

# **Determination of Bus Route Changes Required for the Improvement of Services at the Proposed Kadawatha Multimodal Transport Hub**

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## **1. Introduction**

Multimodality is the usage of several modes during a trip. A multimodal transport hub is a location where passengers transfer from one mode to another and facilitate the following functions:

- The act of changing between modes - interchange
- The place where one changes between modes - interchange zone
- A purpose-built facility to improve interchange quality - interchange facility [1]

Kadawatha is a suburban town centre which is located 16 km away from the centre of Colombo in Gampaha District. Kadawatha city area is located in the Pahala Karagahamuna East, Pahala Karagahamuna North, Pahala Biyanwila East and Ihala Biyanwila North Grama Niladhari Divisions. Mahara Pradeshiya Sabha and Biyagama Pradeshiya Sabha are the administrative authorities of the Kadawatha town area. Ganemulla, Mahara, Kirillawala, Ranmuthugala, Dalupitiya, Karagahamuna (upper and lower), Biyanwila (upper and lower) and Kirimatiyagaraya are the smaller town centres surrounding Kadawatha.

There are some major problems in the existing Kadawatha bus terminal such as poor linkage with the main town centre and inadequate luxury facilities for passengers using expressway buses. Moreover, bus services to Ganemulla and Ragama terminate before reaching the town centre, the express and other regional services operating on the Kandy Road also do not touch the terminal due to such buses not using the by-pass. Absence of direct bus connections to destinations having high passenger demand such as Wattala, Weliveriya is also a notable shortcoming.

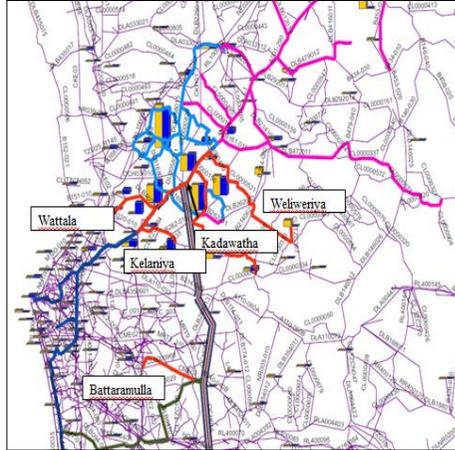
## 2. Methodology

Household Visits Surveys (HVS) and Bus Volume Counts (BVC) data of Colombo Transport Master Plan (University of Moratuwa, 2015) were used as secondary data for this research. The multimodal hub plan being developed by the University of Moratuwa was examined using JICA STRADA, a software for bus passenger demand modelling with GIS mapping to study the current condition of the route network by comparing supply and demand data.

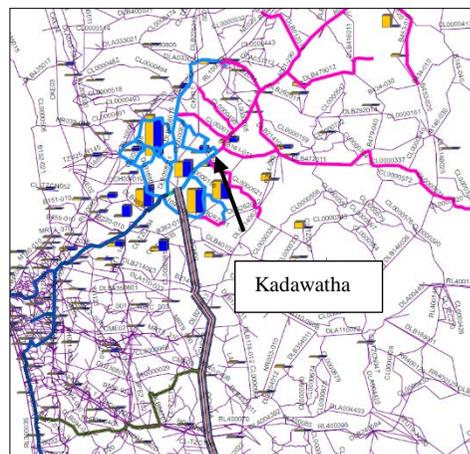
## 3. Results

Figure 1 shows the direct connections available and trip attraction and distribution from each Transport Analysis Zone (TAZ) to and from Kadawatha. High demand for direct connections to Kadawatha can be observed from Weliweriya, Wattala, Kelaniya and Battaramulla among others, none of which are currently connected directly to Kadawatha.

Figure 2 shows the TAZ centroids which can be connected via direct links from Kadawatha according to passenger demand. The new route can be established to cater to passenger demand from the Battaramulla, Thalawathugoda and Malabe areas through the Hokandara interchange. Further services can be established to directly connect areas such as Wattala, Kelaniya and Weliweriya as shown in the above graph. Those direct connections could be an advantage for Kadawatha to function as a hub for that area.



**Figure 1: Existing Direct connections and trip attraction and distribution by TAZ to Kadawatha**



**Figure 2: Proposed Direct connections from TAZ Zone Centroids to Kadawatha**

### 3.1. Proposals for new routes

#### 3.1.1. Route overlapping [2]

Passengers have to use the following combination of bus routes to reach Kelaniya from Kadawatha: first, Kadawatha - Kiribathgoda (along routes 138, 193 or 154, or via long distance bus) and then the Kiribathgoda – Pettah route via Kelaniya.

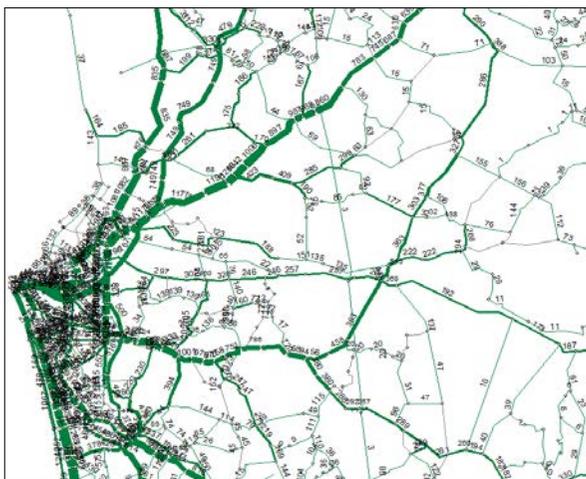
Of these, routes 138, 193 and 154 cannot be changed due to high passenger demand for the status quo. However, the Kiribathgoda - Pettah route can be extended to Kadawatha as an overlapping route to other routes such as 138 and 193.

#### 3.1.2. Route Merging

There are various routes to Ragama from Kadawatha such as 222, 325, 326, 327, 327/1, 222/1 and 815. But passengers are compelled to take buses plying the Kadawatha-Ragama and later the Ragama-Pettah (via Wattala) routes in order to reach Wattala. Therefore, the Ragama-Wattala route and one of the above routes between Ragama and Kadawatha can be merged to establish a direct route to Wattala from Kadawatha. This paper recommends that route 222 is merged with the Ragama-Pettah route, considering passenger demand.

It is also recommended to add Kadawatha-Battaramulla and Kadawatha-Weliweriya as new routes.

### Comparison: Doing Nothing vs Implementing New Direct Connections



**Figure 3: Passenger Demand by link in the Do-Nothing Scenario (DNS)**

The passenger volumes got through the STRADA analysis by each link in the existing network without implementing new links are shown in figure 3. The highest passenger volumes can be seen along the Kandy Road Corridor which are expected to be attracted to the new hub due to direct connections.

Increments in total passengers, total passenger hours and total passenger kms after implementing the new direct connections to Kadawatha from high passenger demand centres such as Wattala, Weliweriya and Battaramulla can be seen along many routes (Table 1). A significant increment in total passenger numbers (1,067

additional passengers) can be seen on the 261 route, while the average total increment along other routes is of 200 additional passengers. These values show a higher level of network improvement with route adjustments alone, do not require the introduction of new modes or of major structural changes to the network.

**Table 1: Comparison of Total passengers, Total passenger hours and Total passenger kms by route in DNS and After Scenario**

Route Number	DNS (bi-direction)			After Scenario (bi-direction)		
	Total Passengers	Total passenger hours	Total passenger kms	Total Passengers	Total passenger hours	Total passenger kms
154 (Kadawatha-Bambalapitiya)	50,967	22,448	224,593	50,971	22,408	224,164
222 (Kadawatha-Ragama)	6,846	2,209	22,121	6,677	2,159	21,624
222_1 (Kadawatha-Ragama)	10,265	2,365	23,742	10,364	2,362	23,703
223 (Kadawatha-Ganemulla)	9,036	3,661	36,643	9,105	3,678	36,814
223R	13,075	5,812	58,164	13,154	5,863	58,664
261 (Mahara-Pettah)	44,277	20,622	20,6495	45,344	21,151	211,814
327_1 (Kadawatha-Ragama)	1,199	299	3,054	1,195	301	3,065
KAD_WAT (Kadawatha-Wattala)				591	243	2,464
KAD_WEL (Kadawatha-Weliweriya)				1,032	790	8,008
KAD_BAT (Kadawatha-Battaramulla)				353	183	1,898

Maximum passengers per hour per Direction (PPHPD) values in Table 2 further confirm the improvement to the network with the new routes. The Kadawatha-Wattala route shows the highest PPHPD amongst newly introduced routes. An average PPHPD of 70 along these new routes confirms the adequacy of passenger demand for these operations.

**Table 2: Comparison of Passengers per Hour per Direction (PPHPD) by route in Do Nothing Scenario and After Implementation Scenario**

Route Number	Max PPHPD (Do nothing Case)	PPHPD (After adding New routes)	Remarks
261(Mahara-Pettah)	1600	1600	Extended to Kadawatha
325(Kdawatha- Ragama)	800	800	
327/1 (Kadawatha- Ragama)	100	100	
222(Kadawatha -Ragama)	500	400	
222/1 (Kadawatha -Ragama)	1100	1100	
223 (Kadawatha - Ganemulla)	1500	1000	
138 (Kadawatha - Fort)	1000	1000	
138_1 (Kirillawala -Fort)	300	300	
154 (Kadawatha -Bambalapitiya)	1600	1600	
193 (Kadawatha -Townhall)	800	800	
KAD_WAT (Kadawatha -Wattala)		100	New Route
KAD_WEL (Kadawatha -Weliweriya)		65	New Route
KAD_BAT (Kadwatha -Battaramulla)		42	New Route

## 5. Conclusions and Recommendations

There are areas with high passenger demand such as Kelaniya and Weliweriya, both situated in proximity to Kadawatha, and which, though lacking direct connections currently, can be directly connected to Kadawatha. Overlap of existing routes such as the Kiribathgoda-Pettah route and route merging can be used to provide a larger number of direct connections to Kadawatha from high-demand areas. Significant improvement of the network with respect to total passenger numbers and passenger hours would be observed upon implementation of these small changes.

## 6. References

- [1] Gargi Gosh (2011). Formulation of framework and guideline for multimodal transport hub.
- [2] Sirisoma R.M.N.T., Bandara J.M.S.J., Kumarage A.S. Development of a methodology for bus route network plan for the western province. Sri Lanka.