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Track access charge for Indonesian railways using full cost method: improving industry competitiveness

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Abstract. The government of Indonesia currently focuses on improving the public railway services to be more effective and efficient by formulating suitable railways infrastructure charges. This paper examines a possibility to determine the track access charge (TAC) for Indonesia railways infrastructure based on a benchmark to other countries. Compared to existing charge that used basic price and product factor, the alternative proposed concept also considers multiplicative surcharge and load component. In-depth interviews will be conducted with related stakeholders from government bodies, operator, and academics to gain more insights and further to validate the research outcomes. The result shows that the suitable TAC value for the railway's operator ranging from 56% to 66% from total proposed payable TAC, while government subsidy will cover the rest of 34% to 44% of determined track access charge to liberalize railways industry in Indonesia.

1 Introduction

Railway infrastructure plays a significant role in increasing national transport connectivity. Many benefits have been identified by many scholars ranging from reliability, speed, and accuracy compared to other modes of transportation such as a bus or personal vehicles [1-3]. The government of Indonesia through the Ministry of Transportation currently focused on improving the public transportation system to be more effective and efficient by increasing the quality and quantity of railway services.

Currently, the management of rail services in Indonesia held by PT Kereta Api Indonesia (KAI) – a state-owned enterprise – that acts as sole operator for railway sector. They annually receive subsidies from the government to operate railway services. In 2012, government supported the operator through a subsidy that amounted for about US $ 79 million and the budget keep increasing every year [4]. Despite improved performance and earnings of PT KAI in the past few years, there are still many aspects in term of technical aspect to user services that can be improved.

The government continues to increase the reliability of rail services by balancing the reduction of costs and subsidies. Encouraging the private sector to get involved in creating efficiencies and innovation is one of the solutions to improve rail services. Firstly, the government needs to create Track Access Charge (TAC) mechanism – access fees for using railway infrastructure that provided by the government.

However, TAC system in Indonesia has not properly formulated to accommodate private sector investment. It can be seen from the framework that shown an unclear formula which plausible for dispute due to undefined components. In the 2000s, TAC mostly equal or higher than infrastructure maintenance and operation or IMO [5]. IMO is the cost of railway infrastructure both for maintenance (e.g. Tracks, ballast) and operation (e.g. human resource) [6]. Considering TAC equal to IMO, thus operator budget from government support to maintain the infrastructure unable to cover the cost of the use of infrastructure. This condition makes a significant decline in term of service for users.

Other developed countries have been successfully improving their respective railway services by implementing proper rail infrastructure charge such as Germany, France, UK and others [7-8] as well as Australia [9]. Considering the needs to create better services in railway infrastructure in Indonesia, this research will examine the conceptual framework of track access charge by evaluating components in current TAC scheme.

It is expected that this research will produce a robust framework that can be used by decision makers to increase the quality services for public interest and also to attract more private sector investment in the Indonesia's railway sector.

2 Experience from other countries

Western Europe countries such as United Kingdom, France, and others, mostly use Marginal Cost (MC+) method for their rail infrastructure charge. In contrary, Full Cost (FC) method commonly implemented by Eastern Europe Countries such as Latvia, Hungary, and

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others. In the western part of Europe, only two countries that use this system; Germany and Italy. Both of them will be included in the case study to gain more insight in determining suitable FC-method for Indonesia's rail infrastructure charge.

2.1 Germany

Deutsche Beteiligungs AG (DBAG) is one of Germany's leading private companies that run railway networks in the country. They oblige to pay for track access charge which covers 60% from railway infrastructure cost. Germany track access charge components consist of following items: basic price, product factor performance – based component and load component. More detail can be seen in figure 1 [10].

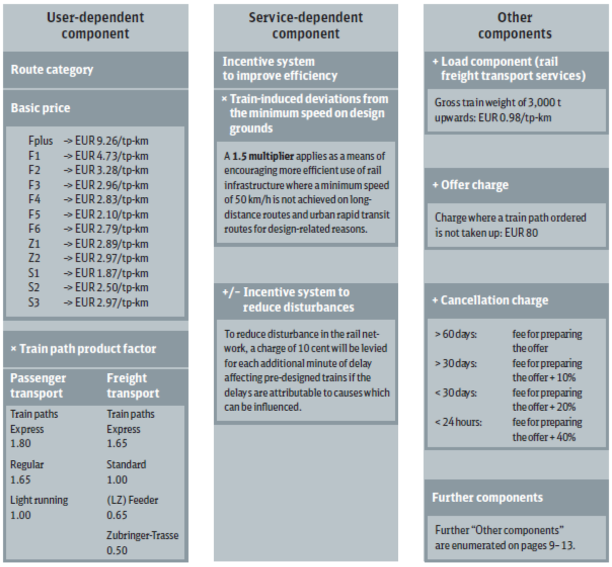

Fig. 1. Structure of the train path pricing system in Germany

Basic price is categorized by using long distant lines (Fplus to F6), feeder lines (Z1 and Z2) and urban lines (S1 and S2). The value varied from 1.87 up to 9.26 €/train km. Nonetheless, F5 has a limitation in the speed for only maximum 120 km/h that runs for inter – regional area with lower traffic. S1 is an exclusive track where S-Bahn train is operated. Compared to that, S2 is a network that connects S-Bahn Berlin and Hamburg [10]. For further calculation, the basic price will then multiply by product factor that considers whether the train categorized into passenger or freight train [11].

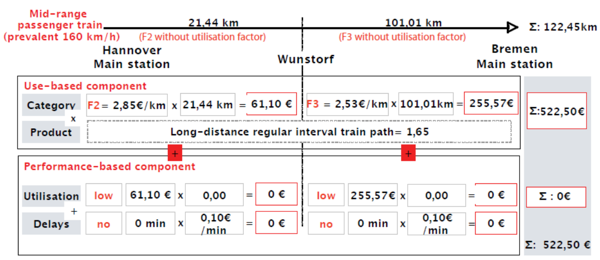

Fig. 2. Cost calculation of medium passenger train in Hannover – Bremen route

In term of performance – based component, it was formed through sub – categories including utilization, and probability of delays. Last, load factor is mainly used for the freight train. 0.92 €/train km will be charged in the condition where freight train surpasses maximum tonnage threshold in 3,000 tons. A sample of track access charge calculation in Germany can be seen in figure 2 [12].

2.2 Hungary

The Hungarian State Railway (MAV Co.) managing Hungarian railways which serve 7 million train passenger and 15 million freight train. Track access charge formula in this country is categorized into three travel distances from long distance passenger (LDP), short distance passenger (SDP) and freight transport (F). The operator also mandates to pay the cost for the quality of service in particular line sections. It comprises of three categories:

- 1st-category (advanced) lines [international routes (corridors)]
- 2nd-category (normal) lines [domestic mainlines]
- 3rd-category (local) lines [regional (branch lines)]
- The basic charge formula for track access charge in Hungary can be seen in table 1 [13]

Table 1. Hungary's basic charge formula for TAC

Line category	1st category International lines (il)	2nd category Domestic lines (dl)	3rd category Regional lines (rl)
Long distance passenger traffic (ldp)	$BC_{ldp,il} = BC_{fixed,il} + BC_{variable;ldp,il}$	$BC_{ldp,dl} = BC_{fixed,dl} + BC_{variable;ldp,dl}$	$BC_{ldp,rl} = BC_{fixed,rl} + BC_{variable;ldp,rl}$
Short distance passenger traffic (sdp)	$BC_{sdp,il} = BC_{fixed,il} + BC_{variable;sdp,il}$	$BC_{sdp,il} = BC_{fixed,dl} + BC_{variable;sdp,dl}$	$BC_{sdp,rl} = BC_{fixed,rl} + BC_{variable;sdp,rl}$
Freight traffic (f)	$BC_{f,il} = BC_{fixed,il} + BC_{variable;f,il}$	$BC_{f,dl} = BC_{fixed,dl} + BC_{variable;f,dl}$	$BC_{f,rl} = BC_{fixed,rl} + BC_{variable;f,rl}$

Table 2. Simulation for Budapest – Austria passenger train

Item	Amount	Unit	Price	Total
Path Allocation	1	Path	23.2	23.2
Station Usage	1	Event	27.	55.6
Stops	4	Stop	13	52
Train Running	270	Train.km	2.3	431.48
Overhead Catenary Usage	270	Electric. train.km	0.5	93.8
Total				€ 656.08

Furthermore, following simulation will visualize the implementation of infrastructure charge that has been conducted in Hungarian Railways Infrastructure [14].

2.3 Italy

Italy has separated its railway in a vertical way from infrastructure manager (*Rete Ferroviaria Italiana SPA* (RFI) and operators (5 passenger operator companies and ten freight operator companies). Railway in Italy differs from node and network. Network consist of trunk network and complementary/secondary network (secondary, scarce traffic and shuttle lines).

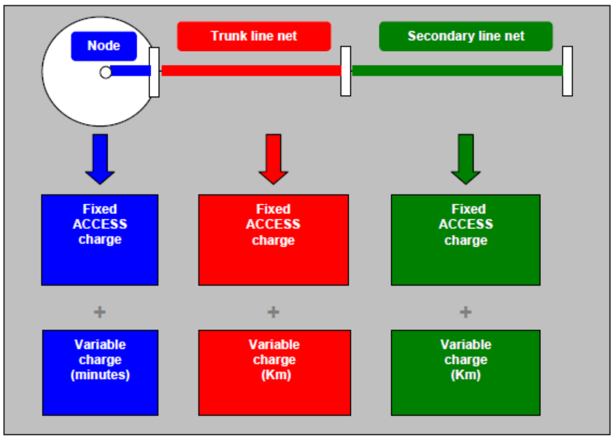

Fig. 3. Track access charge of network and node in Italy

Table 3. TAC comparison among Germany, Hungary and Italy

Countries	Germany	Hungary	Italy
% Total fees charged	60	80	16
Method	FC-	FC	FC-
Contribution	Federal or Local support for investment	Direct support from the state	State pay for investment to operation. User pays for smaller part of service cost
TAC Approach	Simple	2 part tariff	2 part tariff
Categorizatio n between Passenger and Freight	Y	Y	Y
Traffic considered in calculation	Y	N	Y
Categorizatio n through speed	Y	Y	Y
Capacity is being charged	N	Y	N
Delays	N	N	N

Every node and network will have a fixed access charge and variable charge. In node, the variable charge will consider time (minutes) as a multiplying factor. It divided into three categories of time: 22.00 – 06.00, 06.00 – 09.00 and 09.00 – 22.00. Moreover, variable charge in the network will consider the travel distance and expressed by km. More detail about track access charge in Italy can be seen in Figure 3 [15].

Based on previous explanation about the comparison of track access charge system in three countries (Germany, Hungary, and Italy). Therefore a comparison can be derived as follows.

3 Current Indonesia's track access charge

The payment method of existing rail infrastructure in Indonesia has been regulated through Minister of Transportation Decree No 62, 2013 that contain a calculation of railway infrastructure usage. It has been agreed by both government and KAI – a state-owned enterprise that acts as sole the operator.

Several aspects have been considered to determine the payment method including operational and maintenance; the quality of the infrastructure, and operator capability. The formula expressed as follows:

$$TAC = (IO + IM + Depreciation) \times f \qquad (1)$$

where:

TAC = Railway infrastructure charge

IO = Infrastructure Operation cost

IM = Infrastructure Maintenance cost

f = Coefficient

Infrastructure depreciation value is annualized according to its standard life cycle. Meanwhile, Coefficient value in the above formula determined based on government policy for basic use of infrastructure. The magnitude of this factor ranging from 0.6 for a passenger train to 0.9 for a freight train. The detail of priority factors are classified using the following type of classes:

- Economic class: 0.6
- Business class: 0.7
- Executive class: 0.9
- Freight train: 0.9

According to reference [16], one of the reasons why Indonesia's government yet to produce a solid framework of railway infrastructure charge is because the coefficient value justification remains unclear. No standardized coefficient makes track access charge value tend to exceeds infrastructure maintenance cost. Therefore, the operator was at disadvantage position and possible to leads into company shut down due to declining revenue.

4 Proposed rail charge framework

Proposed rail charge framework will evaluate existing Indonesia's rail charge by adopting principles and formula of TAC in Germany. It will use a full cost (FC) principle where all infrastructure cost that being used must be paid by the operator that runs the network. However, despite using single tariff through a train – km approach, proposed rail charge will use a single tariff with a gross – ton calculation.

This approach is more favorable to be applied because freight train playing a significant role in degrading rail infrastructure in Indonesia compared to the passenger train. According to the reference [17], a gross ton-km approach is a right choice for a country that still develops its railway infrastructure formulation into a robust framework. The formula of proposed rail charge can be seen as follows:

TAC = {Base charge x product factor x multiplicative surcharge} + Load Component (2)

Base charge will consider the value of station maintenance, rail infrastructure maintenance, bridge, signal and telecommunication, planning and monitoring cost, maintenance and operating personnel cost, general cost, and depreciation, weight, and length of the track.

The length of corridor derived from all active railway network for every Daop/Divre (kilometer) and also put aside the classification of speed and rail traffic. The type of railway divided into passenger train (executive, business, and economy) and a freight train.

Meanwhile, the multiplicative surcharge will be involved in the calculation to evaluate the use of diesel locomotive in Indonesia railway network. The coefficient expected to reduce pollution and as a means to introduce more sustainable locomotive such as an electrical train. Multiplication among base charge, product factor, and a multiplicative surcharge will produce basic track access charge.

On the other hand, the variable will consider load component that applied for trains that exceed 3,000 ton. Every gross – ton kilometer (GT-KM) will charge around 15,514 rupiah or equal to US$ 1.07. It calculated through a benchmark process with converted currency exchange. This charge aims to cover additional maintenance cost in railway infrastructure from freight train excessive load which occurs multiple times.

Compared to other countries that implement rail infrastructure charge using full cost method, the proposed components for Indonesia's track access charge exclude several items such as incentive system, offer charge and cancellation charge.

Offer charge is a condition where the operator decline to use the track that given by the infrastructure provider. Since Indonesia's still use a single operator, this variable yet to be used. However, it may be possible to be applied for new railway track to produce competition among railway operators.

The following table is summarizing the components of proposed track access charge for Indonesia railway transportation.

Furthermore, considering table 4 and TAC formulation, following flowchart will summarize the proposed calculation of track access charge for Indonesia railway transportation.

Table 4. Proposed TAC components for Indonesia railway

Component	Applied in Indonesia
Product Factor	✓
Multiplicative Surcharge	✓
Incentive System	×
Load Component	✓
Offer Charge	×
Cancellation Charge	×

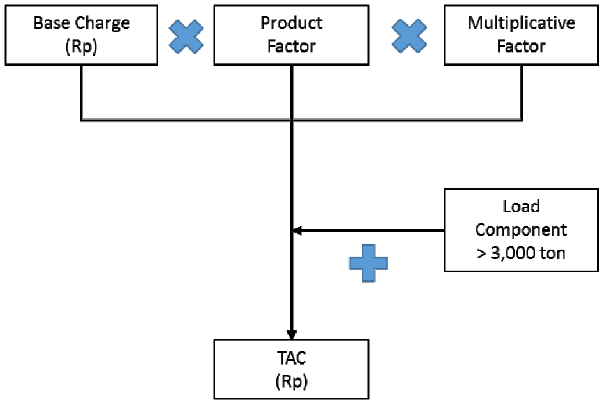

Fig. 4. Flow chart of TAC calculation

Previously, TAC – IMO in Indonesia for 2011 period are about Rp 2,046,095,743,034.44 and Rp 1,354,687,243,847.58 respectively. Using the interpolation from the increasing of TAC – IMO during the past five years (5%), track access charge for Indonesia in 2017 is estimated around 2.7 trillion rupiahs.

5 Government support

Since the proposed track access charge requires an enormous amount of cost to be paid by the operator, the government needs to support with a subsidy to produce a competitive ticket price for users. Compared to other countries, their rail charges are lower than its infrastructure maintenance and operation due to government support by reducing its TAC.

For instance, Germany's operator pays for 60% from total TAC; Italy pays for 16%, Slovenia around 13% and Romania with 52% from total TAC. However, there are also countries where TAC excluded from the government support such as Latvia and Estonia.

Using the figure above where the value is ranging from lowest percentage of TAC around 20% (Belgium) to 100% (Latvia and Estonia), it concludes that there is no single formulation about the government support in reducing the cost of access rail charge. It depends on various factors from the availability of data, economic growth, railway competitiveness, political factors and others.

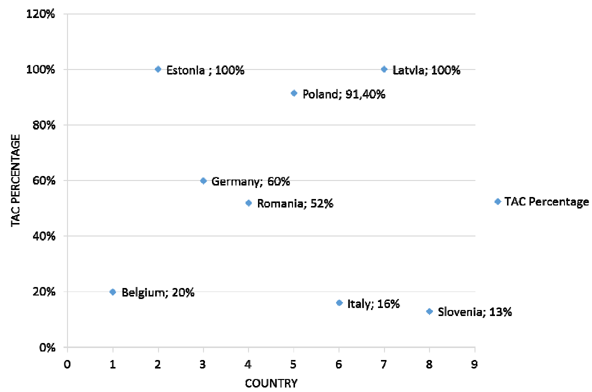

Fig. 5. TAC percentage in European countries

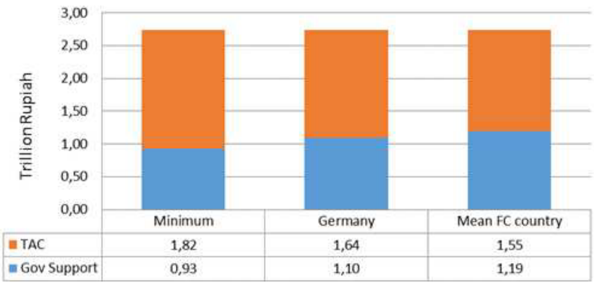

Fig. 6. TAC and government support for Indonesia railway industry

As the comparison between TAC and government support from Germany and other countries that use FC concept, the suitable TAC value for the railway's operator ranging from 56% to 66% from total proposed payable TAC, while government subsidy will cover the rest of 34% to 44%.

6 Conclusion

This research produces alternative track access charge calculation for Indonesia's railway infrastructure. It uses a modified formula from Germany track access charge by considering the local context in Indonesia. The components will involve the base charge, product factor, multiplicative surcharge and load component.

The track access charge by using this approach produce a TAC and IMO values for about 2,046,095,743,034.44 rupiahs and 1,354,687,243,847.58 rupiahs respectively. Furthermore, to generate a competitive ticket price, the operator shall pay the TAC ranging from 56% to 66%. The other will be supported by the government for around 34% to 44% of the overall TAC price.

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