

# The Brazilian Highway Research Institute as Compared With Other Similar Agencies

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## HISTORICAL NOTES ON HIGHWAY RESEARCH

●HIGHWAY RESEARCH is a relatively new scientific activity. A review of these specialized activities will show us this world picture:

1. In the United States, although the idea bore fruit in 1893 when the Office of Road Inquiry was established as the predecessor of the present Bureau of Public Roads, interest in highway research was not accelerated greatly until the establishment of the Highway Research Board in 1920 under the National Academy of Sciences—National Research Council.

2. In Great Britain, the Road Research Laboratory initiated its activities in 1933 through two divisions: (a) Materials and Construction of Roads and Airports; and (b) Traffic Safety.

3. In Canada—although the National Research Council is still the official agency of all Canadian investigations—the Canadian Good Roads Association established in 1962 a Special Coordinating Committee on Highway Research which published in 1964 a report of 441 projects under way or completed since 1958.

4. In France, the Laboratoire Central des Ponts et Chaussées concentrates in 10 different sections all highway research work of the French governmental agencies. Lately, the Centre de Recherches Routières has been established.

5. In Germany, the STUFA (Society for the Study of Highway Construction), established in Berlin in October 1924, was succeeded in 1934 by the present Forschungsgesellschaft für das Strassenwesen (Society for Highway Research), located in Cologne. However, it was not until 1927 that the Ministry of Transport allocated the sum of 30,000 DM for the establishment of highway research institutes in each of the Technical Schools of the Universities of Braunschweig, Breslau, Danzig, Darmstadt, Dresden and Stuttgart.

6. In Sweden, the Statensvagninstitut is the central agency of all highway research work, concentrating specifically on paving materials, frost effects, and traffic characteristics.

7. In Italy, the Centro Esperimentale Stradale dell'ANAS in Rome has just started to assume the functions previously performed by the Istituto Sperimentale Stradale in Milan.

8. In Switzerland, the Union Suisse des Professionnels de la Route conducts its research activities through 11 different specialized committees.

9. In Spain, the Laboratorio del Transporte y Mecánica del Suelo performs its research activities in three different fields: (a) soil mechanics; (b) pavings and traffic; and (c) transport economics.

10. In Portugal, the Laboratorio Nacional de Engenharia Civil conducts also some highway research work.

11. In Poland, the Centralny Ośrodek Kadan is the central agency for highway research work.

12. In the Soviet Union, the Soyuzdornii coordinates all the activities of the different highway research institutes.

13. In India, the Central Road Research Institute and Indian Roads Congress are the principal agencies devoted to highway research work.

14. In Pakistan, the Road Research Institute in Lahore tries to disseminate the highway research work being conducted outside the country.

15. In Japan, the highway research laboratories are grouped into three different categories: (a) those which practice fundamental investigations; (b) those which conduct research work directly related with design; and (c) those which primarily perform routine tests for field work. The first group is connected with the Universities; the second group consists of governmental institutes; the third group includes the laboratories subordinated to the eight Districts of the Ministry of Construction and the Municipal Governments.

16. In South Africa, the National Research Institute in Pretoria contributes to the improvement of highway techniques.

17. In China, the Ministry of Communications in Peiping established in 1949 a central agency for highway research, known as Communications Science Research Institute.

18. In Australia, the Australian Road Research Board is devoted to highway research work.

19. In Brazil, the Instituto de Pesquisas Rodoviaras was established in August 1957, conducting its activities through the following fields: (a) scholarships and grants; (b) specialized courses; (c) technical lectures; (d) monograph contests; (e) national and foreign meetings and congresses; (f) technical publications; (g) technical interchange with similar agencies; and (h) promotion of the first Symposium on Highway Research.

#### ORGANIZATION OF RESEARCH AGENCIES

In spite of so many agencies devoted to highway research, few of them have identical internal organizations. The basic structure of such agencies is determined in accordance with one of the following broad operating policies: (a) conducting research directly with its own personnel using its own laboratories; and (b) allocating or correlating investigations conducted by other agencies or individuals specializing in research work under their own coordination and orientation.

The first policy has been adopted by the majority of the European countries in accordance with the pattern of the Road Research Laboratory organization. One of the few exceptions is found in West Germany, which preferred to follow the policy of the Highway Research Board of the United States. This policy was also adopted by the Instituto de Pesquisas Rodoviaras in Brazil.

In trying to establish a brief comparison among the internal organizations of those three similar agencies which coordinate or correlate activities related to highway research in the United States, West Germany and Brazil, we have the following general picture:

##### Highway Research Board (United States)

1. Department of Economics, Finance and Administration;
2. Department of Design;
3. Department of Materials and Construction;
4. Department of Maintenance;
5. Department of Traffic and Operations;
6. Department of Soils, Geology and Foundations;
7. Department of Urban Transportation Planning;
8. Department of Legal Studies;
9. Special Committee on International Cooperative Activities.

##### Forschungsgesellschaft für das Strassenwesen (West Germany)

1. Administration Working Group;
2. Rural Roads Traffic Planning Working Group;



3. Urban Roads Traffic Planning Working Group;
4. Vehicle and Roadway Working Group;
5. Subsoil Working Group;
6. Foundations Working Group;
7. Asphalt and Tar Surfaced Roads Working Group;
8. Cement Surfaced Roads Working Group;
9. Metalled Roads Working Group.

Instituto de Pesquisas Rodovias (Brazil)

1. Design Working Group;
2. Soil Mechanics and Earthmoving Working Group;
3. Paving Working Group;
4. Equipment Working Group;
5. Traffic Working Group;
6. Materials Working Group;
7. Economics and Finance Working Group;
8. Legislation and Administration Working Group;
9. General Plans and Coordination Working Group.

The simple enunciation of those 8 or 9 departments or working groups indicates a diversification of research work on all highway problems in contradiction to what often occurs from adherence to the European policy which, for economic reasons, may confine the action field to two or three specialized items.

Although there is similarity in the structure of the activities of each of the three correlating agencies of highway research work in the United States, West Germany and Brazil, there are still marked differences in the grouping of some items. For instance, the Highway Research Board includes within the same department all of the subjects related to materials and construction, while the Forschungsgesellschaft für das Strassenwesen subdivides the subjects related to construction into flexible or rigid pavements and the Instituto de Pesquisas Rodovias radically separates materials from construction.

As for maintenance, only the Highway Research Board groups it with equipment. Equipment research is under a separate group at the Instituto de Pesquisas Rodovias. Neither of the two items shows up specifically in the Forschungsgesellschaft für das Strassenwesen.

Among the few comparable groupings in the three similar agencies are those relating to traffic, soil mechanics and administration. The same comparability does not occur, however, with subjects related to economics or legislation, which are included only at the HRB and IPR. As for subjects related to urban transportation, per se, they show up only at the HRB.

IPR might improve its Working Groups by converting them into the Research Sectors which constitute its Technical Scientific Service, in accordance with Articles 20 to 25 of its Internal Regulations. Taking into consideration the experience obtained during its eight years of existence, the following would be a practical structure for the Instituto de Pesquisas Rodovias:

1. Layout and Design Research Sector;
2. Soil Mechanics and Foundation Research Sector;
3. Paving and Maintenance Research Sector;
4. Traffic and Transportation Research Sector;
5. Equipment and Devices Research Sector;
6. Materials and Tests Research Sector;
7. Economics and Finance Research Sector;
8. Legislation and Administration Research Sector;
9. Drainage and Structures Research Sector.

## FINANCING FUNDS FOR RESEARCH

Now let us examine funding of highway investigation in each of the three countries which follow a similar policy for highway research work.

Highway Research Board Special Report No. 55, published in 1959, enumerates for the United States the various highway research fiscal programs among the several governmental and independent agencies for the year 1958 (1). A summary of the data furnished by the Bureau of Public Roads, the State Highway Departments, the universities and the HRB indicates four different fund categories established for highway research work: (a) Bureau of Public Roads administrative funds; (b) so-called 1½ percent funds, Federal-aid with State matching; (c) State highway funds used independently of any Federal-aid matching funds; and (d) funds provided to universities by sources other than federal or state highway funds. For 1958, the funds were distributed as follows:

Bureau of Public Roads	\$ 2,300,000
Projects financed under 1½ percent funds	4,700,000
Projects financed with State funds	5,000,000
University projects funds	1,500,000
Total	<u>\$13,500,000</u>

Adding to this total one fifth of the total cost of the AASHO Road Test in Illinois (a five-year project)—\$21.7 million—the total research activity in 1958 may be estimated as \$17.8 million. Considering that the total amount of highway expenditures in the same year was \$9,927 million or almost \$10 billion, the corresponding percentage for research work represents 0.18 percent of that total amount.

It is interesting to compare the percentage of funds allocated to the Instituto de Pesquisas Rodoviarias in the last 7 years with the Brazilian Federal Highway Department (DNER) expenditures in the same period, which were as follows:

<u>Year</u>	<u>DNER</u>	<u>IPR</u>	<u>Percentage</u>
1958	Cr\$ 9,117,767,917	Cr\$ 2,292,640	0.020
1959	14,588,310,840	6,031,245	0.040
1960	23,348,134,552	8,878,125	0.038
1961	41,465,582,925	14,730,000	0.036
1962	74,407,223,235	55,070,000	0.074
1963	129,814,171,994	73,000,000	0.056
1964	164,378,628,385	72,000,000	0.044

It is also interesting to note that if the expenditures of the several state highway departments were included in the tabulation, the above percentages would drop to lower levels. At present DNER and the National Research Council are the only sources of funding for the IPR.

In West Germany, the highway research work is conducted by technical schools, the State Road Laboratory, and to some extent by the industry laboratories. Means for this work are provided by the Ministry of Transport, the States, a special organization for promoting highway safety and the Forshungsgesellschaft für das Strassenwesen. The following table shows the sums provided by the government, the states and counties during the years 1934-1962 for highway research work as compared with the highway expenditures for the same period (2):

<u>Year</u>	<u>Highway Expenditures (millions DM)</u>	<u>Research Funds (millions DM)</u>	<u>Percentage</u>
1934	312	1	0.320
1936	517	1	0.200
1938	848	1	0.120

<u>Year</u>	<u>Highway Expenditures (millions DM)</u>	<u>Research Funds (millions DM)</u>	<u>Percentage</u>
1950	539	0.3	0.055
1952	688	0.5	0.073
1954	900	0.8	0.089
1956	1,600	0.8	0.050
1958	2,200	1.9	0.086
1960	2,300	2.2	0.095
1962	3,500	2.5	0.072

It is of interest to observe the coincidence that in 1962 the percentages in West Germany and in Brazil were the same: 0.07%. However, after 1962 the percentages in Brazil have been dropping very rapidly, in spite of the fact that costs of research are increasing every year.

In the United States of America the several state highway departments contribute annually a modest sum of funds to provide a cooperative program for highway research to be shared by all highway agencies, a desirable objective for IPR.

#### NATURE OF HIGHWAY RESEARCH WORK

In an excellent report prepared for the Highway Research Board, Mr. M. Earl Campbell (3) enumerates five organizational patterns of highway research work in the United States: (a) noncentralized research; (b) centrally coordinated research; (c) formal research; (d) joint research; and (e) contracted research.

In West Germany, the Forschungsgesellschaft für das Strassenwesen, in connection with the Ministry of Transport, tries to register all research projects and financial sources to insure that no time or money is wasted in duplicative efforts. Its Board—in similar fashion to the HRB or the Technical Council of IPR—recommends projects for research and suggests institutes or individuals to perform the research tasks. Working groups discuss the procedure and its results. Evaluating such results, they draft specifications for planning and construction methods.

The Forschungsgesellschaft für das Strassenwesen, like the HRB but unlike the IPR, has many contacts with the highway departments, technical universities and research-oriented organizations in foreign countries. It also acts as an exchange organization for research work and it is able to match parallel projects, pick out the right institutes for special work and judge the results for practicable uses.

In Brazil the Instituto de Pesquisas Rodoviarias has maintained itself during its eight years of existence with the modest resources furnished by DNER and the National Research Council. Occasionally, some of the state highway departments contribute token amounts specifically for financing the specialized courses promoted by the Institute in several states, such as at Sao Paulo, Minas Gerais, Parana, Rio Grande do Sul, Bahia, Pernambuco, Rio Grande do Norte and Ceara.

In order to classify the funds spent by IPR according to the nature of research work, we have prepared the following table:

<u>Nature</u>	<u>Fundings</u>
1. Bibliographic . . . . .	8
2. Dissemination . . . . .	6
3. Economics . . . . .	5
4. Educational . . . . .	3
5. Probational . . . . .	18
6. Experimental . . . . .	8
7. Investigational . . . . .	9
8. Legislative . . . . .	5
9. Methodological . . . . .	6
10. Operational . . . . .	5
11. Organizational . . . . .	3
Total	<u>76</u>



Grouping our 76 funds according to the five types of highway research work described by Mr. Campbell in his report (3), all of them would be classified in the last group as "contracted research."

### NEED OF INTERNATIONAL INTERCHANGE

The single existence of some twenty agencies devoted to highway research work in the six developed continents attests to the need for establishing an interchange of information and technical knowledge related to common concerns. This interchange, at first exerted directly among interested agencies, now is demanding an international activity so that all agencies can participate in it as they deal with investigations related to highway problems.

In Europe, where the policy adopted by the Road Research Laboratory prevails in conducting research work directly with its own personnel in its own laboratories, there have been discussions since 1960 regarding the best way of establishing an international organization for coordination of all highway research laboratories. There is agreement that such an agency should be a center to collect and distribute all technical information related to the common objective, although some think that it should also conduct research work of a cooperative character. Although it has not yet been possible to establish such an international agency, a compromise has been reached between the two different points of view, namely, the funding of the new agency should be used only to finance ways to stimulate research cooperation leaving the research work of a cooperative character to those agencies directly interested in participating in it (4).

In the meantime, international documentation centers in a few countries are sporadically publishing bibliographical information concerning roads and transport and providing translation services and storage and retrieval of information related to highways. Among such international agencies, the following are the best known:

1. Committee for Scientific Research, OECD, Paris;
2. European Conference of Ministers of Transport, OECD;
3. United Nations Educational, Scientific and Cultural Organization, UNESCO, Paris;
4. Economic and Social Council, United Nations, New York;
5. Documentation Center, International Road Federation, Berne;
6. Permanent International Association of Road Congresses, Paris;
7. International Center for Documentation of the Inspection and Technical Aspects of Motor Vehicles, Brussels;
8. International Council for Building Research, Study and Documentation, CIB, Rotterdam;
9. International Union of Testing and Research Laboratories for Materials and Structures, RILEM, PARIS;
10. International Society of Soil Mechanics and Foundation Engineering, London;
11. International Federation for Documentation, FID, The Hague;
12. International Organization for Standardization, ISC, Geneva;
13. Highway Research Information Service, HRB, Washington (developing).

Recently, the U.S. Bureau of Public Roads authorized the International Road Federation to proceed with an investigation to determine the methodology of an international highway research and development exchange program. A preliminary report (5) based on pilot studies conducted in four Western European countries by IRF President Robert O. Swain, suggests that the initial inventory be continued into a second phase extending eventually to 30 additional countries, including Brazil.

As a consequence, IRF asked the Instituto de Pesquisas Rodoviarias to conduct such an inventory in Brazil. This has been in progress during the past six months in all of the Brazilian States in order to diffuse all around the world the research and development work underway in the largest country of South America.

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