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EVALUATING THE MAIDEN BRT CORRIDOR IN VIETNAM

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Abstract. Bus Rapid Transit (BRT) is one of the most effective solutions to meet an enormous growth of travel demand in developing countries' urban areas where urban rail systems are on the plan or under construction but not in reality yet. Based on collection and synthesis of successful and outstanding experience over the world (e.g. in Bogota (Colombia), Guangzhou (China), Ahmedabad (India)), the Bus Rapid Transit Standard (BRTS) was introduced to provide guidelines to the following creation of BRT. It is a measurement to clarify what are strengths and shortcomings of each case, which contributes to propose approaches to deal with disadvantages and enhance operation. Hanoi inaugurated the first BRT corridor at the beginning of 2017; however, it has performed more poorly than expected. In this paper, it is assessed by the BRTS to show (1) which level it reached compared with international BRT systems, (2) its main limitations and (3) potential remedies for its poor performance. The findings emphasize that its design meets the Bronze standard; however, its actual operation achieves the Basic level only. Its major issues are low (design) capacity, low frequency, limited speed, lack of reliability and convenience. To address them, implementing technical packages to give prioritized signals at intersections and provide multimodal real-time information together with reducing interval at peak hours would be the most important and feasible solutions. Although being ineffective now; BRT would play a vital role in the process of limiting the use of private vehicles, especially motorcycle.

Keywords: BRT, public transport, BRTS, Hanoi, corridor

1. INTRODUCTION

Whilst cities and metropolitan areas of developed countries satisfy successfully travel demand of citizens by deploying metro systems together with other friendly environmentally modes like monorail and tramway, those in developing countries have been dependent heavily on private vehicles, paratransit or/an conventional bus systems to meet inhabitants' mobility. An innovative hybrid of urban rail and bus that is Bus Rapid Transit (BRT) has made a revolution in public transport development in the Global South. Typical examples of successfulness are TransMilenio in Bogota (Colombia), Zhongshan in Guangzhou (China) and Janmarg in Ahmedabad (India). Based on various experience in consulting and designing BRT worldwide, Institute for Transportation & Development Policy (ITDP) in collaboration with other Non-Governmental Organizations (NGOs) composed and published the Bus Rapid Transit Standard (BRTS) to provide a measurement tool to BRT systems. Hanoi, the capital of Vietnam witnesses a boom in travel demand. Dwellers mainly use motorcycles whilst the over 100-route subsidized bus network accounts for under 10% of mode share [1]. The Kim Ma – Yen Nghia BRT corridor, the first member of the mass rapid transit family, came into official operation at the beginning of 2017; yet, it has not been a good advertisement for efforts on reforming the current limited public transport system [2].

In this paper, the Hanoi BRT is analyzed by the BRTS to show (1) which level it reaches compared with international BRT systems, (2) its main limitations and (3) potential remedies for its poor performance. As for the paper structure, Section 2 reviews introducing and revising the BRTS and the previous studies of the Hanoi BRT. Subsequently, the application of the BRTS for the Hanoi BRT together with scores is documented. Discussions about the scores of the Hanoi BRT, potential solutions and prospect of BRT in Hanoi are content of the next. The last encompasses conclusions.

2. REVIEWING THE BUS RAPID TRANSIT STANDARD AND THE HANOI BRT

Rapid urbanization on the one is the strong motivation for the growth of economies and living conditions of citizens. It on the other hand has led to a number of transport-relative challenges, including proliferation of travel demand, rising private vehicle possession, serious traffic congestion, limited public transport services in terms of quality and quantity, not to mention pollution and road accident [3]. Construction of rail-based systems is the key to meeting effectively increasing travel demand and thus relieving other issues [4]. However, the costly construction of metro is a big impediment to the budget-constraint countries. BRT is a preferred response to the need of high-capacity public transport means thanks to its rapid, affordable and efficient establishment [5].

The BRT origin was significant improvements in conventional bus systems thanks to constructing dedicated lanes by 1970s in US and UK. BRT acted as an independent and innovative mode in Curitiba, Brazil [6]. Between 1980 and 2000, inspired by the outstanding performances and creative design of the Brazilian city, a series of cities in both developed and developing countries established BRT. However, BRT reached the leading position in the public transport systems of emerging countries only. A typical model was introduced in Bogota (Colombia) in 2000 with the name of TransMilenio. The 21st century has seen a global proliferation of BRT. Chinese cities show the consistent and great interest in BRT. One of the best practice not only in China but also over the world is the Zhongshan corridor in Guangzhou whose ridership is even higher than that of a metro line [3]. The systems in Mexico, Istanbul (Turkey), Ahmedabad (India), Lima (Peru) and so on have distinct design

characteristics and excellent performances [7]–[9]. The present approximation of total BRT length is about 5000 km in roughly 170 cities of over 45 nations [10].

Standing behind and motivating the pervasive construction of BRT are experts, researchers and consultants from NGOs like ITDP, GIZ, World Resources Institute, UN Habitat. By valuable experience in developing BRT, especially international best practices, they released the first version of the BRTS in 2012. It was an effort to seek a universal definition of BRT. According to it, BRT should be used for a corridor with complex components along it rather than a conventional bus route with some minor improvements. The second edition in 2014 made some revisions related to the BRT definition. Specifically, the minimum length was decreased to 3 km, which allows the definition to cover the BRT corridor in the downtown areas. Besides, it showed a more flexible attitude to practical operation and design of BRT. For example, peak and off-peak frequency was arranged as a potential source of penalty instead of a design element. More points were devoted for basic elements to highlight the most important parts that a BRT should have to make itself obviously differ from bus and more similar to rail in terms of both quality and capacity.

The last BRTS was issued in 2016. ITDP has paid more attention to safety for pedestrian and biking. Penalty has imposed to poor operation such as bus bunching, lack of safety data. The standard shows greater emphasis on physical barrier to achieve more effective enforcement with less effort in operation phase. Another modification is to allocate points for on-board fare validation of tickets bought in prior to getting on vehicles. This type is common in European cities where Bus High-Level Service (BHLS) is an equivalent concept to BRT. Thus, the standard covers both BRT and BHLS. Hereafter, the BRTS refers to the 2016 edition.

As regards structure, the BRTS has two main score groups for design and operation, respectively. The former entitled Design Score (DS) is involved in the highest quality and capacity of a system evaluated by its design characteristics. The bigger the magnitude of an element is, the higher point is awarded. By contrast, the operation category includes problems and limitations in reality, which leads a system to fail to achieve the best performance according to its design. Therefore, the total points achieving in the design group have to subtract (penalty) points in this group to generate the full score of a system. And this is the reason why scores of operation are frequently indicated as Operation Deductions (OD).

Table 1. The BRTS rankings.

Ranking	**Score and description**
Gold-standard BRT	85 or above and meet criteria of Basic BRT
Silver-standard BRT	70-84.9 and meet criteria of Basic BRT
Bronze-standard BRT	55-69.9 and meet criteria of Basic BRT
Basic BRT	- Dedicated lanes: at least 3 km long - Dedicated right-of-way criterion: at least 4 - Busway alignment criterion: at least 4 - BRT basics category: at least 20
Non BRT	Fail to achieve Basic BRT

In DS, there are six categories, including BRT basics, service planning, infrastructure, stations, communications, access and integration. Among them, the BRT basics category is comprised of the essential elements of a BRT corridor. To put it another way, a corridor failing to gain the minimum level of this category should not be considered a BRT system. OD is structure into one category encompassing 12 potential issues to a BRT. Here, the

authors use *criterion/criteria* to refer to both elements in DS and issues in OD. Each criterion is introduced in tandem with the maximum point and responsive requirements. Lower levels of meeting the criteria result in fewer point received.

The maximum score a system can earn is 100. Based on the full score, a system can obtain one among four rankings from the highest to the lowest as follows: Gold, Silver, Bronze and Basic BRT (see Table 1). If a system does not reach the minimum point of Basic BRT, it is simply such a conventional bus route yet being called BRT.

The Hanoi BRT is the outcome of a project lasting 10 years under the consultation and the financial support of the World Bank (WB). It was expected as a cornerstone of establishing the mass rapid transit in Hanoi. Especially, in case of long-lasting delays of urban rail lines, the local government and WB hoped its introduction would change fairly negative views of citizens on public transport. Unfortunately, it has performed so poorly that its patronage of 13500 passengers per day is comparable to that of a traditional bus and that of the Bangkok BRT, a failed system [11]. Possibly as a result of seeing the Hanoi BRT's poor performance, many authors have provided studies focusing on its limitations. On the one hand, the earlier studies have agreed with the fact that the Hanoi BRT would be a failure or unworthy. On the other hand, they seem to ignore an important question that is the Hanoi BRT is whether eligible for a BRT corridor or not. And what are possible and prioritized solutions to it? By means of applying the BRTS for the Hanoi BRT, reasonable responses to the mentioned-above questions would be pinpointed.

Table 2. Operational parameters of the Hanoi BRT.

Parameter	***Value***
Official name	The Hanoi BRT
Commercial kick-off time	01/2017
Corridor length - Segregated length (Km)	14.4 - 14
Interval at peak time (min)	5
Interval at normal time (minutes)	10
Interval at off-peak time (minutes)	15
Commercial speed (Km/hour)	21.5
Opening time	5h00
Closing time	22h00
Operational span (hours per day)	17
Operational vehicle number (vehicles)	22
Vehicle capacity (places)	90
Station number (stations) – Terminal number (terminals)	21 - 2
Daily ridership (passengers per day)	13500
Station position	Median
(Vehicle) Door position	Left
Level of boarding	High
Fare validation	Off-board

3. APPLYING THE BUS RAPID TRANSIT STANDARD FOR THE HANOI BRT

In this section, categories and their criteria are analyzed for the Hanoi BRT before scores are given. As indicated above, there are seven categories with six of DS and one of OD. The final score is the base for ranking the corridor.

3.1. BRT basics (5 criteria)

This category includes five critical elements that enable to eliminate delays and thus create the feature of "rapid" in the name of the mode. They are critical factors to make BRT differ from conventional bus services.

(1) Dedicated Right-of-Way: 97% of the 14.4-km length of the corridor is separated from the mixed traffic by road markings rather than physically. Additionally, it is dedicated for BRT only. Therefore, the score is 7/8 points. *(2) Bus alignment:* The vast majority of the bus lanes are in the middle of two-way roads, which minimizes the conflicts between BRT buses and vehicles turning and those parking in curbs. Therefore, the score is 8/8 points. *(3) Off-board fare collection:* This is one the most important solution to reduce travel time compared to traditional buses that require passengers to purchase and validate on-board. All stations in Hanoi apply manual off-board checking without barriers or turnstiles. Therefore, the score is 7/8 points. *(4) Intersection treatments:* Traffic-signal priority and forbidding turns across the BRT lanes are not available in Hanoi. Therefore, the score is 0/7 points. *(5) Platform-level boarding:* The high level boarding is applied for both stations and vehicles to minimize both horizontal and vertical gap. Therefore, the score is 7/7 points.

3.2. Service planning (7 criteria)

(1) Multiple routes: All vehicles run along the corridor between two terminals. Multiple routes do not exist in case of Hanoi. Therefore, the score is 0/4 points. *(2) Express, limited-stop, and local services:* During operational time, only local services that stop at every station are provided. Express and limited-stop services that skip low-demand stations or directly connect between two terminals are not available. Therefore, the score is 0/3 points. *(3) Control center:* A control center dedicated for BRT have completed but not in operation. The center of conventional bus takes responsibility for monitoring BRT vehicles too. Therefore, the score is 0/3 points. *(4) Located in top ten corridors:* The corridor connects between the suburb and the city center. Longer sections of the corridor pass low-density areas, even agricultural lots. Therefore, the score is 0/2 points. *(5) Demand profile:* In the highest demand segment starting at the terminal Kim Ma, BRT buses run on the mixed traffic 0.4-km lanes per direction. Therefore, the score is 1/2 points. *(6) Hours of operations:* As can be seen in Table 2, the services are delivered both on weekdays and at weekends but not until midnight (late-night). Therefore, the score is 1/2 points. *(7) Multi-corridor network:* The corridor is the only now but there is connection with the planned ones. Therefore, the score is 1/2 points.

3.3. Infrastructure (5 criteria)

(1) Passing lanes at stations: There is a single BRT lane per direction. Therefore, the score is 0/3 points. *(2) Minimizing bus emissions:* Vehicles use diesel and do not meet EURO IV and above. Therefore, the score is 0/3 points. *(3) Station set back from intersections:* Based on the survey results, over 75% of stations on the corridors are far from intersections at least 26 m. Therefore, the score is 2/3 points. *(4) Center stations:* All stations are in the middle of roads and serve both directions of services. Therefore, the score is 2/2 points. *(5) Pavement quality:* The bus lanes use reinforced concrete over most of corridor and they have a thirty-plus-year life. Therefore, the score is 2/2 points.

3.4. Stations (5 criteria)

(1) Distances between stations: With 21 stations on the 14.4-km length, the average

distance between two consecutive station falls into the range between 300m and 800m. Therefore, the score is 2/2 points. *(2) Safe and comfortable stations:* Stations in Hanoi have internal width of over 3m with weather protection. Besides, they are attractive with modern design and under surveillance by cameras. Therefore, the score is 3/3 points. *(3) Number of doors on bus:* The vehicles are standard (non-articulated) type with two doors on the left side. Therefore, the score is 3/3 points. *(4) Docking bays and sub-stops:* There is no station composed of docking bays and sub-stops. Therefore, the score is 0/2 points. *(5) Sliding doors in BRT stations:* All stations are equipped with sliding doors that are synchronized with the door of bus, reducing the risks of accidents and prevent pedestrians from entering the station illegally. Therefore, the score is 1/1 points.

3.5. Communications (2 criteria)

(1) Branding: The Hanoi BRT positions itself as a high-quality service by unique brand and identity for both stations and vehicles. Therefore, the score is 3/3 points. *(2) Passenger information:* Real-time information is not provided for passengers in all stations although being now a part of a bus service-dedicated application (timbuyt.vn). Therefore, the score is 0/2 points.

3.6. Access and integration (6 criteria)

(1) Universal access: Stations are accessible to some of special-needs passengers like ramp for wheelchairs. Therefore, the score is 2/3 points. *(2) Integration with other public transport:* There are two aspects of integration in this criterion. First, physical connection between BRT and conventional bus routes is not a direct transfer. Passengers need cross roads before accessing the BRT stations. Hence, this aspect of the Hanoi BRT does not deserve one point because customers have to completely exit from two different service types. The second integration is involved in ticket. The monthly bus tickets are valid for the BRT service. Therefore, the score is 2/3 points. *(3) Pedestrian access and safety:* All stations have safe pedestrian access to them. As for crossing the lanes to the stations in the middle of roads, 10 pedestrian bridges were constructed. In the rest, passengers take advantages of red light phases at intersections. Therefore, the score is 2/4 points. *(4) Secure bicycle parking:* Apart from terminals, the remainder does not have bike-related facilities. Therefore, the score is 0/2 points. *(5) Bicycle lanes:* There is no dedicated lane for biking in Hanoi. Therefore, the score is 0/2 points. *(6) Bicycle –sharing integration:* The option of sharing bicycle is not available in any station at all. Therefore, the score is 0/1 points.

3.7. Operation deductions (12 criteria)

(1) Commercial speed: The BRT commercial speed is 21.5 km/h over 20 Km/h. Therefore, the score is 0/-10 points. *(2) Peak passengers per hour per direction below 1000:* At peak time, load factor reaches 1 or more. And a vehicle can transport 90 passengers. With the frequency of 12 vehicles per hour per direction, the ridership is approximately 1080. Therefore, the score is 0/-5 points. *(3) Lack of enforcement of right-of-way:* Due to being protected from motorcycles and car by markings only, violating the bus lanes takes place on a regular basis. Therefore, the score is -5/-5 points. *(4) Significant gap between bus floor and station platform:* The gaps between vehicle and station are minor. Therefore, the score is 0/-5 points. *(5) Overcrowding:* At peak hours, some buses reach over the capacity of 90 but not usually. Therefore, the score is 0/-5 points. *(6) Poorly maintained busway, buses, stations, and technology systems:* Whilst buses are maintained well and frequently, stations do not. Many sidewalks at stations downgraded. Therefore, the score is -2/-14 points. *(7) Low peak*

frequency: The peak frequency is 12 buses per hour per direction. Therefore, the score is 0/-3 points. *(8) Low off-peak frequency:* The off-peak frequency is 4 buses per hour per direction. Therefore, the score is 0/-2 points. *(9) Permitting unsafe bicycle use:* This criterion is not suitable for the Hanoi BRT. Therefore, the score is 0/-2 points. *(10) Lack of traffic safety data:* Traffic safety profiles are collected and stored but not published. Therefore, the score is 0/-2 points. *(11) Bus running parallel to BRT corridor:* BRT vehicles use the dedicated lanes whilst conventional buses operate in mixed lanes. Therefore, the score is 0/-6 points. *(12) Bus bunching:* With the lowest interval of 5 mins, there is no bus bunching on the corridor. Therefore, the score is 0/-4 points.

3.8. Final score and ranking

As can be seen in Table 3, the total score of the Hanoi BRT (48 points) is far lower than the level of the Bronze brand (55-69.9 points).

Scores of dedicated right-of-way (7 points), busway alignment (8 points) and BRT basics category (29 points) along with dedicated lane length of 14 Km meet requirements of a basic BRT corridor (see Table 1); hence, the corridor in Hanoi should be considered as BRT corridor according to the global standard.

The total score of OD that includes the six first categories is 55 points that are sufficient for being a Bronze-standard corridor. Among these categories, station and BRT basics categories obtain more than 50% of the maximum points. The rest gains low levels. For example, service planning succeeds 3 out of 19 points.

The deductions in the operational phase stem from two sources. The first is the failure to protect the BRT lanes from other vehicles' violation. The second is the degradation of facilities in stations, especially sidewalks. Whereas, issues related to speed, overcrowded at stations and on-board, frequency and safety data collection are not serious enough to impose penalties.

4. DISCUSSIONS

Based on the DS, it can be seen that the Hanoi BRT is designed to meet the basic standards of the internationally best practices. Specifically, designers focus on the construction of lanes and stations dedicated for BRT, which results in the nearly maximum points (9/10) for station categories. In the BRT basics category, apart from the intersection treatment criterion, the remainder achieves 29/31 points.

Nevertheless, a clear limitation is the low capacity of both stations and vehicles. Single lanes without passing positions, docking bay cause the poor assessment of the service planning and infrastructure categories. The BRT Hanoi is an only trunk service but not established in the high demand corridor. Active transport facilities do not receive a sufficient investment. Whilst the access of the pedestrians and wheelchairs would be quite good to some extent, there is no approach to promote biking. The reason is the minor percentage of using bicycle in Hanoi. Additionally, the weather in Hanoi would be extreme with the temperature being up to 40°C in summer and low at 10°C in winter with frequent drizzle. Moreover, with a budget constraint, bike facilities are auxiliary. The BRT Hanoi creation hinged upon the loan from and the financial support from WB.

Table 3. The breakdown of scores.

CATEGORY AND CRITERION	MAX	AWARDED
DESIGN SCORE (DS)		
1. BRT Basics	**38**	**29**
Dedicated Right-of-Way	8	7
Busway Alignment	8	8
Off-board Fare Collection	8	7
Intersection Treatments	7	0
Platform-level Boarding	7	7
2. Service Planning	**19**	**3**
Multiple Routes	4	0
Express, Limited-stop and Local Service	3	0
Control Center	3	0
Located in Top Ten Corridors	2	0
Demand Profile	3	1
Hours of Operations	2	1
Multi-Corridor Network	2	1
3. Infrastructure	**13**	**6**
Passing Lanes at Stations	3	0
Minimizing Bus Emissions	3	0
Stations Set Back from Intersections	3	2
Center Stations	2	2
Pavement Quality	2	2
4. Stations	**10**	**9**
Distances between Stations	2	2
Safe and Comfortable Stations	3	3
Number of Doors on Bus	3	3
Docking Bays and Sub-stops	1	0
Sliding Doors in BRT Stations	1	1
5. Communications	**5**	**3**
Branding	3	3
Passenger information	2	0
6. Access and Integration	**15**	**5**
Universal Access	3	2
Integration with other Public Transport	3	1
Pedestrian Access and Safety	4	2
Secure Bicycle Parking	2	0
Bicycle Lanes	2	0
Bicycle-Sharing Integration	1	0
OPERATION DEDUCTIONS (OD)		
7. Operation deductions	**-63**	**-7**
Lack of Enforcement of Right-of-Way	-5	-5
Poorly Maintained Infrastructure	-14	-2
TOTAL SCORE	**100***	**48**
** in case the score of Operation Deductions is zero*		

The operation of Hanoi BRT is the main culprit of making it fail to be ranked as a Bronze corridor. The biggest problem is the (very) poor enforcement of the BRT lanes. In the design, physical barriers were accepted; however, markings are using. This separation way is not effective at all in case of without the presence of the police. Even the BRT protection is

not the police's main mission that is to dispatch the mixed traffic in serious congestion [12]. The second source of deduction is poor maintenance of infrastructure that results from the financial limitation.

Notably, speed and frequency on the corridor are not imposed penalty; yet, the public and the press have seriously criticized them. In fact, the deductions are valid for extremely poor cases only. The current level of speed and frequency are in the edge of falling into subtraction. Real-time information of both BRT and bus networks is not provided for passengers. Consequently, they are not positive to make their itinerary. In addition, the BRT cannot demonstrate its reliability.

As for solutions, infrastructure-related limitations are unfeasibly corrected. Therefore, it is better to focus on those passengers easily see and evaluate. Moreover, improving criteria in the BRT basics category would be more effective than others. One solution proposed can affect more than one criterion, thus remedies have multi-effects should be preferred. Based on these principles, the implementation of the technical package is the most feasible and important. In the BRT project, it was assessed as a vital component but not completed until now. If being employed, it will alleviate the conflicts between BRT vehicles and other traffic flows, leading to increase BRT's speed. In addition, it can help to do the provision of real-time information of the whole public transport system. Another way to enhance the BRT is to increase frequency. According to the report of the BRT company, the volume of passengers at peak time consistently rises, leading to slightly overloaded status at stations and vehicles. This is a good reason for decreasing interval to 2 or 3 minutes. By doing it, more commuters are conveyed, contributing to alleviate the backlash against the BRT and earn more money, not to mention the ability to self-protect the lanes by BRT vehicles, at least at peak time.

Whist breaking down stations or lanes to reconstruct is cost-expensive and potentially waste, developing transit points or hubs would be worthy. Although there are commercial centers around several BRT stations but there is not direct connection. So, at stations where metro line, BRT and conventional buses pass, upgrading them become transit centers is necessary to promote the picture of public transport in general and mass rapid transit in particular. The connection with centers around should be considered.

Over the world, there are a number of BRT systems achieve the basic standard in China (e.g. Zaozhuang, Dalian, Hefei), Pakistan (Lahore), Brazil (Recife, Sao Paulo). Notably, a basic-level system in New Delhi (India) was dismantled. For the Hanoi BRT, its removal on the one hand has never been indicated by the local government. Its poor operation on the other hand is primarily responsible for stopping the implementation of the BRT plan that once completed will have 11 corridors with a total of 316 km. BRT corridors will have two main functions. The first is connecting between outskirts and the center of the core area. The maiden constructed line belongs to this type. The second is a fast connection between newly developed satellite urban areas and the core area.

The unrelenting traffic jams and adversely polluted air have made Hanoi think rigorously about pushing citizens to use public transport and limit private vehicle use. However, authority cannot decide which should be done first. To response pollution and congestion issues, the government has shown a more determination in terms of restricting motorcycle and car in the central business districts. Scenarios of different restraint scopes have been revealed and discussed recently [13]. Although the exact time has not been fixed; yet, the pilot limit based on time windows at central business districts would be applied soon.

The most important alternatives are BRT and bus because the light rail routes have taken too much time to be in operation. After 13 years of construction, the first line between Catlinh and Hadong has not operated with an unknown official start. The prospect of BRT in Hanoi is promising in that it is able to offer high-quality service that can be established during a much shorter time than rail and take advantage of existing infrastructure. Above all, limiting motorcycle and car use would make a change in inhabitants' mode choices towards BRT. Offering bus lanes and protecting them have recently received much more supports of the both national and local governments.

5. CONCLUSIONS

This paper presents the results of a rigorous application of the BRTS for evaluating the Hanoi BRT, which helps to search for answers to three questions indicated in the introduction section. First, the Hanoi BRT meets the international standards to be considered as a basic BRT corridor. Second, main limitations of the Hanoi BRT are low (design) capacity, low frequency, limited speed and lack of reliability and convenience. To improve the BRT's performance, the gap between design parameters and operation should be filled. Specifically, carrying out technical solutions is promising. Besides, increasing frequency, especially in the peak hours would be a useful approach to give better service and improve enforcement.

It should be noted that categories and criteria have interactions with others; therefore, it is interesting to re-evaluate the Hanoi BRT by the BRTS after solutions are undertaken. And the improvement of score can act as an evidence to persuade citizens to believe in the quality and capacity of BRT, thus use it more. The Hanoi BRT is performing poorly and even would be indicated as a failure [2]: however, BRT is still a key public transport solution to support the policies on introducing free motorized zones at Hanoi's center. To do it, BRT should be considered an independent public transport service rather than the current view on BRT being a member of conventional bus. In this sense, more dedicated infrastructure-related priority policies should be issued and implemented strictly.

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