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 Kobe. 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

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

- 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).

- 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 system)
  Traffic Control System Section
  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.