TRANSPORT-COMMUNICATIONS

MONTHLY REVIEW

JUNE 1957—No. 122

INDIAN ROADS CONGRESS, NEW DELHI.

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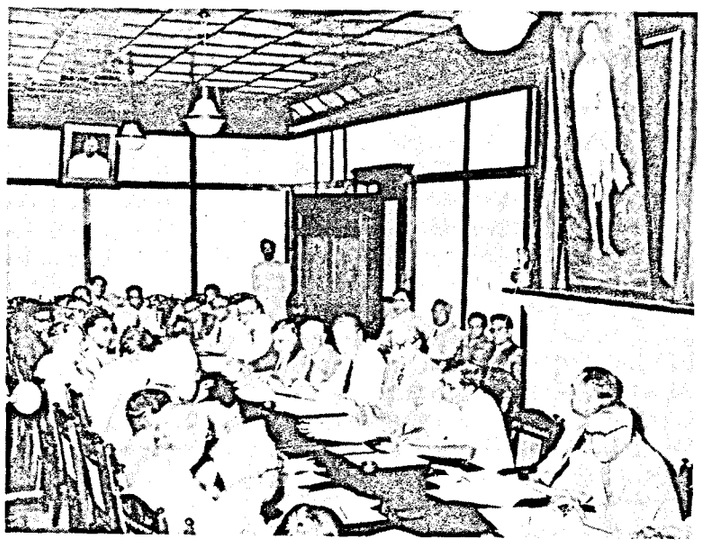
Chief Minister, Assam opens the Exhibition



A Council Meeting

TRANSPORT-COMMUNICATIONS
MONTHLY REVIEW

A REVIEW OF
ROAD ENGINEERING, DEVELOPMENT & TRANSPORT

JUNE 1957

THE INDIAN ROADS CONGRESS—21ST SESSION SHILLONG—MAY 1957.

AT the invitation of the Govt. of Assam, the Indian Roads Congress held its 21st Session at Shillong.

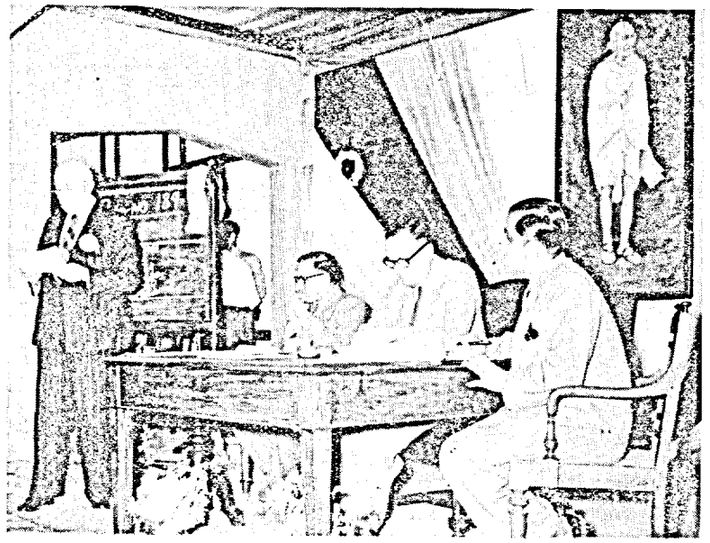
Due to the unavoidable absence of Shri Saiyid Fazl Ali the Governor of Assam, his Address was read by the Chief Engineer, Public Works Department, Assam. Shri Bisnuram Medhi, Chief Minister of Assam also addressed the Session. Shri P. L. Varma, Member, Union Pubic Service Commission delivered the Presidential Address. Shri Y. Guyon, Consulting Engineer, Paris and an Eminent authority on prestressed concrete attended the session. Besides reading a paper on Indian Bridges he gave the benefit of his advice to the Committees of the Congress. Shri J. P. Macgregor and Shri Van Dyke attended the Session as representatives of the Institution of Civil Engineers, London and Bureau of Public Roads, U.S.A. respectively.

Messages of goodwill from Shri Jawaharlal Nehru, Prime Minister of India, Shri C. P. N. Singh, Governor of the Punjab, Shri Raj Bahadur, Minister for Shipping, Govt. of India and several others, were received.

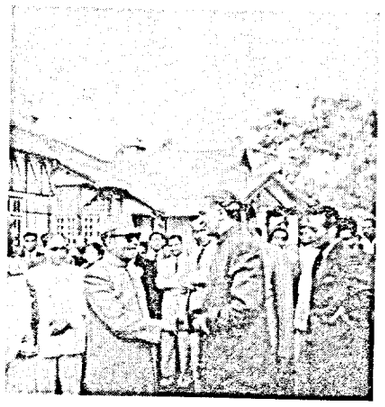
Ten Papers were discussed. For the first time a general report of Road Research in India was discussed. A Panel discussion on Use of Soil in cheap all-weather Road Construction was arranged.

The Paper "Stabilized Soil Construction in the formation of Tuticorin-Tiruchendur Road, by E. C. Chandrasekharan and T. S. Chandrasekhara" read at the 20th Session of the Congress held at Nagpur was commended.

There was the usual round of technical activities. The Specifications and Standards Committee, the Bridges Committee, the Research Organization Division, the Education Subcommittee, the Soil Research Subcommittee, the Manufacture of Road-Making Machinery & Mechanization Subcommittee, the Road Transport Development Committee, and the Road Transport Operation Cost Committee met and

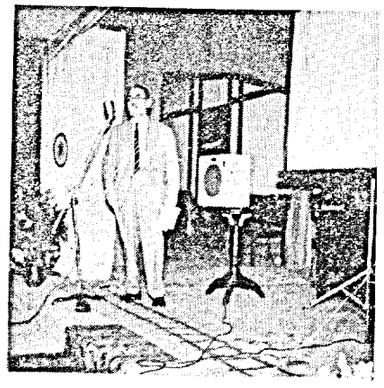


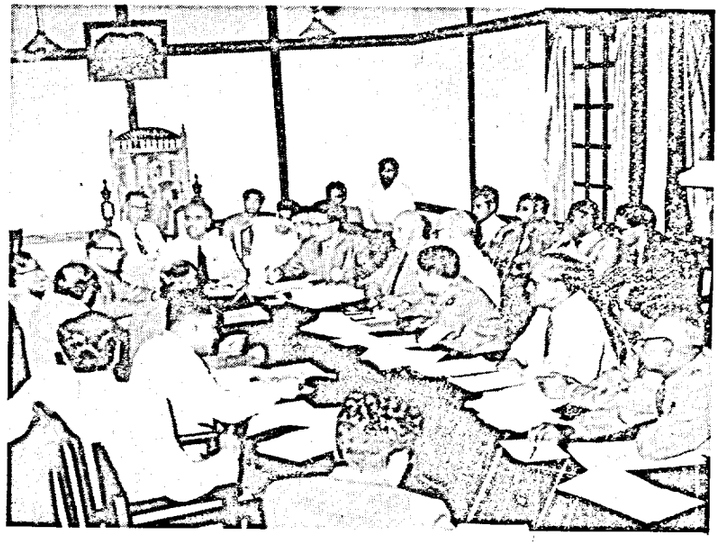
Paper Discussion



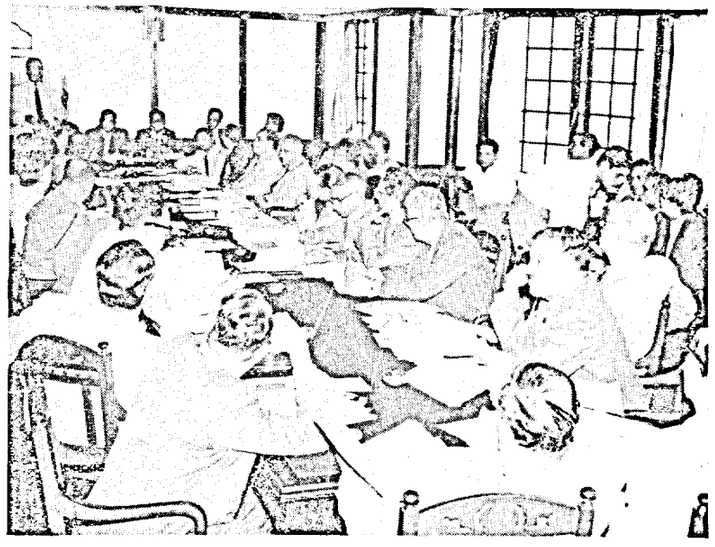
At Home of the Governor

Shri. Y. Guyon
delivering a Lecture to the Congress

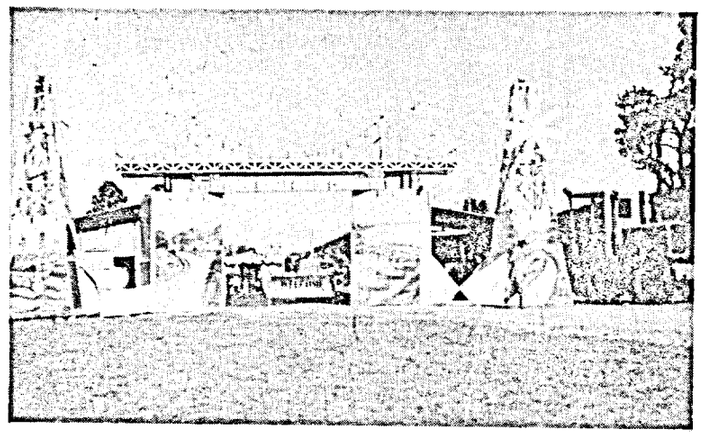




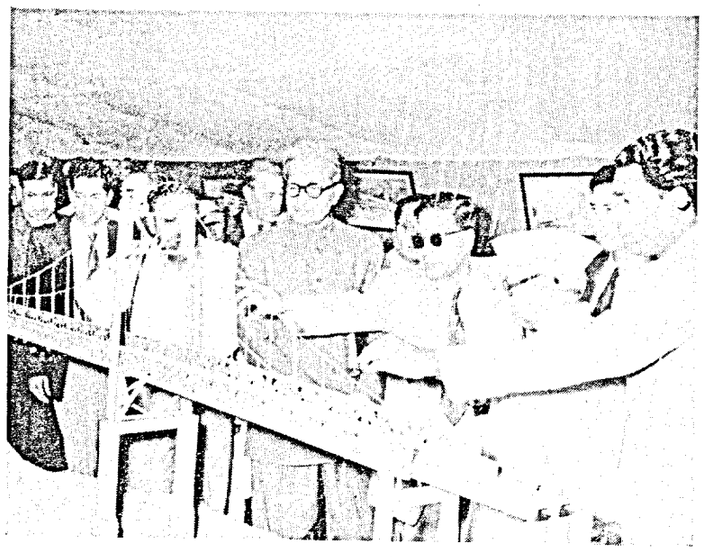
A Committee at work



Chief Engineers' Meeting



Gate of I.R.C. Exhibition



A Stall at the Exhibition

discussed various technical problems during the Session. The Council held its 48th and 49th meetings. At the 49th meeting held on the 16th May, Shri M. S. Bisht, Chief Engineer, Buildings and Roads, Uttar Pradesh was elected President. Shri Kishorilal Mathur, Chief Engineer, Rajasthan, Shri B. Chaudhury, Chief Engineer, Assam and Shri C. J. Fielder of Shalimar Tar Products were elected Vice Presidents.

The Chief Engineers of the various States held a meeting during the Session to discuss various technical problems.

On the 12th May, Shri Bisnuram Medhi, Chief Minister, Assam opened the technical exhibition arranged by the Indian Roads Congress. Declaring the exhibition open, the Chief Minister said that Roads occupied an important position in the national reconstruction work that was now going on in the country and gave an account of the work done in the field of Road Development in Assam.

DEFINITIONS OF HIGHWAY ENGINEERING TERMS

SOIL: A mixture of earthy materials with particles differing physically in size, shape, and cellular structure, and varying in chemical composition.

SPOIL: Surplus excavated material.

THE DIFFERENCE

" Character is what you are — reputation is what people think you are."

PRESIDENTIAL ADDRESS
TO THE
TWENTY-FIRST SESSION
OF THE
INDIAN ROADS CONGRESS

By

SHRI P. L. VARMA

Shillong, May 12th, 1957.

Shri Rajyapal, Ladies and Gentlemen,

It is an honour and a pleasure to me as President of the Indian Roads Congress to extend to you, Sir, our felicitations and gratitude for the honour that you have done us by consenting to open this 21st Indian Roads Congress in your Capital and to welcome you amidst us. To those distinguished guests who have so kindly spared

The President delivering his Address

time to join this function, I am also very grateful. Your presence, Sir, I consider a true expression of kindly thoughts towards, what I may term, "the road movement" in the country, a movement which represents one of the basic needs of the people. Our thanks are also due to your Government who have made arrangements for our stay in a munificent manner and have made us comfortable in these lovely surroundings.

Indian Roads Congress

The Indian Roads Congress, Sir, is a technical Society. It is an All-India forum for examining and assessing the needs of road communications, pooling knowledge of construction of roads and bridges, of traffic engineering and of other allied matters, and preparing a road building programme on sound lines. Sir, this is the first institution, if I may say so without appropriating egotistic praise, which, as far back as 14 years ago, was largely instrumental in producing an integrated road plan for the whole of India—known as "The Nagpur Plan." It visualised an integrated development of roads for the whole country at a time when very few among us were even conscious of country-wide development, and the word "plan" was practically unknown in India in its present concept. This lead augured well and today we have a certain length of road communications which has served our growing economy, if not satisfactorily, at least to some extent. The dynamic planning activity to build up our economy on a country-wide scale has been, to a very large extent, possible by the forethought of our forbears. They could successfully project their mind into the future and we record our gratitude to them. I am happy to state that at the end of the First Plan period, the total milage of roads stood at 3,16,668 (1,21,617 metalled and 1,95,051 unmetalled). The target envisaged in the Nagpur Plan was 3,31,000 miles. This is no mean achievement.

Time To Modify Nagpur Plan

I have talked of the Nagpur Plan. It was the first peep into the future of India. It has served as a beacon-light to shape our road policies. Vast changes are taking place in the country as a result of the rapid development of our economy on all fronts. It is time that we should pause and take stock of the present and future needs. It is time that we should examine policies leading to adequacy of our road system. Various regions of the country are developing on a pattern different from those which the original Plan had visualised. Consequent on the undertaking of river valley projects, the location of new industries, availability of cheap power and large-scale irrigation, the problem of road and rail transport has to be tackled from an entirely new concept of regional planning. It means also that new socio-economic factors have to be reckoned with. Demand for communications in the various regions will naturally take a different pattern. The re-orientation of the needs of transport has, to some extent been examined by the Railways, but when we consider that three-quarters of inland transport in all advanced countries is done by road, we should, without losing any time, take stock of the future regional distribution of population, their needs, and the part that roads will play in fulfilling them. It will be a serious lapse on our part if we allow to develop now a road pattern which will eventually have to be scrapped at least in parts. Industrial zones will want different types of roads and where agricultural economy is predominant, the demand will be of a different type. The Indian Roads Congress needs giving immediate attention to this problem.

Rural Road Plans

This leads me to so-called rural areas. I would term them 'areas of agricultural economy.' There is a movement of rural uplift in the country. It is a dynamic movement. A broad based socialistic pattern of society has been visualised and is being created. It means looking after and nursing the growth of 87 per cent of India's rural population. It means creating rural universities, and rural colleges and execution of various extension schemes. The aim is not only laudable but is obligatory. Even the highly prosperous and industrially advanced nations are seriously taking stock of the weighted development of their society in the city and are making every effort to carry modern civilisation back into the country so as to enrich those who could not so far avail themselves of the advantages of the nation's development.

Mr. Trevor Jones, at one time Chief Engineer of the Punjab, stated, while sending his greetings to me, that I should bring out in my Address the fact that 'civilisation is roads.' If modern civilisation has to be carried right to the last man, the words coming from one who lived 30 years in this country and is now living in a highly industrialized land, are worth heeding. The Extension Services carrying the best medical facilities to the last man, providing him with educational facilities and broadening his mind and making him feel part of the nation, can only (I emphasise the word, *only*) be done by providing suitable communications to his very door. This communication system must be provided first of all if the aim is to have an all round balanced development. We cannot wait and say it will grow gradually after prosperity has dawned. The cost of the effort that is needed to carry modern amenities to every part of the country without communications will be enormous. Can we afford it? Or, can we afford to wait? The reply is obvious.

Rural Development

I have dealt with the problem of rural communications in the foreground of this Address for various reasons. It is an essential development, but the development is slow and as such it is my duty to point out an objective approach to this problem. What factors should we keep in mind while thinking of our rural communications? Land is scarce. Holdings generally are small. The importance of the bullock in our rural economy may keep the bullock cart on the road for an unlimited long period. Owing to the paucity of finances, maintaining of the roads to a usable standard presents a difficult problem. Obtaining land for road construction is a serious problem. Its acquisition for community purposes without compensating in kind is an extremely difficult process and entails hardships on individuals. These have to be and must be reckoned with. In the Punjab, a very successful attempt of consolidating the holdings and taking the land needed for community purposes including that for roads out of the pool of village land and distributing the remaining on pro-rata basis amongst the landholders, has proved a very valuable approach to the problem. It may be the only approach. It does not involve individual hardship. Small losses or small gains to a community, when shared by all, lose their sharpness. The difficult problem of land acquisition for road communications can thus be solved. A Central model legislation with concurrent powers with the States needs to be enacted.

I will be failing in my duty if I do not acknowledge the enthusiasm that has been evinced by rural people in the rural uplift movement. It is popularly called Shramdan movement. This movement can solve the financial problem of the rural road system to a very large extent. It needs to be rationalized, vitalized, and given an impetus. But I will be equally failing in my duty if, from some of the examples that I have seen, I do not sound a word of caution. Uncoordinated, ill-planned and technically unsound schemes, if executed, may subsequently need serious modification. It may kill the laudable incentive of free gift of one's effort in the form in which it is being given. A few words from this platform may be audible all over India and a large measure of human labour may be diverted into the execution of a more balanced rural communication system which should not need large-scale modifications later on. It is time that those who are in-charge of such works should pause for a moment and consider the necessity of obtaining sound technical advice on such matters. Similar uneconomic developments are taking place in other spheres requiring technical advice and skill at the right level, but here I need only refer to rural communications.

Urban Problems

So much for our rural communications; but there are urban problems equally large and equally important. In contrast to the large expansive rural system covering practically the whole of the country, the urban needs are concentrated and are capable of being surveyed and arranged with precision and in detail. A city, however, is no longer a small unit of olden days. Now-a-days, it embraces a region for keeping it

alive and vital. We hear of Greater London Plan—Greater Delhi and Greater Bombay Plans. Our road policy towards the urban needs has been based on chronic poverty idea of local-body finances since old times. The pattern of taxation was so evolved that this chronic poverty became a bye-word—and urban population, the elite and the educated, could never think big. Cities became slums. Their communications went down to low levels. Even the Government considers a national Highway passing through a city a local problem. The incoming day-to-day food from the farms, from the fisheries, from the milkmen in the villages, is carried by man-propelled or slow-moving transport on roads designed for fast traffic which was left and is still left uncared for to sort itself out. The street problems of the city are multifarious, more so in India where we have mixed traffic on the roads. Street capacities need to be enlarged but the work has remained unattended for want of funds with the local bodies. Government must need take up the matter of local body finance seriously.

Still there is another, and a much bigger problem requiring careful thought and decision. The psychology of using self-propelled units by every individual is growing. We should not forget that it takes only 4 sq. ft of area to seat a person in a cinema or a stadium, but it takes 250 sq. ft of area to park his conveyance. If in time to come, as it will happen, every one drives his own car to such a place, the problem, is not of catering for seating in a recreational place, or in a working organization, or in a departmental store, but reduces itself to making provision for parking the cars. Should we allow such an individualistic psychology to grow, or should we resist it and create from the very beginning (the disease has just germinated) the habit of using public conveyance by restricting the use of individual cars outside the limits of certain congested areas of the city. We may learn a lesson from the countries who have allowed this psychology to grow and are unable to solve the problem now. Should we not create a society democratic enough which will use, for going to work and back, a public conveyance? It will be an act most befitting the socialistic pattern of society. It will stop the blight coming to the central portions of the city. It will save a large amount of human effort in constructing, demolishing, and reconstructing some portions of the city which have given "character" to it. Let us make an experimental beginning anywhere but let us make it immediately. It will be an unpopular experiment but a win lead.

The city communication problem is worth serious study. We should consider our urban plans in relation to the region round a city and within the city think of mass transport. And the last but the most important aspect, we should think of altering taxation pattern to obtain finances for the city.

To obtain lasting countrywide results, a thorough study of the three problems mentioned above, viz., regional, rural and urban road communications, is imperative. It needs immediate attention before we get accustomed to forms fixed and rigid when it may be too late to mend. In the perspective depicted above, the Nagpur plan does need revision. Let us revise it boldly, not basing our solutions of the problems, if I may repeat the word, on the subconscious feeling of chronic poverty. Our so-called poverty with proper guidance, can be used to enrich our life just as a badly smelling manure in the hands of a good gardener converts itself into the fragrance of the flower.

Execution of the Plan

Assuming our plan stands reconsidered, revised, brought up-to-date and is approved, the prospect of executing it seems to be worth studying with much more intensive thinking than we do now. To implement any plan, there are three basic requirements:—(1) Adequate finance (2) efficient and conscientious personnel, and (3) an efficient procedural method where effort to execute is reduced to the minimum, mistakes are eliminated, responsibilities squarely shouldered at various levels in a rising order of hierarchy, and when mistakes are committed they are detected easily. I will deal with these problems in detail.

Finance

The second Five-Year Plan provides for Rs 269.5 crore for road construction, comprising Rs 55 crore for National Highways, Rs 27.5 crore as Central aid to States Rs 25 crore as Central Road Fund—representing a part of road-usage taxation, and Rs 162 crore as States' expenditure. Per squre mile of area, the road milage in our country is 0.26 as compared to 1.11 in the United States of America, 1.99 in the United Kingdom, and 2.4 in France. Even in this low figure of 0.26, 60 per cent of the Roads are unmetalled. This amount of Rs 269.5 crore will add a road milage of 0.05 per square mile only. Is it adequate? Is not this progress extremely slow? If 75 per cent of the inland transport is done by road, are we justified in restricting the road plan to the figures quoted by me? I hear even this target is likely to be reduced. Some of the immediate needs of even National Highways such as the cost of widening them at least to two-lane width and building of bridges on main streams, cannot be met from this amount. Should we not change our policy for financing roads particularly if, from the funds available, there is no chance of appropriating a larger figure?

It may be well to indicate the magnitude of road development required in our country. The target in Nagpur plan was to have a road system so that no village was more than 5 miles away from a metalled road in a developed area and 20 miles in an undeveloped area. The milage of metalled roads assessed for this purpose was 1,23,000 miles. This target is expected to be reached during the second Plan period. If we now desire to bring all the villages within a distance of 3 miles of a metalled road in developed areas, 9 miles in semi-developed or forest areas, and 20 miles in undeveloped areas the total length of metalled roads should be 3,20,000 miles. The cost of such a road system with corresponding development of unmetalled roads would be something like Rs 4,000 crores. The total provision for road development in the second plan is Rs 269.5 crore. At this rate we shall need 75 years to attain the proposed target. Even then we shall have a road system at the rate of 0.5 miles per square mile of area against the figure of 1.99 of Great Britain and 2.4 of France. The need for greater allocation of funds for road development cannot, therefore, be over-emphasised.

If finance are scarce and there is no help, we might think of other avenues. Road construction bonds redeemable after a fixed number of years and guaranteed by the State can be projected. Road user taxation can be directly or indirectly ear-marked exclusively for road development only. These methods were stressed at some length by my predecessor last year. The inadequate provision of funds for road development reflects in heavier transport costs. The saving will be of the order of 25 per cent.

The other advantages resulting from good communications which act as High Transmission lines of transport of civilization into the country cannot be evaluated in terms of rupees and pice, but that they are very considerable cannot be denied.

Funds should be guaranteed on a long-term basis. Recently, the United States of America have, in 1956, approved a 13-year programme to be followed after 1970 by a 10 year programme with guranteed funds. The road financing policy followed so far on a halting day-to-day budgeting has proved inadequate for a continuous road programme. Adequate funds on long range basis have to be guaranteed if good road communications are to be obtained.

Apart from the funds for construction, the highway departments should be permitted to utilise one to two per cent of the funds in any plan for preparing the future projects. Collection of data for the plans of the future is very important. Fact finding surveys are indispensable for correct planning. The advantage is that in the subsequent development of the road needs in the 3rd, 4th and fifth Five-Year

a correct and a realistic picture could be projected. Such a fact finding organization will require training and it will take time to evolve. The Centre and the States both need such an organization. I have stressed this point particularly because any organization which does not appear to produce immediate results is looked upon as unnecessary. The statistical sections of this type will not only collect facts and figures for future planning but will assist the administration in checking performance.

Personnel

Regarding the second point, the personnel required for execution is real bottle neck. Trained enginers are not available to the extent that the country's needs demand. I suggest that at least on the road construction the need can be satisfied by taking off a percentage of the engineering students from various institutions and after a short detailed instruction course putting them in the field. The practical side of the engineering can be picked up by them with a certain amount of basic training without difficulty. After 2 to 3 years, each of these young men can be reverted to the college for completing his studies. I feel that for certain types of mind this sort of course will greatly help in making them sound engineers.

Procedure and Administration

The third is the most important problem. With assured finance and even a competent staff in the field, the procedure which is adopted for carrying on works is so faulty that achievements are slow and poor compared with the efforts put in. We are conscious that the government is alive to this problem since it appointed Mr. Appleby to go into the organizational aspect of this problem. It will not be out of place to quote verbatim from this authority. The faults are so obvious that even a study of a few months by an outsider has brought them out. He says:

"The relationship between persons in the secretariat and persons in the 'technical services' is too rigidly remote. It is true that one of the great virtues of the Indian system is the emphasis placed on "generalist" qualifications for officials in top positions. But there is no single source of generalist personnel, no single formula for developing them. Some persons with technical back-ground become competent generalists. Others are capable of transformation into generalists by a diversification of their experience, and some persons put through the experience conventional for preparation of generalists never develop any real capacity for high-level performance. Even some persons in business or in the universities can qualify rather quickly for high-level generalist posts. Conversely, top level governmental generalists often can be admirable heads of technical or industrial organizations. The persons capable of serving well at high levels are rare birds; they must be sought wherever they may be found, and developed by various means.

"The very word 'administration' here is too narrowly conceived as relating to financial administration and personnel administration coupled somewhat vaguely with other functions of the secretariat. Administration is basically the conduct of programmes important to citizens and to the nation; fiscal administration and personnel administration are merely aspects of the general management of a variety of programmes. Administration here seriously needs a much more marked orientation to the conduct of programme, because 'administration' here is by and large negative. The system of personnel arrangement and personnel management contributes importantly to this bad condition."

It has, however, not been possible to implement these suggestions. Administration is run on old lines. Technical services are as remote from Government and, if I may say, more remote than even in olden days. The result is what we see.

There is another and a more vital factor—the procedure laid down for regulating the execution of road works. Suitable alteration in the procedure to meet the conditions created by the demand for highly accelerated progress is necessary. Modification of the outmoded administrative outlook is called for. Frustration following in the wake of poor results despite herculian efforts has to be avoided. New incentive studies are to be made. Such factors leading to indirect losses are many times more than the various committees can be expected to fathom. It is time that national effort (which is not sufficient to cope with the work) should be utilized fully and not at a fraction of the efficiency as at present. The mill-stone of tradition in procedure is hanging round our necks and only allows us to walk at a time when we should be running fast. Balanced delegation of powers, fixing responsibility at all levels, and taking serious note of lapses is the immediate need of the country. Recently, the Prime Minister, speaking at the Institute of Public Administration, stated that only those nations grow who can adjust themselves to changing conditions. His vision sees the faults. Let us eradicate these.

The bottlenecks take the form of sanctions for personnel which lag very much behind. There are abnormal delays in obtaining such sanctions. Further delays occur in obtaining persons from the market. The rules for purchasing of tools for construction have to be stream-lined.

Three-Year Programme

Another aspect of this problem of procedure, which is important, is detailed planning. It is distinct from the broad planning and fact-finding unit mentioned earlier. I have voiced it before at another place, but it applies very forcibly to road development. In any working year, there should be with the department concerned a programme under execution and a completely technically and financially approved programme for the next year, and planning of the third year programme should be in hand to be sanctioned in the following year. The process is to be repeated every year. This procedure will ensure sound and considered schemes both technically and financially. The distinct advantage of this procedure would be a better control on the technical and financial side. No last minute projects will be rushed through. The thoughtlessness that is found in certain schemes will be eliminated. Well considered, balanced, and thoroughly examined schemes will emerge. Hurry which at the present moment retards speed will be eliminated. There will be less work for Audit, less work for Public Accounts Committees and less waste of public funds. At present, the builder is frustrated because he is not able to build well; the user is frustrated because he thinks that he has not got full value for his money; and the Government is not satisfied because of their not being able to prove to the public that they made the best use of the nation's money. There is no other way, as far as I can see, which can be devised to eliminate the present chaotic procedural conditions which are frustrating all concerned, particularly the younger generation whose initiative is being sapped at the very start.

I cannot over-emphasise the immediate need of Government eliminating the devitalising factor of carrying on works under present conditions. I hope they will take notice of this factor.

Landscaping

Now, I pass on to another aspect which is technical, but has an aesthetic bearing. It is not the duty of a Road Engineer only to build roads; his technical contribution should not be confined to providing smooth and safe roads. He must create road environments which contribute substantially to pleasant road journeys. Somehow or other, in the last 150 years this aspect has not received any consideration.

As our ideas are based on immediate and, if I may say, cash economy effects, we let borrow pits be made next to our embankments. They permit not only water to stagnate but at the same time, reduce the stability of the road. The surrounds become unhealthy and a source of malaria. Instead of beautifying the surrounds of the approach of a bridge across a large canal or river and landscaping it and making it a beauty spot which being easily accessible by road may serve as a recreation place, we convert the surrounds into marshes with undergrowth of reeds, brambles and bushes, and make them into places to be shunned rather than sought after. Landscaping of highways is not planting of roadside trees. It is the creation of environment along the road which are peaceful, aesthetically satisfying and make journey along the road pleasant, less fatiguing, and interesting. Every highway engineer's office should have a properly trained landscape architect attached to it. Sooner or later, the society will revolt against the poor surrounds of a road, but the cost of restoration of the damages done will be out of proportion to that spent on executing the work now. Landscaping is a slow process. It takes years to bring nature into a form that will prove satisfying. This neglect of the surrounds of roads to my mind, is unsocial, and sooner a beginning is made to arrest it the better it will be. I am certain that such a proposal will be decried as luxury and something unproductive, as something that can be dispensed with, as something which is not development, and as something which will finally be termed unnecessary, or at best, capable of being postponed. It is for us in the Roads Congress to examine this aspect of road development and provide for it in all the estimates that have to be sanctioned. As I project my mind in the future, I see these roads growing not only as arteries of traffic but providing journey of lasting memories. Let us lose no time in making a beginning of building aesthetic into our roads.

Research

Touching on another technical aspect of the road projects, I have to emphasise the need for a large-scale utilization of our research results.

The Indian Roads Congress has, through its various committees, been very keenly fostering research work on highway problems in the country. It has played an unusually important part in getting the Central Road Research Institute set up as a national laboratory under the Council of Scientific and Industrial Research. A good deal of work is being done in this Institute and other Institutes in the States with the objective of making the execution of road works in the 5-year Plans and the future plans efficient and economical. But there are still several States which do not possess road laboratories. It is essential that such laboratories are set up in all the States as soon as possible. The Indian Roads Congress will assist in collaborating with the State laboratories and the Central Road Research Institute on problems of common interest and investigations on any particular local problems.

Application of the results of research is normally a slow process. It gets sometimes a spurt under conditions of wartime stress or in industrial ventures in which cases strong motives operate. We will be constructing the bulk of our road programme in the next 10 to 15 years. How important it is that the results of research obtained in this country and also in other countries should be made applicable to this heavy programme of construction. May be that in time to come, with large resources of atomic energy where high temperatures can be obtained, it may be possible to simply bake the earth crust to certain width and grades to form roads.

Funds for research work are generally not sufficient. Laboratory conclusions cannot be applied in the field on a large-scale and without experiments under working conditions. It being experimental stage, a certain amount of risk is involved and, under the present conditions, even experimental failures come up for an unusual type of public criticism. The initiative in applying the research to field construction is deteriorating. We have to arrest this tendency at all costs. Probably, out of

construction funds we should create Road Research Fund. It will put road research work beyond the pale of day-to-day problem of budgeting; the irksome and frustrating task of making a convincing case for each research project and its application under field conditions. A high-powered committee of the Indian Roads Congress would help the various Governments in organizing this fund and by providing such expert committees out of their membership which, as we all know, embraces the entire road engineering talent of the country.

Under the auspices of the Road Research Division, there will be a special session this year to examine and co-ordinate road research in India. I hope that as at Nagpur, the country's road plan came to be associated with that city, the research programme in future will be associated with Shillong and will become the basis of our research projects.

I have gone in brief into the question of the necessity of revising our Nagpur Plan, and revising our ideas of rural and urban development plans. I have also discussed the question of finance and the elimination of bottlenecks of serious nature that prove to be impediments to the execution of the plans. I have touched upon the question of personnel and how it can be made available. I have suggested a continuous 3-year programme to be on the table of each engineer. I have emphasised the need for research and the manner in which funds can be provided for research work.

Reading through the Addresses of the past Presidents, I find that suggestions are made every year but they do not find any implementation and that, in certain cases, they are not even considered. I hope that some machinery can be devised in which the suggestions made by the various independent institutions in India are objectively considered by Government, without which our institutions will lose their dynamic thinking.

With these words, Sir, I request you kindly to declare this Congress open.

DECIMALS

At a Midland works men received a bonus of .25 an hour until it was raised to .3.

There followed several callers at the wages department to protest against the lowering of the bonus. The personnel manager altered the cards to show .30.

Then all was well.

INAUGURAL ADDRESS *

By

SHRI SAIYID FAZL ALI

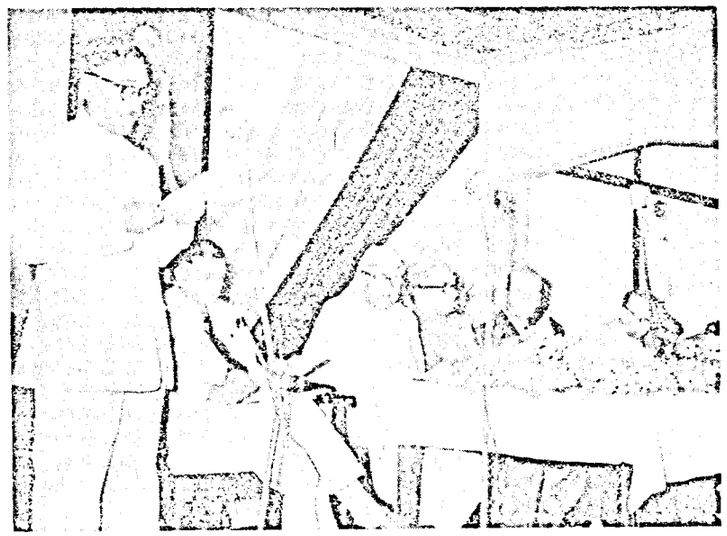
Governor, Assam

Sunday the 12th May 1957.

Ladies and Gentlemen,

I was keenly looking forward to the pleasure and privilege of being present at the opening of this Session of the Roads Congress and of being able to extend my personal welcome to the distinguished delegates assembled here from all parts of the country. Since however, to my deep regret, this has not proved possible, I must content myself with the expression of my earnest solicitude for the success of your deliberations on a subject which is so vital for the progress of our country.

Shillong by virtue of its scenic beauty and salubrious climate can well claim to be the queen of the hill stations of India. Delegates to this Congress could not



Shri B. Choudhury, Chief Engineer, P.W.D., Assam reading out the Address of the Governor of Assam

have failed to notice the picturesque, though tortuous, ascent to this bracing plateau which rises to an altitude of about 5,000 feet above the sea level. With your expert vision, I am sure that you must have been able to discern with greater technical comprehension than an average layman the nature of the obstacles and limitations which must be overcome in order to open up road communications in these parts. The magnitude of the achievement in connecting Shillong with other parts of the

* Owing to the un-avoidable absence of the Governor of Assam, his Address was read by the Chief Engineer, P.W.D., B. & R., Assam.

State is, however, evident even to the eye of the layman and is equally clear that this is an achievement which is fully matched by the importance of the link that has been forged. Road Transport is of far greater importance for Shillong than it is for any other State capital in India, for unlike other State capitals Shillong has not the advantage of any alternative means of transport like river, rail or air and has to rely exclusively upon the road transport for everything.

The importance of roads has been recognised throughout history and there is nothing surprising in the fact that those who built the great Empires of the past were also the greatest pioneers in road-building. Roads were vital for the consolidation, maintenance and expansion of these Empires. The Romans were perhaps the greatest road builders of the past and their success in maintaining their vast Empire for as long as they did was largely due to their net-work of excellently maintained roads. In those days it was literally true that all roads led to Rome, for the only permanent and usable roads at that time were those which were due to the pioneering efforts of the Romans. In our country, all the great Kings and Emperors of the past were fully alive to the importance of connecting various parts of their domains with their capitals through an efficient system of roads. The Grand Trunk Road which is yet maintained as one of the most important artery of communications in Northern India was built centuries ago. Despite the growth of alternative means of transport, such as rail, river and air transport, in the intervening period, the Grand Trunk Road remains a vital link in our country's net-work of transport and communications. This is so because the road transport has advantages which are of its own. These advantages are intrinsic and unique and they are of such a nature that they are indispensable to a country like ours, with limited financial resources and vast distances to negotiate. They are particularly indispensable in this period of our development when we are most anxious to open up new avenues of economic growth and prosperity. One might even venture to say that at least in the foreseeable future there is no chance of road transport yielding its importance or being displaced by other media of transport, no matter how high a stage of development these newer media might achieve. Road transport might not be as cheap as the river transport, but it is certainly much quicker and has a great extensive range than the river transport. It might be neither as cheap in the long run, nor as swift as the rail transport, but it can be opened up more quickly and at a fraction of the initial cost of the latter. It can also reach out to points where rail transport can never hope to find access. It might be neither as swift nor as far-reaching as the air transport, but it provides an incomparably cheaper means for the continuous movement of commodities in bulk.

In our pre-independence days, the road system under the British grew up largely, if not mainly, in response to the needs of a strategy or administration. Since independence however the direction and extent of our road planning has been much influenced by the need for promoting our economic development. It has been increasingly felt that if the country has to progress and if the standard of living of our people is to be raised, road development too must be planned in such a manner as to enable us to use fully our national resources in a balanced and co-ordinated manner, bringing the desired results in the shortest possible time. At about the time of Independence Assam had only 2,610 miles of motorable roads including 899·8 miles of national highways. Of these, 2,040 miles were in the plains districts and 570 miles in the hills.

According to the Grid and Star formula, evolved in the Chief Engineers' Conference held in Nagpur in 1943, Assam's requirements of motorable roads including national highways was fixed at 13,200 miles. On attaining of Independence, shortage of road length in Assam was keenly felt and a programme was drawn up in the post-war plan for augmenting our road mileage. But unfortunately this programme had to be dropped even before it got half way through for want of financial assistance from the Centre. Subsequently, the development of road communications in this State virtually came to a standstill until the First Five Year Plan took

shape. On the completion of the Second Plan, a further length of 1,872 miles of new roads will be added to the existing length bringing the total to 8,668 miles. The Second Plan emphasises improvement and stabilisation of the existing roads in order that these might be able to stand up to heavier traffic rather than the building of new roads. Further 16 bridges of total 5,400 feet in length have also been taken up under the Second Five Year Plan.

But considering the total road needs of Assam, even the programme of expansion as outlined in the Second Plan can hardly be said to be adequate. Unfortunately this is a State where roads are subject to havoc wrought by the elemental forces of floods and earthquakes. The Assam rail link is apt to be disrupted by floods and for several months in the year it happens that the traffic must be either reduced or suspended. Within the State, we have also many turbulent rivers which cause widespread flooding and breaching of roads at many points every year. Inaccessible but important places in the hills too need to be linked up by a net-work of all-weather roads. As such the need for better and more stable roads in Assam can be hardly over-emphasised. We must have roads which must prove capable of withstanding the fury of the elements but which at the same time should not be beyond our means.

I would like to take this opportunity of expressing the importance of road development not only in Assam but also in the entire submontane Northern region of India, stretching from Assam to Kashmir. A net-work of roads facilitating easy transport in this region is considered to be of great national importance from the point of strategy and security. In this connection I cannot do better but to quote from the address delivered by Shri Chandulal Trivedi, Governor of Punjab, at the 16th Session of the Indian Roads Congress held at Simla in April 1952: "To Napoleon", he said, "is attributed the saying that an army marches on its stomach. It would be perhaps equally true to say that in war a nation marches to victory and in peace to progress mainly on its communications of which roads are very important elements."

Founded by Sir Kenneth Mitchell, in 1934, the Indian Roads Congress has grown in strength and importance and to-day it provides a forum where road Engineers from all over India and elsewhere can regularly get together to exchange views, share experiences, formulate opinions and generally tender expert advice to Government on how to plan our road development to serve our mighty national projects as well as our security.

Confronted with problems of such magnitude I need hardly stress that economy in construction and design assumes foremost importance. It is particularly in this regard that the opinion and advice of experts can be of greatest value. I am tempted to quote again from the speech of Shri Chandulal Trivedi on the question of economy without being understood that I necessarily endorse the view expressed therein. "Might I", he observed, "voice the feeling that I have come across that an engineer is sometimes, if not often, a man who can do for Re 1-8-0 what an ordinary man with commonsense can do for himself for Re 1." The distinguished persons who are here would better be able to assess whether and to what extent such a feeling might yet prevail and I am sure that as responsible experts they will do their best to remove any impression of this nature. Of course, it is true that costs are high and with the increasing tempo of our national economy they might even tend to rise, but by the exercise of a little initiative in the judicious use of the local available materials without detriment to quality and if possible enlisting some measure of voluntary offer from the people in the locality, it should not be impossible to effect some economy in what is undoubtedly a costly venture.

I do not propose to take more of your time and I will now conclude with my best wishes for the success of your deliberations.

ADDRESS OF

SHRI BISNURAM MEDHI

Chief Minister, Assam

At the Inaugural Function

Sunday, the 12th May, 1957

MR. President, delegates to the Indian Roads Congress and Ladies and Gentlemen.—

I am happy to welcome you all to-day to Assam amidst the charming scenery and inspiring surroundings of this beautiful hill station of ours. I, on behalf of myself, my colleagues in the Government and the people of Assam, thank you for holding the present session of your Congress in this State. I do hope your stay here will be pleasant and comfortable and you will carry happy memories of your stay here in this beautiful hill station and our problem State.

Assam, situated on the North-East corner of our country has problems peculiar to her own. Heavy rainfall, frequent floods and earthquake often cause devastations which our Engineers have to face both during construction as well as maintenance. I hope the deliberations of your Congress will help to a great extent in solving our problems and in the reconstruction of the country.

The Chief Minister delivering his speech

Economic prosperity of a country depends to a great extent on improvement and construction of a network of roads. In order to achieve an all round improvement, it is essential first to have a good system of road communications. Apart from national economy and other social benefits, we have to consider the question of defence as well.

For this purpose a well developed and properly planned system of roads is an essential pre-requisite. It has a special significance to Assam, as we do not possess

adequate railway facilities, and also due to our peculiar and strategic situation having a very long length of international boundary. Road Engineers have, therefore, a great responsibility in this respect.

In any programme of road development, the cost of construction is a very important consideration. Our funds for development being limited, it is for the Road Engineers to evolve methods for construction of low cost roads. Some research is obviously needed in this direction. I hope Road Engineers from all over the country who have assembled here to-day, will certainly give a serious thought over this matter of construction of low cost roads. In some of the hill areas, where we have started construction of roads, we find difficulty in getting hard stone for construction of all-weather roads and carriage of such materials becomes expensive. It is up to you to see how roads could be economically constructed in these hill areas also.

With regard to the State of Assam as also for the whole of the country, the mileage of roads per square mile of land area and per head of population is much lower than those in other advanced countries. Most of our important villages are not connected by road, and some even are away from any motorable road by 10 miles or over. Under the Second Five Year Plan, we have in Assam a programme for construction and improvement of about 2,000 miles of roads, which will bring up the total of road mileage within the State to 8,900 approximately as against the target of 13,200 miles recommended under the Nagpur Plan. Similar is also perhaps the position in other States of the Republic. Planned efforts to increase our road communications are, therefore, essential.

There is a general complaint from the Public about the inefficiency of the Administration and also delay in execution of projects in various Departments of the Government. Now, that you have all gathered here for technical deliberations, you might also discuss and suggest ways and means for general improvement in these regards and how to speed up the work and economy can be effected. I know, the Indian Roads Congress, during its brief span of existence for about 24 years has rendered yeoman service in the matter of research and laying down of standard specification for roads in our country. With the advent of the 5-Year Plans, highway engineering has become more and more important and construction work has accelerated a great deal. The responsibility and duty of the Engineers have increased very considerably, but the dearth of technically qualified men has been a great handicap, and this greatly impeded the progress of work.

In Assam, particularly Engineering Institutes came into being after independence and even then much remains to be achieved in the standard of teaching. We have to depend a lot on Engineers recruited from outside the State as the requisite number of such persons is not available within Assam. In the matter of smooth and speedy execution of the various projects under 5-Year Plans, dearth of technically qualified persons has proved to be a formidable hurdle to overcome in our State. Nonetheless, we have been trying to push forward our various developmental work and I am proud to say that the success so far achieved is very encouraging.

I am particularly happy to note that as a result of this session of the Indian Roads Congress and your esteemed visit to our State, engineers of Assam will get many experiences and by your valued suggestions, they would be able to carry ahead their various constructional work with success.

I do not like to speak here at length. I accord you all a hearty welcome to Assam and fervently hope that your deliberations under the charming and refreshing atmosphere of Shillong would be fruitful.

JAI HIND!

SPEECH

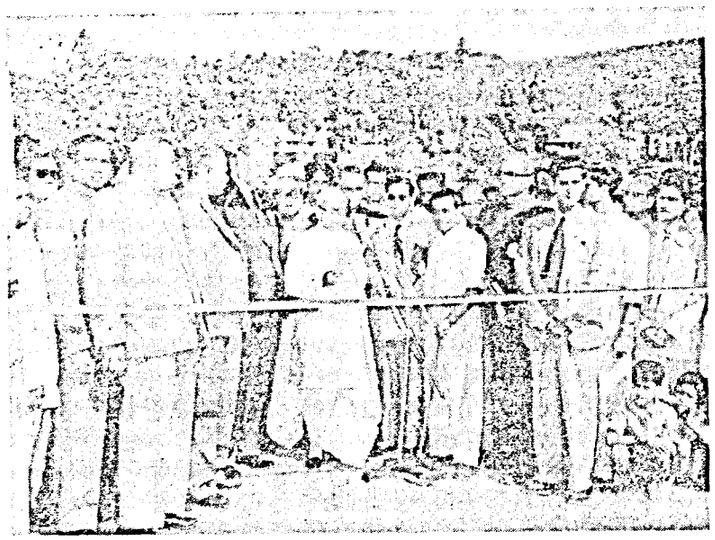
by

SHRI BISNURAM MEDHI, *Chief Minister, Assam,*

at the Opening of the Exhibition.

FRIENDS, I thank you for the honour you have bestowed on me by requesting me to open the Exhibition held in connection with the twenty-first session of the Indian Roads Congress. Roads are the life-line of progress and the necessity and urgency of more and more roads in this strategic part of India cannot be over-emphasized. I am sure, your fruitful deliberations and lessons obtained from this exhibition will go a great way in achieving the goal you have in view.

An exhibition of this kind is something new in this part of India. The Indian Roads Congress has been held for the first time in this State. I take this opportunity of welcoming you all to Assam.



The Chief Minister delivering his speech

A good communication system is a condition precedent for a country's development. In our country, digging of wells, planting of trees, building of roads and rest houses had always been regarded as a great virtue since ancient times. Even then India does not have the required length of roads till today. The road mileage per one lakh persons in India is 89, and that per square mile is .22. A progressive transport system is wholly dependent on a chain of good roads. In India there are 88 vehicles for about a lakh of people. This figure is very low in comparison with other countries. In the United Kingdom, for every one lakh of people there are about 7,000 vehicles. A more efficient network of roads would encourage more use of automobiles and it would, in turn, foster better trade and commerce in the country.

Assam is very undeveloped in the matter of communications. I need hardly emphasize that Assam is one of the most backward States in India in so far as transport and communications are concerned. Nearly two-thirds of Assam are hilly

region, where communications are still in the undeveloped condition. Transport in the hill areas needs a great deal of improvement. Distances in some parts of these hills are measured not in terms of miles or metres, but in terms of walking days.

Assam is a border State surrounded almost on all sides by foreign territories. It is linked up with the rest of the country by a narrow strip of land through the sub-Himalayan region. Railway communication connecting Assam with the rest of the country is also not adequate. The communication and transport problems have been accentuated greatly after the partition of the country. The people living in the border areas of Assam and East Pakistan have been facing great difficulties for want of roads. Their economy, which is entirely dependent on their cash crops, has been thrown out of gear due to loss of markets in Pakistan and want of roads to the nearest markets in Assam. With the attainment of independence, we have given topmost priority to building of roads particularly in hill areas. Road construction in hills is a tough job, but I am glad to find that despite tremendous odds, we are making a great headway in this respect. In this context, therefore, development of road communication in Assam has assumed very great importance. At the dawn of independence, Assam had only 2,610 miles of motorable roads, including about 900 miles of national highways. Of these, 2,040 miles were in the plains districts, while the rest in the hill districts.

The Nagpur Plan of 1943, evolved at a conference of State Chief Engineers, recommended the increase of Indian Union's road mileage to 3,85,000, of which 2,90,000 miles would be motorable. This means that the net increase envisaged in the Nagpur Plan works out at 50 per cent.

According to the Nagpur Plan, Assam's requirement of motorable roads, including National Highways was fixed at 13,200 miles. Under the Post-War Reconstruction programme, a vigorous road making scheme was taken up, but that had to be abandoned half-way, as Central assistance was suspended.

Under the First Five Year Plan, therefore, a bold road development programme was taken up in Assam.

One thousand, three hundred and seventy-three miles of roads and 4,300 running feet of major bridges were included under the general plan. The estimated cost was Rs 432 lakhs and the target of expenditure fixed was Rs. 265 lakhs, within the plan period. The target of expenditure achieved at the end of the Plan period was, however, 262 lakhs. The balance was carried over to the Second Plan as spill over.

For the Autonomous, Hill Districts, 625 miles of roads were envisaged to be constructed with Central assistance under Article 275. The estimated cost was Rs 342 lakhs, and the target of expenditure fixed at Rs 256 lakhs within the plan period. The target achieved was, however Rs 184 lakhs and the balance carried over to the Second Plan as spill over. The target could not be achieved in full, due to various bottlenecks, the main being the shortage of labour and non-availability of bridging materials from outside the State.

In the Plain Tribal areas, 82 miles of roads were included under this programme at an estimated cost of Rs 26.8 lakhs. Rupees 16.8 lakhs were spent during the plan period and the balance carried over to the next plan.

Besides those projects envisaged under the First Five Year Plan, there were also a number of other schemes for road construction from funds available from the Government of India under various grants-in-aid.

With roads, comes the question of bridges. We have in Assam 321 major bridges totalling about 58,500 running feet. Many of the streams and rivers are yet unbridged and there are 105 boat ferries, which present a serious bottleneck to the free

movement of road traffic. Priority had therefore, been attached to the construction of bridges during the First Five Year Plan period. Total length of bridging taken up under different programmes approximated 11,615 running feet at an estimated cost of about Rs 26.6 lakhs. Of these, the Barak Bridge at Silchar, has a special feature worth mentioning. The total length of the bridge will be 720 feet with a free board of 30.09 feet for allowing steam vessels to pass during high floods. The Central span will be a 400 feet suspended span, self anchored.

In the Second Five Year Plan, a gigantic road development scheme has been envisaged, at a total cost of Rs 1,185.84 lakhs. This amount will be spent on implementation of general state level schemes and schemes undertaken with funds available from grants obtainable from the Government of India under Article 275 of the Constitution.

On completion of the Second Plan, a length of 1,872 miles will be added to the existing road mileage in Assam, bringing the total to 8,499 miles. In the Second Plan, much stress has been laid to improve the existing road where traffic is developing considerably, rather than adding to the length.

An additional programme of Rs 38.0 lakhs is being selected for new road schemes, under Article 275 in the Hill Areas. This will bring the total road length to about 8,668 miles by the end of Second Five Year Plan.

Sixteen bridges totalling about 5,400 feet in length had been taken up under the Second Five Year Plan.

Friends, I have already taken a long time. My aim in speaking before you all about Assam's road needs and the programmes of development is to draw your attention to the problems of Assam and to give you an idea as to how, the State Government desire to solve them. I am happy that for the first time Assam has been able to play host to such a distinguished gathering as the Indian Roads Congress delegates. I also hope that your deliberations would help our Engineers to carry ahead our various road construction projects and flood protection measures.

With these words, I declare the exhibition open.

JAI HIND!

NEED FOR CO-ORDINATION

It is useless to have skilled design and specification without skilful and careful production and erection.

LEAST RESISTANCE BENEFITS

Criticism is something that can be avoided by saying nothing, doing nothing and being nothing.

MESSAGES

to

the Twenty-first Session of

THE INDIAN ROADS CONGRESS

held at Shillong from the 11th to the 18th May, 1957.

SHRI JAWAHARLAL NEHRU,

PRIME MINISTER OF INDIA

I SEND my good wishes to the Annual Session of the Indian Roads Congress. I am glad this is being held at Shillong, because the improvement of communications is perhaps more important in the hill regions of India than in any other part of the country.

SHRI C. P. N. SINGH,

GOVERNOR OF THE PUNJAB

I AM very happy to learn that the Indian Roads Congress is holding its next Annual Session at Shillong shortly. Roads form one of the most important features of our development plans. In a way, they symbolise the march of India. The old interior is being rapidly linked up and everywhere the people are coming out of their age-old shells.

It is but proper that an activity of this kind should be backed up by scientific study and thorough research work. The Indian Roads Congress can serve that purpose. The venue of the present session is especially significant for the implementation of the roads programme. I wish the delegates all success.

SHRI RAJ BAHADUR,

MINISTER FOR SHIPPING, GOVERNMENT OF INDIA

IT is a great pleasure for me to send my greetings and good wishes to the distinguished delegates and engineers gathering at Shillong from all corners of the country for the 21st Session of the Indian Roads Congress.

To carry our country forward on the onward march of progress, we have to extend our road-communications to its remotest corners and link up its farthest village and hamlet with what is termed as "modern civilisation."

The success achieved by the nation for the implementation of the First Five Year Plan and the launching of a much more ambitious Second Plan have released an un-precedented wave of enthusiasm and energy in our people for all developmental activities and programmes. This enthusiasm has found expression in the execution and completion of numerous works of construction, major and minor, by voluntary labour organised under the Shramdan movement. May I, therefore, suggest that the Congress while considering the problem of development of rural communications, especially the construction of feeder and approach roads to our villages, may consider the possibility of harnessing this enthusiasm in our people and capitalise it for

accelerating and augmenting the pace and extent of our road-construction programmes and schemes.

The expansion of our industries and our programme of rural reconstruction must be harmonized and synchronized to avoid possible hazards of lop-sided development of our economy.

The extent of development of road-communications provides a safe barometer for measuring the growth and progress of a nation. Keeping in view the present level of development of our road system, we cannot but be conscious of the supreme need to grow in size—and grow at a much greater speed—to measure upto the stature and standard of other advanced countries.

The advice of the Congress, which represents the cross-section or even the cream of our engineers and experts in this field, will undoubtedly be of immense value, both to the Central and State Governments in our country. I wish the Congress the best of success in its deliberations and results.

SHRI K. SANTHANAM,

CHAIRMAN, FINANCE COMMISSION, GOVERNMENT OF INDIA

DURING the past one year, I have travelled along the roads of almost every State in India. While in many places I was pleased to find the roads maintained in a good condition, I regret to say that in other places the road-maintenance leaves much to be desired. I am rather concerned that there should be a large programme of road building without adequate provision for maintaining even the existing roads in good condition. I hope the Session will consider ways and means of ensuring a minimum standard of maintenance throughout the country.

SIR KENNETH MITCHELL,

PAST PRESIDENT, I.R.C.

ONCE again I thank you for your invitation to the 21st Session of the Indian Roads Congress. I fear that I have delayed replying to it until the last day of the Session and can only hope that it was as successful as usual.

The main reason for my delay in replying is that I wanted to look out and send you some old photographs on road conditions in Assam which I collected at the time of the Jayakar Committee. One in particular I remember was labelled "Assam Trunk Road, 1924." It showed a small car down to its axles in mud being towed by an elephant. Also they are locked away in some box and could not find them.

I always hope that some day somehow I shall be able to attend. Thank you for asking me.

SHRI G. M. McKELVIE, PAST PRESIDENT, I. R. C.

AGAIN I have to say I am very sorry I shall not be able to attend but I take this opportunity to send my greetings to my many old friends and to wish you all a very successful meeting.

The Papers to be read this session seem particularly valuable and I sincerely wish I were with you all again to listen to words of wisdom from the pundits and to partake of the good fellowship which is a particular feature of these occasions.

Long may the I. R. C. continue to do its good work.

MESSAGES FOR THE SUCCESS OF THE SESSION HAVE ALSO BEEN RECEIVED FROM :

(i) American Society of Civil Engineers;
(ii) The Institution of Engineers, Australia;
(iii) American Road Builders Association;
(iv) Japan Society of Civil Engineers;
(v) The Road Research Laboratory, Harmondsworth, U. K.;
(vi) The Highway Research Board, U. S. A.;
(vii) The Institution of Civil Engineers, London;
(viii) The Bureau of Public Roads, U. S. A.

LIST OF GOVERNMENT DEPARTMENTS AND ENGINEERING FIRMS WHO PARTICIPATED IN THE TECHNICAL EXHIBITION AT SHILLONG

STATES

1. Andhra Highways Department
2. Assam Flood Control & Irrigation Department
3. Assam Forest Development Department
4. Assam Government Emporium & Central Stores Department
5. Assam Publicity Department
6. Assam P. W. D.
7. Bihar P. W. D., B. & R.
8. Bombay P. W. D.
9. Madras Highways Department
10. Punjab P. W. D., B. & R. Research Laboratory, Karnal
11. U. P., P. W. D., B. & R.
12. West Bengal, Road Development

ENGINEERING FIRMS

1. M/s. Assam Oil Co., Ltd. & M/s. Burmah-Shell Oil Co., (India Trading) Ltd.
2. M/s. Gannon Dunkerley & Co.
3. M/s. Greaves Cotton & Co., Ltd.
4. M/s. Heatly & Gresham Ltd.
5. M/s. James Warren & Co., Ltd.
6. M/s. Jessop & Co., Ltd.
7. M/s. Shalimar Tar Products (1935) Ltd.
8. M/s. Standard Batteries Ltd.
9. M/s. Tractors (India) Ltd.
10. M/s. Voltas Ltd.
11. M/s. William Jacks & Co., Ltd.

OTHERS

1. Central Road Research Institute.
2. Concrete Association of India.

ROADS IN MEXICO

Geography and Climate

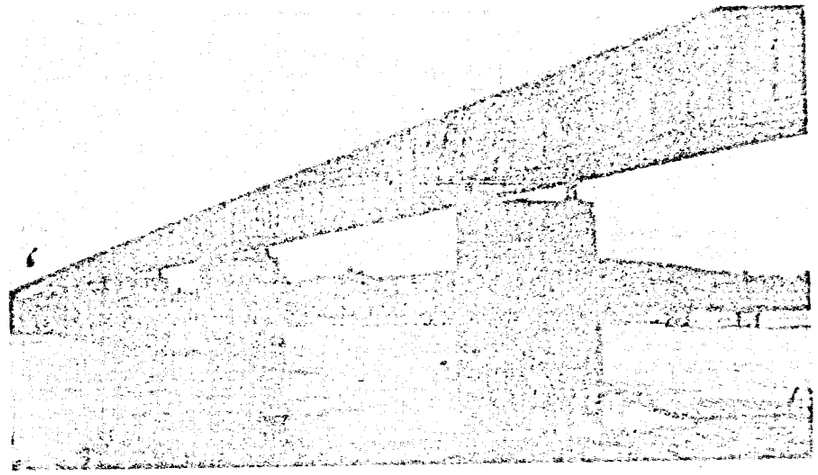
MEXICO has a total area of 780,000 square miles and a population less than three crores. The country is mountainous. The Western Siera Madri range of mountains along the Pacific coast and the Eastern Siera Madri range along the coast of Gulf of Mexico are the important mountain ranges. The plains between the mountain ranges are small in extent and numerous rivers flow into the coast. Therefore, the construction of roads involves large amounts of earthwork and a great number of bridges and culverts. Thus, the construction of roads in Mexico is very expensive.

Because of its geographical position and the altitudes which go up to 10,000 ft above sea level, various types of climate, ranging from tropical to cold, prevail in the country. Severe storms and intense rainfalls make the problem of drainage and slides difficult.

The principal net work of Mexican Roads

Organisation

It may be said that the road system of the country had its beginning in the year 1912 when the President of the Republic constituted a Managing Board for Roads with the main purpose of maintaining the few roads then in existence. This Board was later substituted by the Inspectorate



Above is the San Lorenzo Bridge, 1,400 ft in length, on the Nogales Road. This is one of the main roads linking Mexico City and the U. S. border.

The Motor road from Mexico City to Acapulco, in the Vicinity of Ignala.

for Roads and Bridges. In 1925, realising the necessity for providing a network of modern roads, a National Commission for Roads was constituted. In 1933, the Commission became the Bureau of Ministry of Communications and Public Works.

Road Classification

The roads in Mexico are classified as follows:

(1) National Highways which are maintained and developed by the Federal Government.

(2) State Highways which are maintained and developed by the 29 States and the two Territories which make up the country, through local highway boards.

The State Highways are maintained and developed on a 50 : 50 basis by the States and the Federal Government. In addition to the State highways, there are feeder roads which are maintained and developed in co-operation with private interests.

Mexico has had to have recourse to the toll method of financing highways. In January, 1956, three sections of a toll road with a total length of 112 miles have been opened to traffic between Mexico City and Ignala, on the Acapulco road. The travelling public may choose to use the toll road or the free highway nearby.

Traffic on Roads

The number of motor vehicles in Mexico is 5 lakhs, of which nearly 1/3rd are in the capital Mexico city. The highways within a radius of about 100 miles from the city are highly trafficked. The traffic on roads, except at the border of the United States of America, is comparatively low.

Road Network

The main network of roads consists of 4 highways running north from Mexico city to the border of the U.S.A., and two radial roads running south, one to Gautemala border and the other to Acapulco, a famous tourist centre. The main network of roads of the country is shown in the map. When the system of roads as projected is completed, it will be possible to travel from the United States throughout the country and to proceed to the Central American and South American Republics.

At the beginning of 1956, approximately 18,500 miles of roads were suitable for automobile traffic in addition to about 60,000 miles—that are capable of carrying trucks and larger diameter wheeled cars during the dry season.

(From "Le Strade" Volume 36 No. 7—July, 1956, and "Better Roads"—June, 1956)

ANIMAL HUSBANDARY

Animal husbandary — It means having more than one husband.

EXAMPLE

Example is not one of the ways of influencing people it is the only way. —*Dr. Schwitzer.*

SOME REMARKS ON BITUMINOUS SURFACE DRESSINGS*

By

C. G. SWAMINATHAN

Aggregate

THE part played by the aggregate is as important as that of the binder. The factors involved could be studied under the following heads in detail:

(a) Quality of the aggregate
(b) Grading of the aggregate
(c) Quantity of the aggregate
(d) Application of the aggregate

Quality of the Aggregate

The quality of the aggregate could be subdivided, based on the following characteristics: (a) hardness and strength, (b) texture and porosity, (c) dryness and dustiness.

Hardness and Strength—It is obvious that unless the aggregates are completely submerged by the binder, in a properly laid surfacing, it is the aggregate which has to take to main brunt of the traffic stresses. Polishing, wearing, crushing and weathering are the main characteristics indicated by the toughness and hardness which govern the choice of the aggregate. It is because of the above mentioned quantities that usually broken hard igneous rocks are generally preferred to other types of aggregates.

Polishing is the first stage of wear when the corners and edges of the stone and the rough texture of the aggregates are lost, as a result of which the surface loses its non-skid properties. Only a few aggregates maintain this roughness by virtue of the irregularity in the wear and weathering and it may be possible to choose an aggregate which would wear without getting polished. However, in majority of hard stones the time taken for the polishing effect to be differentiated from wear is quite large.

Wear is the second stage when the projecting particles completely get corroded to a level surface in flush with the level of the binder. Rate of wear under given traffic conditions is governed by particle size, shape and aggregate hardness. With softer aggregates perhaps a larger size is indicated, but at the same time it should be noted that the ability to withstand impact for traffic would be less, unless it is well embedded in the bitumen. However, it is rare that a surface dressing comes to the end of its life by the wearing away of the aggregate.

More often, the surface dressing starts failing as a result of the crushing and dislodgment of the aggregate under traffic. To a certain extent this can be controlled by the quantity and quality of binder used. Resistance to dislodgment could be increased by proper embedment of the aggregate in the binder but the crushing of the aggregates depends on the hardness and toughness of the stone.

When crushing starts, new fracture planes are developed which affect the interlock. In addition, new surfaces of the aggregate which are not embedded are exposed to the surface, as a result of which aggregates are picked up and lost and a gradual thinning down of the surface resulting in a rich mat of binder takes place.

Nevitt[7] has shown that the aggregate wear under traffic will almost be dependent on the Los Angeles rattler Test and according to the U.S. practice[8], the percentage loss in Los Angeles test should not be greater than 40. According to

* Continued from page 21 of May, 1957 T.C.M.R.

another U.S. practice[11], the aggregates should not have a percentage wear greater than 6 and toughness of not less than 5. Also, since harder stones based on aggregate crushing value would give a longer life, British practice[12] suggests that the aggregates should have a crushing value on ½ in. chippings of not more than 25 or 30. Since the aggregates are exposed to weathering, soundness test with sulphates are also specified in certain cases. For example, the A.S.T.M.[13] suggests the use of an aggregate which would have a weight loss of not greater than 12 and 18 per cent with sodium and magnesium sulphates respectively. Since the aggregates should have a higher weight bearing qualities and since in a general way it can be said that the greater the weight per unit volume of the aggregate, the higher is its bearing strength. Light weight aggregates should not be used for surface dressings. This perhaps is a reason why certain A.S.T.M. standards specify that the weight of the aggregate (slag) should not be less than 70 lb per cu. ft.

Since the binder should not easily be stripped from the aggregates in the presence of water, the stone should not be extremely hydrophilic in character and for this reason stripping tests could be specified. However, there is a view[1] that the stone with a greater resistance to crushing or abrasion in the laboratory does not necessarily give a better road performance than one having a lower value. But since the nature of wear of aggregates is probably more important than its extent, physical, chemical and mineralogical features of the aggregate are the controlling factors on which the laboratory tests do throw some light.

Texture and Porosity - Adhesion between the binder and the aggregate is markedly affected by the surface condition, namely, the texture and porosity of the stone metal. Binder is easily displaced by water in the case of stones having a glossy and coarsely crystalline surface such as in the case of glassy types of flint-gravel, certain types of highly silicious igneous rocks and certain quartzites[14], limestones and other calcareous stones are considered to adhere well to bituminous binders. In a broad sense, basic rocks give better adhesion than acid ones. From the point of view of riding qualities a non-skid texture and proper light reflecting qualities are desirableand here again crushed stones score. If the surface of the aggregates is porous, by the entry of the binder into the pores (when the aggregate is dry) a sort of mechanical bond is developed between binder and aggregate and so adhesion improves. But it is rare that a porous material is also sufficiently hard and tough.

No doubt, the surface texture is important in the phenomenon of adhesion. A quantitative method of evaluating this property is still to be developed.

Dustiness and Dampness - Both dust and water, whether individually or together, affect adversely the adhesion of the binder to the stone as well as to the base. While as presence of water will not allow the binder to stick to the stone or the base, the presence of dust on either the aggregate or on the base would act as a blotter and little binder would be left for the aggregate to get properly embedded. Emulsions score over other forms of binders when aggregates are dusty. Foreign matter such as shale, silt and clay adhering to the aggregate, are also harmful to proper bond.

Premature failure due to wet weather is considerably increased where dusty chippings are used. Nevitt[7] also suggests that moisture in the aggregates should not be allowed to exceed 1 per cent or at the most 2 per cent.

Stripping of the binder films from the aggregates during wet conditions is a very common form of failure when construction is done on damp bases and with wet aggregate. The problem of evaluating the stripping properties of the various types of aggregates in a quantitative way still remains to be solved.

Grading of the Aggregate

The grading of the aggregate mainly depends on the size or sizes of the stone chippings selected. The performance of the surface dressing is also influenced by the shape of the aggregates used. So, under this heading, (a) shape, and (b) size or sizes will be discussed.

Shape of the Aggregate - Nevitt[7] has shown that the surface area of the aggregate layer per unit area of the road surface is independent (theoretically) of the particle size and on an analysis of the different shapes of aggregates proves that the surface area of the aggregate layer depends to a great extent on the shape of the aggregate. Generally, the shapes in common use are one of the following, namely, (a) rounded, (b) irregular (c) angular, and (d) flaky.

For any given volume, the more nearly spherical a particle is, the less the surface area it presents. The more the surface area of contact the greater is the tenacity of the bond. From this point of view, if rounded gravels are used, it may be used as crushed gravel so as to contain at least about 60 per cent of fractured particles[15]. According to Lee[1], rounded gravels do not give such a long life as crushed granites since loss of aggregates from the road as a result of traffic is more with the former. Even when the gravels are oiled, there is no definite advantage. Further, rounded aggregates are not preferred more from the point of view of the smoothness than from the point of view of shape. Also, good results are not obtained with rounded gravels, since the rate of spread of binder is more critical with them than with crushed aggregates. However, rounded gravel can be accepted provided they are of good quality as regards other standards (and if they are used in a crushed form preferably), if care and control are exercised in the use of the correct grade and quantity of binder, the method of construction, and more particularly if the work is done in such a way that the freshly laid surface will not be disturbed by traffic. Flaky chippings because of their flatness require a less thickness of binder from embedment and cover a greater area for unit volume of the chippings used. But they do not give satisfactory road performance and according to the British practice[12], the maximum permissible flakiness index for single size road stone is 35. For sizes below ½ in., however, the flakiness index is not applicable. Lee reports that cubic or angular chippings give better results than flaky ones.

Sizes of the Aggregate - The question most often asked is as to whether the aggregates employed for surface dressing should be of single size or graded. What should be the optimum size in the case of the latter, and what should be the nature of gradation to be used ?

If the covering layer of the aggregates should be of one particle depth, it is obvious that the aggregates should be of the same size. Smaller particles will get submerged and unduly large size particles will get dislodged by the effect of traffic. Since particle volume varies as the cube of the size, it takes only a few large particles to make to a considerable percentage of the aggregate volume applied and conversely any normal proportion means a wide spacing of the individual large pieces of stone. These scattered projecting of pieces get the full impact of traffic and their relative embedment is small. So, naturally, they get dislodged and this resistance to dislodgment drops off as the size of the particle increases. In the same way, smaller particles are also injurious. Fines, not only are functionally ineffective since they get submerged, but also are harmful since by blotting the binder they set the larger aggregate free and these are subsequently lost. It is shown [7] & [16] that half a pound of 100-mesh particles or ¼ lb of 200-mesh particles are enough to blot out about 10 sq. ft. of the surfaces. So, it is definitely suggested that particles below a certain size such as passing No. 10, etc., should be eliminated.

The above goes to prove that a predominantly uniform size is preferable. Uniformity at the coarser particles and a limitation on the smaller particles are required. The average particle size—that composing the bulk of gradation—represents a compromise. Aggregates which average a small size are undesirable, as they not only offer a thinner surface, but the quantities of binder required would be so small to be spread evenly, and in such cases emulsions are preferable.

The character of traffic also influences the size of the stone. Heavily trafficked roads demand a larger size chippings than lightly trafficked ones. Also, a smaller size rounded stone should be used as compared to the crushed angular types, since the dislodgment of a large rounded aggregate is easier. From the point of view of

degradation of aggregates, smaller size stone may be preferable than the larger size of the same type and quality.

Since the largest stone in the layer of the aggregates is approximately equal in size to the desired thickness of the finished surface treatment, the proper size of aggregates for the coats would vary for different layers. The various normal sizes that are usually employed are $\frac{3}{4}$, $\frac{1}{2}$, $\frac{3}{8}$, $\frac{1}{4}$ and $\frac{1}{8}$ in.

Usually the stone supplied may not always comply with requirement of a single size specified by the engineer. Hank and Brown[2] show that differences in the grading or the variations in the sizes of the aggregates can mean a lot of difference. A very restrictive specification for the aggregates might defeat the purpose of low cost construction. So, for each type of aggregate used, the type and grade of binder and the quantity to be used should be worked out. And for the success of a surface dressing it is important that the chippings to be used should be tested by a sieve analysis and the binder requirements should be stipulated based on the analysis.

In theory, by having a one sized material good interlock is not possible. Smaller sized angular particles can and should be interlocked to provide a wedging effect which with proper control of binder would provide greater stability. And by having a gradation of aggregates it is possible to have small valleys and ridges on the surface, the ridges formed by the larger sizes and the valleys filled by the smaller sizes and binder. The larger size aggregates should not be too few in number as otherwise they might get dislodged. They must be spaced such that the spacing is not too much nor too little. This spacing depends on the size of the chipping used. Since the valleys should not be too deep this must be filled with reasonably smaller sizes but not too small. This suggests that a proper gradation is necessary and that no gradation is better than a poor gradation.

Nevitt[7] has shown that if an ideal surface should be obtained by embedment of a certain uniform size of aggregate, keyed together by particles of the proper smaller sizes and that for such a condition the sieve analysis would show that nearly 11 per cent of the aggregates would be half the average size of the coarser fractions.

It was attempted to get a proper gradation on the basis of the density curve[17] which by reducing the maximum size and proportioning of ratio of sizes below the maximum size, a good grading was obtained. Too great a spread in the gradation is not desirable, and this suggests that the aggregates should be controlled with a smaller range of sieve sizes.

Nekessan[3] advocated the use of graded aggregates with emulsified asphalt both for single and two coat works and in the latter case, the gradation is such that after construction it behaves just as good as a macadam. With graded aggregates softer binders seem preferable, since in course of time all the aggregates get completely coated. The films will be thinner in these cases and hence great tenacity and toughness are imparted. So, while a single size aggregate with hard binder may be alright for surfacings, use of graded aggregates with softer binders could be used for the formation of a mat and thereby strengthening a building up of the road structures.

Use of a single size aggregate both for the first and second coat does not seem to have any advantage and the use of graded aggregates is obviously suggested for the first coat in any two-coat surface dressings.

According to the practices in most of the States in India, (see Tables 2 and 3)* as well as in the U.S A. (see Table 4),† a large size aggregate is used for the first coat and smaller sizes for the second and third coats. In the United States, for a multiple surface treatment, for each layer the designated maximum size of the smaller size aggregate is about $\frac{1}{2}$ in. that of the aggregates used in the preceding application[13]. This is at variance with the practice in England[12], where it is recommended that a smaller size aggregate is used for the first coat and a bigger

* Pages 25 and 26 of the Transport-Communications Monthly Review, May 1957.

† Page 27 of the Transport-Communications Monthly Review, May 1957.

size for the second coat. The reasons for these are discussed in a section to follow.

A scrutiny of the Tables 2 and 3* shows that in most of the States in India, the size that is adopted is around $\frac{1}{2}$ in. for the first coat and around $\frac{1}{8}$ to $\frac{1}{4}$ in. for the second coat. Some refer it as a standard size and some as nominal size. In this connection the following definitions are suggested:—

(a) Definite or standard size: That size of the aggregate which completely passes the next higher size sieve and is completely retained on the next lower sieve.

(b) Average or Principal size: That size as the screen opening corresponding to the 50 per cent point when the sieve analysis is plotted.

(c) Nominal or Normal size: That size which is predominant but which allows some oversizes as well as under-sizes. The example is given in Table 7.

Since the success of a surface dressing depends very much on the size or sizes of the aggregate used and since the presence of too much of over-size or under-size is injurious and as a definite size aggregate may not always be procurable at reasonable cost, it is suggested that either (b)

Table 7

Requirements of Aggregates for Size and Grading

(B. S. S.—63 of 1951—Single size road stone and Chippings)

Specific-size				Over-size		Under-size			
Nominal size Inches	Passing B.S. sieve Inches	Retained on B.S. sieve Inches	Max. proportion of specified size per cent	All to pass B.S. sieve Inches	Maximum of nominal size retained on B. S. sieve Per cent	Passing B. S. sieve Inches	Maximum proportion of under-size Per cent	Passing B.S. sieve No.	Maximum fines Per cent
$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	65	1	15	$\frac{3}{8}$	7	7	2
$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{8}$	55	$\frac{3}{4}$	15	$\frac{1}{4}$	7	7	2
$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{4}$	60	$\frac{1}{2}$	15	$\frac{3}{16}$	10	7	2
$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{8}$	70	$\frac{3}{8}$	15	7	10	25	2
$\frac{1}{8}$	$\frac{1}{8}$	No. 10	65	$\frac{1}{4}$	15	No. 14	10	25	2

* Pages 25 & 26 of the T. C. M. R. for, May, 1957.

and (c) mentioned above may be adopted wherever the aggregate size is stipulated for surface dressing works.

The practice in the various States in India and the practice abroad [7,8,12, & 13] all indicate that a general gradation is suitable both from the point of view of a tolerance in supply of materials as well as gradation. The gradation in India, however, is not very well defined and it is felt that a certain gradation not too wide and not too close (as for dense carpets) may be suitable.

It is suggested that the gradation chosen could be based on five sieve ranges. If, for example, the sieve ranges are in the decreasing order such as 'a', 'b', 'c', 'd', and 'e', the specifications should stipulate that about 100 per cent should pass 'a', about 90 per cent should pass 'b', about 30 per cent should pass 'c', about 5 per cent should pass 'd', and none should pass 'e'. The figures given are only as an example and are purely tentative. During construction the fraction retained on 'c' should be laid as first layer and the fraction passing 'c' should be laid as first layer and the fraction passing 'e' should be laid as a second layer. By a proper adjustment of the fractions and by the choice of the sieve, a well-knit surface could be obtained.

(To be continued.....)

REFERENCES

11. Agg "Construction of Roads and Pavements." McGraw Hill & Co., New York.

12. British Standard Specifications:

(i)	Single-sized Roadstone and Chippings	63/1951
(ii)	Mineral Aggregates, Sand and Fillers	812/1951
(iii)	Rolled Asphalt	594/1951
(iv)	Tars for Road Surfaces	76/1951

13. American Society of Testing Materials-Standards and Specifications-Part 3 of 1955.
   (i) Crushed stone, slag, crushed gravel for single or multiple surface treatments-D1139-55T.
   (ii) practice of quantities of materials for bituminous surface treatments-D1369-55T.
   (iii) Crushed stone, crushed slag and gravel for bituminous concrete base and surface courses-D 692-54.

14. Road Tar Research Committee-"Adhesion"-British Road Tar Association-Road Tar Bulletin No. 4,1948.

15. Herbert "A review of fundamentals in surface treatment"-Proceedings of the Association of Asphalt Paving Technologists, Vol. 24-1955.

16. Pauls "Surface treatements of existing asphalt pavements"-Proceedings of the Association of Asphalt Paving Technologists Vol. 24-1955.

17. Lohan & Nevitt "Study of Seal Coating"-Proceedings of the Association of Asphalt Paving Technologists Vol. 16,1947.

HERE AND THERE

1. SURFACE DRESSING-CONTROL SAVES COST

THE most important function of control in surface-dressing work is to ensure that the binder is sprayed on to the road in a uniform film at the specified rate of spread. Transverse distribution given by the spraying machine should be checked in the depot by spraying into a series of containers which collect the binder sprayed over each 2 in. of the width of the spray-bar.

In surface dressing the most important property of the binder is its viscosity. This must be suited to the time of the year when the surface dressing is laid, so that the binder is neither too viscous to wet the chippings nor so fluid that it does not hold them under the action of traffic.

A check on variations in the rate of spread of the binder in the longitudinal direction may be obtained by placing shallow metal trays, about 8 in. square, in the path of the sprayer on a selected line. The rate of spread at the location of the tray is obtained by weighing it before and after use on the road. The results of such tray tests illustrate the accuracy which can be obtained with a well-controlled sprayer.

A method of determining the average rate of spread is to measure the area of road sprayed and the volume of binder delivered by the sprayer (by using a dip stick): it should be realised, however, that this method gives no indication of the uniformity of the binder film.

Traffic moving at a steady slow speed is good for a newly-laid surface dressing but fast traffic during the first few hours after laying is likely to cause considerable disturbance and loss of chippings particularly during hot weather when the viscosity of the binder is low. On the main roads every effort should be made to restrict the speed of traffic while the dressing is bedding down; this may be done by the use of warning boards and possibly by using special vehicles.

Very hot weather may mean that the freshbinder (even if of the highest viscosity normally used) is too fluid to hold the chippings under traffic and it is advisable to stop spraying under these circumstances if the road carries more than light traffic. It is also inadvisable to carry on spraying in heavy rain, but the advent of surface active agents ('adhesion agents') now enables surface dressing to be carried out in unsettled weather without fear of damage by the combined action of rain and traffic. It must be emphasised, however, that these agents are only effective if used properly and adequate control is essential. Further, the use of an agent does not eliminate the need to exercise good control over surface dressing; this is just as essential as when no agent is being used.

(From 'Highways and Bridges and Engineering Works, November 21, 1956').

2. "UP-LOADING" OLD R.C. BRIDGE BY PRESTRESSING

THE California Division of Highways has specified prestressing for an existing bridge to raise its loading capacity to the H-20 requirements.

The original bridge, of reinforced concrete tee-beam construction, with a single span of 42 ft and having a loading capacity of H-15, was built more than 20 years ago. The new freeway required that the existing bridge be widened by adding a new reinforced concrete tee-beam span, to provide the over-all width of 205 ft 4 in. necessary to carry six lanes of freeway and four lanes of frontage road.

Pavement was removed at each end of the bridge to permit construction of anchorages and the cutting of holes in the end diaphragms of the abutments for the passage of cables. Steel channels were placed at mid-span in the concrete diaphragm between girders, to serve as saddles for the prestressing cables. Because the bridge was built on a skew, it was necessary to construct off setting triangular anchoring seats that would allow the anchors to take the stress at right angles.

As only two-thirds of the bridge will carry the main freeway, with the other third carrying frontage road, only four of the bridge's six girders were prestressed. One cable was placed outside of the northern most girder, and one cable on each side of the next three girders.

The stress was applied by a hydraulic jack acting against a steel plate embedded in the anchor seat, through which protruded a steel cap on the end of the cable. This cap or thimble was threaded on the outside, and after adequate stress had been applied, a nut was run down against the steel plate to hold the stretch in the cables.

The anchorages were then embedded in concrete by adding a 1 ft extension to the anchoring seats after the cables were stressed, set and anchored.

(*From 'Highways and Bridges and Engineering Works, May 1, 1957'*).

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3. BITUMINOUS EMULSION SLURRY SEAL COATS FOR LENGTHENING HIGHWAY LIFE

ABOUT two years ago the Los Angeles Road Department began using a process for preserving the life of old highways known as bituminous emulsion slurry seal coats. Rather similar to the familiar surface dressing process this new technique preserves and lengthens the life of surfaces which are cracked and spalled. In addition bituminous emulsion slurry seal coats have been used before a road has been resurfaced with a thin carpet so preventing the trouble of reflection cracks from the old surface.

One of the most important requirements of any surface is the ability to exclude moisture from the sub-grade. Otherwise the strength of the supporting soil beneath the road is lost and in low temperatures the strength of the surface is still further reduced by the expansion and contraction of the water.

Bituminous emulsion slurry seal coats are able to effectively seal a disintegrating surface and in addition provide a smooth riding surface, all at a very small unit cost. If the road is one which carries a great deal of traffic the treated surface can be sprayed and chipped or alternatively a machine laid wearing course can be applied.

Composition of Mixture

Essentially the slurry seal consists of a mixture of fine sand or crusher dust or these two together mixed with a bituminous emulsion or water.

Some experiment has to be made to determine the most suitable type of sand or dust and the following is a grading, expressed in United States standards, which has been found to be very successful.

Sieve Size	Percentage Passing
8 ...	... 95-100
16 ...	... 70- 95
30 ...	... 50- 70
50 ...	... 30- 50
100 ...	... 10- 25
200 ...	... 3- 10

Typical quantities for a mix are, 25 gallons of water and 47 gallons of emulsion to each ton of aggregate. It has been found that the correct proportion is not critical as best results are obtained by varying the ingredients to suit the prevailing weather conditions, the condition of the surface and the type of aggregate used in the slurry seal coat.

An example of the variation possible is that with a fine aggregate a greater amount of emulsion and water are required than with a coarse aggregate. Watch must, however, be kept on the proportions of materials used otherwise a fatty slippery surface may result.

Mixing of a slurry seal can be carried out in lorry mounted concrete mixers or for large stretches of road a transit mix truck can be used. Experience in Los Angeles has shown the usefulness of this latter piece of equipment. It has been found possible to hold all the materials required at a central point, added to the transit mix truck in accurate amounts and then mixed on the journey to the site.

Care in Mixing Operations

Adding of the materials to the mixer and the actual mixing process are operations which require a great deal of care. First ingredients into the mixer are the emulsion and the water and when these have been slowly and uniformly blended together the aggregate is added at a slow and uniform rate so preventing the formation of lumps in the mixer. Too rapid addition of aggregate can cause considerable trouble and ruin a whole batch.

Time of mixing is not vital and mixing can be continued for a considerable time, the limit being reached when the emulsion breaks. Apart from this mixing can be continued for some time and any loss of water by evaporation can be made up by further addition.

Before the slurry is applied the road surface should be inspected and all large holes and areas tending to rock should be patched. The surface is then lightly sprayed with water if conditions justify this and all loose grit and dust removed.

Over small areas the slurry can be spread by long handled squeegees. For larger areas a special spreading box has been evolved into which the slurry is dumped to be evenly spread by a rubber diaphragm. An adjustment is provided so that the rubber blade can be compensated for changes in curvature and camber of the road.

As applied in Los Angeles the thickness of the slurry coat was on the average between 1/16 inch and 1/8 inch but in exceptional cases a thickness of ¼ inch was found perfectly satisfactory. Above this thickness several layers had to be used. The process has the disadvantage that unlike surface dressing traffic cannot be allowed over the surface immediately but must be kept off the newly applied surface for between two and three hours depending on atmospheric conditions.

Extremely Low Cost

Cost is quite small, it having been stated that for a thickness of between 1/8 and 1/16 inch the cost is in the region of 0.004 dollars per sq. ft which by a strict rate of exchange is about 3 d. per square yard, a figure which could perhaps be reduced in this country with our lower labour costs. Output is quite high it being quite possible to reach 5,000 sq. yds. per hour in good working conditions.

A great deal of experimental work on this process including the surfacing of a considerable mileage of road has been done. The conclusions can be summarised as follows:

1. That slurry seal coats have a very definite place in maintenance work.

2. Treatment makes a good job of crack sealing and provides a very satisfactory non-skid surface when sand is used as the aggregate.

3. Cost is very low and a large area can be quickly surfaced.

4. Depending upon the weather the slurry seal will quickly set so that it is not marked by traffic.

5. The treatment is very suitable for urban streets.

6. The mixture cannot be considered as a substantial wearing surface and it should not be allowed at a thickness greater than ¼ inch and perferably not greater than 1/8 inch.

7. A good appearance is given to old roads, the slurry seal sticking very tightly to the old surface.

Wherever it has been used in the United States the process seems to have been successful and has been recommended. Whether it is superior to our excellent technique of surface dressing can only be found out by trial in this country.

(*'From Highways and Bridges and Engineering Works, January 23, 1957'*).

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4. A 4 FT. HIGH CENTRAL ISLAND OF EARTH

A barrier of earth 4 ft high is rising in the middle of 7½ miles of New Jersey's Garden State Parkway.

According to the American Public Works Association, the barrier is supposed to prevent headlight glare and to halt out-of-control cars from crossing the division between opposing traffic lanes. This particular center strip of land was narrower than that along the rest of the 164 mile parkway, where the width of the central island and the trees and shrubbery growing on it provide enough of a barrier.

After the earthen barrier is up, the state highway department will add a layer of topsoil and plant 100,000 Japanese honeysuckle vines.

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5. RECOMMENDATIONS OF THE PANEL OF SCIENTISTS

A Panel of Scientists has been appointed by the Planning Commission to recommend ways and means of utilizing results of research. The following are some of the recommendations by this Panel

1. In India, engineering research has so far been almost non-existent at the universities and technical institutions. Immediate steps should be taken to develop research at technical universities and colleges by expanding the cadres, providing equipment, laboratory space and other facilities.

2. Research should not be confined to the Central Laboratories and Government institutions alone. For this purpose, grants should be given by the C.S.I.R., the Universities Grants Commission, National Buildings Organization, etc., to the universities. Such grants should be for a period of atleast five years to ensure continuity of work and reasonable security of tenure for the research workers.

3. An adequate number of research Fellowships should also be created.

4. The research under the universities and the technical institutions should lay emphasis on the fundamental work, whereas the work in the national laboratories and other Government sponsored laboratories should be of the applied type.

5. To attract able men for research, the pay scales offered to them should be sufficiently handsome.

6. The Panel felt that there is a serious gap between the laboratory and field scale research. Therefore, adequate funds should be set apart specially for financing large scale trials. To attain this objective, the following recommendations were made :

(a) Estimates of every construction or development scheme should include a provision of 1½ per cent of its cost for large scale experiments. On sanction of the estimate, this 1½ per cent should be transferred to a non-lapsing fund.

(b) An assessment committee consisting of representatives of the executive and research agencies and experts in the field should be set up, preferably under the aegis of All-India technical bodies such as the Indian Roads Congress, the Central Board of Irrigation & Power, the National Buildings Organization etc., to evaluate research results and decide on large scale experiments. One of the functions of this assessment committee would be allocation of funds for large scale experiments. Recommendations of the assessment committee on the completion of the large scale experiments should be accepted for adoption on Central and State Governments projects.

(c) With a view to co-ordinate research, the above mentioned technical bodies should organize meetings of research committees once in a year. Representatives of interested organizations,

(Continued on page 46)

CURRENT LITERATURE

ABSTRACTS

FREEZE-THAW DURABILITY OF AGGREGATE IN CONCRETE-BULLETIN 143, Highway Research Board, Washington, D.C.

THIS Bulletin contains two papers on concrete aggregate durability.

The first paper, "Freeze-Thaw Durability of Michigan concrete Coarse Aggregates", describes the testing procedures used by the Michigan Highway Department to determine acceptability of aggregates for use in concrete highway work, and laboratory freeze-thaw results as well as field observations as a first step in formulation of a policy regarding acceptance of future aggregates of unknown service behaviour.

In the second paper describes the effect of heavy media separation on durability of concrete made with Indian gravels. Laboratory data on freeze-thaw durability are correlated with field observations to indicate what, if any, effect the addition of crushed stone and the use of heavy media separation have on the durability of concrete made with gravel coarse aggregate.

THE USE OF CEMENTS OF DIFFERENT FINENESS IN SOIL-CEMENT MIXTURES by K. E. Clare, and D. M. Farrer, Magazine of Concrete Research, Volume 8, Number 24, November, 1956.

A study of the literature has shown that increasing the fineness of the cement in mortar and concrete mixes results in an increase in their strength at early ages. This paper describes tests to determine whether a similar effect is obtained with mixtures of soil and cement, so that if possible a reduction could be made in the proportion of cement used in soil stabilization by using a cement of greater fineness than the commercial varieties now employed.

That fraction of a sample of ordinary Portland cement that passed the B.S. No. 300 sieve was added to a silty clay and test specimens were prepared. The 7 day unconfined compressive strength obtained was found to be 140 per cent of the strength obtained when the whole cement was used. Taking the compressive strength at 7 days as the criterion, this suggests that if 10 per cent of ordinary Portland cement was normally required to stabilize this soil, 7 per cent of the fine-grained cement should prove equally satisfactory.

In further tests, a cement clinker was ground to three different degrees of fineness in a laboratory ball mill, the coarsest being equivalent to ordinary Portland cement. The 7 day compressive strength obtained when the finest cement (specific surface = 5,800 cm^2/g) was added to the silty clay was 125 per-cent of the strength obtained when the coarsest cement (specific surface = 2,900 cm^2/g) was used. The corresponding increase for mixtures of sand and cement was 120 per cent.

Chemical analysis showed that the removal of the coarse grains in an ordinary Portland cement increased the proportion of sulphur trioxide present. In a third series of experiments, the compressive strength of a cement-stabilized silty clay obtained with a cement of given fineness was found to increase when the proportion of gypsum added to the cement was increased to a certain optimum value, but the increase was not as large as that obtained in the previous experiments by sieving cement. It is believed that fineness, sulphur trioxide content and possibly also the particle-size distribution can affect the strength obtained with a given cement, and further experiments are needed to determine the combination of fineness and sulphur trioxide content required to obtain a cement of maximum strength from clinker processed in a given way.

WIDENING AND RESURFACING WITH BITUMINOUS CONCRETE—Bulletin 131, Highway Research Board, Washington, D.C.

THE Bulletin contains the following four papers:

"Wire Mesh Reinforcement in Bituminous Resurfacing", describes an experimental project in which the California Division of Highways in 1954 placed several test sections for the purpose of comparing the relative merits of various types of wire mesh.

"Pavement Widening and Resurfacing in Idaho", contains methods and procedures employed in an extensive programme of this nature.

"Highway Rehabilitation by Resurfacing", describes the construction of one-, two-, or multiple-layer resurfacing in the rehabilitation of old asphaltic concrete and portland cement pavements in Hawaii.

"Progress of Reflection Cracking in Bituminous Concrete Resurfacing", contains results of condition surveys conducted on twenty-five 1,000-ft sections of pavement since their resurfacing to evaluate their relative performance.

ACCIDENT ANALYSIS AND IMPACT STUDIES—Bulletin 142, Highway Research Board, Washington, D.C.

THIS bulletin contains the following five papers.

"Automotive Collision Impact Phenomena, which reports the findings from a series of controlled car crashes conducted by the Ford Motor Company. Items such as deceleration of passenger compartment, seat belt loads, occupant decelerations, etc., are reported graphically as they vary with impact velocity.

"A Preliminary Study of Speed as Related to Injury-Producing Automobile Accidents", examines accident and injury data on 3,203 automobiles involved in injury-producing accidents to determine effects which speed may have on the frequency of dangerous or fatal injuries.

"Factors Related to Traffic Death Rates", reports a study, through statistical techniques, of the various characteristics of the various states that are related to the traffic death rates.

"Highway Accident Analysis Through Use of IBM Punch Cards", reports the method developed by the Texas Highway Department for the analysis of Highway accident data and the presenting of such data in a form useful at the district level.

"Virginia's Cooperative Accident Analysis System" describes the system developed and operated cooperatively by the highway department and the Deptt. of State Police for the determination of accident frequency rates; the listing of essential details of the individual accidents for use in formulating corrective measures when needed; and the pinpointing of specific locations where accident occurrence is abnormal.

STUDIES RELATING TO THE TESTING OF FLY ASH FOR USE IN CONCRETE by R. H. Brink and W. J. Halstead, Public Roads—February, 1957.

FLY ASH is a powdery residue resulting from the burning of pulverised coal. In modern power plants this material is collected at the entrance to the stack by electrical or mechanical precipitators to prevent pollution of the air. Fly ash is usually finer than portland cement and consists mostly of small spheres of glassy compounds of complex chemical composition together with miscellaneous materials such as quartz, feldspar, iron oxides, and carbon.

The effect of fly ash on the strength of portland cement-fly ash mortars is considered to indicate the probable effect on the the strength of concrete, and is used in this investigation as a criterion for evaluating other tests of fly ash. The effect of fly ash on the expansion resulting from the alkali-aggregate reaction is also considered. 34 fly ashes from 19 different sources were examined.

(Continued on page 46)

SELECTED RECENT LITERATURE IN ENGINEERING JOURNALS

X. BRIDGES AND OTHER STRUCTURES

1. **Beams of Finite Length on Elastic Foundations - A New Approach to Solution**: S. P. BANERJEE, *Journal of the Institution of Engineers (India)-Vol. 37, No. 3, Part I*, November 1956, pp. 139–157.

2. **The Budni Tunnel - Its Design and Construction**: K. SITARAMAN, *Journal of the Institution of Engineers, (India), Vol. 37, No. 3, Part I*, November 1956, pp. 159-202.

3. **Cantilever Moments in Plates Fixed Along One of the Long Edges and Subject to Concentrated Loads at a Point on the Other Long Free Edge**: PROF. G. V. VARTAK, *Journal of the Institution of Engineers, (India), Vol. 37, No. 3, Part I*, November 1956, pp. 203-212.

4. **A Note on Vibration of Cantilevered Trapezoidal Plates**: J. V. NAGARAJA, *Journal of the Institution of Engineers, (India), Vol. 37, No. 3, Part I*, November 1956, pp. 213-215.

5. **Structural Design Charts**; THOMAS HURAN, *Western Construction, Vol. 31, No. 8*, August 1956, pp. 72-73, *Part I, Vol. 36, No 9*, September 1956, pp. 25-27, *Part II, Vol. 36, No. 10*, October 1956, pp 68-69, *Part III*.

6. **Swiss Special Equipments for Prestressed Concrete Technique**: A. BRANDESTINI, *Schweizerische Bauzeitung, Vol. 74, No. 57*, September 15, 1956, pp. 551-558 (in German).

7. **Grouting Behind Concrete Lining of Vaitarna Tunnels**: V. S. MOKASHI and V. M. SHIDHAYE, *Journal of the Institution of Engineers, (India), Vol. 36, No. 12, Part I*, August 1956, pp. 1929-1947.

8. **A Variation of the Relaxation Method**; R. N. BASU, *Journal of the Institution of Engineers, (India), Vol. 36, No. 12, Part 2*, August 1956, pp. 2017-2022.

9. **Direct Design of Hingless Arches of Constant Section**; JAMES MICHALOS, *Civil Engineering*, July 1956, pp. 61-64.

10. **Prestressed Precast Platform Built in Gulf**; ROBERT N. BRUCE, *Civil Engineering*, July 1956, pp. 41-43.

11. **Self-checking Moment Distribution**; G. SVED, *the Journal of the Institution of Engineers, Australia, Vol. 28, No. 9*, September 1956, pp. 231-234.

12. **Torsion in Reinforced and Prestressed Concrete Beams**; HENRY J. COWAN, *The Journal of the Institution of Engineers, Australia, Vol. 28, No. 9*, September 1956. pp. 235-240.

13. **The First Large French Rail Road Bridge in Prestressed - The Voute Viaduct**; L. CARPENTER, *Travaux, Vol. 40, No. 264*, October 1956, pp. 545-551 (in French).

14. **Experimental investigation on the Mechanical Characteristics of Prestressing Cables Used for the Reconstruction of the Villeneuve - Saint George Bridge Over Sein**: MICHEL BONNET, *Annles des Ponts et Chaussees, Vol. 126, No. 4*, July-August 1956, pp. 462-526 (in French).

15. **Prestressed Concrete Frame Rail Bridge with V - Struts on the New Byepass in Stiglie at Andelfingen**: P. SOUTTER, AND W. SCHAL CHRR *Schweigerische Bauzeitung, Vol. 74, No. 40*, October 1956, pp. 616-621 (in German).

16. **Strength of a Tube Under Local External Pressure**; G. R. HIGGINSON, *The Engineer, Vol. 202, No. 5253*, September 28, 1956, pp. 428-430.

17. **Assembly of Planks Forms Arch Centering for Concrete Bridges**; *Roads and Engineering Construction*, August 1956, pp. 94 & 155.

18. **Economic Advantages of Prestressed Concrete**: *The surveyor, Vol. XIV, No. 3313*, September 3, 1955, pp. 881-882.

19. **Protection of Tunnel Trusts**; OTTO FREY. BAR, *Schweizerische Bauzietung, Vol. 74, No. 38*, September 22, 1956, pp. 567-572 (in German).

20. **Outline of Girder Design**; THOMAS JAEGER, *Der Bauingenieur, Vol. 31, No. 8*, August 1956, pp. 273-291 (in German).

21. **The Bending Stresses of Two Dimensional Frames**; S. FALK, *Der Bauingenieur, Vol. 31, No. 8*, August 1956, pp. 305-307 (in German).

22. **Vertical Trusses Resist Wind Load**: ROST H. BRYAN, *Engineering News Record, Vol. 157. No. 10*, September 6, 1956, pp. 36-38.

23. **Four Lanes Across Tampa Bay at Low Cost**; W. E. DEAN, *Engineering News Record, Vol. 157, No. 12*, September 20, 1956, pp. 42-48.

24. **Muck is jetted Topside As Lincoln Tube Nears Final Stage**: *Engineering News Record, Vol. 157, No. 12*, September 20, 1956, pp. 30-38.

25. **Pretensioned Piles Arc 132 ft Long**; *Engineering News Record, Vol. 157, No. 3*, July 19, 1956, pp. 33-36.

26. **Slip - Forms for Bridge Piers**; *Western Construction, Vol. 31, No. 9*, September 1956, pp. 25-27.

27. **Record for Post-tensioned Girders**; *Western Construction, Vol. 31, No. 9*, September 1956, pp. 52-54.

28. **Stresses on Cast-iron Tunnel Linings, Building Research Station Observations in London and Glasgow**: *The Surveyor, Vol. CXV, No. 3358*, September 1, 1956, pp. 645-646. *See Also-Engineering, Vol. 182, No. 4726*, October 5, 1956, p 437.

29. **Highway Bridges - A Rational Approach to Heavy Loads**; *Engineering, Vol. 182, No. 4720*, August 24, pp. 235-236.

30. **Shear Deflection in Beams - General Theory for Statical Problems**; R. P. N. JONES, *Engineering, Vol. 182, No. 4726*, October 5, 1956, p. 428.

31. **Vibration and Stresses in Girder Bridges - Summaries of Recent American Research Projects**; *Surveyor, Vol. CXV, No. 3359*, September 8, 1956, pp. 677-679.

32. **Erection of Great Egg. Bay Bridge Superstructure**: *The Engineer, Vol. 202, No. 5249*, August 31, 1956, p. 317.

33. **Methods of Extending the Life of Bridges**: *The Surveyor, Vol. CXV, No. 3365*, October 30, 1956, pp. 823-824.

34. **Designing Rigid Structures - Application of Plastic Theory**; *Engineering, Vol. 182, No. 4728*, October 19, 1956, pp. 496-497.

35. **Rubber in Engineering, Flexible, Resilent, Non-catastrophic in Fatigue**: *Engineering, Vol. 182 No. 4725*, October 19, 1956, pp. 498-500.

36. **Some Expedients in Structural Analysis**; B. S. S. RAO, *The Indian Concrete Journal Vol. 30, No. 11*, November 1956, pp. 364-369.

37. **Design of Crane Tracks for King's George's Dock Calcutta**; SUKUMAR GUHA, *The Indian Concrete Journal, Vol. 30, No. 11*, November 1956, pp. 349-356.

38. **The Design of Prismatic of Roofs**; PROFESSOR IBRAHIM GAAFAR, *Concrete and Constructional Engineering, Vol. LI, No. 10*, October 1956, pp. 509-515.

39. **Prestressed Precast Beams 136 ft Long**: *Concrete and Constructional Engineering, Vol. LI, No. 10*, October 1956, pp. 519-520.

40. **Bridging a Double Line Federal Railway with a Prestressed Skew Decking (34°)**; O. BERR and R. MARX, *Der Bauingenieur, Vol. 31, No. 10*, October 1956, pp. 361-372.

RECENT ADDITIONS TO THE LIBRARY OF THE INDIAN ROADS CONGRESS

1. **Selected Abstracts on Engineering Geology and Related Subjects, Geological Survey Circular No. 259 (1954)**; Severine H. Britt, The Geological Survey, **Washington 25 D.C.**

2. **Computation of Peak Discharge at Contraction**; Geological Survey Circular No. 284 (1953), C. E. Kindsvater, R. W. Carter & H. J. Tracy. The Geological Survey, **Washington 25 D. C.**

3. **Recent Estimates of the Abundances of the Elements in the Earth's Crust**: Michael Fleischer, Geological Survey, Circular No. 285, (1953). The Geological Survey, **Washington 25 D C.**

4. **Floods of November-December 1950 in the Central Valley Basin California**; C. G. Paulson, Geological Survey Water-Supply, Paper 1137-F (1953). The Geological Survey, **Washington 25 D.C.**

5. **Stage - Fall - Discharge Relations for Steady Flow in Prismatic Channels**; William D. Mitchell, Geological Survey Water - Supply, Paper 1164 (1953). The Geological Survey, **Washington 25 D.C.**

6. **Geophysical Abstracts 154, July-September 1953 (Numbers 14599-14804)**; Mary C. Rabbitt, S. T. Vesselow Sky and others, Geological Survey Bulletin No. 1002-C (1953). The Geological Survey, **Washington 25 D.C.**

7. **Geophysical Abstracts October-December 1953 (Numbers 14805-15026)**; Mary C. Rabbitt, S. T. Vesselow Sky & others, Geological Survey Bulletin 1002-D (1954), The Geological Survey, **Washington 25 D.C.**

8. **Boundaries, Areas, Geographic Centres and Altitudes of the United States and the Several States - with a Brief Record of Important Changes in their Territory & Government**; Edward M. Douglas, Geological Survey Bulletin No. 817 (1932)-(Second Edition). The Geological Survey, **Washington 25 D.C.**

9. **The Use of Plant Material in the Recognition of Northern Organic Terrain Characteristics**; Norman W. Radforth, Technical Memorandum No. 28, March 1924. Associate Committee on Soil and Snow Mechanics, National Research Council, **Ottawa** (Canada).

10. **Eighth Annual Report for the Year Ending 31st August 1954 of the Institution of Engineers (India): Madhya Pradesh Centre, Nagpur**, The Institution of Engineers (India), M. P. Centre, **Nagpur.**

11. **H.R.B. Report of Sub-Committee on Highway Maintenance, Equipment & Equipment Rental**: Maintenance Division, U. S. Public Roads Administration, **Washington D. C.**

12. **Bibliography on Soil Stabilization**; The Indian National Society on Soil Mechanics & Foundation Engineering, **New Delhi.**

13. **Year Book and List of Members 1954 (Corrected to 1st August 1954) of Institution of Structural Engineers**; Institution of Structural Engineers, 11, Upper Belgrave Street, **S.W. 1, London.**

14. **Transactions of the American Society of Civil Engineers, Volume 119 - 1954**; The American Society of Civil Engineers, **New York.**

(*Continued from page 40*)

universities, technical colleges, etc., should be invited to attend these research meetings. At these meetings, the research work done during the year should be reviewed and programmes and priorities for further work discussed. For co-ordination of the activities of the various organizations, the Council of Scientific and Industrial Research should organize a joint meeting of the C.S. & I.R. and the above mentioned organizations at least once in a year.

7 Post-Graduate Studies

Post-Graduate studies should be encouraged on a large scale. At present the best students get absorbed in service immediately on leaving the colleges. In the absence of sufficient incentive only second rate men seek admission in the Post-graduate courses. Therefore, in order to attract first rate men for post-graduate courses, sufficient incentive should be provided. Promising junior officers should be selected and deputed to undergo post-graduate training and the various departments should pay for the advanced studies.

8 Refresher Courses

Serving engineers and teachers as well as research workers should be required to attend a Refresher course at the appropriate levels of their service with a view to bringing the latest developments and techniques to their notice. Facilities for such refresher courses exist at present at the University of Roorkee and this should be encouraged at other technical institutions.

9 Interchange of Personnel

It is essential that there should be frequent interchange of personnel between Executive branch, the research side and teaching department.

10 Training and Deputation Reserve

In all the departments, there should be a training and deputation reserve of about 10 per cent of the strength of the cadre. Such a reservation would take care of the programme for interchange, deputation for training and refresher courses.

(*Continued from page 42*)

The results of the tests indicate generally that the strength developed in portland cement—fly ash mortars is related to the carbon content of the fly ash, the fineness of fly ash as measured by the amount passing the No. 325 sieve, and the water required for mortars containing fly ash as compared with the water required for similar mortars without fly ash. No well-defined relation between the individual inorganic constituents of the fly ash and the development of strength of the mortar was obtained.

These tests also indicate that the effect on the strength of mortar of replacing a portion of the cement with fly ash varies according to the cement used.

Tests of mortar bars show that fly ash may be used to inhibit the expansion resulting from the alkali-aggregate reaction. These tests indicate that the amount of fly ash required to reduce expansion below a safe limit varies for different fly ashes.

BUDGETS AND ADMINISTRATION REPORTS

ORISSA STATE BUDGET FOR 1956-57

The following extracts relating to Civil works (P.W.D.) have been taken from Orissa State Budget for the year 1956-57.

		In lakhs of rupees		
		Actuals 1954-55	Revised Estimate 1955-56	Budget Estimate 1956-57
Revenue				
Rents		5.56	4.06	4.06
Ferry receipts		0.13	0.08	0.08
Tolls on roads		0.48	0.40	0.40
Recoveries		0.68	1.63	1.61
Transfers from Central Road Development Accounts Ordinary		5.66	4.44	6.71
Ordinary Reserve		0.58	2.55	7.51
Central Grants for Construction and development of State Roads of Economic and Inter State importance		—	5.64	14.32
Miscellaneous		5.69	2.00	1.93
Khondmals Road Fund-				
(i) Plough Tax		0.02	0.08	0.06
(ii) Miscellaneous Receipts		0.02	0.03	0.02
Deduct - Refunds		-0.06	-0.12	-0.09
	Total	18.76	20.79	36.61
Expenditure				
Original works		37.29	30.53	56.40
Repairs		70.65	109.36	85.68
Grants-in-aid		0.07	0.09	0.09
Suspense		97.74	53.00	63.00
Lump addition for regrant of lapses		—	—	2.63
Lump deduction for probable savings		—	-2.63	—
Development Schemes		9.04	4.70	40.29
Recoveries for reduction of expenditure		-93.40	-95.43	-98.53
Establishment, Tools and Plant		21.13	45.54	69.72
	Total	142.52	145.16	219.28

	(In lakhs of rupees)		
	Actuals 1954-55	Revised Estimate 1955-56	Budget Estimate 1956-57
Capital Expenditure on Civil Works outside the Revenue Accounts			
Buildings	—	78.71	48.95
Communications	48.83	81.81	96.42
New Capital Projects Works	59.69	96.70	121.49
Establishment	2.82	3.51	1.53
Add-lump sum creditable to other Government, and Development etc.	0.51	1.09	0.82
Lump deduction for probable savings	—	-0.50	—
Total	112.85	261.32	269.21
Revenue from Roads			
Receipts under the Indian Motor Vehicles Act	2.61	16.00	16.12
Receipts under the State Motor Vehicles Taxation Act-Receipts under the Madras Motor Vehicles Taxation Act (South Orissa)	8.28	24.32	24.81
Taxes on sale of motor spirit and lubricants	19.08	20.00	20.00
Refunds	-0.10	-0.11	-0.11
Total	29.87	60.21	60.82

ORISSA STATE BUDGET FOR 1956-57

(A brief review with reference to Civil Works)

THE total revenue of the State, is estimated at Rs 1937.67 lakhs for the year 1956-57 as against Rs 1975.20 lakhs (revised estimate) for 1955-56 and Rs 1399.04 lakhs (Actual) for 1954-55. The corresponding expenditure figures are Rs 2498.25 lakhs for 1956-57 (Budget estimate) and Rs 2663.36 lakhs for 1955-56 (Revised estimate) and Rs 1548.27 lakhs for 1954-55 (actual).

The revenue expenditure on Civil Works are placed at Rs 219.28 lakhs for 1956-57 while the revised estimate for 1955-56 and actual for 1954-55 amount to Rs 145.16 lakhs and Rs 142.52 lakhs respectively. In terms of total State Revenue the expenditure amounts to 11.3 per cent in 1956-57, 7.3 per cent in 1955-56 and 10.2 per cent in 1954-55. There was a provision of Rs 40.29 lakhs for Development Schemes for the year 1956-57.

The capital expenditure on Civil Works outside the revenue accounts was estimated at Rs 269.21 lakhs for the year 1956-57, while the revised provision for the previous year amounted to Rs 261.32 lakhs.

LIST OF APPROVED WORKS ON NATIONAL HIGHWAYS

S. No.	Job No.	Name of work	Amount (Rs in lakhs)
		JAMMU & KASHMIR	
1.	1729 JK 1A	Construction of a new road over Banihal mountain between North and South Portals of High Level Tunnel in mile 63 of Jammu-Srinagar-Uri Road, N. H. No. 1A.	3.90
2.	1733 JK 14	Construction of approaches to the new bridge over the Jhelum river at Srinagar on the Jammu-Srinagar-Uri Road (N.H. No. 1A), including development of Hotel Road and construction of Service Road.	9.88
3.	1709 JK 1A	Widening of berms along Pathankot-Jammu Road from mile 94 to 125/3.	3.26
4.	1710 JK 1A	Construction of a new bridge over the Jhelum river at Srinagar on Jammu-Srinagar-Uri Road, National Highway No. 1-A. (Bridge portion).	6.12
		KERALA	
5.	1736 KR 47	Construction of the Param Bayam Bridge and other cross drainagar works in the approaches to the Manglapuzha bridge on N. H. No. 47.	3.86
		MADRAS	
6.	1712 MD 49	Construction of a bridge at mile 46/7 of Madurai-Dhanushkodi Road – N.H. No. 49.	2.00
		ORISSA	
7.		Two works each costing less than two lakhs	1.32
		PUNJAB	
8.	1723 PB 10	Reconditioning miles 84 to 89 of Delhi-Hissar-Sulemanki Road (National Highway No. 10) – First Phase.	4.31
9.	1724 PB 2	Construction of approaches to the over-bridge at Ballabhgarh in mile 23 of Delhi-Mathura Road (National Highway No. 2) in Gurgaon District.	4.19

S. No.	Job No.	Name of work	Amount (Rs in lakhs)
10.	1731 PB 8	Construction of a byepass at Sona on Delhi-Alwar Road, National Highway No. 8.	2.50
11.	1711 PB 2	Construction of an overbridge in place of level crossing at Ballabhgarh on Delhi-Mathura Road, National Highway No. 2.	1.69
		RAJASTHAN	
12.		Two works each costing less than 2 lakhs	0.48
		UTTAR PRADESH	
13.		Five works each costing less than 2 lakhs	2.79
		WEST BENGAL	
14.	1721 BG 31	Construction of a bridge over the river Mora Raidak on National Highway No 31 in the Cooch Bihar District.	4.73
15.	TA 64 BG 31	Construction of a permanent R. C. bridge over the river Kurti near Chalsa on National Highway No. 31.	7.31
16.		Two works each costing less than 2 lakhs.	2.54

A limited number of copies of the following publications of the Indian Roads Congress are available for sale.

	Publications.	Price inclusive of postage, etc.		
		Rs.	A.	P.
1.	Volume IX—Part 4—October 1945	3	0	0
2.	Volume IX—Bound—1945	10	0	0
3.	Volume X—Part 4—August 1946	3	0	0
4.	Volume XI—Part 4—May 1947	3	0	0
5.	Volume XII—Part 2—January 1948	3	0	0
6.	Volume XII—Part 3—April 1948	3	0	0
7.	Volume XII—Part 4—March 1948	3	0	0
8.	Volume XII—Part 5—September 1948	3	0	0
9.	Volume XII—Bound—1947-48	12	0	0
10.	Volume XIII—Part 1—December 1948	3	0	0
11.	Volume XIII—Part 2—January 1949	3	0	0
12.	Volume XIII—Part 3—January 1949	3	0	0
13.	Volume XIII—Bound—1948—49	11	0	0
14.	Volume XIV—Part 1—September 1949	3	0	0
15.	Volume XIV—Part 2—December 1949	3	0	0
16.	Volume XIV—Part 3—December 1949	3	0	0
17.	Volume XIV—Part 4—July 1950	3	0	0
18.	Volume XIV—Bound—1949-50	8	0	0
19.	Volume XV—Part 1—August 1950	3	0	0
20.	Volume XV—Part 2—November 1950	3	0	0
21.	Volume XV—Part 3—January 1951	3	0	0
22.	Volume XV—Part 4—August 1951	3	0	0
23.	Volume XV—Bound—1950-51	9	0	0
24.	Volume XVI—Part 2—March 1952	3	0	0
25.	Volume XVI—Part 3—April 1952	3	0	0
26.	Volume XVI—Part 4—October 1952	3	0	0
27.	Volume XVI—Bound—1951-52	8	0	0
28.	Volume XVII—Part 1—December 1952	3	0	0
29.	Volume XVII—Part 2—January 1953	3	0	0
30.	Volume XVII—Part 3—January 1953	3	0	0
31.	Volume XVII—Part 4—December 1953	3	0	0
32.	Volume XVII—Bound—1952-53	9	0	0
33.	Volume XVIII—Part 3—January 1954	3	0	0
34.	Volume XVIII—Part 4—March 1955	3	0	0
35.	Volume XVIII—Bound—1953-54	9	0	0
36.	Volume XIX—Part 2—May 1955	3	0	0
37.	Volume XIX—Part 4—Sept. 1955	3	0	0
38.	Volume XIX—Bound-1954-55	10	0	0
39.	Volume XX—Part 1—October 1955	3	0	0
40.	Volume XX—Part 2—November 1955	3	0	0
41.	Volume XX—Part 3—December 1955	3	0	0
42.	Volume XX—Part 4—January 1957	3	0	0
43.	Volume XXI—Part 1—February 1957	3	0	0
44.	Volume XXI—Part 2—March 1957	3	0	0
45.	Volume XXI—Part 3—April 1957	3	0	0
46.	Road Research Bulletin No. 1	5	0	0
47.	Road Research Bulletin No. 2	5	0	0
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