

# 31 Transport-Communications

## MONTHLY REVIEW

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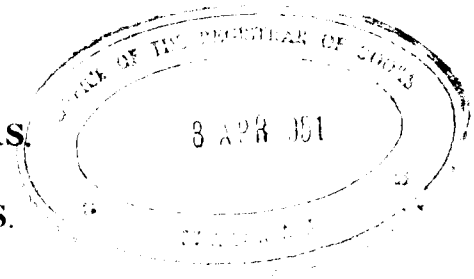
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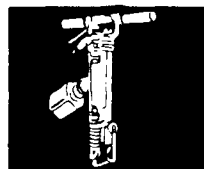
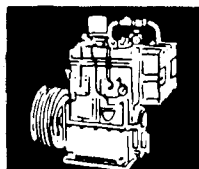
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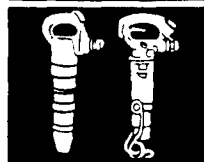
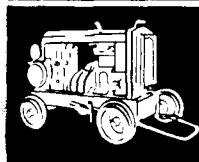
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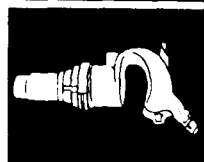
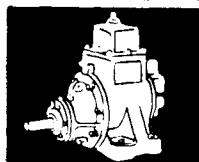
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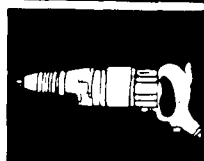
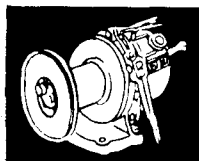
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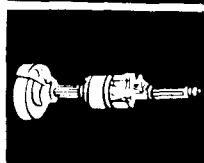
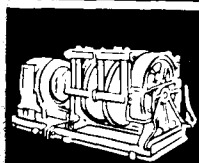
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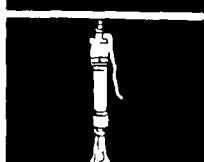
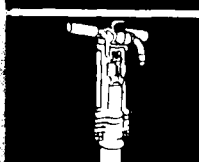
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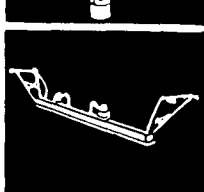
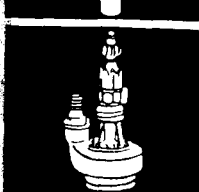
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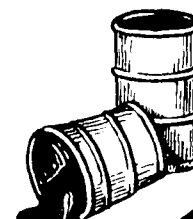
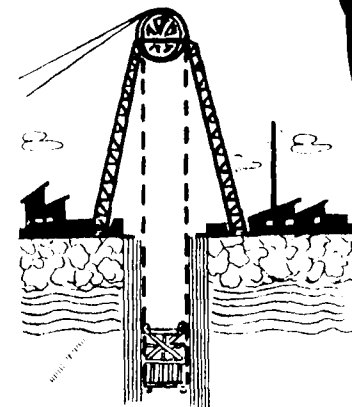
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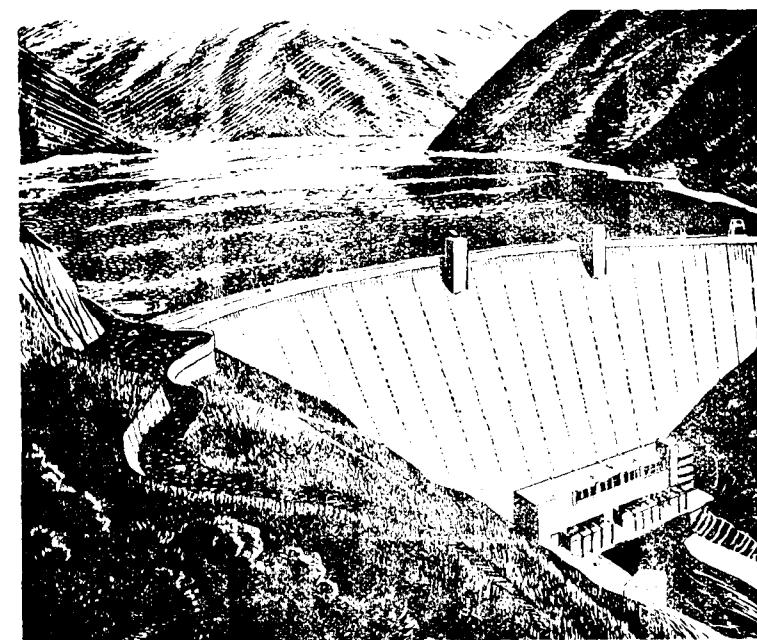
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## **GROUNDNUT ENGINEERING**

### *Editorial*

FROM groundnuts to engineering is a far cry. That is what the sponsors of East Africa's groundnut scheme seem to have thought when they set about that scheme in 1947.

Groundnuts, like jute and rice, have in the past been almost exclusively produced by completely un-mechanised peasant farmers. To switch on to complete mechanisation, without preliminary tests in the shape of a pilot scheme, would be asking for trouble. But such mistakes do occur when engineers are kept out at the initial planning stages. Often the realisation of this omission comes at a tragically late stage, as it did in the case of the ill-fated East African Groundnut Scheme.

### **The Fatal Omission**

Even in this enlightened age, those in authority everywhere (except in the U.S.A. where engineers are very largely in authority) do not seem to realize that it is to the engineers they must turn if they want to overcome the forces of nature, for it is the engineer who has been trained to deal with those forces. In the whole organization assembled together in East Africa to control an investment of £23,000,000, no one possessed those engineering qualifications which were essential for the success of the project.

It has now been confessed by those responsible that they "in the beginning failed completely to realise that the scheme was essentially a large scale engineering project, out of which an agricultural scheme would emerge. At every point success depended upon efficient engineering, whether in clearing, construction, road making, water-supply, maintenance of heavy tractors and other equipment, or efficient mechanization of crops. Yet in our original advance party, which came out to East Africa in February 1947, there was no engineer on the Managing agency staff. We worked on the principle that the contractors could provide all that was needed. To me this error, which I fully shared, appears now almost the biggest disaster of the early days.

"We started the contractors on work without any organization for specifying their tasks or checking their results, either technically or in terms of costs."

It should be abundantly clear that the party needed not one engineer but perhaps should have been composed entirely of engineers—civil, mechanical, electrical and, most important in this case, some agricultural engineers.

## Mistakes

Most of the mistakes committed on the scheme would have been avoided if there had been an engineer guiding it. One such mistake was the reported placing of a bulk order for 300 tractors of an untried type made out of war-time junk (spare parts of tanks). The order is said to have been placed on the basis of a demonstration with a prototype. Now, a tank is a war machine produced and run regardless of costs—cost of running and maintenance, cost of replacements, etc. It is designed only to move itself and is not expected to operate continuously for long periods under severe agricultural conditions. An engineer would surely have placed a trial order for a small number only in the first instance.

Another mistake was committed in regard to the measures adopted to guard against soil erosion by wind and rain. Windrows of bush, stumps, and roots were placed round the contours with the result that very irregularly shaped areas were formed which imposed delays and difficulties and limited the use of large and efficient machines. Suggestions to make the windrows as nearly straight and parallel to one another as practicable fell on deaf (i.e. un-engineering) ears, but were adopted about a year later.

Then there was the very objectionable 'cost-plus' method of dealing with the contractors, the failure to keep proper accounts for stores records, the failure to build any road worth the name for their fleet of vehicles costing £1,294,230 which led to a rapid deterioration of the costly vehicles, and so on.

## The Moral

We leave it to our readers to draw their conclusions from this sorry narrative. To the engineers the moral is clear; will it be equally so to those others who hold the purse strings in India?

## WATCH DOGS

*I believe it would pay the profession (Engineering) to have not only the most active card indexes, science abstracts, and other machinery, but also a number of "Watch Dogs" each with a dual training of engineering and another branch of science to scout over the contiguous hinterland and draw special attention to possible sources of fruitful enquiry, experiment, analysis, or further research.*

—Lord Stamp—'Engineering'—Jan. 9, 1948.

## GOVERNMENT SUPPORT OF RESEARCH

(Extracted from "Science," December 30, 1949, Vol. 110).

\* \* \*  
SPEAKING "historically, research has always required a patron; it has never been regarded as self-supporting. We have become so accustomed to the idea of pure research conducted in universities that we tend to forget this fact. Actually, the universities have become the patrons. Research foundations, which operate more frankly in the older tradition, and certain industries have to some extent also assumed this role. If the funds from these sources begin to fail or the demand for research increases it is not surprising to find a search for ways to add to the traditional means of support. As a matter of fact, both conditions have been operative.

This parasitic view of research should not be regarded as humiliating; it puts research in the class with the creative arts, along with literature, music, painting, and sculpture. It may be that the time will come when it is generally realised that pure scientific research does in fact more than pay its way. Certainly a strong case can be made. But we should be careful not to fall into the error of assuming that great discoveries can be bought or that research in certain fields will never be profitable. I doubt whether any such practical justification of pure science will ever come about through the efforts of scientists themselves. There will always be too many among us who regard with apprehension or resentment the motivation of utility. This is probably as it should be, but we must admit that it is a source of misunderstanding when we ask for money.

\* \* \*  
Just how broad is the need for support of research? Does industry require or want government support of research? Should all colleges aim to do a fair proportion of research? If so, should all receive government support? If not, to which should support go? Should support be given to the institution as a whole, to particular schools or departments, or to qualified or promising individuals?

Or should it be on a different basis—support in certain fields of apparent promise or of interest to the donor? Whatever the answer, one has to reckon with the fact of limited government appropriations for the purpose.

And what of the problem of scientific manpower? If we grant the desirability or even the urgency of increased support of research, have we actually an adequate number of scientists and engineers for the job we need to do? It is commonly supposed that we have not, and that no considerable expansion in support of research can be started at once without serious dislocation of existing programmes. But this statement is only partly true, and, like all part-truths, can prove a serious obstacle to proper action. It is true that the need for competent scientists in industry and in government is great and that the available supply is low, and the same can be said with even more force with respect to the teaching of science at the more elementary levels. But conclusive evidence is available that there is still abundant room for support of research in colleges and universities, and this may take place with little if any detriment to existing programmes for combined research and development. Furthermore, by application of increased support along this avenue we should at the same time take the most direct step toward alleviation of the shortage of highly trained scientific manpower. This research is almost entirely basic in character, and is, consequently, universal in availability to all. Although assistance in this direction could not be counted on to produce immediate practical benefits, the by-products would in many cases lead to important applications. From straight content alone, the outcome would merely add to our store of scientific knowledge. But ideas beget ideas and we should thereby greatly enhance the likelihood of turning up untold treasures, still in the rough.

One may properly ask how it is possible that this situation may exist—an unfilled

demand for research scientists and yet an unfilled capacity for accomplishment of research. The answer is evidently that there are many competent scientists who prefer the academic environment and who cannot be induced to leave it. Among them are good research scientists who can, with the help of a graduate student or two and funds for equipment and materials, turn out good research without interfering seriously with their present share of educational work.

One consequence of the support now provided is an expressed need by the heads of educational institutions for general funds to restore the balance disturbed by support in special fields.

Questions like these should really be considered by a general agency, or by a special commission if the matter is urgent enough. There are other matters, too, which should be more the concern of such an agency, such as support of fellowships, underwriting scientific publications, dissemination of scientific information, exchange of scientists, aid to foreign science, and finally, firsthand scientific advice to the executive and the legislative branches of the government.

\* \* \*

Why is federal support of research a problem? There are three standard answers to this question: government support implies government control, it involves administrative red tape and confusion, it is erratic and uncertain. These objections must be met by such safeguards as can be managed in the arrangement set up.

At the risk of over-simplification, let me suggest that for our immediate purpose, federal support of research is a problem for two main reasons, which may be illustrated by two additional questions:

1. Is federal support of research justified? The government requires a satisfactory answer to this.
2. What will be the consequences of extensive federal support? The answer to this is a matter of concern to science, to scientists, and to scientific and educational institutions.

To the former of these two questions the majority of scientists would probably answer that federal support of research is justified provided the values inherent in the traditional environment of research, such as continuity, initiative and freedom of communication and publication, can be maintained. In other words, most scientists would give an affirmative answer to the former question provided the answers to the latter may be satisfactory.

Let us remind ourselves at this point that Uncle Sam is properly a realist. He may believe in charitable donations for some of the people all the time, for all the people some of the time, but not for all the people all the time. In general he expects to pay only for services rendered. Thus the federal government does not provide financial support unless a need can be established, and when such support is provided it must be expected to show some return to the taxpayer.

As a quick answer to our first question, then, intelligent support of research should be able to accomplish the following:

1. Raise the productive level of research, with the many attendant benefits sure to follow;
2. Increase the output of young research men and women and thus fill the needs of industry, government, and academic institutions.

But let me turn at once to my second question: What may we expect to be the consequences of extensive federal support of research? As mentioned earlier, I shall consider only the case of support in institutions external to the government, and especially in nonprofit institutions such as universities, technical institutions, and colleges. I shall confine my remarks to support given on broad, comprehensive lines, and so not mention the support furnished by agencies with special fields in view—as for example the excellent work done by such agencies as the Public Health Service and the Department of Agriculture.

In the first place, if we are to be realistic we must at once admit that extensive

government support of research will have consequences beyond the important and beneficial ones of stimulating research output and supply of future scientists. It is a commonly observed fact that any attempt to change some factor in a situation is accompanied by effects other than those intended. Indeed experimental science knows that it is only by careful planning and painstaking attention to techniques that these spurious effects may be kept in the background.

For one thing, increased support of research in universities has been accompanied by an increased number of graduate

students. What effect will this have upon the quality of the doctor's or graduate engineer's degree? It may be that by increasing graduate school enrolments we shall succeed in turning out no larger number of potential research leaders but shall actually lower the average competence of the total output, by dilution and by congestion. Perhaps increased demand for trained research men and women and for research administrators may to some extent justify such a tendency, but the situation should be watched.

(To be continued.)

## STATISTICS

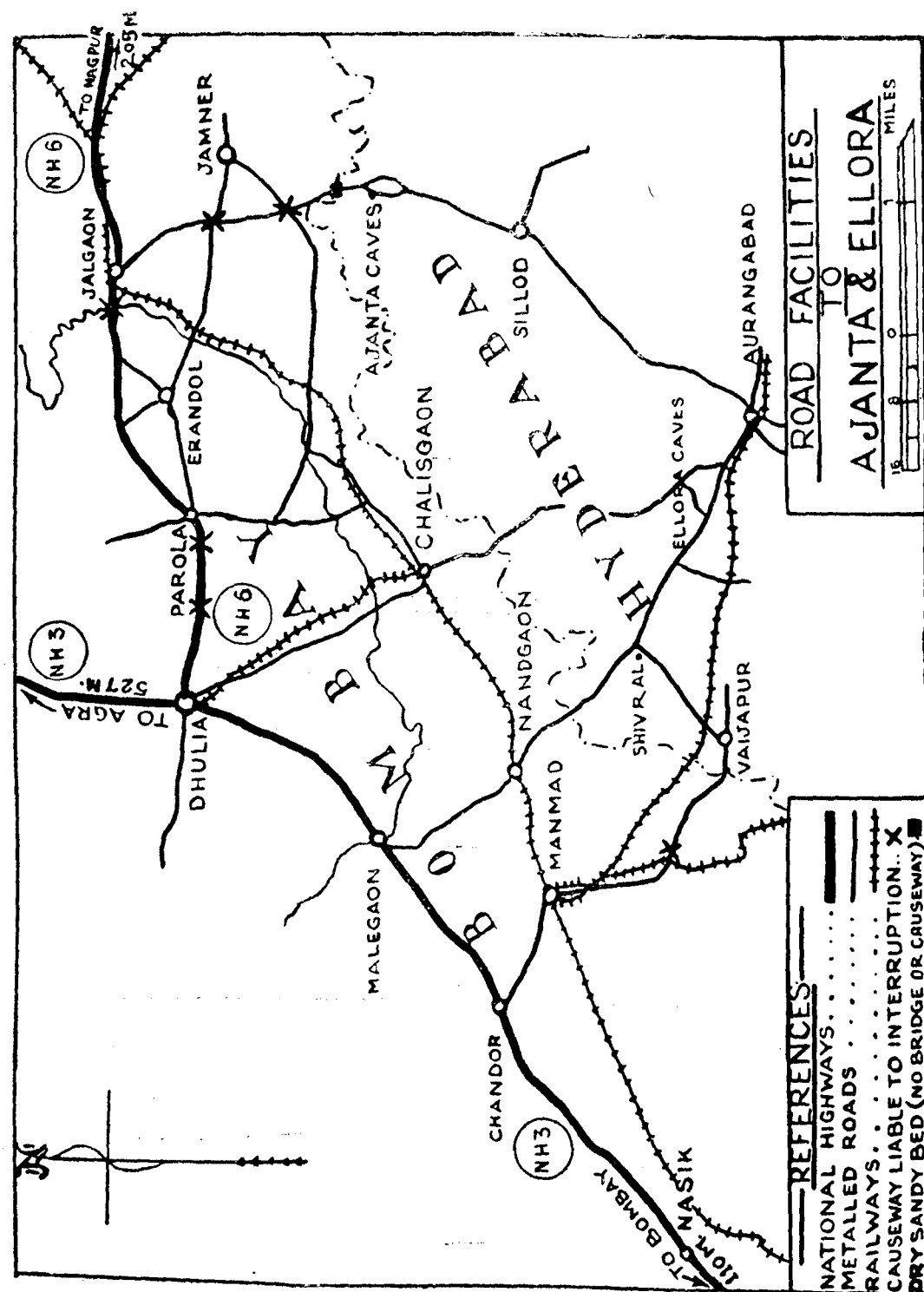
*Patient: "What are the chances of my recovery, doctor?"*

*Doctor: "One hundred per cent. Medical records show that nine out of every ten die of the disease you have contracted. Yours is the tenth case I've treated. The others all died."*

## OMITTED FROM THE GLOSSARY OF HIGHWAY TERMS

*In a National Survey of Rights of Way in England "the position of stiles, stepping stones, kissing gates and footbridges are also to be brought into review."*

*['The Surveyor'—March 17, 1950.]*



## ROAD CONNECTIONS TO THE AJANTA AND ELLORA CAVES

THERE is no train service to the Ajanta and Ellora caves and the tourist must travel by road at some stage or other. Tourists travelling by rail who want to visit Ajanta may detrain at JALGAON on the Bombay-Calcutta line of the G. I. P. Railway or at AURANGABAD on the Manmad Hyderabad section of the N. S. Railway. Jalgaon to Ajanta is 37 miles while Aurangabad to Ajanta is 56 miles (see map opposite)

### Ajanta

The road from Aurangabad to Ajanta lies in Hyderabad State, is fully bridged, and is maintained as a metalled (macadam) road to a high standard. Even a light 10 h.p. car can maintain a speed of over 40 m.p.h. on this road which is an all-weather road.

The road from Jalgaon to Ajanta is metalled, but some of the streams on this route are not provided with bridges and have very low paved causeways only a foot or two above the bed of the stream. As a result the road is liable to be closed to traffic at these points occasionally for periods of two or three days at a time during the rainy season. One stream, the WAGHARA, at CHANDESHWAR on the Bombay-Hyderabad boundary, is not provided even with such a low causeway. Vehicles have to travel over boulders in the river bed. The most important work to be executed on this road is to build a bridge, or at least a causeway, at this point.

While the road surface is very good in the Hyderabad State for all the 63 miles from Aurangabad to Chandeshwar, the length in Bombay (30 miles) is rather bad. A car doing a comfortable 40 m.p.h. on the Hyderabad road has to drop to a bare 20 m.p.h. on the Bombay road, and even then, the going is bumpy. Foreign tour-

ists who are often used to much better road conditions would not appreciate this and Bombay would be well advised to improve her road from JALGAON to AJANTA. Even then the dust nuisance will be there and something should be done to allay it.

### Ellora

The Ellora caves are visited from Aurangabad which is 16 miles away. The road is metalled and fully bridged and the surface is good.

### Road Travellers

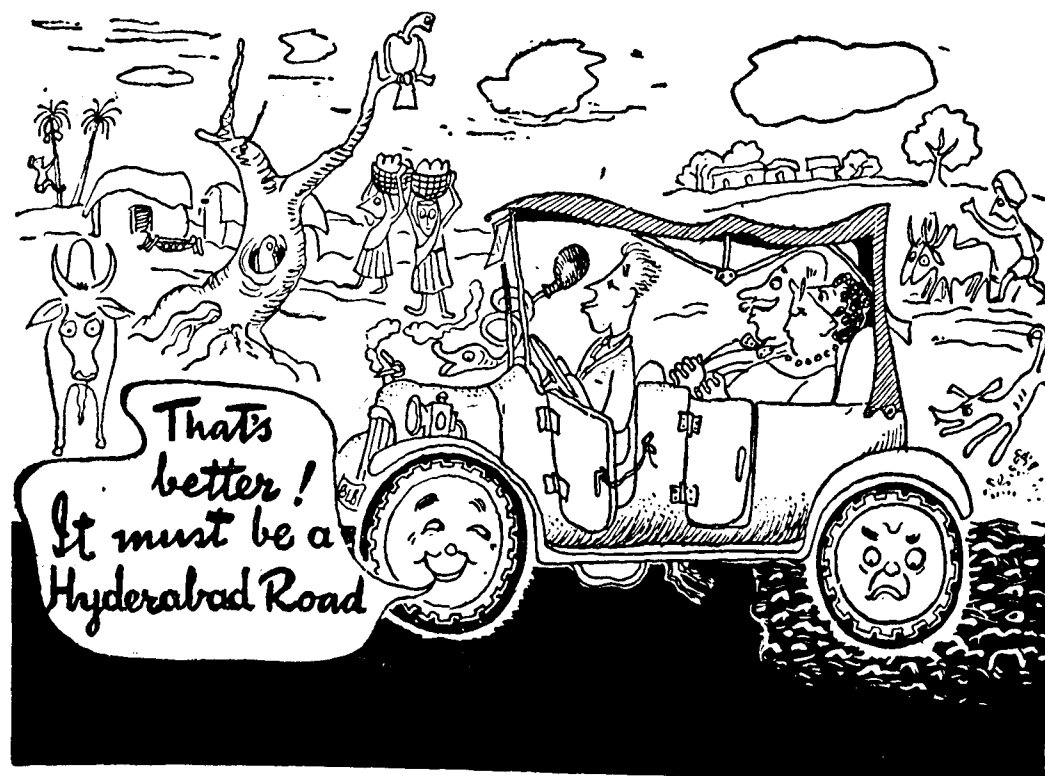
The best route to Ajanta and Ellora for tourists who travel (say from Bombay) by road would be

NASIK (N. H. 3) — CHANDOR (N.H.3) —  
MANMAD — VAJJAPUR — SIVRALL —  
AURANGABAD = 93 miles.

AURANGABAD — AJANTA — JALGAON (N. H. 6) — ERANDOL — PAROLA (N. H. 6) — DHULIA (N. H. 3 and 6) = 95 miles.

For a traveller coming from northern India the direction of travel would be the reverse.

All these roads are metalled but the stretches falling in Bombay, including N. H. 6, are in a poor state of maintenance. Even a speed of 20 m.p.h. gives a jolty ride. The transition from Bombay roads to Hyderabad roads is remarkable; the tourist can "step on it" and can at once go up to 40 m.p.h.



With apologies to Messrs Shalimar Tar Products' 1935

## THE TRANSITION

### Long Hold-ups

Most of the streams in the Bombay area are provided with low causeways only. One particular crossing, i.e. over the GIRNA RIVER on N. H. 6, between Dhulia and Jalgaon, may be closed for traffic even for 10 days at a stretch. The high flood level is marked about 10 feet above the level of the causeway. It is said that long lines of carts and trucks loaded with grain lined up at the Girna during an 11 day hold-up in the monsoon last year. The grain was soaked and had sprouted before the traffic began to move.

Tourists using this road during the monsoon should make sure that the Girna is passable before they leave Dhulia for Jalgaon. This information can be obtained from the Executive Engineer, East

Khandwa Division at Jalgaon. A high level bridge over the Girna is a crying need.

A minor improvement which will increase the pleasure of driving over these roads will be to introduce shock free level causeways (see I.R.C. Paper No. 132). At present a jolt is felt both when entering and leaving a causeway. The cost of making these transition curves could probably be met from the ordinary maintenance funds for these roads.

### Hotels and Food

Good western style hotel facilities are available in Aurangabad. Western style food can also be ordered at the Dak Bungalow at Ajanta.

## BRIDGE AESTHETICS AND TECHNIQUE

[Extracted from "Civil Engineering & Public Works Review" March 1950]

THE issue of December 25th, 1949, of *Techniques et Architecturer* contains, an interesting article by M. H. Vicariot, Engineer of the Highway Board (Ponts & Chaussees), Architect D.P.L.G. on bridge aesthetic and technique. His thoughts on the aesthetic side of the problem are summarised below:

**Stone bridges.** General principles governing stone bridges are given in the book of the noted French bridge builder Sejourne, *Les Grandes Voutes* (Great Vaults). Sejourne was a great architect and the general principles of his bridge design may still be applied. Details, however, must be changed to meet the requirements of our time, especially as regards artistic treatment of structures.

**Steel bridges.** Engineers are often confronted with delicate problems occasioned by the architectural treatment of steel bridges. Sections of bridge superstructure are strictly determined by the design. Engineers anxious to build a satisfying structure seek the collaboration of the architect. According to a noted French bridge engineer, M. Vallette, the design technique is sure enough to enable an engineer to build a bridge on an inspiration of an architect. Mr. D. B. Steinman, a famous American bridge engineer, wrote that success in bridge building trade is generally obtained more by a kind of intuition than by science. In this way, the collaboration of a qualified architect may be of great assistance to the engineer.

The present day tendency is towards simplicity of lines and truth concerning the expression of building materials.

High tensile steels constitute a means enabling the engineers to build long span bridges of gossamer design. Welded con-

structions are different from riveted structures as they are structures with rigid connections. A welded bridge must not be similar in design to riveted ones. Profiles and sections made up of folded sheet steel offer great resource to bridge builders. As regards decoration and adornment mouldings, prudence and discretion are advised.

**Concrete bridges.** Concrete is a "moulded" material. Owing to this fact, it is able to take various shapes according to the mind of the designer.

It must be noted, however, that if concrete works well under compression and relatively well under bending, shearing stresses constitute for this material a serious danger. To remedy for this latter condition, it is necessary to provide main girders with haunches (gussets) which are not always of a very pleasant appearance, especially if their section is exaggerated. Properly designed and applied, concrete leads to well balanced structures.

The conclusions of M. Vicariot may be summarised as follows:

1. In aesthetics, there is no absolute truth, but general principles; their application depends always on the case considered;
2. Engineers and architects must be anxious to express all possibilities of the structural material used;
3. A bridge should give a feeling of durability, especially as regards its outline and decoration;
4. Success in bridge building results from a close co-operation between engineers, architects and contractors.

## PUBLIC CONTRACTS

[Extracted from "California Highways & Public Works" November-December 1949].

AS early as 1862 the Supreme Court of California laid down the rule that a contract made in disregard of a law requiring competitive bidding is absolutely void. The court said that not only could the contractor not enforce the contract, but he could not recover for the reasonable value of the work done and the materials furnished. (*Zottman v. San Francisco* (1862), 20 Cal. 96).

## Right of Taxpayer

In 1899 (*Mock v. City of Santa Rosa* (1899) 126 Cal. 330) the right of a taxpayer to maintain an action against public officials to compel the repayment by them out of personal funds of moneys spent under an illegal contract, was established. A judgment against the members of a city council for 165,000 dollars with a credit in amount of the value of certain water works built under an illegal contract and turned over to the city, was affirmed.

The rule which we have been discussing is an exceedingly harsh one. It may be of interest to consider the reasoning which has led the courts to adopt a principle of individual responsibility irrespective of the honesty and good faith of the officers. The reasoning of the court is perhaps best set out in a ruling given in 1915 (*Osburn v. Stone*, supra) wherein the Supreme Court stated the contentions for the defendants and disposed of them as follows:

## Supreme Court Decision

"The argument here advanced by respondent is that the city council had general jurisdiction over and general power to do all the things complained of and that 'the lower court properly held that it would become utterly impossible to induce good and responsible men to serve the public in an official capacity if the courts of this state should sanction an action of this kind by which it is sought to declare a public official's private property forfeited when he has done no wrong, and there is no showing that the taxpayers of the city have not received full value for every cent of money expended. It would, therefore, be an absolute contravention of sound public policy to deprive cities of the public

services, in an official capacity, of their responsible citizens of substance who might, at any time be made the victims of such an outrageous action as this at the instance of some spiteful and politically aggrieved person.'

"There is a modicum of truth in this, but only a modicum. The converse of the argument is that the powers of municipal officers are well defined. Their modes of procedure in all matters of expenditure are pointed out with particularity. They are given by law a legal adviser, and, if not, are fully empowered to employ one. There is no occasion whatsoever for their taking any step without such advice. There is no reason for their ever making any illegal expenditure of the public's moneys. To countenance the making by these officials of an illegal expenditure in one case, is to open wide the door for like expenditures in every case.

"And even if it can be truly said that in a specific instance the citizens and taxpayers have received the benefit of the expenditure, this by no means answers the objection that the expenditure itself was illegal. Let us use but one illustration. Charters usually call for competitive bidding on contracts involving the expenditure of moneys over a fixed amount. Assume that such a contract is let by the council without the required competitive bidding; assume further that the contract has been properly performed, who shall say that the price at which the contract was so let was the lowest reasonable price that could have been obtained if bids had been called for, and who will not at once say that to permit this is to open wide the door to favoritisms of all kinds, the very prevention of which was one of the important purposes of the law?"

The courts are very strict in their enforcement of competitive bidding statutes. For instance, in one particular case the supervisors called for bids on plans and specifications to be prepared and furnished by the bidder as a part of his bid. This was held to be illegal, as there could be no competition with each bidder bidding on a different plan.

## REGISTER OF NATIONAL HIGHWAYS

AT the meeting of the Chief Engineers of States in India at the Annual Sessions of the Indian Roads Congress at Roorkee (1948) and Ranchi (1949), the question was discussed of preparing a register of National Highways giving full information on such items as local topography, nature of soil found along the road, intensity of traffic in different stretches, annual expenditure, width of formation, width and type of soling if any, width and type of surfacing, surface renewals done each year, position and details of bridges and culverts, curves, etc.

The preparation of this register would put some strain on a State's engineering staff owing to the shortage of technical personnel, but it is expected that the contribution which such a register would make towards the careful design, improvement and maintenance works on National Highways would far outweigh the expenditure on any extra staff.

## Centre's Help

Centre's Engineer Liaison Officers in the States have been asked to assist in the correct preparation of the register. These officers will be helped in this work by temporary surveyors and draftsmen whose number will depend on the volume of work to be done in a State. The register is expected to be completed in every State within a period of 18 months.

States have been authorized to charge any extra expenditure necessary for the preparation of the register to the National Highways maintenance funds.

After considerable discussions the Central Roads Organization have evolved forms for:—

- (1) a road register, and
- (2) a register of bridges and culverts.

For the sake of uniformity and ease of reference these forms are recommended for adoption by all the States.

The road register contains the following forms:—

- (1) A key-map of the locality covered by the register.

- (2) A form for entering intensities of traffic and the amount spent each year on maintenance per mile.
- (3) Surface renewals form which will give the plan, the longitudinal section, a linear chart showing soling, and a surface renewal chart.

The register of bridges and culverts would give full information about a bridge or culvert including hydraulic data, cost, type and nature of soil, etc.

## Uttar Pradesh Gives The Lead

The state of Uttar Pradesh has started work on the lines suggested by the Central Roads Organization with some modifications. The State deserves appreciation for this and it is hoped that other authorities will follow its lead. Uttar Pradesh's main reason for modifying the forms is to take advantage of this opportunity and collect as much data as possible.

The forms adopted by Uttar Pradesh are very comprehensive and aim at collecting more information than the corresponding forms recommended by the Central Roads Organization. Ultimately, however, the information will be transferred to forms suggested by the Centre in order to conform to a uniform practice. The following is the extra information envisaged by the Uttar Pradesh forms:—

- (1) Climate and topography of the country,
- (2) Availability of materials and location of quarries,
- (3) Breakdown of the cost of ordinary maintenance into,
  - (a) establishment,
  - (b) materials,
  - (c) arboriculture,
  - (d) bridges,
  - (e) culverts, and,
  - (f) buildings.

The Uttar Pradesh form for the register of bridges and culverts contains all items included in the form suggested by the Central Roads Organization and in addition will have detailed data about the original cost, maintenance cost, and topographical features.

## TRANSPORT CO ORDINATION IN FRANCE

(Extracted from "Modern Transport," March 18, 1950.)

\* \* \*

THE British long-term method of tackling the problem of road-rail competition, so far as freight is concerned, has been to nationalise both the railways and the competing long-distance road services with a view to eventual integration and a common scale of charges and conditions of carriage.

France has tackled the problem on different lines. The main-line railways were amalgamated as the Societe Nationale des Chemins de fer Francais as from January 1, 1938, with the State as a 51 per cent shareholder, but reliance has been placed on various decrees for the establishment of rail and road co-ordination.

There was an endeavour in 1935 to "freeze" road activities on the basis of what was done on April 19, 1934, and two years later a licensing system was introduced and power was given to local authorities to participate in the development of transport schemes. The Government attempted in 1938-1939 to keep long-distance haulage rates at railway level so that the two media should compete only in respect of service to the trader; a list of minimum rates was issued.

Road competition still menaces the railways, however, and, in view of the heavy loss incurred by the S. N. C. F., further attempts are being made to divert traffic from road and waterway to rail; a genuine co-ordination of all means of transport, including sea and air transport, is nonetheless envisaged.

In the autumn of 1947 there was set up a Conseil Supérieur des Transports, with a president (the Minister of Public Works and Transport) and 68 members, who serve for three years and are chosen from the public administration service (23), from transport undertakings (15), from transport staff (15), and from transport users (15). The first task placed upon the Supreme Transport Council was the study of co-ordination schemes through seven

separate committees dealing with the various media.

On the passenger side the services to be co-ordinated include inter-urban bus and coach routes, coach excursions, shared taxis, and even coach trips to special events, including weddings and funerals. Services have to be registered with the co-ordinating committee of each department, by which the details of public needs and travel facilities are to be thrashed out locally. Compensation is to be provided for operators whose services are co-ordinated out of existence. The departmental committee will also approve agreements as to fares and services between operators; in general the rail fares will determine the level of charges. Special provision is made for the closing of railway routes and the consequential increase in bus facilities.

Road hauliers are seriously affected in that all traffic carried out of the district in which the base is located is subject to co-ordination. Around towns a 25-mile limit is set, with a wider area around Paris; there are also departmental or short-distance zones, visualised as from 60 to 100 miles around the chief town of a department; and a long-distance zone, comprising all metropolitan France. Undertakings will have to register their vehicles by carrying capacity, and apparently claimed tonnage will in the first instance be granted in much the same way as established hauliers were licensed here under the 1933 Act. The S. N. C. F., is prohibited from engaging in anything beyond collection and delivery work without Ministerial sanction, and special measures are contemplated in the event of railways being closed down.

If additional road tonnage is granted to meet economic needs machinery is provided for its distribution among established hauliers by consultation between the Ministry and the National Haulage Committee. The machinery of co-ordination is bound up with the new charges scheme

of the French railways, and road rates will have to accord with those of the S. N. C. F. Responsibility is placed on the hauliers and the S. N. C. F., for agreement on rates, which are subject also to approval by the National Haulage Committee.

There is machinery for settlement of disputes by the Minister of Public Works and Transport in consultation with the Supreme Transport Council. Enforcement of regulations is the responsibility of the chief engineer of the highways division in each department. The provisions of the co-ordination decree in many respects cover the ground of our Road and Rail Traffic Acts, and it remains to be seen

whether they provide a more effective answer to road and rail problems than the method adopted in this country.

In the meantime the French railways are showing great technical skill and commercial enterprise in developing their public facilities and traffic handling methods, and it is most appropriate that Monsieur Roger Guibert, chief of the S.N.C.F., co-ordination department, should have read in London, under the joint auspices of the Institute of Transport and the Societe des Ingenieurs Civils de France, a Paper\*, describing freight handling methods and ways of overcoming the road and rail transshipment handicap.

### CONTROLS

*A British firm and an American firm exchanged patent rights and agreed to build an aeroplane of a certain type. Both were to start construction work at once.*

*After four months the American firm cabled: "Three more rivets and first plane will be completed."*

*The British firm replied:*

*"Three more forms to fill in and then we start."*

### FRONTIERS OF SCIENCE

*Whereas geographical frontiers tend to shrink as exploration proceeds, the frontiers of science are ever expanding into the unknown, and the work of science is never done.*

*—A. S. T. M. Bulletin 153—August 1948; from a pamphlet by the Standard Oil Company.*

\* Details of the Paper are given in "Modern Transport"—March 18, 1950.

## PRACTICE OF ENGINEERING: PROFESSION OR BUSINESS?

[Extracted from "Civil Engineering" — March 1950]

THE question, "Is the practice of engineering a profession or a business?" would have had little pertinency during the latter part of the Nineteenth Century. In the past fifty years, however, great changes have occurred, not alone in the amount and character of technical knowledge, but in the manner in which the practice of engineering is carried on, and in the structure and manner of functioning of groups or firms engaged in it.

### Engineer Sells His Specialized Knowledge

Engineers are in the habit of calling themselves professional men, irrespective of the functions they perform, or the manner in which they perform them. In the sense in which the term "profession" was developed, and in the minds of the general public, a profession is a calling or means of livelihood, the pursuit of which involves the utilization of specialized knowledge, and the ability to exercise independent judgement based on this knowledge. A business, on the other hand, is a means of livelihood in which things, including services and commodities, are bought, sold, produced or handled.

Today, the professional man sells his specialized knowledge and judgement, while the business man sells a product which is the result of his knowledge and judgment. The professional man must operate in what is essentially a non-competitive market, since he may not advertise or compete with others in his profession on a price basis. A business man, on the other hand, operates in a competitive market and must, if he is to survive, do all the self-advertising things which the professional man is prohibited from doing.

### Changes in Practice of Engineering

A century ago, it was customary to speak of the three "learned" professions, medicine

law and theology, entrance into which required a thorough grounding in fundamental principles, usually secured through formal training. As science and its applications developed, formal education was provided for other vocations, including engineering, architecture, accounting, dentistry, etc., and a man who followed such a calling was termed a "professional man."

By the turn of the century, the manner in which the practice of engineering was carried on commenced to change. Engineers began to function differently from those who followed the other "professions." Structures, projects, machines and facilities were becoming larger and more complicated, and large organizations were required to plan, design and supervise their construction or manufacture.

Engineering firms with large staffs came into being, and private and public agencies set up engineering organizations whose staffs functioned as a team. The team was composed of a considerable number of men who were little more than skilled mechanics, a smaller number who performed more or less routine operations, and a few who had a substantial amount of technical knowledge and judgement, but whose duties for the most part became more and more administrative as top of the organization was approached.

The engineering organization, whether public or private, commenced to function as a business organization. Seldom was any member of such an organization called upon to render a personal opinion based on his own individual judgment, experience or effort. The organization assumed responsibility for its product, which was essentially a service, but in the same manner as would a business or industrial concern.

While private engineering firms and companies are prohibited from advertising their product-engineering services-by the

codes of ethics of the various engineering societies, and are likewise prohibited from competing with others on a price basis, in practically all other respects they function as does a business concern.

Moreover, commencing 40 or 50 years ago, educators began to realize the need of formal preparation for the general field of business and industry. Courses in Commerce and Business Administration commenced to be offered in college curricula. Just as the courses in engineering were based on science and mathematics, so the courses in commerce and business administration were based on economics and finance.

### Is the Banker a Professional Man?

The question arises as to whether the head of an engineering firm, the city engineer of a large municipality, or the chief engineer of a large industrial concern, functions differently from the head of a fair sized bank, who has completed a course in business administration, majoring in banking and finance, and acquired further knowledge and judgment through experience. If the engineer is considered to be a professional man, it would seem that the banker, the insurance executive, the head of a manufacturing concern, or any other person with comparable education and experience in the field of business or industry should likewise be called professional.

On the other hand, the head of an engineering organization, like the president of a bank, does not function in the same way as do doctors, lawyers, accountants or those in such more recently developed fields as public relations counseling and advertising counseling. The consulting engineer, however, does so function, since he renders services essentially of a personal character.

### Definition of "Professional" Requires Thought

It would seem that a choice must be made. If the difference between a profession and a business is considered to consist in the amount of formal education, knowledge and experience which the practitioner must have, then any calling that requires such specialized knowledge and preparation, even though essentially in the field of administration, is a profession. On the other hand, if the distinction between a business and a profession lies in the manner in which the practitioner functions, the degree of personal service which he renders, and the personal responsibility which he accepts, then neither the head of an engineering concern, nor even his top employees can be considered professional men no more than can executives in the banking, insurance or industrial fields. This is an age of specialized knowledge, and some serious thinking on this subject is indicated.

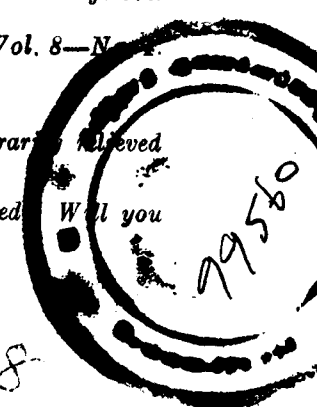
### ILLITERATES BOTH

*It has been said that he who does not read of the latest advancements taking place in his own field of endeavour, has no advantage over him who cannot read.*

—Laboratory, Vol. 8—N

*His wife had just died, and wishing to be temporarily relieved of his duties, he wrote to his boss.*

*"I regret to inform you that my wife has just died. Will you please send me a substitute for the week-end?"*



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## HERE AND THERE

### 1. DEVELOPMENT OF ROAD TRANSPORT IN INDIA

#### *Handicaps and Obstacles*

\* \* \* \* \*

THE Government of India has, in the main, handled its problems subsequent to devaluation in a statesman like manner, but I cannot help feeling that roads and transport development have suffered much that is unnecessary because they have been subordinated to less important matters. It seems to me that India does not yet realise that she pays for her roads whether she has them or not, and she pays much more when she does not have them.

#### Food Traffic

It is patent that the present urban and village roads are not capable of dealing with the volume of food traffic which India's good earth is capable of producing when scientifically cultivated. If agriculture is permitted to develop at greater pace than village roads, we can look forward to reports of perishable food destroyed, and no appreciable reduction in the cost to the people of the staple grains which makes their daily bread.

The Government of India and the Government of our State [Madras] have made it plain that they will deal ruthlessly with Communism where it becomes manifest. I personally know of no better way of fighting this evil than making a plentiful supply of good food available to India's work people at reasonable prices. A great step towards the accomplishment of this ideal is the provision of good roads.

\* \* \* \* \*

I will not detain you by endeavouring to recount the many plans for road development that have been put forth in the last two decades nearly all of which have been dropped because of financial stringency, but I would remind Government that there is evidence that road construction can be as good an investment as Government-owned railways.

The fact that the present revenue from motor transport is roughly Rs 30 crores annually, as against Rs 9 crores prior to the outbreak of war is significant, particularly so when we bear in mind that the demand for new vehicles exceeds the available supply and the fantastic cost of spare parts and replacement vehicles, all of which is the inevitable product of devaluation.

#### Woefully Inadequate

Statistics show that we have no more than one-fifth of a mile of road per square mile of the country's area, and it is thus evident that in the field of primary transportation our roads are woefully inadequate.

\* \* \* \* \*

Economic self-sufficiency is one of India's pressing needs and I am confident that the creation of new and better roads is a first logical step towards its fulfilment.

*(Extracted from the 'Mail' - Madras, 20-5-50 - from a speech by P. Reid, Chairman of the Indian Roads and Transport Development Association.)*

### 2. WHAT CHARACTERIZES AN ENGINEER?

ENGINEERS have been writing definitions of "engineer" and "engineering" for more than a century. As the field broadened, the definitions became more involved. When the time came to define engineering in license laws for engineers

there was a new upsurge of definitions, but no one of them was entirely satisfactory. Most were too all inclusive; they could be interpreted as covering many activities that are not engineering.

Now, as an adjunct to its work in evaluating educational curricula, the Committee on Engineering Schools of the Engineers' Council for Professional Development has written a new definition of an engineer. That committee came to the conclusion that before it could state with any definiteness what courses were essential to the training of engineers it should know what characteristics are peculiar to engineers. So, after considerable study, it has put forward the following definition:

"An engineer is characterized by his ability to apply scientific principles to design or develop structures, machines, apparatus or manufacturing processes, or works using them singly or in combination or to construct or operate the same with

full cognizance of their design, and of the limitations of behaviour under specific operating conditions; all as respects a specific function, economics of operation and safety to life or property."

In presenting this definition for discussion the committee points out that most of the current confusion in the colleges with respect to what is engineering arises from failure to recognize the difference between the sciences and engineering.

*[Can any one offer a better definition and explain why better?.....Ed.]*

*(Extracted from 'Engineering News-Record' March 2, 1950)*

### 3. CHEMICAL SOIL STABILIZATION

LIKE alchemists of old, the soil researchers of today have long sought to make poor soils stable enough to carry highway vehicles or airplanes by in-place treatment with chemicals. Some success was attained with admixtures of asphalt, oils, lime or portland cement, but reasonably good soils were required. More recently, some success was obtained with the addition of small quantities of certain types of resins to clay soils to waterproof the molecules, thus preventing the formation of soft mud.

Meanwhile there were persistent reports that laboratories engaged in secret research projects for the government had obtained spectacular results through the use of compounds that produced changes in the molecular structure of the soil being treated, changes that locked the molecules into new compounds.

Now the details of some of that research have been made public. They indicate that spectacular changes in soil characteristics can be produced by such means. The

usefulness of these stabilization methods for military operations appears to be definitely established. Whether they will be equally useful for highways or airports, where long life is essential, remains to be seen.

Studies of the possibilities of organic compounds other than resins in soil stabilization also have been begun in the belief that the structural strength of soils can be increased by the addition of inexpensive compounds that will produce an exchange of ions.

Even moderate success in some of these new fields of research could have great significance. On main highways, better bases could be obtained at large savings over today's costs, and for secondary road work, better surfaces could be provided on thousands of miles at costs that would be within the reach of local road-building agencies.

*(Extracted from 'Engineering News-Record,' March 16, 1950).*

## 4. STATE AID FOR MUNICIPAL ROADS

\* \* \*

THE Chief Minister told the Calicut Municipal Council: "It is the Government's policy to give half grants towards the cost incurred by municipalities in the dustless surfacing of roads, and grants will be

made in accordance with that policy, subject to the limits imposed by the financial position of the State."

\* \* \*

(Extracted from 'Mail' - Madras, 5-5-1950)

## 5. ROAD FINANCE

\* \* \*

MAJOR H. E. Aldington, late chief engineer, highways, at the Ministry of Transport, in his recent paper, "Ideals of Road Administration," delivered to the Institution of Highway Engineers, emphasised the "start and stop" progress of road improvement and maintenance schemes, and said that this was no way for a manufacturing country such as Great Britain to run its road transportation responsibility, depending as we were on selling our finished products in overseas markets. Modern and efficient highway practice were essential to reduce transportation costs and our export prices.

the State—how can it be resolved? Speaking bluntly, money spent on roads carries no votes with it. "Free" teeth, spectacles, and wigs, certainly do carry votes and the health services can therefore overspread their estimates by more than £98,000,000 in the past year and in the coming year will cost over £400,000,000. Surely it would be better to try to keep people from having to make use of the health services.

We do not know what portion of the expenditure on health services is attributable to road accidents, but it is certainly a substantial one. Would not one-tenth or even one-twentieth of the present health services budget added to the proposed expenditure on roads permit highway engineers to carry out remedial measures that would reduce the toll of the road and automatically lessen the loading on the health services.

\* \* \*

(Extracted from 'Roads & Road Construction'—April, 1950).

## 6. FAST TRAVELLING

\* \* \*

".....across the sandy forest land beyond Esher, the South Downs to the wide open spaces of the New Forest. The low-built white tourer had jumped from a standing start to 30 miles per hour in just over three seconds. Incredible? Another ten seconds and we were doing a mile a minute, and we changed from third gear to top at a genuine 90 miles an hour. On the long stretches in Hampshire the speedometer registered 129 miles an hour. Allowing for wheel spin and an always optimistic clock, I accept the official two-way top speed of 124 miles an hour."

This is not a nightmare vision of an elderly highway engineer dreaming of the problems which will face his successors when the gas-turbine engine is the universal power unit for the motor car, but the day dream of the motoring correspondent of one of our national daily newspapers. Yes, a dream but only in that petrol rationing, purchase tax, and delayed deliveries are things of the past. The car is already with us—as well as others of only slightly inferior performance—are our roads ready for them?

(Extracted from 'Roads & Road Construction'—April, 1950)

## 7. PLANNING IN THE U. S. A.

CORRECTING existing deficiencies in our highway system will require the expenditure of 41 billion dollars according to a report just submitted to Congress by the Joint Committee on the Economic Report. The committee's estimate is based on figures submitted to it by state highway departments, which total to 36 billion dollars, and the committee has added 5 billion dollars to cover states from which it has not received complete estimates of needs.

gress must soon take up highway-aid legislation for the next few fiscal years, it should impress the members with the need for being certain that the programme it authorises will be large enough. It is essential to gain on the deficiencies.

(Extracted from 'Engineering News-Record'—Feb. 9, 1950)

\* \* \*

The committee's report serves this useful purpose: Coming at a time when Con-

We wonder what our own Planning Commission will do. Will it add a few crores to the estimates submitted by state highway departments,?—Ed.

## 8. MOTOR VEHICLE USE TAXES

[Suggestions of the National Highway Users Conference Inc. Washington]

A. Motor vehicle use taxes, of whatever character, should be used solely for highway purposes and in accordance with the "principle of motor vehicle taxation".

according to weight or horsepower, and

b. A motor fuel tax.

B. The total annual collections from motor vehicle use taxes should not exceed the motor vehicle owner's proper share of the cost of highways of general motor use in line with a carefully prepared annual budget based upon a sound state highway plan, nor should they be excessive to the point of discouraging the use of motor vehicles; nor should they exceed the ability of the motorists to pay.

2. For buses and other vehicles carrying passengers for hire:

a. A registration fee, based on mileage operated and graduated according to seating capacity, and

b. A motor fuel tax.

3. For trucks:

a. A registration fee, graduated according to weight, and

b. A motor fuel tax.

C. All motor vehicle use taxes should be reasonable and equitable in amount and incidence. They should be determined in harmony with basic technical and economic analyses as the science of highway transport advances. In the light of past experience these motor vehicle use taxes should take the following forms:

D. The levying of motor vehicle use taxes should be reserved to the several states and should not be practiced by the Federal Government nor by the municipalities or other political subdivisions of the states. The responsibility of collecting all forms of motor vehicle use taxes should be centered in one division of the state government.

1. For passenger automobiles:

a. A registration fee, graduated

## 9. ROADS IN THE PARLIAMENT.

Starred Question No 754 dated the 9th March, 1950.

Question by Giani Gurmukh Singh  
Musafir.towns and facilitate  
communications?

- (a) Will the Minister of transport be pleased to state whether any research has been undertaken in connection with the laying of roads in the country at a cheaper cost recently?

Shri Santhanam: All these experiments are on rural roads only.

Shri R. K. Chaudhuri: May I know in what areas this experiment has been made?

Shri Santhanam: As I have already stated these experiments have been conducted in the Punjab and Madras.

- (b) If so, what are the results of such a research, and how long will it take to put it into practice?

Dr. Deshmukh: Is there any definite and independent scheme for this or are these experiments made in the ordinary way?

Reply by Honourable Minister  
of State for Transport

- (a) Yes.

- (b) Some success has been obtained particularly with respect to stabilised soil base courses in the Punjab and Madras. It is too early to talk of final results (which cannot be known for some years). The new methods are being put into practice in several areas.

Shri Santhanam: We have got research stations where mechanical stabilisation and chemical stabilisation methods are experimented on. Certain tracks are laid, they are watched and data collected; and on the basis of the data further extensions are being attempted.

Shri Kamath: Is it an integral part of the highway scheme of Government?

Shri Santhanam: No, Sir. This does not come under the highway scheme. This concerns only the rural roads. The highways are of cement concrete or metal. These are for mud roads.

Shri Kamath: Are these only by-ways?

Mr. Speaker: Order, Order.

Dr. Deshmukh: Are we to understand that there are no experiments made so far as construction of highways is concerned?

Mr. Speaker: The question does not arise.

Shri Kamath: Has any foreign expert arrived in this country to aid, advise, and add to Government's knowledge on the subject?

Shri Santhanam: I am not aware of any foreign expert being called for this purpose.

Shri Kamath: Is he being invited by Government?

Mr. Speaker: Order, Order.

Giani Gurmukh Singh Musafir } Do Government contemplate construction of roads in rural areas connecting villages with

## 10. NEWS FROM THE HIRAKUD DAM PROJECT.

## Railway Opened.

SAMBALPUR, May 23. It is understood that the railway line from Sambalpur to the bridge on the Mahanadi River, constructed by the Hirakud Dam Organisation has been opened to traffic, and all materials for the construction of the bridge are now being taken to site by rail. In order to complete the bridge in time, work has been started in all the twenty five spans of the bridge at the same time.

The excavation of the foundation of the main Hirakud Dam and the lower power house is going on and earthwork of the

dam dykes and the subsidiary dam is being carried out both by machinery and manual labour. The metalling of roads and the construction of bridges and culverts in the project area are in hand in order to make the roads motorable for the next monsoon season.

## Labour Welfare

To provide increased facility to labour, the dispensary at Hirakud Dam has been expanded into a hospital with 16 beds. This new facility is highly appreciated by the staff and labour; suitable arrangements for treatment of cholera patients have also been made in the Hospital.

## Quiz Corner

## ROAD ACCIDENTS QUIZ

## DO YOU KNOW?

1. In India for every person killed in a motor vehicle accident the number of persons injured is roughly  
(a) 2 (b) 7 (c) 14
2. The average number of persons killed or injured in a motor vehicle accident is roughly  
(a) 1 (b) 5 (c) 10
3. The number of deaths per year per 10,000 motor vehicles on the roads in India is roughly  
(a) 1 (b) 10 (c) 100
4. The number of deaths per one million gallons of motor fuel consumed is roughly  
(a) 10 (b) 100 (c) 500

## Answers:

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

## THE ECONOMICS OF TOLL ROADS

(Extracted from 'Highways, Bridges & Aerodromes' Nov. 10, 1948)

ON several occasions during the past year I have referred to the Pennsylvania Turnpike, which is America's first, and as yet boldest essay in motorways, operated on a toll basis.

Figures issued recently by the Pennsylvania Turnpike Commission, throw light on some interesting aspects of the financing and economics of motorways, and may provide a few facts to help eliminate this gap in our knowledge of road costs while we remain without any positive knowledge of the returns on highway expenditure. Indeed, it is very significant that we are still only aware of the debit side of the picture—what our roads cost — and can only hazard at the benefits, from basing our conjectures on the most incidental information.

The figures now available from Pennsylvania are accountants figures. They do not assess directly the saving in time, temper, safety and mechanical wear and tear which this turnpike, as it is called, has achieved. But in as much as the receipts from tolls indicate the acceptance of the facilities of this motorway, as being worth more than the fares required from the user, they can perhaps be taken as a modest estimate of the saving in personal and goods transport costs attributable to the highway.

It is found that toll or fare revenue, during the eighty months in which the turnpike had been operating up to the end of May, 1947, totalled Rs 770 lakhs, collected from 112 lakhs vehicles. This gives a monthly average of Rs 9.6 lakhs during a period which saw the gradual recession of traffic to about one-third volume, due to the increasing restrictions of war. Before Pearl Harbour the average monthly fare revenue was, in fact, Rs 11.5 lakhs. During the war period it dropped to Rs 7.7 lakhs but has risen to Rs 14 lakhs since the termination of hostilities.

Now the interesting fact about this revenue is that it has been adequate, not only to provide full maintenance of the highway, but to cover interest and amortisation of the loan which enabled this 160 mile motorway to be built at a cost of some Rs 3500 lakhs. In other words, the general taxpaying public of the State of Pennsylvania have not been required to contribute anything to the costs of building or operating the turnpike.

Apart from this, however, the vehicles using the turnpike have, on a reasonable estimate, used 79,866,000 gallons of fuel, on which there is a 4 cent State tax for road maintenance, and consequently the turnpike, which receives no benefit from this source, has virtually contributed some Rs. 152 lakhs to the maintenance of other roads in the State.

The war years that saw a loss of revenue sufficient to cause a deficit on the annual working of the Pennsylvania Turnpike are past. The Commission consider that the twelve months ending May 31, 1947, were the first normal year's operation of their project since in the two years before the war, the use of the turnpike was only in the build-up stage. On this first normal year's working a net income of Rs 145 lakhs was achieved; after deducting all operating costs and interest charges.

From this it will be seen that, even if this figure is not exceeded—and the actual results are likely to be much higher as traffic increases — the loan for the construction of this motorway will be redeemed well within the 35 years as from the beginning of the project in which the bonds are required to mature.

Thus it can be said that, operating on as low a cost basis as under two cents per vehicle mile, or in English currency, 1½d. per mile, motorways can and do pay.

## INDIA'S NATIONAL HIGHWAY BUDGET 1950—51

Grants for the development and maintenance of roads

### CAPITAL BUDGET

#### Demand No. 109.

|                                                               |     | Rs Lakhs.     |
|---------------------------------------------------------------|-----|---------------|
| (1) Construction of National Highways                         | ... | 213.00        |
| (2) Construction of other roads including Agartala Assam road | ... | 102.00        |
|                                                               |     | <u>315.00</u> |

### REVENUE BUDGET

#### Demand No. 68.

|                                      |     |               |
|--------------------------------------|-----|---------------|
| (1) Maintenance of National Highways | ... | 277.72        |
| (2) Maintenance of other roads       | ... | 78.94         |
| (3) Original works on other roads    | ... | 33.43         |
|                                      |     | <u>390.09</u> |

#### Demand No. 67.

|                                          |     |               |
|------------------------------------------|-----|---------------|
| Central Road Fund                        | ... | 290.00        |
| Special Reserve in the Central Road Fund | ... | 22.50         |
|                                          |     | <u>312.50</u> |

Grand Total ... 1,017.59

## BOOK REVIEW

Manual of Report Preparation by Frank Kerekes and Robley Winfrey  
(Wm. C. Brown Co., Dubuque, Iowa, U.S.A.), 1948,  
11 in. by 9 in., pp. xii + 397.

**MEN** of science, technology, and commerce are finding more and more that the ability to write an excellent report is a valuable personal asset and one that many times is responsible for personal advancement and recognition. The Manual under review is meant for the student as well as the man in business, industry or science.

The joint authors who have many years of teaching, writing, research, and practical experience present this excellent work with great modesty and suggest that where an organization has laid down standards, prepared forms and issued instructions and formats for guidance in the preparation of reports they should be followed, but where such good standards do not exist this manual would be helpful.

characteristics of reports, readability, preparation of outlines, collection of information, tabular presentation, illustrations, charts, planning the report, writing rough drafts, revision, the mechanics of style and even the details of typing. The oral presentation of reports and technical papers has an humorously illustrated chapter to itself and should be very useful for those who have to stand up and introduce papers at technical meetings (like the Indian Roads Congress Session).

The book gives numerous examples ranging from the use of words, paragraphs, letter forms, etc., to whole reports and is abundantly illustrated. It is itself a good example of the art it advocates.

A useful book which should be read by every engineer interested in his future.

The book contains valuable tips on the

## MATHEMATICAL SECTION

*Solutions of Problems given in the Transport-Communications  
Monthly Review for May 1950.*

$$(1) 8^{x-1} - 4^x + (5) 2^{x-1} - 2 = 0.$$

$$8^{x-1} = 2^{3(x-1)} = [2^{x-1}]^3; \quad 4^x = 2^{2x} = 2^2 \times 2^{2x-2} = 4[2^{x-1}]^2$$

Substituting  $y$  for  $2^{x-1}$ , the equation becomes

$$y^3 - 4y^2 + 5y - 2 = 0.$$

Factorising:  $(y-1)^2(y-2) = 0$

$$\therefore y = 1 \quad \text{or} \quad 2$$

$$\therefore 2^{x-1} = 1 \quad \text{or} \quad 2$$

$$= 2^0 \quad \text{or} \quad 2^1$$

$$\therefore x-1 = 0 \quad \text{or} \quad 1$$

$$\text{i.e.,} \quad x = 1 \quad \text{or} \quad 2.$$

(2) Let  $A$  gallons be the residue in each reservoir,  $x$  gallons be the capacity of each drum, and  $B, C, D$  the number of times drums are taken out of the three reservoirs respectively. Then

$$A + Bx = 75,748 \quad \dots \quad (1)$$

$$A + Cx = 53,609 \quad \dots \quad (2)$$

$$A + Dx = 45,619 \quad \dots \quad (3)$$

$$\text{From (1) and (2), } (B-C)x = 22,137 \quad \dots \quad (4)$$

$$(2) \text{ and } (3) \quad (C-D)x = 7,990 \quad \dots \quad (5)$$

$$(1) \text{ and } (3) \quad (B-D)x = 30,127 \quad \dots \quad (6)$$

The H. C. F. of 22137, 7990 and 30127 is 47. The capacity of each drum, assumed to be an integral number, is therefore 47 gallons. The residue in each reservoir will then be 29 gallons.

—o—

## CORRECT DIAGNOSIS

*Skinner Bert Jones had been collecting benefits on his health insurance policy for some time. Finally a company examiner called on him.*

*"Mr. Jones, it's quite evident that your arthritis is caused by your teeth and they will have to come out. Let me see them, please."*

*"OK, Doc," replied Jones, "hold out your hand!"*

—o—

*"It is no mere coincidence that for several years in succession the states and cities standing at the top in the national traffic safety contests have been those with highly trained personnel, particularly in the familiar three E's of Enforcement, Engineering, and Education."*

*['Engineering News-Record'—October 6, 1949]*

## INFORMATION SERVICE

### "DELONE"—A SUBSTITUTE FOR ROAD STONE

#### A Suggestion from Burma

*In areas where road stone is scarce burnt clay balls may be used as a substitute. The specification will suit light traffic. Bituminous surfacing, however, will require stone chips.*

#### "What is Delone"?

"Delone" is a Burmese word which means "Puddle Balls"

The delone which is used so extensively in Burma as a road surfacing and soling material is an evenly burnt ball of puddled clay with a central hole made in it by a human finger or thumb going through the ball of puddled clay from one side to the other.

Delone, if properly made and burnt, has the colour of a first class brick, the best grade being a cherry red colour.

When broken to metal size it is generally better than broken brick as a road surfacing material, and in the majority of cases it is found to wear much better than the average broken brick.

#### Method of Manufacture

Good loamy clay is desirable for the manufacture of good delone, but where such clay is not readily available, the best local clay may be used.

The clay should invariably be properly puddled. It should then be made by hand into balls about 6 inches in diameter with a central hole about  $\frac{3}{4}$  inch to 1 inch in diameter going through the ball.

The balls are allowed to dry out in the sun for about 3 to 4 weeks, according to the weather. When they are thoroughly dry, they are ready for the kiln.

#### Delone Kiln

In Burma, delone kilns are generally made measuring 40 ft by 40 ft at the base and are built up into a pyramidal shape approximately 11 ft high and 20 ft by 20 ft at the top, the slope of the sides being approximately 40 deg to 50 deg, the natural

angle of repose of the material. The fuel preferred in Burma is a wood called "KANESU" which is a hard, slow-burning wood. This is an important point if well burnt delone is desired. The fuel wood must be sufficiently dry to preclude the possibility of the fire going out. The fuel generally used measures 6 in. to 8 in. diameter and varies from pieces of 2 ft to 10 ft length. The first layer of fuel is laid to a height of approximately 4 feet. In building the fuel stacks each successive layer of fuel wood is laid across the previous one with a gap of 2 in. to 3 in. between each piece of wood, thus providing the necessary air space for proper combustion.

Holes should be left in the first (bottom) layer of fuel at the ground level, 15 in. square and going about 3 ft into the stack, at intervals of 8 ft to facilitate firing.

When the first layer of fuel is thus laid, the delone balls are stacked, closely packed together, on the top of the fuel to a height of 3 feet. This is then followed by a second layer of fuel to a height of 2 feet which in turn is surmounted by the second and final layer of delone to a height of 2 feet.

The kiln is now ready for firing.

Three or four pieces of 2 in. diameter fuelwood, 4 ft to 5 ft long should also be placed vertically in the first layer of delone with the ends going in to the first and second layers of fuel. These are meant to transfer the flame from the lower layer of fuel to the upper one.

About 25 per cent of delone may be made to 3 in. to 4 in. size instead of the usual 6 inches. In the kiln the smaller balls should be so placed as not to hamper unduly the circulation of flames and hot gases. These smaller balls generally get

overburnt and make very good top dressing.

### Method of Burning

Firing should start from the bottom on the leeward side so that the kiln may burn gradually. When the whole of the fuel has burnt out properly, the delone is ready for use.

### Classification

Delone should be sorted out into three grades or classes viz :

- I. Underburnt, or soft, yellow-coloured delone ;
- II. Correctly burnt, or cherry red delone ; and
- III. Overburnt, or blackblue-coloured delone.

### USE

#### Soling Work

**First Layer:** This should be laid with underburnt delone which can be laid whole, or broken in two, and rolled lightly so as not to cause too much crushing. This layer should be closely hand-packed.

**Second Layer:** This should be of overburnt delone preferably broken in two by hammer beforehand, or it can be hand-packed without breaking and rolled until the balls crack and pack together under the road roller. Rollers should not exceed

six tons in weight. Similarly, a third layer of delone can be added if further depth is desired, but normally for light traffic two layers are adequate.

### Wearing Course

Each of the three grades of delone should be separately broken to 2 in. gauge and laid in separate layers so that the road wears uniformly.

Cherry-coloured delone wears well and the final layer should be of this grade ; as a second choice overburnt delone can be used. Underburnt delone can be used as "hoggin" for the better wearing grades by laying 2 in. or so of soft delone followed by 2 in. or so of good delone or overburnt delone.

### Bituminous Dressing

If this type of road is allowed six months or more to consolidate under traffic it can be successfully treated with bitumen by applying a liberal priming coat of Road Oil followed by either a surfacing paint coat blinded with chips or a chipping carpet with a sand-blinded liquid seal coat. Excellent results have been obtained with 2-1/2 in. bitumen macadam carpets finished with a liquid seal coat sand-blinded. Whatever bitumen treatment is adopted a priming coat is necessary.

(By Courtesy of Messrs Burmah Shell,  
New Delhi)

### LOOKING AHEAD

*When one door closes, another opens ; but we often look so long and regretfully upon the closed door that we do not see the one that has opened for us. Defeat is nothing but education ; it is the first step towards something better.*

—Alexander Graham Bell—*Efficiency News*—August 1948.

## List of Approved Works on National Highways

| Serial No.           | Job No.   | Name of work.                                                                                                    | Amount approved.<br>Rs. |
|----------------------|-----------|------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>BOMBAY</b>        |           |                                                                                                                  |                         |
| 1                    | 380 BM 4  | Raising and rebuilding parapets at dangerous places in mile 8/2 to 11/4 in Katraj Ghat of the Bombay-Poona Road. | 31,500/-                |
| <b>UTTAR PRADESH</b> |           |                                                                                                                  |                         |
| 2                    | 379 UP 28 | Provision of double trackway at the pontoon bridge at Ayodhya Ghat (Dist. Faizabad) on the Oudh-Tirhut Road.     | 1,13,588/-              |

## Books added to the Roads Organisation Library during June 1950

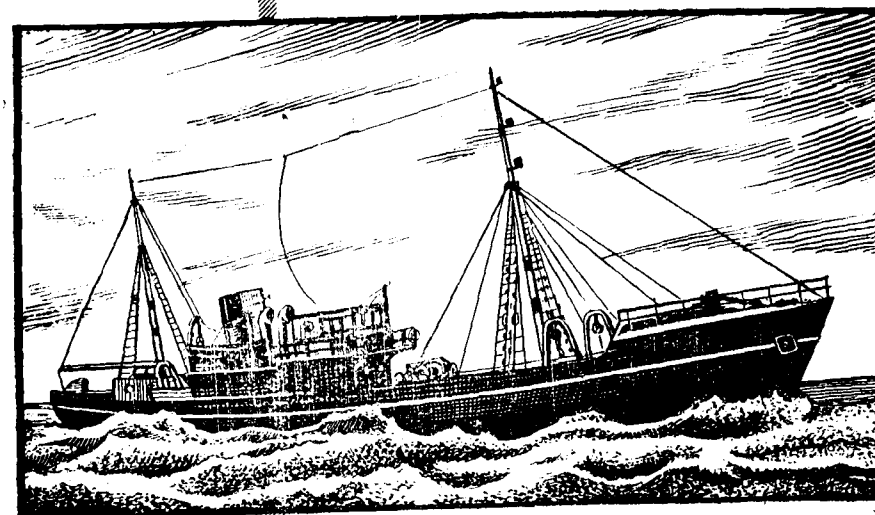
1. German Motor Roads. Road Research Technical Paper No. 8 British Intelligence Objections Sub-Committee Overall Report No. 5. (His Majesty's Stationery Office, London, 1946).
2. Design Standards for the National System of Inter-state Highways. General Administrative Memorandum No. 288. (Public Roads Administration, Washington, 1945. 3 copies.
3. The Application of Statistical Methods to Tests on Road Materials Road Research Memorandum No. 1. (Victoria Country Road Board, Melbourne, 1948)
4. The California Bearing Ratio Method for the Design of Flexible Roads and Runways by E. H. Davis (Road Research Laboratory, D.S.I.R. London, 1949).
5. Design Manual for Airport Pavements. (Wire Reinforcement Institute, Washington, May 1948).
6. Design and Control of Concrete Mixtures. (Portland Cement Association, Chicago, 9th Edition, 1949). 2 copies.
7. The American Transportation Problem by H. G. Moulton & Associates. (The Brookings Institution, Washington, 1933).
8. Towards a Greater Virginia. (Department of Highways, Virginia, USA., 1948). 2 copies.
9. Recommendations presented by the Peruvian Highway Association to the Minister of Development and Public Works on the Establishment of the National Highway Council and Fund, 1948.

10. **B. S. 1623: 1950-Hand Rollers for Road and Constructional Engineering** (British Standards Institution, London). 2 copies.
11. **B. S. 325, 1947-Black Cup and Countersunk Bolts, Nuts and Washers.** (British Standards Institution, London).
12. **Aeronautical Drafting Manual.** (Society of Automotive Engineers, New York, 2nd Ed., 1948). 2 copies.
13. **Aerial Photography in Urban Planning and Research** by Melville C. Branch Jr., (Harvard University Press, Cambridge, Mass, USA., 1948).
14. **Mapping for Planning** Publication No. 101 by E. B. Wilkans (Public Administration Service, Chicago, 1948).
15. **Rainfall and Runoff** by E. E. Foster (The Macmillan Company, New York 1949). 2 copies
16. **Monthly and Annual Normals of Rainfall and Rainy Days based on Records up to 1940.** Memoires of the India Meterological Department Vol. XXVIII, Part V. (Manager of Publications Civil Lines, Delhi).
17. **Manual of Report Preparation—Correspondence and Technical Writing** by Frank Kerekes and Robby Winfery. Wm. C. Brown Company Dulwque, Iowa, 1948).
18. **Applied General Statistics** by Croxton & Cowden. (Prentice Hall, Inc., New York, 1948).
19. **Calculus Refresher for Technical Men** by A. A. Klaf (McGraw Hill Book Co., New York, 1944).
20. **A Course of Modern Analysis** by E. T. Whittaker & G. N. Watson (Cambridge University Press, 4th Ed., 1950 Reprint)
21. **Index to Transactions of American Society of Civil Engineers.** Vol 100 to 112. (1935 to 1947). (American Society for Civil Engineers, 33. West 39th Street, New York, U.S.A.)
22. **Combined Civil List for Pakistan, India and Burma, relating to quarter Oct., to Dec., 1949.** (No. 168 (Civil and Military Gazette Ltd, Lahore).

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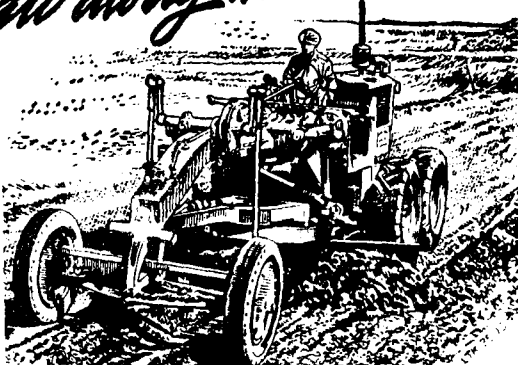
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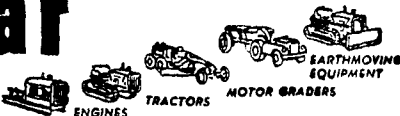


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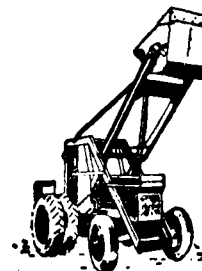
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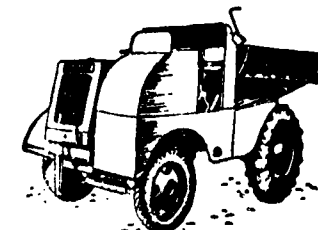
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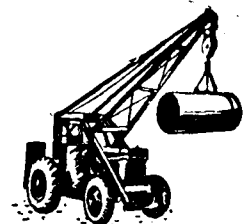
#### THE CHASESIDE SHOVEL

The machine will shovel and load any loose or consolidated material so fast that the cost per ton handled is far below that of unassisted manual work. Models are available with adjustable jib heights and with special loading heights.



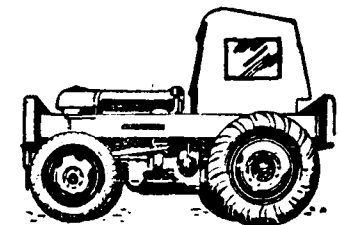
#### THE CHASESIDE DUMPER

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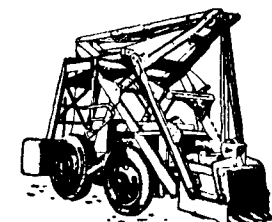
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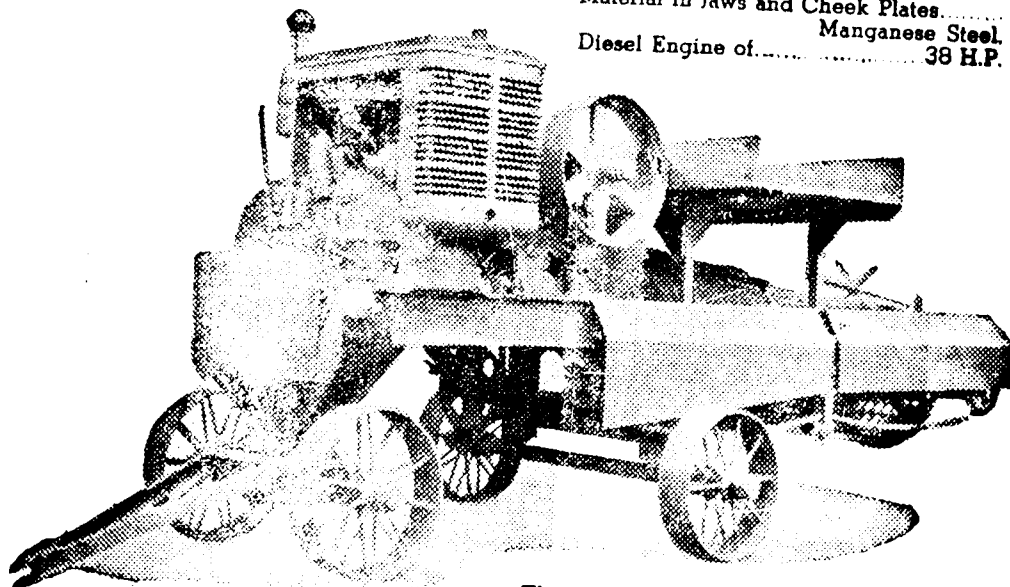
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# AUSTIN- WESTERN No. 1016 JAW CRUSHER

## SPECIFICATIONS

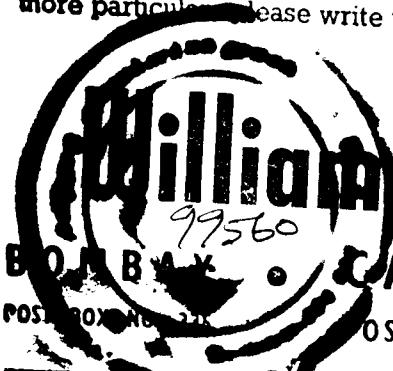
Size of Jaw Opening.....10" x 16"  
 Shaft Speed.....300 R.P.M.  
 Material in Jaws and Cheek Plates.....Manganese Steel  
 Diesel Engine of.....38 H.P.



The Crusher is mounted on a 4-wheel portable trolley with a drawbar and is fitted with a 38 Horse Power Diesel Engine. The screen can be varied in length as required and it is possible to provide perforations to produce any size product desired. The Crusher is protected against overload by a cast iron toggle which breaks if iron or other uncrushable materials lodge in the crusher jaws. The toggle is easily replaced. For more particulars please write to us.

## NORMAL CAPACITIES

| Ring size of Product. | Tons per Hour |
|-----------------------|---------------|
| ¾"                    | 4 to 7        |
| 1"                    | 7 to 11       |
| 1½"                   | 9 to 15       |
| 2"                    | 11 to 17      |
| 2½"                   | 12 to 20      |



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