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

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CORRIGENDUM

IN THE REVIEW FOR MAY 1952.

line 1 on page 42,

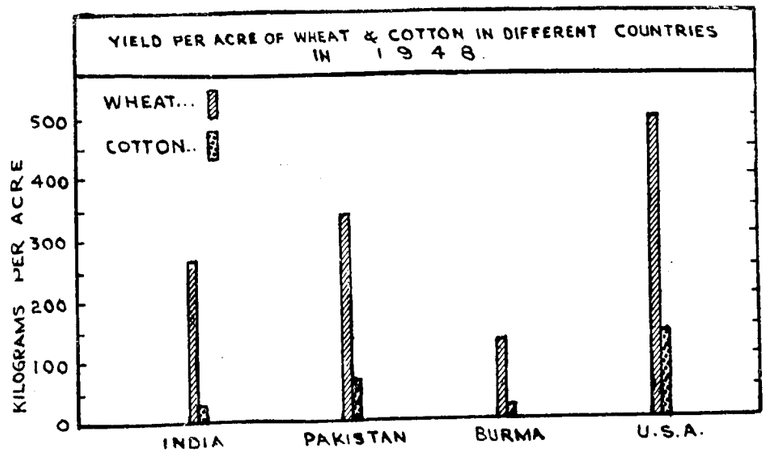
For "Hyderabad"

Read "Madhya Pradesh"

THE LEEWAY IN ECONOMIC DEVELOPMENT IN INDIA AND SOUTH EAST ASIA

[From "A General Survey of the European Engineering Industry" prepared by the United Nations Economic Commission for Europe."]

THE economics of all the countries in the area are gravely under-developed. This "can be illustrated by a comparison between India, with 306 million acres under cultivation, and the United States with 360 million. In India there are 73 million agricultural workers of all kinds, while in the United States only 8 million are actively occupied on the land. In spite of the much more intense application of manpower, agricultural yields per acre are far below those in the United States; for instance, the yield of wheat is less than 300 kg. (660 lbs.) compared with over 500 kg. (1100 lbs.) and the yield of cotton is only 33 kg. (74 lbs.) compared with 156 kg. (344 lbs.) vide Fig. below:



This disparity cannot be explained simply by natural differences of soil fertility; it is the application of capital which enables the farm worker in the United States to produce so much more than the peasant of South and South-East Asia.

For example, in the United States there are over 2,400,000 tractors, whereas in India there are only 10,000. Again, the United States uses, on an area only one-sixth greater, over 13 million tons of fertilizers a year against some 200,000 tons used by India."*

In communications, fuel and power, and industry, the scope for development is illustrated by the comparative examples given in the following table:

* The Colombo Plan for Co-operative Economic Development in South & South-East Asia, Report by the Commonwealth Consultative Committee, London, HMSO., September-October, 1950, Page, 10.

Levels of Economic Development in 1949 : Comparative Indicators.*

(in units per '000 population)

	India	Pakistan	Ceylon	Malaya	United Kingdom	United States (a)
	1	2	3	4	5	6
Electricity production ('000 kwh)	13	1.9	9.6	117	1,033	2,296
Coal consumption (Tons)	80	18	28	85	3,884	3,473
Petroleum consumption(tons)	7.8	11	23	99(b)	327	1,638
Steel consumption (tons)	3.8	1.3	6	16	194	364
Cement consumption (tons)	7.2	3.6	19	25	148	229
Locomotives (nos. (c))	22	16	32	31	410	309
Carrying capacity of railway wagons (tons)	10 (d)	8.8	4.5	13	276	556
Rail freight ('000 t/miles)	65	...	...	32	446	4,568
Load-carrying road vehicles (nos.)	0.18	0.17	1.41	3	16	43
All-weather roads (miles)	0.32	0.1	0.87	0.93	3.7	2.2
Telephones (nos.)	0.37	0.21	2.2	7.7	98	261

The fact that the economic programmes of the countries in South and South East Asia are extremely limited in their ambitions springs mainly from the belief that, in view of the extreme poverty of the people, these programmes are the maximum that the countries can sustain from their own financial resources. Although throughout the area there are some elements of state direction and control, particularly in India, production and development are still taking place essentially within the framework of liberal and semi-liberal economies.

The problem of securing funds for capital investment by curtailment of current consumption is of a different nature from that in centrally planned economies. Whether the countries in South and South East Asia are carrying out sufficiently energetic policies to mobilise available domestic financial resources is a matter for discussion.† It is generally recognized, however, that economic development can proceed only at a low rate, as a result of the shortage of capital.

Productive and per capita national incomes are so low that there is an insufficient flow of savings. The great mass of the people have no margin above a subsistence level. "Consequently there are very limited resources with which to finance the capital expenditure required for development." In India, for example, total home-financed investment is now about 2½ per cent of the national income. In some advanced countries this figure runs above 20 per cent, and in most advanced countries it is as much as five times the Indian figure.

The present situation is in the nature of a vicious circle. Economic development cannot proceed because the rate of saving is inadequate ; saving does not take place because there is insufficient development.‡ In addition, a large part of the limited amount of funds, which might have been

*Source : Colombo Plan, op. cit., page 10.
(a) In most cases, figures refer to 1948.
(b) Excluding Sovrice supplies and bunkers.
(c) Per million population.
(d) Excludes 16,516 wagons for which no carrying capacity is recorded.

† See: Mobilization of Domestic Capital through Financial Institutions of the ECAFE Region E/CN 11/1 and T/40, 3rd January 1951.

‡ Colombo Plan, op. cit., pages 54-55.

available for capital investment, have recently tended to be diverted into non-economic channels.

The Table below gives relevant financial information for the Commonwealth countries. It is believed that no more than the equivalent of 2,885 million dollars will be available from internal sources for capital development from 1951 to 1957. Even then, and in addition to a substantial amount of technical assistance, the equivalent of 3,036 million dollars of external finance will be needed. The cost of capital goods to be imported over the same period is estimated at the equivalent of 1,151 million dollars.

So far as technical assistance is concerned, help is likely to be provided in significant and increasing volume by the United Nations and its Specialised Agencies, the United States Economic Co-operation Administration and the Commonwealth Consultative Committee as well as by a number of bilateral arrangements between industrialised and under-developed countries.

Unfortunately, further difficulties are foreseeable for South and South East Asian countries. Recent trends make it likely that it will become increasingly difficult, even on cash payment terms, for these countries to obtain delivery of some types of capital goods from Western European producers as a result of the increasing demands for defence production.

Analysis of Development Programme of Commonwealth Countries. 1951–1957*

(in million US Dollars)

	India	Pakistan	Ceylon	Malaya & North Borneo	Total U.S/m.	Total %
	1	2	3	4	5	6
Agriculture (a)	1277	246	106	36	1665	32
Transport & Communications	1476	160	62	59	1757	34
Fuel & Power (b)	120	143	22	56	341	6
Industry & Mining	378	148	17	...	543	10
Social capital	610	87	78	148	923	18
Total cost	3861	784	285	299	5229	100
Internal Finance available	2162	423	171	129	2885	
External Finance needed	2291	406	168	171	3036	
From Sterling balances	591	45	53	...	689	
From other sources	1.00	361	115	171	2347	
Cost of capital goods to be imported (c)	664	322	109	56	1151	22

Instability throughout the region has been a deterrent to private foreign investment. According to the Colombo Plan‡ if a scheme involving a substantial amount of Government to Government finance is not worked out, it is very unlikely that sufficient external finance will be available to enable development programmes, limited as they are, to be carried out.

*Source : Adapted from Colombo Plan, op. cit pages 42 and 58.
(a) Including multi-purposes projects.
(b) Excluding coal.
(c) Total "cost of capital goods to be imported" is inferior to "external finance needed, as part of the domestic expenditure will call for external finance.

‡ op. cit., page 62

THE WAY TO FOOD SELF-SUFFICIENCY

More Roads the Prime Need

[Extracted from "Motor Transport", February, 1952.]

TODAY no problem is so pressing, not only for India's prosperity but her survival as an independent country among the comity of nations, as the attainment of self-sufficiency in food. But it is doubtful whether even after spending millions of rupees on the "Grow-More-Food" campaign, any appreciable results can be achieved in this direction unless the Government and the people realise the urgency for an extensive network of roads linking the remotest parts of the country. The "Grow-More-Food" campaign and the development of road transport are so inextricably linked together that it would be futile to strive for the success of the former while neglecting the latter.

Firstly, there are vast tracts of fallow and uncultivated land in the country. It is estimated that for every hundred acres of land sown in India there are approximately 50 acres of arable land which remains uncultivated. If all this land were brought under the plough it would not only go a long way towards wiping out our enormous food deficit but also bring within the reach of our realisation what has so far remained an unfulfilled dream.

No amount of persuasion or force will induce the farmer to cultivate this potential agricultural land unless and until he has the requisite facilities for cultivation, with the expectation of a fair margin of profit. This is possible only when there are good facilities for transport. Otherwise, the energy expended in reaching the lands, in transporting the agricultural implements and equipment and in carrying the produce from the farm to the market exceeds the cost of the articles produced. Efficient transport is, thus one of the most important factors for the stepping up of agricultural production.

The Royal Commission on Agriculture admitted this fact when it stated: "The provision of good communications in any area will often bring within the range of profitable cultivation several crops, not one of which could be grown on commercial basis until its extraction from the area of production was commercially possible by the cheapening of transportation."

Moreover, if fallow lands are cultivated without linking them to the towns by means of roads there is the danger of perishable foods like eggs, milk, fish, etc., being destroyed for want of transport. As a matter of fact thousands of tons of fish are yearly wasted because they can't be carried in time to various consuming centres.

The amazing results achieved in agriculture with the opening of new roads in Nayarit, Mexico, constitute an object lesson to us. Five years ago the mountainous state of Nayarit on the central part of the Mexican west coast had about nine miles of crude roads. Today it has 65 miles of first class paved highways in a 325-mile road network just completed.

Almost overnight the astonished 220,000 inhabitants found themselves in an industrial, agricultural and social revolution, almost unparalleled in modern times as a result of the new road system. Land under cultivation has increased by 25 per cent. Corn production has increased by 570 per cent to 178,000 tons. This year will see an estimated 12,000,000-dollar fruit crops, which before the new roads, was less than one-third of this. Formerly, Nayarit barely produced enough rice for its own population. Today the value of its exported rice crop is reported to be 98,000,000 dollars.

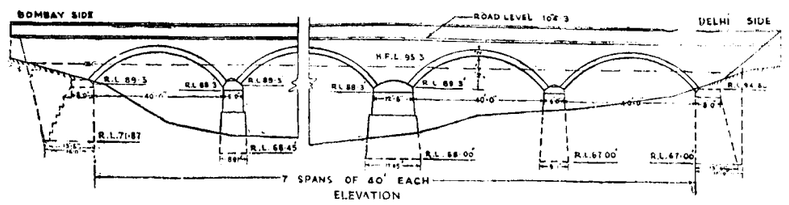
The results are remarkable and the plan worth emulating. It is, therefore, worthwhile to concentrate our energies on the development of roads to stave off the calamity of scarcity and famines and take an honourable position among other nations of the world.

(Continued on page 26)

BRIDGING INDIA'S RIVERS

THE TANSA BRIDGE

FORTY-six miles north of Bombay, near Ambadi in the district of Thana, Bombay State, the route from Bombay to Delhi *via* Gujerat and Rajasthan, called National Highway No. 8, crosses the river Tansa over the recently constructed Tansa Bridge, which was thrown open to traffic in May 1951 by the Hon'ble Shri Jivraj N. Mehta, Minister for Public Works, Government of Bombay.



The bridge replaces the vented low causeway which existed about 600 feet upstream. This causeway was only 18 feet wide between the wheel-guards and rose only 6 feet above the lowest water level in the stream. It did not satisfy the needs of traffic and its frequent submergence during the monsoon often interrupted traffic. Besides, it needed frequent repairs due to scour on its downstream side.

The Tansa bridge is the first to be completed in the 5-Year construction programme of 75 bridges required on the roads of Bombay to improve its road communications and estimated to cost about Rs 7½ crores; the first of a series of six bridges required to link the northern and the southern parts of the Thana District; and also the first of the 16 bridges required to establish uninterrupted all-weather flow of traffic between the two premier industrial centres of the State, Bombay and Ahmedabad.

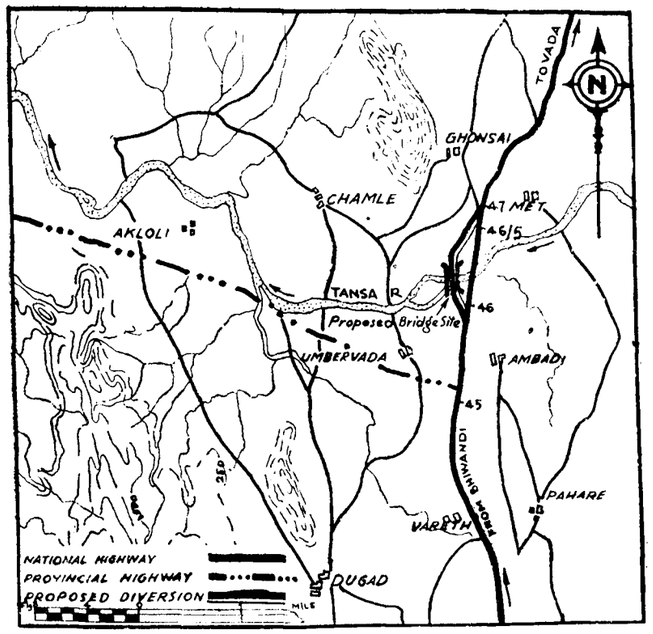
In the Thana District five more bridges on this highway are under construction across the Vaiterna, Prinjal, Deherja, Surya and the Chitpada.

They are estimated to cost about Rs 27 lakhs. The Surya and the Chitpada bridges are situated on the permanent route of National Highway No. 8 and are, therefore, being financed wholly by the Centre. The other three bridges are being aided by the Government of India to the extent of 50 per cent of their cost.

The Tansa bridge project was sanctioned in April 1948 but the actual construction started in October 1948. The original intention was to get the work done on contract, but later it was decided to do it departmentally, since the rates tendered by contractors were excessive. It took about two years and a half to complete the bridge.

The Site of The Bridge

About 600 feet downstream of the existing causeway, a site was available where the river had well-defined banks and flowed through a narrow gorge. Here the length of the bridge required was relatively small and the structure could be founded on rock which existed not much below the surface of the bed of the stream.



—Site Plan—

The site was, therefore, approved. This site entailed the construction of new approaches about a mile long altogether.

The Foundations

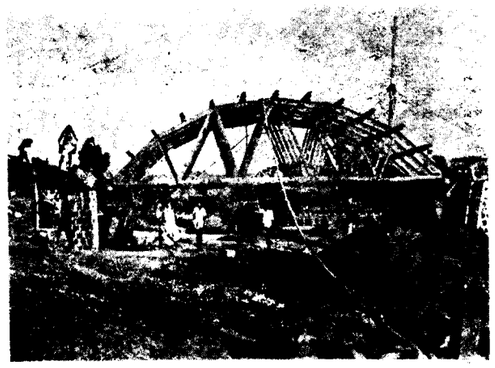
Open type foundations were designed and laid without any difficulty. The overlying weathered rock strata had to be removed to an average depth of 5 ft. 9 in. to reach hard rock. The cement concrete mix used in the foundations was 1 : 3 : 6.

The Superstructure

Since hard rock was available for the foundations and the section of the stream was deep and narrow, it was possible to adopt arched spans. Forty foot clear spans were found economical. Unreinforced arches were designed with a view to avoiding the use of steel of which there was a scarcity in the country. The loading applied in the design was the I.R.C. Class A2 lanes, or Class AA one lane.

At first it was intended to design spandrel-filled segmental arches, 30 ft span, in lime concrete in view of the fact that lime concrete is resilient. But the idea

was given up as good lime was not available within economical distance of the site of the work. It was finally decided to use pre-cast cement concrete blocks (1 : 2½ : 5) in preference to stone or bricks, as the pre-cast cement concrete blocks have greater compression strength than stone or brick, and the arches constructed with them are capable of adjusting themselves to the stresses induced by shrinkage and changes in temperature better than the cast-in-situ cement concrete.



Steel centring for arches.

The arches were constructed with a rise of 1/4 span, the span being 40 feet; thickness of the arch ring, 2 feet throughout; rise of the arch, 1/4 span; thickness of the cushion at the crown of the arch, 2 ft 6 in; piers, 6 feet wide at the top with a suitable batter on each side; abutment, 8 feet wide at the top with a back batter 1 in 4; abutment pier 2 Nos, 12 feet 6 in. wide at the top with a suitable batter on each side: pier caps, 1 ft thick cement concrete.

Abutments and piers were constructed of second class coursed rubble stone masonry in 1 : 6 cement mortar.

View showing the work in Progress.

Salient Features

Spans, 7 of 40 feet each; length of the bridge from abutment to abutment, 345 feet; thickness of the arch ring, 2 feet throughout; rise of the arch, 1/4 span; thickness of the cushion at the crown of the arch, 2 ft 6 in; piers, 6 feet wide at the top with a suitable batter on each side; abutment, 8 feet wide at the top with a back batter 1 in 4; abutment pier 2 Nos, 12 feet 6 in. wide at the top with a suitable batter on each side: pier caps, 1 ft thick cement concrete.

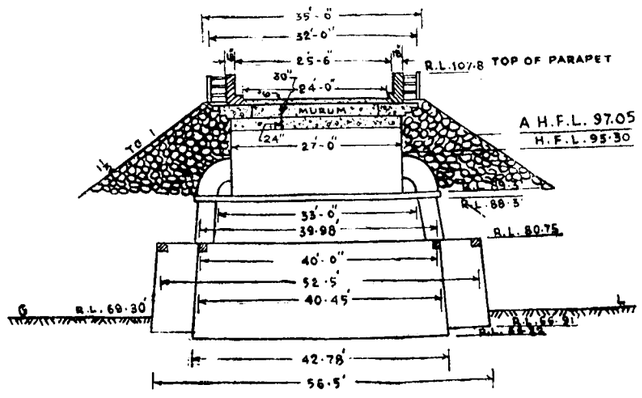
Abutments and piers were constructed of second class coursed rubble stone masonry in 1 : 6 cement mortar.

Width of carriageway, 24 ft between wheel-guards; wearing surface, 6 in. thick cement concrete slab (1 : 2 : 4).

The Tansa drains a catchment area of about 150 square miles and the bridge was designed for a discharge of 84,500 cusecs flowing with a velocity of 30 feet per second.

View showing the work in Progress.

Piers under construction.



Cross section of the Bridge.

COST

The original estimate of the cost framed in the beginning of 1948 was Rs 2.87 lakhs. The actual completion cost of the work was Rs 4.33 lakhs. This rather high excess of the actual expenditure over the estimated cost was mainly due to the rise in the cost of materials during the period of construction. Per running foot the actual cost works out to Rs 1,015 excluding the cost of the approaches.

LOCATION OF UNDER-GROUND SERVICES IN TOWNS AND CITIES

(Contributed by the Standards Section--Roads Organization)

THE amenities and comforts which are a concomitant of modern civilization have brought in their train problems concerning road surfacing and road maintenance which have to be solved by the highway engineer. In a growing township what may modestly begin as the cutting up of a road berm to locate a water pipe or a sewer, may easily expand to the wholesale and frequent opening up of berms to form trenches for other services such as electric cables, telephone cables, storm water drains, unfiltered water mains, etc. All these services have come to be known as **underground services**, and unless these are properly planned and unless agreement is reached between the concerned authorities on the order in which these services are to be provided, there is bound to be serious and frequent dislocation to traffic.

The coming decade will see large-scale developments in the form of (1) satellite

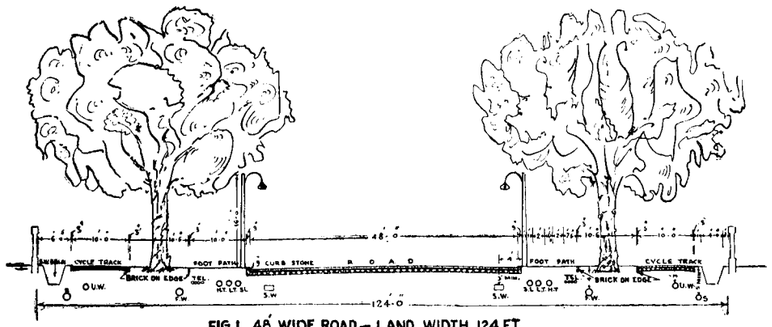


FIG.1. 48' WIDE ROAD – LAND WIDTH 124 FT.

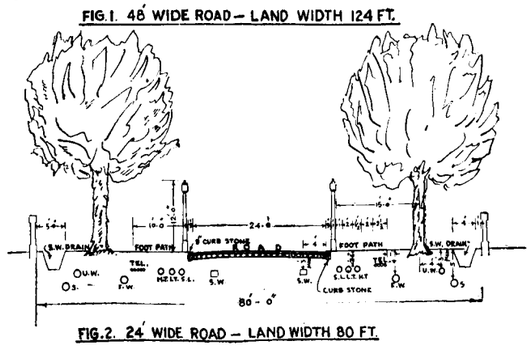


FIG.2. 24' WIDE ROAD – LAND WIDTH 80 FT.

LEGEND

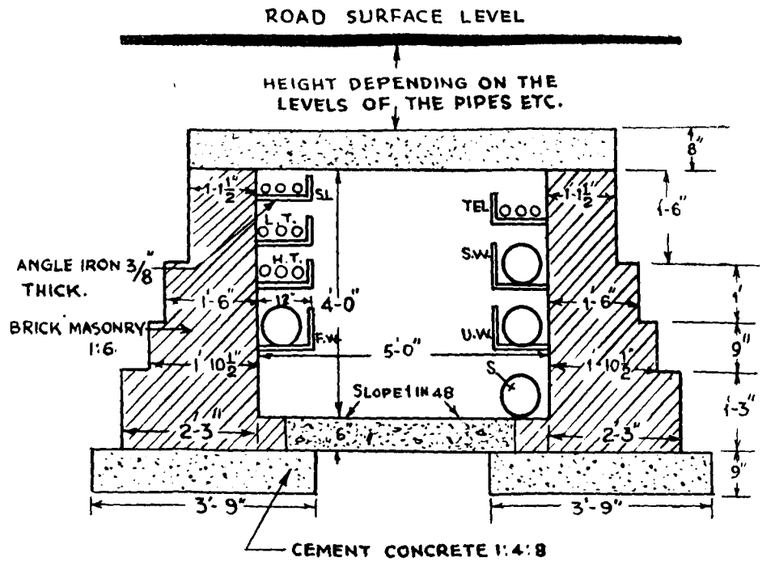
S. L...Street Lighting Cable
L. T...Electric Cable—Low Tension
H. T...Electric Cable—High Tension
F, W...Filtered Water Main
TEL...Telephone Cable
W...Storm Water Pipe
U. W...Unfiltered Water Main
S...Sewage Pipe

townships on the outskirts of existing towns; (2) new townships springing up around major industrial undertakings; and (3) re-development of congested areas in the existing cities. It is necessary for highway engineers to press for a policy for the location of underground services and to insist that the necessary space for each service along a highway is reserved.

Location

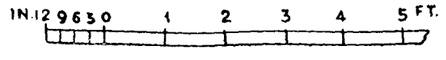
Since the facilities required by the different utility organisations to enable them to instal and maintain the services to houses are not identical, it is necessary to earmark the position of each service in such a manner that, not only should it not interfere with the other services, but that it should also perform its function with the greatest possible ease. While public utility bodies have often the right to lay their mains and services under highways, it is very desirable that their location should be such as to minimise interference with traffic. They should accordingly be laid, whenever possible under the footway or verge and not under the carriageway.

This question of the spacing of underground utilities was at one time considered by a joint Committee of the Institution of Civil Engineers and the Institution of Municipal and County Engineers in the United Kingdom and the Report of the Committee was published by the Institution of Civil Engineers in 1946.



NOTE 1. THE PIPES MAY BE 9" TO 18" DIA.
2. MAN HOLE CAN BE LOCATED ON FOOT PATH PORTION.

Fig. 3. SUBWAY FOR TAKING SERVICES ACROSS ROAD



Note.—*For legend See p. 9.*

They recommend that a width of 10 ft. 6 in. beyond the carriageway should be the desirable minimum for the accommodation of services.

Standards for Delhi. A high power committee of engineers concerned with the planning of improvements in Delhi recently considered the problem in relation to the services obtaining or proposed in Delhi and the decisions arrived at are illustrated in the drawings Figs. 1, 2 and 3.

The Engineers of Delhi were not generally hampered by restriction of space either in width or depth because in all new developments adequate footpaths are being provided. Some special points are explained below.

The storm water drains are located below the carriageway because they seldom need opening up. All electrical services are located below the footpaths, the nearest to road side kerb being the street light cable so as to be easily accessible to the street lights. The filtered and unfiltered water pipes and sewers are located on either side of the avenue trees at a sufficient distance away so as not to affect the trees in case trenching is done for these services.

Where the services have to be taken across a very busy road, special sub-ways have to be constructed to pavement frequent cutting open of the road structure. A typical section of a sub-way is given in Fig. 3. The subways extend from manhole to manhole located on the road berms. In fixing the levels of the supports for each service it should be borne in mind that water pipes cannot easily be bent either horizontally or vertically whereas electric cables can be so handled. Thus the alignment both in plan and section should be so designed as to suit the water mains. Sewers generally work by gravity and it is not always possible to assign them an arbitrary level. Their alignment should be carefully fixed. It may sometimes be necessary to exclude them from the subway.

In the design of subway chambers attention should be paid to the provision of adequate working space for the introduction of pipes or cables, or carrying out repairs. The design in Figure 3 provides a clear width of 2 ft. 6 in. between the two tiers of pipes and cables. This distance can, however, be modified according to the needs in each case.

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MISTAKEN IDENTITY

On a mid-west night train in the U.S.A. a passenger told the sleeping-berth attendant to wake him at 3 A.M. as he had to get out at a small station then.

Passenger. *"Never mind, I am a heavy sleeper and I may protest. Take no notice but push me out with my baggage."*

Attendant. *"Yes, Sir, I'll sure see you get out."*

The next morning the passenger was still in the train. He rang for the attendant in a rage.—

Passenger. *"Why did you not push me out at 3 A.M. as I told you to do? I am very angry and I....."*

Attendant. *"You are not half so angry, Sir, as the gent I pushed out last night."*

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SUCCESSFUL ENGINEERS NEVER STOP LEARNING

This article extracted from "Civil Engineering" July, 1950 is based on the author's address at a recent joint meeting of the ASCE Pittsburgh Section and the Engineers' Society of Western Pennsylvania at Carnegie Institute of Technology.—(Ed.)

THE ENGINEER is a member of a profession that prides itself on its scientific, humanistic, and technological achievements, and on the individual responsibility assumed by its members to apply free, resourceful, and unhampered intelligence to the solution of its problems. Our profession includes men of stature—who have never stopped learning or giving—men like "Boss" Kettering and Herbert Hoover. Every young engineer should aspire to professional competence such as they have attained, and the mature engineer—whether in industry, government, or teaching—should help him achieve it.

Responsibilities to Young Engineers

The college, the employer, and the professional society have definite responsibilities in the development of young engineer, particularly as they can help him to acquire and to maintain healthy attitudes toward his work and toward life in general. How can we co-operate to foster such attitudes? How can we create in him the desire for education as a continuing process upon which his professional growth will depend?

The role of the college is to help the student learn to think and to equip him to go on learning after graduation and to grow throughout stature and in usefulness as a citizen. How well the college does its job depends to some extent upon the physical plant, and upon the academic programme but far more importantly upon the quality of the teacher and the quality of the student and the way in which they work together. The inspiration and the example of a fine teacher are the secrets underlying many a man's success. The teacher must want to teach men primarily—not subject-matter—and he must have personal characteristics that will command respect and admiration. He cannot teach discipline pertinent to the student's chosen field without first arousing the interest of the student and then helping him to maintain that interest. If a student likes his work, and if he can be made to see that he learns only from what he himself thinks and does, the problem is simplified, and the young engineer has a good start on the engineering route.

College can give the embryo engineer a good start, but many of the fine influences of college can be lost if the industry he enters does not show a personal interest in his continued development. I firmly believe that in industry, just as in college, the young engineer should be in daily contact with men he can admire and emulate. Perhaps the most significant aspect of training is arranging manpower so that the beginners are intimately associated with those who are skilled and possess the rare ability to teach others. Such relationships do occur in industry—perhaps more frequently by chance than by design—but everything should be done to foster them.

Professional societies have much to offer beginning engineers. They provide an excellent opportunity for young men to mingle—often on an informal basis—with other and older members of the profession, and to learn from them both about technical engineering and about that even more complex engineering task—the task of designing, building, and maintaining an intelligent, adjusted life. The young engineer can contribute to his profession and incidentally to his own growth and reputation by writing for professional

journals; and by working in the professional societies, he can keep himself constantly aware of the standards, the purposes, and the ethics of his profession.

Seven Basic Rules for Success

The engineer-in-training, under proper direction of engineers of fine character and high ideals, can establish healthy attitudes for himself—a set of basic rules to lead him to success in his work and in his living. Those rules might be something like this:

FIRST, he should remember that he is a free man working for private enterprise in a nation which makes human freedom its primary concern. He should guard this privilege at all times by his thoughts and by his actions.

SECOND, he should take pride in himself and in his profession, and should not sell either of them short. He must realise that the engineer is essential, and is responsible for much of the world's progress and for the success of many of our country's largest industries. He must know his possibilities as a member of the profession.

THIRD, he should be loyal to his company, his superiors, and his associates; give himself completely to every job he does; do more than he is asked—never less. He should fight hard for what he thinks is right, but should learn to carry out the decisions of his superiors if his is overruled. He should give his subordinates a break by defining their tasks clearly, letting them have the authority necessary to discharge their responsibilities, and giving complete and unmistakable recognition to their work.

FOURTH, he should try to see the forest as well as the trees. He should spend time not only on his immediate assignment but also on thinking about the long-range problems of his company. His employer knows that he can think, but hopes that he will also have vision. The methods he has learned to use on engineering problems are equally applicable to other problems of his company—problems of advertising, selling, accounting, and personnel.

FIFTH, he should study people and learn to work with them. Engineers get things done by teamwork. There are fewer and fewer corners for individualists. The young engineer should know the strength of men as well as he knows the strength of materials.

SIXTH, he should carefully watch three things—his health, his appearance, and his tongue.

SEVENTH, and finally, he should always keep in mind that the price of success is hard work; therefore, he should continue to study and learn while he waits for his opportunity to come.

Capsule Advice to the Young Engineers:

1. Guard the privileges of freedom at all times.

2. Take pride in yourself and your profession.

3. Be loyal to your employers and associates.

4. Try to develop vision as well as technical ability.

5. Study people and learn to work with them.

6. Watch three things—your health, your appearance, and your tongue.

7. Never stop studying and learning.

—o—

"Tell me, sir, who was braver than Lancelot, wiser than Socrates, more honest than Lincoln, wittier than Mark Twain, and more handsome than Apollo?"

"My wife's first husband."

—o—

HERE AND THERE

(1) HAZARDS ON THE INDIAN ROADS

I don't think I have ever described to you what driving, even on a paved highway, in India means. It is an exciting experience. No one has the faintest idea of living up to the rules of the road even if the rules are known to them. The paved part of the road is not quite wide enough for two cars to pass, so much of the time one is enveloped in dust. The real hazards of the road, however, are bullock-carts. The driver either goes to sleep in the bullock-cart or if he isn't asleep, he can't control the bullocks which go either right or left as the fancy takes them. Then the herds of loose goats, bullocks, donkeys the occasional riders on donkeys or camels all are hazards! Hundreds of people are met on bicycles and many people on foot carrying heavy loads on their heads.

There are the two-wheeled pony carts, always so filled with people that one wonders if they will pull the pony backwards. The horn honks incessantly and one is always having narrow escapes. One breathes freely as a child running across the road is missed by a few feet, and three minutes later one gasps as a bullock turns squarely before the car. Drivers in India are most skilful, but they cannot make time because it is the other fellow that has to be watched. In addition, if one is on a road that has no paving the dust is pretty bad all the time, but at least one can say that driving in India is never a bore.

Mrs. Eleanor Roosevelt, (The Hindustan Times', New Delhi, April 2, 1952.)

(2) DODGING THE TUNNEL

NEWS that a West of England-London express was stranded for an hour and a quarter in the Box Tunnel would have caused a great stir a century or so ago, when it would have been regarded as a remarkable escape that passengers should have passed unscathed through such an experience. The question of survival in a tunnel was a good deal convassed in the early days, and learned counsel angered Brunel the engineer by suggesting that no passenger could possibly survive two journeys through the Box Tunnel.

This was an opinion so widely held, even by some doctors, that a good many people took what was considered a wise precaution in the early days of the Great Western Railway by leaving the train at the station before the tunnel, covering the distance between the two stations on the surface by chaise, and joining a train again when there was no longer any risk in doing so of exposure to the dangerous atmosphere of the tunnel.

(Extracted from 'The Wednesday Review' 14-5-1952.)

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(3) PRIVILEGE TICKETS

HIGH Court judges, when travelling more prosaically by trains, are provided with reserved carriages, a privilege they share with lunatics, verminous persons, Cabinet Ministers and corpses.

(Extracted from 'The Wednesday Review' 14-5-1952,)

(4) NO FOUNDATION!

FOUNDATION problems reach the ultimate when there is no first storey for a two-storey building. In the fullness of its bureaucratic wisdom the federal agency which now regulates the use of materials for construction authorized the building of a second floor for a municipal building, but denied the permit for the lower one. The small Western city had planned a civil defence headquarters, and the request for this construction was approved. City officials had also asked permission to build a firehouse, and this was refused. In this case half-approval was the same as no approval at all, since the defence headquarters was to be located in the second story over the firehouse. Thus does the strict interpretation of regulations bring confusion to construction.

(Extracted from "Western Construction," February, 1952.)

[The U.S.A. seems to be getting like us-Ed.]

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(5) ICE JAM TOPPLES BRIDGE

THREE piers and four spans gave way to an ice jam on the South Saskatchewan River. The piers and spans were part of a year-old, million-dollar bridge near Swift Current, Sask.

Huge ice cakes had been ramming the bridge for nearly a week. Just before dawn on April 6, the structure collapsed. The broken sections floated down the river on the ice for a short distance and then disappeared beneath the water.

No injuries have been reported. The bridge was located 35 miles north of Swift Current and provided the only link between that town and the northern part of the province. It was a concrete and steel structure that had taken two years to build.

(From the 'Engineering News-Record' 10-4-52.)

(6) TURKISH ROAD BUDGET INCREASED

THE 1952 highway budget of Turkey is approximately (U.S.) 30,000,000 dollars, an increase of more than 5,000,000 dollars over the 1951 budget. Highway development in Turkey is continuing to show progress with many benefits already resulting from the road improvements which have been made. The highway programme is being carried out with the assistance of the U. S. Bureau of Public Roads and Economic Co-operation Administration grants totalling 18,500,000 dollars.

(Extracted from 'World Construction' – March-April 1952.)

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(7) FRENCH ROAD PROJECTS

IT is proposed that work on the express motor road tunnel through Mont Blanc shall begin in the Spring of 1952. The 13 kilometre (8 miles) long tunnel, which is to cost some £7,143,000, will be 8 metres wide and some 4½ metres high, with four traffic lanes. The tunnel, which will take some three years to complete, will be three times longer than the Mersey Tunnel, Englan[illegible] one of the longest exist[illegible] The transit tim[illegible] for motor vehicles will [illegible] age fifteen minutes. The toll pro[illegible] for motor [illegible]hicles is some 10/6d.

creation of a special road fund, by the Government, may be expected to facilitate the financing of the project.

Work has begun on the first section of France's Great North Road joining Paris to Lille. The Lille-Carvin stretch is to be opened to traffic in 1953.

Two other through roads due for completion within the next one to two years are the southern autoroute from Paris and the Croix-Rousse Tunnel, Lyons. Work is also to be started in 1952 on the Tancarville suspension bridge. Modernisation of a considerable mileage of roads is being undertaken at present and 1,000 kilometres (621 miles) of main roads are being transferred into double highways.

(*From International Road Federation Bulletin No. 5/6 – March, 1952.*)

(8) HIGHWAYS PROVE THEIR WORTH

Travel Quicker than by Railway

THE Australian experiment of carrying cattle by truck from outback country to the nearest railhead instead of driving them on the hoof has certainly proved its worth as a commercial proposition, according to Mr. D. M. Fraser, Chief of North Australian Pastoral Co. and its associates.

On the comparatively good Mount Isa road the Leyland Diesel trucks and trailers averaged about 21 m. p. h., and on the bad Dajarra route the average was approximately 14 m.p.h. Although this speed may appear low, it is much greater than that of the railway, which, over 700 miles to Bowen, was only 10.6 m.p.h.

(*Extracted from 'Highways and Bridges' – January 30, 1952.*)

(9) BELGIAN CONGO ROADS

Cheaper Than Railways

THE Belgian Congo ten-year plan authorities believe that, provided Lakes Kivu and Stanleyville are linked, roads transport carrying up to 400,000 tons a year would be cheaper to operate than the railway, reports the International Road Federation. Under the plan, as at present envisaged, the railway network of some 3,000 miles will have to be extended. However, as improved roads would appear to be a more economical proposition for the Colony's freight requirements the proposals for extending the railway are being reviewed, an I. R. F. bulletin states. The network of Viciocongo (Compagnie de Chemins de Fer Vicinaux du Congo) is to be extended by the construction of two modern highways. It has also been considered advisable to improve the road between Boma and Tschela rather than to extend the Mayumbe railway.

First priority is to be given to the construction of five main highways linking the major cities of the Congo with areas inadequately served by rail and waterways. Eleven roads, totalling some 7,600 miles, will connect principal production centres with the river ports and rail centres. The cost of this undertaking is estimated at some £43 million. Belgium has received an E. C. A. grant of £6,37,500 for the building of strategic roads in the Congo while the Export-Import Bank has approved a loan of £5,35,700 for road improvements, waterway modernisation and the construction of power stations.

(*Extracted from 'Modern Transport' – Feb. 2, 1952.*)

(10) ROAD TRANSPORT AND THE NATIONAL INCOME IN U. K.

IN the United Kingdom 11 per cent of the national income was spent on road transport and travel in 1950 and between 3 and 4 per cent was spent on other forms of internal transport, according to estimates arrived at by a member of the Road Research laboratory. In 1950 some £40 million was spent on goods haulage, £210 million on transport by bus, and £340 million on private and business motering.

(*From I. R. F. Bulletin No. 5/6 – March-April 1952*).

(11) SOUTH AFRICAN LONG-TERM ROAD IMPROVEMENTS

DURING the years 1936–49 the Union of South Africa has spent over £49 million on roads, interest on Treasury road loans, administration and other matters connected with roads. Of this sum approximately 63 per cent came from the petrol tax, 35 per cent from Treasury loans and 2 per cent from miscellaneous receipts. During this period 3,000 miles of road have been asphalted, and 1,600 miles have been completed to gravel standards. Asphalting is being carried out at the rate of 200 miles a year. The eventual cost of the 5,000 miles of national roads to be improved and/or built is put at £90 million.

(*From I. R. F. Bulletin No. 5/6 – March 1952.*)

(12) WORLD PETROLEUM CONGRESS

THE Fourth Session of the World Petroleum Congress will be held in 1955 in Italy, most likely in Rome. It has been decided tentatively to hold the Session from the last week of May to the Ist week of June 1955.

2. In general the set-up of the I951 Congress at the Hague will be adhered to viz., a fully petroleum-technical and non-political discussion, split up into ten sections. In order to stimulate and guide the submission of papers a programme committee will be formed for each section. In addition to calling for papers to be submitted individually, these committees will invite experts in the various technical fields of the oil industry to write reviews of the recent developments in their spheres between I951 and 1955.

(13) MEXICAN ROAD PROGRESS

THE Mexican Department of Communications received the highest appropriation of any official department in the Federal budget for 1952. A sum of 435 million pesos (£17,984,000) has been granted for maintenance and the construction of new highways, an amount exceeding the combined totals allocated to the army, navy and air force. Roads in Mexico are being improved to earn tourist dollars and to stimulate economic development generally.

In addition to the Federal grants considerable allocations are provided by State and Municipal Governments and contributions are made also by private initiative.

(*From I.R.F. Bulletin No. 5/6, March 1952*)

[*We would be happy in India to get for 'roads in Budget, not more than in Army, navy, and air force but even twenty per cent of what is spent on those services—Ed.*]

WHO TAKES CARE OF RAILROAD—HIGHWAY CROSSINGS?

(Extracted from 'Better Roads'—October, 1950).

[We have a number of level crossings in India and we want them improved to modern standards. But how should responsibility be shared actually in practice within our legal framework? What should be the standard of improvement? How and when should improvement be undertaken? What should be done to foster co-operation between the Railway and Highway departments? These are some of the perplexing questions that need solution.

The rules and standards for the railroad highway crossings in India were framed years back to suit the railways as the roads were then completely neglected. The old rules are still applied, though now it is recognized by all that good roads are essential for any form of development in the country. The level crossings continue to be hazards for road traffic.

In the U.S.A. many States have State Public Utilities Commissions or State Commerce Commissions that develop standards and specify the division of responsibility between the Railway and Highway authorities. Some time back a contributor to the magazine "Better Roads" posed certain questions relating to level crossings in the U.S.A. The extracts from the replies received by the Editors of that publication are reproduced below in order to afford an insight into the results achieved in the U.S.A.....Ed.]

THE QUESTIONS: 1. How is responsibility for the condition of railroad-highway crossings at grade ordinarily divided between the railroads and highway authorities?

2. Have highway departments found it possible to provide a standard of improvement generally satisfactory to highway users at all existing railroad-highway grade crossings—even on strictly local roads?

3. Have standards been developed to govern grades, sight distance and type of surfacing for grade crossings on roads in various traffic classifications?

4. When the improvement of an existing crossing is undertaken, how is the work and how is the cost divided between the railroad and the highway departments?

Lancaster county, Nebraska..... Crossings are to be not less than 20 ft wide, and to be solidly constructed of the same material throughout; they are to be of a permanent thickness equal to the height of the railroad rails.....

The county improves sight distance at crossings at its own expense whenever it is found desirable to do so.

Marion county, Kansas.....Kansas state law specifies that a railroad grade crossing shall not be less than 24 ft wide on county road and 20 ft wide on township roads. The crossing is to be at the same grade as the track for 30 ft on each side of the centre of the track, unless the county commissioners find this requirement unnecessary. Approaches to the crossing are not to exceed a 6 per cent grade.....

When we feel that a railroad has not made an honest attempt to provide an adequate crossing to fit the needs of traffic, we use the state law to get our improvement. The law is used as our standard, although only a few of the county roads meet its requirements.

If the crossing to be improved requires excessive work to bring it up to standard, I usually call a conference with the railroad's roadmaster, and we work out a schedule of responsibility. If I propose to use the railroad's right-of-way as a borrow-pit, I also arrange for a conference. We have had no serious trouble in getting together with the railroads. Once in a while I have to quote the law to them, but usually I find that they are co-operative.

The county maintains the approaches to the grade crossing, as well as the road as it passes over the track. It would be foolish to lift the blade at the railroad right-of-way line. The railroad maintains the crossing between the rails and on each side of the rail. This arrangement is sound; the railroad should do this work to protect its high speed trains. In this arrangement the county and the railroad each pays its own expenses.

Winnebago county, Wisconsin..... Our experience with the railroads has not been too good. Eventually they get around to repairing their crossings...but after we have sent them many notices and 3 month's time has elapsed.

During the past year we had one experience that left a sour taste in our mouth. One railroad crossed a county trunk highway at an elevation of 8 ft above the road, with only approximately 70 ft of approaches. Without notifying the highway department, the railroad company raised the grade an additional 8 in. It was a bad crossing before anything was done to it; now it is even worse. We do not believe that the railroads should have the right to do such work without first taking it up with highway authorities.

Jackson county, Oregaon.....We try to have the road bed on each side of the crossing as nearly level as possible for a distance of not less than the length of a long truck and trailer .....

The county ordinarily pays the cost of installation or improvement of an existing crossing. Then the railroad assumes maintenance between the ends of the ties. If the improvement is required because of raising or lowering of the grade of the railroad tracks, the railroad pays the entire cost. If the railroad instals an extra siding across an existing road, it also pays the entire expense. Responsibility for the condition of grade crossings rests on the railroads after the crossing has been constructed. The railroad bears all the expense of maintenance between the ends of ties, or approximately 2 ft outside of each rail.

All improvements, including widening of existing roadbeds or any special change in grade, must have the approval of the state public-utilities commissioner. We have had very fine co-operation between the railroads, the commissioner and the county, and we think that our method of keeping crossings in good condition is fair to both the railroads and the county.

Oconto county, Wisconsin...Notifies the section foreman of the railroad company when any crossing repair work should be done. The foreman undoubtedly confers with his superior if the repair job is extensive or costly; but when the job is small the foreman and his men take care of it immediately.

We sometimes finish small improvement jobs and bill the railroad company for the cost. Improvements of a larger nature are undertaken by the railroad. All costs are charged to the railroads and they are responsible for maintenance of their crossings.....

Henry county, Indiana...The railroad companies in Henry County, Ind., are responsible for all railroad-highway crossings at grade. Whenever new crossings are constructed an agreement between the county and the railroad provides that the railroad takes care of its own 32½ ft right-of-way across the road. The railroad pays for all labor and material in constructing the crossing, although we furnish the aggregate to build up the grade to the crossing when it is necessary.

The railroads have been very co-operative in maintaining their crossings, and they work in harmony with the county highway department whenever it is necessary.

Los Angeles County, California...The responsibility of the railroad at crossings at grade covers the area for a distance of 2 ft outside of each rail. Beyond this point the responsibility rests with the Highway department. When new crossings are developed, the State public-utilities Commission specifies the division of responsibility.....

.....Standards developed by the public-utilities commission are observed at all new crossings. Existing crossing are gradually being reconstructed to conform to the standards.

When the improvement of an existing crossing is undertaken, the work is usually divided on the basis that the railroad company takes care of the track and ballast requirements, and the highway department handles all the paving. The division of cost is variable, ranging all the way from 100 per cent paid by the railroad if it develops the crossing. Frequently the cost of improvements is shared equally.

Division of Highways, Illinois.....The State Commerce Commission issues rules and regulations pertaining to the construction and maintenance of railroad-highway grade crossings. We interpret the commission's rulings to mean that the condition of grade crossings is the responsibility of the railroads. Our current policy on the state-maintained highway system is to maintain the highway up to the ends of the track ties, which includes the "islands" between multiple-track ties. In our dealings with the railroads we have found them very co-operative when we have requested that they improve the riding qualities of a crossing that has become rough or in need of additional maintenance.

The installation of crossings of prefabricated full-depth creosoted timber, precast concrete slabs, or other high-type materials would afford a standard of improvement generally satisfactory to all highway users. However, a state-wide crossing replacement using materials of this kind would entail an exorbitant expense to the railroad companies. When we negotiate a grade crossing improvement, we endeavour to secure a material slightly higher in type than that used on the highway.....

Our standard design policies for different classes of rural highways are applicable for use in determining highway grades and sight distance at crossings. The type of surfacing for the crossing proper, however, is determined by the railroad involved. We believe this is right, because the future maintenance of the crossing is the responsibility of the railroad.

When the improvement of an existing crossing is undertaken, it is usually necessitated by improper or poor riding qualities. Its repair or replacement with similar materials, or replacement with a different type of surfacing, is a maintenance problem. The work involved should be performed by and at the expense of the railroad. When an existing highway is widened and a wider crossing is necessary, it is our policy to either bear the entire expense of extending the crossing, or equitably divide the expense between the state and the railroad for the installation of a new crossing.

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BUGS

Jones saw an advertisement in the newspaper for an absolutely sure device for killing bugs. He sent off this five shillings and in due course A small parcel arrived containing two small wooden blocks. The accompanying instructions read—

"Place the bug on one block and press on it firmly with the other. This is guaranteed as an absolutely certain way to kill bugs."

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ENGINEERING AND MATHEMATICS

[*Extracted from "Concrete Constructional Engineering, Vol. XLIV, No. 7, July, 1951.*]

AS the theory of structures develops an increasing amount of higher mathematics appears to be required, so much so that it may well be doubted whether some complex mathematical processes really represent the changes of deformation and stress to which a structural member is subjected. The explanation in some cases may be that, although the basic equations which express the behaviour of the structure are not complex, the solutions of these several simultaneous equations are a complex and lengthy mathematical procedure. The art of engineering lies in the ability to interpret the results of mathematics rather than in the mathematics themselves. For example, analysis may give the bending moments which, under certain conditions, may not all be realistic. To provide resistances equal to these moments without considering the pertinence of the conditions is not good engineering.

An assumption commonly made is that a member is not in a state of strain before the application of the external loads, that is, the deformations and stresses caused by piecemeal construction and by shrinkage restrained by reinforcement, shuttering, or adjacent members are commonly neglected although they may differ greatly from those caused by the load on the completed structure. The large variation of the moment of inertia due to changes of shape, the amount of reinforcement, and the amount of cracking of the concrete is also generally ignored, and conditions of free support are often assumed when such is not the case. Such factors must be taken into account in design by considering whether the results of the mathematical analysis must be increased at one point, or may be relaxed at another. This view is expressed in a publication of the Road Research Laboratory in which about thirty methods of designing roads and runways are reviewed. The methods include empirical ones based on the classification of the soil, methods based on the strength of the soil, methods based partly on theory and partly on experience, and others which are wholly theoretical. There is no method that is generally accepted, and it is shown that many have little in common either as regards the assumptions or the results.

The most reliable methods give only a rough idea of the thickness of the slab required. The best empirical methods give more reliable results than methods which are wholly theoretical, but, as is stated in the publication, all methods require a considerable amount of commonsense and experience on the part of the engineer who uses them.

The modification made recently to the formulae of Professor H. M. Westergaard is considered to be the most reliable method for calculating the stresses due to traffic on concrete roads, and another theory is recommended for calculating the stresses due to temperature changes.

As was the case with nearly all engineering structures up to a century ago, the design of concrete roads has been mostly based on experience, judgment, or guesswork. It is only to be expected that in the course of time attempts would be made to express mathematically the behaviour of a concrete road, as has been done in the case of other structures.

In view of the many influences of unknown magnitude that affect the stresses, it is not remarkable that a satisfactory analysis is difficult to devise. Because of the great loads to which roads and runways are now subjected, a reliable method of design is more than ever necessary if failures or waste are to be avoided. Experience allied to fundamental and applied research is the only source from which such a method can be evolved. The publication suggests that the beginnings of such a method may be seen in the analysis of elastic systems of members composed of layers. This analysis is highly mathematical and is not regarded as suitable at present for practical design, but may eventually be made so if modifications take into account the non-elastic behaviour of the materials.

The emphasis on mathematics in such structural design may be traced to the manner in which engineers are trained, and to the common use of codes and by-laws. Whereas an experienced engineer may often be able to satisfy himself that a design is sound without much calculation, it is a different matter if he has to justify his opinion to someone who is more likely to accept the result of a calculation rather than an opinion unsupported by calculation. In this respect it must not be overlooked that the implication of conventional calculations is that if the results obtained from a certain method of calculation are within certain limits the design is sound. In reinforced concrete it cannot be accepted that calculated stresses, for example, are the actual stresses, although the usual methods of calculation lead to sound structures.

Most engineering subjects have during the past hundred years or so become increasingly considered as branches of applied mathematics, and only students with an aptitude for mathematics are likely to pass the examinations necessary for qualification, while those who may have sound engineering instinct but little taste for mathematics may fail to do so. The system by which a young man was indentured to a practising engineer, and which has now been replaced almost entirely by a more academic training, gave those without, or with, mathematical propensity an excellent opportunity to gain engineering experience. More knowledge of practical design is likely to be gained by working with experienced engineers than from books or lectures.

Applied research, not only in the design of concrete roads but in many other branches of structural engineering, may provide the opening for the engineer with little feeling for mathematics, because it is from realistic research that deductions of engineering value are obtained, and these can be obtained only by those who realise the practical implications. In recent years there has been in civil engineering a tendency to concentrate on research in the laboratory rather than on the site, and this is no doubt one of the reasons why so few new ideas in civil engineering and building construction have originated in Great Britain during the past thirty years.

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SOAP

An old Yorkshire miner had been purchasing some articles at the chemists. At the end he asked for some bathroom paper.

"We call it toilet paper" Snapped the girl at the counter.

The old man collected his packages and began to leave the shop. Before reaching the door he turned back and said :—

Miner—"*Hey, Miss, and I want some soap.*"

Shop Girl—"*Toilet Soap?*"

Miner—"*No miss, I want it for my face.*"

TECHNICAL INFORMATION

1. RESEARCHERS USE RAYS TO DETERMINE SOIL MOISTURE AND DENSITY IN FIELD

[*Extracted from 'Engineering News-Record'—27-3-1952.*]

TWO similar sets of apparatus are being tested by engineers of the Civil Aeronautics Administration as a means for determining soil density and soil moisture directly in the field. South direct determination would eliminate the delays incidental to laboratory determinations.

These studies are being made at the CAA Technical Development Centre at Indianapolis and at Cornell University under a research contract.

Each apparatus uses a radioactive source and an electronic recorder. For each, a probe containing radioactive material is lowered into the soil being tested through a one-inch diameter stainless steel tube driven into the ground.

Soil Density Studies:—The soil density probe is 15 in. long and of a diameter that permits it to fit smugly into the steel tube. A capsule of radioactive cobalt 60 is inserted in the tip of the probe. Gamma rays from this cobalt bombard the soil surrounding the tube and are scattered by it. Some return to a Geiger counter mounted in the top of the probe. The number returning gives a measure of the soil density.

The counter is connected through a coaxial cable to an electronic recorder where the impulses resulting from the returning gamma rays produce neon-light flashes and movements of a swinging needle, which can be recorded.

Counts are made for a three minute period, normally to reduce purely statistical errors.

Graphs are being prepared at the CAA centre for direct translation of the counter record into soil density in pounds per cubic foot.

Although the emissions of cobalt 60 are relatively weak, the probe is kept in a lead or concrete shield when not in use and operators are cautioned to keep at least one foot away from the active end of the probe.

Soil Moisture Determinations.—The soil moisture probe is only 7 in. long. Both polonium-beryllium and purified radium D are being used in the moisture determination. Both emit neutrons, but the useful life of polonium-beryllium is relatively short.

Neutrons are strongly affected by the hydrogen atoms in soil moisture. When they strike hydrogen atoms they are scattered and lose a large part of their energy thus becoming "slow neutrons." After several such collisions some are reflected back to the vicinity of the probe, which also contains a piece of silver foil. When this foil is struck by a slow neutron it emits momentary flashes of beta rays which are recorded on the Geiger counter.

The number of these flashes gives a relatively accurate measure of the moisture content of the soil.

Power sufficient to operate this apparatus can be supplied by small, portable-motor-generator sets.

Similar apparatus for determination of soil density has been under study at Rutgers University for some time (ENR April 12, 1951, p. 67). That apparatus uses two steel tubes driven into the ground, one for the radiation source and one for the radiation meter. In the Rutgers studies, the tubes were placed as far apart as 50 inches.

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2. FRICTION TAKES THRUST OF FRENCH ARCH BRIDGE

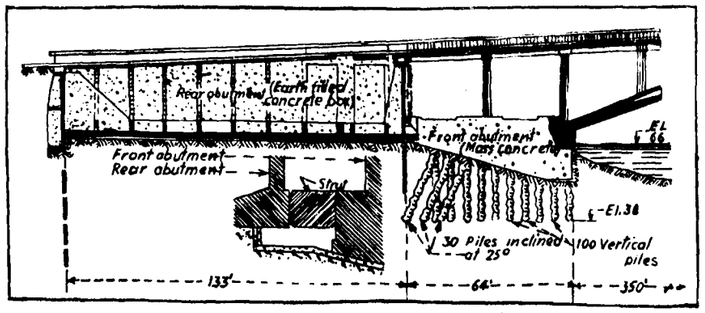
(Extracted from 'Engineering News-Record' – 20-12-1951).

Difficult foundation conditions at the site of a new concrete arch bridge across the mouth of the Oise River–at Conflans abont 15 miles north-east of Paris, led to the use of abutments that furnish 40 per cent of the resistance to the arch thrust through friction on the supporting soil. Conventional type abutments on piles carry the ends of the arch, but each of these front abutments is backed up by a rear box-type abutment, 133 ft long, from 45 to 60 ft wide and about 25 ft high. The boxes are filled with earth, and their back walls bear against the earth ramps of the approaches. The 8,650 sq. ft floor of the boxes bears on clay as do the 62 by 66 ft front abutments although the piles under the latter are driven to a sand and gravel stratum. The total thrust to be resisted is 4,300 tons. The resulting forces :

Inclined piles	820 tons
Friction on sides of front abutment	170
Friction on sides of front abutment	220
Friction on bottom of rear abutment	1720
Earth thrust against front abutment	1810
Earth thrust against rear abutment	1355
Total resistance	5,255 tons

The transfer of thrust from the front to the rear abutments is accomplished by interposing between them a concrete strut whose curved bearing edges keep the load centered even though there may be some differential settlement.

The bridge, built to replace one destroyed in the war, is composed of a 330 ft span fixed arch of hollow section. It has a rise of about 31 ft. Its 32 ft width is divided into four compartments by longitudinal walls. The roadway, resting directly on the arch over the central part of the span, is supported elsewhere by bents of four circular columns arranged in pairs. The columns are made larger at the top than at the bottom for effect.



Special rear abutment with large frictional resistances supplements conventional abutment in opposing arch thrust.

3. MECHANICAL DEVICE PREPARES SOIL SAMPLES

(Extracted from 'Better Roads'—March, 1952)

The apparatus used for preparing disturbed dry soil samples consists of a lifting device, by means of which the operator can force a machined cast-iron mortar upwards by foot pressure, to make contact with a revolving rubber pestle. To obtain maximum pressure, the operator can stand on the foot lever. Usually, reduction of the sample is hastened by moving the mortar continuously up and down. The power source for revolving the rubber pestle is an electric motor mounted on the wall with heavy strap iron. It has a shaft speed of 78.7 r. p.m.

The pestle consists of tire-tread rubber mounted on a steel spider. For best results, the lower contour of the pestle should correspond to the curvature of the bottom of the mortar.

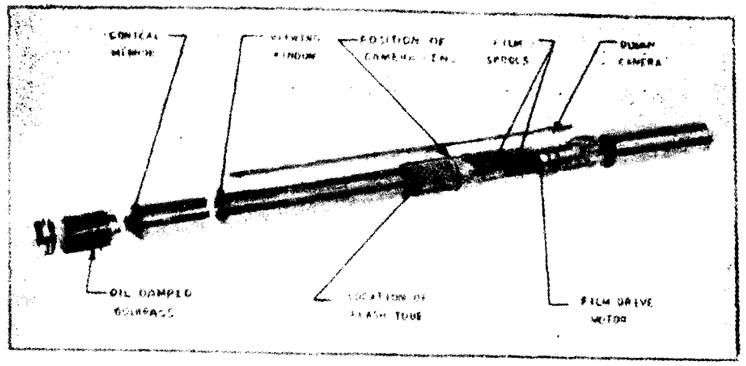
Operator forces cast-iron mortar upwards by foot pressure to make contact with the revolving pestle.

4. BORE-HOLE CAMERA AIDS FOUNDATION WORK

(Extracted from 'Engineering News-Record' – 27-3-1952.)

A new bore-hole camera to be used in solving foundation problems in the construction of concrete structures has been developed by the Engineering Research Associates, St. Paul, Minn., under the supervision of the Corps of Engineers.

Now undergoing extensive testing, the development is expected to improve exploratory methods by the discovery of flaws that commonly exist in all types of bedrock, and which may affect the stability of a dam or cause troublesome construction problems.



The Bore-hole Camera.

The camera can take 360-degree photographs of a 3-in. diam. bore-hole. By a projector the picture can be viewed in undisturbed form on a cylindrical screen. A conical mirror in the camera produces an image of a 360-degree band of the bore-hole, which is photographed on a 16 mm. motion picture film. As the camera descends, full coverage of the bore-hole is given.

A complete pictorial record of the bed-rock features is then made to pass before the observer's eyes as if he were descending into the hole.

(Continued from page 4)

Moreover, road development will eradicate the evil of absentee landlordism, which is a potent factor in impeding our agricultural progress. The rich landholder is reluctant to live on his estate under present conditions as that cuts him off from the amenities and pleasures that city life bestows upon him. A place which is devoid of adequate transport facilities has no access to educational and medical facilities. Consequently migration to towns follows. The evils that follow absentee landlordism and mass migration from villages are too well-known to be emphasised here and it is only when minimum amenities of civilisation can be carried to the rural areas that the countryside can be developed, absentee landlordism stopped and people induced to stay there to produce the food the country needs so badly.

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BUDGETS AND ADMINISTRATION REPORTS

(i) GOVERNMENT OF COORG—CIVIL WORKS BUDGET FOR THE YEAR 1951-52.

The following extracts have been taken from the Coorg State Budget for the year 1951–52 in respect of revenue from and expenditure on Civil Works.

	(In Lakhs of Rs)		
	Actuals 1949–50	Revised Estimates 1950–51	Budget Estimates 1951–52
I. Revenue (Civil Works).			
(1) Rents	.15	.14	.13
(2) Recoveries of expenditure	.01	...	...
(3) Transfer from Central Road Fund	...	.25	...
(4) Miscellaneous			
(i) Transfer from Rural Development Account - Village Communications	...	...	.02
(ii) Miscellaneous	.26	.01	.02
	.42	.40	.17
II. Expenditure (Civil Works)			
(1) Works and Repairs	8.59	7.28	14.23
(2) Establishment	1.47	1.19	2.30
(3) Tools and Plant	.65	.73	1.54
(4) Grants-in-aid	.12	.30	.18
(5) Suspense	...	...	...
Total	10.83	9.50	18.25
III. Expenditure (Communications)			
Original Works			
(1) Original Works-Communications other than Post-War Reconstruction—Central Road Development Account.	.26	.12	.13
(2) Original Works-Communications other than Post-War Reconstruction	.17	.13	.26
(3) Post-War Reconstruction	...	.40	.25
(4) Rural Development Account-Village Communications contribution from benificiaries	1.36	...	.02
Repairs & Communications	3.41	3.37	5.00
	5.20	4.02	5.66

A BRIEF REVIEW OF THE COORG BUDGET

(With special reference to Civil Works)

THE total revenue receipts of Coorg for the year 1951—52 are estimated at Rs 69.34 lakhs and revenue expenditure at Rs 76.18 lakhs with a consequent deficit of Rs 6.84 lakhs. The revised estimates for 1950-51 show a deficit of Rs 6.71 lakhs with the revenue receipts amounting to Rs 52.73 lakhs and revenue expenditure to Rs 59.44 lakhs.

Revenue expenditure on Civil Works for 1951-52 estimated at Rs 18.25 lakhs forms about 24% of total estimated expenditure of the State in the year. The corresponding percentage for 1950—51 is 16%

Expenditure on Communications (Original Works and Repairs) in 1951—52 is estimated to be Rs 5.66 lakhs which is 7.4% of total State expenditure. The corresponding percentages for the years 1950—51 (revised estimates) and 1949—50 (actuals) were 6.8 and 9.2 respectively.

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(ii) GOVERNMENT OF BIHAR—CIVIL WORKS BUDGET

Estimates for the year 1951–52.

THE following extracts pertaining to Civil Works Budget Estimates for the year 1951–52 have been taken from Government of Bihar, Civil Works Budget.

	(In Lakhs of Rupees)		
	Actuals 1949–50	Revised Estimates 1950–51	Budget Estimates 1951–52
I. Revenue (Civil Works)			
(i) Rents	6.72	6.38	6.45
(ii) Recoveries of Expenditure	4.37	1.59	1.32
(iii) Miscellaneous	4.69	1.74	1.68
(iv) Transfer from Central Road Fund—Ordinary	1.39	4.09	3.45
(v) Ferry Receipts	.01	.70	.70
(vi) Deduct Refund	—.43	—.07	—.02
Total Revenue	16.75	14.43	13.58
II. Expenditure (Civil Works)			
(i) Original Works	36.25	38.95	19.38
(ii) Repairs	45.71	45.66	51.46
(iii) Grants-in-Aid Ordinary	14.72	10.31	8.84
(iv) Grants-in-Aid from Central Road Fund	.20	4.09	3.45
(v) Suspense	— 20.62	2.83	2.88
(vi) Lump Addition for Regrant of Lapses	...	...	.25
(vii) Post-war Development	160.77	349.61	671.73
Total Expenditure	237.03	451.45	757.99

(Continued)

	(In Lakhs of Rs)		
	Actuals 1949–50	Revised Estimates 1950–51	Budget Estimates 1951–52
III. Expenditure (Communications only).			
(a) Original Works.			
(i) Original Works—excluding Post-War Schemes	13.98	6.54	4.25
(ii) Post-War Scheme eligible for Union Grants	n.a.*	134.83	314.55
(b) Repairs.			
(i) Repairs to P.W.D. and District Board Roads	22.27	18.16	20.23
(ii) P.W. Schemes—eligible for Union Grant	...	26.37	26.74
	...	185.90	365.77
IV. Receipts from Roads.			
(i) Transfer from Central Road Fund	1.39	4.09	3.45
(ii) Ferry Receipts	.01	.70	.70
(iii) Receipts under Motor Vehicles Act	3.21	4.03	4.09
(iv) Passengers and goods transport tax	...	20.00	20.00
(v) Taxes on Sales of Motor Spirit	24.36	27.00	27.00
Total Receipts	28.97	55.82	55.23

A BRIEF REVIEW OF THE BIHAR BUDGET

(With special reference to Civil Works)

THE total revenue receipts of Bihar for 1951–52 are estimated at Rs 35,96.73 lakhs and revenue expenditure at Rs 31,12.92 lakhs with a consequent surplus of Rs 483.81 lakhs. The revised estimates for 1950–51 indicate a surplus of Rs 54.55 lakhs with the revenue receipts amounting to Rs 27,62.72 lakhs and revenue expenditure to Rs 27,08.17 lakhs. The Budget estimates of revenue and expenditure for 1951–52 are higher than the revised estimates for 1950–51.

Total revenue expenditure on civil works for 1951–52 estimated at Rs 757.99 lakhs forms about 24% of total estimated State revenue expenditure in the year. The corresponding percentage for 1950–51 (revised estimate) is much lower i.e., about 17%.

Expenditure on communications (original works and repairs) in 1951–52 is estimated to be Rs 365.77 lakhs which is nearly double the corresponding figure of revised estimates for 1950–51. The higher figure for 1951–52 is mostly due to an additional provision during this year compared to the last year of about Rs 180 lakhs under the head ' Post-War Schemes—eligible for Union Grant '. The estimated communications expenditure forms about 48% of the estimated expenditure on civil works (original works and repairs) in 1951–52 against 41% in 1950–51 (revised estimates). Of the total state expenditure, the estimated communications expenditure forms about 12% this year against 7% last year.

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* n.a. = Not available.

List of Approved Works on National Highways

S. No.	Job No.	Name of work	Amount approved Rs	Remarks.
		MADRAS		
1.	586 MD 5	Construction of a bridge at mile 92/6 of Madras-Calcutta Road.	29,700/-	
2.	593 MD 4	Cement concreting mile 14/0 to 15/4 of Madras-Calicut Road.	1,40,300/-	
		BOMBAY		
3.	584 BM 8	Earthwork for construction of Wareria-Karjan section of the Bombay - Ahmedabad National Highway	20,000/-	
4.	587 BM 4	Reconstruction of culvert No. 112 on the Poona-Bangalore National Highway	10,491/-	
5.	588 BM 4	Reconstruction of culvert No 134 on the Poona-Bangalore National Highway	9,521/-	
6.	589 BM 4	Reconstruction of culvert No. 142 on the Poona-Bangalore National Highway	3,594/-	
7.	591 BM 8	Improvements to Pardi-Kim section of the Bombay-Ahmedabad National Highway (Length 4·4 miles)	5,39,600/-	
		UTTAR PRADESH		
8.	585 UP 24	Painting miles 62-73 of National Highway No. 24 (Miles 38-39 of Meerut-Bareilly Road).	3,85,800/-	
		PUNJAB		
9.	590 PB 22	Additions and alterations to the subsidiary buildings attached to the Inspection Bungalow at Barog on National Highway No. 22	3,740/-	
		ORISSA		
10.	592 RS 42	Providing R. C. decking in place of timber decking on the bridge at mile 28/2 of Cuttack-Sambalpur Road.	12,000/-	

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List of Books added to the Library of the Roads Organization during April 1952.

1. **Handbook on the execution and maintenance of bituminous pavements for urban roads together with working specifications**. (MERKBUCH) für die Ausführung und Unterhaltung bituminoser Decken auf Stadtstrassen nebst Leistungs verzeichnissen-in German) published by Forchungsgesellschaft für das Strassenwesen e. V. Koln-Deutz. Alarichstr, 35.

2. **Public Roads Administration, Federal Works Agency, U.S.A.**

   (a) Work of the Public Roads Administration—Annual Report for the Fiscal year 1948.

   (b) Work of the Public Roads Administration—Annual Report for the Fiscal year 1949.

   (c) Work of the Public Roads Administration-Annual Report for the Fiscal year 1950.

3. **Highway Design and Construction** by Bruce and Clarkson (3rd edition) (The International Textbook Company, Scranton, Pennsylvania).

4. **A Selected bibliography on vibrations in Structures**, B.R.S. Library, Bibliography No. 152. (Building Research Station, Garston Watford, Herts.)

5. **Description of a Combined Stress** (Tension & Torsion) Testing Machine by H. V. Pollard and H. J. Tapsell. (National Physical Laboratory, Engineering Division.)

6. **A Simple Constant Stress Apparatus for Creep Testing** BNFMRA TM 72 P by L. M. T. Hopkin. (British Non-Ferrous Metals Research Association, London.)

7. **Summarized Proceedings of Symposium on Applications of Ultrasonics** by G. Bradfield. (Reprinted from the Physical Society Vol. LXIII p. 305, 1950).

8. **The Problem of Clay in Road Construction** (Paper read at the Public Works and Municipal Services Congress 1950) by D. J. Maclean (The Institution of Civil Engineers, London).

9. **An Economical Design of Rigid Steel Frames** for Multi-Storey Buildings,—National Building Studies Research Paper No. 10. (His Majesty's Stationery Office, London.)

10. **Highway Bridges and Aerodromes** dated 13—7—1949 containing an article "The Practical Application of Research" by A. G. Tarrant. (The Road Publications Ltd., Crescent House, Ashford, Middlesex, England).

11. **The Bombay Civil List** corrected upto 1st July, 1951. (The Superintendent, Government Printing and Stationery, Bombay).

12. **Roadside Protection**—A Study of the Problem and suggested approaches to Betterment. (American Automobile Association, Pennsylvania Avenue at 17th Street, Washington, 6, D.C.)

13. **The Requisitioning and Acquisitioning of Immovable Property Act, 1952**, No. XXX of 1952. (Ministry of Works, Production and Supply, Government of India, New Delhi.)

14. **CEMENTIFEROUS PAINTS**-Part II -Zinc Phosphate Cements., by J. E. O. Mayne. (Reprinted from the Journal of the Iron and Steel Institute, March 1950, 4, Grosvenor Gardens, London, S.W. 1).

15. **Ordinary Non-Linear Differential Equations** in Engineering and Physical Sciences by N.W. Mclachlan. (The Clarendon Press, Oxford, 1950.)

16. **D.S.I.R., Road Research Laboratory, Harmondsworth, Middlesex.**

   (a) **The electrical resistance of measuring soil moisture** by D. Croney, J. D. Coleman and E.W.H. Currer (Reprint from the British Journal of Applied Physics Vol. 2. pp. 85-91. April 1951.)

(b) **Use of a Surface Dressing for Protecting a Prepared Soil Formation** by W. A. Lewis. (Reprint from the Surveyor and Municipal Engineers, December 29, 1950).

(c) **New Method of measuring the specific surface of Porous Bodies and Powders**—by K. P. R. Ehrenberg, B.R.S. Library, Communication No. 356—DSIR/4271/CT (Translation from the Russian).

(d) **Cements with Controlled Expansion** (Sui Cementi Misuratamente Espansivi) by L. M. L. Booth.—B. S. R Library, Communication No. 424. (Translation from Italian.)

(e) **On the Mechanism of the Setting and hardening of Puzzolanic Cements,**—by K. P. R. Ehrenberg—B. R. S. Liby, Comm. No. 312 — DSIR/4879/CT — Abridged Translation from the Russian.

(f) **Vibration of Concrete and Reinforced Concrete** (Vibration du Beton et du Beton arme) DSIR/4635 CT, by R. Dutron.

(g) **Application of Chemical Engineering in Building** Research Note No. E 213, by W. Kinniburg.

(h) **Measuring a Large Displacement by Interferometry** by H. Barrel and M. J. Puttock. (Reprint from the British Journal of Applied Physics, Vol. I, pp. 87-91, April 1950).

(i) **The Influence of Pore Water on Soil Behaviour**. Note No. E. 223 by L. F. Cooling—Paper read before the Society of Chemical Industry—Road and Building Materials Group on 20—4—1950.