Feasibility Study
on ITS Model Experiment Plan in Japan

Vehicle, Road and Traffic Intelligent Society

(VERTIS)

1. Introduction of ITS Model Experiment Plan

In 1997, the 5 ITS ministries and the agency committee laid out the ITS model experiment plan as a strategy for the Comprehensive ITS Plan, and decided to conduct a feasibility study (FS) of the experiment plan in the 3 years from 1997 to 1999.

The Feasibility Study Committee was set up by representatives from the 5 ministries and the agency, academic circles, and related organizations in Japan to provide opportunities for discussions on the promotion of the model experiment plan. VERTIS was also established as an office for the overall FS.

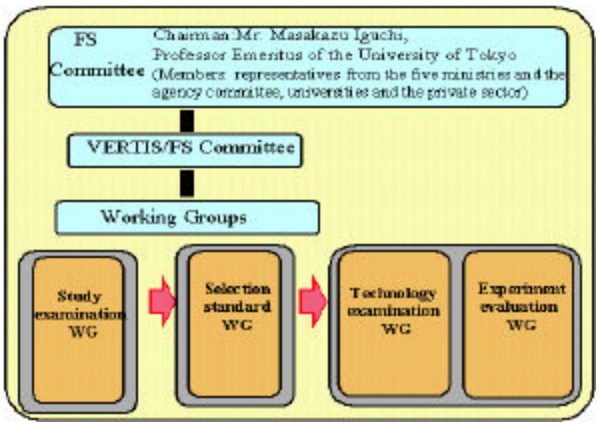

Figure 1. FS Promotion organization o f the model experiments

In 1997, hearings were conducted with intellectuals about their ideal image of model areas, and surveys on model experiments, mostly in Europe and North America and ITS awareness and attitudes toward it among local municipalities in Japan. Based on what we learned, a proposal was submitted to the FS Committee that Japan urgently implement model experiments.

In response, the FS Committee selected the following 5 areas after conducting public advertisements for ITS model experiment areas for 2 months from May 20, 1998.
These areas implemented their experiments and evaluations in 1999.

Table 1. ITS model experiment areas and experiment themes

Local municipalities	**Title of the Experiment**
Toyota City	ITS model experiment in Toyota City
Kochi Prefecture	KoCoRo (Kochi Communication Road)- Proposals for ITS from local community
Tokyo Metropolitan Police Department(MPD)	Examination and experimentation of the effects of PTPS (Public Transportation Priority System) in urban Tokyo
	Plan for a "Resource recycling society" with mobile communication
Gifu Prefecture	Examine the possibility of an ITS-related information providing system with private sector investment in Gifu Prefecture
Okayama Prefecture	ITS model experiment in Okayama Prefecture

The ITS model experiment is part of actual local-level policies of the Comprehensive Plan for ITS, and will be implemented with the following purposes:

.Have new impact on ITS by promoting ITS coordinated with local municipalities.
.Extend ITS from major cities to local cities.
.Apply ITS from the R&D level to the practical users' level.
.Transmit information for local municipalities with similar challenges.
.Activate the private sector.
Create new industries.

Figure 2 shows the flow of the Feasibility Study for Model Experiment plan from fiscal year 1997 to 1999.

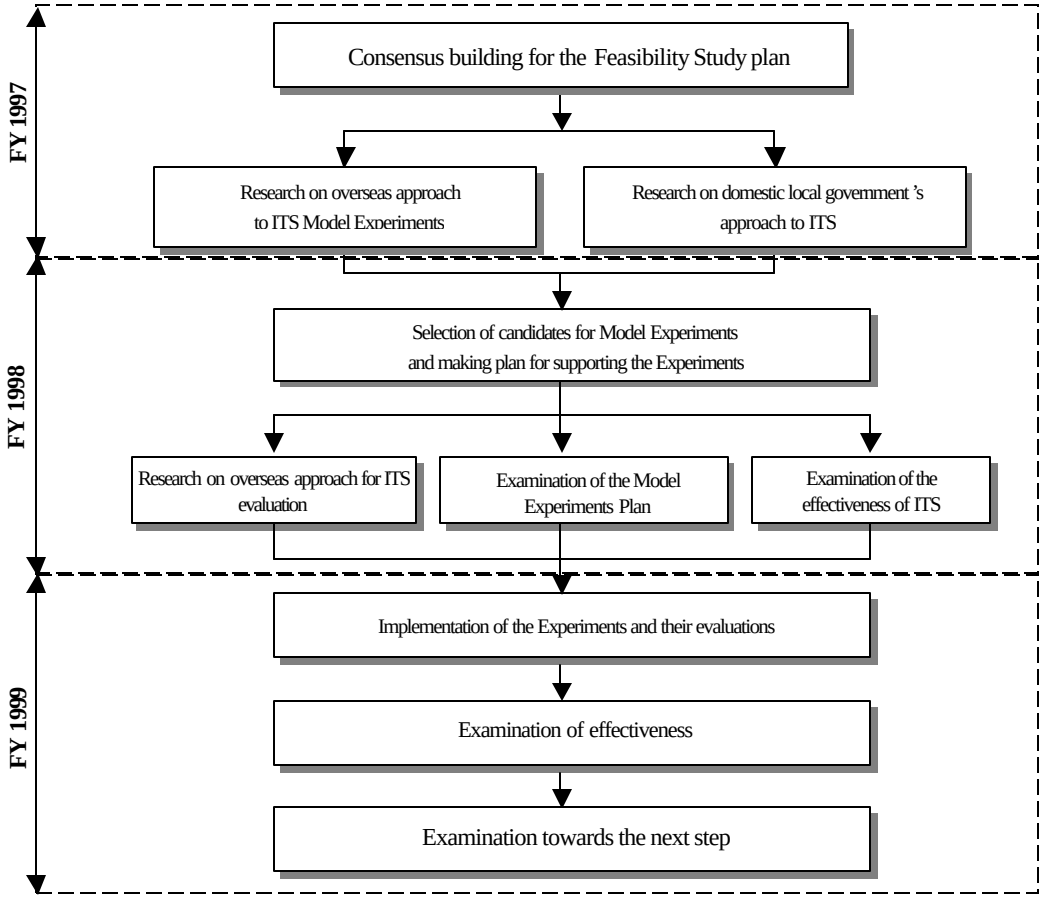

Figure 2. History of the Feasibility Study of the ITS model experiment plan

2. Overview of Model Experiments

2.1 Experiment schedule

Figure 3 shows milestones for ITS Model Experiments.

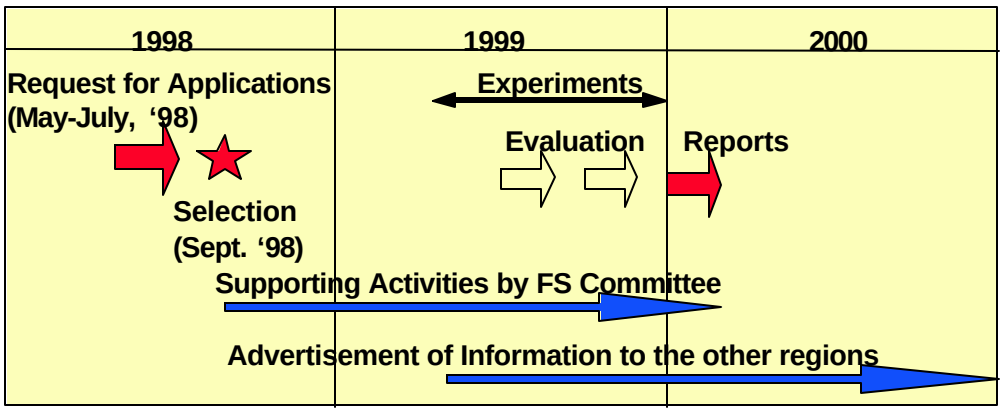

Figure 3. Milestone for ITS Model Experiments

2.2 Overview of systems of Model Experiments

There are 18 recorded experiments, and about 70% of these are related to information services.

Table 2. Experiment Titles of Each District

Local municipalities	Experiment title
Toyota City	1)Advanced road traffic information systems
	2)Electric Vehicles (EVS) sharing experiment
	3)P&R experiment
Kochi Prefecture	4)Wide area road information on the Internet
	5)Testing of vehicle -installed communication devices
	6)Roadway station information terminals
	7)Project transmitting local tourist information
	8)Demand -bus experiment 9)Integrated distribution/EDI, FAZ project
	10)Project building a common information infrastructure
Tokyo MPD	11)PTPS (Public Transportation Priority System)
Gifu Prefecture	12)Feasibility study of system to supply ITS-related information in Gifu 13)Prefecture using private-sector activity 14)Establishment of a recycling society through the use of mobile communications
Okayama Prefecture	15)Build advanced road management systems.
	16)Build information providing systems for public transportation
	17)Build integrated traffic information systems on the Internet
	18)Support commercial vehicles
	19)Road information providing systems for emergency vehicles

Typical Examples of the Experiments are shown in Figure 4 to 11 in the next page.

Figure 4. Road-Traffic Information Service via VMS (Toyota City)

Figure 5. Road Information Service via CATV (Okayama Pref.)

Figure 6. Traffic Information Service via Internet (Kochi Pref.)

Figure 7. Travel Information Service via Internet (Kochi Pref.)

Figure 8. Park and Rail Ride experiment (Toyota City)

Figure 9. Electric Vehicles sharing experiment (Toyota City)

Figure 10. PTPS Experiment at Meguro Street (Tokyo MPD)

Figure 11. CVO using Satellite communication (Gifu Pref.)

3. Configuration of the Evaluation System

An evaluation was established for the FS, then a common area was set up where all districts could be evaluated based on the evaluation system. It should be noted that the results of oversea research in 1998 gave references to establish our evaluation system.

In the common area, benefits and user acceptance are the main 2 fields we use to judge the value of each system. Besides the main 2 fields, our report will refer to other items like technical and financial assessment.

Doing cost benefit analysis is desirable. However, from the standpoint of investment level, not all experiments are big enough to estimate B/C. Therefore, the FS committee announced to 5 districts that doing a cost benefit analysis was not obligatory.

It is fair to say that estimating the effects of fully implementing systems is the next subject.

Technology Examination working group of VERTIS and 5 districts cooperatively analyzed these experiments by comparing them to system architectures from a technological point of view.

Table 3. Evaluation System for Model Experiments

Benefit	Efficiency
	Safety
	Environmental Impact
User Acceptance	User's realization of the effects
	Customer Satisfaction
	Easiness of usage
Socioeconomic Evaluation (Benefit/Cost)	
Technical Evaluation	
Market Assessment	
Financial Assessment	
Legal / Institutional	

An aim for this technical evaluation was to find a way to expand the system to encompass other applications, make the operating function higher, and make the operating scale bigger.

3.1 Benefit and User Acceptance Evaluation

Regarding benefits, items in table 4 were selected as common areas. The FS committee asked 5 districts to evaluate these items. However, the committee did not specify an evaluation method, leaving it up to each district.

Regarding the User Acceptance, items in Table 5 were selected as common areas. The experiment evaluation working group of VERTIS and 5 districts made frequent discussions and introduced common questionnaires for user acceptance evaluation.

Three types of common questionnaires are prepared based on the purpose of each experiment -- road-traffic information service systems, information service systems for public transport users, and support systems for commercial vehicle operation".

Table 4. Evaluation term for benefit

Evaluating term		Output
Efficiency	Journey time	Journey time
		Benefit of time savings
	Congestion	Vehicle/hour
		Congestion length
	Transport cost	Benefit of fuel savings
	Punctuality	Journey time
	Transport efficiency	Person.km
Safety	Traffic accidents	Accidents
Environment	Air pollution	Vehicle emissions
	Noise	Noise level
	Vibration	Vibration level

	realization of the effects	air pollution
		driver's fatigue
		driver's stress
		work efficiency
	Customer Satisfaction	customer satisfaction
		willingness to continual use
	Ease of use	need to be improved

4. Evaluation policy for ITS model experiments

Evaluation policy for ITS model experiments is summarized in the followings .

- Common areas of benefit should be evaluated based on the evaluation system but evaluation methods are left to each district.
- Cost Benefit analysis is desirable but there is no obligation to carry it out .
- The FS committee and the 5 districts agreed that the important areas of user acceptance should be evaluated using a uniform method. Therefore we established a standard questionnaire.

5. Evaluation Results of Experiments

5.1 Overview of Evaluation Results

Results of benefit evalua tion are summarized in Table 6. Benefit like decrease in travel time, congestion length and increase in transport efficiency were reported for introducing ITS.

Results of user acceptance evaluation are summarized in Table 7. Most users showed favorable response to the systems introduced at thease Experiments.

Table 6.Summary of benefit evaluation

Evaluation term		Example of the evaluation
Efficiency	Journey time	*Average travel time decreased in 1min for providing travel time for alternative route..Toyota City. *Average vehicle speed increased in 1Km/h for P&R experiment..Toyota City. *Average bus travel time decreased in 3min for introducing PTPS..Tokyo MPD at Meguro Street.
	Congestion	*Total Vehicle.hour decreased in degree of 0.97 in spite of total vehicle.Km increased as degree of 1.01..Toyota City. *Traffic flow decreased as 10 to 20% because of P&R experiment..Toyota City. *Congestion length decreased as 30% as maximum for introducing PTPS.Tokyo MPD at Meguro Street.
	Transport cost	*Transport cost is expected to be decreased because of decrease in average travel time at Road-traffic information service..Toyota City . *Transport cost is expected to be decreased because of decrease in traffic flow at P&R experiment..Toyota City. *Transport cost is expected to be decreased because of decrease in average bus travel at PTPS experiment..Tokyo MPD.
	Punctuality	*Fluctuation of bus travel time decreased in 20% for introducing PTPS. .Tokyo MPD at Meguro Street.
	Transport efficiency	*Transport efficiency increased as 23% of decrease in vehicle.Km for introducing CVO for by-products recycling truck. (Gifu Pref.)
Safety	Traffic accidents	*There was no report from any district that counted traffic accidents before and after the experiment. However, there were some opinions from users that information service would help them avoid accidents.
Environ-m ent	Air pollution	*Air pollution is expected to be suppressed because of decrease in travel time, congestion length, increase in transport efficiency, etc.

Table 7. Evaluation Results for User Acceptance

Evaluating Term		Category	Evaluation Results
User's realization of the effects	Journey Time	Info. Service*	Many users (60-85%) recognized an effect
		P-Transport**	Bus drivers (57%) recognized an effect more than other users (17%).
		CVO ***	Truck drivers did not recognize an effect
	Congestion	CVO	Truck drivers did not recognize an effect
	Adherence to schedule	Info. Service	Some users answered positively
		P-Transport	17% of users felt PTPS smoothed operation. The system is expected to be widely used because only 32% of users knew of PTPS introduction at interviews.
	Driver fatigue	P-Transport	Some bus drivers answered that after the introduction of bus location system, they did not have to communicate with operators frequently and they felt less stress.
	Driver stress	Info. Service	The realization differed from each system (10-80%).
		CVO	Drivers expected the system would improve safety but not relieve stress.
	Work efficiency	P-Transport	Most drivers and operators felt systems were effective for bus management.
		CVO	About 60% of drivers had positive opinions on systems.
Customer satisfaction	Customer satisfaction	Info. Service	Most users were satisfied. Road restrictions, road surface information, and weather information were regarded as useful. Levels of satisfaction for particularity of information, literacy, and handling depend on media and service.
		P-Transport	Most users were satisfied because systems helped them decide departure time, giving more precise information about travel time.
	Willingness to continue using	Info. Service	Generally, willingness is high, especially for Internet and CATV (80-90%)
		P-Transport	Nearly 90% of users are willing to continue use (bus arrival time forecast system).
		CVO	Drivers intend to continue use (76%).
Ease of use	Need for improvement	Info. Service	Some types of traffic information such as congestion, travel time must be more widely disseminated. Users expected more variety of information for CATV and high-speed service for the Internet.
		P-Transport	Bus users favor expanding servicing roads and media.
		CVO	Many users wanted legibility of displays and picture changing speed to be improved.

* Info. Service. Systems related to road-traffic Information Service
** P-Transport. Systems related to information service for Public Transport users
*** CVO. Support systems for Commercial Vehicle Operation.

5.2 Summary of Evaluation Results

- ITS Model experiments were the first attempt to evaluate ITS experiments with a consistent evaluation policy and system throughout participating local municipalities. This effort will be a useful example for subsequent experiments in Japanese local areas.
- Effectiveness of introduction of ITS to local areas was examined from benefit and user acceptance (Figures 12,13, and 14).
- Model experiments became good examples to build new ITS systems at local levels and dedicated to increase awareness among other local municipalities (Figure 15).
- Model Experiments also dedicated to create new industries (Figure 16).

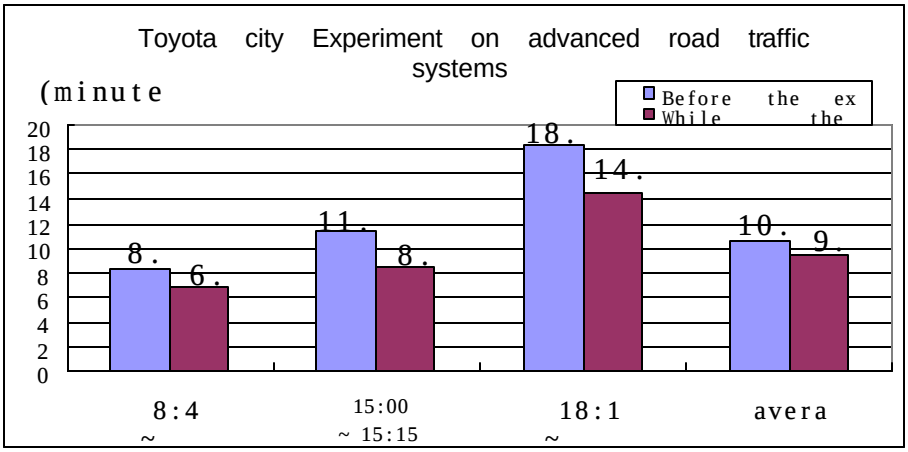

Figure 12. Field measurement result

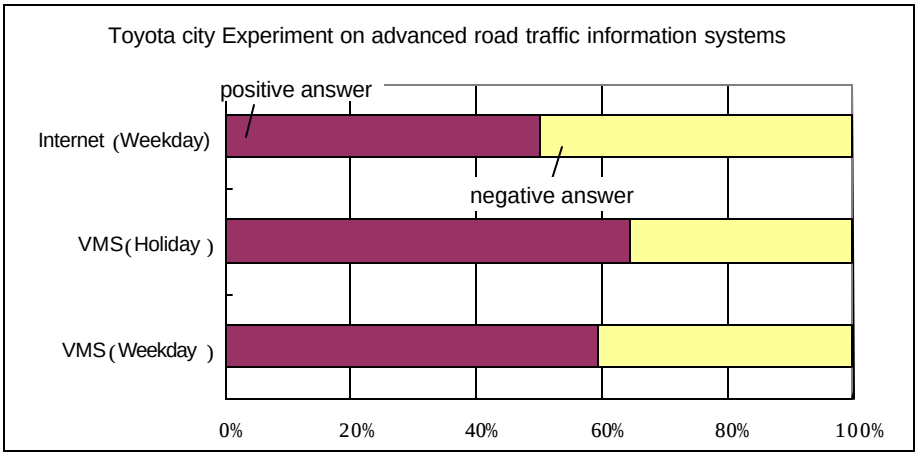

Figure 13. Questionnaire result (Future use intention)

Figure 14.
Scene for measuring and asking questionnaires at PTPS Experiment (Tokyo MPD)

above: Video Camera for recording Traffic Signal

below: Scene for Asking Questionnaires

* Effects of ITS was examined both from the standpoint of benefit and user acceptance.

Figure 15.
Recycling plant tour for CVO demonstration (Gifu Pref.)

*Many visitors from other local municipalities participated in ITS model Experiments demonstration tours. These attempts helped them to introduce ITS systems to their own municipalities.

Figure 16.
Bus arrival time forecast information service using cellular phones (Okayama Pref.)

*This was a first practical experiment to use cellular phones for ITS information service and showed that such kind of experiment could create a new business.