

Core University Program

Research Report

Date Nov.14,2000—Nov.27

Name of visiting scientist:

Professor Bao Yuanlu

Host scientist:

Professor Masao Kuwahara

Research period:

From Nov.14,2000 to Nov.27,2000

Topic of research in Japan:

1. ITS researches in Tokyo University.
2. ITS development in Tokyo and in Japan.
3. Demonstration with GIS producing and the GPS Vehicular Monitoring System in USTC GPSLab.
4. Traffic Problems and replied steps in Japan Tokyo and China Hefei.

Signature

a) Academic activities during my stay in Japan

a-1. Schedule

- Nov.14 Tue Arrive at Tokyo.
Nov.15 Wed Greeting at Kuwahara Lab.
Nov.16 Thu Public Works Research Institute at Tsukuba, ITS Lab.(建设省土木研究所)
Nov.17 Fri Seminar, Prof. Bao Yuanlu at Kuwahara Lab.
Nov.20 Mon Seminar, Dr. Ryota Horiguchi at Komaba on AVENUE;
Metropolitan Police Agency at Shinbashi Control Center by Mr. Yokoi;
(警视厅交通管制中心)
Welcome Party.
Nov.21 Tue Visit Prof. Ohta with Lunch at Hongo Campus;
Visit Prof. Ieda at Hongo Campus.
Nov.22 Wed Metropolitan Expressway Control Center at Hirakawa-cho.
(首都高速道路公团控制中心)
Nov.23 Thu Visit Tokyo.
Nov.24 Fri Prof. Shibasaki on GIS at Komaba;
Dr. Toshio Yoshii on network simulation at Komaba.
Nov.27 Mon Return to Shanghai, China.

a-2. Visiting Public Works Research Institute at Tsukuba, ITS Lab on Nov.16 (Thu).

For over seventy years since its establishment, PWRI of Ministry of Construction (建设省土木研究所), as a governmental research organ, has constructed research and development covering a wide variety of elemental and applied research fields to improve the technologies for major construction projects, and has thus contributed to the development of civil engineering technologies both in Japan and overseas.

Total staff in PWRI is 466. The Annual Budget in 2000 is 191.2 億¥(1.82 億\$), including Personnel and Office Expenses 47.3 億¥(0.45 億\$), Research Expenses 102.22 億¥(0.97 億\$) and Facilities Expenses 41.7 億¥(0.40 億\$).

The Road Department, including Traffic Engineering, Intelligent Transport System (ITS) and Traffic Safety Divisions, was emphatically introduced. It conducts research on the design of geometric highway structures, pavement and tunnel design, and on measures for improving traffic safety. It focuses on research on TTS, which surveys and studies constructed on the Advanced cruise – Assist Highway System (AHS), using advanced information and communication technology, for making highway driving safer, more efficient, and more comfortable.

a-3. Seminar, at Kuwahara Lab, A speech by Prof Bao Yuanlu on Nov.17 (Fri). Institute of Industrial Science, Uni. of Tokyo.

Topic: Introduction to USTC GPS Intelligent Vehicular Monitoring System (IVMS)

The IVMS developed by the GPS Lab of USTC has solved the three problems faced in front of China VMS projects:

* Automatic generation of vector-map. An special intelligent CAD software is needed to develop or generate the vector traffic map even from the city's printed (bitmap form) tourist traffic map and adjusts the vector map database automatically based on some real track records.

* The speed for the monitoring the vehicles. There is within 30 seconds to receive, display and record the information of up to 100 mobile targets and within 3 seconds to get the emergency alarm if any one pilot press an alarm button in his car.

* Real-time adjustment to the errors of vehicle tracing in the intelligent monitoring platform on the Monitor and Control Center.

Via approaching solutions to the three key technologies, the special digital movable multi-communication and control card, the city's traffic database producing CAD software and the IVMS Monitoring center software station, our IVMS has gone forward on the way towards products and commodities.

Early in 1977 The USTC GPS IVMS has utilized in the 110 Alarm Center of Xamen Public Security Bureau with capability of monitoring 255 moving cars on one radio channel. From that time we have constructed real or demonstrated IVMS and simultaneously Car Navigator for six cities including Hefei, Jingjiang, Zhangjiagang, ChongQing, Chengdu. Meanwhile, aimed at accelerating the wider application of the high-technology products, and bringing out more social and economic profits, the GPS Lab is sincerely seeking co-operation opportunities with institutes and any eligible company both domestic and aboard.

At the seminar, Prof. Kuwahara, his colleagues and his students went deep into the project technique discussion, put forward many useful recommends.

a-4. Seminar, at Kuwahara Lab, Dr. Ryota Horiguchi at Komaba on AVENUE, Nov.20

Topic: A Benchmark Data Set for Validity Evaluation of Road Network Simulation Models

Dr. Ryota Horiguchi introduced and demonstrated some research results based on the Traffic Simulation Systems 'AVENUE ver.1' (Advanced & Visual Evaluator for road Networks in Urban areas) and 'AVENUE ver.2' developed and validated by the Kuwahara Lab. in 1993 and 1996 respectively. The traffic simulator deals with urban road networks. Through the experience of the model validation, they have spent substantial effort to collect precise data set including time-varying O-D demand and individual vehicle trajectories. In the speech, Dr. Horiguchi firstly outlines the survey in Kichijoji-Mitaka area. In order to collect precise data, the survey was made with recording number plates for 'every' vehicles traveling the area. Then, the extraction of individual vehicle trajectories from the survey data is briefly explained. The extraction process interpolates misreading data by observers with heuristics rules. The extracted vehicle trajectories are subsequently aggregated to time-varying O-D demand. Finally, the validation of AVENUE is presented as an example of the usage of this benchmark data set.

The AVENUE ver.1 is characterized by the following features: 1) Employing the Hybrid Block Density Method for the traffic (Q-K relationship to each block) flow model so as to reproduce over-saturated traffic conditions; 2) Incorporating drivers' route choice behaviors to meet the recent requirements for the evaluation of dynamic route guidance; 3) Modeling drivers' lane choice behaviors according to their turning movements; 4) Considering conflicts between vehicles at intersections, lane changing, etc. 5) Designed and implemented in Object Oriented Programming in order to satisfy various users' needs; 6) Adopting Graphical User Interface and Animation for easy operations and persuasive presentations. AVENUE ver.1 was validated throughout the several applications to the real road networks which have no alternative route for each O-D pair.

The AVENUE ver.2 is improved to incorporate various rout choice models and to reduce the calculation. It is characterized by the Multi-Scan Hybrid Block Density Method and the multi-layered rout choice model. Then, the traffic model has been verified with several sample networks in terms on vehicle queue setting back, delays at signalized intersections, the decline in capacity of turning movements by interfering traffic, and the route choice behaviors. The model validation including its route choice model using the real road networks which has about 50 intersections is reported.

a-5. Visiting Metropolitan Police Agency at Shinbashi Control Center, Nov.20 Mon

Metropolitan Police Agency at Shinbashi Control Center (警視庁交通管制中心) collects and treats the traffic information of Tokyo and the near counties, turn and derivates transportation flow stream, provides traffic case information, for making for highway driving safer, more efficient, and more comfortable.

It provides Advanced Traffic Information Service (ATIS). With its 985 intersections provided with Display Board, 14314 traffic signals (including 7201 control signals), 16374 vehicle sensors, 307 electrical indicating board, 160 road broadcasts, 295 electrical cameras, and in Control Center 21 TV and 136 Computers (1999.8), it surveys 2,600,000 cars in Tokyo every day. The annual budget of only road device maintenance is about 1100 億¥(10.5 億\$). The on-line information and the introduced contents displayed on the 25m*5m huge screen gave me deepgoing impression.

a-6. Visiting Metropolitan Expressway Public Corporation (MEPC) Control Center at Hirakawa-cho, Nov.22 Wed

Somewhat like that in Metropolitan Police Agency at Shinbashi Control Center (首都高速道路公団控制中心), the real Metropolitan Expressway Traffic Control System being in motion gave me deepgoing impression. The total length of Metropolitan Expressway in service, as of Oct.1999, is 263.4km, and traffic volume 1,160,000 vehicles per day. The MEPC engages in traffic control 24 hours per day to maintain safe and comfortable, Patrol cars give to disposition of accidents quickly and withdraw from fallen objects. In the finite space, the MEPC takes aim of efficiently the Metropolitan Expressways and use the traffic control system to process data at high speeds. The MEPC makes an offer traffic information to users on a real time.

It is somewhat also worth to knowing that the Expenditures for fiscal year 1999 are 7955.8 億¥(75.77 億\$). The Expenditures include the Improvement Program 2055 億¥(19.6 億\$), Repayment of Bonds and Loans 4828 億¥(46 億\$), Infrastructure Improvement Program Loan Repayment 168.5 億¥(1.6 億\$), Consigned Business 361.5 億¥(3.44 億\$), Administrative and Other Expense 542 億¥(5.2 億\$). As a business, MEPC's Revenues for fiscal year 1999 are 7926 億¥(75.5 億\$) includes: Business Income 3142 億¥(29.9 億\$), Bonds and Loans 4284 億¥(40.8 億\$), Investments 481 億¥(4.58 億\$)

a-7. Survey Tokyo on the ITS, Nov. 23

On the streets and highways I observed the data collection devices such as Vehicle Detectors, Closed Circuit TV Camera, Anemometer, Patrol Car, Tollgate for the Electronic toll collection systems. I saw the Data Presentation devices such as Graphic Information Board, variable Message Signs, Travel Time Information Board, Latest Congestion Warning Board, Tunnel Warning Display Board, Emergency Broadcast in Tunnels, Wind Speed Display Board, Variable Regulatory Speed Signs, Metropolitan Expressway Radio, VICS Beacon, MEX Telephone Services.

A popular commodity for car drivers allures me, that is the Car Navigation System named "CUTE NAVI" with price 99,800 日元. There has the whole Japanese GIS traffic Map displayed on the 559*220 pix LCD screen. It can help driver find his position, guide driver's route. It can also receive the ITS broadcast and then to display the congestion information on the Map Screen. With an option CMOS CCD, it become an image detector for observer the state behind the car. It can even as an automatically rear car near Warning. I know that this commodity is also needed in China. For that commodity, how long time after it can appear in China Markets? Five years or ten years? The main problems faced on its procreation in China is Automatic Generation of Vector-Map for Whole of China as I have mentioned above. As our GPS Laboratory has resolved the technical problem, now I would like to say that the main problems faced on its procreation is present state of science in China as I will mention following.

b) Your impressions of the present state of science in Japan

I feel that there are good environment and developing space for the scientists doing research work in Japan. As saying the present state of science in Japan, I think a benign circulation for getting combined efforts with either government organs, universities and public corporations is in process of accelerating the advancement and spread of science and technology. To some extent, the state is as follows:

Govern. Organ -(budget) Sci. Research -(serve people) Citizens -(tax) Government

In this benign circulation, government is in charge of administrate, guide the research directions and provide the research budget for institute. The universities or laboratories are with responsibility for science and technology research. The research results, in most cases are spread by the government organs, so to serve the society and taxpayers. In one word, every organ and every body has its specialty (organization or research) and do his best on the relative work. The determinant for science development is on the government organ.

As compare, I think the situation in China is almost turned over. To some extent, the state in China is as follows:

Government -(result) Sci. Research -(find funds) Citizens -(serve people) Government

In this vicious circulation, government is no charge of administrate for science and technology development. Scientists should find his research directions by himself (that is good for elaborating his ability but) and provide the research budget also by himself. He must find the research funds from citizens, companies, through his ordinary technique services or selling out his technology fruits. This process is very difficult, and takes much time and a lot of trouble, especially because this process is neither his special skill, no his duty. After this far-flung process, the universities or laboratories can be with responsibility for science and technology research. However, the research results, in most cases must be spread by the scientist himself. Government could praise you scientific theses, commend your achievements, but have no ability to help you to spread the research result to real objects. In one word, every organ and every body has no its special responsibility (organization or research) and can do his best on the relative work. The determinant for science development is only on the scientists.

c) Comments or suggestions for JSPS program including any other comments

I would like to continue the JSPS program. We could exchange more research contents and mutual achievements to develop the JSPS program. The Internet Web and Email Box can be as a important transmission tools. I suggest that there should be established a periodical (as USTC publication) for all reports and paper activities with the JSPS program. Of course, some important research results could be published on the opposite side publications.

I would like to pay my great gratitude to professor Masao Kuwahara and all the members of Kuwahara Lab, Institute of Industrial Science, University of Tokyo, for their kind reception and academic report interchanges. I am grateful to professor Hatsutoshi Ohta and professor Ieda Hitoshi for their introduction and the TRIP Annual Report. I would like to pay my special grateful to Dr. Liu H.C on Kuwahara Lab, without his reception and accompany, I can not accomplish this successful visiting.

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