

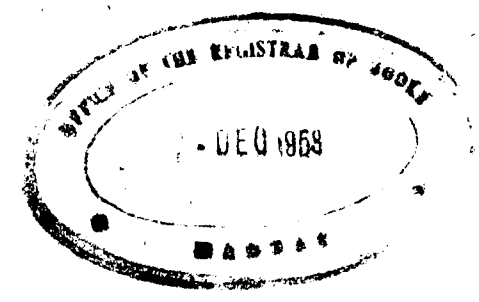
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TRANSPORT- COMMUNICATIONS

MONTHLY REVIEW

NOVEMBER 1953 — No. 79



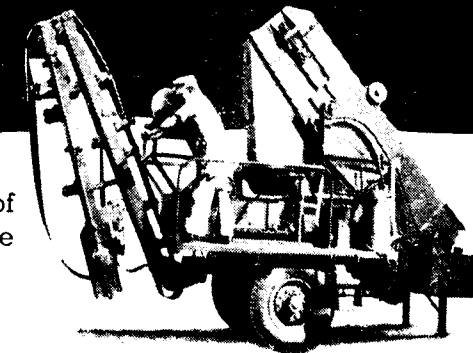
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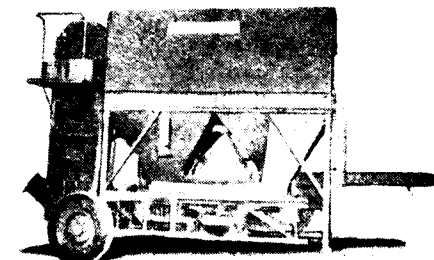
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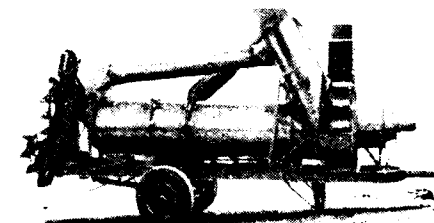
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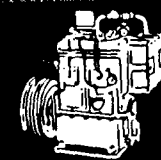
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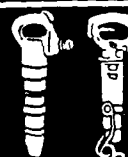
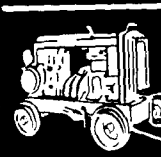
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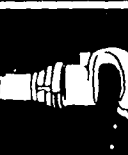
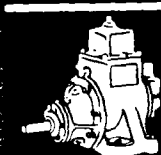
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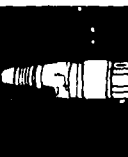
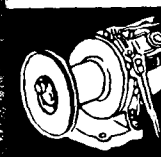
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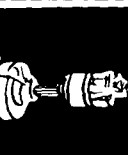
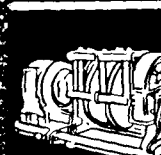
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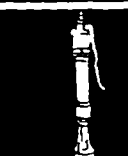
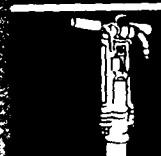
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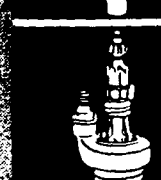
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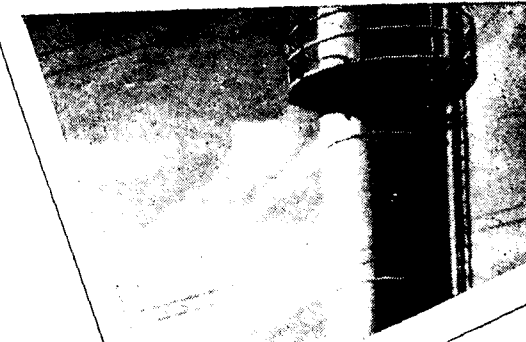
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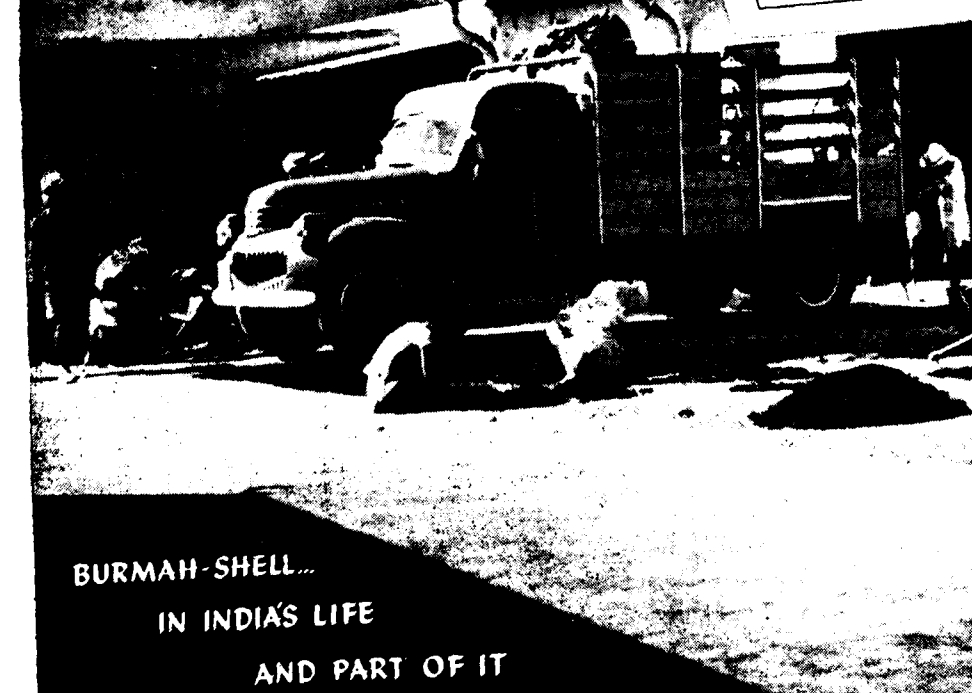
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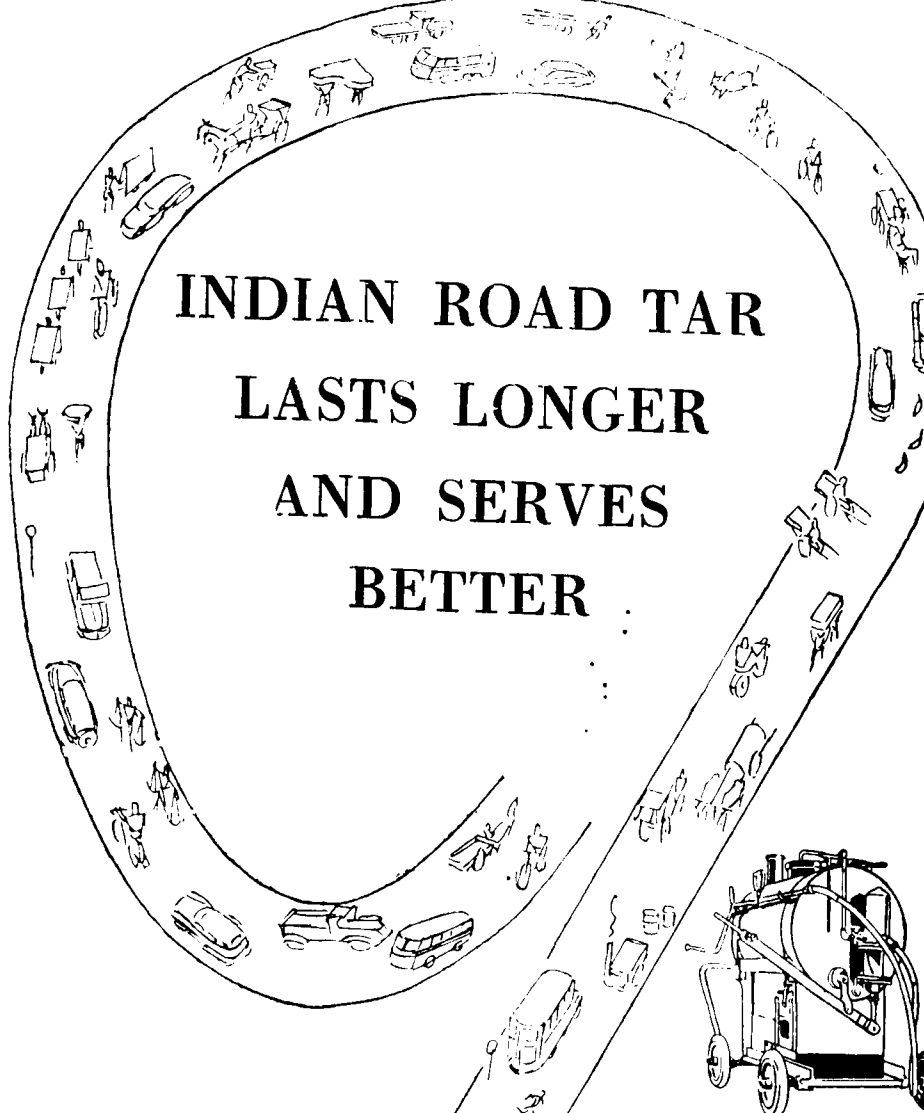
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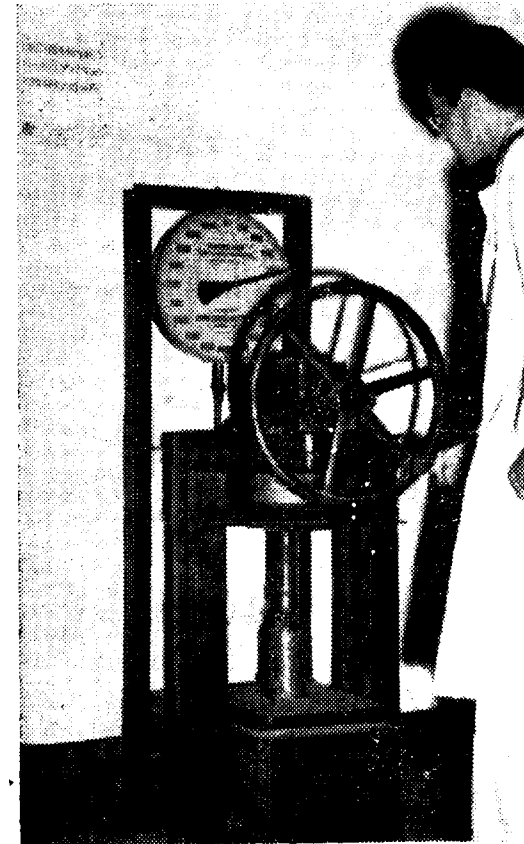
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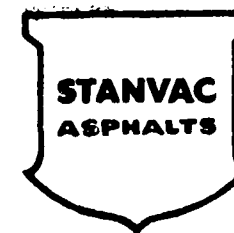
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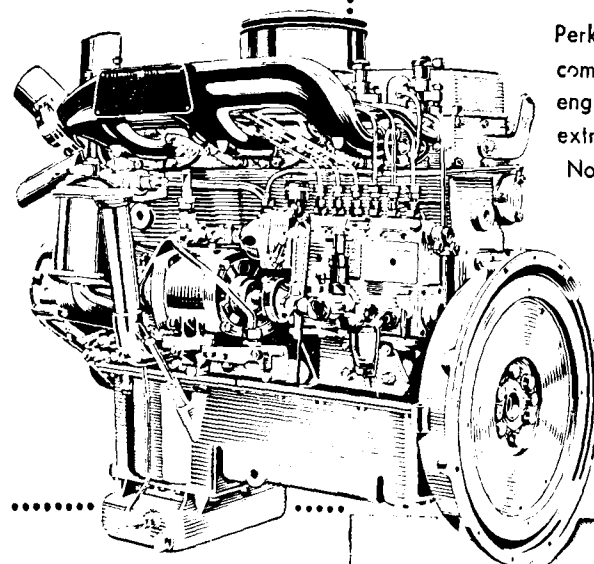
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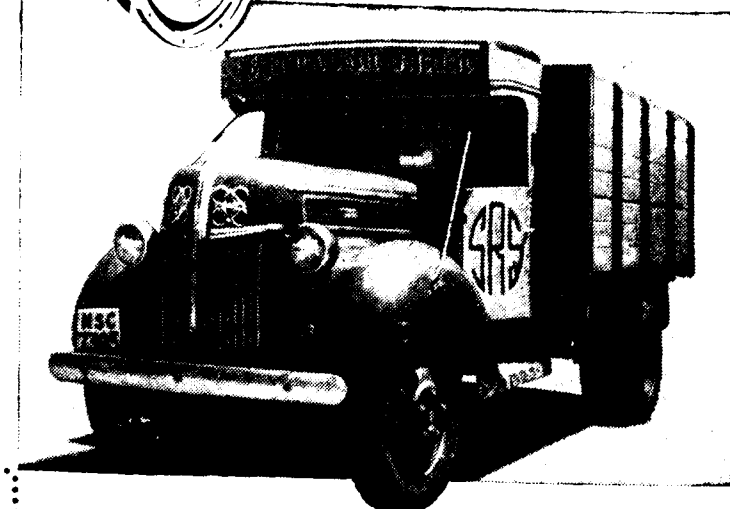
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A REVIEW OF ROAD ENGINEERING, DEVELOPMENT & TRANSPORT

THE SYRIAN ROAD SYSTEM

1. BACKGROUND

considerably extended and the chief Syrian towns were linked by macadamised roads. These roads followed fairly closely the routes of the caravan tracks, but considerable modifications were made to the alignment in mountainous districts.

Until 1928, no asphaltic compositions were employed for surfacing roads outside the towns. By the end of 1939, the total length of roadway with asphalt surface amounted only to 400 km (248 miles), whereas roads constructed of water-bound macadam totalled 1,100 km (683 miles).

During this period the use of asphalt surfacings was greatly extended.

A road system with a modern asphalt surface was essential for transporting troops, munitions and food during the second world war and, consequently, in the period from 1940 to 1945, the length of asphalt surfaced roads rose from 400 to 1,440 km (248 miles to 894 miles) an increase of 260 per cent.

At the end of 1945, the length of macadamised roads was 1,170 km (727 miles).

During this period, the Syrian Government continued the policy followed during the war, namely, the use of asphaltic surfacings as the wearing course and the improvement of road alignments. By the end of 1952, roadways with an asphalt surface had reached a total length of 2,600 km (1,614 miles) equivalent to an increase of 80 per cent on the length in

2.2. Period between the Two World Wars (1920-1939)

During this period the road system was



1945, and to an increase of 550 per cent on that which existed in 1939.

A marked improvement in the layout of the roads also took place during this period. Many sections of winding roadways were closed to traffic and replaced by others having an alignment in accordance with modern practice. At the same time, attention has been given to the superelevation on bends and the verges have been widened.

3. COMPOSITION OF EXISTING ROAD SYSTEM

The existing roads can be divided into three classes, described below.

3.1. A. Main roads and international highways

In view of Syria's geographical location, roads running from the Mediterranean in the West, towards Iraq and Jordan in the East, and roads running from South to North, i.e., from Palestine and Jordan, across Syria, in the direction of Turkey, are regarded as main roads.

These roads are shown in the map at page viii.

The total length of these main roads and international highways is approximately 3,000 km (1,863 miles) and they include 1,700 km (1,056 miles) of asphalt-surfaced roadways.

3.2. B. Roads of economic importance

As Syria is mainly an agricultural country, the roads which are important from an economic point of view are those linking the fertile areas of the country to the principal towns or the nearest main roads.

Roads connecting the towns and the nearest summer resorts are also regarded as roads of economic importance.

These roads have a total length of about 2,240 km (1,390 miles) and include 600 km (372 miles) with an asphalt surface.

3.3. C. Local roads

These roads, which are only of importance for the district they serve, have a length of 2,960 km (1,838 miles) including 300 km (186 miles) with an asphalt surface.

4. STATISTICAL INFORMATION

4.1. The total length of the Syrian road system had reached 8,200 km (5,092 miles) by the end of 1952, equivalent to 44 km of road per 1,000 square km (70 miles per 1,000 sq. miles). (Syria has an area of 185,000 square km). This road system comprises:

	miles.
(a) Asphalt-surfaced roads ...	1615
(b) Roads with a surfacing of waterbound macadam ...	745
(c) All-weather earth roads ...	2732
Total ...	5092

4.2. The following table summarises the development of the road system since the end of 1939:

Class of Road	Milage at the end of		
	1939	1945	1952
Asphalt-surfaced roads	248	1018	1615
Macadam-surfaced roads	683	745	745
All-weather earth roads	1863	1987	2732
Total ...	2794	3750	5092

4.3. The following table shows the lengths of the three classes of roads (main roads, roads of economic importance, local roads) at the end of 1952:

Class of Road	Milage of Asphalted sections.	Macadamised sections.	Earth roads (tracks).	Total.
A. Main roads & international highways ...	1056	180	627	1863
B. Roads of economic importance ...	373	397	621	1391
C. Local roads ...	186	168	1484	1838
Total ...	1615	745	2732	5092

4.4. The funds allocated annually for the maintenance and improvement of the road system amounted, in 1951, to three million Syrian pounds (Rs 64 lakhs) of which sum 700,000 Syrian pounds (Rs 15 lakhs) were earmarked for the roadmen stationed permanently along the roads. Ten per cent of these sums was allocated to the tracks and the remainder was employed in connection with the asphalt and macadam surfaced sections.

5. ADMINISTRATION AND ALLOCATION OF FUNDS

5.1. With the exception of those sections of the roads which pass through the towns, the Syrian road system is constructed and maintained by the technical division of the Ministry of Public Works and Communications. The sections of the roads which pass through the towns are built and maintained by the municipal authorities of these towns.

5.2. The funds required for road construction and maintenance are included in the ordinary state budget. Motor fuels are subject to a special tax which amounts to about 10 French francs, per litre in the case of petrol. This tax is levied directly by the petrol distributors and is paid by them into the Treasury.

In 1952 this tax amounted to one milliard francs (Rs 136 lakhs) of which one third was allotted to road maintenance and two-thirds to the construction of new roads.

No special tax is levied on tyres, with the exception of customs duties, which amount to 25 per cent *ad valorem*.

5.3. Syria has not so far raised a special loan or had recourse to exceptional means for defraying the cost of constructing and maintaining its road network. It should be pointed out, however, that during the Second World War the allied armies made a substantial contribution towards the asphaltting of the main roads and their maintenance.

6. SURFACING AND MAINTENANCE

6.1 Waterbound Macadam

In Syria, roads of water-bound maca-

dam are constructed in the following manner:

1. A stone pitched foundation, 15-25 cm. (6 to 10 in.) thick, consisting of hand-laid blocks of hard stone is prepared and the voids are then filled with quarry waste.
2. This foundation is then compacted with a roller at a pressure of 2 kilometre-tonnes per cubic metre of foundation.
3. A layer of broken stone (size 5-7 centimetres) (2 to 2½ in.) is spread to a depth of 10-15 cm. (4 to 6 in.)
4. This is then rolled, and during the rolling a binder (sand passing a 3 mm gauge) is spread at the rate of 20 litres per square metre and the surface is sprinkled with water. The pressure applied ranges from 6 to 9 kilometre-tonnes per cubic metre of broken stone, depending on the hardness of the stone.

6.2. Asphaltting

Various asphaltting processes are employed, namely:—

1. Surfacing by the hot process, which is used on old carriageways which have been well maintained.
2. Semi-grouting to a depth of 7 to 10 centimetres (2.75 to 4 in.) and then covering with a layer, 2 cm. (.75 in.) thick, of pre-mix (1 cubic metre of sand and 70 to 80 kilos of bitumen).
3. Laying the pre-mix, to a depth of 3 cm. (1½ in.) directly on a carriage-way constructed of water-bound macadam.

Maintenance of asphalt-surfaced roadways is carried out almost entirely by the last-mentioned process.

6.3 Concrete carriageways

These are not employed in Syria—except in the case of water splashes—on account of the high cost of cement.

7. TRAFFIC

7.1. In recent years, the traffic on main roads and international highways has steadily increased.

Unfortunately, no statistics are available to enable a comparison to be made with motor traffic prior to 1939.

However, the number of mechanically-propelled vehicle which travelled over the three main roads in Syria during the course of 24 hours, on 29th March 1953, are given in the table below:

Class of Vehicle.	Number on the Damascus-Beirut road	Number on the Damascus-Aleppo road	Number on the Damascus-Amman-road
Motor-lorries	560	518	378
Motor-buses	76	507	306
Private cars	538	490	291
Motor cycles	8	21	38
Animal-drawn vehicles	-	98	114
Animals	49	138	353

7.2. In order to provide some indication of the increase in motor-traffic, in Syria, during recent years, the following table gives the number of motor vehicles in service at the end of the years 1937, 1948 and 1952.

Class of vehicle.	Number of motor vehicles at the end of		
	1937	1948	1952
Motor-lorries	873	3,443	4,594
Motor buses	348	1,081	1,119
Private cars	2,515	3,101	6,065
Total	3,736	7,625	11,778

8. FUTURE PROSPECTS

8.1. Syria does not yet possess any motorways. Being a country with a considerable transit traffic, a network of motorways is essential in order to link Syria with neighbouring countries, particularly Iraq, Kuwait and Saudi Arabia, which have abundant supplies of petroleum and other natural resources. These motorways can, however, only be designed and constructed in co-operation with these countries. Preliminary plans of an

unofficial nature have already been drafted, but no decision has yet been reached in this matter.

8.2. The Government has under consideration, at the present time, an important programme of projected improvements to the road system. In addition to the maintenance of the roads which already

have an asphalt surface, it intends to asphalt the 930 km (578 miles) of roads built of water-bound macadam which are comprised within the categories of main roads and roads of economic importance.

Attention will, however, be mainly directed to the following projects:

1. The construction and asphaltting of 465 km. (289 miles) of roadways in North-Eastern Syria, in that part of the country where most of the cereal crops are grown.
2. The laying of a macadam carriage-way with an asphalt surfacing on the Hama-Masyaf-Damascus road (95 km. 59 miles) which links the cotton-growing district of Homs-Hama to the Mediterranean coast.
3. The construction and asphaltting of a road between Homs and Tartus which will not run through Lebanese territory and will by-pass the mountains of Safita.

9. CONCLUSION

9.1. Syria is an agricultural country, through which there is considerable transit traffic, and depends to a considerable extent on her road system for developing her national economy.

HIGHWAY TRANSPORTATION ECONOMICS*

(Extracted from 'Public Roads'—August 1952)

SYNOPSIS

HIGHWAY transportation, all things considered, is perhaps the most important of all modes of transport. Not only is it a potent competitive force, but it complements all other modes of transportation and plays an indispensable role in the direct satisfaction of human wants.

What is the proper position of highway transportation in the total transportation field? How should highway costs be assigned among the various classes of motor vehicles, and what responsibility should be assumed by the general public as distinct from highway users? How shall costs and benefits be related? And what is the public willing to pay? How should highway needs be measured in relation to other needs for the general welfare? Extensive research may eventually produce theoretical solutions for some of these problems. But in the final analysis decisions must rest upon collective judgment.

ALLOCATION OF HIGHWAY COSTS

The allocation of highway costs among the various beneficiaries is one of the basic issues in highway finance. One could engage in an involved and extended discussion here, which would lead deeply into the complicated and controversial subsidy issue. What needs to be emphasised is principle. *There are good reasons why users should not be held responsible for all costs of all segments of the highway plant*—a certain share should be assigned to property owners and general tax payers. Once an assignment of responsibility to the highway users has been made, however, they should be expected to defray through user taxes all of the economic costs associated with highway provision.

The second difficult cost assignment problem is the determination of shares of responsibility to be borne by vehicles of different sizes and operating different mileages on the highway. Perhaps no other issue is so bitterly debated. On the one hand, one finds the claim that heavy vehicles are pounding the pavements to pieces; on the other, that properly built highways are unaffected by heavy vehicle use. At one extreme, it is contended that fuel consumption is a suitable measure of highway use; at the other, that weight and distance as reflected in the ton-mile is the best measure of relative highway use and, hence, of highway benefit.

Conclusive Answers Lacking

The very fact that there is so much dispute suggests that conclusive answers have not yet been found. This is the case. Various theories have been proposed for spreading highway costs. Just to name them—differential or incremental costs, relative use, value of service, differential benefits, differential space occupancy—is enough to suggest their complexity and diversity. It is perfectly clear that one cannot hope to find a formula upon which everyone can agree. For one thing, too little is known about highway costs.

There is, of course, a basic difference between private investment for profit and public investment, even when an attempt is made in the latter case to adopt certain principles applicable in the private economy. It is not to be inferred that the highway plant ought to be operated for profit. As in other monopoly situations, prices for highways might be fixed to maximise profits. However, it is well accepted that unregulated monopoly profits ought not to be tolerated even in a private enterprise economy. *Fixing charge for highway use is somewhat analogous to fixing rates for utilities where the purpose is not to maximise profits but to cover all costs plus a fair return on the investment.* In various highway situations, of course, there may be a consumers' surplus in the sense that users would be willing to pay

* Continued from page 7 of the October issue.

† Italics are ours—Ed.

more than would be required to meet costs.

The essential requirement is that we focus attention on the costs of providing highways and strive toward the assignment of costs among beneficiaries on a rational basis. The goal toward which we press is to set the supply prices of highway service as they might be set in the private economy. When this is done in highway management and other fields where public aid is a factor, a realistic and economical basis for competition among the various transportation agencies will be established; and the rates of investment and distribution of traffic among the carriers will be determined by their relative economy and fitness.

Perhaps one of the toughest public issues of the day concerns the appropriate rate of investment in the highway plant. All evidence points to the fact that a considerably faster rate of highway expenditure will be required to bring the highway plant up to standards that will be regarded as satisfactory by the great majority of private and commercial users.

Public Apathy

In spite of the evidence pointing to great highway inadequacy and a vague general realization of the fundamental importance of highway transportation to the national economy, there is considerable reluctance among the public to meet the issues squarely in the one way that really counts—additional financing. *Perhaps an educational campaign with dramatic appeal and readily understandable arguments might dispel this public apathy.* The fact is that a bare inventory of highway deficiencies, regardless of its size, does not in itself make a compelling case for additional financing or furnish a satisfactory guide either as to the aggregate amount that should be expended or as to the rate of annual expenditure that might be tolerable.

Time and again I have heard the heads of business state that their department heads or engineers can supply them with statements of needs and worthwhile expenditure so large in the aggregate that they all cannot be financed, however much they might improve the operations.

Almost every family can make up inventories of justifiable needs that add up to expenditures far in excess of their incomes.

The stark reality is that both the businessman and the family must adjust their expenditure programme to what they can afford out of current income or what they decide may be so essential as to justify pledging future income by borrowing. The businessman's decision is influenced not only by the demand situation as he estimates it, but also by the alternative uses to which he might put the limited capital available to him. The family must inevitably balance benefits from one possible outlay against benefits that would be derived from alternative expenditures.

It is not so with government in its usual operations. The government's power to tax gives it the power to adjust income to the expenditure programme that is regarded as necessary or desirable. The crux of the problem is to determine what is necessary or desirable. Ordinarily there are no positive guides and so we rely on the collective judgment of the people as expressed through their legislators. But in the case of highways, that collective judgment may be influenced and perhaps improved if we can apply at least some of the standards and principles that would apply in the private economy. What is needed is an accurate evaluation of the benefits of improved highway service, and a realistic comparison of those values with the full economic costs of providing the service. This guiding principle is much easier to state than to apply, however.

Measurement of Highway Benefits

One obvious clue to the measurement of benefits to users is the effect of highway improvements on the total costs of highway transportation. As a matter of fact, we (U.S.A.) are spending considerably less than 10 cents of our highway transportation dollar for the road plant. *A larger percentage spent on highways may mean a lesser total cost. This is the real import of the thought that we pay more for poor highways than for good ones.*

For example, savings in distance resulting from a highway improvement may

result in savings in fuel and tyre costs alone that will be more than sufficient to pay for the improvement. *Less congestion, better road surfaces, reductions in grades all tend to reduce vehicle operating costs.* In each case the benefits to the users can be reduced to monetary terms and offset against the highway cost.

Moreover, *savings in time* that may result from any one of a variety of highway improvements may have tremendous economic value even if we conservatively consider only the time of commercial and business highway users. The saving of 5 minutes may seem a small matter for one operator, but over the course of the year, during which thousands of vehicles are involved, the savings add up to enormous sums which, when compared with the highway costs, may justify very substantial investments in highway improvement.

The reduction in accidents that results from highway modernisation also means lower costs for both commercial and private users, not only in the savings through elimination of accidents but also possibly through reduction of insurance rates.

In addition to tangible savings in operating time, and accident costs are *intangibles* to which, unfortunately, money costs cannot be attached—as, for example, the increased pleasure and comfort of the motorists on better highways. Undoubtedly these are benefits for which a great many motorists would also be willing to pay. It would seem proper, therefore, to reduce benefits to money equivalents wherever possible. But when the final decision is to be made, the intangibles must be evaluated by subjective judgment and may tip the scales in favour of higher level of improvement than might be indicated by monetary values alone. Here, then, after the technicians have completed their analysis, the collective judgment must come into play in reaching the final decision.

The Users' Willingness to Pay

Concrete evidence of the highway users' willingness to pay for improved highway service is found in the cases of certain toll roads in the East of the U.S.A., where

existing parallel non-toll roads are worn out, obsolete, or inadequate. Motorists usually pay about 1 cent per vehicle-mile for operation on these toll facilities—the equivalent of a gas tax of 15 or 20 cents a gallon in addition to their ordinary user taxes. Obviously the benefits of the higher type facilities, both tangible and intangible, as evaluated by the users themselves are substantial.

The case is even more striking when commercial and business uses alone are considered, for here the intangibles play a lesser role and the cold calculations of cost against value-of-service are dominant. Yet it appears to be to the advantage of the trucking industry to pay substantial tolls. For example, trucks are charged from 2 to 6 cents per mile, depending on size, for operation on the Pennsylvania Turnpike, yet about two-thirds of the revenue is derived from truck traffic. The reasons are apparent. Studies indicate, for example, that fuel consumption is 50 per cent higher on an alternate route than on the Turnpike, and more than twice the time is required to travel the same distance on the alternative highway.

Problems of Estimating Costs and Benefits.

We have alluded from time to time in this discussion to the need for including full costs in appraising the relative economy of highway transportation. Without further elaboration, it seems self-evident that all costs must be included in any value cost comparison that is to be useful in solution of the highway investment problem.

It should be mentioned that this consideration is generally based upon the assumption of an economy of full employment. A departure from value-cost calculations, in the rigid sense, may be justified in a situation of under-employment. *At such a time accelerated highway improvement may be considered an appropriate device to relieve unemployment and stimulate the economy.* Even under such conditions, however, it is appropriate to maximise the benefits of highway improvement; on the cost side of the equation it will be appropriate to include less than the full monetary outlays (or

perhaps calculate costs at zero) if, in fact, inflationary methods of financing are used which result in the employment of labour and other economic resources that would otherwise be idle. However, for purposes of comparing alternative public expenditure under such conditions it may be useful to develop benefit-cost ratios in which full monetary costs are included.

It should be emphasized that there are tremendous difficulties in the way of making a precise value—cost appraisal for the entire highway plant. Not enough is known about vehicle operating costs for different vehicles under different highway conditions. It is difficult to estimate the value of time savings for business and commercial users and debatable whether time savings for private users should be evaluated in money terms or regarded as an intangible. Placing an acceptable money value on highway accidents is no easy task, even if a satisfactory method of estimating potential reductions is agreed upon. Nevertheless, it seems clear that efforts should continue in this direction. It is to be hoped that continuing research will reduce the areas in which disputable assumptions or purely subjective evaluations are required.

Highways and the General Welfare

It may have been observed that these remarks have been confined to the benefits that accrue to the highway user. No mention has been made of the social and political values which are frequently ascribed to highways and emphasized in justifying an improvement programme. The existence and importance of general benefits cannot be denied. But they do not lend themselves readily to specific economic evaluation. On the contrary, too much emphasis on general benefits may prove misleading. The basic problem under consideration is the diversion of limited economic resources from other possible uses to highways.

In many discussions of general benefits the fact is overlooked that the use of these resources for other purposes, whether private or public, may also render great general benefit to society. Almost every investment results in a general benefit. If it is said that highways aid the national defence, can it not be shown that a steel

plant is also essential to the national defence? If it be said that highways weave together the social fabric, or promote political cohesion, or bring new lands under beneficial use, can it not also be shown that railroads or canals will render similar benefits? If general benefit were the basic criterion of Government expenditure, nearly all economic activity should be subsidized. To attempt to weigh the general benefits of highway provision against the general benefits that would be gained from any one of all the possible alternative uses to which the resources might be applied is a task almost incomprehensible in its sheer magnitude.

Yet it must be admitted that there are situations in which highway or other public expenditures may properly be found by collective judgment to be justifiable, even though they do not measure up under rigorous benefit-cost analysis. *The benefit-cost approach is not panacea.* To illustrate: The public purse has often been opened for the promotion and development of industry; perhaps in no field has its use been more generous than in transportation, starting with early road development and extending to canal building, land grants to railroads, development of inland waterways, and, continuing to the present, airmail subsidies and airport and airway development. Many roads are developed (and more are requested) which cannot be justified on a current traffic basis but which, it is hoped will open new areas for profitable agricultural, mining, lumbering or other development.

Quite obviously, the use of tax money for promotions of this sort must rest largely on collective judgment based upon such facts as can be marshalled regarding the future usefulness of an industry or a transportation agency or a newly developed area to the general welfare. Under such circumstances, it is obvious that any attempt to adopt standards applicable in the private economy must be abandoned. The problem is purely governmental in character, general benefit rather than benefit to individuals or identifiable groups of individuals furnishes the standard. It is inappropriate to raise revenue for such ventures through user charges;

instead, general tax funds should be drawn upon.

Frequently it will be appropriate to use special assessments or property taxes to defray the costs of such highways, as in the case of streets in new subdivisions or roads in areas opened by reclamation projects. In other cases, as for example, access roads to military reservations, appropriations of general funds raised under prevailing tax institutions would seem appropriate.

Practical Expenditure Problems vs. Theoretical Cost Analyses

It would be nice if the value-cost approach provided a simple answer to the highway investment problems, but it does not. Not only must the question of highway justification on the basis of general benefits be dealt with under certain circumstances, as pointed out above, but other practical problems are encountered in the attempt to fix aggregate highway expenditures for the benefit of users on the basis of value-cost calculations. For example, it is quite proper to use true annual costs which include maintenance, depreciation, interest, and possibly taxes rather than expenditures in the comparison of value and costs. If highway improvements are financed through borrowing, or if, by sheer coincidence, annual depreciation on the highway plant provides adequately for new investment, a showing that benefits are greater than costs is useful.

But a pay-as-you-go system of highway finance, however desirable it may be on the basis of other considerations, may make benefit-cost comparisons virtually meaningless as a practical matter, particularly if the entire highway plant is in need of rehabilitation as seems to be the case today. The highway users are called upon to advance money to meet expenditures for improvements long before the expected benefits accrue. It is true that the inclusion of interest in the cost calculation theoretically solves the difficulty. But as a practical matter, the tax-payers are immediately burdened while the compensating benefits they will eventually enjoy are spread out over a considerable time in the future. Under such circum-

stances, a strong case for a credit financing to spread the highway costs over time can be made.

More elusive is the fact that although interest clearly should be included in cost calculations for certain purposes, it is by no means certain that it should be included in tax charges levied for the use of highways that have been financed on a pay-as-you-go basis. This observation warrants much theoretical analysis that cannot be included here.

Previously mentioned was the fact that economists and engineers view the problems of highway finance from different perspectives. Economists would relate user charges to depreciation, maintenance, interest, and possibly taxes, so that the highway user would pay full economic costs for that portion of the existing highway plant for which they are held responsible and which they are currently using. In this manner, subsidy is eliminated. But engineers are looking to the future. They are interested in an adequate expenditure programme to expand the highway plant to take care of existing and anticipated traffic conveniently and economically. The fact is that if only annual costs of the existing plant are met by users the only amounts available for expansion of the plant would be the imputed interest that might be included in ascertaining annual costs. If additional funds are secured by increases in user taxes, users would pay more than annual costs and there would be an overpayment—a negative subsidy.

The difficulty might be solved by borrowing or by the use of general tax funds for highway expansion. In the latter case, the popular notion that the use of general taxes for highways is clearly an indication of subsidy to users should be dispelled. However, the financing of a highway plant through general funds with subsequent repayment by user charges which include interest and general taxes, while conceptually sound in economic theory, would require a radical departure from present thinking about highway problems. It would raise another difficult policy question. Investment of general funds in the highway plant provided for benefit of users would be based, not upon the free

choice of individuals, but upon collective judgment as expressed through legislatures and effected through compulsory taxation. What standard would guide policy-makers in determining how much current income or savings be taken from individuals through general taxation and invested collectively in highways?

Favourable Benefit-Cost Ratio Not Conclusive

The practical problem of dealing in highway expenditures when actually financing highway improvements but dealing in economic costs in making comparisons with highway benefits raises other issues. Perhaps these can be illustrated by a homely example. Let it be assumed that accurate cost studies show that a home freezer will pay for itself over a period of time by direct savings in food costs, and that it will yield other benefits such as savings in shopping time. Establishment of these facts will not be likely to cause every family in the nation to rush out and acquire a freezer. We have suggested one reason: An immediate expenditure is required; the savings will accrue over a period of years. (Even if credit is used for the purchase, the time extended ordinarily will not be long enough to reduce payments to an annual cost basis).

There is another reason. Each family has alternative use for its funds. Suppose a family is faced with a choice between a freezer and a television set. The annual money costs may be the same. But the cost to this family of acquiring a freezer will be the value (anticipated benefits) of the television set which would have to be given up. In its judgement the television set may yield greater benefits than the freezer, even though it has been proved that the freezer will pay for itself over time.

The import of this observation is that costs as computed in highway benefit-cost calculation for investment analysis may be understated. It might be assumed that highway improvements will be justified when the benefits gained, evaluated in monetary terms, exceed the costs. But a home freezer also may yield benefits that exceed its cost. Just as the family

might choose a television set instead of a home freezer, given a choice it might choose either of these instead of highway improvements, even though the latter was shown to yield benefit in excess of costs.

Similar considerations might apply in business situations. Highway improvement may result in savings which over time more than offset their cost for a particular trucking firm. But suppose the firm could gain even greater savings with a similar outlay for modernizing its fleet of vehicles. This would be the more prudent investment, if the firm has any choice.

Again, consider the total economy. Suppose it is proved that a given investment in highway yields benefits that far exceed costs. But society as a whole has alternative uses for its economic resources. And value-cost calculations for a reclamation project may also show benefits exceeding costs. How will the choice be made between the highway improvement and the reclamation project? Perhaps if there were only two alternatives an answer could be devised. But a formula to choose between highway improvements and all other possible uses, both private and governmental, both productive and consumptive, to which the limited resources might be put would be virtually incomprehensible.

Judgment Is Involved

It is clear, then, that benefit-cost analysis is subject to severe limitations, at least in the present state of knowledge. Individuals, businesses, or society as a whole may well find that highway improvements, despite favourable benefit-cost ratios, are less desirable than alternative uses of the resources. *In the final analysis, the decision on aggregate highway investment must rest upon collective judgement expressed through the legislature.* This is not to say that benefit-cost analysis serves no purpose. Quite obviously, if benefits are less than costs, highway expenditures would not be warranted. But where the benefit-cost ratio is favourable, subjective judgment must come into play. The higher the ratio, the more convincing is the case for

highway expenditure. But at some point on the scale, perhaps a cut-off should be established. That point could only be determined by inter-subjective agreement.

Our discussion has been confined to benefit-cost calculations as a possible criterion for highway improvement programmes. An approach to the problem, now widely discussed, is based on an engineering evaluation of the sufficiency of various segments of the highway system, each segment being given a rating in relation to an adequate engineering standard. But unless all roads are to be brought up to the adequate standard, a point must be selected below adequacy which can only be determined by subjective judgment. A possible guide in making this judgement is a comparison of highway benefits with costs at various points on the sufficiency rating curve.

The fact that no formula has yet been devised to grind out a precise answer to the problem of highway investment is not surprising. Wherever economic choices

are acquired, individual or collective judgment is involved. In the private business world, final decisions between alternative courses of action rest upon judgment of the head of the business or the board of directors. The economic decisions of the individual, the family, the business, and the government need to be buttressed by facts. One of the basic aims of economic research should be to supply the facts and make the analyses that will lead to more rational decisions.

With respect to highway finance, there may be no substitute for informed judgment, but as an initial step forward we need merely obtain public recognition of two basic concepts: (1) that highway transportation efficiency and economy depend upon both the public roadway and the private vehicle; and (2) that highway expenditures should be evaluated by weighing benefits against cost, and not as government largess. The results cannot fail to be salutary.

(Concluded)

CAUSE OF DEATH

City clerk: "What do you want to change in this death certificate?"

Doctor: "I signed my name in the space marked 'Cause of death'."

IN QUICK SUCCESSION

Sign outside a Cinema: 'Adam had Four sons': at 12.30 p. m., . 3 p. m., 6.30 p. m. and 9 p. m.

THE ENGINEER AS ADMINISTRATOR

(Extracted from 'The Journal of the Institution of Municipal Engineers'—August, 1953)

ORGANIZATION has become so complex that it is in danger of becoming the prerogative of a new profession. The danger lies here that engineers are not fully taking their place in management. They are already permitting the new product of administrators to usurp their authority. Businesses and governments have now become so huge that management is extremely complex and difficult, so difficult that this new class is thought to be necessary.

Administration has come in practice to mean, in Government Departments, dealing with all the more important things that require no specialised knowledge, or in other words policy matters where the lay administrator thinks he can arrive at a wise decision without direct knowledge of his own and on the advice of specialists. And many things are dealt with in this way, yet they ought not to be, for, more than ever, to reach a wise and correct decision broad and specialised knowledge are at once required.

During the last century, as the size of businesses grew, specialists came forward, ready and able to take their place on the board of management. Accountants, without knowledge of particular manufactures, increased their influence: this was largely brought about by the complexity of income tax and the need for mergers and amalgamations of firms, factors that should be secondary to productivity and technique. Engineers have resisted this incursion with some success, allowing that accountants have their place, an indispensable one in larger business. And so long as accountants do not become obsessed by the importance of statistics and are content, so far as the ordinary running of affairs is concerned, to help and advise the creative post, they do nothing but good. They must take especial care that, in those businesses where development of ideas follows rapidly

on experimentation, they do not hinder progress. Today it may generally be said that the conflict between engineers and accountants is largely resolved and that both work together, acknowledging mutual help. A conflict is, however, now being joined between engineers and administrators, at any rate in government in this country, (U.K.) though generally speaking it does not appear to be so abroad.

In America it is remarkable that promotion is common from the shop floor, in fact the introduction of university graduates to a grade in a business above the lower level is rare indeed, and it seems that appointment to the higher grades occurs but seldom save by promotion. Yet in this country this is not yet so, although the tendency is increasing.

At a town planning conference in America in 1936 it was made perfectly clear that the man who was to become the bureau chief was the technical man who had aptitude, ability and experience, no administrative class being recognised.

The American highway boards, who hold full responsibility for maintenance and improvement of their roads, consist in the main of engineers who have obtained promotion through the grades, to whom are added not more than two or three solicitors and accountants, thus introducing sufficient expert knowledge to ensure broad and balanced decisions.

In France great importance is placed on the quality of the technical degree gained at college, and the clever student carries through his entire career his initial advantage. Promotion is however, open to all who make the grade, the highest administrative posts (although in a technical ministry they are not considered such) being filled by technical men.

Generally these posts are occupied by men of great intellectual ability.

There seems no exact definition of the word administration. The NALGO Conditions of Service say, 'The duties are those concerned with the formation of policy, improvement of organization, general administration of instructions of the employing authority and the control of departments, higher work in the legal, technical, accounting and other departments; also subordinate officers engaged on professional or technical work of a minor character'. Nothing could be at once wider or more vague, while no mention is made of that most difficult task of all—the actual carrying out of large-scale works of supervision of a living and active organization, whether it be highways, water supply, irrigation, police or the fire service.

It has been contended that scientists are too specialised to become administrators, but this is not true today. Science generally has gone full-circle. Not so long before the war it had become over-specialised, so that scientists had become unaware of what others were doing, but they have themselves gone a long way to correcting this fault; had they not themselves seen it, the natural developments of science itself would have rectified it. For example, an experimentalist in optics now finds it necessary to have a considerable knowledge of the dynamics of particles, of radar and electronics and of the properties of gases in order to pursue his studies. Biochemistry and metallurgy are two important interests that have done much to link up isolated lines of thought. Today it will be found that all the leaders in specialised science have an amazingly broad knowledge. Eddington, the astronomer, was able to write on philosophy with great authority, and Bertrand Russell's range of subjects seems almost unlimited.

And so with engineers. At the university their training is not narrow, though when they enter an office they do usually

specialise, perhaps in bridges, sewerage or water supply. But this is only a step, and a necessary one, in their career. As they advance, they delegate more of their speciality to juniors working under their supervision and have more time to survey the broad whole, until finally, when they reach a senior position, while they may have fuller knowledge of one particular section, they have a general knowledge of all. To succeed they must be able to see a problem in its entirety and to do so must have sound judgment and wide knowledge.

The engineer must be the principal officer of his department. He must build himself a strong position from which he can advise his committees on matters within his domain without passing through the head of any other department. Siemens, Krupp and many others who made large fortunes, held that engineers should be at the heads of sections of their industries. What had a hard road to follow before his steam engine was a financial success, and the turning point only came when he collaborated with the industrialist Boulton, but even in this case he did not become a junior but an equal partner, a successful combination that endured for many years.

In Industry endeavours have been made to meet the demand for administrators without creating a specialised class but by the further training of professional men. In Government Departments no new class has, in fact, been made, for all that has been done is the giving of certain duties to men of broad education but who lack, and moreover are unaware of their ignorance of, that further training vitally necessary. *Each profession should produce its own administrators, interchangeable within professions, but not outside them. It is the clear thinking of professional men as scientists, coupled with administrative knowledge and ability, that fits them, their specialised knowledge being merely something incidentally acquired, on the road to success.*

TESTS ON MASONRY ARCH ROAD BRIDGES

*(Condensed from Research Paper No. 16 of Building Research Station, U. K.—
Test on Road Bridges by Norman Dacey).*

UNTIL quite recently, masonry arches of short span, up to about 40 ft, used to be designed by empirical rules which related the thickness of the barrel of the arch to the span and the rise, and bore no relation to the load which the arch was expected to carry. Such rules might have been based largely on the previous experience of engineers and architects who had designed similar bridges for comparatively small live loads. But with the increase in motor traffic, vehicles of much heavier axle loads began to use these bridges without apparent ill-effects to the structure. An investigation into the source of the unsuspected strength of these arches was made by the Building Research Station of the Department of Scientific and Industrial Research, Great Britain. A summary of this investigation and the conclusion arrived at are given in the succeeding paragraphs.

Usual Method of Design

Now-a-days barrel arches in masonry are analysed by considering the proportion of the live load which is likely to come on a strip of unit width of the arch and determining the stresses produced in the rib, on the assumption that

- (1) the rib is fixed at the springing ;
- (2) the spandrel filling forms a dead load acting vertically downwards on the rib ;
- (3) the abutments neither move vertically or horizontally nor rotate about a horizontal axis.

The load required to produce tension at the intrados of the rib is taken to be the load that causes failure, and the permissible load is obtained by applying a factor of safety to the failing load. Tests have, however, shown that these assumptions are far from being correct.

Bridges tested

The bridges which were tested varied in span from 14 ft to 54 ft and consisted of brick or stone masonry barrel arches with spandrel and parapet walls, the space behind the spandrel wall being usually filled with clay and rubble. The part of the barrel lying between the spandrel wall was not often of uniform thickness but was stepped in a series of thicknesses increasing from the crown towards each abutment. Usually the shape of the arch barrel had originally been elliptical or segmental, but departures from the true ellipse or circular arch were the rule rather than the exception. The brickwork varied very considerably in kind and quality: in some cases the joints were badly in need of repointing, while in the others, patches of new brickwork had been inserted into the original structure. In the stone arches, voussoirs were cracked and spalled and the mortar had fallen from the joints.

Nature of tests

Two types of loading tests were made: very detailed tests culminating in a test to destruction and more superficial tests using heavy road vehicles for applying the load.

Three bridges were tested to failure. The first was a stone voussoir arch bridge of 21 ft span, and the second was a brick masonry arch bridge of the same span. The third was also a brick masonry arch bridge of 21 ft span but with a very wide roadway of 33 ft 5 in. The last bridge was also loaded at various stages during demolition and the final test was carried out on the brick arch ring with all filling and superstructure removed.

Superficial loading tests were made with various types of heavy road vehicles on the three bridges mentioned above and on eighteen others.

Method of loading and measurement of deformation

When tests to destruction were made, the loads were applied to the bridge by means of hydraulic jacks as shown in Fig. 1. Timber cribs were built on the approaches to the bridge and were used to support a platform of steel girders and railway sleepers. This platform carried a

span and $\frac{1}{2}$ span points of the arch extrados, excavation of a pit in the fill being then necessary. The stress was measured on the exposed face of an individual brick or voussoir, but sometimes measurement of stress was also made across a joint.

For the measurement of abutment spread and rotation, a length of invar

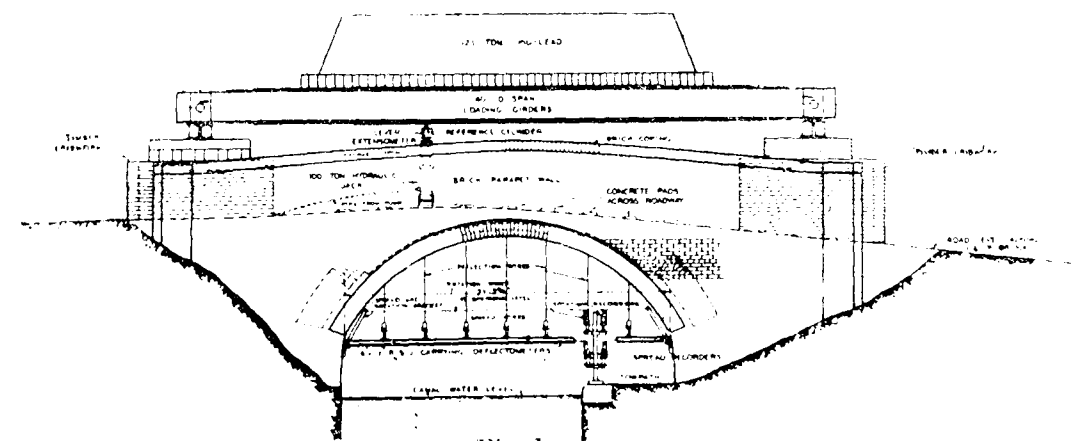


Fig. 1.

Method of applying load to arch.

dead load of kentledge consisting of pigs of lead, cast iron blocks or other suitable material. Hydraulic jacks were inserted between the underside of the platform and the deck of the bridge and were used either singly or in groups of two or four to apply loads to the bridge. The magnitude of the applied loads was measured by means of proving rings or cylinders.

In other cases where it was not intended to reach the failing point, the load was applied by means of heavily loaded vehicles of various types. Deflections were measured by means of deflectometers capable of indicating 1,10,000 in variation in deflection. These deflectometers were usually seated on steel joists spanning the abutments and were located at the $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$ and $\frac{7}{8}$ th points of the span along the centre line of the bridge. Occasionally the deflection along parallel lines near the faces and parapets were also measured.

The strain was usually measured longitudinally at various points on the soffit of the arch along the longitudinal centre line of the bridge and occasionally at the $\frac{1}{2}$

wire was attached to the abutment face at springing level and was carried horizontally to a very light pulley supported on ball bearings and then down to a deflectometer mounted on the same datum post as the pulley. In this way the horizontal movement of the skew back was read. For rotation measurement, a bracket with a long arm was bolted to the abutment face and a similar arrangement to the above was connected to the free end. The difference between the movements recorded on the rotation and spread instruments divided by the vertical distance between the wires gave a measure of the abutment rotation in radians.

General observations on the test results

One significant fact emerging from the tests was that when the bridge was loaded, outward spread of the arch abutments occurred in every case where spread measurements were made; but these spreads varied considerably from bridge to bridge.

Another major feature observed during the test on a stone voussoir arch was the

development of transverse cracks between the voussoirs at relatively low loads. These cracks closed up again on removing the load. The significance of this feature lies in the fact that the development of tension at the intrados as indicated by the presence of a crack or open joint does not entail collapse of the bridge. Moreover, the ultimate load carried was far in excess of that required to cause tension and it would seem inappropriate therefore to assess the carrying capacity on the basis of the load that causes tension.

A further phenomenon observed in tests to destruction was the appearance of diagonal cracks on the arch vault running from the point of application of each load towards the intersection of the skew backs with the nearer face of the bridge. These cracks resembled the diagonal cracks which are seen on concrete slabs when tested to destruction under concentrated loads, suggesting that the arch barrel behaves as an arched slab.

From the tests to destruction carried out, it is possible to summarise the behaviour of a spandrel-filled arch when loaded to destruction by means of concentrated loads at mid-span. As the load is increased, the arch deflects, the abutments spread and there is gradual opening of the joints where the tensile stress exceeds the strength of the mortar or of the adhesion

between the mortar and the brick or stonework. At a later stage, at least with arches of narrow width in relation to their span, diagonal cracks develop in the barrel. Later crushing of the arch barrel occurs.

Arch deflection

Some load deflection curves observed during test of one of the bridges tested to destruction are shown in Figs. 2 & 3. When the load was removed, considerable hysteresis was observed revealing the partially plastic character of the structure. It was also generally observed that the deflection of the arch was greater during the first application of the load than it was during subsequent loadings, this again being a characteristic of plastic or partially plastic structures.

Lateral distribution of load

Fig. 4 shows the lateral distribution of deflection at mid span of a bridge for a single concentrated load of 12 tons placed at half span and placed successively on lines B, C, D, E, F, G and H. The bridge was a brick masonry arch bridge of 21-ft span with a roadway of 33 ft 5 in. at mid span. The negative deflection of parts of the barrel, remote from the load, may in part have been due to slab action, but it was clear also that plasticity was affecting the results.

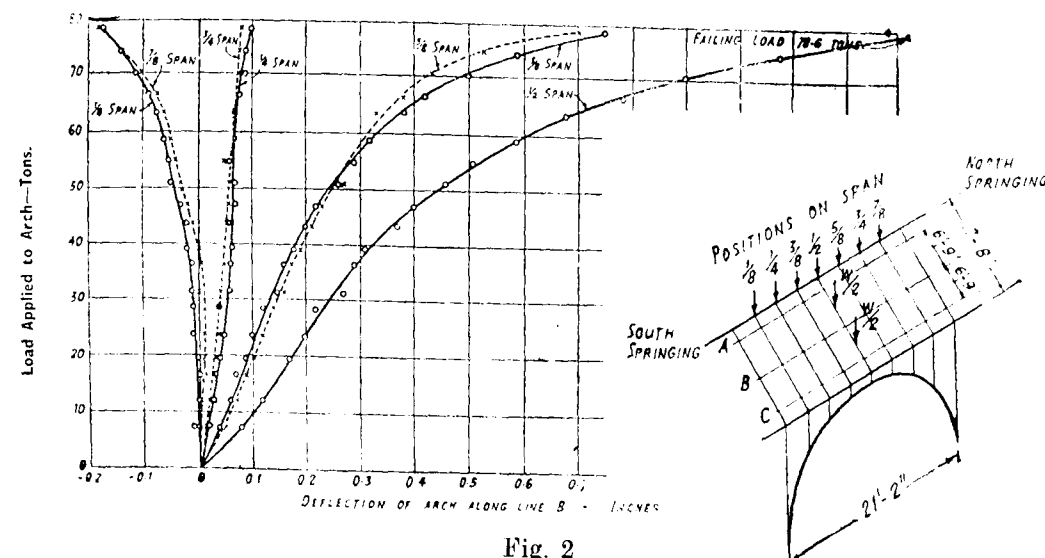


Fig. 2

Load-deflection curves observed during test to destruction, by applying two equal concentrated loads at $\frac{1}{2}$ span, 3 ft 7 in. each side of datum line B.

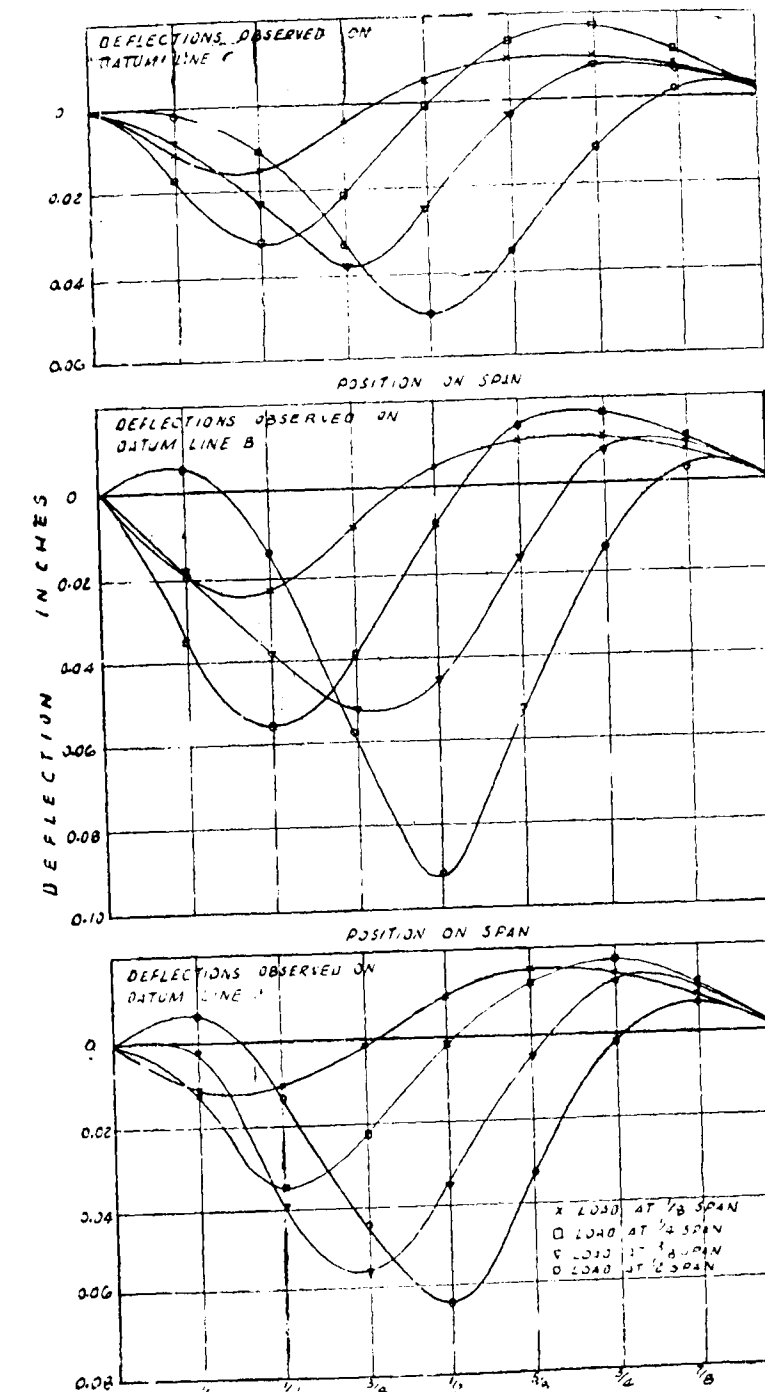


Fig. 3

Deflections due to two equal concentrated loads, one 3 ft 7 in. each side of datum line B. Total load 21.9 tons.

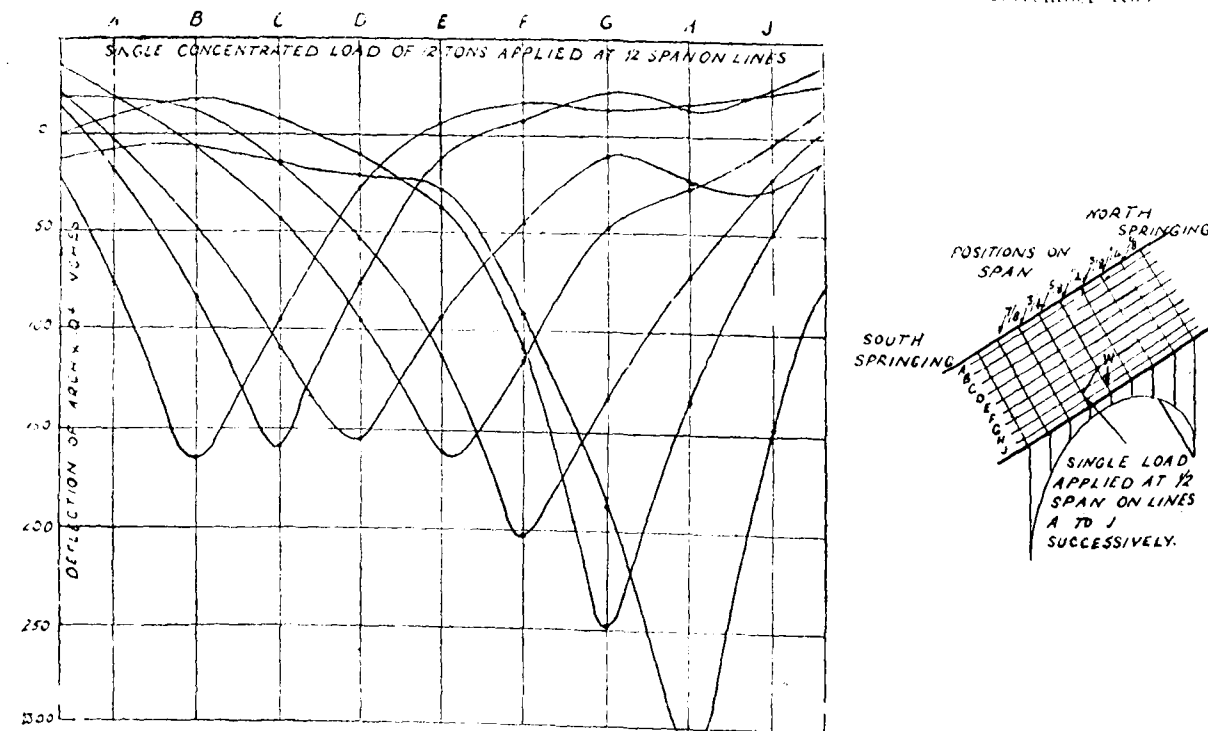


Fig. 4

Transverse distribution of deflection due to single concentrated load of 12 tons applied at $\frac{1}{2}$ span.

One other feature is the much higher deflection observed on one side of the bridge as compared with the other. It is thought that this particular feature may be the result of the greater spread of the abutment on that side of the bridge.

Abutment spread

There was considerable spread observed in almost all cases of spread, the amount varying with the load applied. With nearly all bridges the abutment spread increased more rapidly with increasing load and the amount of spread for a given load varied widely from bridge to bridge. There is no correlation between spread and rise-span ratio or any other simple geometrical property, but in general the bridges having the smaller spread-load ratio are those which are built in a cutting, whilst the larger spread-load ratios occur when the roadway approaches to the bridge are built upon embankments. Tests have also shown that the spread of the abutments may not be uniform across the width of a bridge partly due to foundations being weaker at some places than

at other places. Considerable error in calculations is involved as a result of neglecting abutment spread.

Effect of Spandrel fill

As an illustration of the strengthening of the arch by the spandrel fill, attention is drawn to Fig. 5 which shows the lateral distribution of deflection at $\frac{1}{2}$ span, for a single concentrated load of 6 tons applied at $\frac{1}{2}$ span on the centre line of the bridge. It appears that the deflections and stresses in an arch are greatly modified as a result of the spandrel and abutment fills and it seems that the arch barrel, the spandrel fill and the abutment fill should be assumed as one interacting unit when estimating the horizontal thrust for a given load.

In assessing the strength of an arch bridge, careful consideration should also be given to the condition of the foundations, since if the soil conditions are bad the arch may be seriously weakened. Under normal working load the outward thrust of the arch is balanced by the pas-

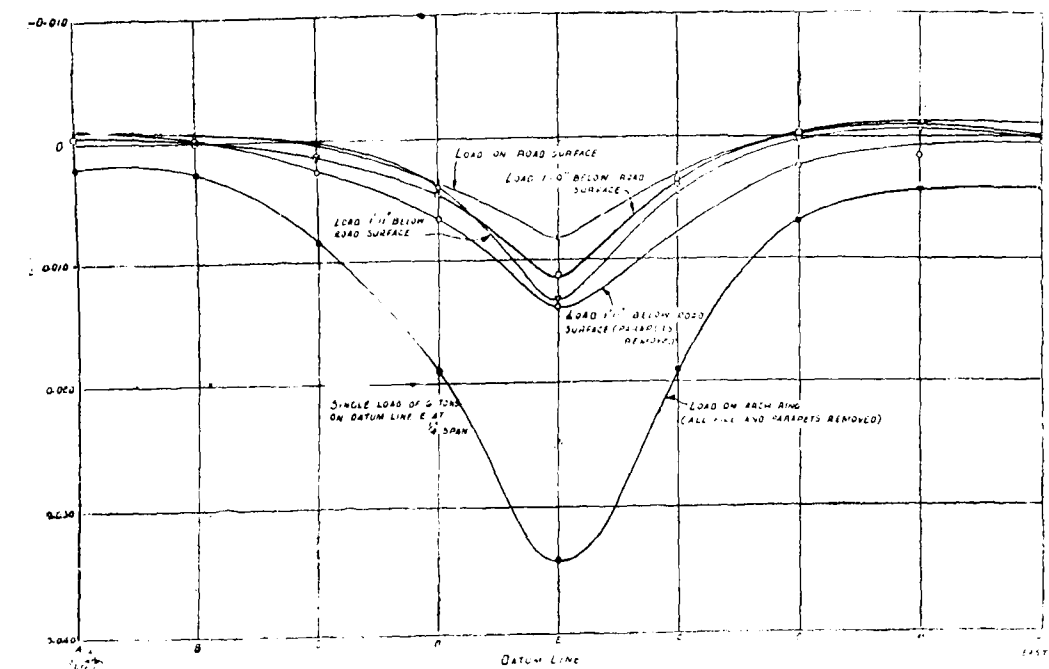


Fig. 5

Deflections at $\frac{1}{2}$ span for successive stages of demolition and plotted to a transverse base.

sive pressure of the abutment fill. A sustained and heavy load on the bridge, for example a heavy vehicle parked on the bridge, may greatly increase the horizontal thrust and if the material behind the abutments deforms, spreading of the abutment can take place with consequent weakening.

Conclusions

The investigations have shown that the strength of masonry arch bridges is, in general, much greater than existing methods of calculating would suggest. The tests have shown that:

- (1) considerable abutment movements can, in fact, take place;
- (2) failure does not necessarily occur immediately tensile stresses are produced;

- (3) the arch barrel may behave as an arched slab rather than as a series of arch ribs or strips;
- (4) the strength of the consolidated fill above the arch barrel contributes greatly to the strength of the structure;
- (5) the bridges reveal both elastic and plastic properties, and failure may occur by creep under a heavy and sustained load.

How best to assess the strength of these old masonry arches is still a problem. Possibly the most direct method and the one recommended is to apply a test load of 20 tons on a single arch to the structure. If the spread and deflection of the arch exceed 0.015 in. and 0.05 in. for bridges up to 45 ft span, the bridge may be treated as suspect and more detailed examination is called for.

SUPERELEVATION

For stability of a vehicle moving on a road curve

$$e + f \geq \frac{V^2}{15R} \dots\dots\dots (1)$$

Where $\frac{V^2}{15R}$ is called the centrifugal ratio :

e is the superelevation ;

f the coefficient of friction between the tyres and the road surface ;

V the speed of the vehicle in miles per hour ; and

R the radius of the curve in feet.

The centrifugal ratio can be balanced wholly by superelevation or friction or a combination of both. Balancing wholly by superelevation will result in large superelevation, inconveniencing slow moving traffic.

On the other hand, if there is no superelevation, the friction alone will have to counteract the centrifugal force and the resulting high value of friction will wear out tyres. Therefore it is desirable to balance the centrifugal ratio partly by superelevation and partly by friction. It is considered proper to design the superelevation so that it will equal the centrifugal ratio at $\frac{3}{4}$ th the design speed.

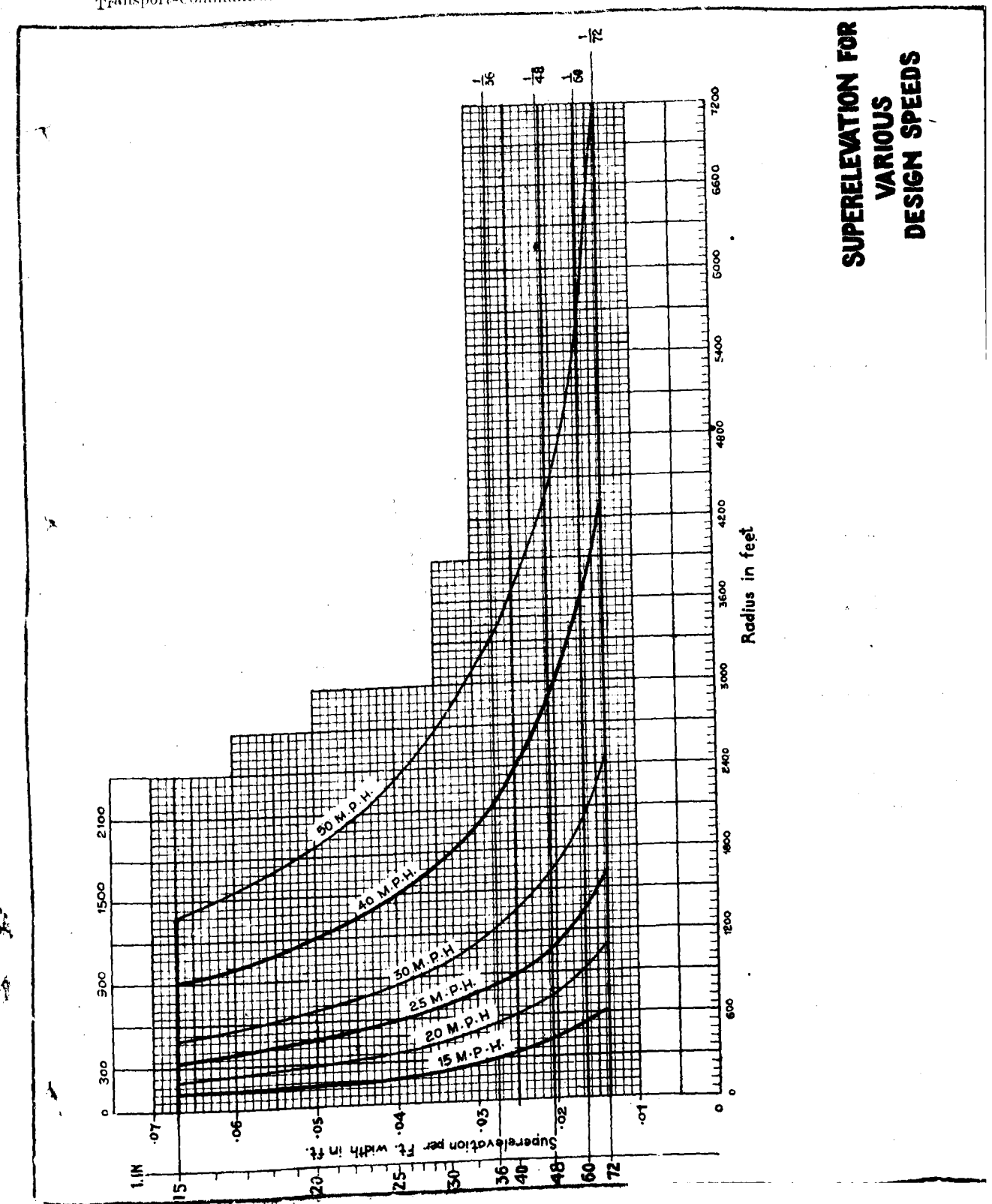
$$\begin{aligned} \text{Thus } e &= \left(\frac{3}{4} \frac{V}{V_d} \right)^2 \\ &= \frac{3 V^2}{80 R} \dots\dots\dots (2) \end{aligned}$$

To suit bullock cart traffic, the value given by the above formula is limited to a maximum of 1 in 15.

The graph on the opposite page shows the superelevation for the various design speeds and radii of curves.

In the October issue on page 20
please read equation (1) as

$$F = M \times \frac{V^2}{g} \dots\dots\dots (1)$$



**SUPERELEVATION FOR
VARIOUS
DESIGN SPEEDS**

OPERATION OF CIVIL ENGINEERING PLANT*

Table No. 2

Fuel and Lubricants Consumed per hour by Various Types of Plant

Type of plant	Fuels				Lubricating oil, gallons per hour	Grease lb per hour
	Diesel oil, gallons per hour	Vaporising oil gallons per hour	Petrol, gallons per hour	Coal, cwt. per hour		
Bituminous mixing plant :						
Barber-Green Model 484, normal duty	...	...	3.00	...	0.026	0.05
Barber-Green Model 842, normal duty	...	...	2.20	...	0.022	0.04
Concrete mixers :						
5/3½	0.20	...	0.36	...	0.010	0.03
7/5	0.30	...	0.54	...	0.012	0.03
10/7	0.40	...	0.72	...	0.015	0.04
14/10	0.50	...	0.90	...	0.020	0.04
21/14	0.60	...	1.08	...	0.022	0.05
Ransome 28s	...	...	1.40	...	0.025	0.04
Ransome 56s	...	...	2.60	...	0.03	0.05
Concrete spreader :						
Barber-Green Model SA	...	...	1.20	...	0.02	0.04
Concrete finisher :						
Barber-Green Model Xc	...	...	1.20	...	0.02	0.04
Compressors						
210 cu. ft/min.	0.70	...	1.26	...	0.018	0.04
315 cu. ft/min.	0.90	...	1.60	...	0.025	0.05
Cranes :						
8 cwt. petrol	...	...	0.80	...	0.02	0.03
12/15 cwt. petrol	...	...	1.00	...	0.02	0.03
20 cwt., petrol	...	...	1.40	...	0.03	0.04
3 ton, steam	...	...	...	1.00	0.02	0.04
Dumpers :						
2 cu. yds.	0.48	...	1.08	...	0.02	0.040
2½ cu. yds.	0.52	...	1.18	...	0.022	0.055
3 cu. yds.	0.60	...	1.26	...	0.024	0.060
Hand tampers with vibrators per unit	...	...	0.33	...	0.01	0.01
“ Hilift ” shovel, ½ Cu. yds.	0.60	...	1.10	...	0.022	0.04
Hoist, petrol	...	...	0.70	...	0.020	0.04

* Concluded from page 25 of October issue.

Type of plant	Fuels				Lubricating oil, gallons per hour	Grease lb per hour
	Diesel oil, gallons per hour	Vaporising oil gallons per hour	Petrol, gallons per hour	Coal, cwt. per hour		
Locomotives :						
10 h.p.	0.60	...	0.90	...	0.02	0.04
20 h.p.	1.00	...	1.80	...	0.025	0.05
Shunting, 4 to 8½ ft. gauge	...	...	...	1.20	0.01	0.06
Lorries :						
2 ton	0.33	...	0.70	...	0.02	0.04
3 ton	0.40	...	0.80	...	0.022	0.04
4 ton	0.50	...	0.90	...	0.024	0.05
5 ton	0.60	...	1.00	...	0.026	0.05
6 ton	0.70	...	1.20	...	0.028	0.06
Mechanical trenching plant :						
Allen Parsons, 12/18	0.70	...	1.26	...	0.03	0.04
Allen Parsons, 16/60	0.90	...	1.60	...	0.04	0.05
Barber-Greene Model 144c	...	...	2.30	...	0.03	0.05
Cleveland Model 110	...	...	1.40	...	0.02	0.04
Mechanical excavators, shovels, skimmers, draglines, etc. :						
1 cu. yd. bucket	0.50	1.00	...	...	0.02	0.04
3/8 cu. yd. bucket	0.60	1.12	...	...	0.022	0.04
½ cu. yd. bucket	0.72	1.30	...	...	0.024	0.05
5/8 cu. yd. bucket	0.86	1.54	...	...	0.026	0.05
¾ cu. yd. bucket	1.02	1.83	...	...	0.028	0.06
7/8 cu. yd. bucket	1.20	2.16	...	...	0.03	0.07
1 cu. yd. bucket	1.40	2.52	...	...	0.032	0.08
Pumps :						
3 in., petrol	...	...	0.50	...	0.02	0.01
4 in., petrol	...	...	0.60	...	0.03	0.02
5 in., petrol	...	...	0.80	...	0.04	0.03
6 in., petrol	...	...	1.10	...	0.05	0.04
Rollers :						
2 ton	0.33	...	0.70	...	0.02	0.04
4 ton	0.60	...	1.08	...	0.025	0.05
6 to 8 ton	0.90	...	...	0.90	0.03	0.06
10 ton	1.30	...	...	1.10	0.04	0.08
Tractors :						
Caterpillar D4, 35-40 h.p.	1.80	...	...	...	0.04	0.50
Caterpillar D6, 45-60 h.p.	2.50	...	...	...	0.06	0.60
Caterpillar D7, 65-75 h.p.	4.00	...	...	...	0.09	0.70
Caterpillar D8, 90-110 h.p.	5.00	...	...	...	0.15	0.80

The data incorporated in these tables have been carefully computed in conjunction with recorded results, and may be used as they stand in building up the working cost per hour of the plant to which they relate.

In order to indicate the manner in which to build up the working cost per hour of a particular item of plant making use of these tables two typical examples are shown, depreciation being allowed for in each case.

Example No. 1

Compute the working cost per hour of a 5-ton petrol lorry, given the following particulars:

Cost of the lorry	Rs 13,500
Interest on outlay	5 per cent per annum
Working hours per annum	2,200
Years of life	3
Insurance premium, cost per annum	Rs 225
Licence premium, cost per annum	Rs 450
Petrol, cost per gallon	Rs 3
Lubricating oil, cost per gallon	Rs 5/4/-
Grease, cost per lb	Rs -/12/-
Operator's effective wage rate per hour	Rs 2 10/-

(a) Depreciation:

Capital cost	Rs 13,500
Allow 5 per cent interest for three years	Rs 2,025
	Rs 15,525
Allowing a three years' life, of 2200 working hours, depreciation per hour	$\frac{15,525}{3 \times 2200}$
	= Rs 2/5 per hour.

(b) Repairs and Renewals:

Referring to the Table* the cost of annual repairs and renewals is given as 12½ per cent of the capital cost based on a three-year working life of 2200 hours per annum.

∴ Repairs and renewals cost per working hour	$\frac{12\frac{1}{2} \times 13,500}{100 \times 2,200}$
	= Rs -/12/- per hour.

(c) Insurance and licence:

Cost of annual insurance	Rs 225
Cost of annual licence	Rs 450
	Rs 675

$$\therefore \text{Cost per working hour} = \frac{675}{2200} = \text{Rs } 0/5/- \text{ per hour.}$$

(d) Fuel and lubricants:

Referring to the Table shown on page 22, the cost of the fuel and lubricants per hour is:

Petrol, 1.00 gallons at Rs. 3/- per gallon	= 3/-/-
Lubricating oil, 0.026 gallons at Rs 5 4/- per gallon	= -/2/-
Grease, 0.05 lb at -/12/- per lb	= -/1/-
Total	= Rs 3/3/- per hour.

Summarising, therefore, the working cost of the lorry per hour is:

	Rs	As	Ps
(a) Depreciation	2	5	0
(b) Repairs and renewals	0	12	0
(c) Insurance and licence	0	5	0
(d) Fuel and lubricants	3	3	0
(e) Operator's effective wage rate	2	10	0
Total	9	3	0
			per hour.

Example No. 2

Compute the working cost per hour of a 3/8 cu. yd. mechanical excavator, given the following particulars:

	Rs	A.	P.
Cost of the plant	52,500	0	0
Interest on outlay	5 per cent per annum		
Working hours per annum	1800		
Years of life	5		
Diesel oil, cost per gall.	Rs. 1/2/-		
Lubricating oil, cost per gallon	Rs 5/10/-		
Grease, cost per lb	Rs 1/2/-		
Operator's effective wage rate per hour	Rs 3/6/-		

(a) Depreciation:

Capital cost of the plant	Rs 52,500	0	0
Allow 5 per cent interest for five years	13,135	0	0
	Rs 65,625	0	0

On a life of 5 years, of 1800 working hours each, depreciation

$$\text{per working hour} = \frac{65,625}{5 \times 100} = \text{Rs } 7/5/-$$

(b) Repairs and Renewals:

Referring to the table on page *, the cost of repairs and renewals is given as 7½ per cent of the capital cost based on a five-year life of 1800 working hours per annum.

$$\begin{aligned} \text{Repairs and renewals} &= \frac{7\frac{1}{2} \times 52,500}{100 \times 1800} \\ \text{cost per hour} &= \text{Rs } 2-3-6 \text{ per hour} \end{aligned}$$

(c) The cost of fuel and lubricants:

Referring to the Table on page 22, the cost of the fuel and lubricants consumed by the plant per hour is given by:

	Annas	per hour
Diesel oil, 0.60 gallons at Rs 1/2/- per gallon	10.80	
Lubricating oil, 0.022 gallons at Rs 5/10/- per gallon	1.98	
Grease, 0.04 lb at Rs 1/2/- per lb	0.72	
	13.50	
		= Rs 0/13/6 per hour.

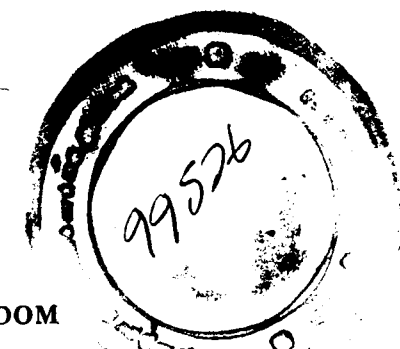
Summarising, therefore, the all-in working cost of the plant per hour is:

	Rs.	A.	P.
(a) Depreciation	7	5	0
(b) Repairs and renewals	2	3	6
(c) Fuel and lubricant cost	0	13	6
(d) Operator's effective wage rate	3	6	0
Total	13	12	0
			per hour.

The Unit Cost of the Work Performed by Plant

Knowing the "working cost of a plant" and its "normal output" per hour, the "unit cost" of the work it performs is given by:

$$\begin{aligned} \text{Plant unit cost} &= \frac{\text{Working cost of the plant per hour}}{\text{output of the plant per hour}} \end{aligned}$$



WORDS OF WISDOM

He who resolves never to ransack any mind but his own will soon be reduced, from mere barrenness, to the poorest of imitations. He will be obliged to imitate himself, and to repeat what he has often repeated.

Sir Joshua Reynolds.

HERE AND THERE

1. ROAD PROGRAMME OF NEPAL

NEPAL is essentially an agricultural country, 95 per cent of her population being peasants. But the methods of agriculture are old and outmoded. Productivity of the country can be substantially increased if modern scientific techniques could be introduced. In order to meet this need and fulfil the task of economic upliftment of the masses the Government of Nepal have taken up a five-year Village Development Programme in conjunction with the Technical Co-operation Administration.

This Programme recognises need for speedy development of inland transportation. To meet this need, the Government of Nepal are proposing to construct motorable roads interlinking her districts in the Hills with the Terai. To this end, the construction of six longitudinal and two lateral roads is under consideration. Since the projects involve heavy and long-term financing, the Government of Nepal contemplate seeking aid from the Government of India under the Colombo Plan.

Kathmandu Bhainse Road

A road linking Kathmandu with Bhainse on the Indian frontier is under construction as a joint Indo-Nepalese venture. The total length of this road will be about 70 miles from Thankot to Bhainse. This road will link up routes along which potatoes are carried to Bhimphedi and from there on to India. Further, it opens much of the countryside where climate and altitude are favourable to development of horticulture.

Altitudes in Nepal vary from a thousand feet above the mean sea level in the Terai region to twenty thousand feet in the hills and there are tremendous possibilities of development which have not been exploited because of the lack of transport facilities.

The road programme, when completed, will not only open Nepal to the sight-seers and develop the tourist industry, but also greatly accelerate the trade between Nepal and India.

2. COUNTRIES DRIVING LEFT

These countries drive left:

Aden	Burma	Cyprus	Rhodesia
Anglo-Egyptain	Ceylon	Kenya	Sarawak
Sudan	England and Wales	Malaya	Scotland
Australia	Ethiopia	Malta	Siam
Bahamas	Fiji	Mauritius	South Africa
Barbados	Gambia	Mozambique	Sweden
Bechuanaland	Gold Coast	New Guinea	Tanganyika
Bermuda	Hong Kong	New Zealand	Tasmania
British Cameroons	Iceland	Nigeria	Trinidad
British Guiana	India	Northern Ireland	Uganda
British Honduras	Indonesia	Nyasaland	Zanzibar
British Somaliland	Jamaica	Pakistan	
British West Indies	Japan	Republic of Ireland	

3. LAYOUT OF NUMBERS

TO facilitate the reading of large values the figures should be separated into appropriate groups. Gaps, not commas, should be used for this purpose. A sequence of four figures not broken by a decimal point need not, in general, be separated into groups unless there is special reason to do so; but a sequence of five or more figures, occurring in textual or tabular matter, is preferably separated into smaller groups. For general scientific purposes (mathematical tables excluded) grouping by threes starting from the decimal point towards the left or the right is recommended. This follows an international recommendation made by the 9th Conference General des Poids et Mesures in 1948.

Examples:

4-figure sequences not broken by the decimal point. Recommended layout for textual and tabulated matter:

9999·0001
0.0002
1000·6435
1000.

Sequences of 5 or more figures upto and including 9 figures.

Use	Do not use	
20 000	20000	20,000
0.787 65	0.78765	0.787,65
10,000.000 01	10000.00001	10,000.000,01
125,531.135 731	125531.135731	125,531.135,731
12,568 731 4	12,5687314	12,568,731,4
0.002 560 33	0.00256033	0.002,560,33
7,154 666 244	7,15466244	7,154,666,244

4. PERMANENT INTERNATIONAL ASSOCIATION OF ROAD CONGRESSES

AT the meeting of the Permanent International Commission of Road Congresses held in January last, Monsieur A. Rumpier, Director of Roads Minister of Works, France, was unanimously elected Public President in succession to Monsieur

D. Boutet, Past-President of the Board of Highways Department, who resigned. The Commission accepted the invitation of the Turkish delegate to hold the Tenth International Conference at Istanbul, Turkey.

5. FUEL CONSUMPTION

THE influence of harsh driving and poor vehicle maintenance on petrol consumption has been studied by the Road Research Laboratory, United Kingdom, in collaboration with the technical staff of "The Commercial Motor" by tests on a 5-ton lorry. The vehicle was driven so as to simulate careful and harsh driving when it was partially laden, fully laden and overloaded. Tests were also made in

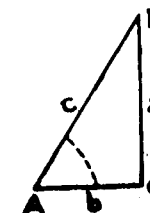
which each of a number of defects was simulated in turn. These comprised tyres partially deflated, a faulty plug, retarded ignition and a poorly adjusted carburettor. The tests showed that a combination of harsh driving and improper maintenance increased the petrol consumption of the particular vehicle used by as much as 50 per cent.

(Extracted from 'Road Research 1952').

6. ANGLES LAID OUT IN FIELD WITH STEEL TAPE ALONE

by Marwin Gates

SUPPOSE we know the perimeter k and one acute angle A of a right-angled triangle ABC. We can evaluate the sides a , b , and c of the triangle in terms of k and A as under:



$$k = a + b + c \dots\dots\dots(1)$$

To find a , eliminate b and c from (1) by putting their values in terms of a & A , viz., $b = a \cot A$ and $c = a \operatorname{cosec} A$. We get:

$$a = \frac{k}{1 + \cot A + \operatorname{cosec} A}$$

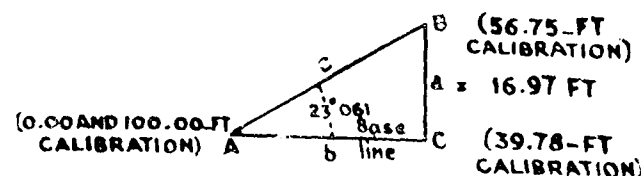
Similarly it can be proved that

$$b = \frac{k}{1 + \tan A + \sec A}$$

$$\text{and } c = \frac{k}{1 + \sin A + \operatorname{cosec} A}$$

Problem: Given a steel tape 100 feet long, to lay out an angle of $23^{\circ}06'$ at A with the line AD .

Solution:



$$a = \frac{100.00}{1 + 2.3445 + 2.5488} = 16.97 \text{ ft}$$

$$b = \frac{100.00}{1 + 0.42654 + 1.0872} = 39.78 \text{ ft}$$

$$c = \frac{100.00}{1 + 0.39234 + 0.91982} = 43.25 \text{ ft}$$

100.00 ft
(check)

Field Procedure.

1. The 0.00 and 100.00 ft calibrations are held on points A of the base line AC .
2. At point C , 39.78 ft from A along the given base AD , the tape is either held or guided around by a nail.

3. The engineer at B pulls the tape taut with a nail or pin at the 56.75 ft calibration. Keeping the tape horizontal, he bobs down to accurately locate point B .

(Extracted from *Civil Engineering*, August 1953).

7. MATS TO REDUCE SCOUR AT BRIDGE PIERS

EXPERIMENTS to investigate the possibility of protecting bridge piers in erodible material from dangerous scour by means of flexible mats placed around the piers have been made by the Rocky Mountain Hydraulic Laboratory in co-operation with the U. S. Bureau of Public Roads (U. S. A.). Observations of the performance of a number of types of mats were made with the aid of a 6-in. dia. transparent pier in a flume 80 in. wide, depths of flow ranging up to 18 in. The bed was of non-cohesive material and observations were made under both equilibrium and degrading conditions.

It was found that the two greatest hazards to the effective functioning of such mats were:

- (1) tendency of upward currents to move material up through the mat, and
- (2) tendency of the mat to bridge or buckle due to bottom irregularities, thus opening up underchannels through which bed material is easily transported away.

The upward currents result from underflow driven by the pressure differential existing between the stagnation zone and nearby zones where the pressure may even be less than hydrostatic. At the point where this underflow rises the bed may become "quick." It is impractical to seal off the underflow with an impervious mat because the greatest pressure occurs next to the pier where water-tightness would be difficult to attain, and because the mat would have to be extremely thick to seal off possible upward flow by sheer weight.

The necessity for the mat to conform to bottom irregularities may arise at the time of installation, if that be attempted during flood, or even after installation under ideal conditions, during the subsequent passage of fortuitous bed irregularities such as sand waves.

The best protection was afforded by a heavy completely flexible mat with comparatively small openings. Proto-

type construction of such a mat could be from worn chains, which with hot-dip galvanising should have long life. Placing gravel under the mat at the time of installation greatly improved its effectiveness. The size of the gravel was such that it would be unable to pass through the mat. The combination provided

complete protection against local scour around the pier until the bed of the entire stream had degraded to such a low elevation that the chain mat was no longer able to follow the bed down around its periphery.

(Extracted from *"Commonwealth Engineer"*, June, 1951).

8. SEPARATE CYCLE TRACKS

THE practice regarding provision of separate tracks for cyclists in some of the European countries is as under:—

Denmark	Separate cycle tracks are normally provided on all roads.
Netherlands	-do-
United Kingdom	When traffic exceeds 500 cycles per day.
Sweden	-do-
France	-do-
Switzerland	When traffic exceeds 700 cycles per day.

The Working Party on Highways of the Sub-committee on Road Transport of the Inland Transport Committee of the Economic Commission for Europe consider that the segregation of cyclist traffic should not only depend on the density of the cycle traffic but the density of other traffic should be taken into consideration as well.

(Extracted from the report on the 2nd Session of the Working Party).

CLEAR THINKING

A college professor of logic was attempting to teach his young son the principles of clear thinking and the necessity for defining all terms. He pointed to a wall clock which had just struck the hour.

"Now if I were to take a hammer and smash that clock," he said, "could I be arrested for killing time?"

"No," said the lad quickly. "It would be self-defence."

The professor frowned. "How do you figure that out?"

"Because," answered the boy, "the clock struck first."

CURRENT LITERATURE

ABSTRACTS

625.7. INTER GOVERNMENTAL CO-OPERATION IN HIGHWAY AFFAIRS — *A recommended action programme for effective relationships, Special Report 9 of the Highway Research Board, U. S. A.*

The provision of adequate highway facilities is the responsibility of various governmental units, requiring co-ordination and co-operation among the various highway agencies. However, there are a few guides to the highway administrator as to the fundamentals on which such relationships are to be founded. Therefore a special Committee of Highway Research Board was constituted to study the problem and the Report is the outcome of their labours.

The recommendations of the Committee are given in the report under the following heads:—

- (1) Highway classification.
- (2) Uniform standards.
- (3) Planning and Programming.
- (4) Organization and Management.
- (5) Authority and Responsibility.

It is hoped that the application of these recommendations would yield.

- (1) a balanced highway programme;
- (2) greater value for funds spent;
- (3) better utilization of knowledge and experience of highway engineers of all levels; and
- (4) more efficient administration.

625.71 FACTORS AFFECTING THE RIDING QUALITIES OF MACHINE-LAID CONCRETE ROADS by R. H. H. Kirkham; Proceedings of The Institution of Civil Engineers, Part II, Vol. 2, Number 3, October 1953.

Measurements made by the Road Research Laboratory had shown that the riding qualities of machine-laid concrete roads are generally not as good as that of hand-finished work. This study revealed that better results might be expected from

closer control of various constructional operations. Therefore studies were made during the construction of two roads in which two different spreading and two different finishing machines were employed.

The Paper gives the details of construction and tests made with a profilometer specially designed to record irregularities of the concrete surface after each pass of the finishing machine. During these tests the accuracy of setting formwork and its deflexions under machines were also studied.

Some of the important conclusions given in the Paper are:—

(i) The evenness of the finished surface depends upon the evenness of spreading. Existing spreading machines do not give concrete of uniform density and it is necessary to control the method of their operation carefully.

(ii) The effectiveness of the finishing machines for removing irregularities left by the spreading depended upon the weight, shape, and method of mounting the oscillating screed.

(iii) Even with high quality workmanship and good supervision the forms were sometimes as much as 3/8th of an inch out of alignment when set by honing. Settlement under the machines on some subgrades may increase the amount of unevenness.

(iv) Unevenness at dummy joints is the least.

A list of references and the discussion on the Paper at the Road Engineering Division meeting held on 31-3-1953 is included.

625.732.1 THE DESIGN OF MOTOR. by WAYS T. E. Hutton; Proceedings of The Institution of Civil Engineers, Part II, Vol. 2, Number 3, October 1953.

The Paper sets out the basic principles of design which are appropriate for motor-

ways. Preliminary reconnaissance and detailed survey of alignment are given under the headings: Surveys, Soil Surveys, Sampling and Testing, and Fitting the Road to the Landscape. A few of the more important points in landscaping given in the Paper are:—

(1) If a vertical curve is not entirely on a straight section of the road, efforts should be made to extend it from the commencement to the end of a corresponding horizontal curve. This is not always possible without excessive earthwork and in such cases a little latitude is permissible, but the aim should be to obtain a reasonable balance of the two curves.

(2) A combination of short curves and straights should be avoided. Horizontal and vertical curves should be as long as possible and adjacent curves should be of comparable length.

(3) Perspective views of the road ahead need either background or continuity, and therefore the road should not form part of the horizon.

(4) Long straights are permissible on level ground but tend to be monotonous, it is therefore an advantage if they can be sited to give a view ahead of some prominent feature which need not necessarily be situated centrally.

(5) Curves in the same direction connected by a straight do not look well, and

should be avoided unless they are hidden from each other by a fold in the ground.

(6) Abrupt development of superelevation will introduce a visual "kind" unless the rate at which it is applied does not exceed one per cent over the general gradient.

(7) The treatment of the slopes of cuttings and embankments is an important factor in merging a new road into the landscape.

Recommendations about the number, and width of carriageways, central reservations, kerbs, roadside tree planting, are given in the Section "Layout".

Recommendations about the design speed to be adopted, minimum radius of curvature, visibility, superelevation and transition curves, gradients, are included in the Section "Design".

Under the heading "Junctions", it is emphasised that standard designs cannot be rubber stamped on to the drawings and that careful consideration of the topography and traffic conditions at each site is necessary to produce a layout wholly suitable to individual problems and requirements.

A list of bibliography is appended.

Discussions on the Paper are also included.

BOOK REVIEW

'The British Commercial Vehicle Industry', Fourth Edition, pages 289, published by the Temple Press Ltd., Bowling Green Lane, London, E.C. 1; price 42 shillings net.

The book contains a comprehensive review of the products of British makers

of commercial vehicle chassis, trailers, engines, bodies, components, and equipment which are offered for export.

Users and prospective buyers would find the publication useful and informative.

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FUEL CONSUMED AT A SIGNAL STOP

The fuel wasted at a signal stop by a car travelling 35 miles per hour is sufficient to carry it more than 1.25 furlongs.

BUDGETS AND ADMINISTRATION REPORTS

1. GOVERNMENT OF UTTAR PRADESH BUDGET FOR THE YEAR 1953-54

The following extracts relating to civil works have been taken from the Uttar Pradesh Budget for the year 1953-54.

	(Rs lakhs)		
	Actuals 1951-52	Revised Estimates 1952-53	Budget Estimates 1953-54
I. Revenue (Civil Works)			
1. Rents	2.70	2.72	2.72
2. Ferry Receipts	21.18	20.00	20.00
3. Tolls on roads	0.42	0.20	0.20
4. Recoveries of expenditure	1.21	1.65	1.65
5. Transfer from Central Road Fund Account	63.13	29.10	26.00
6. Miscellaneous	13.20	13.50	12.80
7. Deduct—Refunds	-1.65	-0.50	-0.50
Total	100.19	66.67	62.87
II. Expenditure (Civil Works) met from Revenue			
1. Original Works	18.75	39.98	39.21
2. Repairs	217.60	259.14	268.17
3. Tools and plant	10.34	5.00	4.77
4. Suspense	-36.75	—	—
5. Improvement of communications (financed from Central Road Fund Account)	63.13	29.10	26.00
6. Capital Outlay on Civil Works met from Extraordinary Receipts	—	—	37.30
7. Establishment	20.87	27.21	27.24
8. Grants-in-aid	26.80	34.39	35.08
Total	320.74	395.40	437.77
III. Expenditure (Communications)			
(a) Original Works—financed from :			
1. Ordinary Revenues	-0.92	3.74	2.63
2. U. P. Road Fund	49.88	100.68	112.00
3. Sugar Research & Labour Housing Fund	—	25.00	30.00
Total	48.96	129.42	144.63

	(Rs lakhs)		
	Actuals 1951-51	Revised Estimates 1952-53	Budget Estimates 1953-54
(b) Repairs—financed from :			
1. Ordinary Revenues	204.98	244.00	252.63
2. U. P. Road Fund	0.07	0.06	0.06
Total	205.05	244.06	252.69
Original Works and Repairs --			
Total	254.1	373.43	397.32
(c) Capital Expenditure—Outside Revenue Account	51.61	8.63	20.61
IV. Revenue from Roads			
1. Receipts under the Motor Vehicles Act	57.31	60.87	92.47
2. Receipts from Sales Tax on motor spirit	25.39	25.12	25.12
Total	82.70	85.99	117.59

A BRIEF REVIEW OF THE U. P. BUDGET

THE total revenue receipts of U.P., for 1953-54 are estimated at Rs 74,38.25 lakhs and revenue expenditure at Rs 78,80.06 lakhs with a consequent deficit of Rs 441.81 lakhs. The revised estimates for 1952-53 indicate a balanced position with both revenue receipts and revenue expenditure amounting to Rs 66,40.68 lakhs.

Revenue expenditure on civil works for 1953-54 estimated at Rs 437.77 lakhs forms 5.9 per cent of total revenue in that

year. The corresponding percentages for the two preceding years 1952-53 (Revised Estimates) and 1951-52 (Actuals) are 6.0 and 5.8 respectively.

Expenditure on communications (original works and repairs, including expenditure from the U.P. Road Fund) during 1953-54 is estimated at Rs 397.32 lakhs and as a fraction of total revenue it amounts to 5.3 per cent. The corresponding percentages for the two previous years (1951-52) are 5.6 and 4.6 respectively.

DEFINITIONS OF HIGHWAY ENGINEERING TERMS

- ALIGNMENT:** The course along which the centre line of a roadway is located in plan.
- CENTRE-LINE:** The median axis of a road, bridge, culvert, sewer, or drain, in the direction of its length.

2. GOVERNMENT OF BIHAR P. W. D. BUDGET FOR THE YEAR 1953-54.

The following extracts relating to civil works have been taken from the Government of Bihar Budget 1953-54.

	(In lakhs of Rs)		
	Actuals 1951-52	Revised Estimates 1952-53	Budget Estimates 1953-54
I Revenue (Civil Works).			
1. Rents	9.45	7.73	7.78
2. Recoveries of expenditure	2.85	2.12	2.36
3. Miscellaneous	5.18	2.40	2.33
4. Transfer from Central Road Fund	26.49	22.64	21.99
5. Ferry Receipts	0.14	0.57	0.56
6. Deduct—Refund	—0.48	—0.08	—0.02
Total	43.63	35.38	35.00
II. Expenditure (Civil Works including communications).			
1. Original works			
(a) Buildings	29.35	97.69	129.62
(b) Communications	22.38		
(c) Miscellaneous	8.93		
2. Expenditure under the 5-year plan	413.77	296.59	286.31
3. Repairs			
(a) Buildings	37.89	35.05	33.38
(b) Communications	34.16	17.40	14.97
(c) Miscellaneous	1.73	0.90	0.81
4. Suspense	23.68	—16.42	18.17
5. Grants-in-aid from Central Road Fund	—	22.64	21.99
6. Grants-in-aid—Ordinary	46.66	43.87	39.57
7. Lump addition for regrant of lapses	—	0.25	0.25
8. Establishment	24.00	21.27	16.97
9. Tools & plant	7.26	10.50	11.68
Total	649.76	529.74	573.72
III. Revenue from Roads.			
1. Receipts under Motor Vehicle Act	5.39	4.65	4.65
2. Passenger & goods Transport Tax	11.67	17.00	18.00
3. Sales Tax on Motor Spirit	—	34.00	41.44
Total	17.06	55.65	64.09

A BRIEF REVIEW OF THE BIHAR BUDGET.

THE total revenue receipts of Bihar for the year 1953-54 are estimated at Rs 33,00.00 lakhs and revenue expenditure at Rs 33,33.98 lakhs with a consequent deficit of Rs 33.98 lakhs. The revised estimates for 1952-53 indicate a surplus of Rs 4,40.98 lakhs with the revenue receipts amounting to Rs 35,76.82 lakhs and expenditure to Rs 31,35.84 lakhs.

Revenue expenditure on civil works for 1953-54 estimated at Rs 573.72 lakhs forms 17.4 per cent of total State revenue in the year. The corresponding percentage figures for the two preceding years 1952-53 (Revised Estimates) and 1951-52 (Actuals) are 14.8 and 18.9 respectively.

BECAUSE her husband was sleeping badly the woman went to her physician and consulted him about the medicine which could be prescribed for him.

The physician handed her a box of tablets and said: "Here are some sleeping tablets. Your husband should have absolute quiet."

"When do I give the tablets to him?" queried the woman.

"Oh, no, you don't give the tablets to him. You take them yourself."

FIRST PRIORITY

After a tour of India's north-eastern border Shri Jawaharlal Nehru said in a press conference at Delhi on the 2nd November 1952:

The tribal folk are a very fine lot, very attractive, hard working and intelligent. What they want is,

first of all, communications,
secondly, schools,
and thirdly, hospitals and dispensaries

LIST OF APPROVED WORKS ON NATIONAL HIGHWAYS

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2.	791 BM 8	Construction of the Pirojpur-Prantij Section of the Bombay-Rajasthan-Delhi Road (National Highway No. 8).	23.93
3.	793 BM 8	Acquisition of additional land for widening miles 6/0 to 11/3 (state miles 191/0 to 196/3) of the Bombay-Ahmedabad Road (N. H. No. 8).	0.97
4.	797 BM 8	Construction of a bridge over the Dokar Khadi in the Pardi-Kim Junction Section of the Bombay-Ahmedabad Road (N. H. No. 8).	0.62
MADHYA PRADESH			
5.	791 CP 6	Resectioning and black topping of Nagpur-Amravati road, a section of N.H. No. 6 (length 31½ miles) in Nagpur District.	5.24
6.	795 CP 7	Survey and preparation of project for the construction of a bridge over Wana river on N. H. No. 7 in Wardha District.	0.08
UTTAR PRADESH			
7.	794 UP 28	Electrification of the Inspection House at Basti on Lucknow-Gorakhpur road (N. H. No. 28).	0.03
WEST BENGAL			
8.	796 BG 31	Widening the Singheehora Bridge No. 7 and approaches thereto in the 8th mile of Siliguri Sevoke Section of National Highway No. 31.	0.59
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9.	798 HP 22	Widening of 2 ft wide trace to 6 ft track on H. T. Road, Section Wangto to Chini.	1.43

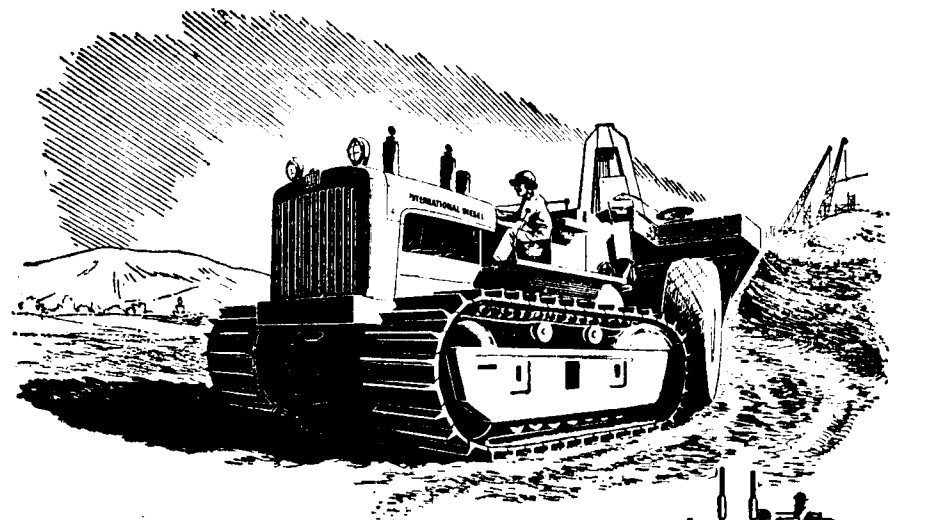
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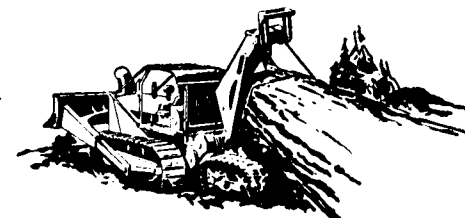
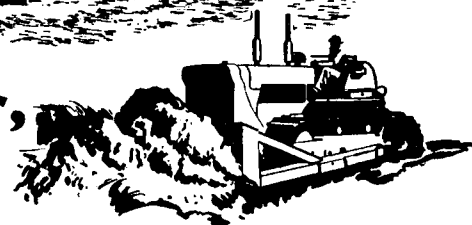
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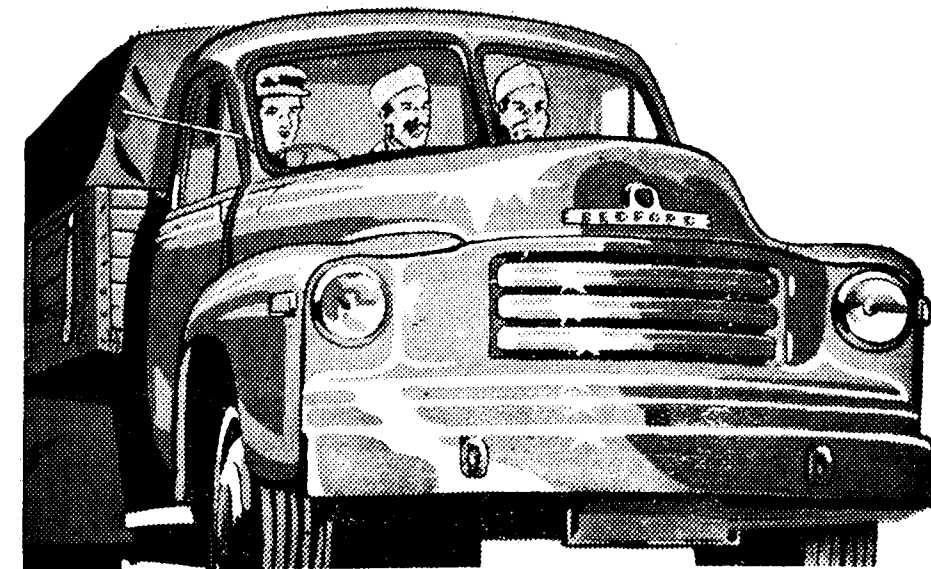
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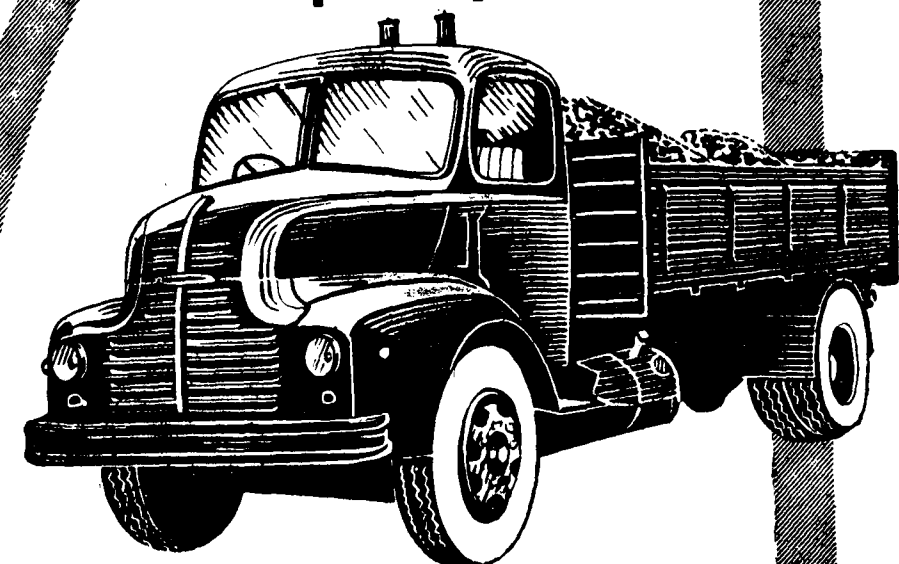
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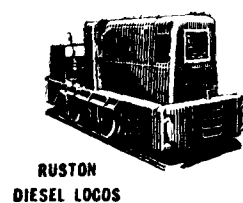
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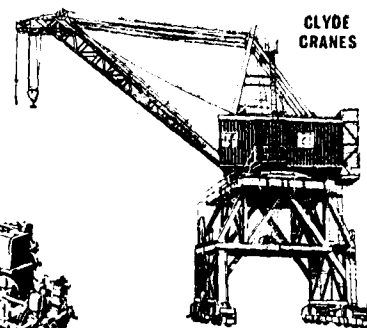
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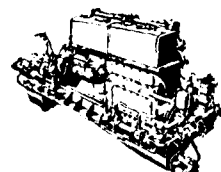
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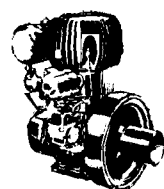
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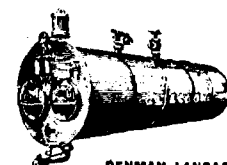
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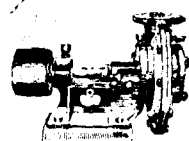
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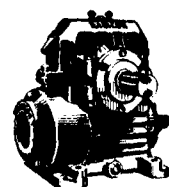
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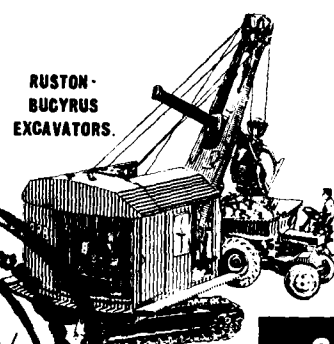
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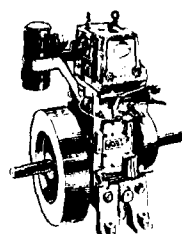
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