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ROAD ACCIDENTS IN DELHI DURING 1950-51

(Contributed)

IN the year ending on the 31st March 1951, 655 road accidents involving motor vehicles were reported in the State of Delhi, a little less than two accidents per day, and on an average about 55 accidents per month. The six months in which accidents exceeded this average were April, August, September and October in 1950 and February and March in 1951. The largest number ef accidents (74) occurred in April and the smallest (38) in January.

The distribution of the types and numbers of motor vehicles for these 655 accidents was as follows:—

Vehicle primarily responsible.	Number of accidents	Percentage.
Motor cycles	52	8.0
Private cars	230	35.1
Taxi cabs (including motor rickshaws)	48	7.3
Public Service Vehicles (Buses)	47	7.2
Goods vehicles	200	30.5
Other classes of motor vehicles and unclassified vehicles.	78	11.9
Total	655	100.0

In this analysis only one motor vehicle for every accident has been taken and, where more than one motor vehicle was involved, only the primary vehicle has been considered. The Table indicates that, of the vehicles involved, private cars lead with 35.1 per cent, closely followed by goods vehicles, which form 30.5 per cent; Other types of vehicles contributed the remaining 34.4 per cent.

Collisions of motor vehicles with other motor vehicles were responsible for nearly 58 per cent of accidents, with cyclists 14 per cent, with animal drawn vehicles 7 per cent, with fixed objects nearly 8 per cent, and with pedestrians 4.6 per cent.

Who Causes the Accidents ?

The distribution of accidents according to the alleged responsibility was as follows:—

	Number of accidents.	Percentage.
Fault of motor vehicle driver	520	79.4
Fault of driver of other vehicles	28	4.3
Fault of cyclist	37	5.7
Fault of Pedestrian	30	4.6
Defective vehicle	26	4.0
Defective road surface and bad weather	5	0.7
Other causes	9	1.3

Thus the motor vehicle driver was alleged to be responsible for every eight accidents out of ten, the pedestrians and cyclists taken together for one accident out of ten, other causes contributing the remaining one accident in ten.

As against these figures we have the yearly average figures for five years (1946-50), which show that the motor vehicle drivers were regarded as responsible for 84 per cent of the accidents, pedestrians and cyclists together for 13 per cent and the rest for only 3 per cent.

Fewer Accidents at Night

Eighty-two per cent of the accidents took place in day light and 18 per cent at night, while 90 per cent of them occurred in built-up areas and only 10 per cent in non-built-up areas. As many as 21.5 per cent of the accidents took place at intersections, 9.6 per cent at bends in the roads and the rest (68.9 per cent) on straight stretches. Only one per cent of accidents are stated to have occurred on wet roads.

Sex and Accidents

Out of 520 drivers involved 517 were men. As there is quite a large number of women drivers on the roads of Delhi, the statistics might be taken to indicate that women are more cautious at the wheel than men. In any case the figures do not prove that women are careless drivers as is often assumed.

Pedestrians

The number of pedestrians involved in road accidents was 30 of whom 80 per cent were crossing the road or running into it. The age distribution was 6.3 per cent adults and the rest under fifteen.

Fatalities

In all, 87 persons were killed during the year in road accidents. Of these, 45 persons (nearly 52 per cent) were either drivers of motor vehicles, riders of motor cycles, or passengers in motor vehicles. Pedestrians and cyclists represent 34 per cent of the fatalities and others the remaining 14 per cent.

"Not Known"

A study of the accident reports reveals that all the columns of the prescribed form are not filled in by the police and there appears to be a tendency to fill in the "NOT KNOWN" column too readily. Name (of driver), **Not known**, Age (of driver), **Not known**, (Driving) "qualifications (of driver) **Not known**", "certificate of fitness of vehicle, **Not known**", have too many entries. It is remarkable that the age or year of manufacture of **none** of the 655 vehicles involved was known. The utility of the accident reports decreases as the entries in the prescribed form become fewer. For example, one motor vehicle was involved in no fewer than four accidents during the year. Was that because of an "accident-prone" driver? We cannot say as the name of the driver was not recorded in any of the four cases. Are there more accidents with old vehicles, are young drivers more rash than old drivers, are unfit vehicles common on the roads—we could ask a hundred such questions all of which could be answered if the form were correctly posted. *(But we have to say along with the police "not known".....Ed.)*

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BLOOD ON OUR HANDS

Planning has had the spotlight so much lately that little has been said about safety. But traffic accidents continue to take their toll, and every broken body carried out of an auto-wreck indirectly splashes blood on road and street designers as well as law makers and enforcement agencies.

(Roads & Streets, Jan. 1945.)

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WASTE THROUGH IGNORANCE IN COMMERCIAL MOTOR VEHICLE OPERATION

(By a Distinguished Contributor)

AN hour spent inspecting the unserviceable Stores dump of any large automobile workshop or a visit to one of those numerous motor junk shops in every big town where they buy and sell large quantities of such used unserviceable stores can be very interesting and instructive. Hundreds of items can be picked out from the dumps, which eloquently proclaim their story of waste through ignorance in the proper maintenance, repair and operation of motor vehicles. Brake and clutch linings which have failed prematurely on account of bad revetting, tyres that had to be discarded on account of bad wheel alignment, batteries which became sulphated by long neglect or broken by bad mounting, cylinder blocks cracked by bad lubrication or improper radiation, crankshafts broken by bad lubrication, are but a few of the more glaring out of the numerous items. To these I must hasten to add the special costly Diesel items—pump elements, delivery valves, and sprayers—which through inadequate attention to the cleanliness of the fuel oil do not often give even a third of the service they should normally give. Even a seemingly indestructible item like the chassis frame is often damaged by indiscriminate drilling of holes on it during body building.

A financial estimate of the national loss under all these items of unnecessary and avoidable wear and damage would be staggering. Can a country like ours, which is compelled by economic necessity to extract the last bit of service out of every item of material equipment, afford, such large-scale waste especially when it involves heavy expenditure of scarce foreign currency? What can be done to reduce such waste? In this short note I propose to examine that problem and to suggest certain measures that may help at least its partial solution.

It may be noted at the outset that wastage and the scope for savings exist to an infinitely larger extent in connection with commercial vehicles than with private cars. The average private car consumes only a fraction of the materials consumed by a commercial vehicle; a bus or lorry consumes annually up to Rs 2,500/- worth of spare parts and accessories even without including tyres. Further the private vehicle is looked after and driven in a proportion of cases by the owner himself. Hence the main problem is to prevent the uneconomic use and maintenance of the commercial vehicle.

Untrained Drivers

The primary requisite of a motor vehicle, or for that matter any other piece of costly and complex machinery, if it is to give the best service, is that it should be used in the proper manner by persons who have been trained in the proper methods. An enquiry among commercial vehicle drivers will show that few of them have had any kind of systematic training. A very large proportion of them are illiterate and probably commenced their career as cleaners or unskilled assistants, clandestinely taking the steering-wheel whenever they could win the favour of the driver and labouring slowly through numerous accidents and damage to persons and property to varying degrees of ability to manage a vehicle. Finally they come to possess a driving licence in the grant of which ability to care for the vehicle without misusing it is no criterion.

I have been told by the service representative of one of the leading motor companies that it appeared to him that drivers of commercial motor vehicles in a certain part of this country are out to prove that a motor vehicle can run without a lot of the gadgets which the makers provide. The first thing they do is to dispense permanently with such appendages as the petrol tank cap, petrol tank filter, air cleaner, oil-cap, radiator-cap, etc. In order to prevent accidental loss some of these are attached to the vehicle by the makers by short lengths of chain but these chains do not seem to present any formidable difficulty to these enterprising drivers. The next step they take is to

remove items like switch-keys, fuses, gear-lever knobs and miscellaneous studs, bolts, and nuts and replace them with a variety of ingenious substitutes made of wire nails and waste-cotton. With the scarcity of tyres even dual wheels on heavy vehicles are replaced by single wheels.

Wanted Ignorance-proof Vehicles

Lest this be considered an impossible exaggeration, I may cite from my own experience that it required nearly one year of patient concentrated drive and repeated replacement of hundreds of lost items to convince drivers in Madras Government Transport that petrol tank caps and oil caps and air-cleaners were quite necessary and that it was easier to change the gear if the knob were on. More recently when the Departmental staff objected to the practice of certain operators of removing the extra rear wheels in the Districts, I received an official request from a certain area to permit permanent replacement of the dual wheels by single wheels. I wonder whether the designers of motor vehicles are aware of these operating conditions, and if so what they think of them—whether they have designed the vehicles to stand up to such conditions : in fact it would be a very good idea indeed if there was a constant interchange of personnel between the designing and servicing sections of the motor vehicle manufacturers' establishments.

We might then get "ignorance-proof" vehicles which will not be damaged by this kind of ill-treatment and misuse like an improper use of the clutch and inadequate attention to lubrication, radiation, tyres and batteries.

But between the two alternatives of designing a vehicle which will operate satisfactorily under such exacting conditions for which the present tyres of vehicles are not obviously meant and training the drivers in the proper operation and maintenance of vehicles, the latter may be the cheaper and the easier course.

Criminal Waste of Fuel

One single item of expenditure, which forms a substantial portion of the cost of transport operation, is that of fuel—more os for a petrol vehicle than for a diesel vehicle. Assuming that the various units of a vehicle are in good condition, the economic use of fuel depends to a large extent on the skill with which the various controls like the clutch, the brakes, and the accelerator are manipulated : in other words, not to raise the engine speed more than is absolutely necessary. As a specific instance, it is not always that one sees the driver correctly manipulating the clutch and accelerator while reversing. It is common practice to see the drivers raising the engine speed to perhaps its maximum capacity and achieving slow movement by slipping the clutch. This, apart from being a criminal waste of petrol, also results in extraordinary wear in clutch. As against this, the correct procedure is to release the clutch and allow the engine to idle when the vehicle will move at a speed of two or three miles an hour and would be capable of easy manipulation by even an inexperienced driver. There are numerous similar practices in the manipulation of the gear, the clutch, and the self-starter motor, etc., in which the right way of operation is as easy as the wrong way and which if acquired would result in substantial saving and economy.

Workshops

Conditions in the average workshop are no better. With the exception of a few that are well-organized and well-managed, most of the automobile workshops in this country are little more than blacksmiths' shops. There are a few essentials for a workshop—a clean dust-proof floor, a ramp or pit, compressed air and a complete range of good quality gauges, hand-tools and implements. This is not much or by any means unduly expensive but the majority of workshops do not have them and, what is more, they attempt precision jobs which cannot be satisfactorily done without a whole range of additional machine tools. Alignment of bearings, regrinding of crankshafts and similar precision jobs are easy to do with the necessary specialised tools and the necessary training, but attempts to do them by guesswork and trial-and-error must inevitably result in waste of labour and valuable material.

It is not only the equipment of the workshop that matters : there is also the technical competence of the worker and his knowledge of correct methods. There is no mystery about automobile repairs—the different operations have been studied in all their aspects and the most satisfactory methods of their execution have been prescribed and are described in the makers' Manuals. But the average mechanic has no use for such Manuals because he has his own ways of doing things and in any case he cannot read the Manuals even if he had them. He relies not on any objective measurements or tests but on his own intuition and experience and almost every car owner has seen perfectly sound parts replaced one after another in an effort to trace the offending part.

I have great respect for the ability and almost uncanny competence of some motor mechanics but I think on the whole we would be much better off without these few men if thereby everyone would be made to follow the more well-known and objective ways of doing things. It is, therefore, of the greatest importance that something should be done to organise proper workshops and to train mechanics and fitters in the use of the right tools and the right methods of doing different jobs and to teach them objective standards such as what performance each part should give, what adjustment it requires, and when it should be replaced.

Systems of Maintenance

There seems some difference of opinion regarding the extent to which the driver should be responsible for routine maintenance and light repairs. Some operators insist that their drivers do certain items of maintenance and repair for their vehicles while certain others prohibit any kind of interference with the mechanism by the drivers and provide special staff for maintenance and light repair. The advantages of either system have been canvassed by their respective followers, but in my view the question involved is not one as to which is better but as to which is more suited for the particular condition of operation.

Thus, as far as Madras City vehicles are concerned, our drivers are not allowed to do any kind of repair or maintenance since the mechanical staff is in a better position to do this, but on long-distance routes vehicles which go to outlying depots 100 or more miles away, the drivers are held responsible for routine maintenance and running repairs. The Army, which has small units of vehicles scattered in different places, has an excellent system by which the driver is made entirely responsible for the maintenance, condition and performance of the vehicle and has also to perform certain scheduled "tasks" at regular intervals. This has also worked well in the case of the Madras Civil Supplies Transport Units and in the case of a few private companies which have vehicles scattered all over the State in connection with their business as distributors of goods.

There has, however, been a tendency for drivers to insist that they are concerned only with the propulsion of the vehicles and the operation of the controls and that other staff should be engaged to clean and maintain the vehicles. It is usually one of the conditions of agreement between employers and workers that the employer shall be at liberty to allot to an employee for whom work cannot be found at his regular occupation such other work as is considered suitable : by the same principle it is open to the transport operator to specify that the duties of drivers shall include certain items of maintenance provided that the total period of work does not exceed the specified limits. Otherwise in most establishments there would be considerable waste in the form of idle hours both for traffic and maintenance staff. There is, therefore, no doubt that drivers should also be trained properly in correct methods of maintenance, particularly "preventive maintenance', that is, maintenance according to a predetermined schedule meant to prevent the failure or deterioration of each working part instead of waiting for that part to break down and then attempting to cure it.

Drivers Must Be Literate

One serious difficulty in the way of training drivers and mechanics is that most of them are illiterate and therefore incapable of learning from written Manuals and Instructions. The rules relating to the issue of commercial vehicle driving licences are in some respects more

strict in this country than in several other neighbouring countries. Thus, while in the Phillippines and in Thailand the minimum age for applicants for commercial vehicle driving licences is the same as for other drivers, i.e., 18, in India it is two years higher. This is as it should be, considering the heavier responsibility on the drivers of commercial vehicles. While in Ceylon a driving licence, once issued, authorises a person to drive a motor vehicle for life, without the necessity of periodical renewal or check of the holder's continued competence to drive, in India the licence has to be renewed annually and the applicant is also liable to be called upon to produce a medical certificate.

But the existing provisions require to be enforced more strictly and, in my opinion, the provisions themselves should be made still more rigorous in the interests of safety of life on the roads and avoidance of waste of material resources. *In the first place*, literacy should be made a compulsory qualification for all new applicants for commercial vehicle driving licences. The lead in this matter has already been taken by Madras State which is considering the question of issuing the necessary amendment to the M. V. Rules. *Secondly*, a written test should be included in all driving examinations so that the applicant's knowledge of the Highway Code can be definitely established. *Thirdly*, an applicant for a commercial vehicle driving licence should normally produce evidence of having served a minimum period of apprenticeship or training in an established institution or road transport organisation and his test should involve a rigorous examination of his ability to handle a heavy vehicle. The test should also cover mechanical aspects like changing a tyre, repairing a tube, cleaning a fuel line block, cleaning and setting the ignition points, adjusting carbon-brushes, and maintenance aspects like lubrication and the care of batteries and tyres.

The question of prescribing qualifications for motor mechanics and issuing them licences has been raised but I do not think it is a desirable or practicable proposition. The reason for the licensing procedure in respect of drivers is that the safety and convenience of the public is involved but there is no such reason for the licensing of mechanics. But the safety of the public is very much dependent on the result of the work of the mechanics and the large number of accidents nowadays points to the necessity of enforcing a high standard of mechanical efficiency for the vehicles themselves. Operators should be asked to maintain correct records regarding the maintenance and repairs carried out to essential parts like the steering and the brake mechanisms and a stricter inspection may be made when the fitness certificate is issued with particular reference to the nature of the service which the vehicle will be called upon to perform.

This will also indirectly lead to the increasing employment of a better and more educated type of young men in the mechanical workshops, the type of men who are coming out of the technical schools and who, with the addition of a few years of hard manual work in a workshop provided with modern tools and equipment, will make as good motor mechanics as those in any other country. Another reason why I plead for the employment of literate men as drivers and mechanics is to make it possible for the employers to provide them incentives for maximum exertion in the form of higher posts and remuneration. With the best of goodwill in the world, the employer cannot promote a man beyond a very limited extent unless he is literate.

Manuals in Local Languages

There is a large amount of excellent literature in English on motor driving and mechanism but little or no such literature exists in the Indian languages. Most motor companies also publish two illustrated manuals—one the owner's or driver's manual dealing with maintenance and running repairs and another called the Workshop Manual, meant for mechanics doing heavy repair and overhaul. But both are printed in English. Presumably these manuals are made very good use of in Western countries but in this country I have observed that little or no use is made of them as the driver and the mechanic who are immediately concerned with the vehicle are in most cases unable to read and understand them.

Some of the methods described in the Manuals are practically unknown in workshops where even the supervisory staff seem to consider it a confession of their ignorance to consult the Manuals. It is high time that these Manuals are printed in the local language and made available to the workers. I doubt, however, whether a single manual which would give complete practical instructions applicable to all makes of vehicles can be compiled. There are several makes of carburettors, distributors, voltage regulators, etc., used in the common types of vehicles; a single detailed manual dealing with all those will be comparable to Dyke's Automobile Encylopædia and is bound to be cumbersome. I would therefore suggest that

(1) simple pamphlets dealing with common items such as care of tyres, batteries, cooling system, lubrication, etc., applicable to all vehicles may be prepared in all local languages and distributed to drivers along with the driving licences,

and (2) the more detailed workshop manuals published in English by the different motor companies be republished in the local languages, by arrangement with the companies, and be made available to mechanical workers.*

Training in Reclamation

Some of the bigger motor companies conduct mechanic's courses at their main workshops at which they give excellent practical and theoretical instructions for men already engaged in the trade. I have watched these courses and I had had several workers trained at them with very good results. But I have two comments to make regarding these courses. The first is that, if the interested companies intend that their efforts should be successful, they should run their courses not only at Bombay as they do at present, but also at every one of their regional dealers' workshops. Secondly, I feel that these courses do not lay sufficient emphasis on reclaiming worn parts. I can quite understand the point of view that cent per cent efficiency cannot be expected from a part outside a certain measure of tolerance and that a workshop-repaired article is not as good as a factory-made article but I think in these days when every operator is working on a very slender margin, the instructors should point out the possibility of reclaiming worn parts and teach the best means of doing so.

Certain transport undertakings with which I am acquainted have demonstrated that worn crankshafts can be successfully reclaimed by metal-spraying and cracked cylinder blocks by welding. Less difficult items can be done by even smaller workshops. In our workshop we have worked out more or less satisfactory methods of reclaiming and using more than 20 valuable items. It would be a blessing to operators if the possibilities and limitations of reclaiming parts could be studied and information and practical instruction given as to what can be reclaimed without prejudice to safety and a reasonable amount of efficiency and what is the best means of doing so.

This would, however, require a certain amount of unselfish effort on the part of motor companies as it would affect their spare parts trade. But from the point of view of conservation of material resources this is most important and if private firms cannot be expected to move in the matter, some other organisation should study the question and supply the necessary information and technique to vehicle operators. In this connection it is interesting to note that very recently the Society of Motor Manufacturers and Traders in the United Kingdom have started an all-out drive in that country for improved maintenance and operational methods for motor vehicles with a view to conserve material resources.

Schools for Cleaners and Fitters

The introduction of evening trade schools in the larger towns in conjunction with the larger workshops is also full of possibilities. The initial difficulty here will be to design a course in the local language. There are schools in the bigger towns teaching automobile engineering and giving a certain amount of practical

* The Ministry of Transport has issued instruction manual regarding Steam Road Rollers in English, Hindi, Bengali and Urdu. - Ed.

training for boys intending to take an automobile diploma, but these and similar schools cannot meet the needs of cleaners, fitters and other semi-skilled workers in local workshops who cannot follow English classes and who have not the mathematical equipment for the usual theoretical course. Their requirements can be met only by specially designed courses making plenty of use of models, films, large-scale illustrations and practical lessons. The design of such courses—each covering a single item such as Lubrication, Engine Overhaul, Steering Mechanism or Electrical equipment—and their publication along with details such as the method of instruction and the equipment to be provided will be a very important contribution in this direction.

Provision should also be made for the training of instructors for such schools at some Central institution. There are some excellent American films illustrating and explaining automobile repairs and these can be used to help the work in these classes. Such films and also mobile touring vans could be used to awaken road transport operators to the benefits of introducing preventive maintenance and standard methods of repair and to demonstrate to them how it can be done and how it is worth while for them to do it.

Who and How

The machinery connected with the administration of Road Transport is mostly absorbed in deciding **who** should run the transport system, whether it should be nationalised and if not how should the privilege or monopoly of operation be distributed. Comparatively little attention is paid to **how** it should be managed and run ; it may be argued that the cost of inefficiency if any is paid by the operator but in practice it will be the user who pays for it and it will eventually fall on the entire country in the form of wasted material resources.

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A PROPHECY MADE IN 1830

In 1830 Macaulay wrote : "The present moment is one of great distress. But how small will that distress appear when we think over the history of the last forty years – a war compared with which all other wars sink into insignificance, taxation such as the most heavily taxed people of former times could not have conceived, a debt larger than all the public debts that ever existed in the world added together, the food of the people rendered dear, the currency debased.....

"If we were to prophesy that in the year 1930 a population of 50 millions (in the United Kingdom) better fed, clad, and lodged than the English of our time will cover these islands, that machines constructed on principles as yet undiscovered will be in every house, that our debt, vast as it seems to us, will appear to our great grand children a trifling encumberance that might easily be paid off in a year or two, many people would think us insane."

[The debt at that time was 200 million pounds. Compare this with the present budget of 4,000 million pounds in the United Kingdom.—Ed.]

ROADS IN SOUTH AFRICA

(Extracted from 'Contractors Record and Public Works Engineer'—June 1951)

System of Administration and Construction

To a great extent roads administration in South Africa follows on the lines of that of Britain, but there are variations that may not be generally known. For instance, while the system of grants for maintenance and improvements prevails there is also a special fund out of which interest-free loans are made available for large new constructional works.

The authorities responsible for the highways generally are the Government, which provides and maintains the national roads chiefly linking up the larger cities and towns ; the Divisional Councils (approximating to English county councils) who, with assistance from the Provincial Roads Administration, construct and maintain the main roads, the divisional roads and the "public" roads ; and the municipalities (equal to English boroughs) who are responsible for the streets within their own areas but also receive grants from the Provincial Roads Administration.

The national roads have come about as a result of the passing of the National Roads Act of 1935. This Act created the National Road Fund, which at the outset derived its income from a customs duty imposed on all petrol imported into the country. Originally a five-year scheme of works, comprising some 5,000 miles of roads, was envisaged, but in view of the great demand for new and improved highways consequent on the rapid development of the country as a whole, the original scheme has been extended indefinitely. Also, as in England, a change has taken place in the utilisation of the money received from the taxation of petrol, and now each year the Minister of Transport draws up a programme of works proposed to be undertaken, and this forms a separate vote from the Government.

Main Road Standards

As regards the non-national roads, a high standard of construction is laid down by the Provincial Roads Administration if grants are to be secured. For instance, all *main* roads must have a width of 80 ft between fences and a formation width of 30 ft on level country and 26 ft on mountain passes, while the bituminised surface must be 20 ft on both. Horizontal curves have to have a minimum radius of 500 ft in open country and 250 ft on mountain passes and vertical curves a minimum of 450 ft and 300 ft respectively. The sight distance on horizontal curves must be not less than 400 ft on level construction and 200 ft on mountain passes, and the maximum gradient allowed is 5 per cent on level and 7 per cent on mountain passes.

Divisional Road Standards

On *divisional* roads, the width between fences must be 60 ft and the formation width 27 ft in open country and 24 ft on mountain passes with a bituminised surface of 20 ft in both cases. The horizontal curve radius must be not less than 300 ft on even country and 150 ft on mountain passes and the vertical curve radius 300 ft in each instance. Horizontal sight distance must be 300 ft and 150 ft respectively and gradients 5 per cent on even country and 8 per cent on mountain passes. All curves must be superelevated to the extent of 1 in 8. These standards cannot be reduced without the first approval of the Provincial Roads Engineer, and then only in very exceptional cases.

Grants payable by the Provincial Roads Administration amount to 80 per cent in the case of main roads and 60 per cent in respect of divisional council roads for maintenance purposes, but for large new constructional works special assistance can be secured from the Provincial Roads Fund in the form of *non-interest bearing loans*. These latter have to be repaid in 15 years so far as roads are concerned and 25 years in respect of bridges. These non-interest bearing loans are also available for the purchase of plant, repayment being spread over five years. At the present time, however, this fund is somewhat low

and all the requests of divisional councils cannot be met, with the result that authority is now being given to these bodies to take up interest-bearing loans towards which grants are payable.

Trunk Roads

A new category of major roads is shortly to be authorised. These will be known as trunk roads and will attract grants of 90 per cent from the Provincial Roads Administration. It is understood that for roads to receive this classification they must be constructed to the required width of main roads and receive their bituminous surface within two years.

Although each divisional council has the power to purchase its own materials, which are generally obtained by tender, the Provincial Roads Administration ensures that the materials used, certainly on important road works, are up to standard and conducts laboratory tests in its laboratories in Cape Town.

Consolidation by Traffic

Owing to climatic and other conditions, the system of road construction in certain parts of the Cape Province, at any rate, varies in at least one particular degree from that generally to be found in England. Little time is spent on consolidation when the road is being formed. After the foundation has been prepared and the upper courses laid, the road is usually left for anything up to a year to enable traffic to consolidate it and also to allow the seasonal rains to assist in this direction. Subsequently the road is again trimmed up to standard before the bituminous surface is applied. Although this may sound strange to some, it must be borne in mind that the volume of traffic is very light —when compared with English standards —and that the roads traverse miles of open country with hardly a habitation in sight, and that any inconvenience caused by reason of the nature of the surface is to the drivers of vehicles.

Whenever highways are being made up to main road or divisional road standard, every endeavour is made to shorten them by straightening out, and to enable this to be done divisional councils have the power to expropriate the necessary land for the purpose although authority is provided for such bodies, with the approval of the Provincial Roads Administration, to make ex-gratia payments in respect of the land taken. Some compensation is, however, generally made to farmers in another manner, the divisional councils frequently constructing cattle creeps in the form of concrete tunnels to enable cattle to pass under instead of across the highway, and also by providing cattle grids on the highways themselves. In this connection it may be stated that as from January of this year, divisional councils have to construct cattle grids at their own expense. If, however, a farmer required fences to be constructed on either side of the highway he must reimburse the divisional council to the extent of 40 per cent of the cost.

Divisional Administration

I have recently had an opportunity of inspecting and discussing the system of roads administration and construction with the chief officials of the Bredasdorp Divisional Council. The area of the division is some 2,000 square miles in extent and contains 180 miles of main roads, 300 miles of divisional roads and 5,000 miles of public roads. No national roads traverse the divisional area as it is even more southerly than the Cape Town area, from which these special roads radiate to the north and east.

At the present moment one of the principal works in hand in this division is the reconstruction of the main road from Caledon through Bredasdorp municipality to Arniston on the coast, and when finally completed it will be one of the first trunk roads in the Cape Province.

The road is being made to the standard width prescribed by the Provincial Roads Administration. The foundation is of shale which abounds in this area and gives a very good foundation. On this is a 6 in layer of coarse gravel and a top course of selected gravel. The final surface will be either of Shellmac or of Trinidad asphalt.

All the work of road formation as well as that of maintenance in this division is carried out departmentally. For this

purpose the council has plant and equipment, chiefly of the American type, comprising two bulldozers, 10 petrol-driven tipping trucks of 4 cu. yds. capacity, three motor graders, an 8/10-ton diesel roller, a mobile loading ramp, a maintainer, two 45 h.p. tractors and a low-loading trailer for transporting the large machines from place to place. In addition, the divisional council also has its own repair depot equipped with electrically-driven welding and other plant for the proper maintenance of its equipment.

The divisional council also constructs in its own workshops all the cattle grids that are required. They are of pre-cast concrete and cost approximately £ 30 each. During the last 18 months something like 30 of these grids have been constructed and put down.

The cost of maintenance of roads in the Bredasdorp Divisional Council area works out at £ 90 per mile for main roads and about £ 23 for divisional roads, whilst the cost per mile of construction of roads with bitumised surfacing works out at about £4,000. All roads, except the national highways, are financed by local rates, and in the Bredasdorp division (except in the area of the municipality, where it is three-farthings) a rate of one pence per pound on assessments is the current levy. The divisional council expenditure on highways is about £ 23,000 a year on maintenance and improvements of 480 miles of main roads and divisional roads—on which the Council receives grants of 80 and 60 per cent respectively from the Provincial Roads Administration—and about £ 2,000 on " public roads " (5000 miles).

One thing which stands out to the visitor is the great distances between towns after leaving the suburbs of Cape Town. Mile after mile of road has to be traversed in open country and it is to the credit of the roads administration generally that, with such limited funds as are available, the highways have been constructed and maintained in the condition in which they are to be found today while the mountain passes are a triumph of engineering skill that would be difficult to surpass.

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ODE TO THE ANGLER

(Or A Fairy Story)

He riseth early in the morning
And upsetteth the whole household.
Great are his preparations.
He goeth forth with a heart full of expectation
And when the day is well spent,
He returneth home smelling of strong drink,
And the truth is not in him.

USES OF STATISTICS

" Some people use statistics as a drunken man uses a lamp-post—not so much for illumination as for support."

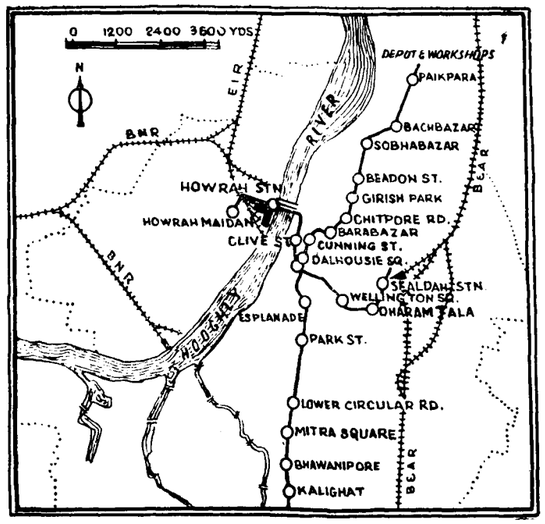
UNDERGROUND RAILWAYS FOR CALCUTTA

(Extracted from 'Modern Transport'—September 1, 1951)

WHEN on January 1, 1948, the Compagnie du Chemin de Fer Metropolitain de Paris ceased to work its railway, bus and trolley-bus system in Paris and handed it over to the Regie Autonome des Transports Parisiens (R.A.T.P.), the directors decided to place the experience of the company at the disposal of overseas governments and municipalities interested in promoting underground railways. By an Act of March 21, 1948, it changed its name to Societe Generale de Traction et d'Exploitations (S.G.T.E.). ***

Having been informed in December 1948 of the wish of the Bengal Government to study the question of public transport in Calcutta, S.G.T.E. sent out a team of engineers, who, in February 1949 obtained a contract for studies for the co-ordination of urban and suburban transport on the basis of the construction of an underground railway. On May 1, 1949, a mission of R.A.T.P. engineers arrived in Bengal. Soil mechanics and deep tunnelling experts lent their aid, while in Paris the Bureaux d'Etudes Specialises concentrated on the difficult problems set by the building of tunnels in the alluvial soil of the Ganges delta.

On November 1, 1949, the mission presented to the President of the Council of the Bengal Government a detailed preliminary scheme in English and with English dimensions, going into all aspects of a problem complicated by distance, soil, climate, and local conditions. The report may be considered as one of the finest studies of its kind of such completeness to be made in so short a time.



Proposed underground lines for Calcutta.

Two Routes

The proposal caters for two double-track shallow lines. Line 1, running west-east, is 3.9 miles long with eight stations, and connects the two important main-line termini of Howrah and Sealdah. It will traverse the Hooghly at a point where it is 1500 ft wide and 48 ft deep.

Line 2 is generally north, and south in alignment and is to be 7.1 miles long, with 15 stations; it will traverse the city, roughly parallel to the river, from Paikpara to Kalighat The two terminal stations will afford interchange with road services, with the prospect of suburban extension. The two routes will cross in the business centre, under Dalhousie Square, where the interchange station will have escalators which will also be provided at other points where they are advantageous.

Full study of the subsoil, which is almost identical in composition throughout, permitted the presentation of some ten constructional methods, some original, ranging from shield working in compressed air to construction with prefabricated sections laid in open cut. The crossing of the river was specially examined. Its width (1500 ft), depth (48 ft at the level of the lowest tide) and the importance of shipping traffic had to be considered.

Proposed Standards

The proposed standards are:—

Paris Metropolitain loading gauge
Standard gauge
Minimum radius curve—240 ft
Maximum gradient, 1 in 42. 5
Indian Vignoles rail (B. S. 115, 115 lb. per yd.) on soleplates
115 lb. conductor rail
Sleepers of sal or asna wood
Broken stone ballast

The traction supply would be 750 volts d.c. with third-rail collection. The rolling stock would consist of two-car sets, equipped with pneumatic and electro-magnetic braking and with fluorescent lighting. Signalling would be of three-aspect type with track circuiting.

The torrential rains, particularly during the monsoons, will necessitate raised and covered entrances at the stations, as well as special measures for exhausting the air in the tunnels, while the hot, humid climate will require installation of a carefully planned ventilating system, with air-conditioning in the tunnels. At Dalhousie Square, an electric ventilator would draw the warm air out of the tunnel and dispel it outside by shafts; at other stations a conditioning plant will cool the air drawn in. Station lighting would be by fluorescent tubes and that of the tunnels by incandescent lamps. There would be auxiliary battery lighting.

Plans Approved

Tickets would be issued from cinema-type automatic machines. Two classes and daily return tickets are contemplated. The preparation of final plans is scheduled to take a year, and the construction of line 2 and workshops and line 1, two and a half and three years respectively. The preliminary scheme has been submitted to Messrs. Sir William Halcrow and Partners, the London firm of consulting engineers, and approved. The present tension in the East is delaying matters, but the Parliament at New Delhi has reopened the question.

—o—

CONSULTANTS

Our work here is necessarily largely consultative and advisory on the basis of our research and Dr. Collins' Committee will also be consultative. Which reminds me of the story of the earnest young parson who had just been ordained and offered up extempore prayer. He lowered his eyes and lifted his voice and said: "Lord, may it be Thy will that I should do Thy work in the vineyard – even if only in a consultative capacity."

ECONOMIES IN SMALL BRIDGE CONSTRUCTION

(Extracted from "The Surveyor" – November 17, 1950)
(Continued from our last issue)

Materials last Longer in use than in Stock

IT is an acknowledged fact that constructional materials deteriorate more rapidly when held in stock than when in use in a structure. Movement, including vibration, has a preserving effect. Ventilation also plays its part in retarding the processes of decay. Disturbance is inimical to atrophy.

Material in store should be turned over at regular intervals, especially when it is kept in the open air. Nothing is immune from the processes of decay, although a perfectly dry atmosphere goes a long way towards arresting them. In this country the temperature and humidity of the atmosphere undergo such extreme fluctuations that any article left exposed will soon show signs of deterioration in one way or another.

The moral to be drawn from these remarks is the obvious one that expenditure on maintenance is even more necessary on material lying inert in a yard than when it is forming part of a working structure subjected to stresses and strains. It would appear that just as the limbs of the human body must be stretched and relaxed, so also must the parts of a structure be treated in like fashion. It is not enough to stretch these parts and keep them stretched as is evidenced by the condition of any bridge which is not used by traffic. The forces of attrition speedily reduce such a bridge to a ruin. The dead load is still being carried but it is the live load that is lacking to keep the bridge alive. It no longer undergoes the beneficial shaking which keeps it in condition.

An abandoned concrete carriageway affords another example of the destructive effect of natural agencies on an artificially constructed object when man has ceased to take an interest in it. The spectacle of what happens after a few years neglect may not be so familiar in this case as in that of the discarded bridge. The very ground seems to have developed an aversion to the concrete slabs resting upon it, and they are found to have been heaved out of level and line and cracked, whilst vegetation sprouts vigorously through the joints and cracks, and brambles have invaded the surface. The heaving is often attributed to fungal growths which exert inconceivable pressure on the slabs in their efforts to penetrate the concrete and reach the air.

This digression from the strict object of this paper, which is the advocating of economy in the use of materials, is justified if it brings home the desirability of keeping a strict eye on materials in stock and using them as much as possible and otherwise maintaining them. It is entirely uneconomic to hold stocks of some kinds of materials owing to the heavy average annual maintenance costs, an example of this category being corrugated iron and others, light welded mesh, link fencing or iron wire. It is sound policy to dispose of these stores when surplus rather than to hoard them for possible future use.

Mechanisation and Small Works

Herein lies a great difficulty. The domain of small engineering works cannot very well be economically and effectively mechanised to any appreciable extent. Manual skill and man-power still persist in being the principal agencies for producing sound work.

It is a common error to put too many men on a job. The output per man is less than it ought to be, and the risk of accident is aggravated. The job instead of being a progressive one is retrogressive in that it will be overspent. The usual power-driven mechanical aids such as cranes, concrete mixers, air compressors with pneumatic tools, winches and petrol pumps should be utilised to the full. These are small plant items which can be kept on the site, and in the country should not require the protection of a watchman. When a watchman is not needed on a small job considerable economy in wages can be effected, as he will in all probability receive a pay packet grater than that of the foreman.

The quantity of excavation is often too small to warrant the expense of hiring a mechanical excavator, although if labour is scarce and one can be diverted from a site in the vicinity a drag-line digger would pay for shallow excavation on bank removal and trimming. It is the idle time and transport to and from the hirer's yard which runs away with a lot of money where heavy plant is contemplated for small works.

Light steel sheet piling can be driven using a frame and a small, general purposes power winch, but heavy concrete bearing piles require a purpose-made piling winch mounted on the pile frame. Heavy steel sheet piling can best be driven and extracted, if need be, by a vibrating steam-hammer slung from the jib of a crane. The hammer should be of the correct capacity, and for direct labour works this means hiring from a specialist firm in the majority of cases.

The various varieties of cast-in-situ piles are almost invariably sunk by specialist contractors under licence from the patentees. Sometimes a small number of bored piles affords a very good solution to tricky underpinning problems and the work can be quickly and reasonably executed with the use of light compact plant.

Inspection can Detect Scour Dangers

When abnormal floods occur, they are frequently accompanied or followed by the collapse of a number of small bridges and culverts. Big bridges may likewise collapse but their foundations usually go deeper and preventive maintenance is perhaps more widely carried out in the case of these more important structures than in that of aged and remote minor ones. In addition, the bigger bridges are more frequently and carefully inspected by the regular bridge examiners than are the little ones.

Bridge examiners are supplied with a standard form detailing the various parts which they should inspect and upon which they enter their observations as to condition.

This is a necessary routine and it stimulates systematic examination of the bridge part by part.

There are, however, other possibilities which are not likely to be foreseen in a questionnaire and three of these will now be cited.

(a) In the event of a tree trunk being jammed across the upstream end of the bridge (or culvert) are the foundations deep enough to ensure they will not be undermined by the resulting scour?

(b) Assuming abnormal floods, are there any subsidiary or potential watercourses joining the river close to the bridge which might discharge rushing waters towards the foundations and by undermining them by a flank attack cause collapse?

(c) Is there any evidence of water going through the bridge by any route, other than the proper one, such as behind the abutments or under the invert? If this is happening, there is a grave risk of scour causing a complete or partial collapse?

Money spent on underpinning foundations whilst the water is low is a sound investment if the answer to (a) is in the negative. Similar action will be helpful if the answer to (b) is in the affirmative. In addition, some diversion of the direction of discharge of the offending watercourses should be carried out by arrangement with the land owners and revetments of banks may be necessary to prevent erosion. If the answer to (c) is "Yes," puddle clay worked into the cavities on the upstream side of the bridge may be the remedy. If, however, there is a hollow under the invert, it may be necessary to remove the latter, underpin the foundations and dispense with the invert unless it is a structural one in the form of a true inverted arch strutting the abutments apart, in which case it must be rebuilt in sections on a firm puddle clay base. A cut-off wall should be added extending well down into the river bed at the upstream end, to prevent a repetition of the old trouble. Inverts are obnoxious to the regime of a river and should preferably not be built as they tend to

encourage scour. It is an interesting fact that bridges over rivers very seldom fail from the effect of the traffic over them, but are peculiarly susceptible to failure from the effects of the water flowing under them. Intelligent, thorough and strenuous inspections of the substructure should be regularly undertaken in order, if necessary, to put into practice, the adage "a stitch in time saves nine."

The Human Element

In the matter of the periodical inspection of structures which is so vital to ensure economy in maintenance, there enters the human factor. It is of no use pretending, in these days of expensive clothes, that men on inspection tours will give priority to those structures which are in most need of examination. For instance, the lure of the underside of a culvert half full of stagnant smelly water on a bed of slimy silt which must be approached via barbed wire and thick prickly undergrowth is easily resisted by a dapper young man who takes a pride in his appearance. Yet it is a safe bet that it is just those structures, difficult of access, which reveal the most glaring defects when scrutinised in detail. The rewards are there for those who go to seek them.

Vegetation plays havoc with masonry or brickwork. Saplings take root in the joints and split and weaken the fabric. Ivy opens up joints and causes decay by harbouring dampness. Bridges, culverts, retaining walls and structures in general should be kept clear of rank plant growth for the dual purpose of preserving them and facilitating access for inspection purposes.

Money-Saving Expedients

A few minor hints on reducing expenditure will conclude this article.

Softwoods, being one of the rare constructional materials, should be creosoted under pressure whilst in bulk. The usual specification stipulates an absorption of one gallon of creosote per cubic foot of timber. This can be checked by weighing the batch before and after it enters the creosoting cylinders. Even if this process increases the cost of the timber by 15 per cent, it is worth while and its life will be increased by a vastly greater percentage.

Plentiful supplies of creosote should always be on tap in depots for local application to any timber which has not been treated under pressure.

The only exception where softwoods are concerned is when they will be painted after manufacture and erection. Creosote oozes through paint.

Hardwoods, e.g., oak and elm, are not normally creosoted nor painted. Oak should be treated at intervals with boiled linseed oil, and elm, used as an engineering timber, principally in the form of thick slabs, is left untreated.

Grade I second-hand sleepers are a worthwhile acquisition for use as plant timber and such things as crib piers.

Puddle clay is a material of great value for many kinds of work, and it could with advantage be put to greater use than is actually the case, notably in lieu of concrete for certain filling purposes. It is quite often required at short notice and supplies of it should be available at points of vantage, where preferably ready-made deposits are to be found in the ground, ready for rushing out for emergency remedial works, such as the repair of breaches in river banks.

Scoured holes in beds of rivers near piers or abutments should be filled with puddle rather than with concrete. The puddle corresponds more nearly with the material of the river-bed than does concrete and is less liable to cause further scour at periods of flood.

It often happens that mass concrete is wrongly used for certain minor repairs to earthworks. Blobs of it are shovelled into cavities or trenches are filled with it when other and cheaper materials, such as hoggin or chalk would cohere better with the surrounding ground. Posts should not be concreted into the ground, it is a wasteful thing to do, as they are held more securely

if the material from the hole is re-used and well rammed.

In this age of concrete and steel, some of the materials which were used with so much success in the past have been forgotten.

Among these are brushwood in the form of faggots or fascines and stakes of sapling wood such as willow, alder or poplar, which are inexpensive, but straight and durable. Their natural habitat being along the banks of watercourses and in marshy ground, it follows that when cut they last well in similar surroundings. Stakes of these woods are useful for protecting the foundations of river walls from erosion and for forming toes for revetments on muddy foreshores. The skilful use of brushwood mattresses on river banks encourages the deposition of silt which aided by the resulting growth of protective grasses, keeps the river within bounds. Mud has preservative properties and it is surprising how long normally quickly perishable materials last when covered by it. Marram and rice grass (spartina townsendii) are valuable for protecting marsh lands from destructive wave action and play a part in reclaiming land from the sea.

Apron revetments and local strengthening of weak banks at the ends of retaining and wing walls can be quickly and cheaply constructed of pitched hardcore of broken concrete or natural stone grouted with weak concrete. Very little cement is required, and this material, when competently used, produces a good transitional link between the formal parts of a structure and natural features of the terrain.

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NEWS ITEM

October 30th, 1876

We understand the Govt. of India has issued a circular to all officers of the Public Works Department.....directing them to utilize native products, manufactures and materials in the construction and maintenance of the Railway Lines.....In all instances indents for foreign materials or manufactures should be limited to the lowest practicable scale.

(The Statesman, Oct. 30th, 1876.)

TOO MUCH HOT AIR

In the recently rebuilt chamber of the House of Representatives at Washington, D.C., stainless steel sheets in the new ceiling buckled and had to be repaired. Experts said this was caused by too much hot air, that is, from steam heat, not the congressmen.

(Eng. News. Rec., Apr. 26, 1951.)

[We seem to remember hearing recently that a fan blade snapped off in our local Parliament in Delhi. It apparently could not stand the strain of circulating the local hot air, that is, air heated by the weather. Ed.]

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HERE AND THERE

1. A NATION OF CYCLISTS

THE nine million people of The Netherlands had among them, in 1939, no less than four million bicycles, or one bicycle for every two persons (infants under two and folks over 90 do not use bicycles in Holland). The present number of bicycles is over three million.

The smooth, level roads through the Lowlands—with hardly a rise or decline except bridges, overpasses, and underpasses are, as it were, a challenge to bicycle riders. Bicycle paths at the sides of the highways are an inseparable part of the road system. Traffic police in the large cities are as busy untangling the bicycle traffic as are the cops at Forty-Second and Fifth Avenue in New York City. Literally everybody uses a bicycle, for business, for pleasure, or for both. The banker, the baker, the schoolma'am and cheesemaker go to work on their bikes.

The Dutch bicycle is different from bikes in other countries. The Dutch ride their bikes as a horseman rides his horse, stately and dignified. The steering bar is placed high, so there is no back-distorting stooping, neither is there any desire nor opportunity to use the bike as a racing vehicle. The law demands that the rear wheel have a mudguard, which must be white and four inches wide; it also must carry, at night, a red light.

Commuters* stations near the large cities present an odd spectacle during the "in-between" hours. There usually is a number of cars parked near the station, but their number is far exceeded by that of the bikes that are parked on the platform awaiting the return of their commuter-owners. Also, when city folks go on a weekend trip, they simply pedal to the railway station, deposit their bikes in a special freight car—carried for that purpose—take them out on arrival at their destination and go pedaling through the woods or along the beaches.

2. DO WE NEVER LEARN?

THE first report of the Royal Commission on Transport, presented in July 1929, contained the following words :—

"In many places cars are frequently left on the public roads for long periods at a time—often on each side of the street—and many people seem to think that they have a perfect right so to leave their cars. This is an entire fallacy. The streets are intended for the movement of traffic of all kinds, not for the purpose of parking cars while the owners or persons in charge are engaged on business or pleasure."

The Select Committee of the House of Lords on the Prevention of Road Accidents (known as the Alness Committee) in their report published in 1939, considered "that the parking of vehicles in busy streets is undesirable and dangerous."

In their interim report (December 1944) the Committee on Road Safety said at paragraph 210 :—

"Standing vehicles in busy streets cause danger to road users and congestion of traffic. Road accident statistics show that many casualties are caused through pedestrians having their view of traffic obscured by standing vehicles, with the result that not infrequently they step out from behind a stationary vehicle in front of a moving one. Danger is also caused to the pedal cyclist who is diverted from his course close to the kerb into the main traffic flow each time he encounters a standing vehicle. Apart from the question of danger to all road users, there is no doubt that it is economically unsound to allow standing vehicles to take up space in busy streets."

(Extracted from 'London Traffic Congestion'—issued by His Majesty's Stationery Office).

* A 'Commuter' is a season ticket holder.

3. RUBBER ROADS PROVE THEIR VALUE

SOME six years before the start of the Second World War, road engineers in Holland made their first experiments with rubber roads Similar tests had already been made in Java and other Indonesian islands. The new roads consist of a mixture of asphalt and a new type of powdered rubber.

Naturally enough, very little attention was given during the war years to the upkeep of these roads. In addition, they were almost daily subjected to the most destructive type of traffic imaginable—military traffic. In Holland, the German Wehrmacht swept across these roads with their tanks and other heavy equipment. The Japanese did the same over the Indonesian roads. At the end of the war, the Allies came to Holland with equipment even heavier than the German.

Remarkably enough, the roads have shown no sign of wear or tear for over ten years. Resembling newly laid asphalt roads, they have retained their elasticity, adhesion and water-resistance. In Java they have withstood wide ranges of temperatures and the destructive influence of the tropical climate.

4. ROAD-BUILDING ON A MARSH

ONE of the greatest difficulties of road construction in The Netherlands is the condition of the subsoil which in a large part of the country is very soft. Especially in the western and northern provinces the upper layers of the subsoil consist in many places of soft clay and peatbog. These layers are often to be found to a depth of thirty-five feet and more and are sometimes so soft that it is possible to push a 15-foot pole entirely into the ground with one hand.

Sometimes, the fen or clay is dredged out and replaced with tremendous loads of sand. Or the sand is poured on top of the clay into which it penetrates until they form a solid mass.

A second system in use is the so-called "floating" foundations, which is nothing else than the willow-twig matting used by Holland's early inhabitants, 3,750 years ago. As it is made today, this matting consists of an upper and lower roster of logs, with layers of twigs filling the space between them. This is laid directly over the clay or fen, after which sand is poured on top of it. In this type of construction, the road will settle gradually in its entirety, until the roster is covered by water and thereby remains preserved. The process of sinking of the road takes about a year.

The third and most costly process is that of building, at a great depth, a wooden or concrete flooring on piles driven into the subsoil. The sandlayer covering the flooring is utilized for drainage pipes, cables, etc.

5. ANALYSIS OF ROAD ACCIDENTS IN GREAT BRITAIN

WHEN asked for a recent assessment as to the respective causes of road accidents, the Minister of Transport stated that the latest available monthly analysis showed that in April, 1951, 89 per cent of the accidents were considered by the police to have been caused primarily by human error, 4 per cent by vehicle defects, 2½ per cent by animals, ½ per cent by weather conditions and ¾ per cent by road defects.

The 89 per cent was still further dissected and analysed as far as possible, and these matters were dealt with in M.O.T. propaganda and educational work.

(Extracted from "Modern Transport", June 23, 1951.)

[Also see the article on "Road accidents in Delhi—1950-51" in this issue—Ed]

6. GOOD ADVICE

'GO straight, it pays every time: respect age and learn something from everyone you meet: in some cases it would be hard not to do things.

'Always try and do a little more than is expected of you by your bosses and employers: it is the right way to get on.

'Try and treat others as you would wish to be treated yourself.

'Work hard and play hard: never neglect business for pleasure, but the two may be combined.

'Don't adopt Army methods in your work or towards those under you: Army discipline is not necessary in business.

'Don't know anything or everything better than anyone else: you don't, you know.

'Do not be afraid to acknowledge a mistake; the man who never made a mistake never did much nor got very far.

'Do not be standoffish or dignified with those in "the trade": they are mostly good fellows and know more than you do, which they will impart if approached properly.'

(From the Presidential Address at the annual conference of the Institution of Municipal Engineers, June 20th, 1951).

7. PETROLEUM CONSUMPTION IN U.K.

DURING the last year, the United Kingdom used nearly 15.3 million tons of petroleum products, 1.5 million tons more than in 1949 and 6.5 million tons above the 1938 figure. The refineries in Britain produced approximately 9.3 million tons in 1950, about 3.1 million higher than in the previous year.

(From "The Eastern Economist"—June 22, 1951)

8. ROAD DEVELOPMENT IN MALAYA

IN addition to the repairing and resurfacing of nearly 400 miles of road in 1950, extensive work was done in Malaya on the rehabilitation of bridges. Emphasis was laid on the construction of new roads useful in maintaining internal security and restoring order. The six-year Development Plan drawn up in the middle of last year envisages a capital expenditure of 22 million dollars* for development of roads and 11 million for bridges; and an annual recurrent expenditure of 770,000 dollars* over and above normal annual expenditures. The revenue collected by the Road Transport Department from licence fees amounted to nearly 9 million dollars in 1950. The number of vehicles registered as of December 31 was 49,800 as compared with 43,922 at the end of 1949.

(From 'The Eastern Economist'—June 22, 1951.)

9. PROFESSIONAL OBSTACLE RACE

A new circular issued by the Ministry of Education shows that an obstacle race of inhuman ingenuity is being devised for the young entrant to the professions. It gives details of the requirements, in terms of the new General Certificate of Education, of such bodies as the Law Society, the Royal Institute of British Architects and the Institution of Civil Engineers. Twenty-two out of the thirty professional bodies had laid down different educational criteria for the aspirants to their profession, only the engineering institutes having managed to work out a common formula.

The new Certificate

The reason for this is that the new General Certificate, unlike the old School Certificate, can be awarded for proficiency in one subject only instead of a balanced group of subjects. The professions, like the universities, have shown that they do not trust the schools to send their pupils out provided with a sound general education irrespective of what may be displayed in examination results, and they have set out requirements which they severally demand for exemption from their own preliminary examinations. Since the different professions have different ideas about basic education, there is a bewildering variety of requirements: almost all the professional bodies require a minimum of four or five subjects, and all but three demand English and Mathematics, but some require Latin and some do not: some require a scientific subject and some a foreign language. To the masters who must devise a curriculum to fit these different requirements, and to the pupils who must follow it, the alleged freedom of the new General Certificate must appear to be an illusion.

(Extracted from 'The Economist'—October 14, 1950.)

* Singapore.

10 HAULAGE RATES

HIGHER rates for sugar-beet haulage during the coming campaign have been proposed. The national sugar beet committee of the Road Haulage Association has recommended the following rates for transport by road throughout to factory.

Lead (miles)	Rate per ton s	d
Up to 3 miles	6	3
Over 3 up to 4 miles	6	6
,, 4 ,, 5 ,,	6	10
,, 5 ,, 6 ,,	7	3
,, 6 ,, 7 ,,	7	6
,, 7 ,, 8 ,,	7	11
,, 8 ,, 9 ,,	8	3
,, 9 ,, 10 ,,	8	8
,, 10 ,, 11 ,,	9	1
,, 11 ,, 12 ,,	9	6
,, 12 ,, 13 ,,	9	8
,, 13 ,, 14 ,,	10	2
,, 14 ,, 15 ,,	10	6
Over 15 up to 18 miles	11	4
,, 18 ,, 21 ,,	12	4
,, 21 ,, 24 ,,	13	4
,, 24 ,, 27 ,,	14	6
,, 27 ,, 30 ,,	14	11
,, 30 ,, 33 ,,	15	4
,, 33 ,, 36 ,,	15	7
,, 36 ,, 39 ,,	16	0
,, 39 ,, 42 ,,	16	3
,, 42 ,, 45 ,,	16	6

The same charges are proposed for the movement of wet and dry beet pulp ex-factory.

This schedule is to apply provided that the beet is placed beside a hard road or similar suitable surface and growers give all possible assistance in loading.

(Extracted from 'Modern Transport'—July 7, 1951.)

AMUSEMENT TAX

"Ten dollars and twenty cents," barked the judge at the gent who had pleaded guilty to wife-beating. "Why the twenty cents?" asked the man. "Amusement tax," responded the judge.

CORRESPONDENCE

INSPECTION OF BRIDGES

To

The Editor of the Transport-Communications Monthly Review.

Sir,

THE article on the inspection of bridges and the equipment required for this purpose published in the August and September 1951 issues of the Review is as interesting as it is timely. Many of the road bridges in India have crossed the century mark. Some of the bridges on the Grand Trunk Road (North), for example, date back to 1850 and others may be older still. On the analogy of the physical condition of a human being with advancing years, the condition of these bridges ought to be our constant preoccupation. That these bridges have so far withstood successfully the ravages of nature and the ever-increasing loads which they are called upon to bear should provide no ground for complacency. That only speaks volumes either of the foresight of the older generation of engineers, or of the inherent strength of the materials used to resist stresses much higher than those originally contemplated, or a combination of both these factors.

The various P. W. D. Divisions in charge of roads no doubt maintain a register of all bridges and culverts situated on roads under their charge. These registers provide for recording brief particulars regarding the location of the bridge, a short description of the structure, and inspection notes recorded from time to time. However, one is not sure whether all this information, particularly on the last item, is entered regularly in the register; neither can one be sure that the inspections carried out are not perfunctory.

There are thus two points which require careful attention in this connection, viz.,

(1) that the inspection should be carried out regularly, say every half-year, and notes invariably recorded in the register meant for this purpose. This, as pointed out in the article under reference, will enable observation of the development of weaknesses and correct assessment of their true significance. Continued movement, even if of small extent is a danger signal and unless steps are taken to stop such movement, collapse may be only a matter of time;

(2) that the inspections are carried out by persons competent for this purpose, i.e., with a full understanding of the principles involved in design. In other words, no effect of any sign of weakness should be minimized, for what seems to be harmless and casual may develop into something dangerous and catastrophic. There is hardly any need to emphasize that the inspecting staff should be aided by the necessary equipment for carrying out the inspection.

As regards the form for the record of inspection notes on bridges, the form in use at present in many states may be inadequate. The Memorandum on Bridge Design and Construction issued by the Ministry of Transport, London briefly outlines the various points which require careful attention in the inspection of bridges. Many engineers will find these points useful to be committed to memory as your correspondent found them in the course of his work. They are, therefore, given below:

(1) the proper functioning of weep holes and other drainage devices;

(2) the free action of expansion joints and bearings;

(3) examination of piers and abutments for signs of scour and the clearing of obstructions in stream channels tending to cause scour;

(4) detection and tracing of water leakage through bridge decks, and maintenance of water-proofing coats;

(5) signs of movement of foundations, especially on clay, as evidenced by cracks in the structure or the road surface over it;

(*Continued on page 26*)

TECHNICAL INFORMATION

(i) DEPOSITING CONCRETE IN ROAD CONSTRUCTION

(*Extracted from 'Concrete & Construction Engineering'- July '51.*)

FULL-scale tests made to determine the effect of different methods of depositing concrete when constructing roads are described in "Roads and Road Construction" for January 1951 by Mr. R. H. H. Kirkman of the Road Research Laboratory. The least irregularity of the finished surface was obtained when small heaps of about one cu. yd. of concrete were dumped from both sides of the slab at regular intervals. When concrete was dumped from one side only the irregularity on this side of the slab was considerably greater than on the other, and it was necessary to place heaps fairly close together. Honeycombing at the bottom of the slab was detected when heaps slightly overlapped.

When the spreading was poor, the riding quality of a level road was improved by substituting concrete of low workability for the usual concrete of very low workability. When the superelevation was great the flow of the wetter concrete considerably increased the irregularity. The wetter concrete was also difficult to handle and appeared to lead to honeycombing at the bottom of the slab. The removal of irregularities became increasingly difficult with each pass of the finishing machine. The best riding quality was achieved when irregularities were detected after the first pass so that an attempt could be made to remove them during the second pass.

Even with high-quality workmanship and good supervision, uneven setting and settlement of the side forms was responsible for much irregularity.

(ii) GOODS VEHICLES ON HILL ROADS

Device to Prevent Backward Movement Proposed New Rules in Bombay

DRAFT rules requiring the carriage of two wooden chocks of prescribed dimensions, for use as a precaution against possible slipping back of goods vehicles on hill roads, were recently published by the Government of Bombay.

Objections or suggestions relating to these rules were invited by the Deputy Secretary to the Government of Bombay, Home Department.

Numerous complaints are received by Government about the danger caused by drivers of goods vehicles using large stones to prevent their vehicles from rolling backwards whenever they halted on ghat (hill) sections of the Bombay-Poona Road. Such stones, of course, are left on the road when the vehicles drive off!

As the practice is dangerous, the State Transport Authority carried out tests and evolved a type of chock considered to be effective under most conditions likely to be encountered. As a consequence the following new draft rules were suggested to be added to the Bombay Motor Vehicle Rules, 1940.

"164-A. **Wooden Chocks.**—(1) In order to prevent a goods vehicle from running backward on slopes or otherwise to render it immobile, every such vehicle shall be equipped with two wedge-shaped solid wooden chocks, each measuring 12 inches in length, 12 inches in breadth and 10 inches in height, with one of its sides having a slope making an angle of 45 deg. at the end and the plane surface of the sloped side being rendered concave so as to fit the outer circumference of the size of tyre (e.g., 32″×6″, 32″×7″) normally fitted to the rear wheels of the vehicle.

(2) Each such chock shall be kept in a bracket fitted on the outer skirt of the tailboard of the vehicle and shall have a hook. The tailboard of the vehicle shall also have a hook in the centre.

(3) Each such chock shall be linked with the tailboard by means of a metal chain of sufficient length and strength fastened to the hooks in the chock and in the tailboard."

(iii) CONTROL OF HOT-MIX ASPHALTIC CONCRETE

(Extracted from 'Roads and Streets'—July 1951)

THE first hot-mix asphalt pavement using petroleum asphalt was laid on Pennsylvania Avenue in Washington, D.C., in 1900. This sheet asphalt pavement was controlled strictly by trial and error, and incidentally, was a complete failure because the asphalt content was too high. From this beginning, more and more hot-mix pavements were laid with a constant improvement in the finished product. As time progressed, engineers, still working largely by trial and error, learned by hard experience the importance of asphalt content, of grading, and many other factors which contributed toward a successful pavement.

These early engineers were artists. Many of them learned to build good asphalt pavements by the same method that grandma baked a cake. Her units of measure were dashes, dabs, and pinches and she could bake a wonderful cake, but when she tried to tell daughter how to do it, the cake usually had to be thrown to the hogs. So it was with these old veteran asphalt men.

In the 20's a new breed began to emerge in the asphalt paving industry known as the laboratory research man. He followed the veteran around, observing his methods and analysing his pavements with the objective of finding the keys and establishing rules for building a good pavement so that it would not be necessary for a man to have fifty years' experience in order to place one which was satisfactory. In this he was largely successful. Guiding principles were discovered and put into use through tests and specification requirements. They were called controls. Now from where did these controls come? They were not the result of so-called research men sitting at a desk and determining out of thin air just what would have to be done to make a good pavement.

They were merely the reflection of the skill of the veterans in the field reduced to definite figures and numbers. As a matter of fact, a statement of the principles of control and design could aptly be considered as a summary report of fifty years of field research in building hot-mix asphalt pavements.

Principles Summarized.

Now let us see what these principles are. In as much as control is merely the design worked in reverse, let us consider the guiding principles in design which have now been agreed upon by the major portion of the engineers in this country.

(1) The aggregate must be reasonably well graded. For instance, the commonly used mixes for surface course must have sizes all the way from about ½ inch down to dust.

(2) Finished pavements must have a certain amount of air included in the mix in the form of air pockets or voids. Experience has shown that the voids should not exist in an amount of less than 2 per cent nor more than about 6 per cent. So taking the middle course, the designer sets the voids at 4 per cent or, stated in another manner, he sets the mix at 96 per cent density. This is accomplished by making up several mixes in the laboratory with varying per cents of asphalt, compacting them as they will be compacted on the road and then selecting the asphalt content which will give 96 per cent density. Thus, the optimum asphalt content of the mix is established.

(3) Having decided on the exact grading and the exact asphalt content to be used, it is now necessary that the compacted mix be tested by some stability method to determine whether or not it will take the traffic to which it will be subjected.

(4) The use of extremely hard asphalts is avoided because the softer asphalts have a longer life. The old concept that the asphalt had to be as hard as a brick in order to obtain the necessary stability no longer prevails. It is now known that a much more important consideration in obtaining a strong stable pavement is the kind of aggregate employed in the mix.

BOMBAY CIVIL WORKS BUDGET 1951—52.

The following extracts relating to Civil Works Budget have been taken from the Bombay Budget for the year 1951—52.

	(In Lakhs of Rs)		
	Accounts 1949–50	Revised Estimates 1950–51	Budget Estimate 1951–52
I. Receipts (Civil Works)			
1. [illegible]	9.09	9.00	8.00
2. Forest Receipts	.71	.76	.76
3. Tolls on Roads	.10	.10	—
4. Receipts from self-supporting workshops.	.76	.50	.50
5. Recoveries of expenditure	1.22	.85	.87
6. Miscellaneous	18.68	14.53	15.46
7. Transfer from Central Road Development A/C	2.74	4.56	53.15
8. Transfer from the Special Development Fund	.05	.25	—
9. Deduct—Refunds	-4.32	-.15	-.03
Total	29.03	30.40	78.71
II. Expenditure (Civil Works)			
1. Original Works	110.07	111.32	195.74
2. Repairs	160.17	121.14	117.20
3. Establishment	51.62	26.78	19.79
4. Tools and Plant	25.24	29.44	30.19
5. Grants-in-aid	22.66	23.41	16.42
6. Suspense	-19.07	.16	.16
7. Charges in England	- .68	-1.52	-1.65
8. Amount transferred from Post-War Reconstruction and Development Fund to finance capital works under "81–Civil Works"	—	130.00	[illegible]
Total Expenditure	350.01	440.73	377.85
III. Expenditure (Communication Only)			
(a) **Original Works**			
1. Ordinary	15.63	10.00	15.37
2. Postwar Reconstruction & Development Programme.	25.30	29.30	39.08
3. National Highways	7.18	10.00	44.64
4. Central Road Fund	2.74	4.46	53.10
Total—O. W.	50.85	53.76	152.19
(b) Repairs	n. a.	n. a.	41.74
IV. Receipts from Roads			
1. Receipts under Motor Vehicles Acts	23.17	26.00	20.10
2. Receipts from Sales Tax on Motor Spirit	57.86	62.00	60.00
3. Tolls and Ferries	.81	.86	.76
Total Receipts	81.84	88.86	80.86

A BRIEF NOTE ON THE BOMBAY BUDGET

(With special reference to Civil Works)

THE total revenue receipts of Bombay for 1951-52 are estimated at Rs 6064.25 lakhs and revenue expenditure at Rs 6059.73 lakhs. According to these estimates, 1951-52 Budget indicates a small surplus of Rs 4.52 lakhs. The revised estimates for 1950-51 indicate a deficit of Rs 2.72 lakhs with the revenue receipts amounting to Rs 6564.48 lakhs and revenue expenditure to Rs 6567.20 lakhs. The Budget estimates of revenue and expenditure for 1951-52 are lower than the revised estimates for 1950-51.

Revenue expenditure on Civil Works for 1951-52 estimated at Rs 377.85 lakhs forms 6.2% of total estimated state expenditure. The corresponding percentage figure for the two previous years 1950-51 (revised estimates) and 1949-50 (actuals) were 6.7 and 5.7 respectively.

Expenditure (Charged to revenue) on communications under 'Original works' in 1951-52 is estimated to be 152.19 lakhs which forms 78% of the total expenditure on Civil Works (Original Works Only). The corresponding percentage figures for 1950-51 and 1949-50 are 48% and 46% respectively. This shows that the part of civil works expenditure (under original works) earmarked for communications—original works in 1951-52 is considerably higher than that incurred in the two preceding years.

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(Continued from page 22)

(6) careful examination of steel structure for corrosion, especially in parts where moist or polluted air may be partially trapped (e.g., the spaces between beams).

This list is by no means exhaustive but in conjunction with the points explained in the article under reference will, I am sure, serve broadly to outline the problem of the inspection of bridges.

I hope the article under reference has not escaped the attention of the readers of the Review. Its careful study is sure to be very useful and valuable.

Simla,
4-10-1951.

Yours faithfully,
X. Y. Z.

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NOT A POLITICIAN

Blessed is the man who, having nothing to say, abstained from giving wordy evidence of the fact.—George Eliot.

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List of Approved Works on National Highways

S. No.	Job No.	Name of work	Amount Rs	Remarks
		UTTAR PRADESH		
1.	499 UP 24	Painting miles 260-269 of National Highway No. 24 (miles 37-46 of Lucknow-Bareilly Road).	3,23,000/-	
		HIMACHAL PRADESH		
2.	500 HP 22	Surface painting of the Hindustan-Tibet Road (National Highway No. 22) from mile 6/2 to 12 in Himachal Pradesh.	54,300/-	

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THE SPARROW

The viewpoint of the Sparrow
Is arrogant and narrow,
He **knows** *that he excels*
He is selfishly obsessed ;
He would not give an ostrich best.
His children leave their shells
Puffed to their very marrows
With pride at being sparrows.

(M. de L. Welch)

(Reproduced after reading the speeches of the leader of a certain political party in India.—Ed.)

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List of Books added to the Roads Organization Library during the month of September 1951

1. **The Fundamental Principles of Road Passenger Transport Operation** by F. G. Fletcher.

   (MacDonald & Co. (Publishers) Ltd., London).

The Superintendent, Printing and Stationery, U. P., Allahabad.

2. **Annual Report on Research Progress during the year 1950–U. P., P.W.D., Technical Memorandum No. 21** by J. N. Mitra, etc., 1951.

3. **Annual report on Research Progress during the year 1949—U. P., P.W.D., Technical Memorandum No. 20,** by J. N. Mitra, etc., 1951.

4. **Bulletin of the International Association of Road Congresses, No. 126.**

5. **Bulletin of the International Association of Road Congresses, No. 127.**

The Manager of Publications, Delhi.

6. **The Unrepealed Central Acts with Chronological Table and Index** — **Vol. I, from 1835 to 1871 (both inclusive) 2nd edition.**
7. Do — **Vol. II, From 1872 to 1882 (both inclusive) 2nd edition.**
8. Do — **Vol. III, From 1882 to 1897 (both inclusive) 2nd Edition.**
9. Do — **Vol. IV, From 1898 to 1907 (both inclusive) 2nd edition.**
10. Do — **Vol V, From 1908 to 1910 (both inclusive) 2nd edition.**
11. Do — **Vol. VI, From 1911 to 1916 (both inclusive) 2nd edition.**
12. Do — **Vol. VII, From 1917 to 1923 (Both inclusive) 2nd edition.**
13. Do — **No. VIII 1924 to 1930 (both inclusive) 2nd edition.**
14. Do — **Vol. IX, from 1931 to 1938 (both inclusive) 2nd edition.**
15. Do — **Vol. X, From 1939 to 1947 (both inclusive) 2nd edition.**
16. **The Land Acquisition Act 1894 (I of 1894) as (modified up to the 15th September 1949).**
17. **Act No. XII of 1941 Delhi Restriction of Uses Land Act, 1941.**
18. **Report of the Local Finance Enquiry Committee (with Appendices).**

The Railway Executive, London.

19. **British Holiday Guide-Area No. 1—Scotland, (1951 edition).**
20. **British Holiday Guide - Area No. 2-Wales & North West (1951 edition).**
21. **British Holiday Guide - Area No 3-Eastern England (1951 edition).**
22. **The design of Flexible and Rigid Pavements - University of California Syllabus No. 319** by Hobert Horonjeff and John Hugh Jones. (University of California Press, Barkeley and Los Angeles, 1951).
23. **Proceedings of the 8th Annual Meeting of South - eastern Association of State Highway Officials, from 1-2 December 1949.** (Southeastern Association of State Highway Officials, Marion Hotel, Little Rock, Arkansas, U. S. A.)
24. **American Railway Engineering Association, Bulletin No. 492, Vol. 52, January 1951.** (American Railway Engineering Association, 59 Eastern Bureau Street, Chicago 5, Ill.) 2 copies.
25. **Engineering Experiment Station News, Vol. XXII, No. 5, December 1950.** (Engineering Experiment Station, Ohio State University, Columbus, Ohio.)

26. **Curing of Concrete—A. R. B. A.—Technical Bulletin No. 165, 1949.** (American Road Builders, Association, 1319 F Street, N. W., Washington 4, D. C.)

27. **Brick and Tile Engineering Handbook of Design** by Harry C. Plummer. (Structural Clay Products Institute, Washington, D. C.)

28. **The Hydraulics of Culverts - Engineering Station Series Bulletin No. 56.** (Engineering Experiment Station, The Pennsylvania State College, Pennsylvania).

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

29. **Selected Bibliography on Highway Finance** compiled by the Bureau of Public Roads.

30. **Highway Statistics, 1949.**

31. **The Mathematical Theory of Vibration in Suspension Bridges—A Contribution to the Work of the Advisory Board on the Investigation of Suspension Bridges** by Freidrich Blich and others.

Publications of Royal Swedish Geotechnical Institute, Stockholm

32. **The Vane Borer: An Apparatus for Determining the Shear Strength of Clay Soils directly in the ground—Proceedings No. 2 (in English)** by Lyman Cadling and Sten Odenstad.

33. **Soil Sampler with Metal Foils: Devices for taking Undisturbed Samples of very great length—Proceedings No. 1** by W. Kjellman, T. Kallestenius and O. Wager.

Publications of His Majesty's Stationer Office, London

34. **Cellular Concretes and Some other Insulating Building Materials in Germany**—B. O. I. S. Final Report No. 1352, Item No. 22.

35. **London Traffic Congestion - Report by the London and Home Counties Traffic Advisory Committee.**

36. **Report of the Road Research Board with the Report of the Director of Road Research for the year 1949.**

37. **The Protection of Buildings and Timber against Termites—Forest Products Research Bulletin No. 24**

38. **Temperature Stresses in Concrete Pavements - Proceedings No. 14** (in English) by Sven G. Bergstrom. (Swedish Cement & Concrete Research Institute at the Royal Institute of Technology, Stockholm, 1950).

39. **Proceedings of the First Commonwealth Conference on Tropical and sub-Tropical Soils—T. Communication No. 46.** (The Commonwealth Bureau of Soil Science, **Harpenden, England, 1949**).

40. **Legal Phases of Engineering Contracts and Specifications** by I. C. Crawford. (Macmillan and Co, Ltd., Martin Street, London, W. C. 2, 1950).

41. **Vales Plant Data Book (4th edition).** (Vales Plant Register Ltd., 14 Lower Grosvenor Place, London, S. W. I.)

42. **Road Transport Law—A Summary of the legislation effecting the construction and use of Motor Vehicles (7th edition)** by L. D. Kitchin. (Illiffe and Sons, Ltd., London).

43. **An Introduction to Aluminium and its Alloys.** (Aluminium Development Association, 33, Grosvenor Street, London, W. 1, December 1950).

44. **Some Recent Developments in Rheology** by V. G. W. Harrison. (United Trade Press Ltd., 24 Birde Lane, Fleet Street, London, E. C. 4, 1950).

45. **Incentive and Quality** by J. Armstrong. (Chapman & Hall Ltd., 37 Essex Street, London 2, 1950).

46. **Compulsory Purchase of Land by Local Authorities under the Acquisition of Land Authorisation Procedure Act, 1946,** by A. J. W. Jeffery. (The Thames Bank Publishing Company, Ltd., 1773, London Road, Leigh-on-Sea, Essex, London, 1949).

47. **School Crossing Signals by C. C. Wiley.** (Department of Civil Engineering, University of Illinois, Urbana, Ill., 1950).

48. **Pennsylvania Highways Today and Tomorrow**—Report of the Highway Planning Commission to the Governor and General Assembly of the Commonwealth of Pennsylvania, December 1, 1950) (Highway Planning Commission, Commonwealth of Pennsylvania, Harrisburg, 1950).

49. **World Geography of Petroleum**—American Geographical Society Special Publication No. 31 by Wallace E. Pratt and Dorothy Good. (Published for the American Geographical Society by Princeton University Press, Washington).

50. **Interstate Barriers to Truck Transportation** by Margaret R Purcell. (United States Deptt. of Agricultura, Bureau of Agricultural Economics, December 1950).

51 **Traffic Survey Report of Bluefield,** West Virginia, 1949. (The State Road Commission of West Virginia, Planning Division).

52. **Final Report Lockbourne No. 2—Experimental Mat** (U. S. Engineers Corps—U. S. Army). (The Ohio River Division Laboratories, Mariemont, Ohio).

53 **Civil Engineering Code of Practice No. 5 (1950)—Drainage (Sewerage).** (The Institution of Municipal Engineers, 84, Eccleston Square, London, S. W. 1).

54. **Civil Engineering Code of Practice No. 1 (1950)—Site Investigations.** (The Institution of Civil Engineers, Great George Street, Westminister, S. W. 1).

Publications of the British Standard Institution, London

55. **B. S. 743: 1951—Materials for Damp Proof Courses.**

56. **B. S. 1707: 1951—Binder Distributions for Road Surface Dressing.**

57. **Vehicle Movement on Sections of Curves on Gradients and its Influence on Alignments of Logging Roads, Sport Tracks and Motor Roads** (Die Bemegung in Kurvenge), (in German) by Prof: Leo Hanska. (George Fromme and Co., in Wien, 1948).

58. **Molesworth's Handbook of Engineering Formulae and Data** (34th edition), edited by Albert Peter Thurston. (E. & F. N. Spon Ltd., London, 1951).

59. **What Bombay Government did and said**—January to March 1951. (The Director of Publicity, Govt. of Bombay, Bombay).

60. **An Interim Note on the Landslides occurring on the motor road between Dharmasala and Mcleodganj.** (May 1951) by G. Kohli. (Geological Survey of India, July 1951).

61. **Fourth Annual Report to the Governor of California on the Activities of the Division of Highways for the year July 1, 1949, to June 30, 1950,** by the Director of Public Works. (Division of Highways, Department of Public Works, State of California).

62. **City Planning—A selection of Readings in its Theory and Practice,** edited by Theodore Caplow. (Burges Publishing Co., 426 South Sixth Street, Minnespolis, Minnesota, 1950).

63. **Proceedings: Convention Group Meetings, Papers and Discussions, San Antonio, Texas, 1949.** (American Association of State Highway Officials, 917, National Press Building, Washington 4, D. C.)

64. **Solution of Hydraulic Flow Distribution Problems Through Use of the Network Calculator—Research Report No. 18,** by L. M. Haupt. (The Engineering Experiment Station, The Texas A & M College System, College Station, Texas, 1950).

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