PERFORMANCE INDICATORS
AS A MEASUREMENT OF SUCCESSFUL OF ROAD DEVELOPMENT

Budi HARTANTO
Researcher of Transportation Engineering
Department of Civil Engineering
Maranatha Christian University
Jalan Suria Sumantri 65, Bandung 40164
West Java, Indonesia
E-mail : budihs@maranatha.edu

Yusak O. SUSILO
Researcher of Transportation Engineering
Department of Civil Engineering
Maranatha Christian University
Jalan Suria Sumantri 65, Bandung 40164
West Java, Indonesia
E-mail : yusaksusilo@bdg.centrin.net.id

Abstract : Performance indicators are important to measure the output of programs which is made by road administrator, how far the target have been achieved by them or how far the road users feel, is any improvement on level of road services?

Performance indicators are combined from available road statistic data which are in quantitative assessment to level of road services. These indicators will be useful if can described the requirement of public and done regularly.

The role of performance indicators could be functioned as monitoring, diagnosis, management, prognosis, effectiveness and efficiencies and comparison which is could be used by road user, road administrator, transport company, contractor and road material supplier and other related units.

The performance indicators could be divided in three groups of orientation, from economic sub sector, provision, road user point of view. By using observation study, it is recommended to use five (5) main indicators : International Roughness Index, Bridge Condition Mark, Net Present Value, Vehicle Operating Cost, Average Travel Speed values.

Key words : indicators, economic, provision, road-user, development.

1. INTRODUCTION

Beginning with a question in a road developer scope : **"How to measure performance or work result from Bina Marga (Indonesian Government Main Road Developer and Administrator) in these years ?"**. To answer this question, it is necessary know another measurement device like the increasing or decreasing of travel speed average in one route or a road segment, rising or less the vehicle operation cost (VOC) or even the IRI value which describing the road surface condition and other indicators.

Of course this description not only needed by Bina Marga as a main road developer and administrator but also by road user, public transport provider, consultant and road contractor, material supplier or even citizen representation in parliament, including another related institutions.

These indicators can reflection the policy of government road developer and administrator and also can describe its ability in serve road user community.

For example, in certain road segment in 1997, the time travel was 4 hours, but 3 years later, the value was become 6 hours. This condition means that the road was experience the decreasing in serving level because the condition getting worse, may be because lack of maintenance or there was a huge increasing of traffic flow. With these indicators, the road

administrator can handle the problem sooner, or the road user community can reminds them, is it through a mass media or in another ways.

The purpose of this paper is to give **input and suggestion** various indicators which can be extracted as main indicators as a measure device to indicate the successful of the road administrator and developer these years, start from economic sub-sector sight point, social and environmental, or even from provision (road builder) sight point and also from road user sight point with using of database which already provide in Bina Marga, like IRMS (Integrated Road Management System), URMS (Urban Road Management System), KRMS, BMS, and another management systems.

2. PERFORMANCE INDICATORS BENEFIT

Many countries were starting to use performance indicators in many things including in road development to measure **effect, result, output and input** from road sector activities.
The using of these performance indicators is to clarify the relation between factors that are used to :
- describe objective level which already reached, e.g. average speed in the road is 60 km/hour
- to identification the problem which probably happen, which can influence the objective which will be reached or disturb the objective which already reached.

With introducing this performance indicators to the road user community, the road developer and administrator will be more objective and responsive to the real demand level from that community, so the focus of their mission are more clearly, more motivated to reach the target, increasing the work and operation efficiency and effectively to give a better product.

3. USE OF PERFORMANCE INDICATORS

Performance indicators can be seen from their purposes, is it for monitoring, diagnosis, management, prognosis, effectiveness and efficiency, or even comparisons.

- Monitoring
  to assess the adequacy of government and managerial policies, and the effectiveness or programs in achieving their objectives; for the road sub-sector, these might be reduction in accidents, improving the road network, reducing the cost of road travel, etc.

- Diagnosis
  to identify critical needs for investment or policy change, by type of investment or region, to determine priorities, and to identify key factors influencing performance.

- Management
  to provide inputs to managerial decisions such as levels of investment, maintenance expenditures and standards, allocation between regions, and where to focus effort on policies such as road safety.

- Prognosis
  to give early warning of undesirable trends and potential future problems.

- Effectiveness and Efficiency
  incentive for improvements in the effectiveness and efficiency of organizations or agencies, and which could be used as a basis of a performance contract between government and the entity.

- Comparisons
  to enable comparative studies to be made within the sub-sector, between sub-sectors and sectors, geographic regions, or other countries.

The use of performance indicators can be seen from their process, like what World Bank done, which are : strategic planning, performance accounting, forecasting and early warning, measuring results, marketing and public relations, bench-marking, and quality management.

4. USERS OF PERFORMANCE INDICATORS

Who will use these performance indicators ? They are : road users, transport service provider, road network developer and administrator, policy makers and they supporters.

- Road Users
  Road users like side-walkers, private and public vehicle need better level of service in transportation, like : safety, comfortable, mobility, easiness, support and environmental systems.

- Transportation Providers
  Transportation providers including their crews as public transport providers have a concern and interest about the service level of road network and policy effects in transportation application level.

- Road Providers
  Road providers are consist of the owner and funding resources, road developer and administrator, road consultant and contractor, including road materials suppliers which have concern and interest about efficiency, productivity, and effectiveness to fulfill road users demand.

- Policy Makers
  The institutions which make a transportation policies need to have a concern about the efficiency of development funding allocation and road management and road using cost which equipped with regulations and acts like traffic regulations and its detail explanations in government constitution like safety, vehicle load and dimension, etc.

From performance indicators users, can be seen the same need, like about transportation safety which written in acts, government regulations, and their application guides. Because of it, it is necessary to determine which performance indicators that can describe these needs.

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5. KINDS OF PERFORMANCE INDICATORS

Kinds of performance indicators can be classified based on its perspective or sight point, such as sub-sector perspective, provision, and road users.

What did meant with this perspective sub-sector is how to see road sub-sector in generally, including its parameters and its relationships with economics, financial, social, and environmental sub-sector. So as with road provision perspective which is related with safety, efficiency, productivity, development and management. From road user perspective, correlated with quality of service, mobility, risk, and vehicle operation cost, including fuel and environmental effect because of emission.

To simplify the understanding of these performance indicators, so they were grouped in perspective classification, in Table 1, 2, and 3 in statistic operation form, including its unit.

6. PRESENTATION OF PERFORMANCE INDICATORS

Although performance indicators are groups of statistic data, but not function as yearly road statistic which is used by road administrator to predict the successfully of road sub-sector management. Performance indicators are more related with effect and perception from road users and become objectives which want to reached externally by all side, from funding institution, road administrator and developer, road user, and policy maker

Table 1. Sub-sector Perspective on Performance

Aspect	Performance Indicator	Units	Included in IRMS
Asset	Road length	Kilometer by road class	IRMS
	Structures length	Meter by structure type	BMS
	Network density	Kilometer / 100 km², km/capita	-
	Network capacity	Lane-km/vehicle	-
Road User	Vehicle Fleet	Annual registration	-
	Motorization	Vehicle/capita	-
	Ownership	Public, commercial, private	-
	Vehicle travel	Million vehicle-km/year	-
	Passenger travel	Million passenger-km/year	-
	Freight travel	Million ton-km/year	-
Value	Asset replacement value	Rp. trillion	-
	Fleet replacement value	Rp. trillion	-
	Asset depreciated value	Percentage of replacement value	-
	Fleet depreciated value	Percentage of replacement value	-
	Road transport cost	Rp. trillion	-
	Road expenditures	Rp. trillion	-
	Road sub-sector costs	Rp. trillion	-
Economy	Road sub-sector costs	Percentage of GDP	-
	Sustainability in terms of road space per unit of GDP	Lane-km/million rupiah	
	Employment of labor	Number by type	-
	Road accident fatalities	Number	-
	Road accident casualties	Number	-
	Energy consumption	Gigajoules	-
	Fuel consumption	Liters	-
	Emissions	Total by type : NOx, SOx, particulate	-
Financial	Cost recovery	Percentage revenue/expenditure	-
	Borrowing	Percentage of expenditure	-
	Sub-sector expenditure	Percentage of Government expenditure	IRMS
Structure	Ownership structure	-	-
	Autonomy of agencies	-	-
	Separation of powers	Policy, management, implementation	-
	Public/private expenditure	-	-

GDP = *Gross Domestic Product*

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Table 2. Provision Perspective on Performance

Aspect	Performance Indicator	Units	Included in IRMS
Productivity	Expenditure	Preservation (Rp. trillion)	IRMS
		Development (Rp. trillion)	RIDPD
		Operations (Rp. trillion)	-
	Works	Kilometer by works type	IRMS
	User savings	Rp. trillion / year	IRMS
Efficiency	Preservation average cost	Expenditure/ lane-km by works type	IRMS
	Output per employee	Works expenditure per staff-year	-
Effectiveness : asset development	Network extension	Length (km) and percentage	IRMS
	Congested road space reduction	Lane-km and per cent of congested road space	IRMS
	Sub-standard geometric reduction	Length (km) and per cent of sub-standard length	IRMS
	Achievement of stable pavement condition	Length (km) and percentage increase	IRMS
Effectiveness : asset preservation	Preservation standard	Pavement by length and percentage	IRMS
		Bridge by number and percentage	BMS
	Asset condition	Pavement by length and percentage	IRMS
		Bridge by number and percentage	BMS
Effectiveness : program	Program benefits	NPV, average NPV per kilometer	IRMS
	Program savings-expenditure ratio	User savings/total expenditures	IRMS
	Program economic returns	Minimum and median EIRR	IRMS
	Program backlog	Kilometers deferred maintenance	IRMS
	Budget shortfall	Percentage of expenditure deferred	IRMS
Effectiveness : Safety	Fatalities reduction	Percentage	-
	Casualties reduction	Percentage	-
	Accidents reduction	Percentage and number by type	-
	Black-spots reduction	Number and percentage	-
Resource use	Materials	Aggregate, bitumen, cement (ton)	-
	Recycling rate	Tons, percentage of total by material type	-
	Energy-fuel consumption	Liters, Gigajoules in works operations	-
	Emissions from works	Tons by NOx, SOx, particulate	-
Institutional	Contract expenditures	Rp. trillion and percentage of total	IRMS

Table 3. User Perspective on Performance

Aspect	Performance Indicator	Units	Included in IRMS
Service quality	Surface ride quality	Percentage of vehicle-travel by standard	IRMS
	Road corridor quality	Percentage of vehicle-travel by standard	-
	Black-spot incidence	Major spots/network-km	-
Mobility	Annual travel	Kilometers/year/vehicle by vehicle class	-
	Travel speed	Sample by vehicle class	-
	Total delays	Vehicle-hours	-
	Road closures	Facility-days by class	-
Risk exposure	Fatality risk	Fatalities/million vehicle-km	-
	Casualty risk	Casualties/million vehicle-km	-
	Accident risk	Accidents/million vehicle-km	-
User cost	Vehicle operating cost index	Average VOC/baseline VOC	IRMS
	Vehicle operating cost savings	Rupiah/vehicle-km and percentage	IRMS
Resource use	Fuel consumption	Annual per user (gigalitres/vehicle)	-
	Emissions	Annual per user by type (ton)	-

The purpose of performance indicators in road management is to describe whether the providing of road service has been fulfilled, appropriate with community needs to carry-on their social economic activities. These describe shaped in quantitative value that shows the existing level of service. These values will gives benefit in appropriate with public needs and this thing is need to be done regularly and periodically. Examples can be seen in Figure 1 to Figure 3.
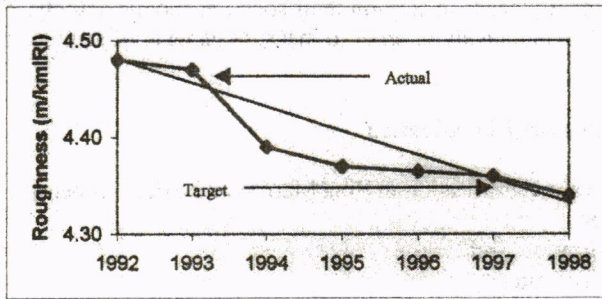

Figure 1. Example of a line graph presentation of a roughness performance indicator showing progression over time
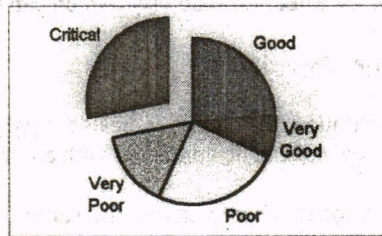

Figure 2. Example of a pie chart presentation of a performance indicator showing proportions of road network in different conditions
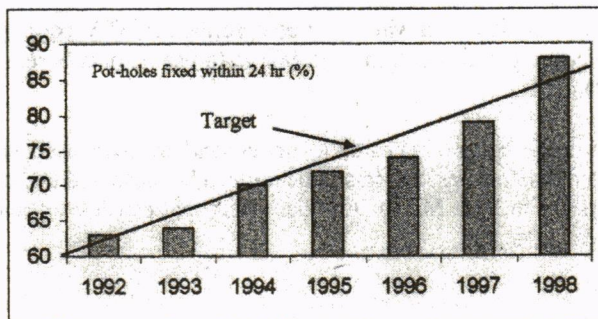

Figure 3. Example of a histogram presentation of a performance indicator showing achievement of pot-hole patching over time

7. PERFORMANCE INDICATORS FOR ROAD ADMINISTRATOR

7.1 Basis Recommendation of Performance Indicators

Performance Indicators, which are needed for Bina Marga as a road administrator and developer, are indicators, which can measure its performance in providing, and managing roads that fulfill community needs to cary-on their social-economic activity. These indicators must can be measured quantitatively in order to measure its level of service and to reflect the right policy.

7.2 Performance Indicators Classification

The performance indicator classification in Bina Marga can be done as below :
- Government Factor
- Bina Marga Organization Factor
- Bina Marga Activity Product
- The Effects which Felt by Road Users

Of course not every indicators in Table 1,2, and 3 are can use by Bina Marga. Because of that, it was need another selection, grouped in : managerial factor, technical factor, physical factor, financial and economic factor, and the effect for road user, which can be seen in Table 4.

7.3 Performance Indicators Chosen Description

In government factor or related institution, the chosen indicator is preservation cost because it gives describe of operation efficiency and can be compared with another countries.

Works indicator was also an indicator that can measure the value of fund that provided by government. To explain the physical characteristics of the road network can be described with road condition asset for road user and for road administrator, may be pavement condition indicator more usable like IRI (International Roughness Index) which can popular describe as very stable, stable, less stable, critical, very critical or disconnect. So as the bridge, its condition can be measured from 1 to 5 (good until disconnect).

Program benefits and economic return which can be described in NPV per cost ratio which is a main indicator to measure projects within Bina Marga to use its data base, such as : IRMS, URMS, KRMS and BMS.

Average travel speed is the easiest indicator to understand by road user, so this indicator becomes another main indicator. Besides, this indicator can be measured and calculated easily by all management system in Bina Marga. Another effect that can felt by road user is VOC indicator (vehicle operating cost).

Table 4. Statistic Operation which provided by IRMS and Used by Bina Marga as Performance Indicators

1. Managerial factors relating to institutional arrangements within Bina Marga		
Financial Management	**Preservation average costs**	**Expenditure/lane-km by works type**
	Expenditure	Preservation (Rp. trillion)
	Contract expenditure	Rp. trillion and percentage
2. Technical factors relating to works and activities that are undertaken by Bina Marga		
Efficiency	Works	Kilometers by works type
3. Physical characteristics of the road network		
Physical Asset	Road length	Kilometers by works type
Preservation Asset	**Achievement of stable pavement condition**	**Length (km) and percentage increase**
	Preservation standard	Pavement by length and percentage
	Asset condition	Pavement by length and percentage
	Program backlog	Kilometers deferred maintenance
Developing Asset	Network extension	Length (km) and percentage
	Congested road space reduction	Lane-km and percent of congested road space
	Sub-standard geometric reduction	Length (km) and per cent of sub-standard length
Service Quality	Surface ride quality	Percentage of vehicle-travel by standard
4. Financial and economic factors relating to the road network		
Value	Budget shortfall	Percentage of expenditure deferred
Economics	**Program savings – expenditure ratio**	**Program savings/total expenditures**
	Program benefits	NPV, average NPV per kilometer
5. Impacts on road user who are the 'customer' of Bina Marga		
Economic	**VOC savings**	**Rupiah/vehicle-km and percentage**
	VOC index	Average VOC / baseline VOC
	User savings	Rp. trillion / year
	Economic return program	Minimum and median EIRR
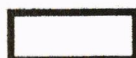
[ ]   suggested performance indicator

7.4 Suggested Performance Indicators

Based on above explanation, there are 5 main suggested performance indicators, which are :
1. **International Roughness Index Value** (IRI), to figure out the condition of road surface services.
2. **Bridge Condition Mark Value** (BCM), to figure out the condition of bridge services.
3. **Net Present Value** (NPV) of construction or maintenance cost, to reflect the rate of feasibility of road construction or maintenance.
4. **Road User Cost Index** or **Vehicle Operating Cost** (VOC), to figure out the rate of direct cost from road user.
5. **Average Travel Speed**, to reflect road condition and its traffic that is felt directly by road user.

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