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In this issue

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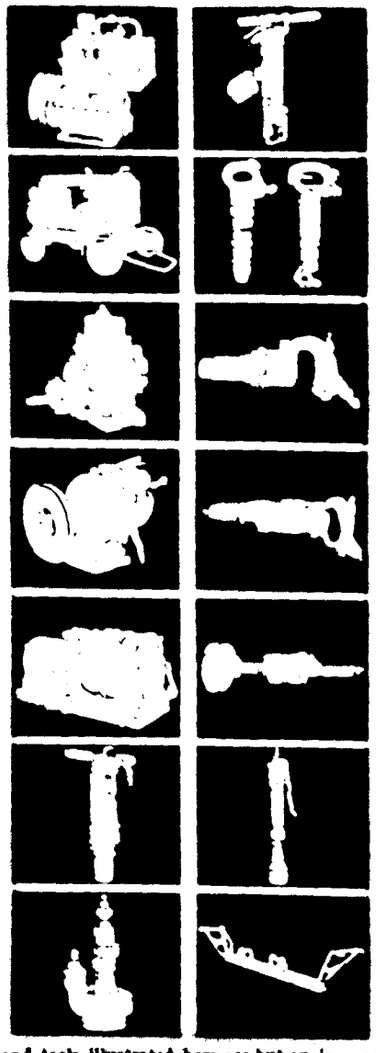

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ENGINEERS AS ADMINISTRATORS AND MANAGERS

(Extracted from 'The Journal of the Institution of Engineers Australia' Jan.—Feb. 1951)

SHOULD senior administrative positions be filled by Engineers? There are many people who contend that they should. There are just as many who are equally emphatic that they should not. The views of both groups are frequently influenced by prejudice, and often by examples of a few conspicuous successes and failures.

A contributor to **Rydge's Business Journal** (August 1950), discussing the question of engineers in top-management, charges them with extravagance, accuses them of building up large establishments which are out of proportion to the job, with failing to understand the necessity of supplying sufficient information for costing purposes, and with resenting the efforts of the Accountant to keep expenditure down and within legitimate channels. He further complains that the Accountant is not given sufficient status and authority in relation to the Engineer.

It might be claimed with equal justification that many engineers are frustrated by financial and accounting controls. The endless filling-in of forms, the necessity of obtaining approval for individual items of expenditure after an estimate has been approved, and the maintenance of records that provide no data of use for future development, all contributing to the overhead of the job, are often unnecessary controls devised by administrators whose training and experience have been secretarial.

There have been many unsuccessful and inefficient administrators. Among them have been engineers, but they include members of many other professions and those with secretarial or financial training. An examination of each case will usually disclose that the fault lies not with the man's training but with the man himself, and his appointment has been the result of mistaken assessment of his capacity, adherence to some system of promotion by seniority, or political preferment, or some consideration other than ability only.

The conspicuousness of the failures should not obscure the success of the brilliant administrators, or the qualifications that have made them so. They have included engineers as well as those with some other background of specialised training, and some with no academic qualifications and even negligible primary education.

To say that managers are born is perhaps an overstatement, but there can be no question that the potential manager requires inherent qualities as a foundation on which to build. These include powers of leadership and the capacity to inspire loyalty in colleagues and subordinates, a sense of true values, an appreciation of the importance of essentials, a capacity for detail-but with it an ability to delegate responsibility for it to others-imagination, and a good deal of commonsense.

* * *

The importance of education, training and experience, in addition to inherent characteristics, cannot be overstressed. It is abundantly self-evident that it is an invaluable asset to a manager to have a theoretical as well as a practical knowledge of the products and processes for which his organization has been established. The Banker who has studied economics and accountancy, the controller of a chemical industry who has studied chemistry, the steelworks manager who has studied Metallurgy, and the insurance company executive who has had actuarial training, are better equipped for their responsibilities than those who have not. The engineer who has the other qualities required of a manager is better equipped to control an engineering industry or an authority with engineering functions than anyone else.

* * *

If, then, so many factors contribute to the making of the successful administrator, it is obviously unreasonable to argue that an engineer must, **ipso facto**, be the

best administrator for a certain type of organization. It would be more effective to examine the need for producing good engineer-administrators. A man commences with his inherent qualities and these must be accepted and developed and used to the best advantage. Professional knowledge can be acquired from the educational establishments with suitable curricula. Knowledge of the principles of management must be sought usually by post-graduate study, and there are colleges which offer these facilities. It is the responsibility of the young engineer aspiring to executive rank to seek out and use such facilities, and too few at present realise the importance of this.

However, the acquisition of experience in management is in a different category. Few young engineers have it in their power to ensure that they are afforded opportunities to acquire such experience. The responsibility, therefore, rests on those in senior positions to realise the importance, both to their own organizations and to the profession, of adopting a definite policy of training their subordinate engineers by experience for filling the senior executive positions.

STANDARDIZATION

The underlying principle of standardization, in whatever form it may be considered is to increase efficiency.

(*"Engineering" London 16 2-51*)

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FRUSTRATION

Frustration is a disease that is highly contagious, and rapidly undermines the spirit of goodwill that might have existed but for its baleful influence. At a certain works an experimental machine was urgently required by a given date, and a spirit of enthusiasm was evident in the shop so that the work was satisfactorily completed to time. But then the machine lay unheeded on the shop floor for several weeks! Actually, at the last moment, altered circumstances necessitated the postponement of the experiment for which the machine was being constructed. But all concerned naturally felt frustrated. Was it really too much to expect that on grounds of mere tact the machine should have been removed out of sight?

(*Extracted from 'The Engineer' Dec. 29, 1950*).

ROAD CONSTRUCTION IN EGYPT

(*Extracted from 'World Construction'—Jan.-Feb. 1951.*)

ALL life in Egypt is centered around the Nile. For more than 550 miles south of Cairo, the towns and villages and farmlands, supporting scores of people to the square kilometer, are confined to a narrow strip of land along this river. To the north of Cairo is the famous Delta region, formed by the Nile's east and west branches which reach the Mediterranean at points more than 60 miles apart. This area, together with the adjacent land brought under cultivation, is the **Lower Egypt** of ancient times, and the most important part of Egypt today.

There is no continuously paved road along the Nile connecting the cities and towns of Upper Egypt and affording outlet to Cairo and Lower Egypt. Although this region is heavily populated for a short distance on either side of the Nile, there has not yet been a sufficient demand for highway transport to bring about the construction of this arterial route. This region probably offers the best evidence of the dependence of Egypt upon the Nile, and more recently upon railways for transport. The main line of the Egyptian Railway traverses this area, it handles much freight and passenger traffic.

With the exception of some desert roads, highways constructed in Egypt are located on the trunk routes which will continue to carry a large proportion of the total traffic. There is a growing need for the extension of improved roads to cover less important routes. As the work on the improvement of trunk routes nears completion, Egyptian highway engineers are turning their attention to plans for construction on secondary highways. **There is therefore an increasing interest in various designs for adequate low-cost pavements for locations where travel volumes are small.**

Factors Influencing Highway Development

In attempting to predict future trends in Egyptian highway construction, the various factors which have influenced the development of the present highway system should be considered. Most of these factors must also be included in the determination of future policies for construction programmes.

The geographic pattern of the inhabited portion of Egypt has been the most important factor in the establishing of design standards. With the numerous large cities of Lower Egypt placed more or less symmetrically about the triangular area north of Cairo, and with many of the ancient trade routes still in existence, the pattern of highways needing improvement were well defined. Engineers, recognising the potential traffic loads which were to be carried on these routes across the Delta, planned accordingly. Consequently, with the exception of the desert roads, pavements have been built to **very high standards**. There have been three or four projects constructed using portland cement concrete pavement, and other projects on which a bituminous concrete wearing surface was placed on a concrete base At various other locations, bituminous concrete was placed on a base constructed of bituminous-coated aggregate. However, most of the existing pavements have a heavy course of hand-placed limestone, as a base, and have some type of bituminous-treated aggregate for levelling and wearing courses.

All of these designs require relatively expensive construction, and they are appropriate only for those locations having heavy volume of traffic. Thus it has been that both highway engineers and public officials have learned to think in terms of high-type pavements, and little attention has been given heretofore to methods of pavement maintenance and to reconstruction operations.

Materials

Aggregates for highway construction are not well distributed throughout the country. A large quarry near Cairo, operated by the Government, is the principal source of basalt, hardest and best aggregate available in Egypt. There are also several quarries near Cairo which

are producing limestone aggregate of fair quality, although it is not generally as hard as aggregate normally desired in concrete pavement. Most other stone sources in the Delta and adjacent desert areas produce limestone of inferior quality, which is usually considered too soft for use in pavement wearing courses.

Much of the **sand** conveniently available on or near the Delta is wind-deposited, and not of good quality for portland cement concrete, but appears to be satisfactory for use in bituminous mixtures.

The **distribution of aggregate** has been one of the most important factors in establishing pavement design policy, and in developing programmes for highway construction. In the first place most Egyptian highway engineers have felt that basalt is practically the only available aggregate suitable for surface courses on heavily travelled highways. Since work has been concentrated on roads of this kind, basalt has been shipped from the quarry near Cairo to nearly all parts of the Delta. This situation has not only made the cost of such pavements relatively high, but it has limited the amount of work which could be carried on in each area, because of the limitations of transport facilities. Some of this stone is shipped by rail, and also much of it by water via larger canals.

Steel Tyres

In one location, a portland cement concrete pavement was constructed in two courses, in order that the harder basalt aggregate could be used in the wearing surface, while a structurally-sound limestone aggregate, too soft to withstand abrasion, was used in the lower course. This same general method, is commonly used in bituminous pavements. The great numbers of steel-tyred, animal-drawn vehicles offer a serious problem in surface abrasion that must be considered in pavement design.

Desert Roads

In desert locations, Egyptian engineers have shown much technical skill and ingenuity in producing serviceable roads in isolated places, using a minimum of bituminous material, mixed with almost any of the many types of granular materials found on the site of the pavement. Small portable mixers have been used for this work. Several hundred kilometres of these pavements have been constructed, all at relatively low cost, and they are all giving good service. Because of the differences in the materials incorporated, between one location and the next, their performance records can offer a good source of information for use in designing future low-cost pavements.

Soils Effect Design

Egyptian soils constitute another factor which has affected the design of existing roads. The desert soils, of course, present few problems. On the other hand, the deep Delta silt has generally been considered to present somewhat of a problem in road construction. However, this soil has the advantage of being uniform in character, at least throughout the length of a single project. During the past few years, soils engineers have made many investigations and have developed compaction methods which insure dependable performance of subgrades in providing adequate support for pavement courses.

Probably the most important trend in the use of aggregates is in the greater use of denser graded aggregates for plant-mixed bituminous concrete. This construction will promote the use of sand and crushed limestone, and will tend to decrease the importance of the harder basalt in surface courses in areas where the basalt is expensive, because of shipping charges. Most of the present bituminous surfaces were constructed of open-graded aggregate mixtures, easily mixed in small portable mixers, but requiring a harder stone for satisfactory performance.

Any future programme of extensive highway development must take into consideration the use of most of the aggregate sources in Egypt. Many lessons regarding the use of inferior aggregates were learned in building the desert roads. With the present high interest shown by many highway engineers, it is certain that an economical use will be made of most types and grades of aggregates in both high-type and low-cost pavement construction.

Special Soil Tests

Soils engineers have made good progress in solving the problems involving the silty soils of the Delta. **It has been found that ordinary laboratory methods for establishing the control of compaction operations are not adequate for this soil. and modified tests have been developed.** Compaction to specified densities is a part of current contracts, and these specifications will probably be carried over to the construction on secondary routes. Investigations are now being made to determine the possibilities of increasing the bearing capacity of these silty soils by the use of granular materials, either as a separate insulating course, or by mixing into the soil.

It is apparent that soils engineers will play an increasingly important part in future highway construction.

Equipment Used

There is a definite trend towards the use of more heavy construction equipment. Since most of the grading operations are light, becaue of the flat terrain, most of the heavy machinery will probably consist of paving equipment and mixers, together with various types of rollers.

On one recent portland cement concrete paving project, the contractor used a continous batch concrete mixer and a pavement finisher with a vibrator attachment. The mixer was charged by hand-labour, from stockpiles of materials located along the roadside. Although the fine aggregate used was a local sand, and not of high quality, this equipment made it possible to lower the water-cement ratio to a point where the resulting strength of the concrete was acceptable.

In bituminous construction several of the new pavements have been constructed of bituminous concrete, produced in large stationary plants.

Another important improvement which is being made possible by the introduction of machinery is the production of smoother riding surfaces. The hand-placed bituminous surfaces have a tendency to be rough, and to have an irregular surface texture.

In general, the machinery which is being introduced appears to be of the type which will make more effective use of available materials, and produce better riding surfaces. There is apparently no machinery being introduced for the specific purpose of eliminating hand-labour.

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OBSCURING THE OBVIOUS

Dorothy Sayers expressed the ordinary man's reaction, perhaps somewhat unkindly, in **Gandy Night**, *when she made a character say that "the biggest crime of these blasted psychologists is to have obscured the obvious."*

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MOTOR VEHICLE TAXATION

(From "The Eastern Economist" Jan. 5, 1951)

THE elaborate and carefully reasoned conclusions of the Motor Vehicle Taxation Enquiry Committee can be summarised in one very brief statement. The Committee has discovered, as a result of the first comprehensive enquiry into road transport problems since the Mitchell-Kirkness Report, the application of the laws of increasing returns in the transport industry. When the Committee was set up in April 1950, after the controversies of the budget session, it had three main questions to tackle.

One of these, and a comparatively minor one, since the concurrent list of powers now grants final jurisdiction to the Centre, was to decide how co-ordination in taxation was to be obtained. The other two, which were of more importance were to assess the nature of the unrequited contribution, which motor vehicle users can equitably be called upon to pay to general revenues, and to assess the level of import duties on vehicles and spares which will be reasonable in present circumstances.

All these three questions have now been answered in the belief and knowledge that when taxes are low, and enterprise is free, and when road-rail competition is an ancient and meaningless bogey the war of competition in goods transport being assessed at 1·6 per cent of railway goods traffic—the law of increasing returns will immediately begin to apply.

"Hidden" Tax

There is a blackout of recent statistics even in this Report. A firm estimate of the total yield of motor vehicles taxes is not, therefore, possible, but a near guess will be Rs 35 crores in the current financial year, to which is to be added a "hidden" tax of about ten crores, which is levied on road users by bad maintenance of the highways. The Committee thinks that of this sum, about ten crores of rupees would be about reasonable as the motor vehicles users' unrequited contribution to the exchequers. The rest of the money is to be earmarked and allocated for implementing the Nagpur Plan for Road Development, which may cost at present prices some 750 crores of rupees.

Taxes are now to be uniform, and except for the annual vehicles taxes by laden or unladen weight or seating capacity or luxury rating, they are to be levied by the Centre in the interests of simplicity. Petrol prices, it is also recommended, should be made uniform by a freight equalisation surcharge. A road cess of one anna on land revenue is to be levied, one million and odd bullock carts and "thelas" are to be taxed at a flat rate of sixty rupees per annum, and the entire proceeds of all this taxation, except for moicty of eight annas in the import tax on motor spirit, are to be credited to various road funds. To round off the logical simplicity of these very simple recommendations, private road transport is to be liberated from every sort of control (including the code of Principles and Practices for Road Transport) and motor vehicles—this description may be of some importance—are to be granted relief from the additional duty on imports, which was imposed in the 1950 budget.

Policy Benefits

How far this very streamlined policy will be practicable and successful can be judged only in the light of statistics—if they are gathered now as the Committee has recommended. But two indications of the indirect benefits which can be obtained from this policy are very useful. One is that there are nearly 50,000 public motor vehicle carriages plying on the roads, with a turn-round which is much more rapid than that of railway locomotives; they are estimated to carry goods at 40 to 48 pies per ton per mile. The other is that the passenger rate in Madras has been six pies per mile, levied in preference to a permissible maximum of seven pies. If the load factor were better, if taxes were less, and competition were keener the turnover in traffic in regions of 150 miles or less will obviously be more considerable than it is, and this is a result worth striving for in itself.

The crippling character of the competition which road transport vehicles meet at present should be apparent from the facts that the bullock carts compete

with them on short distance, paying no taxes at all except municipal taxes, while the railways are in a position to compete with them on long distances in view of the incidence of motor taxes, estimated by the Committee as equal to the earning per ton mile on the railways. **The indirect advantages to the country of freeing road transport from all these restrictions are hardly to be measured.**

Earmarked Taxes

So far, everything that the Committee has said makes sense, and can be justified in the light of its eight principles. But when one passes from this general prescription to other suggestions which have been made, the implementation of the road plan obviously depends very much on the course of events in the future. The total and almost ruthlesss earmarking of road revenue for road expenditure which the Committee has recommended, is about as practicable as the parallel recommendation of the Planning Commission (on which it is based), that a sum of Rs 107 crores should be earmarked for irrigation. No State Government will in practice be able to assign away these considerable sums.

Also, if the policy of building an automobile industry is accepted by the country, theoretical simplicity of subsidies as an alternative to protective duties will not alter the fact that a high tariff wall may, after all, be the only practicable means of building up this industry. The only way in which these two problems can be solved will be if, as a result of this new found freedom, road transport develops to such an extent that the yield of the reduced taxes is much more than the present yield—at a level of annual taxation which leaves some room for levying protective duties and inflating the capital cost.

Growth in the number of Motor Vehicles

Many of the recommendations of the Committee, excluding perhaps the reduction of duty on vehicles and spares intended for commercial purposes, will obviously have to await this natural growth in revenue; and the only consolation which is available to State Chief Engineers (Roads), who now nostalgically look back on the Nagpur Plan, is that this growth can take place, in view of past statistics, within a comparatively short period of time. The rate at which we are adding to the equipment on the roads is obvious from the table below:

Table showing the Imports of Mechanically Propelled Vehicles in the six months Ending September 1950

	(Value in crores of rupees)
Motor cars including taxi-cabs	1·14
Motor cycles, including scooters	0·11
Motor omnibuses and lorries	2·37
Parts of mechanically propelled vehicles	4·35

With no more than the reasonable allowance for improvements, it should be possible for us in future to import (in C.K.D. condition) about Rs 30 crores worth of mechanically propelled vehicles and parts, and this rate of import, if maintained for about three years, should enable the Central Government to implement the recommendations made by the Committee regarding road development, by earmarking all the extra yield for the road Funds. Incidentally, this rate of development of the road transport industry will also save an increasingly awkward situtation, by enabling the local assembling plants to deliver and repair vehicles, at nearer their rated capacity of 80,000 vehicles every year.

Quick Action Needed

These are not insignificant gains, and **laissez-faire** in transport is, therefore, eminently worthwhile as a change from existing conditions. It is necessary if the recommendations of the Committee are to be implemented in their entirety that the freedom and the relief, which they have recommended for the road transport industry in India, should be granted as early as possible, while conditions are still propitious for development. No one who has any appreciation of the role of distributive costs in any economy can, therefore, be indifferent now to the need for implementing the simpler and earlier parts of this Report.

TYPES OF ROADS FOR TOWN AND COUNTRY*

Introduction

The most important criterion of the efficiency of a road system is that each road in the system is fitted for the purpose for which it is used. In practice this means that each road can carry adequately and safely under normal conditions the traffic, including pedestrian traffic, for which the road exists. If the road system fails to match up to this test then it is obsolete and economically wasteful.

It is doubtful whether any road system in the world is really efficient according to this most searching test; indeed the conditions of road usage are varying so rapidly that during the time which must elapse between the planning of a road system and its completion the conditions of usage would have varied considerably and estimates of these changes have seldom been accurate.

Conditions of road usage imply much more than number of vehicles per hour—they connote also **speed of vehicles, size of vehicles** including length and width, **habits of pedestrians** and **vehicle drivers**, design of details such as brakes and tyres, and even the use of road frontages.

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Aims of Modern Design

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The ideal road should enable a journey to be completed with safety in the shortest possible time: it should serve economically the needs of the district and the centres of population. With regard to the time factor it is interesting to recall the experiment conducted by Sir Charles Bressey. He found that it was quicker to travel round the north circular route, a distance of about 22.75 miles, than to travel across London by a route ten miles shorter but on which the average speed was sometimes as low as 3.6 m. p. h. and never more than 18 m. p. h. This shows the effect of delays due to congestion, which the Ministry of Transport has estimated to cost in Central London no less than 12½ million pounds per annum. It has been estimated by J. F. Bramley that on this basis the cost of inadequate roads in urban areas resulting in congestion and delay, is at least £ 125,000,000 per annum for the whole country.

So far as road safety is concerned, out of over 500,000 deaths per annum from all causes road accidents are the largest single cause and amount to nearly one per cent of the total.

* * *

Professor Harry Jones has estimated that the total cost of road accidents to the Nation is probably £ 100,000,000 per annum.

The segregation of various types of traffic seems to be the only reasonable solution to this problem of safety. The trespassing of pedestrians on railway lines—even branch lines for comparatively slow trains—is actively discouraged; it is just as important to separate pedestrians alongside roads from motor vehicles which are capable of speeds exceeding a mile a minute.

Most of the minor details of road design are directly related to these two factors of speed and safety.

* * *

Types of Modern Road

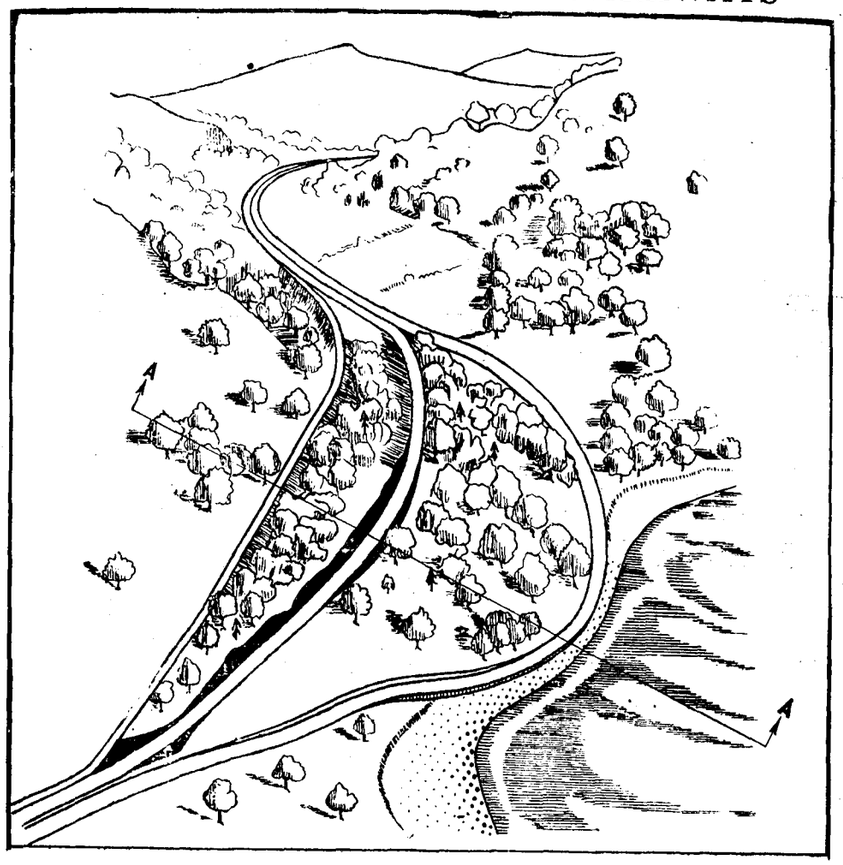
(*a*) Motorways

Motorways have been advocated in Britain for a number of years and especially since the construction of such roads in Italy and in Germany has shown their usefulness. They are intended for use by long distance motor traffic travelling at high speed and, although not generally passing through them, will link up large towns with each other and with the principal docks. High speed requires provision for safety and therefore dual carriageways will be essential.

Points of access should be restricted to those with links to large towns and with main trunk roads and other heavily

* Extracts of a Paper by Herbert J. Manzoni, C.B.E., M.I.C.E., M.I Mun E, MTPI., City Engineer and Surveyor, Birmingham at the Public Works and Municipal Services Congress, London, Nov. 17, 1950.

POSSIBLE TREATMENT OF PARKWAYS



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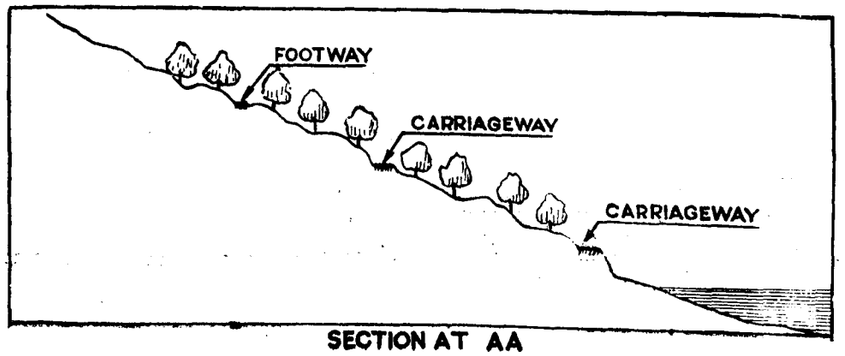

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trafficked routes. Other roads should either pass under or over the motorways. Generally speaking, the average distance between junctions—which should include a round-about or other type of safety junction—should be 8 to 10 miles. The junctions should be designed with a fly-over for the motorway and acceleration and deceleration lanes leading to the round-about underneath.

Long straight lengths should be avoided but curves should be of large radius: gradients should not exceed 1 in 30 except in special cases where 1 in 20 may be allowed. Lay-byes and parking places should be provided at intervals of about 5 miles so that drivers can stop to rest without obstructing the carriageway.

The present indication is that carriageways will be 22-ft wide, with a 6-ft wide central reservation and a 10-ft wide verge alongside each carriageway. This will give a minimum formation width of 70 ft but it will be advisable to increase this figure by about 20 ft to allow for the future widening of the carriageways.

In this connection it is suggested that, particularly since the permitted width of public service vehicles has been increased to 8 ft, the unit lane width should be increased to 12 ft instead of 11 ft thus making the initial carriageway width 24 ft

(b) Urban Roads

Under modern traffic conditions the roads in urban areas—as distinct from cross country roads—can be divided into different categories dependent on their use and the nature of the predominant class of traffic for which they cater.

1. Probably the most important, or at least the most difficult to construct adequately under the limitations imposed by existing building development is the **traffic way**. This may be on the line of the original main highways or arterial roads around which the urban community developed: it may be a new link between two or more of these basic highways: it may be a newly planned ring road: or it may be a by-pass to avoid a residential or shopping area. These arterial roads should be located and designed to attract as much through traffic as possible.

2. Next in importance from the traffic point of view is the **industrial road** mainly concerned with taking heavy goods vehicles in a factory or dock area or perhaps in a trading estate. In some cases the weight of traffic may be as great as on a traffic road but the average speed will generally be slower.

3. **General Business Streets** cater for the wholesaler's van and the business man's car and requirements as to traffic capacity are easier to meet than in the former types.

4. **Residential Streets** may be subdivided into:

(a) main residential roads carrying an omnibus service, and

(b) " domestic " streets.

5. **Shopping Streets** are rarely found performing this sole function but are usually incorporated with one of the previous types. From the traffic standpoint this is a bad thing; shops attract pedestrians and standing traffic, both of which are unsatisfactory in conjunction with moving traffic. The problem with a shopping street is to reconcile the requirements of the shopkeeper with the need for adequate control of traffic to promote traffic flow and prevent accidents. The shopkeeper wants narrow streets and plenty of traffic, both vehicular and pedestrian. If traffic is diverted or prevented from passing his shop he is concerned in case it is taking potential customers away. He tends to follow the traffic and the problem of congestion recurs.

The main " down-town " shopping centre must of necessity be compact so that even if an inner ring road is constructed it may be necessary to allow shops along its frontage, provision being made for standing vehicles. In building a new town or rebuilding a blitzed city centre, the area can be designed so that through traffic is prevented from easy access to the shopping streets.

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6. **Pedestrian ways** are less common in urban localities than the previous types

of vehicular roads. They may take the form of shopping arcades or passages forming " short cuts " between two main throughfares, as short cuts to railway stations or omnibus termini, or to enable children to walk to school without danger from traffic. Where there is considerable difference of level between the two thoroughfares the pedestrian ways may incorporate flights of steps.

(c) Rural Roads

In open country outside villages and towns the Roads are traffic highways whatever their capacity, open to and used by all types of traffic from driven cattle to traction engines.

(d) Parkways

This specialised type of highway may bring rural conditions into an urban area or may be wholly sited in the country as distinct from the town.

In an urban area it can be used to introduce a " green wedge " into the development. If the road follows the contours and there are two carriageways the distance between the carriageways may be varied to save excavation and filling and the reservation between can be treated to prevent headlight glare.

The footpaths need not be parallel to the carriageway as in normal circumstances, but may be sited to meander about through clumps of trees or alongside a stream.

Roads passing through rural areas of special scenic beauty should more often be developed as parkways and additional land purchased on either side of the roads. Provision should be made for car parking at view points and if necessary the road diverted to bring a beauty spot into view.

(*To be continued*)

HASTY CONCLUSIONS

A family in Germany was enjoying a special mushroom dish for supper. Suddenly they noticed the family cat under the table—mewing piteously and writhing in pain.

Papa, who just a few moments before had given the animal a taste of mushrooms, rushed the entire family to a hospital where all had their stomachs pumped.

Shaky from the ordeal, but grateful to the cat for the timely warning, they returned home. There was their benefactress, still under the table, cuddling seven new kittens.

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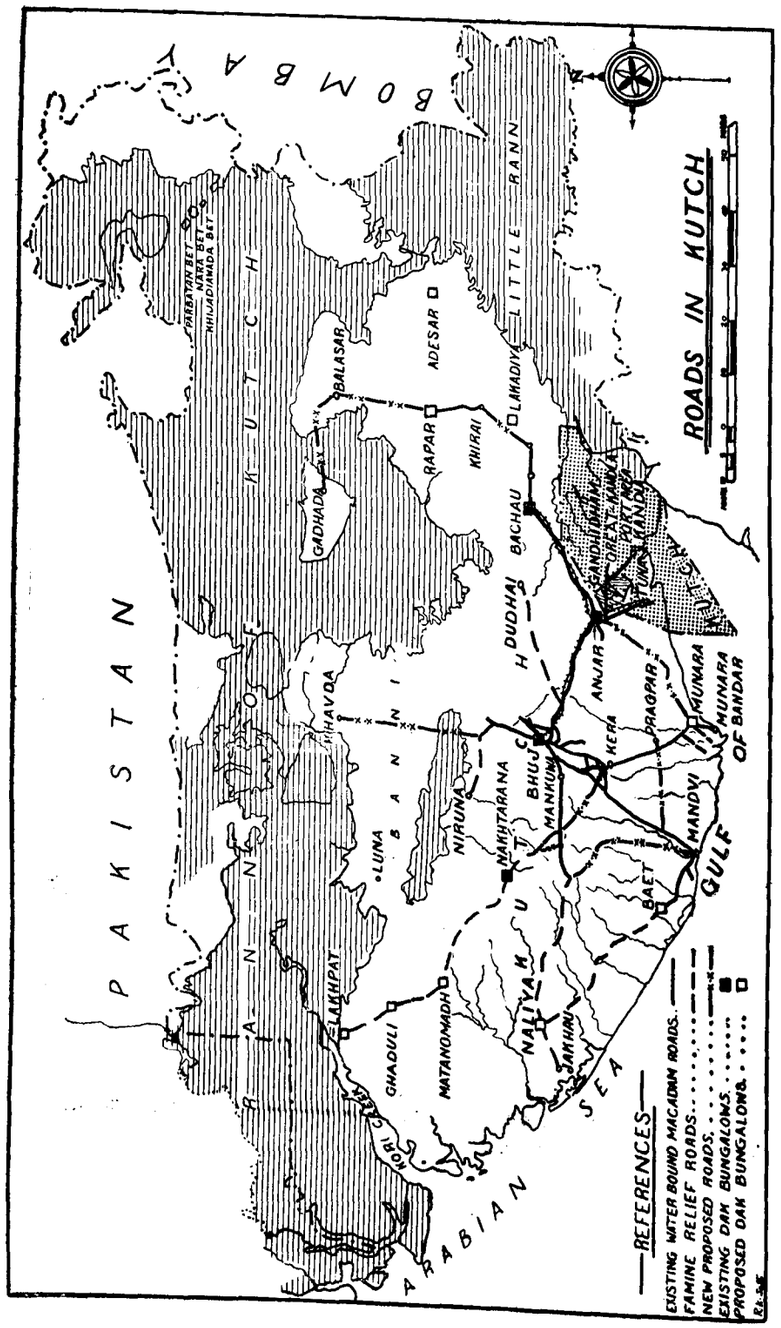

ROADS IN PART C STATES

The States of India, which are administered centrally under Chief Commissioners, have been in the news lately. There are ten such States, some of which are rather backward in their means of transport. We propose to describe these States briefly in this Review with an emphasis on their transport requirements.

In October 1950 we published an article on "Roads in Himachal Pradesh". This month we will speak about Kutch.

KUTCH

Kutch is a maritime State on the west coast of India, administered centrally under a Chief Commissioner. Formerly an Indian State, it was merged with India in June, 1948.

The State has an area of 8,460 square miles exclusive of the Rann of Kutch which has an area of 8,864 square miles. The population is 500,800. The annual revenue is about Rs 80 lakhs.

The capital is Bhuj, founded in 1549.

There is a fair proportion of good arable land in Kutch, the principal crops being bajra, wheat, barley, and cotton. For irrigation there are 27 reservoirs and twelve more are under construction as famine relief works. Many more dams are planned to be built in the course of the next ten years, which will raise the area of dam irrigation to two lakhs acres.

A Treeless Land

On the whole Kutch is a treeless and waterless land. Sterility of large tracts of land and brackishness of water are the striking feature of the country.

The average annual rainfall ranges between 16 in. in the east and 12 in. in the west. The entire rain falls during July and August, the number of rainy days in the year being only about seven. The maximum recorded annual rainfall was 45 inches in 1926. Last year (1950) also it was a year of highly abnormal precipitation and 23 inches of rain fell in about 36 hours. As a result there was extensive damage to roads and bridges.

Famine is a frequent occurrence. In the past in years of scanty rainfall people used to stray with their flocks to the irrigated land of Sind which is now in Pakistan.

The chief means of communication is the sea. Goods are carried by countrycraft along the coast, the main export and import centres being the flourishing ports of Mandvi, Tuna, Mundra, and Kandla. The last named port is now being developed into a major port on the west coast.

Road Communications

In this State, which is about 170 miles long and about 110 miles wide, the total length of metalled roads is 266 miles—less than 0.03 mile per square mile of area. Another 178 miles of famine relief roads are under construction, but even after the completion of these famine relief works the total road length of the State will remain inadequate for the proper development of the country.

A glance at the map will show that the existing metalled roads serve only the south-eastern corner of the State round the capital town of Bhuj. Large tracts of land still remain isolated. The proposed famine relief works (178 miles) will improve the situation, but to a small extent only.

The Kutch State metre-gauge railway connects Bhuj, Kandla, Tuna, and Bachau. The metalled roads connecting these places run along the railway line, sometimes on the same formation.

Present State of Roads

In the past repairs and maintenance of roads have been rather neglected and their present condition is very poor. On an average only 6½ miles, out of a total metalled length of 266 miles, have been remetalled every year for the last ten years. Indeed, much more could not be expected of the only two old decrepit and unreliable road rollers which the State possesses.

The renewal of 6½ miles every year assumes a life of 40 years for water bound macadam It would be more reasonable to

assume a life of seven years and renew 38 miles every year if the prevailing standards of construction continue. This would require more equipment and the Central Roads Organization have supplied one new road roller recently. More road rollers, bitumen boilers and spreaders, scarifiers, and stone crushers are proposed to be purchased.

The State P. W. D. which consists of a State Engineer, an Assistant Engineer, and four Overseers is in charge of the construction and maintenance of roads and bridges. In addition to these it is responsible for the upkeep of state buildings scattered all over the country. The Department also controls factories, electric plant, flour mills, and so on.

Standards Old and New

At present the roads in Kutch have very narrow formation widths. The land width is all that is occupied by the formation. Widening, therefore, involves immediate acquisition of land. This is likely to be strongly resented as culturable land is scarce in the state. But it is desirable that the formation should be increased to at least 24 ft.

The roads recently built as famine relief works have a 30 ft wide formation with 30 ft wide drainage crossings.

Estimates for the new proposed roads, mentioned later on in this article, provide for 66 ft wide road land, 16 ft wide formation, and 12 ft wide surfacing.

Most of the metalled roads are water bound macadam, surfaced with moorum. As the climate of Kutch is dry and the intensity of traffic is low, W.B.M. has a fairly long life. But it has to be kept covered with moorum, otherwise the surface is too rough to drive upon and tends to unravel. Moorum surfacing is done every three years.

Black Topping Suggested

A comparitive study of the economics of surface types in Kutch reveals that surface dressing with bitumen would cost about 20 per cent more than water bound macadam including initial construction and subsequent maintenance. In spite of this slightly extra cost it might be worthwhile to try the higher type of surfacing on the roads leading to Kandla.

In this comparative study a life of seven years for water bound macadam has been assumed with moorum covering every third year. For a bituminous road a life of only 12 years has been taken with resurfacing at four year intervals. This is quite conservative and it is expected that actually the difference in ultimate costs might be even less than 20 per cent.

Materials

Kutch, from all reports, is the road builder's paradise. Excellent trap stone may be quarried in many localities and road metal costs, on the average, Rs 25 per hundred cu. ft.

Moorum can be had along the road everywhere. In the most unfavourable cases the lead might be three miles if very good material is insisted upon. The average cost would be Rs 10/- per hundred cu. ft. at the site of the work. Sand and lime are also abundant.

Several varieties of stone suitable for masonry are available in plenty everywhere. Kutch is famous for her stone masons of great skill. Stone arch bridges could be adopted as a standard and should prove the most economic design.

Cement at Rs 6/- per cwt, steel at Rs 600 per ton, and coal at Rs 60/- per ton, and bitumen at Rs 280/- per ton are imported. There is no indigenous timber.

The Future

A road development plan estimated to cost Rs 64 Lakhs has been suggested and phased as under :-

Year	Rs (Lakhs)
1950-51	5.5
1951-52	11·2
1952-53	10·8
1953-54	15·0
1954-55	11·5
1955-56	10·0
Total	64·0

The plan embraces the following works in that order of priority :-

1) Completion of the famine relief roads under construction ;

2) Construction of causeways on some of the existing roads :

3) Construction of essential inspection Bungalows ;

4) Construction of new roads, totalling about 200 miles.

Work on the new proposed roads will begin in 1953-54. Till then it is not likely that funds will be available for this purpose. When construction of the new roads begins, cross drainage works will be taken up first. These works are badly required because without them even the existing village tracks cannot be used during the rains. In the period 1954-56 the embankments and the remaining work will be completed.

By 1956 the mediaeval State of Kutch may expect to have an up-to-date port (Kandla) and a good network of roads.

INGENUOUS

Official ingenuousness is boundless. There is that classic example in 1933 (not that there have been no instances since) when Mr. Chamberlain, in introducing his budget, said: " ..... I certainly have no desire to cramp the development of the diesel engine....." and in the same breath announced that the tax on its fuel would be increased by 700 per cent!

(From 'Roads and Road Construction' Feb., 1951)

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HIGHWAY

The word "Highway" comes from England where kings built roads along paths the native animals had worn in following high ground. Thus, the words "heigh-rode" and "high-waye" become "highway," meaning public thoroughfare.

(From 'The Highway,' —December 1950)

THE PRACTICE OF THEORY

Accomplishing the Impossible

(Extracted from 'Journal of the Franklin Institute'– January, 1937.)

WHEN a crazy cockney first walked a London street, during a heavy rainy downpour under a peripatetic tent which he called an 'umbrella', it soon became the target for rotten eggs and decayed vegetables, and it was a long time before another brave soul risked an avalanche of ridicule.

When a fool called Murdock had lighted up his factory in Soho with gas obtained from coal, and proposed to pipe the streets of London to carry this deadly, dangerous explosive to private houses, he was literally laughed out of town. Tallow dips and oil lamps were good enough for conservative old John Bull.

Protest Parades

Many years afterward I saw a "Protest Parade" wending its way down Broad Street in the City of Brotherly Love, to denounce the erection of a Gas Works; and another wholesale exhibition of conservatism took place in the same way to protest against the installation of the electric trolley and the stringing of highly charged copper conductors over the public streets; when any school boy could tell you that copper wire corrodes and electric current kills. Away with these crack-brains who would menace pedestrians.

There was many a shaking head and frowning face at the proposed erection of water works with underground pipes to convey drinking water to our homes, the precious fluid that some people had the audacity to use for bathing purposes, and there was much talk of frozen pipes, flooded cellars, and floating corpses. "Why change the sane and safe hand pump?"

When John Fitch announced that he would on a certain day propel a boat by steam-power from Philadelphia to Trenton, **upstream**, there came from the banks of the Delaware a might gale of laughter; for that, surely, was the height of absurdity. Any fool could tell you that steam could not overcome gravity. But it did; and those who came to jeer were the loudest to cheer.

And poor Professor Langley, dubbed by many "Darius Green Number Two," with his theory of human flight upon which he had worked many years before he built his steam driven "Aerodrome," and watched it upon its first flight splash and sink in the Potomac; but, alas, not living to see that self-same airplane make several successful flights when furnished with a modern gasoline motor.

Taking a leaf from Langley's book, the two shy, modest, Wright Brothers sought the seclusion of lonely Kitty Hawk to make a practical test of their theory of human flight, and to evade the smarting ridicule of the Press. How did they fit Practice to Theory?

A Heavy Task

The practice of theory is no light task; for the Conservatist is smug and soulless, and ridicule is a brake on the wheel of progress; but before the mind's eye of the Pioneer burns a steady light that leads him on to final accomplishment; for

As they watch the valiant son
Start out to do what can't be done,
The gods are wise; they understand
He does not need a helping hand.
The Pioneer will find each day
Rocks, ruts and ridges in the way
To give him strength to dare and do
And make at last his Dream come true.

—o—

TO OUR ADVERTISERS TO BE

In one of our very early editions (how long ago it seems) when we were trying to persuade advertisers to take space in our Journal, we published the following verse. Later we found that many people could not follow the phonetics; so this time we have given some explanation.

TO OUR ADVERTISERS TO BE

Oh, Traders in your hours of E.E.E.E. *(ees or ease)*
If on this paper you should C.C.C.C. *(seize)*
Take our advice, you'ld be Y.Y.Y.Y. *(wise)*
Through us, straight off, to advert — I.I.I.I. *(advertise)*

This is the latest of Rev — U.U.U.U. *(Reviews)*
Not meant for men who stand in Q.Q.Q.Q. *(queues)*
But for the stalwarts in the thr — O.O.O.O. *(throes)*
Of solving India's Transport W — O.O.O.O. *(woes)*

Good space we'll give the firm that S — L.L.L.L. *(sells)*
The best of goods: selection T — L.L.L.L. *(tells)*
Publicity's the thing that P — A.A.A.A. *(pays)*
Neglected business soon de — K.K.K.K. *(decays)*

We hope this little verse (or worse) will catch the eye of prospective advertisers as it is only with their aid that we can keep on publishing and improving this review.

Our circulation is still small (under 2000) BUT OUR MAGAZINE REACHES THE HANDS OF THE MEN WHO COUNT, THE MEN WHO ACTUALLY PURCHASE ADVERTISED PRODUCTS, the road engineers of India, the Secretaries and Ministers of our Public Works Departments, and (but they will deny reading it) the very numerous and powerful staff of our departments of finance who spend most of their lives, like Molotov, in saying "NO".

Do advertisers consider that much of the seed they sow (or ninety nine per cent of it) falls on stony ground? Our Review is rich soil in which it would pay to grow GOOD seed. We shall not accept advertisements for questionable products.

HERE AND THERE

1 TO ROLL OR NOT TO ROLL

THE usual method of finishing the surface dressing is to roll the chippings with a three-wheel roller weighing 3 to 8 tons, and sometimes even 10 to 12 tons. Sometimes no roller is used at all.

The cost of rolling is small (0·6 d per sq. yd for fully mechanized work).

The decision whether to roll or not and what type of roller to use would depend on its effect on the life and quality of the dressing.

Experiments have been carried out in England using different kinds of chippings, different sizes of rollers and no rollers at all, compaction being left to traffic only (pneumatic tyred traffic at 10 m. p. h).

It is too early to draw final conclusions, but the results suggest that (a) the use of the different steel-tyred rollers had little effect on the appearance of the dressing, except that the number of chippings crushed was greater with the heavier rollers ; (b) no detrimental effect resulted when no roller was used, providing the traffic was controlled to a speed of 10 m. p. h. or less for 15 minutes after application of the dressing; (c) in the experimental work the use of a large notice asking drivers to reduce speed to 10 m. p. h. had sufficient effect to prevent any damage to the surface dressing. It was felt, however, that, in the long run, a more positive means of restricting speed would be necessary.

Recommendations :— (i) Heavy rollers which crush the chippings should not be used, but lighter rollers of 6 tons or less help to finish the dressing before the traffic can damage it.

(ii) Except on the most lightly trafficked roads, it is inadvisable to dispense with a roller unless it has been found that traffic can be slowed down to a speed that will bed down the chippings rather than throw them off the road.

* * *

Extracted from ' Highway Research Abstracts '–Sept. 1950]

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2. ROAD SURFACING WITH RUBBER POWDER

A plant capable of producing 50 tons of powdered rubber a month, with a potential of several times that amount if the demand so warrants, is being built at Singapore. The managing director stated that full commercial production would commence soon. He also stated that the only other place where powdered rubber is being produced is the pilot experimental station at Buitenzorg in Indonesia. A larger plant is reportedly being built on a Government estate in Indonesia.

[*' Highway Research Abstracts '–Sept. 1950*]

[*A report from Madras states that the price of rubber has become almost 4 times what it was some time ago. The cost of rubber powder per furlong of highway would be about Rs 1200/- while the cost of bitumen would be only Rs. 450/-.....Ed*].

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3. HIGHWAY FUNDS MAY BE SPENT TO ADVERTISE TOURISM

KENTUCKY state road funds can be spent on tourist-promotion apvertising, maps and highway information bulletins, according to an appellate court ruling. The court's order reversed a ruling of a lower court that such expenditures are unconstitutional

The opinion state that advertising Kentucky's attractions in newspapers and magazines gives a potential tourist advance information on what he can see in the state. Out-of-state tourists bought 87.000,000 gallons of petrol in Kentucky last year, and paid more than 6,000,000 dollars in fuel taxes. The cost of maps and advertising space, the opinion said, is "relatively nothing in comparison with the huge amount of revenue they attract into the road fund."

The court pointed out that it would be the duty of the highway department to notify motorists if a catastrophe should make Kentucky's roads and bridges impassable; conversely, it declared, it is proper to inform motorists of what roads are open to traffic and can be travelled with the greatest assurance of safety.

The case grew out of a promotional programme in which the highway department placed advertisements in newspapers and magazines containing coupons to be cut out and mailed in for maps and further information.

(*Extracted from ' Better Roads '—September, 1950*)

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4. HYDRAULIC TESTING MACHINE CRUSHES 9-INCH STEEL BARS

A machine combining tremendous power and extreme sensitiveness of operation is now being used by the United States Bureau of Reclamation.

The "universal hydraulic testing machine," as it is called, is as high as a five-storey house. It can crush or pull apart, for example a forged steel bar nine inches thick by exerting a 5,000,000 lb force. But it can also be adjusted so accurately that a watch glass can be cracked without breaking the watch.

The machine is used to test the stresses and strain of various materials under pressure. Exact measurements are made of changes in the form of materials under pressure by small elecronic gauges. (U. S. A. IN REVIEW, 23—2—51).

(*From ' Science Newsletter ' No. 15*).

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5. INTERNATIONAL RECIPROCITY

PRESIDENT Truman has ratified the Convention on Road Traffic, opened for signature at Geneva in September 1949, and a related protocol concerning occupied countries or territories opened for signature at the same time. The convention is designed to facilitate international motoring. It establishes a basis for world-wide uniformity in the reciprocal recognition of motor vehicle registration certificates, drivers' licenses and customs bonds; rules for safe driving: equipment requirements; and maximum sizes and weights on high ways designated for international traffic. When the treaty comes into force, a United States motorist will be able to take his car to any foreign country which is a party to the convention and enjoy reciprocity similar to that which he now experiences in his travels in the various states.

(*Extracted from ' Traffic Engineering '—November, 1950*).

(*India also has signed the Protocol—Ed.*)

6. WHY AMERICA KEEPS TO RIGHT

WHO knows, for instance, that the use of a certain type of horse-drawn waggon was responsible for changing the rule of the road in early America? The English custom of keeping to the left prevailed at first and waggons and carriages had been driven from the right side. With a kind of waggon known as the Conestoga, however, the driver was always at the left, either astride a nearside horse, walking, or sitting on a sliding board between the left wheels, from which he could apply the brake or guide his team of six horses. To ensure a clear view of the road ahead—horses and waggon extended sixty feet—it was necesssary to keep to the right. Other vehicles soon adopted this practice for it was easier to follow the ruts made by the heavy Conestogas than to cross them. In due course the new custom found legal expression, hence the rule of the road today.

(*From an article " Highways in our National Life "—' Roads and Road Construction '—Feb. 1951*).

7. CEMENT AND LIME IDEAL CONSTITUENTS FOR SOIL STABILIZATION

FOR the past few years work has been in progress at Military Engineering Experimental Establishment on a new technique of construction. This is soil stabilization —the mixing of chemical constituents with ordinary soil to form a road foundation.

When success has finally been achieved on this project, the Army engineer will have been freed from a necessity which has plagued him since the Romans built Watling Street—the need to carry stone for road construction for long distances over often unsuitable country.

The Establishment works on soil stabilization in collaboration with the Road Research Laboratory, the latter organization having pared down the number of suggested chemical constituents by laboratory trials to a short list with which practical tests are being carried out by M.E.X.E. These are designed to reveal which chemical will be suitable for mixing with each or even any type of soil.

Using adapted American wartime plant for mixing the soil with chemicals on test, the Establishment first built a test road in 50 ft strips, each consisting of a mixture of sand and one or more chemicals. Traffic was then run over the road until each strip was destroyed.

The experiment is now being repeated, using clay instead of sand, and will be followed by further tests using a specially difficult soil, imported from Isle of Ely, consisting of a mixture of clay and peat.

Tests carried out so far, incidentally, indicate that cement and lime may well be the ideal constituents. They have also shown that roads of this type stand up extremely well to traffic; the Establishment, in fact, has found it a hard and lengthy job to test them to destruction.

(From an article "Experiments in Road Construction Techniques" — 'Highways and Bridges'—Jan. 23, 1951).

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8. ENGLAND NEEDS A DICTATOR

SIXTEEN years ago Mr. Hore-Belisha introduced his famous beacons, and ever since that day the correct procedure to be adopted by motor drivers and pedestrians has been left in a fog of uncertainty. Pedestrians could use them if they liked, and need not if they did not want to; motorists were vaguely supposed to give way if a pedestrian showed indefinite signs of intending to cross the road. Few motorists complied with this shadowy and unofficial rule, and fewer still were prosecuted for ignoring it. Pedestrians could duck in front of moving traffic at a crossing provided with signals, even if an indicator showed the warning words "Do Not Cross." After 16 years of this nonsense, Mr. Barnes has at last given utterance to the profound wisdom that traffic, having been given the right-way signal by a green light, can start moving, and the pedestrian must then give way to the traffic.

This example is only one instance of the slowness of Whitehall in everything which concerns roads and road traffic. It is such slow motion, in fact, that it is almost imperceptible. Another classic example is the Great West Road, otherwise known as the Brentford By-pass. This was first proposed in 1837, the traffic conditions in Brentford High Street being intolerable even in those days. Ninety-eight years elapsed before it was finally constructed.

It is well known that the preliminaries, land negotiations, conferences with this authority, that authority and the other one, the everlasting "passed to you" game with half-a-dozen Ministries taking part and the "referring back" of as many committees, takes far, far longer than the designing and construction of a new arterial road. The original plans, in fact, are often obsolete before the work can be started.

I return, therefore, without apology, to my heading. We need in this country, as never before, a Director-General of Roads with power to act and adequate financial backing. He should be an engineer, not a politician, and we would remind the timorous, who may regard such a suggestion as "totalitarianism," that **previous periods of intensive road development have always occurred under the dominant leadership of engineers. The solving of our road problems is a technical, not a political matter,** and only a technical dictator, freed from all the tangles of official red tape, can do the job.

The whole thing, in fact, may be summed up in the words of a harassed London policeman, recently addressed to a member of the staff of this journal while seated at the wheel of his car during one of the fantastic traffic jams which are now an everyday occurrence. Nothing had moved for about ten minutes and several lines of vehicles were tied up in knots when the perspiring Bobby came up to the side of the car and said: "The trouble is guv'nor, there are too many b.....experts at this job." The Shavian adjective, we are informed, was pronounced in the inimitable manner of the true born Cockney.

(Extracted from "Highway and Bridges" December, 13, 1950.)

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9. LIQUIFIED PETROLEUM GAS

A result of recent developments in automobile research is the production of buses with high compression engines designed to use propane, bottled gas, instead of petrol or diesel fuel. Called liquified petroleum gas, propane is a slow-burning, high octane fuel. A by-product of petrol, it burns without smoke or odour. Propane leaves no carbon deposit and eliminates much gear-shifting. As a result, intervals between oil changes and engine overhauls are longer. Propane also costs less than petrol.

(From 'Science Newsletter,' No. 10).

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10. DESPAIR

SIR Eric's statement (on his resignation) went on to explain that he had long been dissatisfied with the structure of the (National Coal) Board and the manner in which it was operating. **His firm conviction was that while it continued on the existing Civil service lines,** it could never produce the quantity of coal, and at prices, which the national interest demanded. Sir Eric Young said that he had more than once thought of resigning, but had hoped that by remaining he might help to bring about necessary changes. That hope, however, had steadily diminished and, with it, his own prospect of useful service.

(Extracted from 'The Engineer, -Dec. 15, 1950).

LOADS AND ROADS

EFFECT OF HEAVY VECHICLES ON ROAD PAVEMENTS

[Extract from "MAIN ROADS"—September, 1950].

* *

THE trend towards higher total vehicular loads and higher axle loads is not unreasonable in itself provided it does not result in destruction of roads and bridges. The capital asset, represented by the roads and bridges has been created by the community in the past and must be protected against undue damage.

Looking to the future, it is apparent that a balance must somehow be struck between Loads and Roads. The point at which this should occur, should be determined by road transport costs, and will be the point at which the total costs per ton-mile are a minimum, including in total costs both cost of road upkeep as well as direct cost of vehicle operation. This point of balance will not be the same in every country owing to variations in cost of vehicles, fuel, labour, road construction and maintenance and other components of total road transport cost. Likewise, it will not necessarily be the same in all parts of any particular country.

While it may be in the community interest to provide heavily constructed pavements on some routes, adapted for heavy wheel and vehicle loadings, there will remain a far greater mileage of roads where it would not be economical for pavement construction to be much heavier than that existing, and where in any event the necessary funds could not be found for more costly roadways.

The problem of road damage resulting from heavier vehicular loadings has received considerable public notice in the United States during recent years, as a result of a trend there also towards the use of heavier vehicles. Highway authorities have not been slow to point out the inevitable results of the trend, and the need for calling a halt to it.

The economics of road transport in respect of vehicular weights and roads costs has received some study in Australia.

The subject is under special research in the United States by the United States Highway Research Board. Such research and studies will gradually build up a body of reliable information leading to the theoretically correct economic adjustment of roads and loads under various conditions. Should investigation indicate that heavier road pavements are necessary in the interests of the community, to secure cheaper total cost of road transport, such heavier pavements could only be provided over a lengthy period on account of cost involved. It is apparent, therefore, that at this stage all efforts must be directed at preserving from undue damage the asset in the road system already created by the community.

* * *

The amended limitations are based on a maximum axle load of 18,000 lb (8 tons) on dual tyred axles, corresponding to that recommended by the American Association of State Highway Officials and adopted in most American States. On this basis of an 18,000 lb (8 tons) axle load, the following limitations have been provided for single and bogie axles with varied tyre equipment and for tyre pressure not exceeding 100 lb per square inch :—

(a) (i) Single axle, single tyres (2 tyres only), 4½ tons.

(ii) Single axle, single tyres (2 tyres only), if the tyre pressure does not exceed 75 lb per square inch, 5½ tons.

(b) Single axle, dual (or more) tyres, 8 tons.

(c) Two (or more) axles (bogie), single tyres, 9 tons.

(d) Two (or more) axles (bogie), dual tyres, 13 tons.

The overall loading or, in other words, the maximum permissible vehicle loaded weight, is covered by a tabulation of limitations based on the formula $W = C(L+40)$, also developed by the American Association of State Highway Officials, and applies to all axle groups. In this formula —

W = Weight in lb
C = A coefficient
L = The length in feet.

The coefficient adopted is 600 for axle spacing to 18 feet and 650 for axle spacing in excess of 18 feet. The break at 18 feet has been adjusted to a smooth curve. Overall loadings are as set out in the tabulation which extends to 60 feet.

Distance between axles of vehicle or any group of axles of the vehicle	Maximum loaded weight of vehicle or group of axles.	
	tons.	cwts.
Exceeding 40 inches and not exceeding 8 feet	13	0
,, 8 feet ,, ,, ,, 9 ,,	13	3
,, 9 ,, ,, ,, ,, 10 ,,	13	10
,, 10 ,, ,, ,, ,, 11 ,,	13	17
,, 11 ,, ,, ,, ,, 12 ,,	14	3
,, 12 ,, ,, ,, ,, 13 ,,	14	10
,, 13 ,, ,, ,, ,, 14 ,,	14	17
,, 14 ,, ,, ,, ,, 15 ,,	15	3
,, 15 ,, ,, ,, ,, 16 ,,	15	10
,, 16 ,, ,, ,, ,, 17 ,,	15	17
,, 17 ,, ,, ,, ,, 18 ,,	16	3
,, 18 ,, ,, ,, ,, 19 ,,	16	10
,, 19 ,, ,, ,, ,, 20 ,,	16	16
,, 20 ,, ,, ,, ,, 21 ,,	17	3
,, 21 ,, ,, ,, ,, 22 ,,	17	9
,, 22 ,, ,, ,, ,, 23 ,,	17	16
,, 23 ,, ,, ,, ,, 24 ,,	18	2
,, 24 ,, ,, ,, ,, 25 ,,	18	9
,, 25 ,, ,, ,, ,, 26 ,,	18	15
,, 26 ,, ,, ,, ,, 27 ,,	19	2
,, 27 ,, ,, ,, ,, 28 ,,	19	8
,, 28 ,, ,, ,, ,, 29 ,,	19	14
,, 29 ,, ,, ,, ,, 30 ,,	20	1
,, 30 ,, ,, ,, ,, 31 ,,	20	7
,, 31 ,, ,, ,, ,, 32 ,,	20	13
,, 32 ,, ,, ,, ,, 33 ,,	21	0
,, 33 ,, ,, ,, ,, 34 ,,	21	6
,, 34 ,, ,, ,, ,, 35 ,,	21	12
,, 35 ,, ,, ,, ,, 36 ,,	21	18
,, 36 ,, ,, ,, ,, 37 ,,	22	4
,, 37 ,, ,, ,, ,, 38 ,,	22	10
,, 38 ,, ,, ,, ,, 39 ,,	22	16
,, 39 ,, ,, ,, ,, 40 ,,	23	3
,, 40 ,, ,, ,, ,, 41 ,,	23	9
,, 41 ,, ,, ,, ,, 42 ,,	23	15
,, 42 ,, ,, ,, ,, 43 ,,	24	1
,, 43 ,, ,, ,, ,, 44 ,,	24	7
,, 44 ,, ,, ,, ,, 45 ,,	24	12
,, 45 ,, ,, ,, ,, 46 ,,	24	18
,, 46 ,, ,, ,, ,, 47 ,,	25	4
,, 47 ,, ,, ,, ,, 48 ,,	25	10
,, 48 ,, ,, ,, ,, 49 ,,	25	16
,, 49 ,, ,, ,, ,, 50 ,,	26	1
,, 50 ,, ,, ,, ,, 51 ,,	26	7
,, 51 ,, ,, ,, ,, 52 ,,	26	13
,, 52 ,, ,, ,, ,, 53 ,,	26	19
,, 53 ,, ,, ,, ,, 54 ,,	27	5
,, 54 ,, ,, ,, ,, 55 ,,	27	10
,, 55 ,, ,, ,, ,, 56 ,,	27	16
,, 56 ,, ,, ,, ,, 57 ,,	28	2
,, 57 ,, ,, ,, ,, 58 ,,	28	8
,, 58 ,, ,, ,, ,, 59 ,,	28	14
,, 59 ,, ,, ,, ,, 60 ,,	28	19

Saurashtra, Civil Works Budget, Saurashtra 1951-52

THE following extracts pertaining to the civil works budget estimates have been taken from the General Budget of Saurashtra for the year 1951-52.

	Actuals 1949-50	Revised Estimate 1950-51	Budget Estimate 1951-52
I. Revenue (Civil Works)			
(i) Rents	2·54	4·06	4·00
(ii) Ferry Receipts	·16	—	—
(iii) Tolls on Roads	·16	—	—
(vi) Receipts from Workshops.	·92	·01	—
(v) Transfer from Central Road Fund	·59	—	—
(iv) Transfer from Bhar Singh Ji Polytechnic Institute Fund.	—	·30	—
(vii) Miscellaneous	4·96	4·40	1·08
(viii) Deduct Refunds	·04	—	—
Total	9 29	8·77	5·08
(ix) Recovery of over payment	·54	·07	·07
Total Revenue	9·83	8·84	5·15*
II. Expenditure (Civil Works)			
(i) Original works	20·82	39·00	47·73
(ii) Repairs	18·39	27·14	31·04
(iii) Establishment	·18	5·86	9·75
(iv) Tools and plant	1·35	·68	·44
(v) Grants-in-aid	·33	5·51	2·00
(vi) Suspense	5·73	1·50	—
Total Expenditure	46·80	79·69	90·96†
III. Expenditure (Communications only)			
(1) Original Works			
(i) Ordinary	10·93	28·07	56·83
(ii) Lump Cut	—	3·07	—
(iii) Expenditure to be met from State Road Fund.	—	—	30·00
Total Original Works	10·93	25·00	26·83
(2) Repairs			
(i) Ordinary		11·09	13·00
(ii) Special	10·13	4·50	5·00
(iii) Rearing of Roadside trees in M. S. Div.		1·91	1·50
Total Repairs	10·13	17·50	19·50
(3) Total Communications (Original works and Repairs)	21·06	42·50	46·33*
IV. Receipts from Roads			
(1) Receipts under Motor Vehicles Act	16·11	16·10	16·47
(2) Receipts from Motor Spirit Sales Tax.	N. A.	2·75	5·50**
(3) Ferry Receipts	·16	—	—
(4) Tolls on Roads.	·16	—	—
(5) Transfer from Central Road Fund	·59	—	—
Total Receipts	—	18·85	21·97

† Does not include the provisions for expenditure from the State Road Fund of Rs 30 lakhs and from subventions from the Central Road Fund (Rs 60 thousands).

*Does not include the provision of Rs60,000 on accountof the subventions from the Central Road Fund.

** Increased receipts due to the enhanced Sales Tax on Petrol of 4 annas a gallon during 1951-52 against that of 2 annas a gallon during 1950-51.

A BRIEF REVIEW OF THE SAURASHTRA BUDGET.

(With special reference to Civil Works)

THE Saurashtra Budget for 1951-52 provides for total revenue receipts of Rs 807·54 lakhs and expenditure chargeable to revenue of Rs 805·40 lakhs leaving a small surplus of Rs 2·14 lakhs. According to the Revised Estimates for 1950-51 the revenue receipts amount to Rs 803·22 lakhs and revenue expenditure to Rs 791·18 lakhs with a consequent surplus of Rs 12·04 lakhs.

Total revenue expenditure on civil works for 1951-52 estimated at Rs 90·96 lakhs forms 11·3 % of total revenue expenditure of the State in the same year. The corresponding percentages for the two preceding years 1950-51 (Revised Estimates) and 1949-50 (Actuals) are 10·1 and 4·8 respectively.

Revenue expenditure on communications (original works and repairs only) in 1951-52 is estimated to be Rs 46·33 lakhs in addition to an expenditure of Rs 30 lakhs on original works met from the State Road Fund. The revenue expenditure on communications amounts to about 60 % of the revenue expenditure on civil works (original works and repairs) while the same for the two previous years *i.e.* 1950-51 and 1949-50 was about 64 per cent and 54 per cent respectively.

The proportion of communications expenditure to total state expenditure for 1951-52 (Estimates) and the two earlier years is given below.

	Communication Expdr as % of total expdr.
1951-52 (Budget Estimates) ...	5·8
1950-51 (Revised Estimates) ...	5·4
1949-50 (Actuals) ...	2·2

—o—

(Continued from pega 26)

same principle. The prisoners were accordingly made over to Colonel Kennedy, who placing them under the orders of some sapper privates acting as non-commissioned officers, opened out a piece of perfectly level road superseding one of the worst ascents and descents in the Governor-General's daily journeys.

The result was as the Colonel expected: his Lordship was so pleased with the experiment that he sanctioned the construction of the road to the plains on the same principle, and directed it to be immediately constructed".

The road construction work having been formally sanctioned it was taken in hand in right earnestness and many officers of Sir Charles Napier's staff worked on the project under the direction of Colonel Kennedy. The work was carried out in a most scientific and skilful manner and, ere long, the road was opened for loaded animals and travellers. On the departure of Colonel Kennedy to England before the line was wide enough for carts, the work was carried on under the direction of his energetic and able successor, Major Briggs. The construction was eventually finished in 1856 and took about six years to complete. For many years the road was popularly known as 'Kengree Sahib ki Surruck'.

Writing on the same subject, Mr. William Edwards says: "There is nothing I look back to with greater pleasure in the whole course of my long service, than having been, in some measure, instrumental in relieving the hill people from this enforced labour, which was nothing short of an insupportable and fearful system of serfdom".

The story has many a moral for us today and let us not forget to profit by it.

Yours etc.,

CORRESPONDENCE

THE KALKA - SIMLA ROAD

A Case of "Progress under Protest".

Sir,

THE following notes regarding the Kalka Simla Road (part of National Highway No. 22) will, I think, be of interest to the readers of the Review:

Few will gainsay the fact that this road, no less than the wonderful mountain railway running parallel to it, is a masterpiece of engineering skill and provides a most interesting study for engineers. Very few people could have ever thought that the construction of this road was a waste of money, and still fewer have remained unconvinced of the innumerable benefits that this road has brought to the population of the hill areas through which it passes. Yet, it is true to say that the history of the construction of this road is not an exception to the many cases of 'Progress under protest'.

It is not difficult to imagine how difficult must have been the conditions of travel to Simla from the plains before the construction of this road. The 38 miles between Ambala and Kalka at the foot of the hills had probably to be done either by the Government van or the 'dawk gari', either of which methods no doubt left much to be desired from the point of comfort of travel.

From Kalka onwards the mode of transit was either by means of 'jampans' or ponies; all the luggage was carried up by coolies or on mules. It seems on one occasion as many as 15,000 to 20,000 men had to be collected together from great distances, and for very inadequate remuneration, for private and public service as the hill-station became more and more popular. This must have caused a great hardship to the hill people who were detained from their homes during seed-time or the harvest season when their presence was most required in their fields.

Mr. William Edwards, the then Superintendent of the Hill States, in his **Reminiscences of a Bengal Civilian, 1866**" writes:

"...There seemed to me but one way of remedying this sad state of things, and that was by the construction of a road from the plains to Simla which might be practicable for wheeled carriages and beasts of burden, and so **substitute animal carriage for human porterage.** With this view, one of my assistants and myself were endeavouring to lay out a new line of road and had marked by flags a considerable part of it, when I was called to meet the new Commander-in-Chief, Sir Charles Napier, and accompany him from the plains to Simla. As we rode along the old road the flags attracted the attention of His Excellency's Military Secretary, Colonel Pitt Kennedy, one of the first engineers of the age. The object in view, when explained to him, seemed to his large and benevolent mind, to be of the highest importance, and he immediately offered to survey and lay out a line of road suited for wheel carriages. I was most thankful to accept his offer in substitution of my own crude and imperfect attempt.

Some labourers were shortly after placed at Colonel Kennedy's disposal, and in a very short time, but after great labour and trouble, and with much personal risk, he succeeded in laying out a line by which Simla could be reached from the plains by a gradual and easy ascent the whole way.

The line being thus laid out, the next thing was to induce the Government to accede to its construction; but all my proposals for this purpose were looked on very coldly, and I almost despaired of success. At length Colonel Kennedy suggested that I should place all the prisoners in my goal, only ninety in number, at his disposal, in order that he might open out, by their means, a mile of road on his new principle, parallel with a very steep and tortuous portion of the way leading to Lord Dalhousie's country residence, which might attract his Lordship's attention on passing and repassing. Colonel Kennedy was convinced that the Governor General's practical mind would not fail to notice the experimental portion, and acknowledge its superiority over the old system, and perhaps be led in consequence to sanction the proposed new road being constructed on the

(*Continued on page 25*)

TECHNICAL INFORMATION

(i) STUDIES OF SKEW SLAB BRIDGE MODELS

LABORATORY test data on four skew slab-bridge models of reinforced concrete are reported. Three of the models had 45-deg. angles of skew, and were half scale, with span lengths normal to the abutments of 9 ft 9 in. The fourth model had a 60 deg. angle of skew, and was fifth-scale, with a normal span length of 5 ft 10-5/8 in. The amount and arrangement of steel reinforcement varied from bridge to bridge. All bridges were of two-lane capacity, had integrally cast curbs, and were designed for H-20 highway truck loading.

The purposes of the tests were: (1) to compare the actual behaviour of the bridges with the behaviour as predicted by the theory of isotropic slabs and (2) to observe conditions at and near ultimate loads-in particular, the manner of cracking of the concrete and yielding of the reinforcement, crushing of the concrete, and magnitude of loads at initial yielding and at ultimate capacity.

The principal findings are: (1) The theory and experiments are in good qualitative agreement for bridges in both uncracked and cracked conditions. (2) The quantitative agreement of the theoretical and measured strains is fair for uncracked structures, poor for cracked structures; however, only a rather crude application of the theory is used herein, mainly for purposes of comparisons of experimental results. (3) The effects of varying amounts and arrangements of reinforement on the distribution and relative magnitudes of strain are detectable and can, in the main, be qualitatively explained. (4) Initial failure in the 45 deg. skew bridges appears as yielding of the bottom spanwise steel at the centre of the slabs and in the 60-deg. skew bridges, as yielding of the top transverse slab steel in an obtuse corner of the bridge. (5) Ultimate loads range from 1½ to 2½ times the loads at initial failure.

(*Extracted from 'Highway Research Abstracts' —Sept. 1950*)

(ii) FUNCTIONING OF DUMMY JOINTS IN CONCRETE PAVEMENTS

AS a matter of concern to concrete pavement designers the Missouri Highway Department has made a limited survey of dummy type contraction joints to determine if the concrete below each dummy groove is cracked through to the bottom of the slab. This was done to answer a question as to whether some joints have failed to function and thereby caused excessive opening of other joints or cracks.

All of the sections of pavement included in the survey were of fairly recent construction (less than 8 years of age). They did not contain expansion joints. To reveal the presence or absence of cracks below the dummy joints it was necessary to remove the earth shoulder material at one or both ends of the joints and closely examine the edges of the concrete pavement.

The data which were furnished in tabular form show the results of observations on groups of joints selected at random from 27 projects, located in 16 counties. The conclusion, quoting from the letter, "apparently, practically all joints are cracked through at an early age as intended."

All of the joints that were recorded as being uncracked, representing a small percentage of those observed, were found in five of ten projects in which the joints were spaced only 20 ft apart. In all of the rest of the projects surveyed, some of which had 30 ft joint spacing and some of which had 50 ft joint spacing, no instance of an uncracked concrete below a dummy joint was found.

It may be of interest to some to note that the dummy joints, on projects where the joint spacing was 20 ft or 30 ft were not equipped with dowels and that the observer's remark in these instances was, "no loss of interlock" of the slab ends.

(*Extracted from 'Highway Research Abstracts'—Sept., 1950*)

List of Approved Works on National Highways

S. No.	Job No.	Name of Work.	Amount approved Rs	Remarks
		BOMBAY.		
1.	468 BM. 3	Construction of a skew bridge over the railway line in mile 73 of Bombay-Agra Road.	75,426/-	
2.	469 BM. 3	Construction of a diversion road to pass under the bridge on the railway line in mile 73 of Bombay –Agra Road.	40,861/-	
3.	470 BM. 4	Construction of drains with Hume Pipes in miles 300/0 to 304/0 of the Bombay-Poona-Bangalore-Madras Road.	20,000/-	
		WEST BENGAL		
4.	467 BG. 31A	Surveying the alternative alignment of N.H. No. 31A, portion lying in West Bengal.	15,300/-	
5.	471 BG. 34	Construction of 555′ span boat bridge consisting of 30 Nos. of boats on river Mahananda on National Highway No. 34.	1,89,268/-	
6.	472 BG. 31	Permanent restoration of flood damage caused to Siltorsa ferry ghat at Silbari and approaches on Falakata-Patlakhowa section of Bihar-Assam N.H.	53,000/-	
		PUNJAB		
7.	463 PB. 10	Widening Delhi-Multan Road in mile 214-215 near Malout in Ferozepur District.	64,790/-	
		HIMACHAL PRADESH.		
8.	466 H. P. 22	Metalling and surfacing Theog-Matiana section of the Hindustan -Tibet Road.	6,67,000/-	
		MANIPUR.		
9.	A474 MN, 39	Survey for the construction of a bye-pass at mile 34 of Dimapur –Imphal Road.	2,657/-	

List of Books added to the Roads Organization Library during April, 1951

1. **Joint Summer Meeting of the Institution of Civil Engineers and Institution of Civil Engineers of Ireland-A collection of papers.** (The Institution of Civil Engineers, Great George Street, London and the Institution of Civil Engineers of Ireland, 35 Dawson Street, Dublin, 1949).

PUBLICATIONS OF HIS MAJESTY'S STATIONERY OFFICE, LONDON.

2. **The Traffic Signs (Size, colour and Type) Regulations, 1950-S. 1. No. 953.**
3. **The Traffic Signs (General) Directions, 1950–S. 1. No. 954.**
4. **The Road Vehicles and Drivers order, 1950-S. 1. No. 1166.**
5. **Plant for Prestressing Concrete-National Building Studies, Bulletin No. 12.**
6. **The Analysis of concretes–National Buiding studies Technical Paper No.** 8. by S. R, Bowden and E. H. Green.
7. **Colonial Road Problems-impressions from visits to Nigeria** by H. W. Pollitt.
8. **Interim Report of the Departmental Committee on Determination of Cast Iron and Spun Iron pipes.**
9. **The Highway Engineers pocket Book** by Prof. F. G. Royal Dawson. (E & F. N. Spon, Ltd., 22 Henrietta Street, London, W. C. 2, 1950)
10. **Mechanics via the Calculus** (3rd edition) by P. W. Norris and W. Seymour Legge. (Cleaver-Hume Press, Ltd., London).
11. **The Analysis of Asphalt Paving Mixtures, May 1950.** (Asphalt Roads Association, 53 Victoria Street, London, S. W. I).
12. **Directory of Building Research Organisations in Europe.** (United Nations Economic Commission for Europe, Industrial and Materials Committee Housing Sub-Committee, Geneva, Sept., 1950.)
13. **Report on the Nationalization of Road Transport Services—Govt. of C. P. & Berar.** (Supdt., Govt. Printing, Madhya Pradesh, Nagpur, 1950).
14. **Proceedings of the Conference on Building Research.** (United Nations Economic Committee for Europe, Industry and Materials, Committee Housing Sub-Committee, Geneva, December, 1950).

PUCLICATIONS OF THE CENTRAL WATER POWER IRRIGATION AND NAVIGATION COMMISSION, NEW DELHI, JANUARY 1951.

15. **CWINRES, Poona.**
16. **Water Transport in India.**
17. **Hiracud Dam Project.**
18. **The Kakrapar Dam Project.**
19. **Official Statistics, Commonwealth of Australia–Transport and Communication 1948–49, Bulletin No. 40.** (Commonwealth Bureau of census and Statistics, Canberra)
20. **Bombay Marches on—A Review of the work and activities of the Government of Bombay for the period from October 1947 to March 1949.** (The Director of Publicity, Government of Bombay, 1951).
21. **The Civil List for the Hyderabad State corrected up to October 1, 1950)** (The Supdt., Govt. Press, Hyderabad, DN., 1950).
22. **Contributions to Proceedings of the Second International Conference on Soil Mechanics and Foundation**

Engineering held at Rotterdam, the Netherlands, June 1945-Circular Series No. 55-Experience with Flexible Culverts through Railway Embarkments by O. K. Peck and B. K. Peck (University of Illinois Engineering Experiment Station, Urbana).

23. **Handbook of Experimental Stress Analysis**, by M. Hetenyi, Editor-in-Chief. (John Wiley and Sons, Inc., New york, 1950).

24. **Prize Bridges 1928–1948**. (American Institute of Steel Construction Inc., 101 Park Avenue, New York, N. Y.).

25. **The Motor Industry of Great Britain, 1950** (The Society of Motor Manufacturers and Traders, Ltd., 148, Piccadilly, London, W. I).

26. **Related Instruction–a Key to Apprentice Training in Construction.** (Construction and Civic Development Deptt., Chamber of Commerce of the United States, Washington 6, D. C.).

27. **Traffic Analysis on a Danish City-The Moisture content Pavement-SVENSKAVAGFORNINGENS** Tidskrift; 1950-(Summaries in English.)

28. **Mathematics–A Text book for Technical Students** (2nd edition), by B. B. Low. (Longmans Green and Co., London).

29. **The Mathematical Theory of Plasticity,** by R. Hill. (The Clarendon Press, Oxford, 1950).

30. **TEER—UND ASPHALTSTRASSENBAU (Road Construction with Tar and Bitumen**. by Dr. J. O. Berbach.—(in German) (Strabenleau, Chemic and Technik Verlargs-geseles Chaft m. b. H. Heidelberg).

31. **Bombay Civil List showing Particulars of Gazetted Officers in the P. W. D. of the Bombay State,** corrected up to 1-7-1950.

32. **Construction and Maintenance of forest Truck Roads**, by C. R. Silversides. (Pulp and Paper Research Institute of Canada, 3420, University Street, Montreal 2, Canada, 1949).

33. **The Design of Flat Plates (Session 1949–50),** by C. C. Pounder. (The Association of Engineering and Ship-Building Draughtsmen, 96, St. George Square, London, S. W. 1).

34. **The Rigid Frame Bridge (3rd edition)** by Arthur G. Hayden and Maurice Barron (John Wiley and Sons, Inc., New York).

35. **Reinforced Concrete Bridge Design** (2nd edition reprinted), by C. S. Chettoe and H. C. Adams. (Chapmen and Hall, Ltd., Essex Street, London, W. C. 2, 1941).

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22.	Volume XV—Part 1—August 1950	8	0	0
23.	Volume XV—Part 2—November 1950	3	0	0
24.	Volume XV—Part 3—January 1951	3	0	0
25.	Road Research Bulletin No. 1	3	0	0
26.	I. R. C. Standard Specifications and Code of Practice for Road Bridges in India (1937)	5	0	0
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