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Road Network Operation

ITS Project Evaluation

Tsuneo KATO

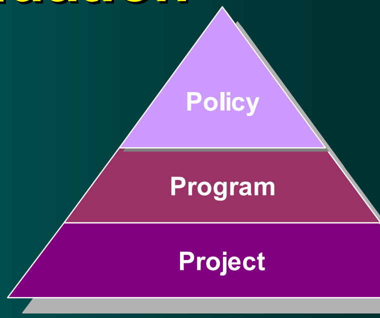
PIARC TC1.4 Committee WG(3)

Changes in road environment

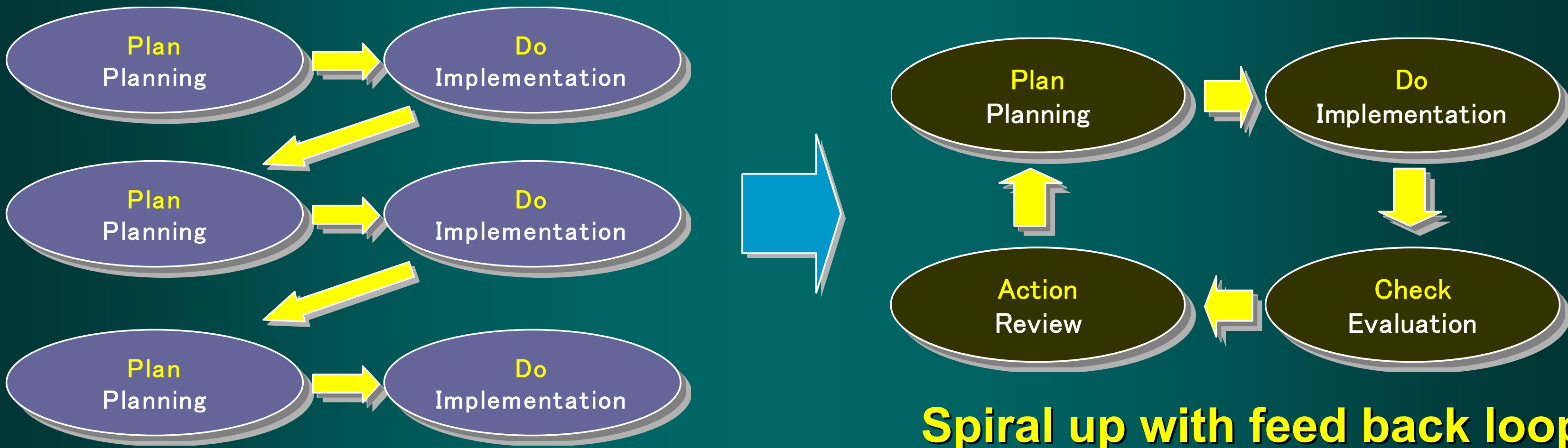
- **Shift from construction to road network operation**
  - Rising public awareness to the sustainable road facility
  - Urgent needs of efficient network operation to solve traffic problems
- **Rising demand for balanced use of transportation modes**
  - Increase in inter-modal trips
  - Global warming problem encourage modal shift to public transportation
- **Public-sector reform is going on in many countries**
  - Incorporate private-sector's management methods into public sectors
  - Main philosophies; Results-oriented management & Customer-first policy
  - New Public Management (NPM), the philosophy originated in UK in early 1980's, has influenced many countries

Background of ITS project evaluation

- **Road policy evaluation proposes project evaluation**
  - Projects are the components of a program and a policy



- **Results-oriented management based on the post-project evaluation**
  - The management in the past didn't pay much attention on post-project evaluation, but on pre-project assessment.



Spiral up with feed back loop

Objectives of ITS evaluation

*** Widely used two(2) objectives**

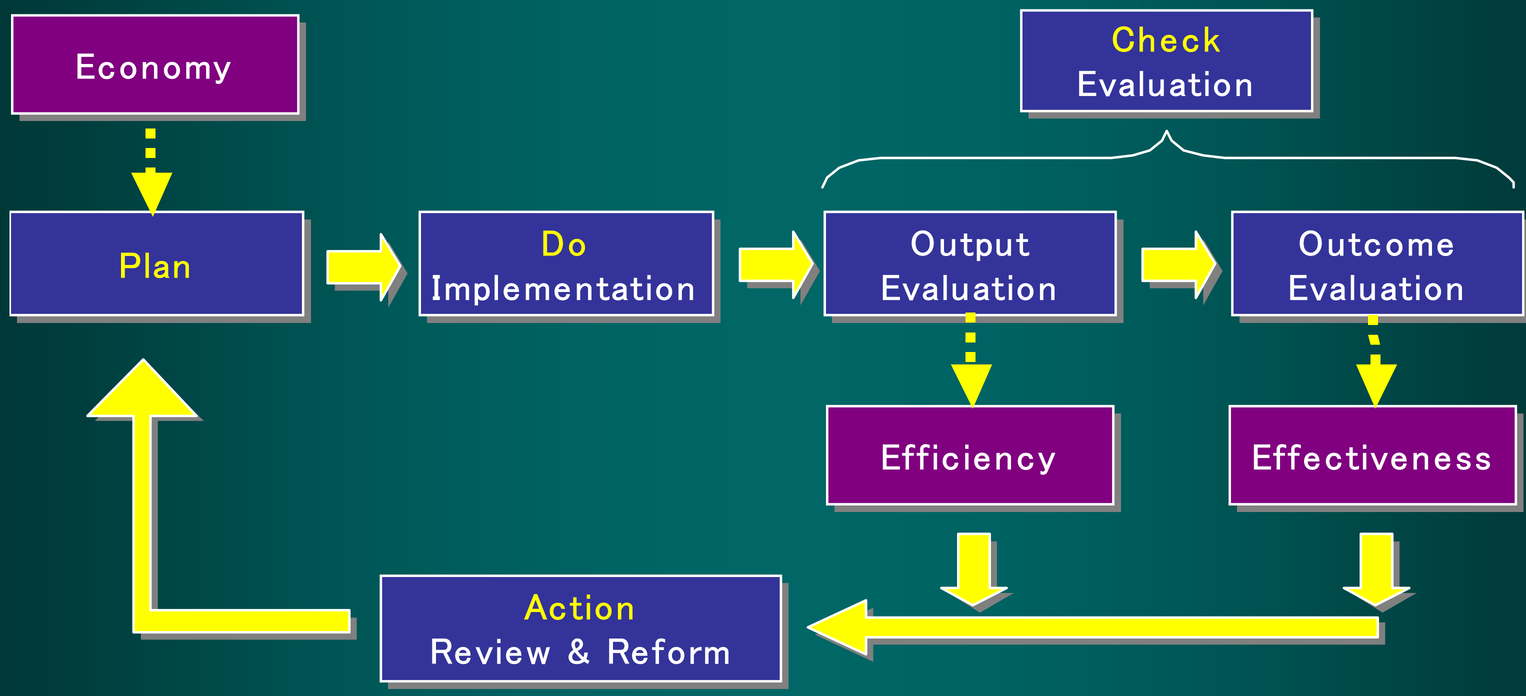
1. Look outside; Enhance accountability to the public

- to ensure transparency of road network operation policy
- to gain public consensus on the policy

2. Look inside; Enhance implementation efficiency and upgrade technologies and services

- to maximize benefits to be brought by investment
- to develop ITS technology and services on a step-by-step basis

Two loops in Plan-Do-Check-Action(PDCA) cycle



- **Decision be made on which PDCA loop is prioritized**

  - PDCA cycle and benchmarking are the key factors

Which is to be prioritized, "Output" or "Outcome" evaluation ?

Output Evaluation	***Outcome Evaluation***
Output; Direct changes caused by ITS	Outcome; Impacts on objectives
Appropriate for project-level evaluation	Appropriate for policy- & program-level evaluation
Used for evaluating implementation efficiency of a project	Used for ensuring accountability
More focused on ITS technology performance	Comparison between output and benchmarked target

- **Benchmarking is a key element in the outcome evaluation**

  1) Benchmarking from the good lessons-learned in the past

  2) Benchmarking as a strategic target

Continue

- **Example;**

  Project target; Improve safety

  ITS functional target; Speed reduction by enforcement using variable speed limit signs

Performance Indicators	
Output (Efficiency)	**Outcome (Effectiveness)**
Changes in; - Vehicle speeds - # of lane changes - Violation rates - Conflict rates - Driver's awareness	Impacts on; - Accidents and accident rates - Fatalities/injuries and fatality/injury rates - Road user satisfaction

Note; Hard to put outcome evaluation into results-budgeting

- Effectiveness sometimes comes out long time after project implementatior
- Uncertainty still remains in some cause-and-effectiveness relationship

Other key factors of ITS project evaluation

- **Objective-based evaluation rather than tool-based**

  - ITS project generally consists of various ITS tools

  ⇒ **Objectives of ITS projects need to be clearly defined**

- **Comprehensive evaluation rather than detailed evaluation**

  - Detailed evaluation, which emphasizes quantification of outcomes, may incur much man-power and cost for evaluation

  - Now, it is hard to quantify all outcomes into monetary terms

  ⇒ **Recent trend is to do comprehensive evaluation**

Continue

- **Selection of appropriate evaluation items and indexes**

Direct Impacts	Indirect Socioeconomic Impacts
- Impact evaluation on safety, environment and efficiency - Public acceptance & User satisfaction - Technical evaluation - Cost/benefit evaluation, etc.	- Market evaluation - Financial evaluation - Institutional & regal evaluation - Human-machine interface evaluation - Technical feasibility evaluation, etc.

Example; Traffic efficiency Indicators

Evaluation Items		Performance Indicators		
Project Objectives	ITS Functions	Output (Efficiency)	Outcome (Effectiveness)	Economy
Improve Efficiency	Reduce congestion	Changes in; - Traffic demand - Vehicle speeds during peak hours -Travel time loss(Delay) - Trip length - Throughputs - Number of bottleneck sections - Stability of traffic flow - Perceived traffic fluency	Changes in; - Travel time - # of congestions - Time duration of traffic congestion - Vehicle delay - Public acceptance and road user satisfaction	- Benefits and costs analysis

Theoretical approach to the selection of ITS tools - Safety

Objectives of ITS Projects		ITS Functions	Traffic Management	Automatic Enforcement	Electronic Payment	Incident Management	Traffic & Traveler Information	Parking Management
			-Variable message signs -Ramp control -Adaptive signal control -Area signal control -Intelligent vehicle speed adaptation -Intelligent road markings, etc.	-Speed Enforcement -Stop/Yield Enforcement -Lane enforcement -Vehicle Crime Enforcement etc.	-Road user charging -Congestion charging -Heavy vehicle charging -Multi-purpose Payment, etc.	-Incident detection -Emergency vehicle priority -Mobilization and Response	-On-board traffic information & route guidance -Variable message signs -Pre-trip traveler information, etc.	-Parking space guidance -Car-park & Roadside security
mprove afety	Reduce Traffic Accidents	Reduce Dangerous Driving Behavior	*	*			*	
		Displace Vehicles from an Area	*		*			
		Reduce Secondary Accidents	*	*		*	*	*
		Reduce effects of incident and maintenance works	*				*	
	Improve Accident Survival	Improve Incident Detection & Response Times				*		
	Public Transport Security	Reduce Crime & Fear of Crime		*				*
	Roadside & Parking Security	Reduce Crime & Fear of Crime						

Case study ; M25 Controlled Motorways – London UK

- Since 1995, Controlled Motorways has been operational on the western part of the M25, a dual-4-lane motorway.
- The objective is to optimize traffic flow, thereby reduce congestion.
- ITS employed is speed enforcement with variable message signs tha can provide vehicle-activated speed limits.

Results of evaluation —M25 Controlled Motorways

Impact Area	Indicators of Impacts	Overall Improvement (Y/N)
Journey times	− Increase in peak-time journey times on the clockwise carriageway and decrease on the anticlockwise carriageway.	N
Safety	− 10% reduction in injury accidents. − 20% drop in the ratio of damage only to injury accidents.	Y
Emissions	− Decrease in overall emissions between 2% and 8%.	Y
Throughput	− No increase in the peak 1-hour throughput. − Increase in total throughputs during the 5-hour peak periods by approximately 1.5%.	N
Speed limit compliance	− Reduction of 5% in drivers exceeding the 40mph speed limit.	Y
User reaction	The Controlled Motorways scheme is well accepted and there is a perception of key benefits.	Y

(Note) The costs outweigh the benefits for this case. But, some benefits do not currently have a monetary value. If all the benefits are taken into account, the project at further sites is likely to be more favorable.

Results of evaluation from Data Base – Safety

ITS Projects	Country	Output Evaluation (Efficiency)	Outcome Evaluation (Effectiveness)	Traffic Management	Traffic Enforcement	Electronic Payment	Inciden Managem
omated Traffic orcement	France	Considerable reductions of **speeding**	Not available		-Speed enforcement		
eed-over-distance orcement	Netherl ands	Experiment shows reduction of **vehicle speeds** from 100 km/h to 80 km/h.	Not available		-Speed enforcement		
ctronic Tolling and yment in ndheim	Norway		**Accidents** have fallen by 60 - 70% on the new sections of road, mainly because the mixed traffic pattern has been removed.			-Congestion charging -Multi-use payment	
lligent Speed	Sweden	Minor differences between the systems, with an **average speed** reduction of 3-4 km/h on stretches between intersections	Not available	-Intelligent vehicle speed adaptation			
folk Interactive er Optic Signs	UK	Average reduction in speed of 4.3mph.	1.National Research has shown a drop in 1mph equates to 5% reduction in **accidents**, so on average there is a potential reduction in **accidents** of 21.5%. 2. At 21 sites, there were one third less **injury accidents** overall.	-Speed activated signs			
OOT in Tronto	Canada	Comparison between SCOOT and fixed signal timing plans indicated; 1. **Vehicle speeds** were improved by 3% to 16%. 2. **Left-turn violation** was reduced by 71%.	Rear-end collision was reduced by 24%.	-Area traffic signal -Bus priority traffic signal			
n Cities Ramp ering	USA	Not available	# of **crushes** was redices by 26% with ramp metering.	-Ramp metring			

Conclusions

- **ITS project evaluation;**
  - An element of network operation policies/programs evaluation
- **Three view points needed;**
  - Economy, Efficiency and Effectiveness
- **Post-project evaluation;**
  - A key factor of PDCA loop
- **Evaluation planning and ITS project planning should be done simultaneously**
- **Budget arrangement for evaluation**
  - Past practices indicate this to be 3% to 5% of a project cost
- **Needs of R&D**
  - ITS evaluation is still on the development

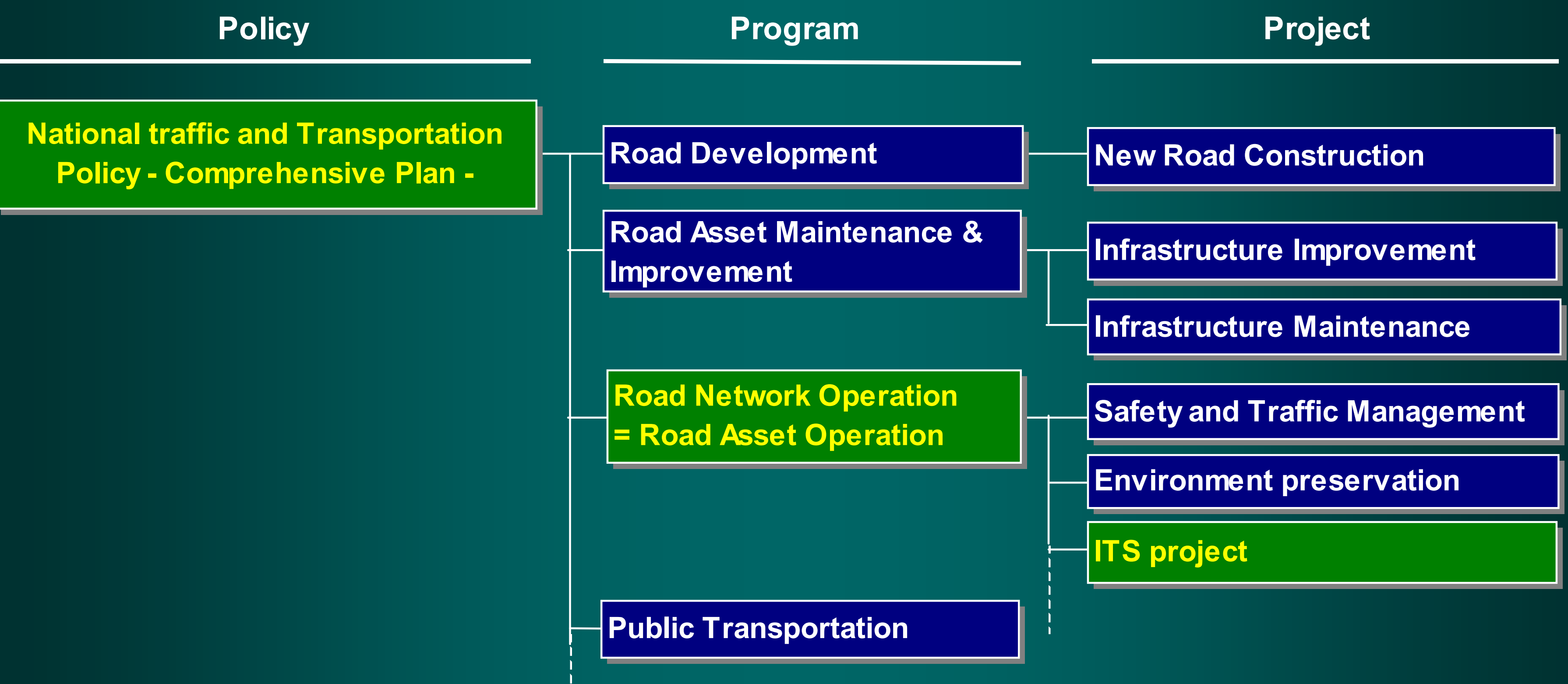
End of Presentation

Many thanks for your attention !

See you again in Paris in September 2007

What is road network operation ?

- Defined as all traffic management and user support activities intended to permit, improve, or facilitate the use of an existing network, whatever its conditions of use.
- Three levels ; Policy, program and project level



Results of evaluation from Data Base – Traffic efficiency

S Projects	Country	Output Evaluation (Efficiency)	Outcome Evaluation (Effectiveness)	Traffic Management	Electronic Payment	Traffi Trave Informa
ss Control Shared Road e in elona	Spain	1. **Car traffic** within the controlled zone has been reduced by 78% and vehicle travel times within the zone have fallen by 18%. 2. **Occupancy** of parking spaces is less inside the zone and greater outside it. 3.The number of **traffic violations** fell after the shared lane was introduced.	There are considerable benefits in managing **peak-hour traffic flows**.	-Access control to historic spot -Lane control		-Variabl messag signs
ANCE	USA		Data demonstrated that motorists could reduce **travel time** by 4% under normal or recurring conditions; however, a small sample size and relatively high standard deviation formulated the basis for this result.			-On-boa ruoute- guidanc
am Road Charging	UK	A 10% increase in **pedestrian** activity - each day between 13,000 and 19,000 pedestrians use the same stretch of road, which is wide enough for just one vehicle at a time. A steady increase in **use of the Cathedral Bus service**	In the first 3 months, **traffic levels** within the zone during charging hours fell from 2,000 to 200 vehicles a day - a drop of 90%.	-Rising bollard	-Access control charging	
on estion ging	UK	1. 50,000 fewer **cars** per day but only 4000 fewer people 2. **Increase in patronage** against a service increase of 23%. Approximately 1/2 of the **increase in patronage** is estimated to be due to the charge. Cycling has increased by 30%. 3. Overall **bus speeds** within the zone improved by 6 %. 4. Additional **waiting time** due to service fell by 30%	1. 14% reduction in **vehicle journey times**. 2. **Reliability** has improved by an average of 30%. 3. 30% **reduction in congestion** within the zone (after one year) 4. Within the charging zone there were marked improvements in both the main indicators of **bus service reliability**. disruption due to **traffic delays** fell by 60%.		-Congestion charging	
OT in Tronto	Canada	1. **Intersection stops** were reduced by 18% to 29%. 2. **Vehicle stops** were reduced by 10% to 31%.	1. **Ramp queues** were reduced by 14%. 2. **Vehicle travel time** was improved by 6% to 11%. 3. **Intersection delay** was reduced by 10% to 42%. 4. **Left-turn delay** was reduced by 0% to 35%. 5. **Vehicle delay** was reduced by 6% to 26%. 6. **Public transport travel time** was reduced by 2% tyo 6%. 7. **Public transport delay** was reduced by 30% to 40%.	-Adaptive traffic signal -Bus priority traffic signal		
Cities Ramp ring	USA	1. **Traffic volume** increased by 14% with ramp metering which results in annual saving of 25,121 hours.	1. **Travel time** decreased by 22% with ramp metering.	-Ramp metring		