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RESEARCH ARTICLE

STAKEHOLDERS' PERCEPTION OF BUS PRIORITY LANES (BPL) IN COLOMBO, SRI LANKA.

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Abstract

Bus priority lane (BPL) has been a widely adopted and successful strategy in the planning context to attract passengers towards the public transportation. In the implementation of bus priority lane, it is required to fulfill the basic infrastructure of space allocation for the priority lane, the number of buses available for the circulation, sufficient bus halts and stations, access to bus priority lane and other relevant amenities at the bus halts. However, it is essentially required to identify the stakeholder perception in regard to the implementation of the bus priority lane since the service needs to be utilized from the public in order to harness the value of the investment. To carry out the research study, two dominant and congested roads in Colombo district were selected where the use of bus mode share has been recorded as 47% from the overall mode share. Nine factors were identified to carry out the study among a sample of 455 passengers selected from the stratified sampling method. The responses were analyzed in comparison to the international case studies. The conclusion of the study emphasizes (80%) that the left side entrances to the bus priority lane create conflicts at intersections and to users. Further, it can be concluded that the vehicle blockage at intersections and physical segregation in the bus priority lane are important factors to be considered in its implementation.

Introduction:-

Buses have been the main mode of transport in Sri Lanka. However, 'a large number of residents try to avoid using bus transportation due to low speed, lack of comfortability and less punctuality, As examples, bus mode share in Colombo Municipal Council (CMC) boundary area reduce from 65% (in 1985) to 47% (in 2013)' (JICA, 2014). To overcome this situation, the Megapolisand Western Development Ministry has implemented Bus Priority Lanes (BPL) project in Colombo city and suburban areas with the objective of reducing traffic congestion and promoting public transportation.

BPL was first introduced on 15th August 2017, from Kurusa Junction in Moratuwa to the Katubedda Junction on Galle Road.

Many researchers have highlighted that it is important to identify perceptions and attitude concerning BPL from bus riders, bus drivers, and car drivers and surrounding activities in the initial stage of the project (Sakamoto, Abhayantha, & Kubota, 2007), (Agrawal, Goldman, & Hannaford, April 2012), (Du & Sun, 2013), (Bounzaghrance & Arhin,

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2014), (Jayasinghe & Munshi, 2014), (Barikrou, Safa, Vaziri, & Ghadirifaraz, 2017). Further, researchers argue that modeling and theoretical calculations can give different answers than actual observation, so actual observationsare important to know about reality (Jayasinghe, Sano, & Nishiuchi, 2015), (Levinson, et al., 2003), , (Sakamoto, Abhayantha, & Kubota, 2007), (Malandraki & Papamichail , 2014), (Barikrou, Safa, Vaziri, & Ghadirifaraz, 2017). In backdrop, this study aims to investigate the stakeholders' perception of the newly introduced BPL in Colombo, Sri Lanka.

Methodology:-

At first, the study conducted a literature review about BPL characteristics, stakeholders involved in BPL and factors impacting stakeholders with reference to nine case studies in the world. Next stage, a questionnaire survey was conducted to examine the stakeholders' judgment of BPL. Accordingly, the study collected the stakeholders judgments about BPL compared to the previous situation with reference to nine factors listed in table 1. The questionnaire survey was carried out along BPL corridors implemented in Galle road and JayawardenapuraMavatha. The study used stratified random sampling method, and the sample size of the survey was 455. The study recorded the stakeholders' judgment about the situation with new BPL compared to the previous situation using 1-5 Likert scale (1- Greatly exacerbated, 2- exacerbated, 3- Same as previous, 4- Improved, 5- Greatly improved).

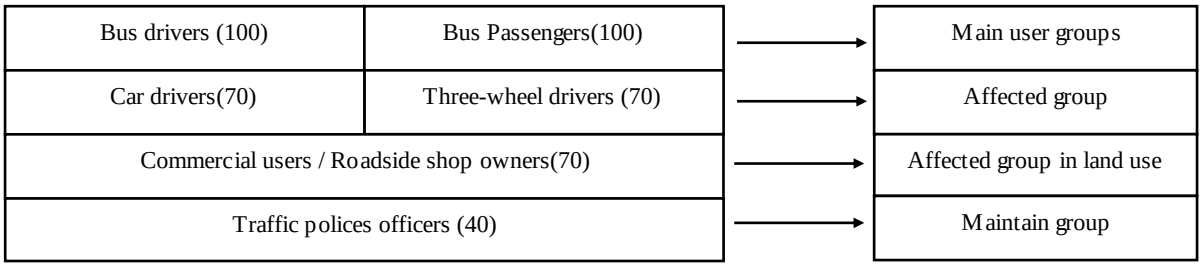

Fig 1:-Characteristics of the sample

Table 1: Factors considered by stakeholders

Stakeholders	Factors								
	Time	Safety	Fuel cost	Access to surrounding land use/ activities	Comfortable	Roadside Parking	Income	Violation of road rules	Road self-discipline
Buses	√	√	√	√	-	√	√	√	√
Passengers	√	√	-	√	√	-	-	-	√
Three wheels	√	-	√	√	-	√	√	-	√
Private vehicles	√	√	√	√	-	√	-	-	√
Shop owners	√	-	-	-	-	-	√	-	√
Traffic police officers	-	-	√	-	-	-	-	√	√

Results:-

The study analysed perceptions of BPL as held by different stakeholders along two BPL corridors selected in the study. For this purpose, the study has employed descriptive analysis and factor analysis method.

Bus drivers' perception on BPL

Figure 2 and table 2 recorded mean values along with standard deviation (St. Deviation) as per time factor, income factor, safety factor, fuel cost, complains reduction, parking and feedback.

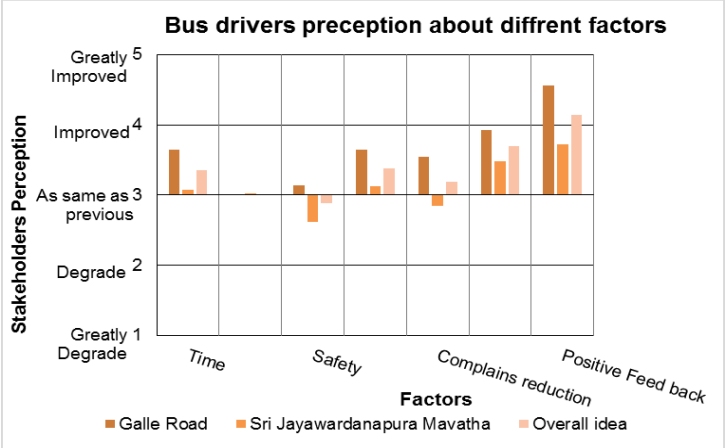

Fig 2:-Bus drivers' perception on different factors

When refer the results pertaining to time, the results clearly indicated that travel time is improved (Mean = 3.64) in Galle road where as travel time (Mean = 3.08) and fuel cost (Mean=3.02) are same as previous (before implementing BPL) in Sri JayawardanapuraMavatha area. Further, restriction (mean=3.92), money saving for fuel (fuel cost) (mean=3.64), positive feedback on bus driving (mean=4.56), Complains reduction on bus driving (mean=3.54), safety (mean=3.14) have been greatly improved with the BPL in Galle road. However, safety (mean=2.62) and complains reduction (2.84) have been degrade with the BPL in Sri Jayawardanapura Mawatha. With restriction (Mean =3.48) greatly agreed and have positive feedback (Mean=3.71) bus drivers of Sri Jayawardanapura Mawatha. Further, ability to park bus on curb side of has been greatly degrade with the BPL in both roads (Parking mean for Galle road=1.96 and Parking mean for Sri JayawardanapuraMavatha=2.52). Income level of bus drivers remain same as pervious in both route (Route-1 mean =3.00, Route-2 mean =3.01).

Table 2: Mean and St. deviation of bus drivers'

	Factors	Time	Income	Safety	Fuel cot	Complains reduction	Restriction	feed back	Parking
Route 01	Mean	3.64	3	3.14	3.64	3.54	3.92	4.56	1.96
	St. deviation	1.27	0.35	0.87	0.82	0.81	1.02	0.73	0.78
	n	50							
Route 02	Mean	3.08	3.02	2.62	3.12	2.84	3.48	3.72	2.52
	St. deviation	0.63	0.14	0.80	1.13	0.84	1.12	1.07	0.73
	n	50							
Overall idea	Mean	3.36	3.01	2.88	3.38	3.19	3.7	4.14	2.24
	St. deviation	1.04	0.26	0.86	1.02	0.85	1.09	1.02	0.80
	N	100							

Three wheel drivers' perception on BPL

Figure 3 and table 3 recorded mean values along with standard deviation (St. deviation) as per time, income, safety, when pick passengers, restriction, when pick passengers and feedback.

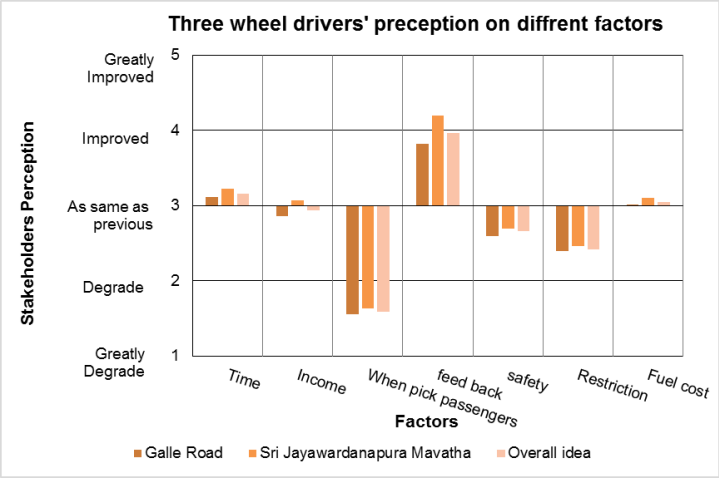

Fig 3:-Three wheel drivers' perception on different factors

Table 3: Mean value & St. deviation of three wheel drivers'

	Factors	Time	Income	When pick passengers	feed back	safety	Restriction	Save time
Route 01	Mean	3.12	2.86	1.56	3.82	2.6	2.4	3.02
	St. deviation	0.98	0.75	0.50	1.00	0.69	0.80	0.95
	n	50						
Route 02	Mean	3.23	3.07	1.63	4.2	2.7	2.46	3.1
	St. deviation	1.10	0.25	0.49	0.92	0.56	0.89	1.09
	n	30						
Overall idea	Mean	3.16	2.94	1.59	3.96	2.66	2.42	3.05
	St. deviation	1.02	0.62	0.49	0.98	0.65	0.83	1
	n	80						

When refer the result of route 01 and 02 time (Route 01 Mean=3.12 & Route 02 Mean=3.23), feedback (Route 01 Mean=3.82 & Route 02 Mean=4.2) greatly improved. Income (Route 01 mean =2.86, Route 02 mean = 3.07), safety (Route mean=2.6, Route mean=2.7), restriction (Route 01 mean= 2.4, Route 02 mean=2.46) remain same as previous in both routes. When pick passengers it is affected degradedly (Route 01=1.56, Route 02=1.63) both route users. Further, fuel cost (Route 01= 3.02, Route 02 = 3.1) remain same as previous value.

Commercial users' perception on BPL

Figure 4 and table 4 recorded mean values along with standard deviation (St. Deviation) as per time, income, parking and feedback.

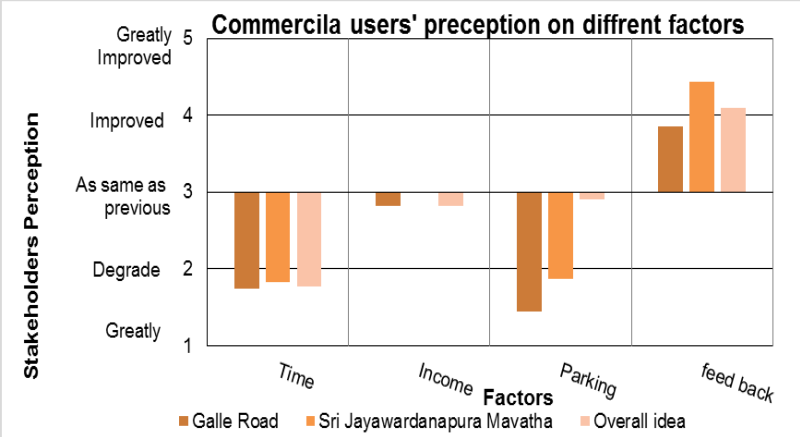

Fig 4:-Commercial users' perception on different factors

Table 4: Mean value and St. deviation of Commercial users'

	Factors	Time	Income	Parking	feed back
Route 01	Mean	1.75	2.82	1.45	3.85
	St. deviation	0.43	0.54	0.50	0.89
	n	35			
Route 02	Mean	1.8	3	1.86	4.43
	St. deviation	0.37	0	0.34	0.67
	n	35			
Overall idea	Mean	1.78	2.82	2.9	4.1
	St. deviation	0.41	0.43	0.42	0.85
	n	70			

Both route users highly appreciated (Route mean = 3.85, Route mean = 4.43) the BPL. Here also income (Route mean= 2.82, Route mean = 3) remain same as previous in both routes. When prepare the result, the result clearly indicate time factor (Route 01 mean = 1.5, Route 02 = 1.8) degradedly affected because lack of parking. Greatly degrade with parking (Route 01 mean = 1.75, Route 02 mean =1.83)

Private vehicle users' perception on BPL

Figure 5 and table 5 recorded mean values along with standard deviation (St. deviation) as per time, fuel cost, safety, restriction, parking and feedback.

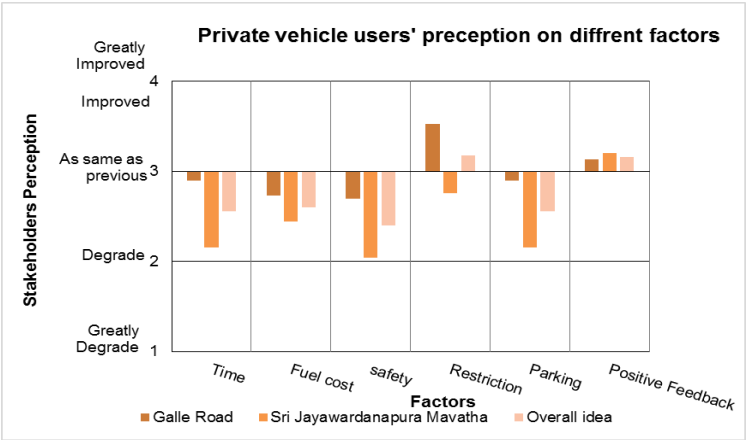

Fig 5:-Other vehicle users' perception on different factors

	Factors	Time	Safety	Comfortable	Restriction	Circumstance	Feedback

Table 5: Mean value and St. deviation of private vehicle users'

	Factors	Time	Fuel cost	safety	Restriction	Feedback	Parking
Route 01	Mean	2.9	2.73	2.7	3.53	3.13	2.9
	St. deviation	1.26	0.94	1.08	0.81	1.43	1.26
	n	35					
Route 02	Mean	2.16	2.44	2.04	2.76	3.2	2.16
	St. deviation	0.89	0.71	0.79	0.92	1.29	0.89
	n	35					
Overall idea	Mean	2.56	2.6	2.4	3.18	3.16	2.56
	St. deviation	1.16	0.85	1.01	0.94	1.358	1.16
	n	70					

When consider about the result of feedback (Route 01 mean = 3.13 and Route 02 mean = 3.2) and restriction (Route 01 mean = 3.53 and Route 02 mean = 2.76) greatly improved with the BRT. Future, result of travel time (Mean=2.9) in Galle road and Sri Jayawardanapura Mawatha (Mean = 2.16) clearly indicate it is degrade. And also fuel cost (Route 01 mean = 2.73, Route 02 mean = 2.44) and Safety (Route 01 mean = 2.7, Route 02 mean = 2.04) results do not represent improvement. With curb side lane design both routes users' result of parking (Route 01 mean = 2.73, Route 02 mean = 2.44) have degrade with the BPL.]

Passengers' perception on BPL

Figure 6 and table 6 recorded mean values along with standard deviation (St. deviation) as per time, safety, comfortable, restriction, Circumstance and feedback.

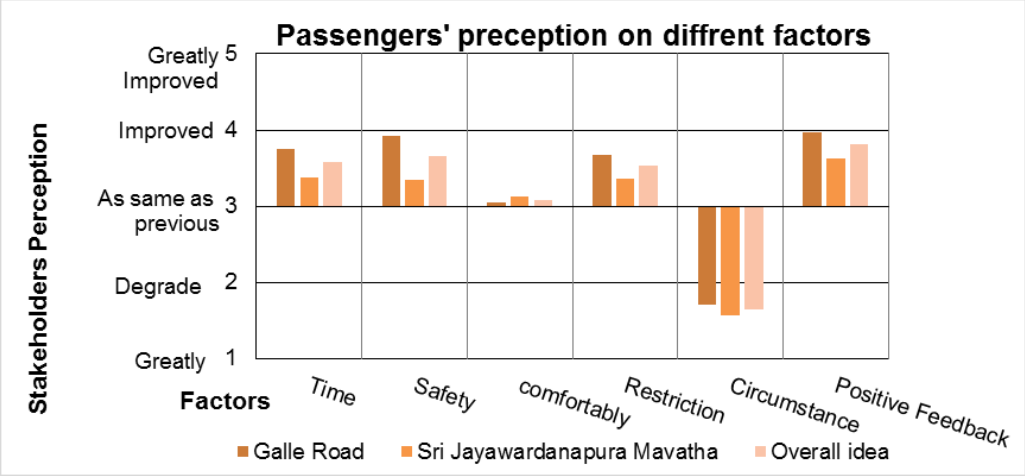

Fig 6:-Passengers' perception on different factors

Table 6: Mean value and St. Deviation of passengers'

Route 01	Mean	3.75	3.92	3.05	3.68	1.7	3.97
	St. deviation	0.98	0.98	0.62	0.93	0.46	1.05
	n	50					
Route 02	Mean	3.38	3.34	3.12	3.36	1.56	3.62
	St. deviation	0.98	0.93	0.89	0.82	0.50	1.15
	n	50					
Overall idea	Mean	3.58	3.65	3.08	3.54	1.64	3.81
	St. deviation	0.99	1.00	0.75	0.895	0.48	1.11
	n	100					

When refer the result travel time is improved (Mean = 3.75) in Galle road Sri Jayawardanapura Mawatha (Mean = 3.08) after implementing the BPL. Result of safety (Route 01 mean = 3.92, Route 02 mean = 3.34) and restrictions (Route 01 mean = 3.68, Route 02 mean = 3.36) it is greatly improved. Circumstance are both routes (Route 01 mean = 1.7, Route 02 mean = 1.56) greatly degrade with BPL. Future, comfortably (Route 01 mean = 3.05, Route 02 mean = 3.12) remain same as previous. BPL project is highly appreciate (Route 01 mean = 1.7, Route 02 mean = 1.56) by passengers.

Traffic police officers' perception on BPL

Figure 7 and table 7 recorded mean values along with standard deviation (St. deviation) as per violations, as successful strategy and feedback.

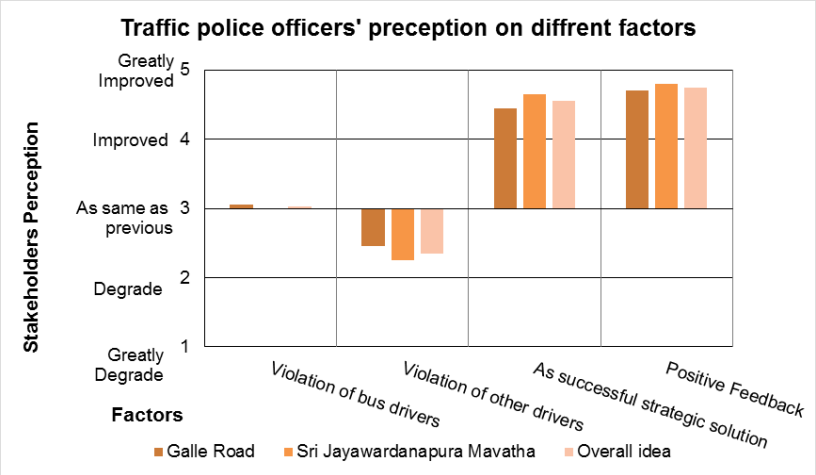

Fig 7: Traffic policer officers' perception on different factors

Table 7: Mean value and St. Deviation of traffic police officers'
Source – Compiled by author, 2017

	Factors	Violation of bus drivers	Violation of other drivers	As Successful strategy	feedback
Route 01	Mean	3.05	2.45	4.45	4.7
	St. deviation	0.06	1.19	0.68	0.57
	n	20			
Route 02	Mean	3	2.25	4.65	4.8
	St. deviation	0.45	0.81	0.58	0.41
	n	20			
Overall idea	Mean	3.03	2.35	4.55	4.75
	St. deviation	0.53	1.02	0.63	0.49
	n	40			

Based on the result bus drivers (Route 01 mean = 3.05, Route 02 mean = 3) violation remain same as previous. Other vehicle users greatly degrade with violation (Route 01 mean = 2.45, Route 02 mean = 2.25). However based on result BPL is accepted as successful (Route 01 mean = 4.45, Route 02 mean = 4.65) strategic solution for traffic and feedback (Route 01 mean = 4.7, Route 02 mean = 4.8) is also greatly improved.

Table 8 summarises the results. Results indicate that bus passengers, bus drivers, and traffic police groups have judged BPL as having improved the condition whereas car and three-wheel drivers, while commercial users/ roadside shop owners, judged that BPL had worsened the condition compared with the previous situation. The results indicated that travel time and safety are improved on Galle road whereas travel time increased in Sri Jayawardanapura Mawatha. The income levels of buses and three wheelers remain the same as before along both routes while adherence of road rules and self-discipline improved with BPL.

Table 8: Summary of stakeholders' judgments on BPL

Routes	**Stakeholder groups**	**Judgments**
Galle road	Passengers	Improved
	Bus drivers	Improved
	Three-wheel drivers	As same as previous
	Car drivers	Degrade
	Commercial users/roadside shop owners	Degrade
	Traffic police officers	Improved
Sri Jayawardanapura Mawatha	Passengers	Improved
	Bus drivers	As same as previous
	Three-wheel drivers	Degrade
	Car drivers	Degrade
	Commercial users/roadside shop owners	Degrade
	Traffic police officers	Improved
Routes	**Factors**	**Judgments**
Galle road	Time	Improved
	Safety	Improved
	Access to surrounding land use/ activities	Degrade
	Comfortability	As same as previous
	Income	As same as previous
	Fuel cost	As same as previous

	Following road rules	Improved
	Road self-discipline	Improved
	Roadside parking	Degrade
Sri Jayawardanapura Mawatha	Time	Degrade
	Safety	Improved
	Access to surrounding land use/ activities	Degrade
	Comfortability	As same as previous
	Income	As same as previous
	Fuel cost	As same as previous
	Following road rules	Improved
	Road self-discipline	Improved
	Roadside parking	Degrade

Stakeholder groups have mentioned that due to the following reasons BPL has been exacerbating the condition compare to the previous.

- When entering into lane through the intersection or left side of the road it is affected for all users. (80% fromthe total sample)
- Vehicles are blocked at interconnections (70%)
- BPL corridor is not physically segregated (60%)
- When turning left the safety of private vehicle users, three-wheel drivers and also buses is affected. (55%)
- BPL corridor is not continuous throughout the main road (40%)
- Lack of awareness of drivers about BPL (15%)

Compare with international case study

The result of this research compare with the international case studies to recognize the variance of Sri Lankan case study. Seoul (Korea) and Ahamedbad (India) were selected as case studies as international case study.

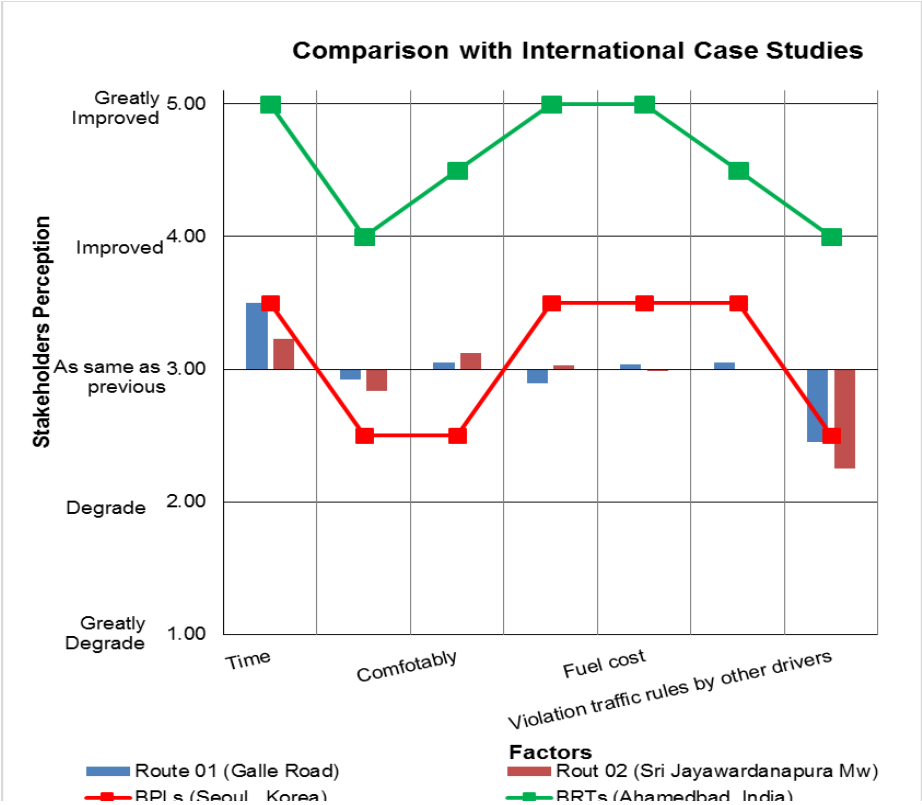

Fig 8: Compare with international case study

Comparison study only can do with international case studies. Because of Sri Lankan context only Colombo PBL has been implemented. When looking at the figure 4.4.4.1 can recognise current situation of BPL. Income, Fuel cost, traffic violation these factors still in improving level when compare with Seoul case study. Ahamedbad case study is about BRT. To achieve that level these factors should be increased. Finding the reasons for degrade can find out the solution from international case studies. When consider about selected case studies in literature reviewing section can examine their strategies. Just as example violation of traffic rules by other vehicle users have been degrade. Through examine the restrictions and allowance Seoul case study can identify how strategies have identify to maintain private vehicles.

Conclusion and Recommendations:-

This research conducted in the initial stage of BPL in Colombo, Sri Lanka. This study was able to fill the existing gap about stakeholders' perception on BPL. The study was able to identify which factors have been improved, worsened, or remained the same as previous, as well as which stakeholders responded in each manner. Accordingly, this study can be usedaninstrument to evaluate the effectiveness of BPL and generate planning and engineering solutions to improve the public transportation system in Colombo, Sri Lanka.

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