

PRESENT AND FUTURE OF TRANSPORT RESEARCH IN
SOUTH AMERICA : WHAT TO DO ?

Sergio R. Jara Díaz and Sergio M. González
Departamento de Ingeniería Civil
Universidad de Chile
Casilla 5373, Santiago
Chile.

1. INTRODUCTION.

Transport Research has evolved in many respects during the last fifteen years. This is apparent in South America (S.A.) where most research centers were born at Engineering Schools, offering transport related programs usually oriented toward facilities design and construction. As the operational and economic dimensions of transport problems became increasingly important, individuals recently formed on the basis of such programs began to explore areas of knowledge associated to these dimensions, as Operations Research, Economics and Social Sciences, in an effort to embrace the full range of causal relations and implications immerse in transport analysis. This is not an uncommon story, if one reviews "old" collections of proceedings from transport related meetings during the sixties in the developed world. After all, journals like Transportation Research and Transportation Science were born during the second half of that decade. But it is true that some well established research groups in S.A. have been consolidated only at the end of the seventies, in spite of having been born a decade before.

In this paper we try to characterize and analyze both positively and normatively the evolution of transport research in S.A. and we propose some courses of action in order to reformulate the role of transport research at a regional level, which should influence the type of relation with the rest of the world. Our objective is both to inform about our reality and to influence over our academic environment. We would consider ourselves satisfied if this paper increased the degree of perception on transport research in S.A. both internally and externally. In the following section we describe this evolution through a series of variables and indexes. In section 3 this information is analyzed and a sort of diagnostic of the present situations is put forward, in terms of problems and objectives. A set of actions is proposed in section 4, as a working program for transport research within the region. Section 5 summarizes diagnostic, analysis and alternatives.

It is undoubtedly difficult to cover all facts and to account for everything in a paper of this nature. But we consider this as a first attempt to give an informed opinion on this matter. We expect answers and disagreements. After all, there is no other way to build up consciousness.

2. EVOLUTION OF TRANSPORT RESEARCH.

Design and construction of transport facilities based upon adaptation of foreign technology, was the activity around which some kind of transport research existed in S.A. till the end of the sixties. Probably due to the industrialization process followed by S.A. countries during the first half of the century, the decision making process associated with the transport activity rested mainly on the willingness to undertake certain projects considered necessary. Accordingly, the minimum cost criteria within certain standards was the privileged rule to decide

among alternative ways to reach the objective. Thus, the measurement of benefits was relegated to a second place, when not forgotten.

At the end of the sixties, groups of transport research were formed at some universities, but the flow of research outputs began to stabilize much later. Tables 1 and 3 provide information on research projects undertaken by institutions in S.A. countries. Both tables are based upon surveys published by the International Road Federation. Naturally, this information deals preferentially, but not exclusively, with roads related projects.

Table 1. Number of Research Projects.

Year Country	1969	1974	1975	1976	1978	1979	1980	1981	% Infrastructure (approx.)
Argentina	--	30	--	--	49	49	9	8	100
Brazil	--	65	79	75	35	168	145	9	75
Chile	--	--	--	--	10	17	40	18	50
Colombia	7	--	4	--	90	92	29	34	60
Perú	--	--	--	--	--	26	4	8	70
Venezuela	20	--	--	--	--	59	--	--	65

Source : IRF Reports.

Table 2. Number of Institutions Involved
in Research Projects

Year Country	1969	1974	1975	1976	1978	1979	1980	1981	% Universities (approx.)
Argentina	--	5	--	--	7	7	5	6	40
Brazil	--	17	22	22	16	37	39	7	40
Chile	--	--	--	--	6	5	6	4	95
Colombia	2	--	1	--	13	23	5	12	85
Perú	--	--	--	--	--	7	2	4	10
Venezuela	6	--	--	--	--	27	--	--	50

Source : IRF Reports.

Besides the evolution in terms of annual number of projects, the last column in Table 1 shows the percentage of projects exclusively oriented toward infrastructure, e.e. soil mechanics, pavements, and so on, which ranks from 50 to 100 per cent ; the remainder deals with aspects of evaluation, demand and operation. Most applied topics are repeated across countries. The last column of Table 2 gives an idea of the origin of projects by indicating the approximate percentage of projects developed at the universities, which is high in Chile and Colombia and medium in Argentina, Brazil and Venezuela.

Eight internationally distributed transport journals were followed from 1969 to 1982*. We looked for articles with at least one author from S.A. (either temporarily abroad, or working in S.A.), and articles generated in S.A. institutions. The result is shown in Figure 1, where three periods can be distinguished: low and unstable level (1969-1973), low and stable (1974-1977), increasing trend (1978-1982).

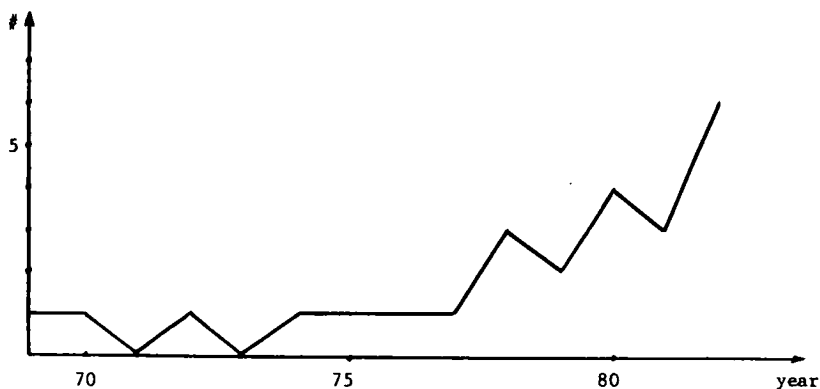


Figure 1. International Publications.

The average contribution by country of origin of the author in this last period is Brazil 0.6, Chile 2.6, Colombia 0.2 and Venezuela 0.2. The emphasis is strongly theoretical or methodological, following the pattern of each journal. The preferred topics have been users' behaviour (25%), firm's behaviour (25%), evaluation (12%) and pricing (8%). Only a 60% of the articles explicitly recognized a S.A. institution as author's origin.

With respect to international conferences, a review of papers presented to the PTRC meetings shows a somewhat similar pattern in time, i.e. 1 in 1977, 2 in 1978, 3 in 1979, 1 in 1980 and 6 in 1982 (60% from Chile). The content, however, is roughly 60% methodological and 40% related to the national transport system. Regional conferences

* Transportation Research, Transportation Science, Journal of Transport Economics and Policy, Transportation, Transport Planning and Technology, Traffic Engineering and Control, Traffic Quarterly and Transport Reviews.

are relatively scarce in average during the last 12 years, but the recent experience indicates that the trend is to stabilize around one or two periodical (semi-annual) meetings.

Some qualitative information can be also given on the basis of a survey made to different individuals from five S.A. countries. The answers are highly consistent with the quantitative information already exposed. In Brazil, transport research is developed by the Universities and public institutions (slightly predominant). Studies are very much oriented toward the national transport system; examples are a navigation system for the Amazonas, programming of air services, railways, and low cost pavements. On methodological grounds, the emphasis is on model validation as part of a process of technology adaptation. The level of human resources is high for S.A. standards in quantitative terms. Brazil has internal diffusion of transport research outputs; there are some journals oriented toward infrastructure, and at least two national meetings take place annually. The development of a national transportation industry (vehicles) has also played a positive role on research activities.

In Colombia, transport research locates mainly at the Universities though some support is given by other institutions (public and private). Research is basically oriented toward roads and urban transportation, with emphasis on infrastructure and technology adaptation. Although not systematically, national and international meetings have taken place in Colombia. There was an effort on developing an Information Center on transport research.

In Ecuador both transport research and education are extremely incipient, and some preoccupation has been detected mainly on infrastructure and traffic.

Transport research activity in Chile concentrates at the Universities. Some financial support is beginning to be offered by public institutions, particularly on urban transport analysis. Research topics cover both theoretical-methodological aspects (demand, evaluation, economics, production theory) as well as applications and technology transfer (market of taxi-cabs, accidents, land use, traffic simulation, signals coordination). In terms of human resources, two universities concentrate 4 Ph.D., 5 M.Sc. and 4 Engineers full-time devoted to transport research.

Finally, research in Argentina is highly concentrated outside the Universities. Public institutions have laboratories and are somewhat prepared for experimental research (infrastructure oriented). A big effort toward designing a National Transport Plan has been done during the last years, around which a training experience (abroad) is taking place. Model calibration and project evaluation has been emphasized in a framework of technology transfer.

In summary, although the story is somewhat the same, clear differences exist in terms of the degree of development of transport research across S.A. countries. Also, there are countries where research efforts concentrate at the Universities (Chile, Colombia), while in others public institutions play the predominant role (Argentina, Brazil). The trend in terms of research topics is to go toward the understanding of transport activities from both the users and producers viewpoints. The need to evaluate benefits of transport projects seems to mark the difference with previous periods. External training has privileged the U.S.A.

and U.K. as sources of formation and information. This, and the process of technology transfer and adaptation from those countries also characterizes transport research evolution in S.A. during the last twelve years. Scarce communication among centers was detected, but regional meetings are beginning to stabilize.

3. ANALYSIS.

From the information collected and exposed in the previous section, it seems apparent that transport research in S.A. has recently entered a period of sustained development, with some characteristics that prevail regionally in spite of the national singularities. Although intra-regional differences do exist, the formation of some research groups at the end of the sixties was followed by a period of self-formation and training which resulted in well established research centers at the beginning of the eighties. Naturally, this does not mean that the present situation is optimal, but an objective basis in terms of demand for research and availability of human resources seems to have been established.

The overall emphasis has gradually changed from infra-structural aspects to both operative and economic dimensions, which have been developed mostly around applications although theoretical and methodological contributions have also emerged. These latter have entered the already established channels of diffusion for the academic activity, which are journals and meetings, resulting in an increase in the international presence of S.A. research institutions. On the other hand, it is symptomatic that theoretical research outputs are not regionally aired before their international diffusion.

The applications of fairly advanced technical tools for design, analysis and evaluation of transport projects seems to be generalized practice in some countries. However, it is quite surprising to detect continuous reference to the application of models that are apparently general but actually country-specific. Causal relations that are implicitly postulated in different models (operating costs, highway design, vehicle flow behaviour, etc.) are sometimes accepted even in terms of the validity of its parameters (e.g. accident rates, vehicle speed). This is beginning to be challenged through calibration, validation and/or estimation of models based upon own data. Some results show that behavioural and environmental characteristics make this task highly relevant. In other cases, methodological transferability even in the form of models seem to have been accepted in a more sensible way, i.e. adapting the framework to the national reality; this is the case with disaggregate choice models, traffic simulation and others.

Unfortunately, results from applications and technology transfer are rarely reported even at a regional level, due to the lack of a well established system of interaction, e.g. meetings and journals. Mutual knowledge at an individual level and bilateral communication at an institutional level are, undoubtedly, at a very low level. Some recent experience is encouraging in this respect since the need for interaction and integration has been recognized, but actual channels of communication are yet to be established.

In terms of modal research emphasis, the most frequent topics common to all countries have been design and evaluation of road systems or their components, urban transport and the operation of railways. Both air and maritime transport activities have been clearly rele-

gated to a second place, when not forgotten, with some exceptions. This trend seems to be the reaction to some external stimulus, which include the financial influence of lending organizations, the international research and the already chronic inorganic growth of the automotive stock within urban areas. In this sense, the lack of a normative view from the transport academic community toward transport problems within the region is to be deplored. However, there is some preoccupation in terms of identifying research areas explicitly oriented toward policy design.

Not less important although apparent, the role of the Universities has been essential in the development of transport research in S.A. Through training programs and self-formation, academic centers have established a solid basis for their own development. The influence of Europe and the U.S.A. in this sense is evident, such that better and stronger relations exist between individual S.A. centers and institutions in developed countries than among those centers. This tends to maintain a dependence situation. Nevertheless, maturity has been helped by the training abroad in those cases where self-consciousness is objectively present.

Finally, research priorities are difficult to establish in a document like this, but a summary of opinions collected in different countries overlap in the following areas from both methodological and applied viewpoints :

- validation of models and ex-post analysis;
- estimation of projects benefits and distributional effects;
- traffic and public transit;
- information systems;
- management;
- national transport systems.

4. WHAT TO DO ?

The diagnostic and analysis contained in the preceding sections show the need to develop actions toward increasing the communication and exchange of ideas among transportation researchers in S.A. Fortunately, there are objective reasons which suggest that such a task is not only desirable but feasible. Here we examine short and medium run actions from both a normative and positive viewpoints.

First of all, we advocate for the development of a regional academic environment which could help to cultivate a more adequate approach to face transportation problems within S.A. The organization of periodical regional meetings would provide a natural channel of interaction in this sense. Some recent experiences reinforce the idea that this is both useful and feasible. During June 1982, the First Latinamerican Seminar on Transport Planning took place in Buenos Aires, organized by the Economic Commission for Latin America (CEPAL). Among the conclusions of the seminar, "it was thought to be convenient to repeat periodically this type of meetings" due to "the great interest shown by the planners within the region in the interchange of experiences" (U.N., 1982). Moreover, the Argentinean Journal *Temas de Transporte* was proposed and accepted as a mean to divulge transport planning activities undertaken by different countries. Recently, the Second Panamerican Congress on Traffic and Transport Engineering (Popayán, Colombia, November 1982), made it possible for individuals from 14 Latin American countries to agree on the formation of the Latin American Society of Transport Engineering, following a proposal

presented by delegates from the University of Chile; an ad-hoc committee was formed.

Secondly, we think that the rich cumulative experience on the application of methodologies generated in the developed world to the South America reality, should be aired internationally. This experience, which is part of the process of technology transfer, have been rarely exposed from the viewpoint of the recipients of that transfer. Although it is true that there is no methodological novelty in applications, the extent to which foreign methodologies are applicable to our reality is of great interest not only to the users but to the exporters. Therefore we encourage existing transport journals to promote articles on the applications of techniques to the analysis and/or solution of transport problems in developing countries in general and in S.A. in particular. Some effort in this direction has already been done and the disposition of individual journals is extremely receptive.

A third aspect worth promoting is the development of joint efforts among South American centers. The fact that many individuals presently engaged in transport research within S.A. have received formal training abroad, plus the existence of fairly solid and stable programs of transport education within the region, makes the cooperative game both rewarding and attractive for the students, the academic community, and the centers themselves. Isolated experiences with guest speakers and visiting professors from the region can be found in the near past, with encouraging results. However, this is by no means standard practice. In addition, research topics do repeat from country to country particularly on applications and technical transfer, which makes cooperation not only attractive but efficient.

The problem of technical and methodological dependence is somewhat chronic in S.A. This classic vicious circle is difficult to break. The problem is how to overcome the dependence situation keeping an adequate level of cooperation with centers of the developed world. And here lies one of the most challenging aspects of the whole problem of what to do : although South American centers should concentrate their efforts in the application of technical tools to the South American context, generic problems and theoretical contributions should not be overlooked but encouraged and promoted. An academic journal edited within the region but reaching an international audience would facilitate some necessary intellectual autonomy. It should be recognized that the process of diffusion of knowledge has two stages : proposal and judgement. Being close to the source of diffusion clearly helps to be considered as a potential participant in both.

Many of the proposed courses of action require funding, and funding is difficult in S.A.. Organizations at a regional or international level should be attracted to promote the diffusion of transport research in S.A., particularly through the funding (or direct organization) of meetings, courses, stable programs or journals. The Organization of American States, UNESCO, CEPAL or others should help in this direction. Undoubtedly, the implementation of the Latin American Society of Transport Engineers would greatly help in giving an impulse to many of the implicit and explicit tasks we have described. Notwithstanding, individual initiative would also play an important role in the same direction, if adequately developed.

5. CONCLUSIONS.

The evolution of transport research in S.A. during the last decade shows that, in spite of the qualitative and quantitative differences across countries, there are common areas of interest, particularly on applications and technology transfer. In a twelve years period, some groups have reached a solid status in terms of human resources and regional and international presence. There is little normative discussion on what to investigate, and the interchange of ideas lacks the adequate channels.

This paper suggests the development of a regional academic environment that helps to cultivate a more adequate approach to South American problems. Such a situation would also help to redefine relationships with centers in developed countries. Existing specialized transport journals should also be encouraged to promote articles on the application of techniques to the analysis and/or solution of transport problems in developing countries. South American centers should concentrate their efforts in the application of technical tools to the South American context without overlooking methodological problems and/or theoretical contributions. The main obstacles to these and other initiatives are financial support, lack of integrating efforts in other areas of knowledge and the chronic status-quo that shows a South America strongly dependent in a technological sense.

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