

30 Transport-Communications

MONTHLY REVIEW



No. 39

July 1950

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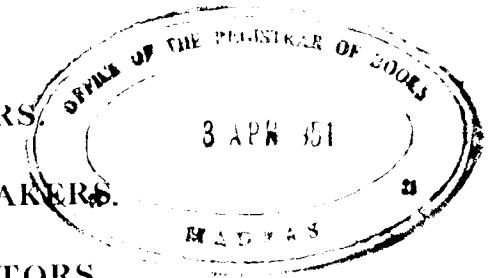
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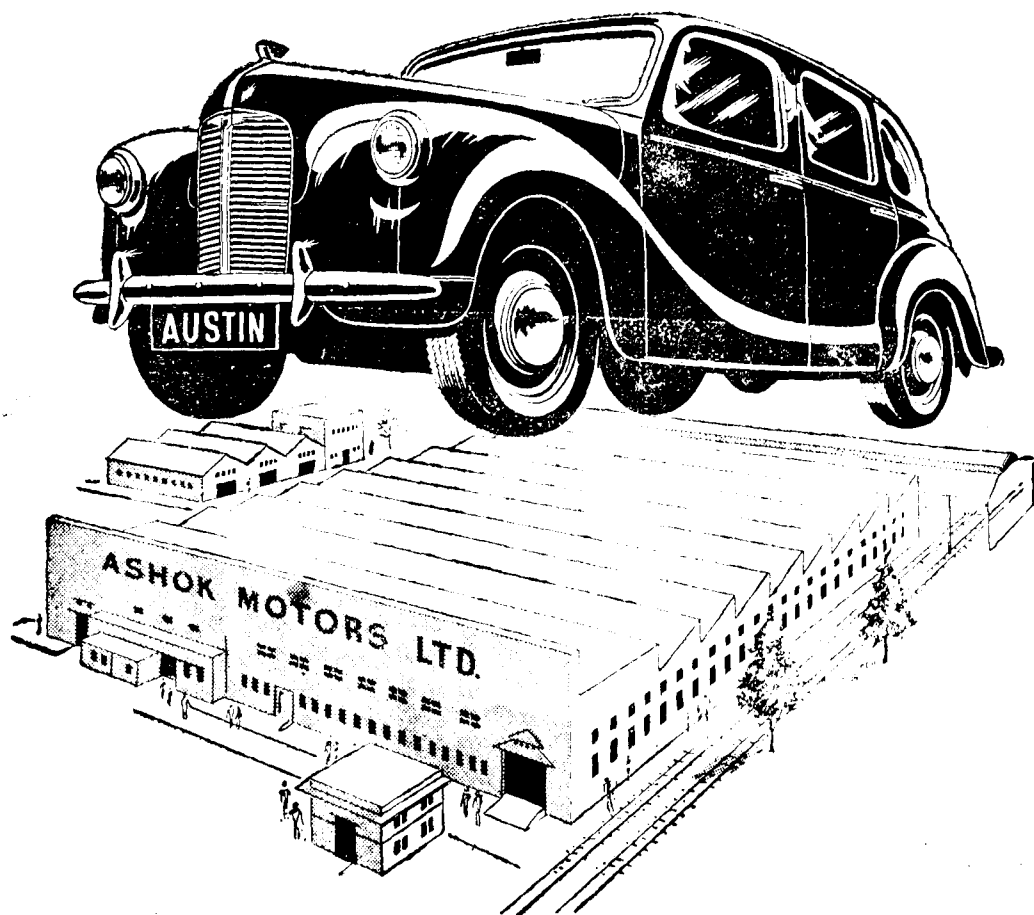
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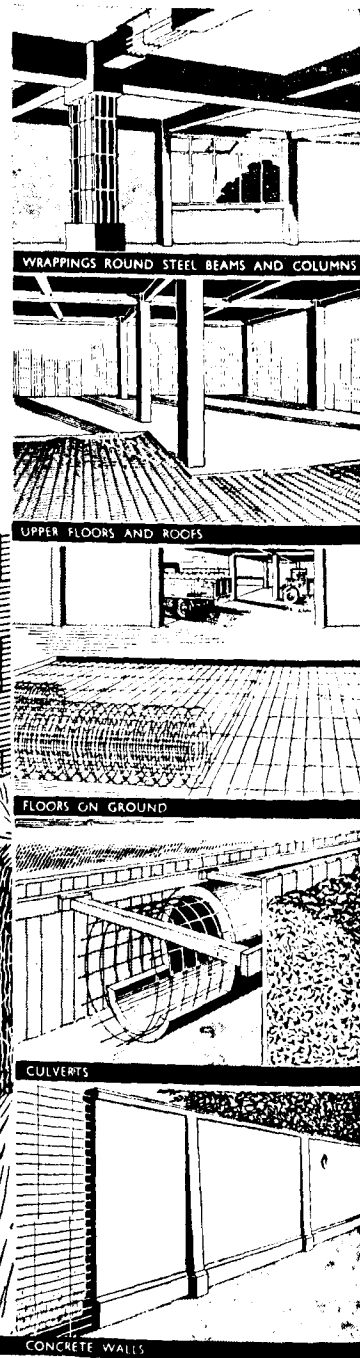
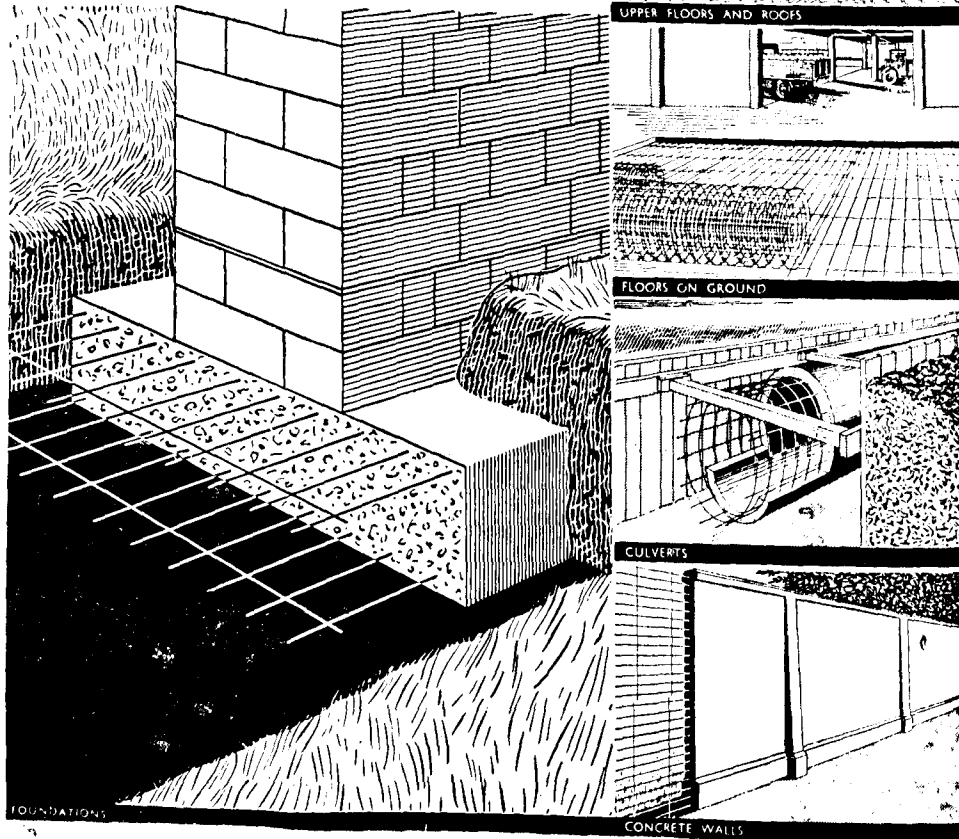
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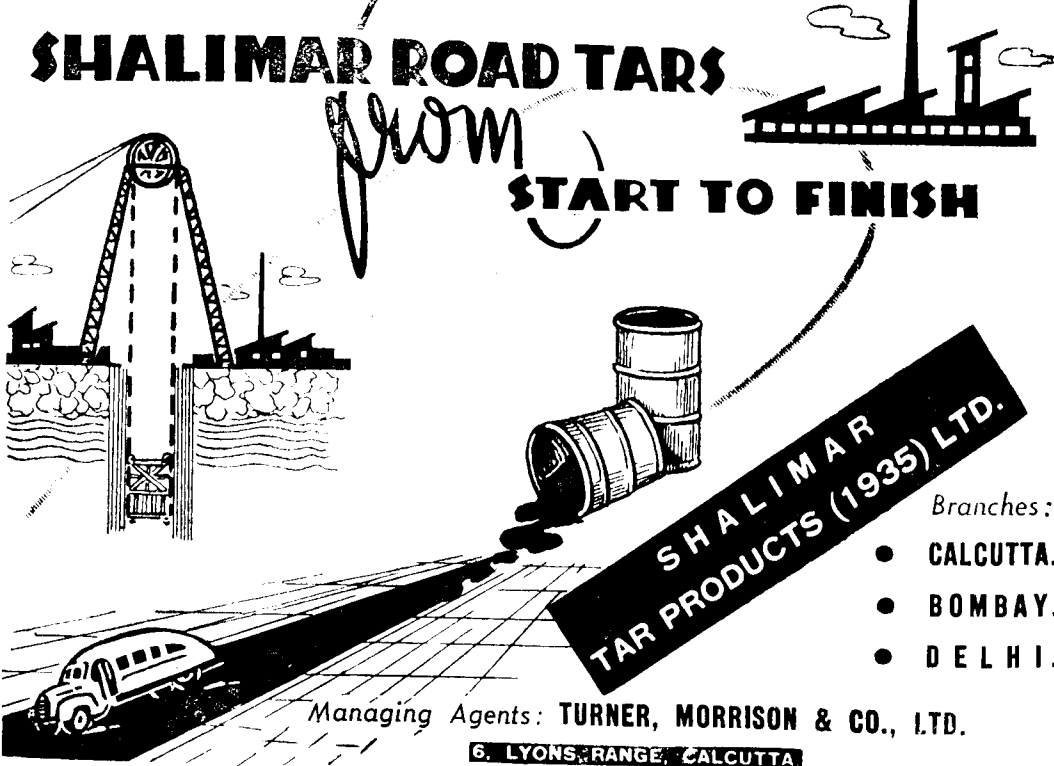
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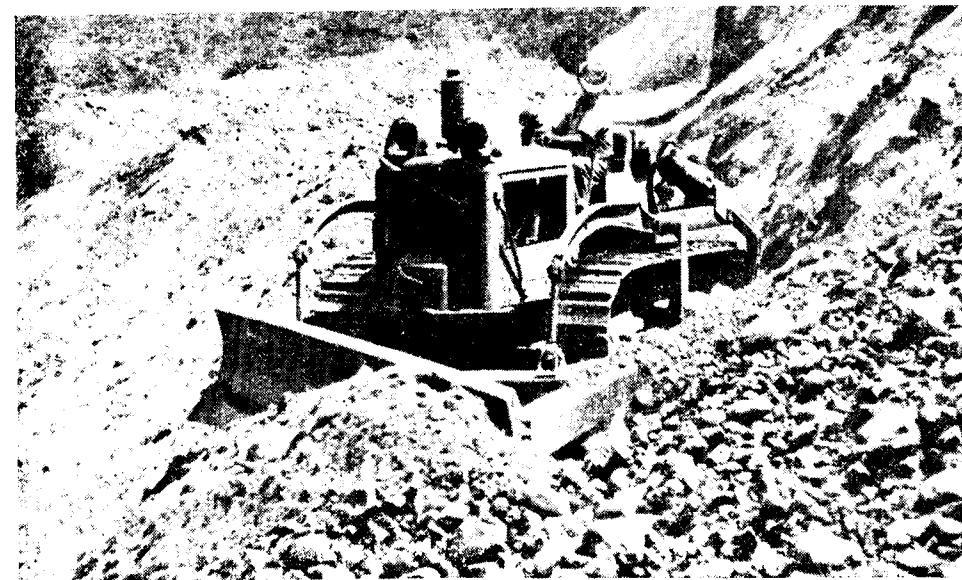
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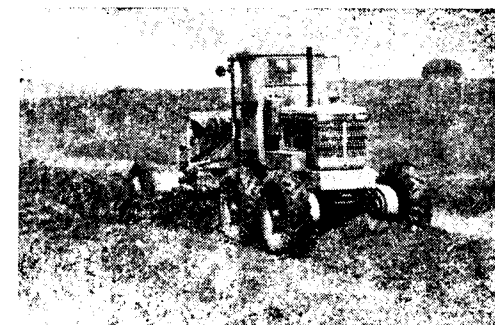
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Editorial

IN January 1950 we published an article entitled "Roads and Railways" in which the respective roles of these two transport services were reviewed. The article said that although the 20th century so far was the age of the petrol-driven car, the usefulness of the railways was by no means exhausted; the railways had had their day of monopoly and "must re-orient themselves as purveyors of long distance major traffic only."

In the United States of America and in the United Kingdom—we quoted statistics—the route mileage of railways had been going down since 1925, while in Canada the downward trend began after 1935. In India there has been a decline in recent years, attributable probably to the War.

In this issue we publish an article from a valued contributor, (written seemingly more in sorrow than in anger) entitled "Are Railways Becoming Obsolescent?" Our contributor thinks the figures we published last January may mislead those of our readers in India who have not an intimate knowledge of railway transport.

We were aware, as the contributor tells us, that the railways examine every new construction proposal very critically just as every financier investigates, before embarking upon any new venture, how it will affect his pocket. If the Railway Board had their way, rarely, if ever, would an "unproductive" railway line be sanctioned. Our January article was not addressed to the Railway Board or to those who had made a study of transport but to the general public and principally to merchants who, as our newspaper columns show, cry out for new railway construction or the restoration of dismantled lines without considering the true economics of their proposals. In a democracy we have to try to educate our masters, the voters.

We agree the road-rail controversy, which has done so much harm in the past, should be "buried and forgotten" and we think there will be no controversy if, as stated in our January article, each question of road or rail expansion is examined with a view to seeing, with reference to every proposal, **"whether road or rail transport fits in better into the economy of the country."**

We welcome the entry of railways into the field of road transport provided this entry does not take a monopolistic turn or, if there must be some element of monopoly, provided there are sufficient statutory checks to ensure that the road service provided will be cheap, rapid, and efficient. We note that there are no fewer than twenty-six checks or controls imposed by Statute on the London Passenger and Transport Board: we are not aware that so much fear of monopolies has been displayed in India.

Our January article was, we think, right in claiming that India was in a fortunate position—she has not yet gone very far in the development of her

This Review is sponsored by the Roads Organization, Ministry of Transport, but the Government of India accept no responsibility for any views or opinions expressed therein

transport-communications and will have less to discard if she decides to develop a co-ordinated system of transport of her own. The country obviously needs all its available means of transport and needs more of every type.

A reference to our past issues will also establish that we have always advocated the best utilization of all the different available forms of transport in combination or separately with a view to improving services and cheapening costs; but our well-grounded fear of monopolies has always made us sensible of the desirability of encouraging the granting of permits to private operators (of goods vehicles at any rate) as a protection against possible inefficiency of monopolistic services.

We are thus at one with our contributor in thinking that different forms of transport should not be rivals but partners, each catering for the traffic for which it is best suited. We agree that "function should govern" when function means fitness of a means of transport measured by economy, efficiency, and convenience. If there were no monopolies and no regulations, function would automatically govern.

Since regulation is necessary and monopolies appear inevitable in India, we agree with our contributor that technical men engaged in the transport industry should find some means of meeting and working out a transport policy which will give the country cheap, rapid, and efficient transport by the means best suited for the kind of traffic involved. On how this is to be done, we would like to have the opinion of our readers. The efforts of the Indian Roads Congress to provide such a meeting ground have so far failed.

ELEPHANT'S LUNCH HOUR

The lordly elephant, when tamed and trained, makes an ideal animal for jungle work. He is virtually self supporting. He combines in his person the attributes of a crane, tractor and bull-dozer, and can develop almost full power while at a standstill. He will start work at first light, but is sufficiently intelligent to demand a "lunch hour" from 10 a.m. till 4 p.m.

India has used the elephant as a road roller also.

[Some people in our Government Secretariats have a comparable lunch hour'!—Ed.]

PERU'S HIGHWAY PLANS—1950-54

[For our readers' information we give a brief account of Peru.]

PERU is a mountainous country on the Pacific coast of South America. Culturally, it is the oldest of the South American nations. Here the Andes reach their highest altitude, seven peaks towering above 19,000 feet. The 30-mile wide strip of land along the Pacific is a desert. The uplands are well watered, and also the eastern descent to the Amazon basin, tropical lowlands, very fertile, thickly wooded and thinly populated.

Area 482,258 square miles. Population 7,039,000; Capital LIMA.

The monetary unit is the Sol (15 soles = one U.S.A. dollar).

PERU'S Association of Highways, a body probably parallel to the Indian Roads Congress, have recommended the creation of a National Highway Council and a National Highway Fund because, in that country, "as in others, the main problem is to obtain the necessary resources in the most dependable form."

Peru's peculiar geographical features place her highways on a high plane of importance. Few nations in the world are so dependent on motor transportation as Peru.

To fix the size of the highway fund and the amount the beneficiaries should pay, the Association have attempted to assess the value of the most urgent needs to be satisfied over a five year period, 1950-54. Maintenance of existing and new roads is given the highest priority.

Five Year Plan 1950-54

The estimated cost of the 5-year highway plan is summarized below:

	Length (Kilometers)	Soles (thousands)
a) Maintenance	36,672	123,200
b) (i) Improvements	2,586	88,390
(ii) Paving	2,359	85,380
c) Construction of National or regional high- ways	1,133	72,800
d) Construction of District or Local roads	4,000	80,000
e) Bridges	3,809	27,198
	Total	476,968

[15 Soles = One U.S. dollar]

Available Funds

If the execution of the 5-year plan were to depend solely on the present normal income for highways it would take 10 years to complete the plan, and taking the effective exchange rate into consideration the plan would take 13 years to finance.

National Highway Fund

The normal development of the plan and of the successive steps, which may be formulated, requires not only an increase in the available income but the institution of a National Highway Fund. The contributions which constitute the fund should be related to the state of the financial market, in such a way that the costs of importation of materials and plant and the increase or decline of collected income may be regulated automatically.

In accordance with the experience of countries which have achieved effective results in regard to highways, the benefits of highways, for the purpose of determining the contributions intended for the work, may be classified thus:

Class A — Benefits to Society in general, such as influence on general education, health, recreation, police protection, national defence, postal services, costs of living and distribution.

Class B — Benefits to definite groups, such as agriculture, manufacturing industry, labour, railroads, mining, sea and

air communications and commerce.

Class C — Benefits to property served by it.

Class D — Benefits to highway users.

The highway users provided more than 90 per cent of the contribution to the present highway funds through the gasoline tax. To require that a highway user bear the cost of construction as well as the maintenance and improvement of roads is not right; it is contrary to transport economy, the ultimate goal of highway policy. On the other hand, the indiscriminate use of the funds provided by highway users leads to the postponement of necessary improvements or to carelessness in maintenance occasioning in this way the double cost.

The highway users should be expected to furnish only, as transportation economists recommend, the necessary expenses of maintenance, administration and improvements to permit safer and more economical transit.

Owing to local difficulties, Peru finds it impracticable to expect an appreciable contribution from the property served by highways. The other categories of beneficiaries are, therefore, expected to contribute all the funds.

A—The Contribution of Society in General

In spite of the short distances involved, 553 capitals of departments, districts and provinces lacking access by land, river or ocean do not enjoy benefits of communications. Access to such capitals, farming or mining communities, and in general to those centres in which an appreciable portion of the population lives, can be accomplished to some extent by arterial highways, but the fundamental necessity is local roads. To this end it is essential to have the co-operation of the society in general and the communities which have communication facilities and of those which lack them.

Poll Tax

The report goes on to examine and reject a proposal to levy a poll tax of 10 soles per head for men and five soles for women on all inhabitants between the ages of 20 and 65. The report recommends that funds should be drawn from an appropriation of the general budget for 18,000,000 soles an year (which would be the amount of the poll tax if levied).

B—The Contribution of Specific Groups

By means of roads producers get manual labour, provisions, materials, supplies, and services. Food is brought to areas unsuited for agriculture, avoiding any shortage occasioned by the increase in the population of such areas.

Thanks to roads, labour, the manufacturing industry and commerce find new markets. By raising the living standard of the people roads increase the consumption capacity and amplify the potentialities of business.

Maritime, river, air, and rail communications have a powerful auxiliary in motor transport both as a collector and distributor.

In order to make the contribution of the various groups in this category proportional to the benefits they derive from highways and in order to correlate the contributions to the current exchange rate, the report recommends the creation of an *ad valorem* tax on exports and imports. Since production requires imported items, which would already be taxed, the export tax is proposed to be lower than the import tax.

The size of the contribution which it is desirable to draw from this category of beneficiaries is about 18,000,000 soles a year, which may be obtained by an *ad valorem* tax of $\frac{1}{2}$ per cent on imports and $\frac{1}{4}$ per cent on exports according to 1948 figures. It is recommended that these percentages should be added to the existing rate of one per cent *ad valorem* on exports and imports and should be earmarked for highway works.

C—The Contribution of Highway Users

This will be obtained by an additional tax of 3.0 soles per gallon of petrol. Benefits of adequate maintenance and improvement of roads would be the highway users' compensation for this additional burden.

Income of the National Highway Fund and its Distribution

To summarize, the present and proposed income would give the following amounts, expressed in millions of soles:—

Year	Present Income			New Income			
	Present gasoline tax.	General Funds.	Special Laws.	General Budget.	Import Export tax.	Additional Gasoline tax.	Totals.
1950	44.6	3.0	1.2	18.0	18.0	31.8	116.6
1951	49.0	3.0	1.2	18.0	18.0	35.0	124.2
1952	53.9	3.0	1.2	18.0	18.0	38.5	132.6
1953	59.3	3.0	1.2	18.0	18.0	42.4	141.9
1954	65.2	3.0	1.2	18.0	18.0	46.6	152.0
Total	272.0	15.0	6.0	90.0	90.0	194.3	667.3
Per cent	42	2	1	13	13	29	100

The National Highway Fund thus constituted would be provided with a balanced share from the beneficiaries of distinct groups:

	Soles.	Soles.			
A. Society in General:					
1. Special laws in force	6,000,000				
2. General Budget	90,000,000	96,000,000 (14%)			
B. Special Groups:—					
1. Present amount of general funds	15,000,000				
2. Specific tax of $\frac{1}{2}$ per cent on imports and $\frac{1}{4}$ per cent on exports	90,000,000	105,000,000 (16%)			
C. Highway Users:					
1. Present gasoline tax	272,000,000				
2. Additional gas tax	194,000,000	466,000,000 (70%)			
Total		667,000,000 (100%)			

The expenditure is proposed to be distributed between works as indicated below:

Works.	Beneficiaries	Amount
Local Roads.	A. Society in General	96,000,000
National and Regional roads	B. Special Groups	104,999,400
Services S		36,300,000
Maintenance		166,793,100
Improvement		115,756,400
Paving		111,814,500
Bridges		35,618,800
	C. Highway Users	466,282,800
	D. Balance	17,800
	Total	667,300,000

It will be noticed that the distribution corresponds to the contributions of the beneficiaries.

With the creation of this special fund earmarked for highways the country would be in a position to effect credit transactions on a secure foundation, both foreign and domestic, which would accelerate the realization of a general road plan.

THE MAN BEHIND THE WHEEL

Causes Most Accidents

Teen-ager drivers are lethal. Older drivers react slowly but are more careful and safer. In America women drivers cause the least number of accidents.

[Based on an article entitled "Some Road User Characteristics in the Traffic Problem," in the 'Traffic Quarterly,' January, 1950.]

EVERY year more than thirty thousand persons meet their death in traffic accidents in the U. S. A. Some of these deaths are caused by engineering failures in the modern car and the highway system. However, such failures are relatively unimportant when compared to the failure of the men behind the wheel. Drivers in the U. S. A. include children of ten and eleven years as well as old persons of seventy or eighty. Altogether, more than 50 million drivers use U. S. A. highways every year.

The accident statistics show that the procedures now used eliminate only a few of the potential hazardous drivers. We must know more about the nature of the average driver. Some driver characteristics are discussed here.

Age Characteristic

Studies show that 10 per cent of the drivers are 19 years of age and under and about 6 per cent are in the age group of 60 and over. About 55 per cent fall in the age group of 20 - 39 years and 29 per cent in the group 40 - 59 years.

The young and inexperienced drivers have more than their share of accidents. The following table gives mileage driven per fatal accident by drivers of various ages in U. S. A.

Age Group	Millions of miles driven per fatal accident	Age Group	Millions of miles driven per fatal accident
16	2.3	24	12.7
17	3.5	25-29	12.2
18	5.0	30-34	15.7
19	4.7	35-39	16.8
20	5.2	40-44	18.6
21	6.4	45-49	21.9
22	7.6	50-59	19.7
23	9.7	60-69	12.1

From the above table a 16-year old driver would appear to be the most dangerous to third parties and one between 45-49 the safest.

There is naturally a correlation between experience and age, since most people learn to drive while they are young. Most limitations on drivers are based on age, while it may be that experience is equally important. For an unrestricted driver's licence it may be essential to insist on an experience limit in addition to an age limit.

Sex Characteristics

Women drive slightly slower than men, indicating a greater caution on their part. According to accident facts, women drivers constituted 6 per cent of all drivers involved in fatal accident and 90 per cent of the drivers involved in no fatal accident, though 13 per cent of the driving done on U. S. A. highways is done by women drivers.

Knowledge of Traffic Regulations

Drivers differ also in their knowledge of traffic regulations. In one study of 1,147 drivers, selected at random, it appeared that the best scores were made by persons 25-30 years of age. On the whole, however, the scores were only slightly lower for other age groups.

Attitude

One of the most important factors (and yet the most difficult to measure) in the accident record of a driver is *Attitude*.

Specially devised but simple tests confirmed the general feeling that older persons acquire a better attitude than the younger driver who has not yet learned the social consequences of his driving habits.

Vision

Since a driver receives by far the most of his information through his eyes, they are one of the most important factors in traffic safety. It is well known that visual acuity at a distance drops off with increased age, especially after the age of 40. A great many people realize this and use corrective glasses. In a check up a slightly larger percentage of women drivers than men was found to wear glasses.

Even though many drivers correct or improve their vision with glasses, the vision of an average driver on the highway decreased with age, in spite of the glasses.

Another visual factor which may be even more important than visual acuity is the ability to see at night. It is a generally accepted fact that in the U. S. A. the mileage traffic accident rate at night is about three times the daytime rate. The difficulties of night seeing are doubtless a very important factor in this high night accident rate.

Most States require a test of daytime visual acuity for a driving licence; but, unfortunately, there are no practical tests, accurate and easy to administer, for screening out the people with seriously deficient night vision.

Reaction Time

Vision and reaction time are probably considered by lay drivers as a major factor in driving ability, since the ability to avoid an accident frequently depends upon seeing it in time and stopping before a collision results. Studies made in the U. S. A., however, go to show that a person who is slow to react may fully compensate for the deficiency by driving more slowly and avoiding traffic situations which require quick reaction.

As with many other human characteristics age has an important effect on reaction time. After about 40 years of age, reaction time starts to increase. As the reaction time increases with age, the driver's experience and judgment also increase and probably more than offset the handicap of increased reaction time. Consequently, in spite of the increased reaction time older drivers have a better accident record than

younger drivers. It would be unfair to penalize a driver for a long reaction time without carefully considering all other factors.

As traffic situations become more complex and the driver's attention must be divided over a wider field, reaction time naturally lengthens. For this reason, driver training instructors and text books must emphasize, the importance of concentrating full attention on the driving problem rather than dividing attention by conversation with other passengers and viewing the passing landscape.

Reaction time is probably more important from an educational standpoint than it is as a basis of selecting drivers. Most drivers claim that they can stop on a dime and have no appreciation of the distance travelled while reacting and after the brakes are applied.

A simple device called the *brake reaction detector* has been found to be very effective in getting this point across to the average driver. This device mounts on the front bumper of the car and the driver is tested at any speed. The examiner or instructor fires the first 0.22 blank which makes a mark on the roadway and also serves as an order to the driver to make an emergency stop. As soon as the driver hits the brake, a second blank is fired making this point on the roadway. By measuring between these two chalk marks, the driver is given concrete evidence of his reaction time distance. This incontrovertible evidence is one of the most effective means of impressing on a driver the distance required for stopping at various speeds.

Physical Stamina

The modern car requires less physical exertion than the cars of two or three decades ago. However, a certain amount of physical stamina is required. After 50, the physical stamina of most drivers begins to decline.

Accident-Prone

The accident-prone driver is generally a person who has more accidents than he would normally have, according to the laws of chance, but "accident-prone" cannot be defined without studying the

records of drivers over a long period of time.

In an accident-prone driver past performance is an indication of future performance. But if a man's past accident record is due largely to chance, and he is not an accident-prone driver, there is no reason to believe that his record in the future will be any worse than that of the average driver. In such a case it would not be fair to revoke his licence.

Driver Licensing

Because of the lack of adequate research information, motor vehicle departments must rely chiefly on the judgment of experts in setting up standards for the licensing of drivers. The fact that these standards vary widely from State to State indicates that even the experts do not agree on the desirable minimum standards. Visual acuity requirements vary from 6/21 to 6/9 among the States. A person considered unfit to drive in one State may be given a licence in a neighbouring State.

In most cases drivers are given an examination only on the original application. Renewals are made by application and payment of a fee. It does not appear practical to re-examine every one of the 50 million drivers at regular intervals of time. The more logical solution, as adopted by the State of Pennsylvania, seems to be a thorough clinical examination of those drivers who have been involved in accidents or traffic violations.

Drivers of commercial vehicles are responsible for life and property to a much greater extent than private passenger car drivers. Realizing this some commercial organizations have set up portable driver clinics to examine drivers. In some instances private organizations examine commercial drivers for a fee. If these clinics are not used merely as promotional schemes and if they are operated by trained personnel imbued with the idea of rendering a real service, they should be successful and meet a real need isolating the effect of each one.

Training of Drivers

Driving is a skill like any other mechanical operation. Like any other skill it

must be developed by properly guided practice. Trial and error method may result in hazardous habit forming practice. In the past a large percentage of the drivers learned to drive by picking up information of their own, or by receiving a few pointers from a friend who had never been properly trained. The small percentage of people who have received special training is shown in the following table based on polls taken of nearly 8,600 persons:

Method of learning to drive	Per cent of total
Self taught	37.8
From a friend	28.8
From a relative	19.2
From a driving school	9.8
From an auto salesman	4.4

More and more the general public is beginning to appreciate the importance of proper training. Studies made among high school students indicate that proper training will cut accidents in half.

Training to students in high school is probably more effective than any other age group. Interest is high and the students have already developed study habits and are used to receiving formal instruction under trained teachers. Older people generally find it more difficult to take formalized training.

Private driving schools operated by the Automobile Associations and other similar private organizations fulfil a real need. Progressive owners of commercial fleets conduct their own driver training schools, as they have a personal interest in training their drivers.

Control of Drivers

Highway facilities must be built and "signed" so as to keep to a minimum the drivers conflict with other users of the highway. Education will make the driver conscious of his responsibilities. Through enforcement it must eliminate drivers incapable of driving or those who are capable but will not abide by the rules. But more research is needed to solve the complicated problem of why drivers have accidents—complicated because of the multiplicity of factors involved and the difficulty of isolating the effect of each one.

THE IRON CURTAIN ROUND MUNICIPAL COSTING

(From the "Surveyor", February 3, 1950).

UNTOUCHED by the rigours of commercial and industrial competition, many local authorities continue to function indifferent to the measurement of actual value, expressed in simple terms of goods and services, which they give for the rates they collect.

Although municipal services vary considerably in their respective capacities for measurement direct labour works are the beginning of cost accounting, but they should not be the end. A greater proportion of expenditure is thereby left untouched by methods of efficiency assessment.

Costing in the Doldrums

Where 1 per cent of the nation's working population is employed and 8½ per cent of the national income is spent, costing suffers a severe depression. The causes are chiefly that:—

(a) The purpose and functions of modern cost control in this sphere are not universally recognised or understood. Certain eminent municipal treasurers and accountants, although admitting the need for financial audits, are not yet educated to the equally urgent necessity for spotlighting leakage of efficiency. They say their respective authorities are efficient, but cannot indicate how efficient.

They publicly disavow costing in such irresponsible statements as "unit costs are the more division of any expenditure by a quantity or measurement, and have no place in municipal accounting"; "number of personnel is a more satisfactory method of controlling expenditure"; and "costing is too expensive."

No wonder that unit costs are insufficiently applied by finance departments, or that standard and uniform costing are the pious hopes of a few.

(b) Costing systems still waver uncertainly between centralisation and decentralisation, and between mechanisation and the pen, while departmental heads fight for their respective retention or transfer.

Centralised machines may alternatively speed the results, or delay them through machine bottlenecks at peak periods, while prepared under technical supervision, what they gain through greater use of unit cost methods is frequently lost by lack of central finance control.

Present trends appear to be towards centralised mechanisation of costing, although the ideal system may come through the combination of this development with certain decentralised liaison officers having both costing qualifications and technical knowledge. The latter would interpret to engineers and architects the machine-prepared figures, and calculate unit costs while having close knowledge of the actual jobs, processes, production methods, or maintenance of services in hand. They may also have experience of the application of time and motion study and rate-fixing. Extremely close collaboration with the centralised costing staff would be essential.

(c) It is regrettably true that the qualification of Cost and Works Accountant (F. C. W. A. and A. C. W. A.) does not, in municipal service, return to its holders a similar reward or recognition to that of the orthodox financial municipal accountant. The examinations, the subjects of which deal mostly with correct allocation of expenditure and measurement of efficiency of output, are frequently summarily dismissed by certain municipal accountants as unsuitable for local government appointments in finance sections, sometimes even when the duties comprise costing.

(d) Local government finance is, by tradition, reactionary to change and suspicious of "commercialisation."

Definition of Costing

Cost accounting may be defined as an efficient method of recording the cost of man-hours and materials expended in such a way that it can easily be compared with a standard form of measurement of output achieved or of the extent of the services rendered thereby. It follows therefore that merely listing

expenditure, even in certain forms used today and described as "financial accounting," is ineffective accounting. If expenditure is finely allocated, and units of work produced are accurately measured, then the resulting costs per unit should be "standard yardsticks" of, or reasonable guides to efficiency.

Such most commonly known examples are:

Per yard super, or lineal, of carriageway or footway maintained, or per ton of material used, according to nature of work, type of material, and extent of repair.

Per ton of refuse collected or disposed of, classified by method, subject to special circumstances.

Per house painted, according to type.

Per million gallons of sewage treated to certain specifications under varying conditions.

Highways and sewerage reconstruction, etc., particularly where standardisation of headings of bills of quantities has been introduced, are most suitable for treatment by standard cost methods.

Unfortunately, use of the above, or similar, elementary examples of unit costing is far from universal, while research and development of others more complex (e. g., direct labour housing construction cost units) is left to a few progressive authorities.

Correct Yardsticks

Abstracts of accounts, more or less standard in form, are considered satisfactory if, duly balanced and audited, they prove that income has been fully accounted for, that no odd coppers lay undetected under the rate counter, and that all this has been spent in strict accordance with the approved rate estimates for the year. All is well, therefore, if no deficit remains to swell the next year's rate. Still more laudable is a slight under-expenditure of these estimates. But let us inquire whether or not suitable detailed programmes of works, priced with reasonable accuracy,

formed their basis: whether such "pricing" was economic, and comparative, to the work of similar authorities under similar circumstances. Then yardsticks of output cost are required which are more accurate than "numbers of personnel" or "a slightly higher figure than last year as wages and materials, etc., have risen." Unfortunately, they are also required more detailed in nature and broader in scope than those available at present, or likely to be available in the near future with the present lack of facilities for national research.

For example, surface dressing of highways may appear to be slightly underestimated in the abstract of accounts, should the abstract indicate annual estimates, but perhaps the engineer is aware that lack of prompt unit costs, coupled with rough estimating, caused premature cessation of work, in order to prevent over-expenditure and his consequent censure by the committee concerned.

Reasonably accurate unit costs are, therefore, essential, where applicable, in the preparation of future programmes of works which are the basis of estimates, particularly for departments maintaining highways and sewers, sewage works, cleansing and haulage services housing, and to a lesser extent, parks, open spaces and allotments. With improved facilities for development their use could be extended to expenditure on education, trading services, social welfare, etc., and other committees.

Estimates which are the basis of the rate levied may bring subsequent financial confusion through inaccuracy, finally causing mad readjustment of "probable actual expenditure" towards the end of the financial year, particularly if earlier departmental "adjustments of allocations of expenditure" has been successfully foiled by the treasurer.

Penny Wise.....

Even where it is considered that unit costs are not sufficiently applicable, the principles of cost accounting may bring order into the form and classification of both estimate and expenditure headings. Frequently are observed global sums of

many thousands covering one composite expense heading, which is probably the greater proportion of the cost of a respective service of the Council, e.g., "maintenance of sewage works, £5,000," which includes wages, materials, haulage, etc., for all processes. In absurd comparison small items of telephones, repairs to distributor arms, etc., are often shown separately.

Although £4,989 only out of the above £5,000 may be spent during the year, and considered satisfactory, yet how does the council know that £3,999 or even £2,999 may not be a more accurate and economic figure for the actual work carried out.

Commercial and Municipal Accounting

The need for the assimilation of commercial practices by local authorities is realised when direct labour costs and estimates are compared with those of outside contractors for tenders for the same jobs. The private contractor has to recover all his costs, but the engineer or architect may have included in his tender some, or all, of the following items of expense: Supervision, holiday and sick pay, wet time, national insurance, hire of right plant, and tools, central administrative expense, stores expense, central depot charges, etc. Overhead expense may have been charged at a flat rate on prime cost, or by a direct labour hour rate.

Greater standardisation of procedure must occur, in order to prepare reasonably accurate standards of a more uniform type.

Local government may indignantly repudiate charges of extravagant spending, but it must of necessity more universally adopt and extend modern cost accounting principles and methods, in order to either prove its case or reveal and remedy its leakages. Already the first warnings may be heard and read from political utterances and in newspapers and journals. Furthermore, many councils are fighting to retain and administer services in the face of constantly increasing costs without making corresponding increases in rate demands. This renders still more urgent the need for financial yardsticks of efficiency more reliable than the mere comparison of total figures of expenditure and income against estimates, which is the frequent monthly or yearly practice of ordinary financial accountancy.

Lost Accountants

Let us ensure that wages and salaries paid and materials purchased, etc., are used to the maximum advantage of the ratepayers, and perhaps the "Institute of Lost Accountants" in the municipal world will truly become the "Institute of Cost Accountants" during this bloodless revolution.

HOT

The Yankees are noted for telling tall stories and for exaggerating. A Yankee soldier who had spent a hot weather in Delhi told his chums "way back" home, when he got there, that it was so hot, nobody could do any work.

"See" he said "I saw a dog chasing a cat but it was so hot, both were walking."

PHOTOGRAPHY IN ENGINEERING AND RESEARCH

(Abstracted from 'Machinery Lloyd,' No. 21--1947)

THE camera and the photographic plate, besides being common-place things of every-day life, are amongst the most marvellous pieces of scientific apparatus. Photography aids us in obtaining records of objects within a second and even in natural colours too. It is now possible to photograph stars invisible to the eye even when aided by powerful telescopes. Among the engineering uses of photography the simplest and most widely used applications is the production of exact prints in blue, brown or black on paper, cloth or even tracing cloth.

Photographic records

Photography aids in economising storage space by providing records of drawings and documents on micro-films, which could be enlarged as and when required. These records could also form the basis of a number of techniques for business efficiency, speeding communications, and facilitating access to information of different kinds.

Transfer Sensitising

A recent use has been the perfection of phototemplate technique by which a photographic and correct duplication of the master drawing may be made direct on to sheets of metal sensitised with photographic emulsion. This avoids all "making art" and ensures that the parts can be exactly duplicated. This process enables fabrication in different factories of completely interchangeable parts.

Research Problems

In many research problems in engineering it is necessary to record simultaneous readings from a number of indicating instruments. This is conveniently carried out by taking photographs at desired intervals of a group of instruments.

Motion Study

The simplest application of photography towards 'motion study' is that of recording the movements of operators when

engaged in some particular piece of work. A small pea lamp is attached to an operator's wrist and the movements of his hand are recorded as lines of light on a photographic plate, when the general room lighting is somewhat subdued and the camera shutter is left open. By this means the motion of the hand of a skilled worker can be compared with that of an unskilled worker. Thus an improved technique can be established. Generally two or four volt lamps are used, operated from a dry battery.

A simple and extremely valuable addition is the use of a clock interruptor which can be arranged to give a definite number of light flashes per second, so that instead of continuous lines appearing on photographic plate, a series of dots is obtained. By this contrivance, the time, in fractions of a second, to complete any operation can be accurately ascertained.

Stereoscopic Photographs

By means of a stereoscopic camera photographs are taken from which a stereoscopic views can show the components in their true relationship to one another. In a more modern system which avoids the use of stereoscopic print, we take prints on 'Vectograph' films which are polarised and superimposed one on the other. A single print is then viewed by the aid of polarised spectacles.

Photoelastic Analysis

A scale model is made of the object to be tested using a suitable transparent material. Loads, proportional to those acting on the real object, are applied to the model. This model is viewed in a suitable polariscope, when a pattern of light and dark bands is seen. The bands can be recorded photographically. The stress condition at any point can be defined by a study of these bands. Very close bands denote a steep stress gradient. Such stress distribution will be the same regardless of the material of which the model is made provided that only elastic

stresses are considered and the material of the real object is homogeneous.

X-Radiography

Radiography has afforded the most satisfactory and reliable method of examining any internal defects in the structures of castings, alloys, welds, and even of plastic assemblies of telephone hand sets and fountain pens.

Gamma Radiography

The radiation emitted by a small quantity of radium, about 30 mg. enclosed in a lead sphere provided with a controlled window are used to detect flaws in objects too thick or inaccessible to X-rays. By suitable modifications photographic recording of diffraction of X-ray beams by crystalline structure

in metals and even on fibrous materials has made possible the investigation of structure of outermost layers of atoms. This is connected with problems on lubrication, corrosion, etc.

Television

It is now possible to take photographs on to a cinematograph film and take the resultant picture on to a cinema screen in ten seconds. To synchronise sound all that is necessary is to retard it by ten seconds.

Spectroscopy

When the light emitted by a minute quantity of a substance heated in a electric arc is passed through a spectroscope, it reappears in a spectrum. Thorough examination of such spectra aids us in analysing substances very accurately.

Quiz Corner

PETROL QUIZ

DO YOU KNOW?

- The total petroleum production in the world is
(a) 100×10^9 gallons (b) 30×10^9 gallons
(c) 600×10^9 gallons.
- The production of petrol in India is
(a) 15×10^6 gallons (b) 30×10^6 gallons
(c) 60×10^6 gallons.
- The per capita (rationed) consumption of petrol per year in India is
(a) 3 gallons (b) 1 gallon (c) $\frac{1}{2}$ gallon
- The per capita consumption of petrol per year in the U. S. A. is
(a) 6 gallons (b) 30 gallons (c) 150 gallons

Answers:

(a) 1 : (b) 2 : (c) 3 : (c) 4

NINE GUIDEPOSTS TO BETTER HIGHWAYS

Policies of the National Highway Users Conference, Washington D. C.

1. Each state should have for its guidance a sound long-range highway programme—the product of an official highway study committee created and implemented by legislative action.

2. Such Committee should be composed of duly designated members of the Legislature and should include, from the beginning, organized highway user representation both rural and urban and such other official and public elements as may be directly concerned in developing a long-range plan covering state, county and local roads and streets.

3. The long-Range highway programmes should be based on a sound and realistic approach, balancing actual and reasonably anticipated need with ability and willingness of the tax payer to pay the cost. In the evaluation of needs the Committee should consider reasonable standards rather than desired ideals and all plans for improvements should be in accordance with sound engineering and fiscal practices.

4. The study should review the existing classification of road systems to insure that all roads are properly grouped in accordance with the traffic and benefits rendered. The administrative responsibility for the several systems should correspond with these classifications. The agencies charged with this responsibility should be so organized as to operate with maximum efficiency and economy.

5. The study should analyse existing highway administrative and financial practices and recommend remedial action where necessary. Such action should provide for the elimination of any financial abuses, such as diversion of highway funds to other purposes, and dispersion of such funds.

6. The Committee should determine the

equitable allocation of costs of such long range programme among highway users and other beneficiaries. It should also ascertain the number of years that will be required to carry forward such a programme to completion on the basis of estimated total net available resources and revenues at existing rates of taxation. Correction of existing abuses, whether administrative or financial, is a fundamental pre-requisite to any sound programme.

7. It is, of course, physically impossible to satisfy all road needs simultaneously. In order to assure orderly development of the highway system in accordance with needs, a priority schedule should be established. This scheduling of improvements should be set up for the life of the programme but should be subject to re-examination at reasonable intervals in order to keep abreast with changing needs and conditions. Timing of the programme should consider the current availability of materials, equipment and personnel so as not to contribute to an inflationary spiraling of prices.

8. The Committee should afford opportunity for presentation of views by the public at convenient places. Any reports of the Committee contemplating legislative action should be made public at least ninety days prior to submission to the Legislature. The supporting detailed data, including the designation and description of planned road improvement, should be published at the same time and made readily available to the public.

9. It is recommended that Highway Study Committee should devote more attention to the study of highway needs as they relate to trends in motor vehicle sizes and weights and should give more consideration to the full utilization of our existing highways.

HERE AND THERE

1. SEE, WHAT THEY CAN DO IN OTHER PLACES!

WE publish here a photograph of the 540 ft high Ross dam built near Seattle U. S. A. Cost 28 million dollars.

The dam, whose construction began in 1937, had an exceptional safety record.

Even without its own power plant the dam will repay its cost in six years, by helping downstream power plants.

"No other dam can compare with this one for freedom from cracks, dryness, and an estimated strength of 8000 lb. per sq. in.," that is the proud boast of the resident engineer.

Engineers in this country think a strength of 3000 lb per sq. in. good enough for cement concrete.

(See also page 18)



[ENR. 15-9-49.]

2. THE SCIENCE OF TRAFFIC ENGINEERING

IN the United States of America "Traffic Engineering"—the study of traffic flow, congestion, driver habit and the causes of accidents—has for some time been regarded as a science in itself, quite apart from highway engineering which is concerned only with the road bed, and automotive engineering, which is concerned only with the vehicle. Those who study and apply the science of traffic engineering are described as traffic engineers. Roughly 70 per cent of the States and 55 per cent of cities, of which the population is over 50,000, have traffic engineers on the establishment of their highway departments.

In few countries, other than the U. S. A., is the movement on the road studied as a science in this way and it may, therefore, be of interest to examine briefly the reasons why the U. S. A. established traffic engineering as a science and profession.

Contemporary highway builders in the U. S. A. are the offspring of railway engineers whose primary object was to lay out the road bed. Indeed the attitude of many was "we provide a smooth surface and a straight road. If the automobile

drivers are foolish enough to kill each other it is their own concern and no fault of the road designer". This, together with great advances after the first World War in the output and speed of cars, led inevitably to congestion and a high rate of accidents. This in its turn resulted in a public outcry demanding that the movement of traffic on the road should be fully and scientifically studied. Finally Mr. Paul Hoffmann, then head of the Studebaker Corporation initiated fellowships at Harvard University for the training of engineers in this new profession. (His reason for this action was that congestion and traffic casualties in New York had had a detrimental effect on the demand for cars in that City).

Traffic engineers were trained at Harvard until 1938. The Bureau of Highway Traffic was established at Yale University at this time and now looks after post graduate training in Traffic Engineering.

* * *

(Extracted from 'The International Road Federation Limited, Bulletin No. 21—1st Dec. 1949)

3. LIGHTWEIGHT SLABS FOR BRIDGES

THE insertion of fibre tubes in reinforced concrete slabs forming the decks of bridges has been carried out by the Department of Public Works, Philadelphia, and the consequent reduction of the dead load has enabled spans to be increased by 40 per cent. The tubes, which are placed in the slab between the tensile reinforcement and the neutral axis, have an external diameter of 5-5/16 in. and a thickness of 5/32 in. They are made of seven plies of jute fibre stock wrapped with asphalt-impregnated paper fixed with waterproof glue. A coat of paraffin wax is applied by dipping. The tubes are made in lengths of 10 ft.,

successive lengths being fastened together by rubber tape. Wooden plugs are used to close the open ends

The tubes are reported to be strong enough to carry a load of 21 lb. per linear inch or to support a man standing on one foot. In one instance the tubes were inserted at 8 1/2-in. centres in a doubly-reinforced concrete slab about 11 in. thick, the distance from the bottom of the tube being 2 1/8 in.

(Extracted from "Concrete and Constructional Engineering" September, 1947).

4. ROADS ARE BEING MADE WATERPROOF

MANY types of synthetic resins—particularly the melamine groups are coming to the fore both in the manufacture of plastics, and the processing of textile fabrics for crease-resistance and anti-shrinkage. They also have another use to make roads "waterproof". They are, of course, largely used in those sections of the textile processing trades where proofing against moisture penetration in fabrics is desirable, but their application to other substances, such as soils, is a striking innovation. It comes from experiments which were undertaken in the U. S. during the war period. It was noticed that miles and miles of roads, on which heavy trucks would travel during the winter months, turned to seas of mud after torrential rain, and remained in that condition until the sun's rays turned them into dust-covered highways. Most of the roads were too far off the beaten track to allow them to be paved or treated with creosoted layers, yet something had to be done. It was Dr. Winterkorn, a soil expert, who emigrated from Heidelberg to U. S. A. in 1931, who accepted the challenge. He got on to the right track, strange to say, through an unrelated problem that arose in Florida. Citrus trees in certain districts were dying; apparently the particular soil in which they had been planted would not absorb water. Dr. Winterkorn deduced that the soil must contain some kind of a "water-

proofing" agent. He followed up the clue, tested scores of materials, and found that a number of resinous powders would waterproof surface soil when mixed with it in a ratio as low as 1 to 200. He sat to work on his thesis. In collaboration with a chemical manufacturing firm he developed a resin from pine stumps. A mixture of this resin and Portland cement was evolved. Applied in disc form and rolled into the ground to a depth of a few inches, it was found that the surface was impervious to rain, or snow penetration. Thousands of miles of "dirt" roads have since been treated, and reports prove that they have remained dry through seasons of torrential rains and are likely to do so for some years hence.

But, it is pointed out by the inventor, it would be a mistake to assume that anyone can sprinkle any road with this "magic powder" and end the mud nuisance for all time. On the contrary, to effect satisfactory and permanent results soils must be analysed, and experts must apply the correct type of resin stabilizer. This is all the more necessary when it is borne in mind that the acid and alkaline soils react differently. No known resin will water proof sand, nor will it stand up under heavy traffic.

(Extracted from "Science News", Vol. 5.)

5. OVER 1,000 MILES OF NEW ROADS TO BE LAID IN MADHYA BHARAT

MADHYA BHARAT will soon have about 1,120 miles of new roads in the undeveloped portions of the Union according to the programme of the Public Works Department of the State Government. The present total length of metalled roads in Madhyabharat is 3,770 miles. The cost of laying these roads will be Rs 30 lakhs.

While the cost of road maintenance generally depends upon the kind of traffic, the intensity of traffic and the nature of road surface, the average expenditure per mile of road maintained by the P. W. Departments of other states is about Rs 2,730 as against Rs 800 in Madhya Bharat.

('The Hindustan Times' 30-11-49).

6. 7000 MARK PASSED IN ASSOCIATION MEMBERSHIP

RECENT acceptance of 129 applicants has brought the membership of the Association of Professional Engineers of Ontario to 1044, a growth of over 2½ times during the past 10 years. The meeting of the Association's Council dealt with 191 applications, the civil branch heading the list with 61, electrical 51, mechanical 51, chemical and metallurgical 15, mining 10.

Of the 62 not immediately accepted, 36 will be asked to pass either partial or complete examinations.

(Extracted from 'Roads and Bridges'—September 1949).

[Do our Members know how much the I. R. C. membership has grown during the past 10 years?Ed.]

7. WAGE RATES ON U. S. FEDERAL PROJECTS

[Administrators are no better paid than skilled labourers—How different this is from India.....Ed.]

REPORT of the average hourly wage rates on federal-aid highway projects for the third quarter of 1949 has been issued by the U. S. Bureau of Public Roads.

Wages for skilled labour average 1.84 dollar for the whole country, ranging from 1.51 dollar in the westerly south central area to 2.54 dollars in the Pacific area.

Wages for immediate grade workers average 1.45 dollar for the whole of the United States, varying from 1.00 dollar

westerly south central to 2.30 dollars Pacific.

For unskilled labour the national average was 1.46 dollar, ranging from 79 cents easterly south central to 1.65 dollar Pacific.

Administrative, supervisory and executive worker's wages showed a national average 1.84 dollar, ranging from 1.51 dollar westerly south central to 2.54 dollars Pacific.

(Extracted from 'Roads and Bridges'—September, 1949).

8. THE SHORT—BORED PILE

A tip for black cotton soil areas

A large part of south-eastern England is covered by a firm, shrinkable clay. This clay has adequate load-bearing strength but it dries and shrinks in summer and swells in winter. In such ground shallow foundations for a building are dangerous, for the clay shrinks away from the footings during the warm, dry weather, the foundations settle unevenly and the walls crack. Thousands of buildings have suffered in this way, sometimes nearly every house in a street being affected. Repair is always difficult and costly, and further damage may often occur.

An obvious way of avoiding trouble is to make the foundations at least 3 ft 6 in.

deep, for at this depth movement due to shrinkage is very slight. But deep foundations are expensive and cheaper solutions are being sought.

The Building Research Station, in collaboration with the Ministry of Works, has been examining the possibilities of short-bored piles as an alternative method of providing safe foundations. Holes are bored in the clay by hand or mechanical auger to a depth of 8 ft or more, and are filled with concrete, forming piles which may be spanned by floor slabs, or by precast or cast-in situ reinforced concrete beams. The spacing and size of piles depend on the site plan, the load to be carried, and the soil strength.

Such foundations have already been used. At two schools, one at East Barnet and one at Chigwell, the Building Research Station and the Ministry of Works have co-operated with the authorities concerned in the study of the problems

involved. The method has been shown to be practicable and capable of saving both manpower and material.

(Extracted from 'Journal of the Institution of Municipal Engineers' April 4, 1950).

9. UNIVERSAL PUBLIC SERVICE—A PROPOSAL

A drastic modification—of present methods of manning the public services is proposed by David E. Lilienthal, retiring Chairman of the Atomic Energy Commission, in his challenging book, *This I do Believe*, published by Harper & Brothers.

It seems to me (says Mr. Lilienthal) that a moral obligation to engage in the public service during a part of every qualified man's best years has become, for the generation that lies ahead, an actual necessity; that there must be an increased movement into the public service from private pursuits by exceptionally qualified people who would not in ordinary times consider public service as any part of their life's work; it is equally important that we put increased emphasis on rotation in the public service, in order to augment the flow into private responsibility of men with knowledge of government gained from actual experience

I am inclined to think that the idea of public service as a life-time career has certain severe limitations, judged by present-day public needs. Here I differ with some students of public affairs; it seems to me that the advantages of the permanent-career public service are customarily over-stated, in the light of

our own American needs, and that the disadvantages have not been sufficiently understood.

What I urge is a fluid kind of citizen-service, in which men and women move from private life into public service for a period of years, and then back to private life. Thus there will be an almost ideal situation, as I see it, in this: On their return to private life, these citizens will be experienced in first hand knowledge of public affairs and of the special difficulties that beset the public servant, we will have public servants whose judgment will be enriched by recent experience in the day-to-day problems of private affairs.

Such a plan has a number of advantages to the country. The proposal also has in it an element of common fairness, for the grim and wearing tasks that so often are the lot of the responsible public servant should not be exacted of one man for an indefinite period, but should be deliberately rotated.

(Extracted from 'The American City' December 1949.)

[A good idea no doubt but how to put it into practice? There would unfortunately be a tendency on the part of those in public service to stick to their jobs.....Ed.]

10. THE STRENGTH OF CONCRETE

THE specification required the strength of concrete test cylinders to be 9000 lb. per square inch (equivalent to about 7500 lb. per square inch in cube tests). Hundreds of test cylinders were made of the concrete as used in the slabs, and these showed an average strength equivalent to cube strengths of more than 10,000 lb. per square inch, many of the

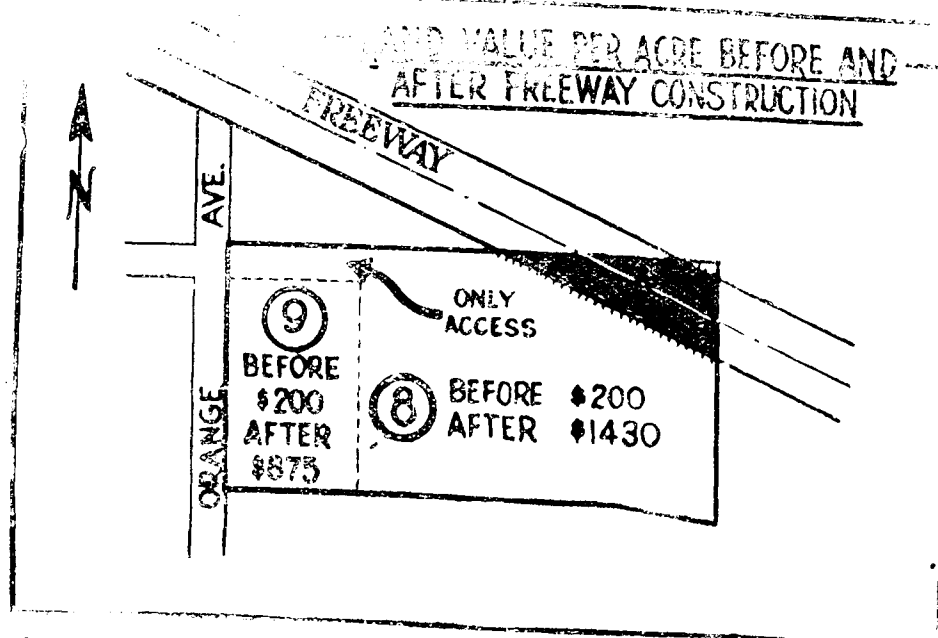
cylinders having strengths equal to cube strengths of more than 12,500 lb. per square inch and the highest recorded being equal to a cube strength of about 15,000 lb. per square inch.

[Also see page 14]

(Extracted from "Concrete and Constructional Engineering" August, 1949.)

11. BETTERMENT EFFECT OF HIGHWAY DEVELOPMENT

PRIOR to acquisition this was a rectangular parcel of unimproved land containing approximately 20 acres. Proposed construction plans necessitated acquisition of a 180-foot strip off the northeast corner. The State's acquisition was com-



pleted in June, 1944, at an indicated value of 200 dollars per acre. Subsequent to the opening of the freeway the easterly 12.9 acres of the remaining property having its only access by way of an easement to Orange Avenue which, in turn, connects

with the freeway, sold for a price of 1,430 dollars per acre.

(Extracted from 'California Highways and Public Works' Nov.-December, 1949).

SAFE DRIVING

Asked to give a 15-minute radio talk on safe driving, an American taxi-driver who had driven a million miles without an accident, announced: "It won't take me any 15 minutes to tell how to avoid accidents. It's simple—just drive on the theory every other guy in the world is crazy."

* * * * *

A: What does 'L' on a car denote?

B: In Delhi it denotes 'Lethal' or 'Lady driver', I just forget which.

FUNDAMENTAL HIGHWAY POLICIES

[Suggestions of the National Highway Users Corporation, Inc., Washington]

A—General

1. Highways should be constructed or improved in accordance with sound interstate and primary highway plans and in accordance with the benefits received by all classes of highway users, proper balance being given between main trunk highways (interstate and primary) and other highways.

2. Highway taxes in general and motor vehicle use taxes especially should be distributed equitably on the basis of highway transportation needs so as to give maximum benefits in highway transport to all classes of beneficiaries.

3. Highway construction work should be carried out by private contract after the receipt of competitive bids and award made to the lowest responsible bidder.

4. The investment in necessary highways must be preserved. The highways must be safeguarded from deterioration by systematic and adequate maintenance and preserved against obsolescence through improvements and additions scientifically and rationally planned in advance.

5. In planning the highway programme, in addition to new highway construction, provision should be made for modernization of existing interstate and primary highways in the interest of efficiency and safety. The planning of all such work should be based upon thorough financial, economic and engineering studies.

B—Federal

1. All control over Federal highway expenditures and related matters should be centered in the Public Roads Administration of the Federal Works Agency.

2. Improvement of highways lying within or providing access to areas held or owned by the United States Government is a responsibility which rests with Congress and should be met from Federal funds.

3. The Federal Government should not make direct Federal grants to the states

for the construction of highways other than those included in Section VII-B-2, above, or repair of widespread flood damage, and should continue the sound policy of Federal aid, with the states required to match this aid with appropriate amounts.

4. All highway development undertaken by the states with the aid of the Federal Government should be subject to the standards contemplated in the Federal Aid Highway Act.

5. The Federal Government should not collect motor vehicle use taxes or special excise taxes on motor vehicles, tires, accessories, or motor fuel, since the government's obligation to carry mail and provide for the national defense makes Federal highway aid a proper charge against general revenue.

C—State

1. The state should construct all interstate and primary state highways either directly or in co-operation with the Federal Government; should maintain all such highways; and should exercise supervisory control over the construction and maintenance of all secondary highways. Arterial city routes financed in whole or in part from Federal or state taxes should be constructed and maintained under the control of the government agencies appropriating the funds.

2. The county (or comparable political sub-division of the state) should be the smallest highway administrative unit and should levy, collect and expend such taxes, other than motor vehicle use taxes, as may be required for county and local highway expenditures, including the county's share of the cost of secondary highways. The county should construct and maintain all rural roads not built and maintained by the state.

3. Administrative responsibility for city streets other than arterial city routes, reposes in the city government.

4. All motor vehicle use taxes and other road funds collected by the state

should be expanded by or under the direction of the state highway department.

D—Administrative and Engineering

All public highway affairs should be administered in accordance with sound business and engineering principles. To this end there is need for emphasis on the following:

1. *Continuity of Policy.* Efficient forms of highway administration should be maintained to insure continuity of policy and attract to public highway service the best available administrative and engineering talent.

2. *Uniform System of Accounts.* A uniform system of highway accounting, when,

as and if recommended as a policy by the American Association of State Highway Officials, should be adopted by the states and political subdivisions thereof, and it is recommended that Federal aid be withheld from those states which did not use such uniform accounting systems.

3. *Safety and Economy.* Sound economic and engineering policies, conceived to effect all progressive and consistent economies, to meet present needs, and to anticipate the demands of the future for safe and economical highway transport should govern in major planning and in the determination of highway types, locations, width, alignment, grades, separation of opposing lines of traffic, acquisition of rights-of-way, control of access where needed, and similar considerations.

MATHEMATICAL SECTION

We published two problems in our May issue to which we have not received any solutions so far. We give two more problems here.

New Problems

1. A goat is tethered at a point on the circumference of a circular field. What must be the length of the

tether to permit the goat to graze over one half of the field and no more.

2. One engine can pull a heavy train at 15 m.p.h. and another can pull it at 25 m.p.h.

At what speed could both engines together pull the train?

MUDDY BEGINNINGS

The U. S. Public Roads Administration was once but a small division of the Dept. of Agriculture and its slogan was "Get the farmer out of the Mud"

CORRESPONDENCE

The following article has been sent to us by a distinguished engineer. We have commented on it editorially as we think the subject discussed is of more than ordinary interest—Ed.

ARE RAILWAYS BECOMING OBSOLESCEMENT?

[N the January Number of the T. C. M. R. an article appeared under the title "Roads and Railways" which quoted a number of statistics and asked "Are Railways Becoming Obsolete?" The purpose of the following article is to show that, as far as India at least is concerned, some of the deductions previously made are incorrect and that reference to figures alone, without an intimate knowledge of the conditions giving rise to them, can be very misleading.

It is argued that as there has been a steady decline in the route mileage in the United Kingdom, the United States of America, and Canada, there should be a similar decrease in India and the writer even goes so far as to say "...we are in an advantageous position, since we have much less to discard..."

Comparison with other countries

Let us examine the position elsewhere. In Great Britain, railway development was carried out by an enormous number of small companies; reference to the lists of proprietors of these early companies shows that they consisted mainly of industrialists anxious to provide a cheap form of transport for the goods in which they were principally interested. By and large these goods were in an un-manufactured state and the railway, with its capacity for moving large volumes at low cost, rapidly superseded the canal. Incidentally, it is worth noting in passing that many of the canals, which had during the hundred years of their heyday paid steady profits to their owners, were bought out by the railways. It was at a slightly later stage that the speculation element entered into railway construction and competition to build lines which the promoters hoped would be remunerative displaced the manufacturer-owner.

It soon became clear that a small railway could not employ technicians of the standard required to ensure development, and almost at once a process of mergers and amalgamations started. This process has just been completed with the nationalisation of all railways in Britain. But with each earlier amalgamation, unprofitable lines were closed down and the more direct, convenient, or easy routes were developed. This development was not only in the direction of doubling or quadrupling single lines, but in increasing the capacity of the locomotives, improving station yards, introducing complicated and expensive methods of signalling and train controlling, and building up a highly qualified staff to make the best use of all these improvements.

A similar situation arose in America and Canada, but in all three areas, the volume of traffic handled, which is the real measure of service to the community, has shown a steady increase.

Indian Railways

In India the picture is slightly different; from the earliest days railway development has been controlled by the Government and, although there have been amalgamations of railways, there has never been any necessity for closing down lines because of two competitive routes coming under one control. Indian Railways show the same expansion in capacity to move goods and passengers as those elsewhere and, taking the figures for the years 1900 and 1946 (to avoid the difficult adjustments to allow for the taking over of a very considerable mileage by Pakistan) the number of passenger miles increased nearly seven times and the net ton-miles nearly four times.

In face of these figures, and knowing that every proposal for new construction

is not only rigorously examined by the railways before it is sponsored, but also submitted to the Provincial Boards of Communications, it is difficult to accept that railways are becoming obsolescent, or that their scope is being artificially extended.

Entry of Railways into the Field of Road Transport

The writer of the January article also takes exception to the entry of railways into the field of road transport and calls it a sheer confession of the superiority of the more flexible road transport, at any rate in short distance hauls. He conveniently forgets that the railway engineer or promoter is fundamentally no different from a road engineer. In the early days he developed a cheap form of transport with the means at his disposal; and, what road engineers have neglected for nearly a century, he persuaded either the public or the Government to provide the finance to enable him to put his schemes into execution. If he had not been able to show a reasonable return on the capital used railways would not have made the progress that they have done.

For many years progress was along the lines of bigger engines, better permanent way and works, and better operation; but, when the Internal Combustion engine was available, the railway engineer had as much right as any other transport operator to use it, and to develop it to meet the needs of the community. Why should road engineers imply that they, and they only, should be interested in road vehicles?

One of the British main line companies prior to Nationalisation operated a fleet of 12,000 motor vehicles for departmental use: in this country the Nizam's State Railway developed a transport system which included rail, road and air.

The railway promoter, with his experience in handling traffic and maintaining valuable plant should be welcomed into the road transport industry. To quote one example, the claim is made that capital investment is less on a motor vehicle than on a locomotive or wagon; but capital investment is not all the story; cost per

ton of goods moved is the real criterion and the authorities in Hyderabad, after experimenting with the so called cheap type of American truck found that it had a life of 75,000 miles as compared to a life of over 400,000 miles for a Diesel-engined and more expensive type of lorry. Unfortunately for many years to come there will be so-called transport operators with sufficient capital to buy one cheap lorry and join in the clamour for the suppression of railways.

Rail-Road Controversy

It is surely time that the Road-Rail controversy was decently buried and forgotten; energy and time spent in it could be directed to more profitable ends. The real problem is to develop transport. Francis Bacon, who has been claimed by some as the writer of "Shakespeare", said many years ago "There be three things which make a nation great and prosperous—a fertile soil, busy workshops, and easy conveyance of goods from place to place."

So far few who have written or spoken about roads or railways have given any indication that they have studied transport as a whole, as opposed to the particular branches of it; and it is a matter for regret that most proposals are on the lines of limiting or restricting rivals instead of on the line of trying to see how their task can be assisted.

Turning once again to the United Kingdom this matter has been discussed at great length during the past five years in the Institute of Transport. It is a great pity that there is not a similar Institution in this country where transport problems could be ventilated and examined. Several speakers in that body have emphasised that a negative approach or restrictions are not going to be sufficient or adequate.

Broadly there are two courses open; the first is to eliminate all regulation in both fields except in relation to wages, hours of duty, conditions of service, public safety and such like matters and leave both road or rail to attract such traffic as it could. The other course is to embark on a pro-

gramme of complete planning for both road and rail. The system of planning should preserve to the user the advantages of all forms of transport under terms which will not injure any. This is surely equitable and will provide a framework round which an adequate national economy can be built.

It is idle to argue that either the road or the rail can meet all the transport needs of the country: if railway stations were built at close enough intervals to provide the many stopping places of the average bus route the cost would be enormous and the service would be appalling. One writer has used the analogy that using a railway for short haul traffic is like employing a steam hammer to crack nuts. When a goods train is marshalled it should get a clear run for as long a distance as possible; why hold up 1,300 tons of goods every time another 10 tons has to be added to the train?

Route mileage no Criterion

If a plan of a railway is drawn and each line is made thick enough to represent the volume of traffic which it moves the result is very like a tree; the roots are in a port, like Calcutta or Bombay, or Madras, and the branches reach out. A similar conception is behind the plans for National Highways, Provincial Highways, and District and Village Roads; but is there any reason why we should have two such trees when suitable grafting offers great benefits to both?

The roads need the railways to move the petrol to keep vehicles running; the railways could derive great benefit from a road transport system which carried much of the short haul goods. It is agreed that it is not reasonable to restrict methods of doing a thing cheaper in order to maintain in existence ways of doing it dearer; the motor vehicle, being within the compass of the individual, did much to assist industry to free itself from railway monopoly. But unless the need for organising road transport is recognised now, and railways are

permitted to make such use of it as they consider desirable, there can be no real progress.

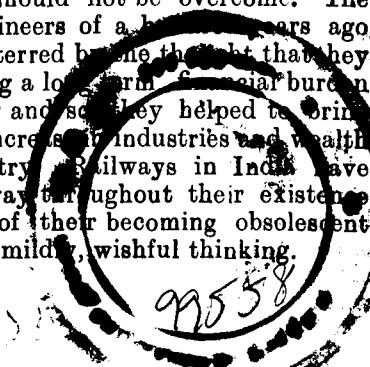
Frank Pick, of the London Passenger Transport Board, had probably more varied transport experience than most men. In 1940, on the eve of his retirement from active service, he said "In the long run function will govern, unless the Government itself intervenes to remove Government, so to speak. Function means fitness for transport measured by economy, efficiency, and convenience. All other considerations, selfish or otherwise, will be thrust aside sooner or later. Transport of whatever sort, to be healthy and prosperous, will be compelled to readjust itself to the fulfilment of its purpose and nothing else."

Road and Rail should Help One Another

Instead, therefore, of suggesting what restrictions should be placed on roads or railways to enable the other to survive, we should ask ourselves how each can help the other to improve their operational efficiency. If we do this we are more likely to get positive results.

There are many difficulties; road statistics are not so authentic as those on railways; there is a grave shortage of personnel trained in transport as opposed to those trained in road or railway construction, and there is no suitable meeting ground for the technical men engaged in these industries.

There are, however, no reasons why these difficulties should not be overcome. The railway engineers of a few years ago were not deterred by the thought that they were placing a long term financial burden on posterity and so they helped to bring about the increase of industries and wealth of the country. Railways in India have paid their way throughout their existence and to talk of their becoming obsolescent is, to put it mildly, wishful thinking.



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INFORMATION SERVICE

(i) BOMBING THE DESERT WITH SPEED

(Adapted from 'Popular Mechanics'—October 1947.)

PLANTING grass seed from planes is the latest technique in the fight against soil erosion and reclaiming barren areas. Seed is coated with clay and the clay coated pellets are dropped from whirling fan-like chutes attached to low-flying planes. Uncoated seed cannot be thrown loose in the wind.

2. The evils of soil erosion are well-known and some indication of the amount of erosion in America is given below.

More than 1,35,000 acre-feet are deposited as silt every year in Lake Mead, behind the Hoover Dam. Each square mile of eroded land contributed enough silt to cover one acre to a depth of two feet. A Reclamation Service Survey for the period 1910 to 1939 showed a loss in water storage capacity of four reservoirs on the Salt river amounting to 7,562 acre-feet each year or enough silt to form a one acre pile considerably more than a mile in height.

3. Consequent to soil erosion, the loss in investment including cattle sale and crops runs into hundreds of millions of dollars a year. The trouble has been so acute as to restrict the cattle grazing to one-third of what was 28 years back, 640 acres supporting barely no better than two to four head of cattle. Only grass can save the land and only the aeroplane can plant it fast enough to halt steady inroads of erosion.

4. After the burning of the Los Angeles watersheds some years ago, mustard seed to bind the soil was successfully planted from the air. The African "love grass" is the best seed for tough conditions and is very fine.

As fine seed would be destroyed by weather or eaten by insects or animals, it has to be protected. Several minute seeds are coated with rodent repellent adobe or clay so that they may penetrate the earth when dropped and lie dormant till rains

come. The plantings usually precede rains, but in arid locations it may be many weeks before rains come.

5. Raw, fine clay is pulverised by running it through a hammer mill. It is then blown under pressure through a metal pipe into hoppers above trough like containers. A fine spray of water is blown into the containers and a worm gear kneads the mixture to doughy consistency. Fertilizer, rodent and insect repellent, fungicides and finally the seed are added. The dough is then placed in hoppers of a machine that pours out finished pellets from twin chutes, at a rate of 48,000 a minute, or 3 tons a day, enough to cover 4,500 acres. The pellets are either one quarter or three-eighths inch in diameter.

6. The pellets are spread from an air-plane through a whirler resembling a rimless wheel, with metal chutes for spokes. Whirled by wind, the pellets are tossed by centrifugal force ensuring an even planting pattern. Flying at 500 feet, a plane would seed a 1,000 feet wide strip at the possible rate of 20,000 acres a day. Ten thousand acres require 240 tons of small pellets or 300 tons of larger pellets. Sky planting costs nearly half as much as hand planting, besides being quick and could easily reach otherwise inaccessible places.

7. Various seeds have been used and African "love grass" is particularly good where grazing cattle menace the shoots. In test plantings it has been observed that a 10-acre test field grazed two horses for a year, whereas an adjacent untreated 640 acre section carried only the usual two head of cattle. The effects of reseedling in checking erosion can be seen within a few years.

[... station by aerial sowing of seed offers great possibilities. In India the method could be used to prevent soil erosion in the catchments of rivers and arrest the steady expansion of deserts.—Ed.]

(ii) PERMANENT AND VISIBLE TYRE PRESSURE GAUGE

(Extracted from 'Machinery Lloyd'—No. 21, 1948).

ONE of the directives listed in all automobile handbooks is the checking of tyre pressures at least once every week. This advice is well founded on long experience since under inflation leads to tyre troubles giving difficult steering, sluggish

be seen that the body of the gauge is of strong construction whilst being of lightweight alloy so that the balance of the wheel is in no way affected. Carried by the body of the valve is a transparent dome of plastic material specially developed to withstand all road conditions. Inside this dome is a small balloon of almost indestructible red rubber which is capable of being inflated so that it fills the dome.

Fig. 1. "Vitex" Permanent Tyre Pressure Gauge. This picture is full size and shows the bubble inflated.



acceleration, increased tyre wear and, in the extreme case, risk of an accident.

A common method of testing tyre pressure is by kicking the tyre and taking the "feel" as a measure of the pressure. This system is entirely dependent upon the judgment of the kicker and is worse than no test at all.

The normal method involves the use of tyre gauges, shaped like a pencil, applied to the valve. Such a gauge, however, means that the dust cap must be removed from the valve, the gauge must be relatively accurately located on the valve and that the gauge must be withdrawn and read. Moreover, after air has been pumped into the tyre the gauge must be brought repeatedly into use until the tyre is finally at the correct pressure. An additional point is how easy it is to forget to replace the dust cover on to the valve after use, or to replace it loosely so that it is lost when the vehicle is started up.

The new "Vitex" Pressure Gauge shown in Fig. 1 enables the above difficulties to be overcome for a very small expenditure. One of these gauges is screwed on to the valve of each tyre in the same position as the dustcap, which it replaces. It will



Fig. 2. Shows the gauge in operation. If the balloon does not inflate when the plunger is depressed, this is an indication that the tyre is soft and needs more air.

hand, the balloon does not inflate it will be an immediate indication that the tyre pressure is low and the tyre should be blown up. Inflation can be carried out without removing the gauge, which is a distinct advantage.

It is claimed that this gauge has undergone the most exhaustive tests and has proved most successful under all conditions. Gauges can be supplied in English or Metric pressures to suit all recognised makes of cars, tractors, motor cycles, etc.

MULTUM IN PARVO

Highway transportation in the United States employs nine million workers and accounts for one seventh of the total national economy.

In the United States maintenance costs have been rising since 1933. At that time they totalled about 400 million dollars; for 1947 maintenance costs were estimated at 1,001 million dollars.

A motorway, designed for a speed of 150 km. (93 miles) an hour, is being constructed between Belgrade and Zagreb in Yugoslavia.

*(Extracted from 'I. R. F. Bulletin, No. 5'
December, 1949)*

List of Approved Works on National Highways

Serial No.	Name of work.	Amount approved.	Remarks.
I. NATIONAL HIGHWAYS.			
MADRAS.			
		Rs.	
1. 373 MD 45.	Construction of a bridge over the Palar river at mile 38/3-5 of Madras-Dindigul Road.	19,00,000/-	
2. 374 MD 5	Construction of a bridge over the Champavathi river at mile 520/3-6 of Madras-Calcutta Road.	8,47,000/-	
BOMBAY.			
3. 372 BM 8	Improving and strengthening minor bridges on miles 152-175 of the Bulsar-Navasari Road.	44,662/-	
WEST BENGAL.			
4. 370 BG 31.	Construction of a new ferry ghat together with new approaches on East and West sides of the Siltorsa river on Assam Access Road at Silbari.	1,72,900/-	
UTTAR PRADESH.			
5. 371 UP 24.	Modernisation of miles 168-169 (local miles 137-138) of the Lucknow-Bareilly Road.	71,557/-	
6. 376 UP 2	Cement concreting miles 494-495 of the Grand Trunk Road.	1,35,258/-	
ORISSA.			
7. 375 RS 5	Construction of semi-permanent fair weather roads over the Mahanadhi and Birupa rivers near Cuttack.	1,41,368/-	
II. OTHER COMMUNICATIONS.			
BILASPUR.			
1. OC/B.P. 101	Construction of a fair weather road from Ghumarwin to Hatwar.	50,000/-	Technical approval accorded subject to the condition that the amount of the estimate viz., Rs. 61,100/- is reduced to Rs. 50,000.

List of Books added to the Roads Organisation Library during May 1950

1. **The Mechanisation of Municipal and Highway Engineering Works and its Economics.** Seventh Public Health Congress and Municipal Engineering Exhibition. (The P.H. & M.E. Congress Organising Council, London, 1948).
2. **Report of the Joint Committee on Location of Underground Services,** (The Institution of Civil Engineers, London 1946).
3. **House Foundations on Shrinkable Clays.**—Buildings Research Station Digest No. 3 (Feb. 1949). (His Majesty's Stationery Office, London, Reprinted Jan. 1950).
4. **Present Situation and plans for the Development of Roads in India** — appearing as an article in Transport and Communications Vol. 11 No. 4 Oct. — Dec 1949) (Transport and Communications Division, Deptt. of Economic Affairs, United Nations, Lake Success.
5. **Basic Road Statistics—1949** (British Road Federation, London) 1949 3 copies.
6. **Memorandum on the Post-War Development of Transport in Ceylon by the Director of Transport.** (Supdt. Government Press, Colombo, Ceylon, 1944.)
7. **Motor Guide to the Central Provinces and Berar with Sectional and Town Maps.** (Supdt. Government Printing, C. P. Nagpur, 1931).
8. **The Taxation of Motor Vehicles in 1932** by the Bureau of Public Roads. Supdt. of Documents Washington, (USA).
9. **Fluid Pressure Mechnics.** by H. G. Gonway. (Sir Issac Pitman and Sons, Ltd., London, 1949).
10. **Development of Fluidity and Mobility Meters for concrete Consistency Tests.** by Anders G. Erikson (Swedish Cement and Concrete Research Institute, Stockholm, 1949).
11. **Reinforced concrete.** by A. L. L. Baker (Concrete Publications, Ltd., London 1949).
12. **The use in Germany of Water Proofing and other Additions to Mortar and Concrete (Cyclostyled)** B. I. O. S. Final Report No. 1663. Item 22 (H. M Stationery Office, London, 1947).
13. **Structural Analysis by moment Distribution.** by S. Buttersworth. (Longmans Green and Co., London, 1949).
14. **Strength of Materials** by Davis Brunel Low. (Longmans Green and Co., London, 1949).
15. **The Elementary Theory of Stressed—Skin Construction,** by W. S. Hemp (Aircraft Engineering, London, 1949).
16. **International Railway Statistics 1947.** (The General Secretariat of the U.I.C. 10 Rue De Prony, Paris)
17. **The Principles of Scientific Research** by Paul Freedman. (Macdonald and Co., Publishers, Ltd, London, 1948)
18. **Social Surveys** by D. Caredog Jones. (Hutchinson's University Library, London)
19. **Central Public Works Department Code.** First Edition (Second Reprint) embodying all corrections issued to end of March 1949. (Manager of Publications, Delhi). 2 copies
20. **A Statistical Atlas of the Madras Province Revised & brought up to**

the end of 1940-41 (Economic Adviser to the Govt. of Madras).

Publications of the Central Water-power, Irrigation and Navigation Research Station Poona:

21. **Note on the Theory, Design and Construction of Gibb. Models** which, without moving parts give a constant discharge within working limits irrespective of variations in up stream and down stream water levels—Research Publication No. 3 by C. C. Inglis & D. V. Joglekar.

22. **Annual Report (Technical) of Work Done during the year 1942-43 and index for 1938-42.** Research Publication No. 13. by C. C. Inglis and D. V. Joglekar.

23. **The Behaviour and Control of Rivers and Canals with the aid of Models Part I.** Research Publication No. 13. by C. C. Inglis and D. V. Joglekar.

24. **The Behaviour and Control of Rivers and Canals (with aid of Models) Part II.** Research Publication No. 13. by C. C. Inglis and D. V. Joglekar.

IDEAS

A man who was looking at a big excavator machine at work said.

"Think of the hundreds of men with picks and shovels that that machine is taking away employment from".

His friend answered, "Think of the thousands of men using spoons and forks for digging that could have been employed on that job."

INEXORABLE

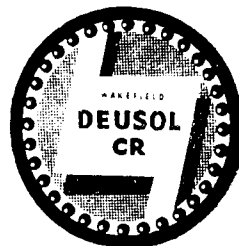
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[Form a Peruvian Report.]



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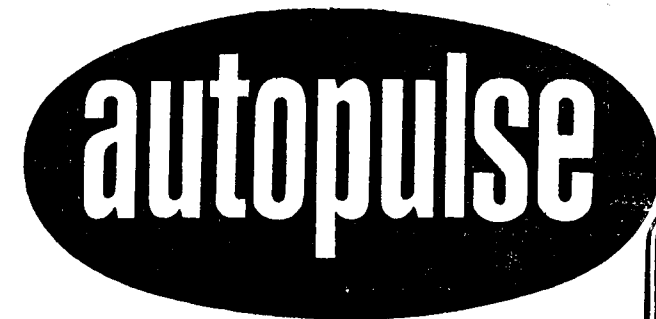
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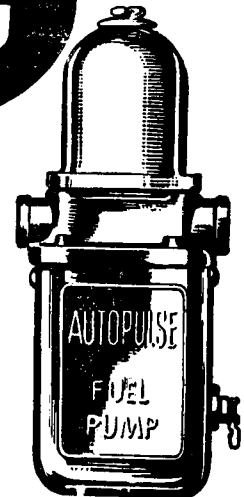
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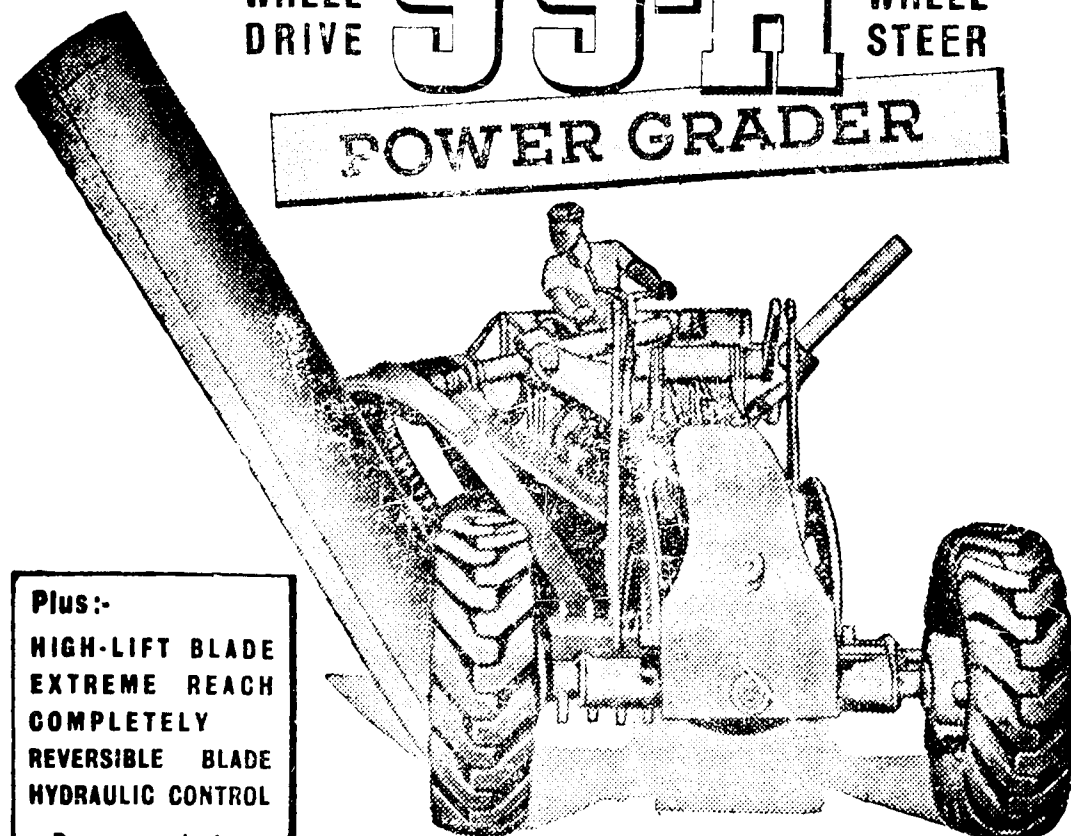
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