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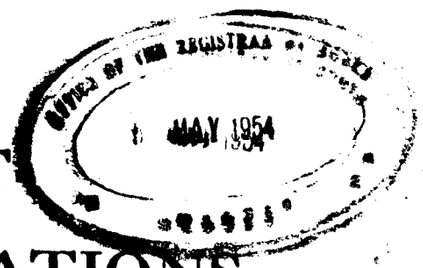

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TRANSPORT-COMMUNICATIONS

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TRANSPORT-COMMUNICATIONS
MONTHLY REVIEW

A REVIEW OF
ROAD ENGINEERING, DEVELOPMENT & TRANSPORT

APRIL 1954

DEVELOPMENT OF ROADS IN RAJASTHAN

Rs 4-Crore Scheme of State Government

(Extracted from 'The Times of India'-2nd September 1953)

RAJASTHAN'S Rs 4-crore Road Development Plan provides for asphalt surfacing of 222 miles, construction of 1,728 miles of metalled roads, 286 miles of gravelled roads, and 56 miles of fair-weather roads.

The plan, when completed, will make a great difference to the poor system of communications which holds together this sprawling State with an area of 1.30 lakhs. square miles.

The development of roads has always been considered a prime necessity for better administration of law and order and industrial development. The integrated State inherited from its component units a road length which worked out to 6.5 miles for each 100 square miles of area. One half of this meagre road milage comprised fair-weather roads which, in reality, were no better than cart-tracks. The ratio of road-milage to total area in Rajasthan was among the lowest to be found in this country. Even the five divisional towns, Jaipur, Jodhpur, Kotah and Udaipur were not interlinked with roads. Pucca roads, however existed connecting Jaipur with Kotah and Jodhpur.

Serious administrative difficulties resulted when, faced with a virtual challenge from the concerted gangs of dacoits all over the State, the Rajasthan Government's police forces tried to move into areas under control of dacoit gangs. The absence of roads held up movements of the police forces on crucial occasions.

The State's mercantile community and industrialists have repeatedly pointed out that without proper means of communication and development of roads, industrial development is bound to suffer. The sources of mica, emerald and soap-stone in Bhilwara and Deogarh areas, lime-stone quarries at Chittor and Partapgarh, the sand-stone quarries in Bharatpur, Karauli, Bareta and Begana and the gypsum mines in Bikaner will remain largely unexplorited if these are not connected by a satisfactory road system.

The rigours of recurring famines in Rajasthan will be less if the grain-producing areas of Ganganagar, Hindaun, Gangapur, Lalsote, Baran, Bhilwara and Bundi are connected by good roads with the consuming centres of the State.

The deficiency of roadways in Rajasthan has not been supplemented by railways of which the State has only 3,157 miles which works out to 2.5 miles per 100 square miles.

Under the Rs 4-crore plan, the State Government proposes to complete the following roads during next three years:

The Jaipur to Ratangarh road via Chomu, Reengus, Sikar, Fatehpur, will provide the missing link between Jaipur and Bikaner along the Delhi road, while the Sikar to Didwana road via Losal will provide shorter route from Bikaner to Jaipur.

The Shahpura to Singhana road via Neem-ka-Thana will open up the Sheikha-

wati countryside, long regarded as one of the worst infested refuge of desperadoes. The proposed road from Dudu to Lalsote via Phagi and Chatsu will facilitate freer flow of grains from the grain-producing area of Lalsote.

Another road from Swai Madhopur to Tonk via Aligarh and Uniara is expected to remove the transport bottleneck which now retards the grain movement from the fertile district of Sawai Madhopur to the deficit areas of Rajasthan. The Jaipur-Agra road will be given bitumen treatment to enable it to bear the increased traffic. The Lakheri-Tonk road via Indergarh and Uniara will place the industrial township of the Lakheri Cement Factory within easy reach of the outside world. The Jodhpur-Nagaur road will provide the the missing link between Jodhpur and Bikaner.

The Beawar to Sirohi road via Pali will be upgraded with bitumen treatment in view of the increased traffic the road is carrying now. Ganganagar district, the granary of Rajasthan, will be connected with the divisional headquarters with a new road.

The Kotah-Udaipur road which will pass through the hilly terrain and the country inundated by the life giving Chambal water via historic township of Bhainsrorgarh, Singolo, Parsoli, Chittor and Mangarwar, is perhaps one of the most important road-links undertaken by the State Government.

The two proposed roads, from Deogarh to Mandalgarh via Mandal and Bhilwara and the Deogarh-Kanlrolli road via Mandal and Bhilwara, which will criss-cross the rich mining area of South Rajasthan, are expected to mitigate the difficulties the mining interests suffer from.

The Dungarpur-Partapgarh road via Banswara, and the Udaipur-Partapgarh road via Salumber and Dariawad will connect the extremely backward and undulated part of the South Rajasthan with the rest of the State. Though Dungarpur is now the district headquarters, its nearest railway station is Udaipur, which is 66 miles away. Banswara cannot be reached unless one goes through Bombay territory, or undertakes a difficult and long journey by bus on a road which during the rainy season often cannot be negotiated. The Gulabpur-Nimbahera road via Bhilwara and Chittor will serve another section of the mining area in South Rajasthan.

DEFINITIONS OF HIGHWAY ENGINEERING TERMS

DATUM : A defined plane of elevation with the level of which the level of other points may be compared or related.

G. T. S. BENCH MARK : A bench mark fixed by the "great Trigonometrical Survey of India," with reference to the mean sea level at Karachi.

A BANKER

A banker is a man who will lend you money if yon can prove to him that you don't need it.

SOME EDITORIAL OPINIONS ON SHRI BATRA'S PRESIDENTIAL ADDRESS

"**AMRIT Bazar Patrika**" writes "Shri R. K. Batra, Chief Engineer of Madhya Pradesh, who presided over the Congress, put forward several practical suggestions which deserve serious consideration. One of his suggestions is that the Central Government as well as the State Governments should have separate non-lapsing funds for the development of roads. The idea of establishing a separate road fund bas been accepted in principle by the Planning Commission. It is obvious that without a certain continuity in the supply of funds it is not possible to avoid wasteful expenditure and to pursue any large-scale programme without interruption. It may be expected, therefore, that the preparation of a comprehensive national road-building programme covering a period of years should be followed immediately by the provision of clear guarantees for a continuous flow of adequate funds. So far as the State Governments are concerned they may divert the revenue derived from motor vehicle taxes and road cesses to the proposed non-lapsing road fund. Road building should find a place in the defence budget also, because some of the trunk roads, specially those which run along the frontiers or connect the frontiers with important cities or Railway centres, must be maintained properly in order to make military transport easy and comfortable at any critical moment.

Shri Batra laid stress on rural road development and suggested the construction of low-type, cheap village roads giving the villagers easy access to main roads leading to towns and big markets. Such roads, if constructed on a carefully considered comprehensive plan, may serve several useful purposes. They may provide a much-needed link between urban economy and rural economy. They may also make available for the villagers some of the amenities of life which are now confined only to the town-dwellers. Indirectly they may also serve as a check on the growing tendency towards migration to urban centres where such amenities as well as opportunities of earning are available. We frequently repeat the old saying that real India lives in the villages. That 19th century idea has lost much of its force as a result of the rapid industrialisation of the country and the consequent growth and expansion of urban centres. Even now, however, the villages have not lost their importance in the social and economic life of the country. They can be reconstructed and given a new lease of life consistent with current socio-economic tendencies if we put a premium on their needs and demands in our road-building programmes."

"**Free Press Journal**" of Bombay: "The Indian Roads Congress has just concluded its 18th annual session. The Congress discussed various aspects of road construction in the country and, significantly enough, adopted resolutions favouring the all-out extension of the highway network connecting India's villages.

Village roads are vital to the development of village economy. Even low-type village roads, at extremely small costs, with labour provided mainly by the villagers, can be of great help.

The rural folk are thus able to gain access to the main highways and amenities of life they require can be acquired more easily. These village roads can also help the dispersal of industries in the country-side, so useful for the improvement of the standard of living of the rural folk.

The Central Government has offered token grants for the construction of these village roads, on a co-operative basis by the villagers themselves, providing free labour and gifts of land. The State Government should add to the Central grants and approach the villagers in an attitude that the rural people will appreciate and respond to.

The development and expansion of village roads is one of the most effective means of creating a new life in rural India."

The Hitavada of Nagpur *in its Editorial dated 9-2-54, wrote:*

"Village Roads"

Shri R. K. Batra's address to the eighteenth annual session of the Indian Roads Congress at Bhubaneshwar was happily devoted to a plea for stepping up rural road development in the country. He suggested that at first at least those villages which lay within a few miles of existing roads should be linked up. Such links would bring amenities of life within reach of the villagers and would facilitate the exploitation of the unexplored resources lying in the interior. We are glad to note that Shri Batra, our Chief Engineer, has appealed for a concentration on rural areas. National and State highways are no doubt of vital importance in the development of the country as a whole, but eventually all progress will depend on the network of district and village roads that we provide. In the Nagpur Plan of road development which was drafted about a decade ago, one of the main objectives was the provision of rural roads in such a way that no village in a well-developed agricultural areas would remain more than 5 miles from a main road. This is as things should be. Yet ten years after the Plan was drawn up we can hardly say that our rural road milage is adequate, much less that it fulfils the objective of the Nagpur Plan. The Planning Commission in its First Five-Year Plan has tried to attain the targets laid down in the Nagpur Plan. Modifications have however been made to meet such factors as paucity of funds, scarcity of trained men and shortage of materials. On the subject of village roads the Planning Commission has suggested that "the broad aim should be to connect the more important villages with marketing centres and district headquarters." After observing that the absence of a sufficient milage of village roads is a serious drawback in the system of communications, the Commission recommends that "the State Governments should pay special attention to the construction and maintenance of these roads and for this purpose enlist the cooperation of villagers."

USE OF SOAP

One fourth of the world's population still knows nothing about the use of soap.

Quite true - Most of the others know only the theory of its use, but fail in its successful application.

HIGHWAY DEVELOPMENT IN SWEDEN

(Extracted from "Modern Transport"—January 30, 1954). 19

AT the beginning of 1953 the population of Sweden was nearly 7,000,000, and as its area is not quite 175,000 square miles and its length about 1,000 miles, the density of population is small and varies considerably, due to the diversity of industrial development. Forest areas, particularly in the north, are only sparsely inhabited and the mountainous districts to the far north are practically unpeopled. Climatic conditions also vary considerably, there being normally snow for only one month in the year in the south, while in the centre and north it may lie for six months.

Road Taxation

It was only in 1840, following the appearance of the stagecoach, that the Government began to take interest in the building of highways. Until the end of the 19th century the maintenance of the roads in country districts was the responsibility of farmers and landowners, In the 1890s a road tax widened the scope of this responsibility, 10 per cent of the maintenance costs being repaid from public funds. A sounder basis for the upkeep of roads was established through the introduction of taxes on petrol and motor vehicles in 1923.

A reorganisation took place in 1937, when the 374 highway districts were merged into 170 districts for more efficient working. From 1944 onwards, the maintenance of public rural roads has been a State responsibility and is administered by a Board of Roads and Waterways with 24 sub-districts, one in each county. The public roads in Sweden are divided into three categories main roads, country roads, and roads in desolate regions.

To the first belong roads that are vital for long-distance through traffic (national highways), or are otherwise of importance for communication between the principal localities in other counties (county main roads). Country roads are those which constitute a rural district's inner lines of communication. Finally there are "roads in desolate regions," those which run for the greater part of their length over mountains or through forest or sparsely populated regions.

Desolate Region Roads

These, although not regarded as of prime importance for general communications, are nevertheless maintained in good condition for the purpose of promoting the gradual cultivation and settlement of the more remote regions. For instance, the forestry industry in Varmland in 1940 floated 80 per cent of its timber to the mills. By 1950 this figure had decreased to 20 per cent, due to the increasing use of road haulage. On January, 1, 1951, the combined length of roads was about 56,200 miles, of which 2,700 are national main roads, 12,300 county main roads, and 41,200 miles rural roads and roads in desolate regions.

Of the public roads, only about 3,350 miles are surfaced. Over about 425 miles stone is used; there are 200 miles of concrete roads and over 2,100 miles of high-class bitumen surface, the remainder being classified as "other bitumen." The severe winter conditions prevailing over Central and Northern Sweden cause considerable damage to roads, and result in a heavy permanent main charge on the Budget.

Preventive measures such as erection of snow screens and the marking of verges also involve considerable expenditure. Road maintenance in the year 1949–50 amounted to about £ 10,000,000 (Rs 13.5 crores). The nationalisation of public road maintenance has resulted in some savings since centralised vehicle and material stocks are now possible.

Road Traffic

In 1923 a total of 50,460 road vehicles was registered, representing a figure of

one vehicle to each 119 of the population. By 1939 this number had increased to 248,854 or one to each 26 persons. The war years saw a sharp decline in the number of vehicles on the roads, but by 1948 the 1939 figures had been slightly exceeded, and today nearly 500,000 vehicles of all classes are registered.

Year	Private cars	Buses	Lorries	Total	Number of Persons per vehicle
1923	37,823	731	11,906	50,460	119
1939	180,717	5,109	63,028	248,854	26
1945	50,108	3,977	41,882	95,967	70
1950	252,503	7,546	84,904	344,953	20
1951	313,068	7,818	89,486	410,372	17
1952	360,552	8,138	97,089	465,779	15

Taxation is levied on vehicles by weight, private cars paying a basic £ 7 ls. 6 d. (Rs 95) plus £ 2 6s. 8d. (Rs 32) for each 100 kg. (220 lbs) up to 900, (2000 lbs) commercial vehicles a basic £7 ls. 6d. (Rs 95) plus £3 ls. 8d. (Rs 42), for each 100 kg., (220 lbs) and buses a basic £ 7 ls. 6d. (Rs 95) plus £2 15s. (Rs 37) for each 100 kg. (220 lbs). A gallon of motor spirit costs at present 3s. 4d., (Rs 2) of which 5d. (Rs 0-4-6) goes to the Road Fund. The sums raised from the taxation of motor vehicles in Sweden are intended for the upkeep and improvement of roads. Road building has, however, proceeded on a comparatively small scale during and since the war. During the war it was necessary for reasons of national economy to restrict constructional work of kinds. Since 1945 the shortage of labour consequent upon the infiltration of workers to better-paid labour in factories or at forestry has been a major factor in restricting expenditure. Since 1951, however, the labour position has changed owing to the export market for timber and paper having somewhat declined so that more men can be employed on road construction.

Money Unspent

Accordingly, in the years 1946-51, Kr. 625 million (about Rs 57.5 crores) remained unspent and were placed to reserve, although in those years expenditure totalled Kr. 1,153 million or (Rs 106 crores). In 1952, however, work was begun again on several major projects, and expenditure on the building and maintenance of roads is now nearly 100 per cent of the sums raised.

The picture thus presented is not so rosy as would appear. The officials responsible for the planning and maintenance of roads have, since 1945, been able to do little more than endeavour to widen existing roads, and effect other obviously necessary improvements.

Over the years the trend of commercial vehicle sizes has begun to emerge so that today 33 per cent of such vehicles are in the one-ton class, 20 per cent in the 3-4 ton class, and 23 per cent in the 4-5 ton class. This has had a considerable influence on future planning. Apart from the newly built major road between Malmo and Luno in the south, and projects such as the by-pass at Botkyrka near the Stockholm, there are no roads capable of handling the heavy traffic of the future.

It is clearly recognised by the officials of the Road and Waterways Department that the progress of motor traffic in Sweden will create a serious situation, and steps are being taken to deal with it. A central organisation is now being planned, headed by Director Tanneryd, the present chief of the department, to co-ordinate road planning on a scale suitable for a country the size of Sweden, which with its growing industrial potential and its important farming and timber industries, requires a system of modern roads for fast traffic. Future speeds of 63 m. p. h. on first-class roads, and 50 m. p. h. on the second-class routes, are to be taken as the norm.

RECENT TRENDS IN DEVELOPMENT OF ROAD TRANSPORT IN INDIA *(Continued)**

(Contributed)

Trends in the Development of Road Transport

Pepsu

At present all passenger and goods services are operated by private operators. The State Government has no proposal for nationalising road services in the near future. Licences for goods carriers have been recently liberalised. The topographical condition of the State does not encourage zonal division in respect of freight services.

Rajasthan

There has been considerable progress in road transport in Rajasthan since 1950 as shown by the following figures:

Before the formation of Rajasthan Union	1950	1951	1952	As on 30-6-53
Stage Carriers	847	1281	1498	1986	2103
Public Carriers	935	2251	2339	2385	2485

The passenger road transport is at present run by private operators. In view of this and until an increased financial provision is forthcoming for road transport, road transport operation will continue to be in the hands of private operators.

The Rajasthan Government would appear to favour co-operative societies and associations to individual operators while granting licences which are issued for a period of three years in order to give the operators a sense of security and stability. Due to paucity of funds, there is no proposal for operation of freight transport as a nationalised service.

Lack of roads and bridges in Rajasthan is a great handicap to the development of road transport. During the rainy season almost all kuccha roads become impassable because there are no bridges. Even on the main roads, transport facilities for transporting essential commodities come to a standstill and considerable degree of inconvenience and difficulty in transporting supplies is experienced.

Saurashtra

The Saurashtra Government appears to be in favour of going slow with the nationalisation of road transport and of encouraging co-operative societies in this field. Licences are given generally for three years. The Government do not at present envisage freight operations for State Transport. Licences for public carriers for freight transportation are granted as and when applied for.

Travancore-Cochin

The road transport services have been nationalised and they extend to over 600 road miles. Monopoly services are being operated so far to suit the requirements of traffic between several centres. Nationalisation has not been effected on any route, though the State Transport Department is now handling a very small fraction of the goods traffic as the bulk of it is being satisfactorily handled by private agencies. The State Transport Department has under contemplation a scheme for the immediate improvement of the

* The first portion of this article appeared in the March 54 issue of this publication, pp. 22-25.

existing goods services throughout the State.

Most motorable roads in the State are adequately served by both passengers and goods services and are covered by more than one private operator. The present position is that the central and regional Traffic Boards in Travancore-Cochin are refusing to issue any further permits except when warranted by increased traffic so as to prevent unhealthy competition and uneconomic operation. In the case of permits, normally the period for which they are issued is three years. The State Government is of the view that a change in the present policy of licensing does not appear to be called for, with regard to motor transport in Travancore-Cochin.

Part 'C' States

Ajmer

Depending on the funds made available, the policy is to nationalise passenger transport in Ajmer. The entire programme of nationalisation of motor transport (including the public carriers) is expected to be taken on hand during 1954-56. On non-nationalised sectors, permits will be issued to private operators for a period ranging from a minimum of three years to a maximum of five.

When the scheme is implemented in the second stage, freight transport will be taken up by the Road Transport Corporation which will have both the State Government and the Railway administration on its management.

Bhopal

The Bhopal Government do not propose nationalisation of road transport but it is examining the possibility of organizing road transport, passenger as well as goods, on co-operative basis with Government assisting in providing superior management and workshop facilities.

Bilaspur

Transport Services in the State are nationalised. Due to paucity of funds, there is no proposal to expand the nationalised services to cope with increasing requirements. On certain routes, private vehicles are also allowed to operate. The licences are valid only for a year. The State aims at adding about 8 vehicles every year to its moving stock in the nationalised services. Licensing of public carriers in the field of freight transport will continue to be as liberal as is required by circumstances.

Coorg

Though certain road development schemes have been envisaged, no extension of road transport services which are owned and operated by private operators is contemplated during the period of the Plan. Owing to heavy finances involved, their nationalisation has not so far been considered by the State Government.

Himachal Pradesh

Along with passenger traffic, freight traffic has been nationalised.

Kutch

Road transport in Kutch is operated by the Kutch State Motor Service which is a semi-government concern. A proposal to transform this organisation into a full-fledged Road Transport Corporation is under consideration. It is not intended at present to nationalise freight transport, licences for which are liberally granted to the private operators. The State Government is persuading private road lorry owners to form co-operatives.

Manipur

The Manipur State Transport Department is running at present passenger services on the line from Imphal to Dimapur, Pukhao and Churackckapur. It has a monopoly only on the line Imphal to Pukhao (14 miles).

Tripura

Surrounded on three sides by Eastern Pakistan and on the fourth side by hills, Tripura is connected by a strip of plain land with Assam. The Road plan of the State has to be implemented. Thereafter, reorganisation of the present system of motor vehicles in Tripura is expected to be taken up.

Vindhya Pradesh

Nationalisation of passenger services is not contemplated during the period of the Plan. Licensing policy of the State has been very liberal, the main considerations for the grant of permits being (i) road worthiness of the vehicle and (ii) economics of the road. Permits are granted generally for a period of three years and renewed at the end of the third year.

A liberal policy in the grant of permits for public carriers is being followed. The problem in the State is not that of supplementing the railway service with road services but of expansion of road transport or introduction of railway system in the State.

Having briefly reviewed the trends in Road Transport development in various States, let us now proceed to make an analysis of the various factors described in the foregoing paragraphs. An attempt is made here to bring out the more prominent points or questions arising out of such an analysis which, it is hoped, would help to formulate possible lines for future action. It is distinctly clear that the need for increasing and rapid development and utilisation of Road Transport is great and urgent. Broadly speaking, the problem has to be viewed with due regard to the following principal aspects :

(a) Nationalisation and Licensing Policy.

(b) Taxation.

(c) Roads—their Condition and Development.

Nationalisation

Except in the case of Coorg and Himachal Pradesh, which have gone in for complete nationalisation of transport services, freight transport services continue generally to be in the hands of private operators. In Orissa, a State-sponsored Joint Stock Company, operating freight transport services between Berhampur and Russelkonda along with private services, is being run on an experimental basis. Nationalisation of freight transport services in the immediate future is not contemplated in any other State.

Statutory Road Transport Corporations are now operating in the States of Bombay, Delhi and Bilaspur. In the following States, there are the Road Transport Services, owned wholly or partially by the State Government and providing mainly passenger transport services. The following statement gives the over-all picture on the basis of the mode of operation :

Departmental Operations	Statutory Authority	Joint Stock Company	Non-Statutory Authority
Assam	Delhi	Madhya Pradesh & Orissa.	ch
Bihar	Bombay		
Madras (composite)	Bilaspur		
Punjab			
Uttar Pradesh			
West Bengal			
Hyderabad			
Madhya Bharat			
Mysore			
Rajasthan			
Saurashtra			
Travancore-Cochin			
Jammu & Kashmir			
Himachal Pradesh			
Manipur			

Goods Traffic

Most of the State Governments have already been adopting a liberal policy in regard to the grant of permits for goods traffic, the exception being Coorg and Himachal Pradesh. In the case of passenger services, some of the States, pursuing a policy of progressive nationalisation, are issuing permits for a short period at a time.

Taxation

It would appear that the backwardness or inadequacy of the existing transport facilities in India is due in some measure to the heavy burden of taxes on motor vehicle and the absence of a common taxation policy. The burden of taxation on the motor vehicle user in India has been stated to be **the highest in the world**. Both Central and State taxes contribute substantially to the heavy burden of taxation on roads. The Central taxes consists of customs and excise duties on motor vehicles, tyres and parts and accessories and also motor spirit. The following table will show that the Centre's share is quite heavy :

Tax per ton mile (pies)

State	Centre's share	Share of the State & Local Authority	Total
Madras	14.3	11.8	26.1
Bombay	14.3	7.3	21.6
West Bengal	14.3	6.5	20.8

The Motor Vehicles Enquiry Committee whose recommendations are now under the consideration of the Government of India came to this conclusion on the present high rates of taxation. One of the recommendations of this Committee in regard to Central taxes on motor spirit was that the Centre should levy a " transport cess " of 1½ annas a gallon on this commodity, in addition to the customs and excise duties levied on it. The realisation from such a cess should be utilised to pay the cost of distributing motor spirit by rail so that its selling price would, more or less, be the same throughout India. The recommendation has been endorsed by the Technical Committee of the Transport Advisory Council, though some of the maritime States do not appear inclined to agree to this recommendation.

Presumably no State appears to be inclined to commit itself on the question of reduction of tax burden on motor-vehicles. This is because taxation on motor vehicles has assumed an increasing importance in the States in recent years. In fact, the States appear to be banking to an appreciable extent on this source of revenue for meeting their commitments under the Five-Year Plan. Appendices I and II bring out the growing importance of this source of revenue in the tax-structure of the States. Receipts under the Motor Vehicles Act and Sales tax on motor spirit have been grouped together in the statements so as to give the total contribution to the State Exchequer by the Motor Vehicles operators. This, however, excludes sales tax on motor vehicles and parts. The table below summarises the general trend in Part ' A ' and ' B ' States in recent years.

Part ' A ' and ' B ' States

Year	Total States taxes excluding share in Central taxes	Yield from Receipts under M.V. Act and tax on sale of spirit	Percentage of column (3) to column (2)
	Rs Lakhs	Rs Lakhs	
1950–51 (Actual)	221,94	12,64	5.7%
1951–52 (,,)	227,40	14,32	6.3%
1952–53 (Revised)	229,78	16,78	7.3%
1953–54 (B. E.)	242,79	19,00	7.8%

In view of these considerations, it can perhaps be reasonably concluded that in any scheme for the development of road transport services, it will be safe not to depend too much on the possibility of reduction in the tax burden.

It will thus be seen that the licensing policies or programmes of nationalisation in the States do not form any serious impediments to the expansion of road services for goods. Taxation, both

from the point of view of its burden and the manner in which it is realised, is an important factor hindering the growth of road services, but the financial position of the States being what it is today, not much relief in taxation can perhaps be expected in the near future. The procedure of collecting various taxes might perhaps be simplified so as to minimise the harassment caused. This will, no doubt, have wholesome effect on the road transport services but it will be too much to expect any spectacular results ensuing from this reform alone.

Other Points

(1) Already a few States have state-owned road transport vehicles which run along with private transport. In Calcutta, for instance, a fleet of 275 buses employing nearly 3,000 people is in operation. In Bombay, the Bombay State Transport Corporation is operating both passenger and goods traffic along with private transport. In the city of Madras, passenger traffic has been nationalised. State-owned transport vehicles are operating in a few other States also.

(2) Experience of those States which have undertaken road transport services indicates that in addition to easing the transport situation, such services usually absorb comparatively larger number of people in employment than services sponsored by the private agencies. For example, in Madhya Pradesh 7.2 persons are employed on a bus owned by the State as against 4 in a privately-owned bus.

(3) The Code of Principles regarding motor transport initiated by the Central Government lays down that a compact area for road transport should consist of a circle with a radius not exceeding 75 miles. This provision appears to have created certain difficulties where railway facilities are meagre.

(4) In Rajasthan, there is a general lack not only of railway facilities but also of roads making the transport situation extremely difficult.

(5) It may not be out of place here to make a reference to the water or river transport system in our country. Most of the difficulties seem to obtain in the Indo-Gangetic plains and in Assam State. It is unlikely that the development of river transport will supplement the load carrying capacity of Railways in the near future. If the Ganga-Barrage Project is implemented and through routes opened between Calcutta and Assam on the one hand and between Calcutta and Uttar Pradesh on the other, there will be introduced river transport on a large-scale.

Conclusion

(1) When the priorities of the Five-Year Plan were first suggested, there was a strong feeling in some quarters that transport was being given undue precedence. It has become more difficult now to hold that view. Opinion both public and informed, has decisively swung over to the position that transport inadequacies or bottlenecks may jeopardise the progress of the agricultural, industrial and other sectors of development.

(2) Clearly the essential thing is to get the most out of existing transport facilities and resources. Can the railways do a better job through more competent planning of traffic and improvements in operating efficiency? Are the incidence of motor vehicle taxation and the nationalisation and licensing policies of State Governments creating an artificial shortage of road transport?

(3) What place should the inland waterways or river transport occupy in the development of the nation's transport facilities? Is it not possible for reviving this form of transport which requires so little capital investment or imported machinery and yet is capable of yielding

so much in the shape of cheap carriage, especially of agricultural products over areas not blessed with roads or railways?

(4) These are questions which need careful and urgent attention. It is sometimes argued that as Roads have been proved to yield returns many folds, the initial capital invested on them through increase in the socio-economic wealth of the areas they open up increasing expenditure on development of more of them should not be grudged. Here as obtains in other fields of development which are equally demonstrably desirable and paying in the broader sense, targets and priorities have to be determined on the basis of available resources.

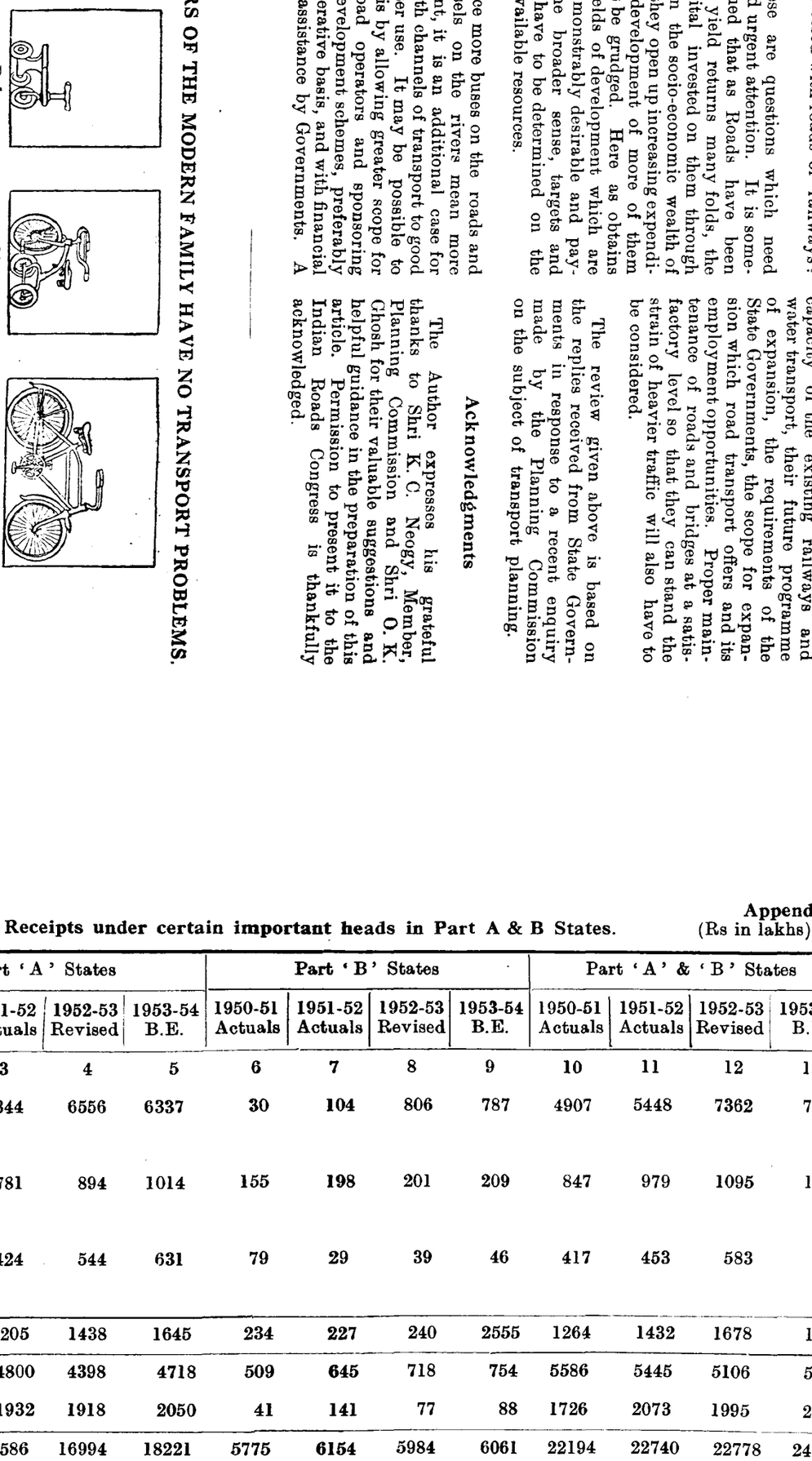
(5) Since more buses on the roads and more vessels on the rivers mean more employment, it is an additional case for putting both channels of transport to good and greater use. It may be possible to achieve this by allowing greater scope for private road operators and sponsoring regional development schemes, preferably on a co-operative basis, and with financial and other assistance by Governments. A comprehensive road transport policy must necessarily take into consideration the capacity of the existing railways and water transport, their future programme of expansion, the requirements of the State Governments, the scope for expansion which road transport offers and its employment opportunities. Proper maintenance of roads and bridges at a satisfactory level so that they can stand the strain of heavier traffic will also have to be considered.

The review given above is based on the replies received from State Governments in response to a recent enquiry made by the Planning Commission on the subject of transport planning.

Acknowledgments

The Author expresses his grateful thanks to Shri K. C. Neogy, Member, Planning Commission and Shri O. K. Ghosh for their valuable suggestions and helpful guidance in the preparation of this article. Permission to present it to the Indian Roads Congress is thankfully acknowledged.

MEMBERS OF THE MODERN FAMILY HAVE NO TRANSPORT PROBLEMS.



Courtesy Traffic Engineering—January, 1954.

Appendix I

The Revenue & Receipts under certain important heads in Part A & B States. (Rs in lakhs)

Heads	Part 'A' States				Part 'B' States				Part 'A' & 'B' States			
	1950-51 Actuals	1951-52 Actuals	1952-53 Revised	1953-54 B.E.	1950-51 Actuals	1951-52 Actuals	1952-53 Revised	1953-54 B.E.	1950-51 Actuals	1951-52 Actuals	1952-53 Revised	1953-54 B.E.
1	2	3	4	5	6	7	8	9	10	11	12	13
I. Share of General Taxes.	4877	5344	6556	6337	30	104	806	787	4907	5448	7362	7124
II. State Taxes (a) Receipts under the Motor Vehicles Act	692	781	894	1014	155	198	201	209	847	979	1095	1223
(b) Tax on the sale of Motor spirit.	338	424	544	631	79	29	39	46	417	453	583	677
Total of (a) & (b) ...	1030	1205	1438	1645	234	227	240	2555	1264	1432	1678	1900
General Sales Tax ...	5077	4800	4398	4718	509	645	718	754	5586	5445	5106	5472
Other taxes & duties	1685	1932	1918	2050	41	141	77	88	1726	2073	1995	2138
Total State. Taxes (incl. L.R. etc.)	16419	16586	16994	18221	5775	6154	5984	6061	22194	22740	22778	24279
State taxes plus share in Central taxes.	21296	21930	23550	24558	5806	5258	6790	6845	27101	28188	30340	21403
Other Sources: (Total of Forests, irrigation & Electric schemes).	2411	2637	2516	2950	558	630	668	752	2969	3267	3184	3702

Appendix II

ADDITIONAL TAXATION MEASURES

Estimates of additional revenues to be raised by the States during the Plan period 1951–56 (Rs in lakhs)

Name of the State.	As agreed by the States originally.	After taking into account recent changes in the size of the State Plan.	According to the measures taken so far.	Remarks.
Assam ...	3,50 (a)	3,50 (a)	1,17 (12)	Rate of motor taxation enhanced in 1952.
Bombay ...	23,50	23,50	12,40 (4,90)	Increase in rate of tax on motor vehicles & of sales Tax on petrol.
Bihar ...	5,60 (b)	7,30 (b)	1,52	
Madhya Pradesh ...	10,60	10,60	2,31	
Madras ...	25,00 (c)	39,30 (c)	8,22 (2,59* 2,25)	Increase in tax on M. V. (from 1952-53) Sales Tax on petrol increased from 2 to 4 As. per gallon from 1952-53.
Orissa ...	6,50	9,40	...	
Punjab ...	5,00	5,00	**2,06 (1,43)	The Punjab passenger goods tax from 1952-53.
Uttar Pradesh ...	43,50 (d)	50,20 (d)	15,65 (96,12)	Increase in taxes on M. V. from 1953-54. Increase in sales tax on petrol from 1952-53.
W. Bengal ...	36,50	36,90	4,76 (275)	M. V. T. enhanced from 1951-52.
Total for Part 'A' States.	159,70	185,70	48,09 (15,12)	
Hyderabad ...	6,00	7,40	66 (6+13)	Various taxes & fees on M. V. retained in IG (53-54) Sales tax on motor spirit increased from 2 to 3 As.
Rajasthan ...	2,30	4,10	3,05 (26+15)	Rate of motor tax raised 1951-52, sales tax on petrol in 1953-54.
Mysore ...	9,20 (e)	9,20 (e)	3,14 (129+75)	Tax rates on M. V. enhanced in 1951-52 & proposed to be further enhanced in 1953-54 Sales tax on motor spirit proposed to be enhanced from 4 As. to 6 As. per gallon in 1953-54.
Saurashtra ...	5,00	4,70	1,37 (17)	Sales tax on petrol increased from 2 to 4 As. per gallon in 1951-52.
Pepsu ...	3,20 (f)	3,30 (f)	52	
Travancore-Cochin...	9,70 (g)	11,00 (g)	3,98	
Madhya Bharat ...	5,00	4,90	2,81 (15)	Imposition of Sales Tax on motor spirit from 1953-54.
Total for Part 'B' States.	40,40	44,60	15,40 (2,96)	
Grand total for all Part A & B States except Jammu & Kashmir.	210,10	230,30	63,49 (18,08)	

(a) Including Rs. 50 lakhs to be made available for the Plan from economies in non-developmental expenditure.
(b) ,, Rs 200 ,,
(c) ,, Rs 500 ,,
(d) ,, Rs 300 ,,
(e) ,, Rs 40 ,,
(f) ,, Rs 50 ,,
(g) ,, Rs 100 ,,

* Figures within bracket contain estimates of additional revenues to be raised on the basis of the increases already made in the rates of taxation on motor vehicles.

** 227 (21 being the anticipated loss on a/c of reduction on water rates.)

GENERAL MANAGER AND PROFESSIONAL LEADER

THE job of the county board and the legislature is the exercise of political judgment. A board cannot collect facts, it cannot assemble specialized data, it cannot engage in research; but it is the genius of the democratic faith that the judgement of the layman is good. All he needs is the facts collected for him, the issues defined, and he will make the proper judgement with respect to them. The layman is not supposed to know how to make a shoe, but he can tell when it pinches. And though it must be left to him to select a new pair, he needs the advice of the expert to guide his choice.

On this assumption our whole system of government is organized. In the judicial system we have the jury. In the school system we have a school board. At the head of the Department of Defence we put a civilian. And so it goes throughout the whole system; it is always a man as a civilian that we hold responsible. If we choose a president who has been a General, we choose him as a civilian, and as a civilian he holds professional men responsible to him.

There has been such a great accumulation of specialized knowledge in our world that the possessors of this kind of knowledge hold the key to nearly all activity in virtually every area of human action. The role of the county highway engineer is not unlike the role of the expert wherever he is found in contemporary western civilisation. The layman who makes decisions without consulting the expert is like a blind man selecting a bottle of medicine from a druggist's shelf. He is in peril until someone reads the label. Unless the experts accept their responsibility to supply the facts they know, to explain the implications of this knowledge and to assist in sharpening the issues, contemporary civilization can hardly hope to survive. For without an expert reading of the label, we cannot tell whether a substance is a lump of sugar, which will nourish us, or a radio-active isotope, which will disintegrate our bones.

(Extracted from Better Roads, December, 1953).

BICYCLES IN HOLLAND

Bicycles are very common in Holland; out of a population of about 10 million inhabitants there are approximately 5 million bicycles. Bicycles are not only used for touring, but they also play an important part in the everyday life; for going to business, shopping; school, sports, movies, etc.

THOMAS ALVA EDISON

EDISON was born on February 11, 1847, at Milan, Ohio. Though the son of a successful shingle manufacturer, young Edison went to work as a news boy on the Grand Trunk Railway, because he needed money to equip his laboratory and to buy books. At school he did poorly and actually his schooling was limited to only three months, the rest of it being taken care of by his mother.

Edison's first invention was a device recording the votes in Congress but no one was interested in it. This taught him to make sure that there was a market for every thing he developed and his judgement in this regard was quite extraordinary.

In 1876 Edison moved to Menlo Park, New Jersey from where he carried on his many experiments, and which later on gave him the title "Wizard of Menlo Park."

It was here, soon after moving into Menlo Park that Edison one day handed one of his chief assistants a sketch of a machine consisting of a long, spirally grooved cylinder turned by a crank; on each side of the cylinder was a small tube with a parchment diaphragm with a small needle at the inner end.

When a few days later the assistant brought back the completed model, Edison wrapped the long cylinder in tinfoil and adjusted one of the small tubes so that a needle rested on the tinfoil over a groove in the cylinder. Then turning the crank, he recited, "Mary had a little lamb." When he placed the other needle in the groove and turned the crank, the words "Mary had a little lamb" was repeated from the machine to a bewildered crew. And thus the phonograph was born. It was Edison's favourite invention.

The phonograph was also instrumental for the invention of the electric incandescent lamp. For the phonograph made him a national figure and helped him to obtain the needed financial backing for the development of the incandescent lamp.

The search for the right filament material showed Edison's capacity for long and sustained hard work. Literally tens of thousands of different materials were tried till a proper one was obtained. Skilled people were sent to different parts of the world in search for the material. A species of bamboo from Japan proved to be the one that was wanted, till a couple of decades later metallurgists were able to draw fine filaments from brittle metals like tungsten and tantalum.

In his experiments on the electric light bulb, Edison made another discovery that was to have a remarkable and revolutionary social consequence the "Edison Effect", which has been the basis for the radio tube. The Edison effect, the flow of current in one direction only through the vacuum between filament and plate, was put to the greatest use a couple of decades later, when it gave rise to the modern electronic tube, which is the foundation for radio broadcasting, long-distance telephones, the X-ray, electronic musical instruments and innumerable other devices.

An estimate carried out in 1947 put the value of the industries that Edison gave rise to as 20,000,000,000 dollars and the number of persons employed as 4,000,000. Including other industries, which though not directly descended from his inventions would have been impossible.

Edison's interests were very varied, for example, in the 1920's he became interested in finding a rubber-yielding plant which could be grown in the United States. More than 15,000 plants were tested. And though he never found a plant that could compete with the tropical rubber tree, yet the one that he had found best was cultivated during the second World War, to augment the production of synthetic rubber.

Before his death on October 18, 1931, Edison's inventive genius had been recognised throughout the world.

(*Extracted from 'The Indian & Eastern Engineer', February, 1954*).

TRANSPORT-COMMUNICATIONS

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INDIAN ROADS CONGRESS, NEW DELHI.

Index to Transport-Communications Monthly Review, Volume Nos. 69 to 80. (January 1953 to December 1953)

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* The number represents the issue number and the second within bracket the page of that issue.

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SUBMERSIBLE ROAD BRIDGES

(Extracted from 'Civil Engineering'— December 1953).

THE submersible bridge is most suitable when the difference between ordinary flood level and high flood level is considerable and when the site is subject to sudden and violent floods of a few hours duration. It may then be cheaper to keep the road level just above ordinary flood level, providing enough waterway under the bridge to pass ordinary floods and to allow it to becomes ubmerged for brief periods during an occasional high flood. This will involve the temporary cessation of traffic during high floods. If this can be permitted, this type of bridge should prove a cheaperialternative, under suitable site condtions since, because of its lower level, a considerable saving results through the elimination of long " land-spans."

A typical chart of the daily water levels in a river justifying the provision of this type of bridge is shown in Fig. 1. It can be seen that by providing a roadway at level 140.00 the bridge will be out of use only three times during the year, whilst it may be over-topped by 15 feet of water. Clearly, the cost of a conventional bridge above maximum high flood level would be considerably greater. Moreover, with a design of conventional type in a year of unexpectedly heavy rainfall, should the flood level rise higher than the maximum known for which allowance was made in the design, considerable damage would result. If designed as a submersible bridge, then it should be able to survive undamaged. This happened once in India in 1926, when exceptional floods exceeding the worst recorded in the century overtopped and washed away two railway bridges of conventional type, whereas upstream on the same river a submersible road bridge escaped with very little damage.

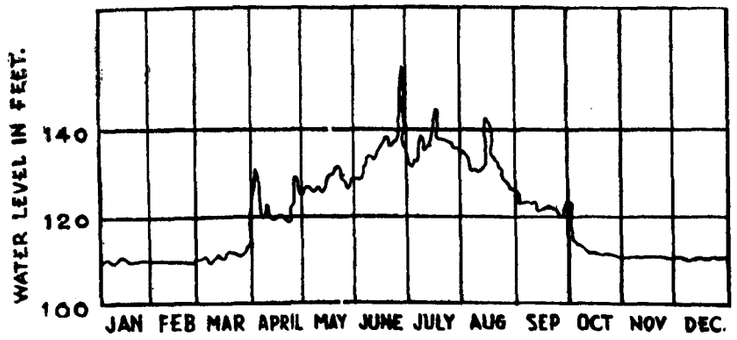

Fig. 1. Typical chart of daily water levels.

Describing the construction of a submersible road bridge over the Nerbudda River, Dean (1)* states that in high floods the rise of the Nerbudda River takes place very rapidly, 2 to 3 feet per hour being usual and up to 10 feet per hour having been recorded. The following levels which are presented in the Paper, give some idea of the conditions at the site described :

	Level
Highest flood-level (occurring occasionally at indeterminate intervals)	1,263
Ordinary high flood-level (occurring every year at least once)	1,230
Average river level during the rainy season	1,210
Average summer water level	1,178
Lowest bed level	1,175
Lowest rock level	1,152

*The figures in parentheses refer to the bibliography at the end of the article.

The bridge was constructed with road level at 1,215.

The conference of Chief Engineers, as a good practice proposed that (2), "The permissible likely interruption to traffic should generally not be for a greater period than 12 hours at a time, on 6 days a year and there should not be frequent stoppages for shorter periods. In the case of other district roads and village roads, the interruptions to traffic may be up to 3 days at a time and up to 6 times a year."

The submersible type of bridge construction is specially suited (1) to sites having :—

(i) a straight reach of river ;

(ii) well defined and fairly high banks ; and

(iii) good foundation possibilities.

A straight reach of river is especially important as with this type of design there is a greater danger of outflanking.

High banks are preferable as it is desirable to have the approaches in cutting, since embankments are liable to be washed away in each flood. But in cutting there is always the problem of silting. Silting can be appreciably reduced if the approaches are aligned at a slight angle to the centre line of the bridge, so that the gradient falls in the direction of flow of the river.

Good foundations are desirable for any type of construction, but in this case it is especially so, because scour is liable to be more severe. Foundations should preferably be on rock or should be taken down well below the maximum anticipated scour level, and should be provided with ample protection against scour. However, a number of good examples of construction on soft foundations when rock was not available within reasonable reach are available. Foundations on soft materials demand special treatment, a subject which has been elegantly dealt with by Lall (3).

If possible, the site of the bridge should be upstream of any villages or towns so as to avoid possible damage to property during heavy flows through the damming effect.

Rainfall and runoff statistics extending over long periods are necessary if really reliable hydraulic calculations are to be forthcoming. The velocity of the river should be determined by a formula applicable to the particular site under consideration. In India, Chezy's formula with the coefficient C as evaluated by Kutter and Ganguillet's formula is extensively used. With this value of velocity the afflux should be estimated but the correct evaluation of this has never been a simple problem and much yet needs to be done to produce a reliable method enabling the designer to arrive at any reasonable approximation. The formula for afflux as given in Molesworth (4) is :—

$$\text{where } H = \left(\frac{V^2}{58.6} \text{ plus } 0.05\right)\left[\left(\frac{A}{A-a}\right)^2 - 1\right]$$

H = Afflux in feet.

V = Mean velocity over the entire unobstructed section of the river in feet per second.

A = Sectional area of unobstructed river.

a = Area of obstruction.

A further discussion on afflux by Bligh(5) may be found in reference (6). It might be mentioned that the author suggests that for practical requirements the afflux need only be calculated to the nearest half foot.

A submersible type bridge, then, must be designed for two conditions :

(i) When passing a discharge under the bridge, it may be treated as conventional bridge structure.

(ii) When submerged, it must be treated as an anicut or weir with undersluices.

In case (i) the bridge should cause the minimum afflux. An adequate waterway should be provided so that the bridge does not become submerged during floods of a magnitude at which it is still intended to be passable.

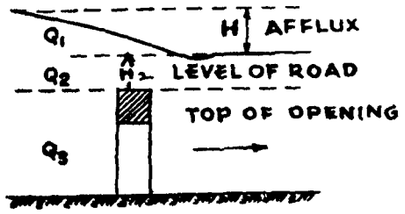

Fig. 2
Minimum of Obstruction.

In case (ii) it should cause a minimum of obstruction to the total discharge. The total discharge in this case (Fig. 2) is —

$$Q = Q_1 + Q_2 + Q_3$$

where :

$$Q_1 = 2/3\ Cd_1 \sqrt{2g}\ B\ [(H+ha)^{3/2} - (ha)^{3/2}]$$

$$Q_2 = Cd_1\ B\ H_2 \left(\sqrt{2gH} + Va\right)$$

$$Q_3 = S\ Cd_2\ \sqrt{2g}\ \sqrt{(H+ha)}$$

where :

B = the breadth of the river

S = the sectional area of the openings under the bridge

ha = the head due to the velocity of approach Va

Cd_1, and Cd_2 are coefficients.

The value of Cd_1 may be taken as 0·62 and Cd_2 as 0.9 when curved cutwaters are provided.

In addition to the normal live loads and the dead load, the bridge must be able to withstand horizontal thrust, uplift and buoyancy due to the flood waters with live loads absent. The effect of the forces acting on it is probably worst in the condition when water is just overtopping the bridge. An accurate estimate of the forces acting on the bridge under this condition may not be easily obtainable, but as pointed out by Nilsson(7), it may be considered sufficient to make approximations erring on the safe side. In practice, the bridge may be considered as subject to the following forces :

(i) Static head due to the afflux ; this is approximately equal to WH acting normal to the area of the structure projected in a vertical plane, where W = the weight of water in lb. per cu. ft. and H = the afflux in feet.

(ii) Horizontal load due to water currents(8), which is given by $P = KWV^2/2g$ where P = the pressure in lb. per sq. ft. of vertical projection, K is a constant, V is the velocity of the current in feet per second and W = the weight of a cubic foot of water. A value often used for $KW/2g$ is 1.5 for flat surfaces and 0.75 for rounded surfaces, with a minimum of 150 lb. per sq. ft. for flat surfaces subjected to freshets and 50 lb. per sq. ft. for tidal streams, with one-half of these values for rounded ends.

(iii) The friction of the water against the piers and soffit given by $F = f.p.(V/10)^2$ where f = the coefficient of friction between the surface of the pier (and soffit) and the water. The value of f as given in the P.W.D. Handbook, Bombay(2), for well dressed surfaces without bushing may be assumed as 0.588 lb. per sq. ft. For rough surfaces the same handbook suggests $f = 1$ lb. per sq. ft.

(iv) Uplift on the soffit. In the case of a slab, the uplift in lb. per sq. ft. equals $W[(H+t)-(V_1^2 - V_2^2)/2g]$ where W = weight of water in lb. per cu. ft., H = afflux in feet, t = the slab thickness in feet, V_1 = velocity in the opening through the bridge in feet per second and V_2 = the velocity in the natural stream in feet per second.

(v) Buoyancy. This may decrease the weight of the submerged portions by as much as 65 lb. per cu. ft. in muddy water.

Horizontal forces are considerably increased due to the large quantities of timber or other debris which may block the waterway during floods and for which an adequate allowance should be made. Of the horizontal forces (i) above is the greatest. The piers should be designed for the no tension condition ; i.e., the design should be checked to see that resultant of all horizontal and vertical forces falls within the middle third. The bridge, therefore, needs to be of heavy and massive construction. In this connection, it will generally be necessary to give a batter to the downstream faces

of the piers. If the piers rest on piles, provision against bending in the piles may be made by the use of raking piles. To prevent arches or deck slabs from being lifted during floods, they should be tied down to the piers.

Since the structure should cause a minimum of obstruction to flow in the channel, all ornamentation should, as far as possible, be avoided and the structure should be streamlined. No holes and crevices should be present to collect debris brought down by floods. To reduce obstruction, the parapets provided on bridges of conventional design should not be used. Collapsible railings have been devised which are kept lowered during the flood season.

S. P. Raju, Director of the Engineering Research Laboratory, Hyderabad, from his recent experiments on hydraulic models of submersible bridges (9), concludes that "the period of submergence may be reduced by decreasing the hydraulic resistance and thereby lowering the afflux through the use of the following methods:

(a) by increasing the coefficient of discharge of all openings by giving them a bell-mouth on the up-stream and divergence on the downstream side;

(b) by increasing the coefficient of discharge of the roadway by rounding or bevelling the upstream edge of the causeway;

(c) by giving a one way camber (downstream to the road surface);

(d) by giving all guardstones a streamlined shape."

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REASON SUFFICIENT

"I was surprised to see you at the theatre last night, Bill I thought you were staying in."

"So I was, but when I told my wife I had made up my mind to stay in she said she had made up her face to go out."

HERE AND THERE

1. ROAD DEVELOPMENT IN INDONESIA

ROAD, rail and shipping transport sustained severe damage in Indonesia as a result of the war and its aftermath. There are about 75,000 km. (46,500 miles) of roads in Indonesia. Of these rather more than two-thirds are hard roads and the remaining 20,000 or so kilometres (12,400 miles) are unconcreted rural tracks. In 1952 some 9,000 km.(5,600 miles) of the concrete roads were still in a damaged state. In that year's budget Rupiah 50 million were allocated for capital expenditure on roads and bridges. Most of this sum was used for repair work, but in Kalimantan and South Sumatra new roads were begun. Also in hand are preparations to complete the 2,600 kilometre-long (1,600 miles) road joining north and south Sumatra. By the construction of these new roads it is hoped to open up regions which hitherto have been isolated.

-Extracted from 'Modern Transport', December 19, 1953.

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2. WHAT IS IT THAT IS ESSENTIAL IN RESEARCH

AN observation that might well be spread in large type on the walls of all research laboratories where young engineers and scientists may read and reflect on it is found in a recent statement by Charles L. McCuen, general manager of the research laboratory division of the General Motors Co. Mr. McCuen said: "In research, as in education, things are subordinated to the greater values which spring from the questioning attitude of people and their desire to learn. **Neither elaborate equipment nor well appointed laboratories can think.** These inanimate things make research possible, but creative values from these things can result only from the questioning, analytical minds of men."

In research today the trend appears to be to place great emphasis on impressive physical facilities. This is all to the good, but it is also well to remember that one of the greatest scientific discoveries of all time was made as the result of a man with an inquiring mind watching an apple fall from a tree.

(Extracted from 'Engineering News-Record'-December 24, 1953.)

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3. RESEARCH AND EXPERIMENTATION AND THE ENGINEER

EXPERIMENTATION falls broadly into two classes, that of a more elaborate and scientific nature which is the province of specialised scientists, and that which is essentially practical, realisable with apparatus ready to hand and in the course of normal works.

For true research, a man must for a continuous period be withdrawn from ordinary work, for the many distractions of a busy office engaged on the execution of works prevent him from the necessary concentration on a subject governed by such dissimilar conditions. This is rarely possible, nor is the average engineer trained in the rigorous methods of pure science. It seems therefore that this work should be left to specialists. Many an engineer would, however, be greatly improved could he have a period working in this sphere.

Experimentation of the second sort is concern of engineers and is moreover most important for the well-being of an

office. Its utility in improving technique or lowering costs is clear, but what is not so obvious is its effect on the staff. Every engineer is an imaginative man and when he invents something reaches heights of mental pleasure and satisfaction unknown to those who do not do original work, and the greatest pleasure of all when after hard labour and great patience he sees his idea actually work. Brunel wrote: 'Really good improvements are not the result of inspiration ; they are not, strictly speaking, inventions, but more or less the results of an observing mind, brought to bear upon circumstances as they arise, with an intimate knowledge of what has already been done, or what might now be done, by means of the present improved state of things.'

Time today moves so much faster than before the war that we are compelled to put into practice new discoveries as soon as they emerge from the laboratories, and often before they are properly understood, certainly before they have stood the test of time. Witness the celerity with which prestressed concrete has been put to use, before durability tests have been carried out. Risks must be taken, greater than in earlier days, for conservative times are over.

An engineer working in an office where experimentation is encouraged has his competitive instinct aroused, finds an outlet for his creative urge, is exercised in patience, and finally takes a pride in his department.

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

4. HISTORY OF THE THEORY OF ARCHES

Robert Hooke in 1678 stated that the true form of an arch is an inverted suspension chain.

David Gregory in 1697 published a theory of the arch in which it was assumed that the line of pressure must of necessity coincide with the intrados of the arch.

According to the Wedge Theory of **La Hire and Atwood** in 1712 it was supposed that the pressure must be perpendicular to the meeting surfaces of the voussoirs or ring stones which were considered as frictionless blocks in equilibrium under the action of the load and normal reactions from adjacent blocks.

Such was the state of Arch Theory when **William Edwards** built his masonry arch at Pontyprid in 1755 with its span of 140 feet which for three-quarters of a century remained the largest arch in the U.K.

In 1773 Coulomb corrected the theory of La Hire by allowing for friction between the voussoirs.

The subject was further elucidated by **Professor Moseley** of King's College, London, in 1843 and a theory based upon the conditions actually existing in a real arch was established.

Navier is credited with the statement that the line of pressure for no tension must lie within the middle third of the ring thickness.

He was also the first to apply the mathematical theory of elasticity to the calculation of Arches.

In Rankine's "Manual of Civil Engineering" (1862) equations are developed for an arch rib allowing for elastic distortions. The method of analysis and the assumptions that the span is unchanged and that the supports remain at the same level are the same as in the ordinary elastic theory but Rankine's equations are cumbersome.

Martin: The earliest publications of the three equations of the elastic theory of arch ribs in modern form is probably that in a Student's Paper on "Arched Ribs and Voussoir Arches" read at a meeting of the Institution of Civil Engineers By H. M. Martin, Wh.Sc., Stud. Inst. C.E., in 1888.

The elastic theory of the arch is included in Castigliano's Theorem of Least Work, the equations for which, published in 1875, give the same results as Martin's three equations.

(Extracted from 'The Structural Engineer,' May, 1938).

5. HIGHWAY RESEARCH BOARD (U.S.A.) APPOINTS A COMMITTEE TO STUDY HIGHWAY LAWS

RECOGNISING the need for revision of existing highway laws which are inadequate to meet the problems brought about by increasing traffic, the Executive Committee of the American Association of State Highway Officials had in 1951 requested the Highway Research Board to sponsor study of such laws. While the Highway Research Board were considering the matter it developed that the Legislative Research Committee of North Dakota had studied the subject in all its various aspects, viz., review of the entire existing highway code, the State's constitution, court decisions, and the statutes of other States. The recommendations of this Committee were accepted almost entirely and the result was modernization of North Dakota's highway laws.

Following this successful demonstration, the Executive Committee of the Highway Research Board decided that the time was opportune for an intensive study of the highway statutes of all States. A small steering committee has been set up—The Committee on Highway Laws—under the Board's Department of Economics, Finance and Administration to : (a) assemble and analyse state constitutions and highway statutes in terms of their functional parts, as they pertain to system classification, highway design, control of access, traffic engineering, land acquisition, construction, maintenance, and others related to the responsibilities of highway officials ; and (2) isolate the essential principles and elements which constitute adequate highway laws in each functional field delineated.

It is expected that the composition of this Committee will be broadened to include representation of all States, country and municipal engineers, law officers and judges, legislators, planners, economists, etc.

(Circular No. 224 — Highway Research Correlation Service — Highway Research Board, Washington, D. C.)

6. A FOUNDATION PROBLEM

AN interesting foundation problem is described in a Paper by W. J. R. Nowson entitled "The history and Construction of the Foundations of the Asia Insurance Buildings", which was presented to the Institution of Civil Engineers. The site of this building overlies an old beach, with decomposed shale and sandstone below it, and the original borings gave indication of firm sandstone at depths of 30 ft to 42 ft. It was therefore decided to sink number of reinforced concrete cylinders to bear on the rock stratum, with bearing pressures up to 10 tons per square foot, and to connect them together with a reinforced concrete raft at column base level. Trouble was experienced in sinking the cylinders, and it was eventually determined that the expected firm sandstone stratum consisted of core boulders. A reconsideration of the foundation design at this stage indicated that it was necessary to reduce the bearing pressure to $3\frac{1}{2}$ tons per square foot. The method adopted was to "bell out" the bases of the cylinders by the successive addition of rings of bolted precast concrete segments. The cylinders were first back grouted, and various kinds of segments were utilised, with sloping circumferential faces, or, alternatively, a longer upper flange bolted to the shorter lower flange of the ring above, to achieve the "belling out" effects. In some cases the cylinders were under-pinned through the beach formation, using compressed air. On completion of the under-pinning the shafts were sealed with a reinforced concrete slab, and a lining was cast inside the segmental rings. Finally, the tops of the cylinders were trimmed to level and a 4 ft thick reinforced concrete raft was cast over them, to take the columns of the building.

(Extracted from "The Engineer" February 19, 1954)

7. WELDED-STEEL GIRDERS AND PRESTRESSED CONCRETE DECK SLABS USED TO ATTAIN SHALLOW CONSTRUCTIONAL DEPTHS.

A COMBINATION of welded steel work and prestressed concrete has been used in the reconstruction of a railway bridge at Carlisle (U. K.). The bridge is of three spans of about 40 ft each and carries a double line branch. A very small construction depth was available for the new structure, due to the steep gradient into the goods yard and the very low headway under the bridge. Traffic both over and under the bridge is heavy, and a form of construction had to be devised which could be erected with the minimum interference with the running of trains.

The design eventually adopted comprised a "through" bridge with two outer girders and one centre girder in each span, with prestressed concrete floor slabs spanning between them, on which steel plates were placed, with the running rails attached to them, thus reducing construction depth to a minimum. The girders are all welded and have intermediate web stiffeners at 6 ft centres with shear-plate connections to carry the corners of the deck slabs. Thus the slabs do not bear on the bottom flanges of the girders and floor loading is transmitted to the web. The three girders in each span are tied across at 6 ft intervals by steel "tee" sections; they rest on welded steel pedestal bearings giving easy access for inspection and painting.

To facilitate erection and to cut down occupation time the prestressed concrete floor slabs were precast in 6 ft. They are 12 in thick and weigh about 5 tons each and they were prestressed by the Freyssinet method using twelve wire cables. Direct rail to concrete support was continued over the piers and because of the necessity of avoiding interference with traffic, the concrete here also was precast in slabs similar to the main spans.

The low headway precluded the use of smoke-plates and, therefore, to protect the steelwork from smoke and blast the bottom flanges of the main girders were aluminium sprayed before erection to a thickness of 0.006 in. and the remainder of the exposed steelwork was also sprayed with aluminium to a thickness of 0.003 in. The underside of the concrete slabs in the main spans was sprayed with a bitumen compound, while the top surfaces of all slabs were treated with a hardening solution.

The site work was carried out by first removing the whole of the existing superstructure, one span at a time, and erecting temporary way beams to carry one line of traffic into the goods yard as each span was demolished, thus allowing half of the existing abutments and piers to be prepared for the new superstructure. At subsequent week-ends the new steelwork and deck slabs for the whole length of this side of the bridge were placed and a temporary sleepered track laid over the new decking. The temporary waybeams were then removed and the remaining portions of abutments and piers were prepared as before to accommodate the second half of the superstructure and so complete the new bridge.

(*Extracted from "The Engineer, January 29, 1954"*).

CURRENT LITERATURE

ABSTRACTS

624.131. STABILIZATION OF SOIL BY SILT INJECTION METHOD FOR PREVENTING SETTLEMENT OF HYDRULIC STRUCTURES AND LEAKAGE FROM CANALS by G. E. Johnson, Vol. 79, Separate No. 323, *Proceedings of the American Society of Civil Engineers*, November, 1953.

The use of silt slurry under pressure to jack up low spots in concrete pavement, known as the mud jacking, is a standard practice in America. This Paper presents a method of consolidating porous soils by injecting silt slurry into the moist soil. Field [illegible] tests had revealed that when silt is injected into a porous soil it was safe to found structures. Also when porous soil is consolidated after injection the grains would close sufficiently to prevent excessive leakage.

The success of this method of consolidation depends on the porous soil having sufficient porosity to allow the excessive water to move out under pressure.

Costs under American conditions are given and description of a project where this method has been used is included.

625.71. "THE VARIABLITY OF CONCRETE AND ITS EFFECT ON MIX DESIGN" by F. R. Himsworth, Proceedings of the Institution of Civil Engineers, London, Part I, Vol. 3, No. 2, March, 1954.

An important feature of modern concrete design is recognition of the fact that concrete is variable in strength and that the design should allow for this. Keeping the above fact in view, this Paper, which is in two parts, has devoted Part 1 to the statistical principles used in concrete mix design. Part 2 contains detailed analysis of the factors causing variation in concrete strength, viz., (1) quality of cement, (2) water-cement ratio, and (3) testing errors. These are discussed in detail and the following conclusion are drawn:

(1) Cement quality contributes much less to variability than has been supposed. On one very large job, cement quality accounted for only 10 per cent of the total variation in concrete strength. Faulty methods of deducing the effect of cement quality have previously led to much larger estimates.

(2) Variations in water-cement ratio are the most important source of variation in concrete strength. A thorough analysis is made of the factors causing variation in the water-cement ratio. It is shown that high accuracy in weighing materials is unnecessary, and does not ensure low variability, unless the moisture content of the aggregates can also be accurately measured. The most effective form of control is by workability and, if this is reasonably well controlled, very accurate proportioning is unnecessary. Good volume batching, is quite as satisfactory as weigh bat ching, so far as uniformity of strength and workability are con cerned.

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BUDGETS AND ADMINISTRATION REPORTS

COORG CIVIL WORKS BUDGET 1953—54

The following extracts relating to Civil Works have been taken from Government of Coorg Budget for the year 1953-54.

(In lakhs of rupees)

	Actuals 1951-52	Revised Estimates 1952-5	Budget Estimates 1953-54
I. Revenue (Civil Works)			
1. Rent	0.12	0.14	0.14
2. Miscell us	0.06	0.06	0.06
Total	0.18	0.20	0.20
II. Expenditure (Civil Works)			
1. Works and Repairs	...	11.44	20.80
2. Establishment	...	1.87	2.50
3. Tools & Plant	...	1.42	1.00
4. Grants-in-aid	0.12	2.21	1.70
Total	0.12	16.94	26.00
III. Expenditure (Communications)			
1. Original Works	...	0.15	...
2. Repairs	...	5.00	5.00
3. Planning & Development Works	...	...	6.62
Total	...	5.15	11.62
IV. Revenue from Roads			
1. Receipts under Motor Vehicles Acts	4.75	4.94	5.02
2. Sales Tax on motor spirit	0.59	0.60	0.60
Total	5.34	5.54	5.62

A BRIEF REVIEW OF THE BUDGET

THE total revenue receipts of Coorg for the year 1953-54 are estimated at Rs 103.85 lakhs and revenue expenditure at Rs 140.95 lakhs with a consequent deficit of Rs 37.10 lakhs. The revised estimates for 1952-53 show a surplus of Rs 4.09 lakhs with the revenue receipts amounting to Rs 91.14 lakhs and revenue expenditure to Rs 87.05 lakhs.

Revenue expenditure on Civil Works for 1953-54 estimated at Rs 26.00 lakhs forms 25 per cent of total revenue in that year, the corresponding percentage figure for the previous year (1952-53 R.E.) being 18.6. The proportion of expenditure on communications (original works and repairs) to total revenue for 1953-54 (Estimates) and 1952-53 (R.E.) are 11.2 and 5.7 respectively.

LIST OF APPROVED WORKS ON NATIONAL HIGHWAYS

S. No.	Job No.	Name of work	Amount (Rs in Lakhs)
		ANDHRA	
1.	853 AH 5	Construction of a bridge across the drain in mile 7/8 of Rhemadole-Chelerola Section of N.H. No. 5 in the West Godavari District.	0.44
2.	860 MD 5	Widening and blacktopping miles 29/0 to 33/0 of Madras—Calcutta Road; N.H. No. 5.	1.59
		BOMBAY	
3.	852 BM 8	Protection works to safeguard the south approach bank of the bridge over the Narmada river at Branch on the Bombay—Ahmedabad National Highway No. 8.	12.11
4.	854 BM 8	Construction of a bridge with approaches over the Kampri Khadi on the Bombay-Ahmedabad Road; National Highway No. 8.	2.31
5.	855 BM 8	Construction of a bridge with approaches over the Amla Khadi on the Bombay-Ahmedabad Road; National Highway No. 8.	4.67
6.	858 BM 4	Asphalting miles 245/2 to 353/1 of the Poona-Bangalore Road; National Highway No. 4.	16.76
		PUNJAB	
7.	844 PB 22	Construction of a bridge in furlong 5 mile 9 of Ambala-Kalka Road (N.H. No. 22)	0.71
		MADHYA BHARAT	
8.	846 MB 3	Construction of bridge over the Chambal river near Dholpur on Agra-Bombay National Highway No. 3.	41.30
		MADRAS	
9.	201 MD 49	Construction of a bridge at mile 66/0 of Madura-Dhanushkodi Road.	2.67
		ORISSA	
10.	856 RS 42	Construction of 8 culverts on National Highway No. 42 between Chawdwar and Nuapatna (Sections I and III near Cuttack).	0.53

S. No.	Job No.	Name of work	Amount (Rs in Lakhs)
		SIKKIM	
11.	843 SK 31-A	Widening narrow reaches between miles 30-35 of Teesta Rangpo Section of National Highway No. 31-A.	0.31
		TRAVANCORE-COCHIN	
12.	850 TC 42	Black-topping miles 31 to 35 of Trivandrum-Quilon Road in Quilon Division.	1.36
13.	851 TC 47	Black-topping Alwayes-Ankamali Road miles 2/2 to 6/7 in Ernakulam Division.	0.93
		SAURASHTRA	
14.	847 SR 8-B	Providing 1½″ premix asphalt carpet, after re-conditioning, to Goudal-Jetput Section of the Bamanbore-Rajkot-Porbandar National Highway No. 8-B.	5.86
		WEST BENGAL	
15.	848 BG 34	Construction of screw pile bridge over Falgoo river on Raghunathganj-Dhulian Section of National Highway No. 34.	1.44
16.	849 BG 34	Construction of a semi-permanent Inspection Bungalow at Dhulian in connection with the construction of National Highway No. 34.	0.18

WANTED A REFRIGERATOR

An advertisement was inserted in a local newspaper for a kerosene-operated refrigerator.

The advertiser received two replies, and here is one sent to me for these columns: "I have the honor most respectfully to submit this my humble application soliciting for an employment as a kerosene refrigerator in your department.

"I have successfully passed the seventh standard in the Methodist Middle School last year and hold a testimonial issued by the schoolmaster and documents testifying my character and ability."