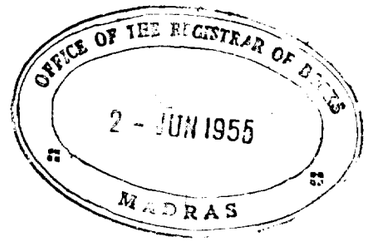
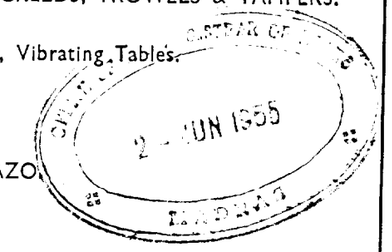
TRANSPORT-COMMUNICATIONS

MONTHLY REVIEW

MAY 1955—No. 97



INDIAN ROADS CONGRESS, NEW DELHI.



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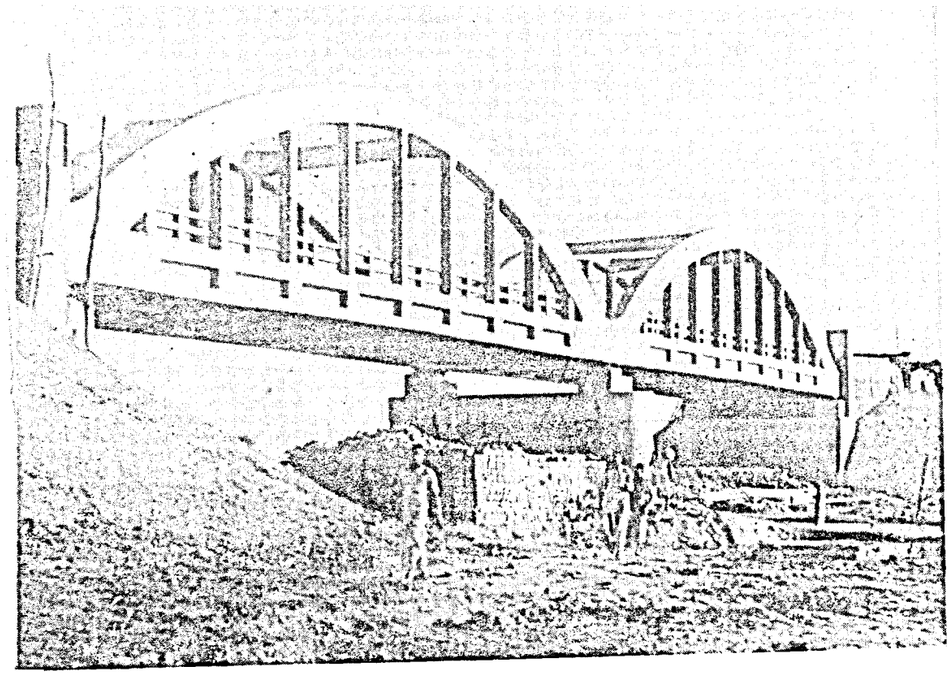

ARIL NADI BRIDGE

The old bridge across Aril Nadi in mile 20 of Moradabad-Chandausi Road (State Highway) was washed away in the heavy floods of 1948. A Reinforced Cement Concrete bow-string girder bridge of 2 spans of 90 ft clear each has been completed at a cost of Rs 3.98 lakhs in October, 1954. It has a clear roadway of 22 ft and is founded on wells.

Chandausi is one of the biggest grain centres of Uttar Pradesh and Moradabad is the District Head-Quarters.

TRANSPORT-COMMUNICATIONS
MONTHLY REVIEW

A REVIEW OF
ROAD ENGINEERING, DEVELOPMENT & TRANSPORT

MAY 1955

NINETEENTH SESSION OF INDIAN ROADS CONGRESS

SRINAGAR—June 1955

ON the invitation of the Government of Jammu and Kashmir, the nineteenth Session of the Indian Roads Congress will be held at Srinagar from 18th to 25th June 1955. Various technical Committees of the Congress dealing with Specifications and Standards, code of practice for road bridges, soil research, co-ordination of research done at the various Road Research Laboratories in India, test track, etc., will meet to discuss technical problems.

Nine papers, synopses of which are given below, will be discussed. Besides discussion of Papers, there will be a panel discussion on 'Surface Dressing'. Members will also inspect works of engineering interest in and around Srinagar on the 24th and 25th June.

1. Paper No. 171, "A New Approach to the Analysis of Stability of Slopes" by P. C. Varghese.

A procedure for analysing homogeneous clay slopes by "Resistance Envelopes" is described. It is claimed that "Resistance Envelope" which is evolved by assuming a number of "Circles of Failure" for a given slope, can be used as a design curve for that slope.

The results obtained show agreement with the "Friction Circle" method. Worked out examples are given.

2. Paper No. 172, "Bituminous Treatment of Brick Metal Water-Bound Macadam Surfaces in U.P." by D. C. Chaturvedi.

The Paper describes the behaviour of surface dressing over brick ballast water-bound macadam road surfaces in Uttar Pradesh. The chips used for the surface dressing were of hard stone.

Many miles of the surfacings laid during the last 20 years have been observed to stand satisfactorily traffic ranging from 300 to 1,000 tons per day. There was no difference either in service efficiency or life in comparison to surfaces where hard stone metal was used. The specifications followed and the special precautions necessary to obtain satisfactory results are described.

The economics of the treatment is discussed.

This treatment is recommended for roads bearing traffic up to 800 tons per day in areas where stone metal is scarce or is available at high cost, and specially

for providing dustless surfaces through built-up areas.

3. Paper No. 173, "Construction of a Submersible Bridge Across River Mahanadi near Bhanjanagar (Ganjam) in Orissa".

This Paper deals with the details of design and construction of a submersible bridge over raft foundation. The work was executed departmentally; some pertinent details of organization and costs of certain items of work have been given to show that under favourable conditions, departmental execution is worth undertaking as it is the best way of training young engineers.

4. Paper No. 174, "Shear Failure in Anisotropic Materials," by C. G. Swaminathan.

Extending the principles laid down by Casagrande and Carillo and modifying the version given by Hank and McCarty, this Paper deals with the problem "Given the shear constants on two mutually perpendicular planes and one of the principal stresses, to determine the critical circle of failure in an anisotropic material."

Both analytical and graphical solutions are given. As the procedure given by Barber involves a certain amount of trial and error, a purely graphical solution is worked out for the general case. Twelve particular cases of such materials have also been studied and graphical procedure for some included.

A discussion based on the various equations obtained is also incorporated, from which it follows that the test data are likely to be misinterpreted unless the consideration of anisotropy is stressed and the validity of Coulomb's Law is also ascertained.

5. Paper No. 175 "Cement Concrete Surfacing and Experimental Concrete Road Construction on Agra-Bombay Road" by R. J. Dhumal and M. A. Mehta.

Beginning with a brief historical introduction, the Paper describes the construction of 23 miles of concrete pavement on the Agra-Bombay Road. The pavement was initially laid in one course with blue trap as aggregate, but rising costs necessitated the adoption of two-course construction with cheaper and stone aggregate for the bottom. Owing to the scarcity of water in certain reaches membrane curing was carried out.

Taking advantage of the large scale concrete road construction, eleven experimental stretches had been constructed. They were:

1. Unreinforced bonded concrete pavements;
2. Cement macadam sandwich method;
3. Cement macadam grouted method;
4. Slabs of 100 ft and over without joints;
5. Pavements with varying construction and expansion joint spacings.

The behaviour of these roads under traffic is reported.

The savings in materials and labour by the adoption of the Sandwich and Grouted methods are brought out.

6. Paper No. 176, "Rivers and Ferries of North Bengal" by R. P. Chanda.

The Paper describes the characteristics of rivers in North Bengal. An account of the changes in the course of the Torsa near Cooch-Behar and the Teesta near Mandalghat is given. Some of the important ferries such as those across the Kalyani, Gadadhar and that across Sil-Torsa at Silbariaghat are described through all the various stages of development. The general problems of operating ferry services and a few accidents are given.

7. Paper No. 177, "Design and Construction of Prestressed Concrete Bridge across river Palar" by K. K. Nambiar.

The Paper describes the construction of the prestressed concrete bridge across

River Palar at mile 38/3-5 of the Madras-Dindigul Road. The bridge consists of 23 spans of 90 ft clear each and is founded on wells. The superstructure for each of the spans consists of an R. C. slab 6 in. thick cast *in situ* over four precast, prestressed, U-shaped girders each 95 ft 10 in. in length.

Details of design, precasting of the girders, prestressing and launching the girders weighing 60 tons each from the casting yard to their positions over the piers are given.

8. Paper No. 178, "Traffic Rotaries" by the Specifications and Standards Committee of the Indian Roads Congress.

This Paper discusses the various factors that influence the design of traffic rotaries and lays down standards for:

(i) the radius of the central island,

(ii) the minimum and maximum weaving lengths and weaving angles,

(iii) the width of the rotary roadway,

(iv) the radii of entry and exit curves, and

(v) the pavement widths at entrances and exits.

The influence of the slow-moving bullock cart on the capacity of rotary is discussed and, in the absence of observed data, tentative recommendations for evaluation of the slow-moving vehicles in terms of passenger cars are made.

Desirable practice in respect of super-elevation and camber at rotaries is given. The construction of channelising islands, and special considerations for footpaths, cycle tracks, and illumination are detailed.

The limitations, advantages and disadvantages of rotaries are mentioned.

Detailed designs of some rotaries constructed in Delhi are included.

9. Paper No. 179, "The Influence of a Super-imposed Layer in Increasing the Load Bearing Capacity of a Rigid Pavement" by Col. S. K. Bose.

The effect of a super-imposed layer consisting either of a rigid or of a flexible construction or a combination of both has been discussed. The general conclusion is that a flexible super-imposed layer increases the load bearing capacity of an existing rigid pavement greater than a rigid super-improvement does.

The application of the general conclusion to strengthening of existing concrete airfields has also been studied. The advent of jet aircraft has complicated the choice of pavement materials. The development made in the design of jet aircrafts and methods adopted to enable bituminous material to stand the deleterious effect of jet blast and fuel spillage have been discussed. Recently published test reports from the U. S. A. and the U. K. are summarised, which are in general agreement with the theoretical analysis.

The need for further investigations on temperature stress producing conditions in India are stressed.

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LABOUR DECREE

Bolivia has issued a Decree requiring all men between the ages of 18 and 60 to pay a highway tax of 400 Bolivian pesos (15/4d) or to do two days of highway work annually.

A SURVEY OF RECENT ROAD DEVELOPMENTS IN EUROPE

IN the April 1955 issue of the Transport-Communications Monthly Review extracts relating to the Road Developments in Asian countries were published. The following extracts relate to Development in Europe.

The urgent need for flexible, inexpensive transportation in Europe following the Second World War was naturally considered as a priority programme by the Economic Commission for Europe soon after it was founded. Subsequently studies were carried out to determine the routes which should be specially equipped for international traffic, the characteristics these highways should have, the ancillary services that would be necessary and the oenditions under which the construction of these routes could be undertaken and financed. As a result of these efforts, the Declaration on the Construction of Main International Traffic Arteries was drawn up in Geneva and was signed by Belgium, France, Luxembourg, the Netherlands and the United Kingdom on 16th September 1950. Austria, Greece, Norway, Portugal, Sweden and Turkey have since adhered to the Declaration at the United Nations Headquarters in New York.

The European International System of Roads comprises twentyfive main roads, with seventy feeder or connecting roads, the total length of which is 46,825 kilometers. Statistically it relates to the European countries as follows :

Country	Total length of international roads	Area (km^2)	Length of international roads in proportion to area of country	Population (in thousand per kilometer of international road)
Austria ...	1,755	84,000	0.02	7,100
Belgium ...	1,075	30,500	0.035	8,600
Denmark ...	690	43,000	0.016	4,200
Finland ...	2,340	337,000	0.007	4,000
France ...	6,595	551,000	0.012	42,000
Germany, Federal Republic ...	5,968	245,400	0.025	48,300
Greece ...	2,190	133,000	0.017	7,300
Italy ...	6,015	301,000	0.02	46,600
Luxembourg ...	90	2,600	0.035	300
Netherlands ...	1,150	34,000	0.034	10,800
Norway ...	2,140	324,000	0.007	3,200
Portugal ...	860	89,000	0.009	8,500
Spain ...	1,776	505,000	0.004	26,000
Sweden ...	3,675	449,000	0.008	6,900
Switzerland ...	1,150	41,300	0.03	4,700
Turkey ...	4,335	766,900	0.006	18,900
United Kingdom ...	1,545	242,000	0.006	50,600
Yugoslavia ...	1,700	256,000	0.007	15,800
Total ...	46,825	4,434,700	0.01	313,800

One Kilometer=0.62 miles.

Realization of the International system is a national problem, however, for the international roads are, in every case the principal arteries of the country. Already over-burdened with domestic traffic, they are of vital concern to the nations and the national officials who look after them. Moreover, European economists have discarded the theory that discriminatory taxation on road traffic as a luxury benefits the general body politic, since any addition to the transport cost of raw materials raises the cost of the finished product many times over before it reaches the consumer. Plans are well advanced, however, for financing the investments needed.

ROAD EXPENDITURES BY NATIONAL GOVERNMENTS OF EUROPE

Europe as a whole has some 3.4 million miles of roads with a widely varying traffic density. Although in some countries the value of the national currency has fallen during the last five years, the tables below show a very substantial increase in road expenditures, indicating that Western Europe is becoming progressively "road-conscious".

Expressways (four-lane divided highways) for motor vehicles only are becoming popular. In Belgium, the Brussels-Ostend road is near completion; in the Netherlands, the Utrecht-Amsterdam motorway was completed last spring; in France, a highway leading north out of Marseilles was finished last year; in Austria, the auto-route Linz-Salzburg-Vienna was begun last summer, and the German programme for the construction of *autobahnen*, undertaken some years ago, is again under way.

In all the countries of Eastern Europe road transport has greatly altered since the end of the Second World War. Before 1939, it was only in Czechoslovakia that it occupied a position of more than minor importance in the over-all transport picture; to-day road transport plays a vital role throughout Eastern Europe.

Typical example of road expenditures and road programmes, taken from the reports of the International Road Federation, are given below.

AUSTRIA

	(Federal roads only—in millions of schillings)						
	1948	1949	1950	1951	1952	1953	1954
Maintenance ...	68.1	94.3	120.2	180.1	177.8	124	
Improvements and new works ...	99.2	104.4	160.8	188.8	230.9	253	
Total ...	167.3	198.7	281.0	368.0	408.7	377	1.000*

BELGIUM

The highway budget for 1954 provides for the following items :

	Francs (in millions)
Road Fund	850
Construction projects and repair work	101
War damage	153
TOTAL	1,104

The budget for 1953 was 893 million francs.

BULGARIA

Before the Second World War, new road construction in Bulgaria averaged only 90 miles annually. Some 250 miles were built in 1947 ; 285 miles in 1948 ; 312 in 1950 ; 1,080 miles in 1951.

* Estimated.

CZECHOSLOVAKIA

During the current Five-Year Plan, Czechoslovakia expects to increase the length of modern standard routes from 6,700 miles to 10,200 miles. The Plan particulary stresses the development of heavy road transport.

FINLAND

An official committee has recommended a ten-year road improvement plan to cost an estimated 23,000 million marks per annum. The plan, to be inaugurated in 1955, provides for :

(1) Construction of 1,785 kilometres of new national roads ;

(2) Resurfacing of 3,430 kilometres of existing roads ;

(3) Removal or improvement of more than 800 dangerous grade crossings ;

(4) Modernization and completion of 2,233 kilometres of roads ;

(5) Construction of 900 kilometres of secondary roads ;

(6) Modernization of 1,420 bridges and 38 ferries.

Finnish highway expenditures increased 1,850 per cent from 1948 to 1953. Expenditures in 1948 amounted to 483,753,000 Finnmarks, and in 1953 spending reached 8,935,393,000 Finnmarks. Expenditures for 1954 are estimated at 7,200,000,000 Finnmarks. Expenditures for the other years were : 1949, 2,237,177 ; 1950, 3,252,363,000 ; 1951, 2,360,841,000., 1952, 2,398,121,000.

From 1948 through 1954 a total of 5,495 kilometres of national and local highways were improved or constructed.

FRANCE

The French are intensifying their highway improvements to regain the position held prior to the Second World War, when the French road system was among the best in the world. During the war period, from 1939 to 1945, the roads were severely damaged, and both maintenance and construction drastically reduced. This situation extended into the post-war period for a few years, because of the lack of credits, materials and machinery.

In 1948 the French national Government spent 11.8 billion francs for maintenance, 820 million for equipment and 7.5 billion for reconstruction of national highways. The budgets were raised to 16.3 billion for maintenace, 13.4 billion for equipment and 7 billion for reconstuction in 1953, and 14.9 billion for maintenance, 17.8 billion for equipment and 6.1 billion for reconstruction in 1954.

Expenditures on secondary roads *chemins departementaux* for maintenance and equipment amounted to 40.8 billion in 1953, as compared with 21.3 billion in 1948. Equipment was identified as a separate item in the budget in 1952. Expenditures for equipment rose from 2 billion in 1952 to 2.8 billion in 1953 and 3.6 billion in 1954.

Expenditures on local roads *chemins vicinaus ordinaires* totalled 10 billion francs in 1948 and 18.3 billion in 1953. The amounts spent for equipment in the years 1952, 1953 and 1954 were identical with those on secondary roads.

GREECE

In the past five years, Greece has constructed more than 3,200 kilometres of new roads and reconditioned an additional 4,800 kilometres.

Special committees set up by the Governments of Greece, Turkey and Yugoslavia have been meeting to effect co-operative agreements on road development. These meetings have led to the following decisions :

(1) There shall be co-operative planning of roads crossing two or more of the countries concerned.

(2) Material to be used in the construction of these roads shall be free of duties and shall be given preferential freight transport rates ;

(3) Technical supervision of these roads shall be co-ordinated by the three countries;

(4) Secondary road construction in the next five years shall emphasize junction points and roads of mutual interest to the three countries ;

(5) Some sections of road will be jointly financed through a common investment fund.

HUNGARY

Hungary has improved its road network by new construction and by changes to heavier-type surfaces on many important existing roads. Three hundred and sixty miles of new concrete roads, 186 miles of macadam roads and 1,350 miles of other hard-surface roads are to be built. Provision has been made for the reconstruction of important road bridges over the Danube.

ITALY

In the period 1945 to 1953, Italy reconstructed 34,906 kilometres and built, paved or improved 16,367 kilometres of national and secondary roads destroyed or damaged by the war. At the same time, 6,554 bridges were reconstructed and 263 bridges were newly built. The total cost of highway construction and reconstruction was 193,343,000,000 lire.

The Italian highway network amounts to 170,682 kilometres, including 21,851 kilometres of national roads, 42,351 kilometres of provincial roads, and 106,683 kilometres of local roads.

For many decades Southern Italy has been a depressed area where obsolete methods of farming, deforestation, soil erosion and flooding depleted the land, while poor communications led to the neglect of the area by both the industrialist and the tourist. In August 1950, as part of a wider scheme for the rehabilitation of the Italian economy, the Government introduced a comprehensive plan to remedy unemployment and the low standard of living. The scheme, known as Casa per ilmezzogiorno (Fund for the South) was originally conceived as a ten-year plan covering the expenditure of 100,000 million lire on public works for each of the financial years 1951 to 1961 ; this was later extended to provide an increased expenditure of 1.3 million lire over a period of twelve years.

LUXEMBOURG ROAD EXPENSES

Years	Belgian francs (in millions)
1951.....	112.2
1952.....	129.5
1953.....	171.1

NETHERLANDS

Highway expenditures in the Netherlands have more than doubled in the seven-year period 1948 to 1954. Maintenance and improvement expenditure increased from 13,852,000 guilders in 1948 to 28,690,000 in 1954 ; construction from 17,330,000 in 1948 to 37,600,000 in 1954, and grants to the provinces from 16,457,000 in 1948 to 32,500,000 in 1954. The 1954 figures, which are estimated, compare with 1953 figures of 27,220,000 on maintenance and improvement 33,460,000 on construction and 30,565,000, on grants to provinces.

NORWAY

The highway system of Norway was 48,270 kilometres long in 1953, as compared with 44,395 kilometres in 1948. Main roads increased from 15,822 kilometres in 1948 to 16,031 kilometres in 1953 ; county roads from 5,323 kilometres in 1948 to 6,538 kilometres in 1953 and country or parish roads from 22,776 in 1948 to 25,701 in 1953.

	Expenditures (in millions of crowns) Fiscal years				
	1949–50	1950–51	1951–52	1952–53	1953–54
All road expenses	132.2	122.3	145.6	171	193.3

POLAND

In 1938, Poland possessed only 10 motor vehicles of all kinds per 10,000 inhabitants; in 1949 this figure had risen to 31. In 1939 Poland had three passenger cars for every truck, but by 1951 there were two passenger cars for every 5 trucks.

Under the Six-Year-Plan, the polish automobile industry is expected to produce 12,000 passenger cars, 32,000 motorcycles, 11,000 tractors and 25,000 trucks in 1955.

Poland's network of hard surface roads is now much longer than before the war—some 58,000 miles in 1948 as compared with 36,500 miles in 1937. During the current Six-Year-Plan, 3,900 miles of new hard-surface roads are to be built, the surfaces of another 2,400 miles of roads are to be improved, and some 500 miles of road are to be rebuilt. These improvements will increase the length of heavy-surface roads by 38 per cent of medium-weight-surface roads by 56 per cent, and of light-weight-surface roads by 5.6 per cent. During the period of the Plan, over 18 miles of new bridges are to be built and an equivalent mileage reconstructed, increasing the total length of bridges by 38 per cent.

PORTUGAL

A new draft law published recently provides for the expenditure of 6,000 million escudos on Portugal's road system during the period 1956-1970. The Government's road construction expenditures will be raised from a present average (for 1954-55) of 256 million escudos per annum to an average of 400 million escudos per annum over the period concerned.

RUMANIA

According to the Five-Year-Plan now in effect, Romania will modernize 720 miles of roads, and some six miles of new bridges are to be built.

SPAIN

The United States Foreign Operations Administration allocated 3 million dollars for highway development in Spain for the fiscal year ending 30th June 1954. The current highway programme in Spain requires an estimated 15 million dollars in addition to the recent allocation, and it is anticipated that further grants will be made during the coming fiscal year.

In 1950 Spain inaugurated a general highway improvement plan which provided for the expenditure of 2,363 million pesetas, 300 million pesetas being allocated in 1951 and 500 million pesetas for each succeeding year up to 1955. At the beginning of 1953, almost the entire allocation provided up to that date had been expended on 1,455 miles of highway.

The modernization programme now covers some 6,800 miles. The unit cost per mile is approximately 1.5 million pesetas. The Government proposed to spend 2,000 million pesetas on highway development in 1954.

SWITZERLAND

The table which follows indicates the expenditure on roads made by Switzerland in recent year.

—	(Cantonal roads only; in millions of Swiss francs)						
	1948	1949	1950	1951	1952	1953	1954
Maintenance, improvements, new works	124.9	140.5	143.3	160.6	184	190	200

SWEDEN

Data on the Swedish road programme are contained in the following tables

—	(In millions of crowns) Fiscal years				
	1949–50	1950–51	1951–52	1952–53	1953–54
Maintenance ...	167	179	223.5	225.8	254.3
New roads ...	85.5	125.1	180	317.6	287
Overhead cost and miscellaneous ...	20.3	17.8	25.3	66 3	40.9
Total ...	272.8	321.9	428.8	609.7	582.2

TURKEY

New bridge construction in Turkey will be speeded up with the awarding of contracts to build 131 bridges totalling nearly 13,000 feet in length during 1954–1955. This is in addition to 322 bridges with a total length of 60,000 feet already in process of construction in different parts of Turkey at an estimated cost of more than 18 million dollars. Seventy-two of the spans were scheduled for completion by the end of 1954.

The Turkish Department of Public Roads is conducting, in co-operation with the United Nations, a higway training centre at Ankara for engineers from Middle Eastern Countries.

The centre opened on 26th August 1954, with a course lasting ten weeks. The Programme included lecture sessions, field trips and specialized studies on such subjects as highway administration and planning: road surveys and design; materials research and design; mechanized road construction and maintenance, and bridge surveys, design and construction.

The Turkish road programme provides for the expenditure of 19 million Turkish pounds on road development in 1955. The objective is ultimately to develop a network of 14,400 miles of first-class national roads.

UNITED KINGDOM

Road expenditures in the United Kingdom have risen from 73,728,000 pounds sterling in 1948 to 85,170,000 in 1953. In the same period motor vehicle registrations increased from 3,728,432 in 1948 to 5,282,222 in 1953.

(From "Transport and Communications Review" Vol. VII, No. 4, October—December 1954.)

SALESMANSHIP

The House was entered by burglars, who made a good haul while the large watchdog slept. The owner reported the dog's dereliction of duty to the dealer. "Well, what you need now," said the pet shop man, "is a little dog to wake up the big one."

SECOND INTERNATIONAL COURSE OF LECTURES ON ROAD TRAFFIC ENGINEERING

BRIEF summaries of four out of the eight topics discussed at the 2nd International Study Course on Traffic Engineering held in September 1954 were given in the April Issue. The following are the summaries of the other four topics discussed.

Advantages and disadvantages of roads with three traffic lanes.

Two reports were submitted on this subject. Only tentative conclusions could be reached, owing to the lack of ample data and the existence of European roads with 3 traffic lanes 3.50 metres wide. One of the advantages of a road with 3 traffic lanes appears to be the fact that the 3rd traffic lane can be constructed without prohibitive cost within the existing limits of the highway. Nevertheless, it would seem, in view of the slight improvement in the flow of traffic resulting from widening a road from 2 to 3 traffic lanes, that a great deal more is to be gained by widening a road from two traffic lanes to 4 traffic lanes, arranged in 2 separate carriageways, without passing through the intermediate stage of a road with 3 traffic lanes which are not separated from one another.

The lay-out of intersections and traffic interchanges.

Six reports were submitted on this subject. Five of these reports described examples of lay-outs and gave information on the position before and after the improvement had been carried out. Emphasis was laid on the value of islands for channelising the traffic which should be properly designed and should clearly demarcate the possible paths for the vehicles, while at the same time obviating any misunderstandings.

Special mention should be made of the Dutch report which emphasises the presentation of the intersection, that is to say the means employed to make it easy for the road user to understand either by traffic signs or by the simplicity of the layout.

In addition it was pointed out that although roundabouts improve the movement of traffic in rural areas, they appear to be inadequate when the volume of traffic exceeds a certain value.

Another report deals with the sections of road on which traffic can accelerate or slow down on entering or leaving motorways. Various arrangements were recommended.

Controlling and regulating urban traffic.

Five reports were submitted describing methods for regulating traffic by means of traffic lights in Amsterdam, Brussels, Dusseldorf, Paris, and Stockholm.

The repporteur general, M. Feuchtinger (Germany), submitted the following 10 questions to those taking part in the course.

(1) How is the "right of priority" exercised in practice? To what extent should attempts be made to secure standardisation of the practical application of this right?

(2) Does the provision of traffic lights of an intersection improve road safety at the intersection?

It was pointed out in this connection that although there was no change as a rule in the number of accidents recorded at such intersections, the seriousness of such accidents was, on the other hand, considerably reduced.

(3) What are the lower limiting values for traffic volume at which traffic lights become useful?

The French report indicated that for an average crossing that is to say, with a carriageway 10 to 12 metres wide, which, in addition to parking, enables one line of cars to travel easily in each direction, a flow of traffic of 400 vehicles per hour in each traffic lane would be the minimum figure. This figure did not give rise to any special comment.

(4) Standardisation of the succession of colours used in traffic lights.

It was pointed out that in Belgium there is no amber light and that the signal for which the amber light is usually used in France is made by the simultaneous appearance of red and green lights. Reference was made to the international recommendations and to the discussions at international levels which are now proceeding with regard to such standardisation. It was emphasised that according to these recommendations the amber light must always precede the red light, but must never follow it.

(5) What modifications should be recommended in the systems of signals for pedestrians?

It was pointed out that this question had usually been neglected.

(6) Ratio between the length of the cycle and the traffic capacity of the intersection.

It is well known that the Americans have established very accurate graphs for this ratio. It was pointed out that these graphs require adjustment to make them suitable for use in Europe, on account of the differences in the characteristics of the vehicles and of European traffic. Stress was also laid on the fact that traffic capacity mainly depends on the number of vehicles making a left turn (a right turn in England). Where there are no such vehicles the green phase may properly be allowed to last for 30 seconds, otherwise it should not exceed 20 seconds.

(7) What are the practical limits to vehicle actuated traffic lights?

The British consider that traffic lights of this type are satisfactory. The number of accidents occurring at points where they are installed is 2 to 3 times less than in Paris.

(8) Systems of co-ordinated traffic lights.

(9) Are advance signals to be recommended?

This question arose from a suggestion put forward by one of the repporteurs. He noticed the increasingly marked effect of the time taken in starting when the cycles are short, and was thus induced to suggest the provision of advance signals above the crossing whereby the distance over which the vehicles start is carried back sufficiently far from the crossing so that vehicles can arrive level with the main traffic lights, while travelling at 30 to 40 kilometres per hour, at the very moment when the lights change to green. The author considers that a gain of 5 seconds of green phase could be obtained at each cycle.

The repporteur general asked whether any experiments had been carried out in other countries but he received no definite reply.

(10) Field of application of informative signs.

This question also arises from a suggestion made by a repporteur and based on the following observation:

In the case of a road with a co-ordinated system of traffic lights, the drivers manage to regulate their individual speeds, correctly when the intersections are located at the right distance, corresponding to the maximum flow of traffic; if the distance between 2 consecutive intersections is appreciably greater than this optimum distance the differences between the individual speeds are accentuated and all the vehicles in a group are unable to cross the intersection without being obliged to stop there. Hence the advantage of placing intermediate signals, at points which do not correspond with intersections, to provide drivers with an indication of how the green wave is being propagated along with street. No example of such an installation could be quoted.

(Continued on page 30)

EXPERIENCE IN SYDNEY WITH BITUMINOUS PAVEMENTS

BETWEEN 1924 and 1931 dense-graded bituminous surfaces were laid on a number of the more heavily trafficked Main Roads within the Metropolitan area of Sydney, mainly on cement concrete bases.

The mixtures were generally sheet asphalts laid by hand to a thickness of about 2 inches, comprising particles all passing No. 14 British Standard Sieve, with up to 30 per cent of "filler" (i.e., material passing 200 mesh sieve). All of these early mixtures were substantially waterproof. Some patching was carried out by the contractors during five-year free maintenance period. Where early attention proved necessary, the most common fault was a local excess of bitumen which reduced stability and gave rise to "shoving", a form of movement resembling the corrugation of gravel roads. Such areas were treated with a pavement heater, unstable material being removed by rakes, and new asphalt rolled in while hot. Several sections of dense graded pavement constructed in 1927 and 1929 have not yet been resurfaced.

In recent years failure of many of these older dense pavements has occurred by craze cracking, by "shoving", or by loss of bond with the concrete base. Cracking does not necessarily involve serious loss of stability, and frequently the position can be met by resurfacing with a fine graded mixture. A moderate degree of "shoving" can be treated with the road heater and new asphalt, but "shoving" often accompanied by loss of bond with the base, necessitates total removal and replacement of the asphalt material.

In the period 1931 to 1938 dense mixes were virtually abandoned in favour of the cheaper premixed bituminous macadam (hot open graded mix) and bituminous seal coat (surface dressing), both of which were mainly laid by day labour. The seal coat, although low in first cost, offered a relatively short life under heavy traffic, and as a rather high bitumen content is an inherent feature of the process, smooth surfaces usually developed. Seal coats have the further disadvantage of not improving the riding qualities of uneven pavements.

Increasing speed and density of motor traffic created the need for a process which would improve riding qualities on existing pavements and at the same time provide added strength, and to meet this situation premixed bituminous macadam was adopted by the Department on a large scale. This material was commonly laid by the drag spreader, which provided correction of shape on uneven road surfaces. Such a mix is open in texture, contains up to 20 per cent. Voids, has moderately low bitumen content, and for stability depends largely on the mechanical interlock of relatively large particles of crushed metal. It is not watertight; consequently the admission of water and air permits ready oxidation of the bitumen being separated from particles of metals by the action of water. This action is prone to occur with hydrophilic aggregates (material having a greater affinity for water than for bitumen).

Open graded mixes under heavy traffic are liable to deteriorate after a few years by loss of surface particles of aggregate ("ravelling"), the chief symptom being a decided roughening of surface texture. This action can be largely arrested by the application of a bitumen seal, which in itself has the disadvantages mentioned earlier. Prior to 1949 it became normal practice on main roads in the Sydney area either to resurface alternately with open graded mix and bitumen seal coats, or use thin layers of fine graded open mix, consisting of $\frac{3}{8}$ in. gauge metal, coarse sand and bitumen. There were occasional exceptions to this procedure, especially in 1938-39, when a few resurfacing works were undertaken with a dense graded mix termed stone-filled sheet asphalt.

In 1949, the Department designed and put into service in the Sydney area, dense graded mixes (fine asphaltic concrete), consisting of carefully balanced amounts of small gauge crushed metal, coarse and fine sands, limestone dust filler and bitumen, the whole being proportioned to give maximum density and stability. Laboratory control of this material is essential to maintain the low voids required (2 to 5 per cent) and ensure that overall grading and bitumen content closely approached the design targets. Stability has been checked in the laboratory by the Hubbard Field method.

These dense graded mixes are virtually waterproof, have anti-skid or "sand paper" surfaces, pleasing appearance, and long life, which is expected to be many times greater than that of open graded mixes. At the present time, surfacing and resurfacing of roads controlled by the Department of Main Roads is now performed almost exclusively with that class of mix. No dense graded mixes laid since 1949 have yet been resurfaced and there is no record of any patching of surface faults. However, in one case, where a steep grade and sharp curve cause road vehicles to brake heavily, some movement of asphaltic surface on the concrete base necessitated a small amount of burning off and placing of new asphaltic concrete.

Typical gradings and other details of dense and open graded mixes used by the Department in the Sydney area are given in the following tables:

Nominal Gauge of Mix Passing B.S. Sieves (%)	Dense Mixes		Open Graded Mixes			
	$\frac{3}{16}$ in.	$\frac{3}{8}$ in.	$\frac{3}{8}$ in.	$\frac{1}{2}$ in.	$\frac{3}{4}$ in.	$1\frac{1}{2}$ in.
$1\frac{1}{2}$ in. ...	...	...	...	...	...	100
1 in. ...	...	...	...	...	100	77
$\frac{3}{4}$ in. ...	...	...	...	100	99	67
$\frac{1}{2}$ in. ...	...	100	100	98	64	42
$\frac{3}{8}$ in. ...	...	99	99	78	59	39
$\frac{1}{4}$ in. ...	100	90	85	63	52	33
$\frac{3}{16}$ in. ...	99	73	61	50	39	21
No. 7 ...	61	53	32	26	20	14
14 ...	49	46	24	19	16	12
25 ...	42	38	16	13	11	9
52 ...	27	23	5	4	3	2
100 ...	15	12	...	...	...	...
200 ...	10	10	...	...	...	...
R. 90 Bitumen (lb. per 100 lb. of mineral aggregates)	6.4	6.0	5.0	4.8	4.4	4.0

Voids ...	2 to 5 per cent.	12 to 20 per cent.
Density ...	140 to 150 lb. cu. ft (1 ton covers 20 sq. yds. at 1 inch consolidated thickness)	130 to 140 lb cu. ft. (1 ton covers 22 sq. yds. at 1 inch consolidated thickness).
Stability (Hubbard Field)	3,500 to 6,000 lb.	Not specified.
Mixing Temp. ...	290° to 310 ° F.	220° to 250° F.
Cost per ton (at mixer) ...	85 s.	72 s to 66 s.

(*Continued on page 30*)

PRESTRESSED CONCRETE ROADS

THE wide applications of prestressed concrete in structural engineering have overshadowed its development and use in road and runway construction. Roads are representative of all ground-supported slabs and a consideration of the possible use of prestressed concrete indicates that it can have advantages provided that the cost can be made comparable with the conventional road construction costs. Unlike industrial buildings or bridges, it is difficult to predict the useful life and serviceability of roads. The factors which affect the design of our highway systems are changing rapidly due to high axle loads and increase of traffic density.

The weakest part of our roads is the joints and a common defect in concrete roads is the formation of cracks. Experimental stretches of up to several miles with continuous reinforcement have been constructed in U. S. A. with the object of reducing the number of joints and cracks in the concrete. But cracks have appeared in all of these test roads indicating that effective arrangements have to be made to allow for expansion and contraction. Differences in temperature and moisture in the top and bottom of road slabs lead to warping. What has prestressing to offer against these defects? It is obvious that pretensioning of the reinforcement can eliminate cracking and make the slab behave as an elastic structure which recovers its original shape when heavy or excessive loads are removed. Cracking depends on length of slab and is due largely to the dead weight of the slab, the superimposed traffic loads and the subgrade restraint preventing the slab from freely warping with daily temperature changes and from giving it much longitudinal freedom of movement.

Ordinary reinforcement does limit the width of the cracks and the amount of surface water and dirt which gets into them. The purpose of the steel is therefore to maintain relative unity of the slab with definite joints every 30 to 100 ft and some degree of load transfer at the joints. The continuously reinforced road slab, already referred to is flow over twelve years old and contains about 1 lb. of steel per sq. ft and the cracks induced are very fine and are at very close spacing. It is questioned whether such amounts of steel involve efficient use of the material and whether a concrete road with cracks spaced 2 to 3 ft apart will have a sufficiently long life to call it a permanent structure. It is only time and experience that can give us the answer to this question and it is doubtful whether a final opinion can be obtained under a period of twenty years owing to readjustment of subgrade support.

When a road is prestressed a compressive stress of 200-500 lb. per sq. in. is induced, and much greater flexure can take place before cracking results. Joints need only be provided for expansion and contraction at intervals of 300-1,000 ft. The riding quality is improved, the maintenance costs less and its life is much increased. The most important disadvantages of prestressed roads are that it is not easy to dig through the slab and the expansion joints become complicated when the bays are long.

Basis of Prestressed Concrete Road Design. Much depends on the site conditions and on the traffic to be carried. The present tendency in this country is to limit the lengths of bays to 400-500 ft, in view of the uncertainty as to the value of the frictional or subgrade restraint. A longitudinal joint for every 15 ft of width is desirable, otherwise transverse prestressing become necessary. Slabs should be tied across the longitudinal joint with a tie which will permit a slight longitudinal movement of one slab relative to the other. This is necessary as one-half is usually cast and often prestressed before the other.

The slab thickness is 5-6 in. and the amount of prestress, on lengths of 500 ft, should be at least 250 lb. per sq. in. at the

time of stressing. Little information is available about the co-efficient of friction except that it varies considerably and under good conditions has a value ranging from 0.23 to 0.50. A sub-grade restraint of 0.50 represents a loss of prestress of 100 lb. per sq. in. on a length of 400 ft assuming the ends of the bay to move relative to the centre. The longitudinal prestress may be applied by (a) post-tensioned cables, (b) post-tensioned bars, (c) pretensioned wires, (d) exterior or slab-gap prestressing.

Some Developments in U.S.A. The work of the Public Roads Administration has established figures for sub-grade drag varying from 0.5 to 2. It is advocated that the friction must be controlled within narrow margins and the concrete road prestressed so that it can resist this friction without cracking. In a large Chicago warehouse a jointless prestressed slab consists of a 3 in. thickness placed on a concrete base with an intermediate friction reducing sheathing. The co-efficient of friction can be established by tests and a prestressed carpet, with joints several thousand feet apart, is possible. This carpet is placed on a 9-in. thick unreinforced concrete slab. The live load consist of rope reels, each weighing 10 tons, with a contact pressure of 1,000 lb. per sq. in. as compared with about 250 lb. sq. in., for the heaviest plane on a runway. There is no trace of hair cracks in this carpet after four years.

The use of high prestress following experience on structures would suggest a great decrease in slab thickness. But this is unlikely to be adopted as thin slabs show a large increase in elastic slab deflections. The prestressed slab would withstand the large deflections but it is doubtful that that the sub-grade would take them without permanent deformation.

Future of Prestressed Roads. This depends very largely on the economic position of prestressed concrete roads, and current trends show that prestressed roads can be made for about the same cost as ordinary reinforced concrete on poor subsoils, and their adoption by road builders of the future will depend largely on the amount of research and development work carried out to simplify present construction methods and to develop the pretensioned and slab-gap post-tensioned systems of prestressing.

In particular the pretensioned system offers great possibilities providing a continuous and automatic machine can be designed to maintain a minimum travelling pretension force of about 10 tons per foot width of slab. The pretensioned wires would be anchored at one end and the tension applied continuously at the other end by means of heavy tractors. A heavy tractor has a tractive force of about 0.9 of the weight on the tracks so that not more than five tractors would be required. The wire-feed platform pulled by the tractors, would be track mounted and the wires stressed by the well-known wire-drawing method. The great advantage of a pretensioned prestressed road is that the stress in the wires is relatively constant along their lengths and is accurately known. The prestress does not therefore decrease along the slab length on account of the friction loss between the cables and concrete, thus resulting in less tendency to produce cracked slabs. What is required now is ingenuity and determination to design a machine to carry out the operation of pretensioning satisfactorily for day-to-day work.

Gap post-tensioning may be achieved by any suitable jack and especially by Freyssinet's flat jacks. If no longitudinal cables are used the ends of the slab must be anchored according to the value of the sub-grade restraint. After jack widening to the required opening, about 6 in. per 100 ft slab length, the opening is filled with concrete and the jacks removed.

(From "The Journal of the Institution of Municipal Engineers, London," October, 1954).

HERE AND THERE

1. ROADS PAY FOR THEMSELVES

WHEN a new street or highway is built or an old highway modernized, four things happen :

1. Values of property adjoining the road increases.
2. Commercial and industrial establishments experience an immediate increase in business.
3. Traffic volumes increase above normal expectancy.
4. Highway users begin to experience unusual savings due to smoother, safer travel.

(From the Bulletin 'Summary' of the Virginia State Chamber of Commerce —December 7, 1954).

2. PROVINCIALISATION OF DISTRICT BOARD ROADS IN THE PUNJAB

IT is learnt that the State Government has drawn up a 10-year programme for provincialisation of all the 2nd Class roads in the State, which at present are being maintained by the District Boards.

So far 25 miles of these roads have been taken over by the Government and the work of reconditioning is in progress.

(Times of India, dated 1-2-1955.)

3. COURTS SHOULD NOT TRY TO LOCATE HIGHWAYS— ALABAMA COURT DECISION

" STICK to your last—courts shouldn't try to locate, build or maintain highways, said Alabama's Supreme Court in reversing a lower court decision that would have stopped construction of a new by-pass near Montgomery.

"A motel owner had obtained an injunction against the highway bureau, charging loss of business and that the new by-pass is unnecessary.

"Said the high court: Individual financial loss can't be controlling against general public good; it's not the court's business to decide where a highway should do most public good."

(From 'American Highways'—January, 1955).

4. M. VISVESVARAYA

SHRI Mokshagundam Visvesvaraya, K.C.I.E., the most distinguished and the oldest living engineer in the country, was born on September 15, 1861, barely four years after the first war of Indian Independence of 1857. After graduating from the Central College, Bangalore, where he took his B.A. degree in Science, he came down to Poona for his engineering studies at the College of Science (now College of Engineering) and was ranked first in the final examinations at which he was awarded the coveted Buckley Prize. Soon after, he joined the Public Works Department, Bombay, as an Assistant Engineer. He was promoted as Superintending Engineer in 1904, four years before his retirement from the service in 1908.

In 1908 Sir Mokshagundam was only 47, and his career and real life's work still lay ahead of him. On his return from a world tour in 1909, he was appointed a special Consulting Engineer to the Nizam's Hyderabad State where he was responsible for the Musa Project. Three years later, he had moved to Mysore State and within three years he had climbed steadily from the post of the Chief Engineer to that of the Dewan. In Mysore,

the engineer-statesman found full scope for his visionary capabilities and within a decade had laid the foundations of a planned industrial economy in the state based on a philosophy and view of life which is only too familiar at present but was considered quite revolutionary and unorthodox in those years before the First World War. The Krishnarajsagara Dam on the Cauvery for whose planning and construction he was principally responsible held in 1918 the biggest storage reservoir in India. He also planned and guided the execution of the Bhadravati Iron works. A number of technical institutes were started in line with his ideas on technical education in India. When he moved away from Mysore on to the broader field of national affairs, he had gained for himself a unique reputation not only as an engineer, but a far-sighted statesman, an able administrator, a radical economist and an enterprising idealist.

From 1921 onwards, his has been a royal progress, the progress of a man, of definite uncompromising ideals, of infinite industry, of devoted service to the cause of industrialization, of a man, who whenever he spoke, spoke for the good of his country and the welfare of his countrymen. He has served on innumerable committees, advised a dozen governments on water supply schemes, irrigation projects and hydro power schemes, drawn up blue prints for a score of industries, founded and presided over a host of institutions including the All India Manufacturers' Organization, designed intricate engineering machinery such as sluice gates for the Five Reservoirs at Khadakvasla, Poona, lectured all over the country on planning and the role of industry in India's economy, and written scores of pamphlets including two most famous books, "Reconstructing India" and "Planned Economy for India". Engineering has been only one facet of Sir Mokshagundam's extraordinary life. There is hardly an aspect of our national life he has not touched, and having touched, not enriched and brought to it to its fulness.

He was awarded the Bharat Ratna in 1953.

(From 'The Indian & Eastern Engineer,' February, 1955.)

5. A "LANDSLIDE" TO END ALL LANDSLIDES

FOR many years the railway and main road round the northern tip of Hungary's "inland sea" Lake Balaton have been gradually pushed towards the lake by slipping subsoil. Landslides from a 250-foot bank have continually damaged the tracks and roadway. After failure of many attempts to stop the landslips, engineers have decided on a novel solution. The railway and road in the affected section are to be shifted 100 yards into lake itself by building a two-mile causeway in the shallow waters. And to build the causeway they are to adopt a method which has proved successful in the Soviet Union—the water-sluicing method. Earth and sand from the overhanging embankments will be reduced to sludge and the fluid passed down pipes into the lake where the sediment will build up the new causeway. It will then be left for one year to dry out and consolidate before the railway and road are built.

(From 'Highways & Bridges', March 23, 1955)

6. HINTS ON LOCATION OF MOUNTAIN ROADS

WHERE the location of the line will permit, as much of the road as possible should be made in cutting. In earth, or soft rock, yielding to the prick, the excavated material is to be used to form the outer portion of the road, and the protection mound or bank required at the approaches to the cross-drainage works at

the re-entering turns. At steep rocky salients the road to be in cutting. In other situations the cost of rock-cutting, and of retaining-walling, to determine which is to have the preference.

Remark:—It is frequently recommended that a road should be made in cutting, but this cannot be accomplished if the road is properly designed as regards direction, slopes, and curves. If these matters receive, as they should do, the first attention of the engineer, the road will sometimes be in cutting, and sometimes on a bank. A road may be located to be more in cutting than on a side-bank; but unless every inequality of the ground be followed, which would be absurd, a well line-out road must sometimes be cut into a hill, and sometimes be on a bank outside. To say that a hill-road should be formed on a neutral section throughout would be equally wrong. Whether or not, a road be well and economically laid out, will depend entirely upon the personal skill of the engineer.

(*From the book "Treatise on Mountain Roads, live Loads and Bridges."*)

7. GOOD ROADS ALLOW THE HAULING TO BE DONE WHEN OTHER WORK IS IMPOSSIBLE

IN rainy weather it is impossible to work in the crop. The farmer can make a trip to town to haul in his products or bring out supplies at this time. If he has a good road he can do this hauling. If the roads were bad, he must wait until it is dry enough. Good roads help the farmer to make a trip to the town in rainy weather and thereby facilitate his attending to the crops at the right time after the rains.

(*From 'Bulletin of the Agricultural and Mechanical College of Texas'-July 18 1917.*)

DEFINITIONS OF HIGHWAY ENGINEERING TERMS

BACK-FILLING:

(a) Earth or other material used to replace material removed during construction, such as in culvert and pipe line trenches and behind bridge abutment, retaining walls, etc. The material removed during construction may be used as back-fill.

(b) Material placed between an old structure and a new lining.

BALANCED EARTHWORK:

Earthwork in a length of a project in which the quantity of "Excavated material" is nearly equal to the quantity of filling and can be economically utilised for filling.

CURRENT LITERATURE

ABSTRACTS

THE TAR OR ASPHALT ROAD by H. Mallison—Bitumen, Teere, Asphalte, Peche—1953 November (In German).

A method is described for determining on the spot whether a road surfacing contains road tar or bitumen as binder. The method consists in the application of a piece of filter paper moistened with benzene to the road surface followed by pressing with the thumb so that a definite mark appears on the paper. From the colour of the mark, blackish-brown in the case of bituminous surfacings and brownish-yellow to chestnut brown with tar surfacings, it is possible to distinguish between the two types of binder

EFFECTS OF METHODS OF USING SMALL VIBRATING SCREEDS ON THE DEPTH OF COMPACTION OF CONCRETE—R. H. H. Kurkham, Surveyor, London, 1954—113.

TESTS were made to examine whether the method of using a small vibrating screed affects the depth of compaction obtained in a concrete road. Results are given showing the variation of concrete density with depth and the conclusions were: (1) To obtain full compaction in a slab 8 in. thick the vibrator must be moved forward in steps and lifted on to the spread concrete at each step. (2) Full compaction of a 6 in. slab is obtainable if the vibrator is tilted or is fitted with some sort of leading edge and allowed to slide along the forms, but if no leading edge is provided and a plain rectangular beam is used a second pass will be required as well as a finishing pass.

WELDING ENGINEERING by B. E. Rossi—McGraw-Hill Book Company, New York, 1954.

IT is the scope of this book (1) to familiarise the student or the beginner with certain fundamental facts concerning welding, (2) to give those now in the welding field a wider understanding of the process, and (3) to provide a useful source of reference for the draughtsman, designer, engineer, researcher, executive and any one seeking information on welding and its uses.

The book which is nearly 800 pages contains 21 chapters. The subject matter is dealt with under the following sections:

(1) Process
(2) Metals and their weldability
(3) Design and fabrication considerations
(4) Testing and inspection.

THE EFFECT OF ORGANIC MATTER ON THE SETTING OF SOIL CEMENT MIX TURES by K. E. Clare and P. T. Sherwood.

MIXTURES of soil, cement and water will harden sufficiently to be used in place of stone for road-making. Some soil types, however, contain organic matter that prevents the mixture hardening. Experiments are described in which a range of organic compounds, of the types occurring in soil, were added to clean sand, which was subsequently mixed with cement and water. Compressive strength tests on specimens made from these mixtures showed that the organic compounds could be grouped according to their 'activity' in retarding the setting of cement; of the compounds considered, the most active were glucose and nucleic acid.

Later experiments with a natural organic sandy soil showed that the retardation is probably due to an 'active' fraction of the organic matter, which affects the setting of cement by absorbing calcium ions liberated during hydration. The 'active' material is produced in the surface soil, where it is associated with a low pH; it is subsequently leached into the subsoil, where it becomes absorbed as a complex with iron in a zone of accumulation where the pH is higher.

The retarding effect is overcome by the addition, with the cement, of calcium

chloride, either in the form of super-rapid-hardening cement or as a separate additive.

STUDIES IN PLASTIC STRUCTURES by A. J. S. Pippard. Published by Edward Arnold & Co., London.

THE book is a collection of studies of elastic structures. There are 12 chapters. Of these, the following are of particular interest:

1. Stresses in interconnected bridge girders,
2. Multiple lattice frames,
3. Analysis of open-panel structures,
4. Bow girders and transversely loaded frames,
5. The elastic arch rib, and
6. The masonry arches.

The chapter on Masonry Arch describes experiments on two pinned and fixed ended arches with idealized voussoirs of steel with no jointing material. Experiments with concrete voussoirs using lime and cement mortar joints on an arch of 10 ft span with a rise of 2 ft 6 in. are also described. The conclusions drawn from these tests are given below.

(1) Although the lime mortar used as a jointing material had apparently no tensile strength, it did in fact develop sufficient to prevent joint-failure until the linear arch was well outside the middle-third core.

(2) Cement-mortar joints developed sufficient tensile strength to prevent joint-cracking until the linear arch was well outside the arch ring.

(3) After the first crack in the lime-mortar-jointed arch there was a big reserve of strength before instability occurred. The load producing instability was less than that calculated because the lime crushed and caused the virtual pins to form at short distances from the edges of the arch ring.

(4) The tensile strength of the cement-mortar joints not only delayed the first crack, but also raised the ultimate loads to values considerably higher than those calculated. After the first crack it was usual for no other crack to occur until the arch suddenly failed by instability; that is, the last three cracks developed practically simultaneously.

(5) Spalling of the voussoirs caused premature instability in certain tests, but this danger can be reduced or eliminated by using suitable materials for the voussoirs.

(6) Slip only occurred in the tests as an accompaniment of crushing or spalling and never as a distinct type of failure.

It appears from these tests that, even when a weak mortar is used, the middle-third criterion is unduly pessimistic. This has been recognised by various authors, who have suggested that the middle-half core should be considered as the safe region for the linear arch. With good cement mortar, however, even this is very much on the safe side and there seems little doubt that no cracking of joints would occur if a still wider margin were adopted. It must be emphasized that the development of tension at a single joint does not indicate that the structure is unsafe, since a very large margin of strength is available before instability occurs.

The experimental arch was not subjected either to traffic conditions, which give repeated loads, or to weathering effects, and it may be that continual application of the load would cause a joint subjected to tension to open ultimately, and this is undesirable even if it is not dangerous.

An appropriate method of estimating the safe load on existing masonry arches taking into account the span, rise at the centre, depth of the arch ring, and the cushion at the crown is given. Also the effect of propping a weak arch at the centre or at two points equally spaced from the centre is analysed. The conclusion is that such props do not serve useful purpose.

SELECTED RECENT LITERATURE IN ENGINEERING JOURNALS.

X-BRIDGES AND OTHER STRUCTURES.

1. **Analysis of Statically Indeterminate Structures by the Deformation Method**; M. SMOLIAR.

   Part I – Concrete and Constructional Engineering, July 54, pp. 209-220.

   Do. *Part II* Do. August 54, pp. 251-260.

   Do. *Part III* Do. September 54

   Do. *Part IV* Do. October 54, pp. 315-321.

2. **A North-Light Roof with Vierendeel Girder of 81 ft Span**; *Concrete and Constructional Engineering*, July 54, pp. 221-224.

3. **Test of Prestressed Beam of 55 ft Span – Interpretation of Test Results from Load-Deflection Curves**; *Concrete and Constructional Engineering*, July 54, pp. 235-237.

4. **The Design of Staircases**; A. KRYSZTAL, *Concrete and Constructional Engineering*, July 54, pp. 227-234.

5. **New Method of Prestressing Beams**; *Concrete and Constructional Engineering*, July 54, p. 234.

6. **Partially-Prestressed Flat Slabs**: *Concrete and Constructional Engineering*, August 54, pp. 261-263.

7. **Effects of Underwater Explosions on Elastic Structures in Water**; ERIK ENHAMRE, *Transactions of the Royal Institute of Technology, Stockholm, Sweden* – No. 82, 54.

8. **Safety and the Probability of Structural Failure**: A. M. FRENDENTHAL, *Proceedings of the American Society of Civil Engineers*, August 54, Separate No. 468.

9. **Investigation of Results of Tests on Joint Performed at** C. E. B.T.P.–CHAGNEAW (A) & FOARGEANAD (J), *Annales de l' Institut Technique da Batiment et des Travaux Public*, September 54, pp. 827-853 (in French).

10. **The Interpretation of European Techniques in Prestressed Concrete**; G. C. ENTRICAN – *New Zealand Engineering*, September 15, 54, pp. 294-304.

11. **Tests on Composite Prestressed Beams**; H. W. CORMAK, *New Zealand Engineering*, September 15, 54, pp. 305–306.

12. **The Pescadoires Bridge on the Lot and Cahors to Libos Railway Line**; PAUL JAUBERT, *Travaux*, October 54, pp. 745–751 (in French).

13. **Skin Plating on Steel Gates**; SERGE LELIAVSKY, *The Engineer*, Part I, October 8, 54, pp. 474–476.

    Part II, October 15, 54, pp. 510–512.

14. **Composite Partially-Prestressed Concrete Slabs-Strength under Repeated and Static Loading**; P. W. ABELES, *Engineering*, October 8, 54, pp. 464-468.

15. **The Beam Strength of the Reinforced Concrete Cylindrical Shell**; JAI KRISHNA and O. P. JAIN, *Civil Engineering and Public Works Review, Part I*-August 54, pp. 838-840.

    —Do—*Part II*-September 54, pp. 953-956.

16. **A Review of Unit-Construction Bridge**; ROLT HAMMOND, *Civil Engineering and Public Works Review*, August 54, part 3, pp. 845-848.

    —Do—Sep. 54, part 4, pp. 964-66.

    —Do—October 54, part 5, pp. 1086-1089.

17. **The Design of Tee-Beams**; H. J. HOPKINS, *Concrete and Constructional Engineering*, October 54, pp. 303-306.

18. **A Small Prestressed Roof**; *Concrete and Constructional Engineering*, October 54, pp. 326-327.

19. **Slip of Joints under Static Loads**; R. A. HECHTMAN, R. D. YOUNG, A. G. CHIN and E. R. SAVIKKO, *Proceedings American Society of Civil Engineers*, Separate No. 484— September, 1954.

20. **Structural Application of High-Strength Bolts**; T. R. HIGGINS and E. J. RUBLE, *Proceedings American Society of Civil Engineers*, Separate No. 485—September 1954.

21. **A Strain Balance System for Analysis of Redundant Structures**; OLIVER A. BAER, *Proceedings American Society of Civil Engineers*, Separate No. 486—September 1954.

22. **Spiral Stairs in Reinforced Concrete**; P. SOATTER, *Schweizerische Bauzeitung*, October 9, 54, pp. 595-598 (in German).

23. **Outlook on Prestressing**; ROBERT M. JOHNSON, *Concrete*, September, 54, pp. 22-23.

24. **Fatigue of Welded Structures—Discussion on a Paper**; by Dr. R. WECK, *The Structural Engineer*, October 54, pp. 274-281.

25. **The Development of Prestressed Concrete in Germany**; P. W. ABELES, *Civil Engineering and Public Works Review, Part I*—September 54, pp. 948-950.

    —Do—*Part II*-October 54, pp. 1089-1092.

    —Do—*Part III*-November 54, pp. 1211-1213.

26. **Some Aspects of Modern Prefabricated Construction**; K. K. MCKELVEY, *Civil Engineering and Public Works Review, Part I*, September 54, pp. 933-935.

27. **An Interesting Factory Construction**; *Civil Engineering and Public Works Review*, September 54, pp. 936-938.

28. **Investigations into the Strength of Short Reinforced Concrete Columns**; S. MACKEY, *Civil Engineering and Public Works Review, Part I*—September 54, pp. 945-948.

29. **New Country overcrossing on the Ratishen Line**; CONRADIN MOHR *Schweizerische Bauzeitung*, October 16, 54, pp. 606-607 (in German).

30. **Chart Eases Moment Calculations**; *Engineering News Record*, October 7, 54, pp. 320.

31. **Reinforced Concrete Columns Quickly Designed by Charts**; R. L. SANKS, *Civil Engineering*, September 54, pp. 603-604.

32. **San Marco Bridge—A Prophetic Design in an out-of-the Way Place**, BLAIR BIRDSALL; *Civil Engineering*, September 54, pp. 574-575.

33. **San Marcos Bridge, "Cable-Truss" Design Greatly Increases Stiffness**; NORMAN J. SOLLENBERGER, *Civil Engineering*, September, 54, pp. 576-579.

34. **San Marcos Bridge—Cable Erection Complicated by floods and Tropical Climate**; H. W. HILLS, *Civil Engineering*, September 54, pp. 582-583.

35. **Reinforced Concrete Clarifying Tower Subjected to Temperature Stresses**; GEORGE SCHULZ, *Beton Und Stahlbetonbau*, October 54, pp. 225-232 (in German).

36. **Construction of a Prestressed Concrete Bridge According to the "Holzmann System" with Partial Use of Heavy Precast Concrete Beams**; FRITZ GOTZ, *Beton und Stahlbetonbau*, October 54, pp. 232-235 (in German).

37. **Reinforced Concrete Foundation for 2500 ft Forging Press**; KARL A. LASSANSKE, *Beton und Stahlbetonbau*, October, 54, pp. 235-238 (in German).

38. **On the Effective Flange Width of T Beams with Prestressing - Results of Computation and Testing**; EWALD SCHORSCH, *Beton und Stahlbetonbau*, October, 54, pp. 238-241 (in German).

39. **The New Mosel Bridge at Koblenz Outline and Design**; Dr. ULRICH EINSTERWALDER and Dr. GEORG KNITTEL, *Der Bauingenieur*, August 54, pp. 278-294 (in German).

40. **The Construction of the New Mosel Bridge at Koblenz**; KARLHEINZ GRIES and HANS SCHWARZER, *Der Bauingenieur*, August 54, pp. 295-304 (in German).

41. **The Architectural Design of the New Mosel Bridge at Koblenz**; GERD LOHMER, *Der Bauinengieur*, August 54, pp. 305-307 (in German).

42. **On the Temperature Stresses of the Main Girders of the New Mosel Bridge, Koblenz as a Result of the Hydration Process of Cement**; Dr. A. MEHMAL, *Der Bauingenieur*, August 54, pp. 308-310 (in German).

43. **Strengthening a Bridge Through Welding**; K. LATZIN, *Der Bauingenieur*, August 54, pp. 319-320 (in German).

44. **Model Testing for Doubly Curved Arch Dam**; F. TOLKE, *Der Bauingenieur*, August 54, pp. 325-326 (in German).

45. **Northham Bridge in Full Use by Traffic**; *The Surveyor*, October 23, 54, p. 924

    see also the Surveyor, February 3, 55, p.125.

46. **The Casablance Stadium**; DANGLETERRE and LOSSIER, *Annales de' Institut Technique du Batiment et des Travaux Publics*, October 54, pp. 899-918 (in French).

47. **The Bridging of the Severn**, J. E. A. BAKER and GILBERT ROBERTS, *The Journal of the Institution of Highway Engineers*, October 54, pp. 23-37.

48. **Aerodynamic Research in Relation to Bridge Design, progress Report and Commentary**; J. M. BERTEINE, *The Surveyor*, November 6, 54 pp. 955-958.

49. **Strain Measurements on the Temporary Road Deck for the Toronto Subway**, WILLIAM ROBERT SCHIEVER, *Proceedings of the Institue tion of Civil Engineers, Part I, Volum-3*, November 54, No. 6 pp. 720-735.

50. **The Secant Approximation and the Perry Formula-Expressions for Eccentrically Loaded Struts**; R. G. PEARSONS, *Engineering*, November 5, 54, p. 594.

51. **Demonstration Apparatus for Structural Problems-visual Aid for Moment Distribution Calculations**; R. J. WILKINS, *Engineering*, November 5, 54 p. 595.

52. **Stress Concentration at Holes in Rotating Discs**; M. G. EDMURDS, *The Engineer*, November 5, 54, p 618-620.

53. **High-Level Cantilever Bridge Spans Savarnah River**; ALFRED HEDEFIME and THOMAL R. KUESEL, *The Civil Engineering*, June 54, pp. 54-58.

54. **World's Third Tallest Structure Erected in Greenland**; S. D. STURGIS, *The Civil Engineering*, June, 54 pp. 59-63.

55. **A Bailey Dual-Carriage-Way Over-Bridge**; Col. V. V. RUTHNASWAMY, *The Journal of the Institution of Military Engineers, Vol, 6, No.* 4, October, 54, pp. 278-281.

56. **The bridge over the Straits of Mersina to Connect Sicily and Italy**; D. H. STEINMAN, *Travaux*, November, 54, pp 773-779 (in French.)

57. **Are the Indications of Extensometers Always Correct?** H. CAMBEFORT and R. CHADEISSON, *Travaux*, November 54, pp. 801-803 (in French).

58. **Two Hangers in Prefabricated Reinforced Concrete**; JEAN - JACQUES COULON, *Travaux*, November 54, pp. 804-807 (in French).

59. **—Do— Design of the work**; M. LEYZERSON, *Travaux*, November, 54, pp. 807-808 (in French).

60. **Reservoir has Precast Roof that Resists Earth-quakes**; *Engineering News Record*, October 14, 54, pp. 30-32.

61. **Bridge Salvage**; *Engineering News Record*, October 14, 54, p. 35.

62. **Lightweight Framed Dome**; *News Engineering Record*, October 14, 54, p. 31.

63. **Precast Concrete Sandwich Panels for Tilt-up construction**; F. THOMAS COLLINS, *Journal of the American Concrete Institute*, October 54, p.p. 149-164.

64. **Ultimate Strength in Shear of Simply - Supported Prestresssed Concrete Beams without Web Reinforcement**; E. M. LWOYER and C. P. SIERS, *Journal of the American Concrete Institute*, October 1954, pp. 181-200.

65. **Determination of Fixed-End Moments in Beams with Irregular Loading without the Use of Formulas from Handbooks**; K. T. SUNDARA RAJA IYENGAR, *Journal of the American Concrete Institute*, October 54, pp. 201-203.

66. **The Hjulsta Bridge in Sweden**; SUNE EWERDAHL, *World Construction*, September-October 54, pp. 19-21.

67. **Design Data for Single Span Brid ges in Prestressed Concrete**; A.W HILL, *The Surveyor*, November 13, 54 pp. 991-994.

68. **The Baur-Leonhardt Method and the Design of Prestressed Concrete Bridges**; G. STEINMANN, *Schweizerische Bauzeitung*, October 30, 54, pp. 639-644 (in German).

69. **Plane Frame for Testing Structures**; J. C. CHAPMAN and S. R. SPARKES, *The Engineer*, November 12, 54, pp. 654-655.

ITALIAN PROVERB

If the trumpet gives uncertain sound who shall prepare himself to the battle.

PUBLICATIONS ADDED TO THE ROADS WING LIBRARY DURING MARCH 1955

1. **Proceedings of the engineering conference, 1953 held at Melbourne from 16th-21st March, 1953, containing article "Some recent developments in structural analysis and design".** by A. J Francis (The Institution of Engineers, Australia).

   Manager of Publications, Delhi.

   Items 2 to 7

2. **Scheme for improvement of population data P. C. C. 125** by R. A. Gopalaswami. (Two copies)

3. **Census of India, Paper No. 5, 1954-Literacy and Educational Standards—1951 Census P. C. C. 30.** (Two copies)

4. **Report of the Taxation Enquiry Commission 1953-54. Vol. I, F.D. 104-I.** (Two copies)

5. -do- -do- Vol. II, F.D. 104-II. (Two copies)

6. -do- -do- Vol. III, F.D. 104-II. (Two copies)

7. **Census of India, 1951, Vol. I-India-Part II-C-Economic tables (Rural and urban population)** by R. A. Gopalswami. (Two copies)

8. **Report of the Second Reviewing Committee of the Council of Scientific and Industrial Research.** (Council of Scientific and Industrial Research, New Delhi).

9. **Earth Manual-a manual on the use of earth materials for foundation and construction purposes; a reclamation manual specialist supplement (Tentative edition).**

   Highway Research Board, Washington.

   Items 10 to 12

10. **Channnelization; The design of highway intersections at grade (Special report No. 5)**

11. **Parking Turnouts and rest areas. (Special report No. 7).** by George B. Gordon.

12. **Proceedings of the fourteenth highway engineering Conference, 2-4 March, 1953, Bulletin No. 61.** Compiled & edited by A. Diefendorf. (University of Utah, College of Engineering, Deptt. of Civil Engineering, Salt Lake City, Utah, 1953).

13. **Road design in relation to Traffic movement and road safety** by R. J. Smeed. (Reprint from the Journal of the Institution of Municipal Engineers, September, 1954).

DILEMMA

A Three-Hundred-Pound man stood gazing longingly at the nice things displayed in a haberdasher's window for a marked-down sale. A friend stopped to enquire if he was thinking of buying shirts or pyjamas.

"Gosh, no!" replied the fat man wistfully. "The only thing that fits me readymade is a handkerchief".

RECENT ADDITIONS TO THE LIBRARY OF THE INDIAN ROADS CONGRESS

1. **"Soil-Cement Roads" The Public Works & Municipal Services Congress, Tuesday, November 6th 1954, at 2-30 P.M.** by K. E. Clare & J. S. Tanner (Road Research Laboratory, Middlesex (England).

2. **"Adhesion in the Construction & Maintenance of Roads":**—by A. R. Lee & J. H. Nicholas (Road Research Laboratory, Middlesex (England).

3. **'Road-User Characteristics,' Highway Research Board Bulletin No. 60 (1952)**; (Highway Research Board, Washington 25, D. C.

4. **Elektrifizierung Von Vollbahnen Mit 50 HZ Eipphasenstrom Und Das Periodenum—Former system (1952)**; by Dr. Ing. F. Rat Kovszky (Sonderabdruck Aus Acta Technica Band IV, Seite 3-12.)

5. **27th Annual Report of the Deptt. of Main Roads for the Year ended 30th June, 1952** ; (Deptt. of Main Roads, New South Wales, Sydney (N.S.W).

6. **"Postwar Road Development"—Agenda & Memoranda for Chief Engineers' Conference held at Nagpur, 15th Dec. 1943, (Confidential for Office use only).**

7. **"Highway Spirals, Superelevation & Vertical Curves"** by H. Criswell (The Carriers Publishing Co., Ltd., 66, Victoria Street, London S. W. I.

8. **"Zoning for Truck-Loading Facilities," Highway Research Board Bulletin No. 59 (1952)**; (Highway Research Board, Washington, 25, D.C.).

9. **"Traffic Assignments"; Highway Research Board Bulletin No. 61 (1952)**; (Highway Research Board, Washington 25 D.C.)

10. **"Subgrade Soil Exhibit of the Bureau of Public Roads. U.S. Deptt. of Agriculture"**: (Sixth Congress of the Permanent International Association of Road Congresses, Washington 1930).

11. **"Highway-Materials Surveys" Highway Research Board**; Bulletin No. 62, (1952). (Highway Research Board, Washington 25, D. C.).

12. **"Indian Practical Civil Engineer's Handbook"** by P. N. Khanna (Engineers' Publishers & Advertisers Patiala.)

13 **"The Text book of office Management" (Third edition) 1950** by W. H. Leffingwell & E. M. Robinson (McGraw-Hill Book Co., Inc., New York, Toronto, London).

14. **"Modern Vibratory Screens" (Reprinted from the March 1953 issue of The Quarry Managers' Journal)**; by W. Kluge (Road Research Laboratory, Middlesex. (England).

15. **"Conference on Highway Planning & Soil Stabilization" (July 1940).** The University of Tennessee Record (The University of Tennessee. Knoxville, Tennessee.)

16. **Proceedings of the Residential Study Course on "Management Practice". (February 15th-28th 1953 Part I to IV)** by H. N. Nanjundiah (Govt. of India Publication)-(Indian Institute of Technology, Govt. of India, Kharagpur).

17. **The Use of Iowa Clays in Small-Scale Production of Ceramic Art** (Iowa Engg. Experiment Station Bulletin No. 133, 1937). by Paul E. Cox (Iowa State College of Agricultural & Mechanics, Arts Ames, Iowa, (U.S.A.)

18. **"Negative Projecting Conducts"** (Iowa State College Bulletin Engg. Report No. 14. (1952-53) by M. G. Spangler & W. J. Schlick, Iowa State College Ames Iowa (U. S. A.)

19. **"Distribution of Load Stresses in Highway Bridges"** (H. R. B. Research Report No. 14-B, Highway Research Board, Washington, U. S. A.)

20. **"Resealing Joints & Cracks in Concrete Pavement (Minnesota)"**, (H. R. B. Bulletin No. 63, 1952,, (Highway Research Board, Washington, 25).

21. **"Analytical Studies of Continuous Structures"** (Iowa State College Bulletin—Engg. Report No. 15 (1952-53) by J. P. Michales & others (Iowa State College, Ames, Iowa, U. S. A.)

22. **"Papers on the Wisconsin Loess of South Western Iowa 1951-52,"** by D. T. Davidson and Associates, Iowa State College Bulletin—Engg. Report No. 16 (1952-53), Iowa State College, Ames, Iowa, U. S. A.)

23. **"Highway Planning & Urban Development"**—H. R. B. Bulletin No. 64 (1952)-(Highway Research Board, Washington 25, D. C.)

24. **"The International Comparison of Accident Rates"**-by R. J. Smeed, Road Research Laboratory, Middlesex (England).

25. **"The Use of Bituminous Sealing Coats for Protecting Soil Formation"** by D. J. Maclean—Reprinted from Vol. 7 No. 1 of Road Tar, (Road Research Laboratory, Harmondsworth, Middlesex (England).

26. **"Runway Surfacing Use of Bitumen,"** Road Research Laboratory, Middlesex (England).

27. **"Mapping & Sub Surface Exploration for Engineering Purposes"**—H. R. B. Bulletin No. 65 (1952) Highway Research Board, Washigton.

28. **Proceedings of the conference on Highway Economics & Highway Transport (Oct. 10-11, 1921)** by N. W. Dougoerty (University of Tennessee, Knoxville, U. S. A.).

29. **"Conference on Highway Planning & Highway Design Record," July 1939, Vol-42, No. 4** (University of Tennessee, Knoxville, U. S. A.)

SOCIALISM

There are only two places where socialism works—one is a bee-hive-and the other is an anthill.

—Sir Ian Stewart-Richardson.

(*Continued from page 15*)

Dense graded mixes offer great advantages where levels are controlled by gutters and tram tracks, as it is practicable to lay very thin coats (approximately ½ in.) having long life. Prior to 1949 the more frequent and thicker resurfacing with open mixes led to considerable difficulties with raised levels, sometimes necessitating removal of layers of old material.

The use of open graded mixes is now confined mainly to correcting the shape of uneven pavements, strengthening pavements which are slightly low in strength, and providing an intermediate course over new broken stone bases. Normal practice is to apply a dense graded surface course, although this can be deferred for some months, allowing traffic to use the open mix course temporarily.

The following mixes are normally employed for the purposes shown:

Type of Work	Class of Mix	Nominal Gauge of Mix	Consolidated Thickness
		Inches	Inches
Strengthening Course ...	Open graded	1½	2 to 3
Corrective course ...	,, ,,	¾	1 to 2
Intermediate course on new stone base ...	,, ,,	¾	1 to 1½
Normal surfacing or resurfacing ...	Dense graded	⅜	¾ to 1
Light resurfacing ...	,, ,,	3/16	⅛ to ¾

(*From* "Main Roads" – *December, 1954*)

(*Continued from page 13*)

The hope was expressed that a greater degree of standarisation would be achieved at international level as regards traffic signal equipment and methods of working.

The behaviour and education of road users.

Six reports on this topic were submitted by representatives of the police and the automobile clubs of various countries.

Apart from questions of a psychological nature on the behaviour of various categories of road-user, these reports describe the efforts to increase road safety which have been made in different countries:

— influence brought to bear on children by means of films and games and by forming school patrols. Interesting information was given in this subject with regard to the responsibilities of parents and schoolmasters in the matter.

— influence brought to bear on adults by propaganda through films and by providing facilities for testing vehicles.

We should like to draw special attention to an original suggestion made during the discussion by one of those who attended the course namely, that the Church should be asked to collaborate in the propaganda compaign against road accidents by a judicious combination of the Ten Commandments and the principles of the Highway Code.

(*From Bulletins No. 137 and 138 of Permanent International Association of Road Congresses — 1954*)

BUDGETS AND ADMINISTRATION REPORTS

DELHI STATE BUDGET FOR 1955-56

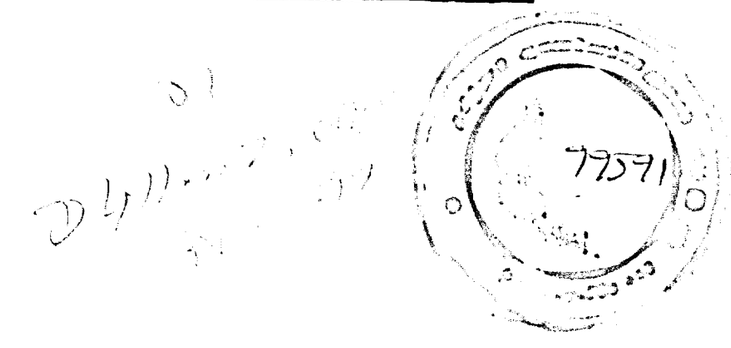
The following extracts have been taken from the Delhi State Budget for the year 1955-56.

CIVIL WORKS

	(In lakhs of rupees)		
	Actuals 1953-54	Revised Estimate 1954-55	Budget Estimate 1955-56
REVENUE			
Rents	0.01	—	—
Miscellaneous	0.71	—	—
Transfer from Central Road Fund	—	7.08	42.73
Total	0.72	7.08	42.73
EXPENDITURE			
Buildings			
Original Works	0.83	3.52	4.81
Repairs	9.10	7.72	7.50
Communications Original Works	2.56	7.47	2.89
Repairs	6.52	5.02	5.02
Rent control Establishments	—	0.03	—
Grants-in-aid, Contributions etc.	0.63	1.03	0.53
Total	19.64	24.79	20.75
Works to be financed from the Central Road Fund			
Communications: Original Works	—	—	36.71
Repairs	—	—	2.50
Establishment charges	—	—	3.33
Tools and Plant charges	—	—	0.19
Total	—	—	42.73
Total Expenditure on Civil Works	19.64	24.79	63.48
Capital Expenditure on Civil Works outside the Revenue Account.			
I. Buildings			
Original Works	—	19.37	128.44
Establishment charges	—	1.64	10.92
Tools and Plant charges	—	0.10	0.64
Total	—	21.11	140.00

(*Continued*)

S. No.	Job. No.	Name of work	Amount (Rs in Lakhs)
13.	1143 MB 3	Widening the existing 10 ft black top surface to 12 ft in certain miles between 41/0 to 94/0 of N. H. No. 3 on Indore South Section in Nimar Division.	1.83
14.	1157 MB 3	Regrading and black topping the widened portion from miles 2/F6 to 13/6 of Indore North Section of N. H. No. 3.	0.77
15.	1162 MB 3	Widening the existing 10 ft black top surface to 12 ft in miles 27/0 to 41/0 of N. H. No. 3 in Indore South Section.	1.09
		PUNJAB	
16.	1132 PB 2	Special repairs to Inspection Bungalow at Hodal in Gurgaon District.	0.04
17.	1140 PB 22	Improvements to P. W. D. Inspection Bungalow at Barog on Kalka-Simla Road, N. H. No. 22.	0.06
18.	1141 PB 22	Furnishing the P. W. D. Inspection Bungalow at Barog on Kalka-Simla Road, N. H. No. 22.	0.02
19.	1156 PB 22	Filling depressions and correcting super elevation from mile 39 to 46 of Kalka-Simla Road, N. H. No. 22.	0.21
20.	1166 PB 1	Construction of culverts on bye-pass on Grand Trunk Road (N. H. No. 1) at Jullundur.	1.43
		RAJASTHAN	
21.	1137 RJ 8	Improvements to mile 32/0 to 40/4 of Nathdwara-Kankroli road, N. H. No. 8.	0.94
22.	1152 RJ 8	Providing 3 ft wide shoulders on Jaipur-Ajmer Section of N. H. No. 8.	2.40
		JAMMU & KASHMIR	
23.	1139 JK	Providing R. C. C. culverts over small dips along the Pathankot-Jammu Road.	0.36
		DELHI	
24.	1142 DLH 1	Raising Upper Bela Road to the Standard of National Highway (Part II) – Retaining walls.	7.28
25.	1164 DLH 1	Widening, raising and black topping of the Upper Bela road.	5.83



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