



# Advanced Traffic Control Center and Research Institutes in Japan

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ADVANCED TRAFFIC CONTROL CENTERS  
AND RESEARCH INSTITUTES IN JAPAN

Horst Strobel

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Advanced Traffic Control Centers  
and Research Institutes in Japan

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1. The Aim of the Japan Trip

The Japan trip has been made with the following aims:

o To study the most advanced Japanese traffic systems concerning the used concepts for computer control, the applied methodology and the results and experiences obtained in real applications, as well as expected from simulation studies. It was already well known that some of the most advanced traffic control systems are in operation in Japan. On the other hand, no detailed information has been published in English. Therefore, one purpose of the trip was to provide a possibility for personal discussions with leading scientists and engineers on the latest state-of-the-art and about Japanese answers to the questions: What contribution one expects in Japan from advanced computerized urban traffic control systems in the reduction of the serious present and future urban traffic problems, i.e. concerning congestion, accidents and fatalities, endangering of the urban environment (noise and air pollution) and resource consumption (energy, land)?

o The visit was to provide one essential part of the information needed for an international comparative analysis which shall result in a state-of-the-art report of the urban project, leading to a manuscript for a volume on Computerized Urban Traffic Control and Guidance Systems (CUTC) of IIASA's state-of-the-art series.

o One special aim of the trip was to have personal discussions with possible Japanese co-authors to that CUTC volume, who should be asked to prepare case descriptions on advanced Japanese systems.

o The trip should be used for asking some leading Japanese scientists for contributions to the IFAC Workshop "Optimization Applied to Transportation" (Vienna, February 1976), co-sponsored by IIASA.

## 2. The Working Program

- o June 16th: Meeting with Dr. K. Ichikawa, Professor of Control Engineering of Sophia University in Tokyo, and former research engineer of the research institute of Japanese National Railways: discussions on computer control of railway systems.
  
- o June 17th: Meeting with Professors T. Ishii and M. Iguchi of Tokyo University, the leading Japanese experts in the development of the Japanese CVS (Computer Controlled Vehicle System): comprehensive discussions on Japanese concepts and results in the creation of new urban transportation systems like the CVS and the KRT (Kobe Rapid Transit) systems.
  - Flight to Osaka.
  
- o June 18th: Visiting the area traffic control center of Osaka in the Osaka Metropolitan Police Office: comprehensive discussions with engineers of OMRON (Omron Tateisi Electronics Co.) responsible for the hardware and software design, as well as for the implementation and with the operational staff.
  
- o June 19th: - Visit to the Computer Control Center of the HANSHIN Expressway in Osaka under the guidance of Prof. Hasegawa, the leading expert in the development of both the Osaka area and expressway control system: detailed discussions on latest experiences and visits to the control center, as well as to the expressway itself.
  - Visit to the Hankyu Bus Co. in Osaka under the guidance of Prof. Hasegawa: comprehensive discussions about the DEMAND BUS SYSTEM operated by the Hankyu Company during the past several years and about future developments. As yet, no publication in English exists about this system.
  - Travel to Kyoto by train.

- o June 20th: - General discussions with Prof. Sawaragi, member of the Japanese IIASA Committee at Kyoto University: special attention was paid to the subject "Traffic Control" as a part of the large Japanese research project on "Environment Control" (project leader is Prof. Sawaragi).
  - Presented a lecture on "Computerized Urban Traffic Control Systems--A Research Subject in the Urban Project at IIASA" in a 1 1/2 hour seminar with about 60 participants at the Department of Applied Mathematics and Physics at Kyoto University.
  - Round-table discussion with Professors Hasegawa and Akashi (Kyoto University) and experts of Omron Company on the future of area and freeway control systems in Japan.
  - Discussion with Prof. Ohno (Kyoto University), a former research engineer of the Japanese National Railway Research Institute, on computer control of the SHINKANSEN line (System COMTRAC). Visit to Prof. Ohno's laboratories for information technique.
- o June 21st & 22nd: Sightseeing of Kyoto, returning to Tokyo by SHINKANSEN Super Express Train.
- o June 23rd: - Meeting with Professors Takaba and Hamada of the Institute of Industrial Science of Tokyo University: discussion about and demonstration of a hybrid simulation system for urban street traffic.
  - Visit to the HIGASHI-MURAYAMA CVS Project Experimental Center of the Japan Society for the Promotion of Machine Industry: detailed discussions about and observation of the new guideway system, which was running in test operation during the visit. This CVS will be exhibited at the International Maritime EXPO in Okinawa during July 1975.

- o June 24th: - Visit to the Research Institute of Japanese National Railways with discussion of Computer Control of Railway operation (systems COMTRAC [Computer Aided Train Control] and ATOMIC [Automatic Train Control by Mini Computer]).  
  
- Visit to the Computing Center of Japanese National Railways (JNR); explanation and demonstration of the seat-reservation systems MARS and TARS for the JNR. The used computing system is the largest one existing in Japan. It is coupled with a very large number of terminals distributed over the whole country.
- o June 25th: - Visit to the Control Center of the Tokyo Metropolitan Expressway System: comprehensive discussions on the used methodology and the obtained experiences.  
  
- Visit to the Agency of Industrial Science and Technology of the Ministry for International Trade and Industry. This Ministry sponsors a large research project for the development of the so-called CAC (Comprehensive Automobile Control) system. This system shall involve the automobiles itself in a comprehensive control and route guidance system by on-board driver displays. Though the activities for the similar ERGS (Electronic Route Guidance System) in the U.S. have been stopped, the Japan Ministry will continue the work and plans to prepare a full scale experiment in an area of 5 km x 7 km in Tokyo in 1977.
- o June 26th: Visit to the Area Traffic Control Center for Tokyo in the Tokyo Metropolitan Police Office: detailed observations of the system in operation and discussions about operational experiences with this largest area traffic control system.
- o June 27th: Visit to the Control Center of the SHINKANSEN (New Tokaido Line) in the headquarters of Japanese National Railways (JNR) under the guidance of



Dr. S. Inada, director of the COMTRAC (Computer Aided Traffic Control) project. The COMTRAC system and the SHINKANSEN line itself shall be extended to the north part of Japan. For this extension, the research work concerning the computer control system has just been finished by a 2 1/2 year project with about 100 engineers of J.N.R. and 100 engineers of the Hitachi Company. Dr. Inada was the leader of this project.

- o June 28th: Return to Vienna.

### 3. Summary of Essential Results

3.1 The Japan trip confirmed our opinion that several of the Japanese computerized traffic control systems have to be considered as the most advanced ones in the world. This is especially true for:

- o the expressway and area traffic control systems (Osaka, Tokyo),
- o the railway control systems (especially for the SHINKANSEN) and
- o the new guideway system CVS (Computer Controlled Vehicle System).

Concerning these systems, comprehensive descriptions exist in the Japanese language only. The author of this report could get a remarkable number of these reports, which will be evaluated during the next month.

3.2 The following Japanese scientists gave oral commitments to prepare case descriptions for the proposed CUTC (Computerized Urban Traffic Control Systems), volume of IIASA's state-of-the-art series:

- o Prof. Dr. Toshiharu Hasegawa  
Department of Applied Mathematics and Physics  
Faculty of Engineering  
Kyoto University  
Kyoto 606, Japan

He agreed to prepare the manuscript of about 30 double lined pages for paragraph 8.2 by the end of April 1976. The content of this paragraph shall be enlarged to

the Osaka area control system so that the title shall be changed to "8.2 The Hanshin Expressway and the Area Traffic Control Systems of Osaka."

- o Dr. Shinichi Inada  
Director of Project COMTRAC  
Department of Electrical Engineering  
Japanese National Railway  
1-6-5, Marunouchi, chiyoda-ku  
Tokyo 100, Japan

He has promised to prepare, by the end of April 1976, the case description of paragraph 9.3 of the COMTRAC system in operation for the SHINKANSEN (New Tokaido Line). He has agreed to include a description of the quite recently developed ATOMIC (Automatic Train Control by Mini Computer) system, as well as of computer control systems, developed in Japan, for subways and other urban railway systems. The manuscript shall consist of about 20 pages (double-spaced). Originally, Prof. Ohno, who is now with the Kyoto University, was proposed by myself for this paragraph. However, Prof. Ichikawa, as well as Prof. Ohno, recommended strongly the inclusion of Dr. Inada in this activity as the best expert of Japan.

- o Dr. Takemochi Ishii  
Department of Mechanical Engineering  
Faculty of Engineering  
University of Tokyo  
1-3, 7-chome  
Hongo Bunkyo-Ku  
Tokyo, Japan

He has given an oral commitment to prepare a manuscript of about 20 double-spaced pages for the case description 10.4 dealing with the new Japanese CVS (Computer Controlled Vehicle System) by April 1976. He has agreed to include a description of the other new Japanese system, the KRT (Kobe Rapid Transit) system, which will soon come into operation in Kôbe. Prof. Ishii has recommended the inclusion of

Prof. Dr. Masakazu Iguchi, as well as Prof. Dr. Masaki Koshi  
The Department of Mechanical Engineering  
The University of Tokyo  
7-3-1, Hongo  
Bunkyo-Ku  
Tokyo, Japan (same address for Dr. Koshi)

in the preparation of the manuscript. These three Professors, Ishii, Iguchi and Koshi, are the project leaders for the operation of the system, the vehicles and the guideways respectively.

The author of this report promised that the scientists mentioned above will get official IIASA letters, by Sept. 1975, asking for their cooperation if the first outline of the proposed CUTC volume has been accepted by the NMO countries of IIASA.

3.3 The announcement for the IFAC Workshop on Optimization Applied to Transportation, which will take place in Vienna in February 1976 and will be sponsored by IIASA, was handed over to several scientists. Professors Hasegawa and Ishii have been asked to participate in a small seminar on possible future activities of IIASA in the field of Urban Traffic Control which is scheduled to take place at IIASA after the IFAC Workshop.

#### 4. Addresses of Japanese Traffic Control Experts with Regard to Possible Future Cooperation

##### 4.1 Freeway and area traffic control

- o Prof. Dr. Toshiharu Hasegawa (cf. paragraph 3.2 of this report).

- o Dr. Takashi Hamada  
Associate Professor  
Institute of Industrial Science  
University of Tokyo  
22-1, Roppongi 7 Minatoku  
Tokyo 106, Japan

Specialist for traffic simulation and software for area traffic control (involved in the development of the Tokyo system).

- o Dr. Sadao Takaba  
Associate Professor  
University of Tokyo  
Institute of Industrial Science  
22-1, Roppongi 7 chome, Minato-Ku  
Tokyo 106, Japan

Hardware oriented traffic control and simulation specialist.

- o Yusuke Kajiura  
Tokyo Metropolitan Expressway  
Public Corporation  
Traffic Control Department  
Tokyo, Japan
  - o Kazuo Shigata  
Manager  
Traffic Control Department  
Tokyo Metropolitan Expressway  
Public Corporation  
1-4-1 Kasumigaseki  
Chiyoda-Ku  
Tokyo 100, Japan
  - o Dr. Nobuo Yumoto  
Assistant to Manager  
Systems & Electronics Division  
Sumitomo Electric Industries, Ltd.  
3-12, 1-chome  
Motoakasaka, Minato-Ku  
Tokyo 107, Japan
  - o Kazuyuki Wakasone  
Senior Officer for Development Program  
(Solar Energy)  
Sunshine Project Promotion Headquarter  
Agency of Industrial Science & Technology  
Ministry of International Trade & Industry  
1-3-1 Kasumigaseki  
Chiyoda-Ku  
Tokyo, Japan
- Responsible for the development of the CAC  
(Comprehensive Automobile Control) system.
- o Masaru Sakamoto  
Senior Engineer  
Information Control System R&D Lab.  
Omron Tateisi Electronics Co.  
20 Igadera, Shimo-Kaiinji  
Nagaokakyo-City  
Kyoto 617, Japan
  - o Sadayuki Uryu  
Department Manager  
Traffic Control Systems R&D Lab.  
Omron Tateisi Electronics Co.  
20 Igadera, Shimo-Kaiinji  
Nagaokakyo-City  
Kyoto 617, Japan

- Dr. Sadayuki Tsugawa (Research engineer for CAC  
Traffic Control System Section system)  
Automobile Division  
Mechanical Engineering Laboratory  
5-12-2 Fujimi-Cho  
Higashimurayama City  
Tokyo 189, Japan

#### 4.2 Railway systems

- Dr. Shinichi Inada  
Director of Project COMTRAC  
Department of Electrical Engineering  
Japanese National Railway  
1-6-5, Marunouchi, Chiyoda-Ku  
Tokyo 100, Japan
- Dr. Kunihiko Ichikawa  
Professor of Sophia University  
Mechanical Engineering  
Kioicho, Chiyoda  
Tokyo, Japan

Specialist for control theory applied to train control.

- Prof. Dr. Ohno  
Kyoto University

Specialist for the application of computers in  
railway systems.

- Shinabu Yasukawa  
Chief Researcher  
Railway Technical Research  
Institute of Japanese National Railway  
2-8-38, Hikari-cho  
Kokubunji-shi 185, Japan

Leader of the project for the development of the  
ATOMIC system.

- Tsunehisa Tateiwa  
JNR Computer Center  
1-47-4, Hikari-cho  
Kokubunji-shi 185, Japan

#### 4.3 New urban transportation systems

##### 4.3.1 Demand Bus

- o T. Tanizawa  
Managing Director  
Hankyu Bus Co., Ltd.  
1-24 5-chome  
Syonai Nishimachi  
Toyonaka City  
Osaka, Japan

Leader of the demand bus project of Hankyu  
Bus Co. Ltd.

##### 4.3.2 Total systems innovations: guideway system

- o Prof. Takemochi Ishii (cf. para. 3.2 of this  
report)
- o Prof. Masakazu Iguchi " "
- o Prof. Masaki Koshi " "
- o Hajime Kawashima  
Pro-Manager  
Japan Society for the Promotion of  
Machine Industry  
c/o Kikaishinko Bldg.  
3-5-8, Shiba-Koen  
Minato-Ku  
Tokyo, Japan

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Prof. Ziro Yamauti will visit IIASA, together with another scientist, from August 21 to 27, 1975. His arrival from Amsterdam will be on KLM 835 at 12:50.