not", etc—but when he found that the word "plague" had one syllable and "ague" two he said "Let plague take one half of the language and ague the other half."

(Extracted from 'Capital'—15-4-1951).

During the debate on the Budget for 1951-52, the Finance Minister (Shri Deshmukh) said in the Parliament—"After all, an engineer has been defined as a person who can build a bridge for Rs 1 lakh which any fool can build for Rs. 10 lakhs (laughter). Therefore, we shall put them to the test this year".

(The usual definition puts the ratio at 1:2. The Finance Minister makes it 1:10. The Engineer's stock is rising!)

List of Approved Works on National Highways

S. No.	Job No.	Name of Work	Amount approved Rs	Remarks
		BOMBAY		
1.	475 BM. 8	Providing and laying 2" premix asphalt carpet on approaches to the Watrak-Bridge at Kaira on National Highway No 8.	19,500/-	
		UTTAR PRADESH		
2.	482 UP. 28	Providing two power barges for Ayodhya Ghat ferry in Faizabad District (N. H. No. 28)	1,24,880/.	
		BIHAR		
3.	476 BR. 34	Construction of National Highway No. 34, Section from the West Bank of Nagar river to Dalkhola in the District of Purnea in Bihar.	20,31,000/-	
4.	479 BR. 31	Improvement of Ganges–Darjeeling Road N. H. No. 31 from Purnea to its junction with National Highway No. 34.	7,22,000/-	
		ORISSA		
5.	480 RS. 43	Construction of Jeypore bye-pass on National Highway No. 43 in Orissa.	27,700/-	
6.	481 RS. 43	Replacing the existing wooden decking of four bridges on N. H. No. 43 by R. C. T. beams and slabs.	97,600/-	
		HIMACHAL PRADESH		
7.	A478 HP. 22	Surveying and cutting 2 ft. wide trace for the new motor road alignment from Narkanda to Luri (N. H. No. 22)	15,950/-	
		TRAVANCORE-COCHIN		
8.	477 TC. 47	Investigation work for siting of the bridge over the second arm of the Periyar river.	15,300/-	

Books added to the Roads Organization Library during May, 1951

1. **Public Finance** by Alfred G. Buchler. (McGraw Hill Book Co., Inc., New York, 1948).
2. **Public Finance** by Ursula K. Hicks. (Nishbet & Co., Ltd., London)
3. **Report of the Fiscal Commission 1949-50 - Vol. I** (The Manager of Publications, Delhi.)
4. **Report of the Indian Tariff Board on the Aluminium Industry PTB. 90 (N) 825** (The Manager of Publications, Delhi.)
5. **Report of the Technical Committee of the Transport Advisory Council held at New Delhi, from the 24th to 26th February, 1947).** (The Manager of Publications, Delhi.)
6. **Report by the Railway Board on Indian Railways for 1948-49, Vol. II-Statistics.** (The Manager of Publications, Delhi).
7. **A Commentary on the Constitution of India (1st edition) by Durga Das Basu** (The Madras Law Journal Office, Post Box 604, Madras 4, 1950).
8. **Quick Construction - Practical Building Problems** by H. H. Siegele. (Frederick J. Drako & Co., Wilmette, Illinois, 1949).
9. **Standard Methods for Testing Petroleum and its Products** (11th edition, 1951) (The Institution of Petroleum, Manson House, 26, Portland Place, London, W. I., 1951)
10. **UBERGANGSBOGEN IM STRASSENBAU. (Transition Curves for Highways)** by Gerhard Schramm, Hans Lorenz and Hugo Kasper, (Erick Schmidt Verlag, Berlin).
11. **Taxes and Economic Incentives** by Lewis H. Kimmel. (The Brookings Institution, Washington, D. C., 1950).
12. **Foundations of Structures** (1st edition) by Clarence W. Dunham, (McGraw Hill Book Co., Inc., New York, 1950).
13. **Talk by Shri K. M. Kantawala on various methods on soil stabilization at the 29th Annual Session of I. E. (India), Bombay held on 28-2-51.**
14. **Preparing Metal Surfaces for Painting - Ministry of Works 1950.** (His Majesty's Stationery Office, London) five copies.
15. **Vehicles (excise) Act, 1949** (His Majesty's Stationery Office, London).
16. **The Weathering Preservation and Maintenance of Natural Stone Masonry (Part I)** - Building Research Station Digest No. 20, July 1950. (His Majesty's Stationery Office, London).
17. **The Constitution of India** by K. Santhanam. (The Hindustan Times, New Delhi).
18. **Report of the Work Done in the Roads and Buildings Research Laboratory, Karnal for the year 1950-51 (Cyclostyled).** (Roads & Buildings Research Laboratry, Karnal.

PUBLICATIONS OF THE PUBLICATIONS DIVISION, MINISTRY OF INFORMATION & BROADCASTING, GOVERNMENT OF INDIA, NEW DELHI.

19. **India in Maps.**
20. **India Tourist Information,** 4 copies.
21. **Explanatory Handbook on the B.S. Code of Practice for Reinforced Concrete** by W. H. Scott, W. H. Glanwille & F.G. Thomas. (Concrete Publications Ltd., 14, Dartmouth Street, London, S.W.I) 3 copies.
22. **A.S.T.M. Methods for Chemical Analysis of Metals (a part of the Book of ASTM Methods).** (American Society for Testing Materials, 1916, Race St., Philadelphia 3, Pa).
23. **The Mysore Half yearly Civil List. Part I (corrected upto 1st Oct. '50)** (The Director of Printing, Stationery and Publications, Bangalore).
24. **Typical Design – Large Covered Van or Pantochnicon, Development Bulletin, April, 1949.** (Aluminium Union Ltd., London).

25. **Typical Design - Service Bus Development Bulletin, July 1950.** (Aluminium Union Ltd., London).

26. **Facts ond Figures of the Automobile Industry, 1949 edition.** (Canadian Automobile Chamber of Commerce, 1006, Lumsden Building, Toronto, Canada).

27. **Statistical Statements relating to the Administration of Municipalities in the Province of Bombay (including City of Bombay) for the year 1943-44.** (The Superintendent, Printing & Stationery, Bombay).

28. **Budget Estimates A & B - The Municipal Budget for 1950-51.** Adopted by the Municipal Corporation of the City of Bombay. (Municipal Printing Press, Bombay 1950)

29. **Notes on Soil Engineering and Soil Testing for Road and Airfield Construction** by B. W. Abbott. (Soil Engineering Station, India, Kankinara, April, 1945).

30. **Proceedings of the Ninth Annual Highway Engineering Conference, March 1-5, 1948, Bulletin No. 38,** by A. Diefendorf. (University of Utah School of Engineering Deptt. of Civil Engineering, Salt Lake City, Utah).

Publications of War Department Corps of Engineers, U. S. Army, Ohio River Division Laboratories, Mariemont, Ohio, March, 1946.

31. **Lockbourne No. 1, Test Track Final Report, Accelerated Traffic Tests of Concrete Pavement.**

32. **Final Report Investigation of Concrete Pavements on Different Subgrades.**

33. **Hyderabad Motor Vehicles Rules of 1355 F.** (Published in the Jarida No. 23, dated 21-6-55 F) (Govt. Central Press, Hyderabad-Dn., 1946).

34. **For OFFICIAL USE ONLY Climatogical Atlas for Airmen** (The Govt. Photozonic Office, Poona, 1943).

35. **Quarterly Report of Revenues, Expenses and Statistics Class I Mottor Carriers of Passengers-Budget Bureau No. 60-R050.** Issued by Interstate Commerce Commission, Washington, (The Supdt. of Documents, U. S. Govt. Printing Office, Washing-ton).

36. **Geology applied to Building and Engineering by Arthur Bray.** (Sir Issac Pitman & Sons, Ltd., London, 1948).

37. **Report on the Structural use of Aluminium Alloys in Buildings.** (The Institution of Structural Engineers, II Upur Belgrane Street, London, S. W. I.).

38. **Scale Models in Hydraulic Engineering** by J. Allen. (Longmans Green & Co., London, 1947).

39. **Osborne Reynolds and his work in Hydraulics and Hydrodynamics** by A. H. Gibson (Longmans Green & Co., London, 1947).

40. **The Economic Design of Rectangular Reinforced Concrete Section** by T. P. O'Sullivan. (Sir Issac Pitman & Sons, Ltd., London, 1950).

41. **Structural Theory and Design-Vol. I** by J. Hardy Young. (Crossby Luckwood and Sons Ltd., 39, Thurloc Street, London, S. W. 7, 1950).

42. **Mastic Asphalt Work** by F. E. Drury & A. W. Gittins. (Crossby Luckwood and Sons Ltd., 39, Thurloc Street, London, S. W. 7, 1950).

43. **Deformation and Flowan Elementary Introduction to Theoretical Rehology** by Markus Reiner. (H. K. Lewis & Co. Ltd., London, 1949).

44. **METALS Reference Book** by Colin Smithells (Butterworths, Scientific Publications, London, 1949).

45. **Basic Road Statistics, Great Britain 1950.** (British Road Federation, 4 Bloomsbury Square, London, W. C. I.

46. **Soil Mechanics (Part I)** by M. P. Beausang (M. P. Beausang 65, Calderwood Road, Dublin).

47. **The Motor Vehicle - a description text book for students, draughtsman and owner-drivers** by K. Newton and W. Steeds (Iliffe and Sons, Ltd., London).

48. **Engineering Metrology** by K. J. Hume, (Macdonald & Co. (Publishers) Ltd., London).

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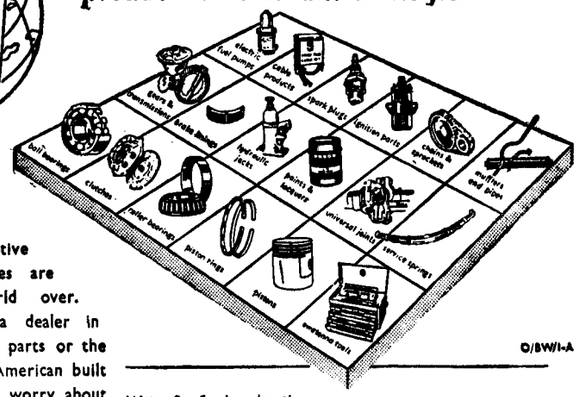

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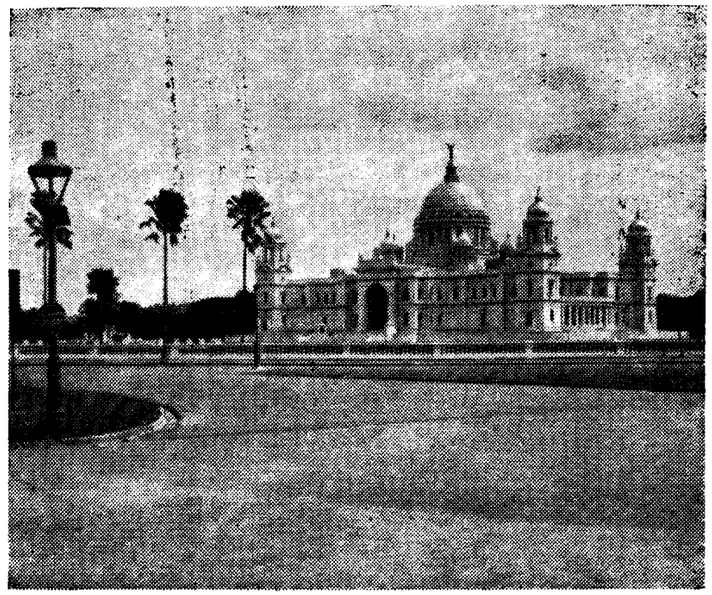

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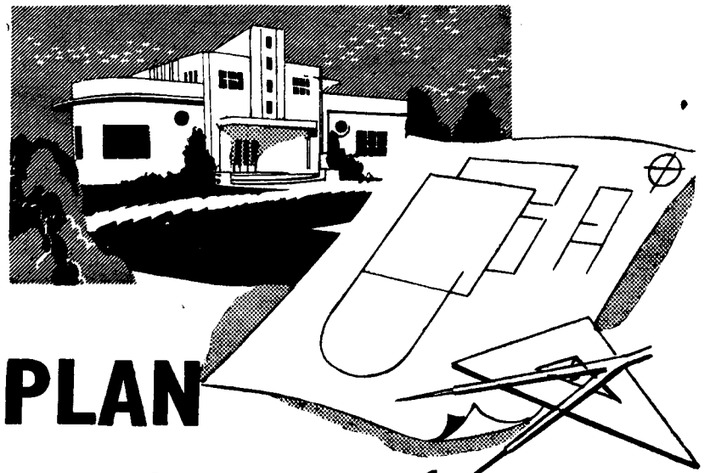

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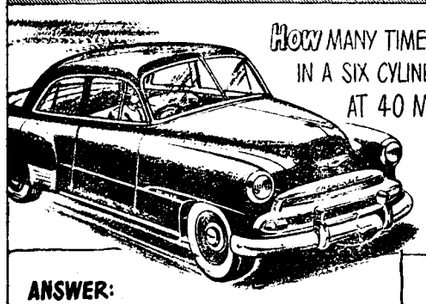

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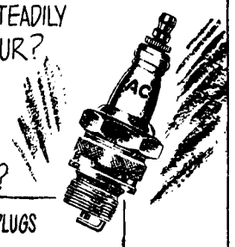

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