Route Rationalization and City Bus Improvement Study for Trivandrum

July 2021

E-TRAM | Tool Introduction

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Implemented by
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

KERALA STATE ROAD TRANSPORT CORPORATION

Technical Partner

CRDF CEPT RESEARCH AND DEVELOPMENT FOUNDATION
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E-TRAM

An ETM based Tool for Route Analysis and Monitoring

Version - 1, July-2021

E-TRAM is a tool to monitor the operational performance of transit routes which helps to take decisions regarding service frequencies, route modifications, route curtailments and types of services. Additionally, it also identifies major boarding/alighting stops, major OD patterns which helps transit agencies to introduce new express/limited stop services and to plan for infrastructure facilities.

This is an open-source tool which can be used by any transit agency where route based ETM data is available to use as an input. It uses the software Power BI Desktop.

E-TRAM - An ETM based Tool for Route Analysis and Monitoring

Objective: Enables city authorities/transit agencies to monitor the operational performance of transit routes with respect to route planning/ modifications and overall system level assessment.

- ***E-TRAM*** *is prepared by CoE-UT, CRDF, CEPT University as part of the Trivandrum Route Rationalization project under SMART-SUT, GIZ.*
- *E-TRAM is a tool to monitor the operational performance of transit routes*
- *This tool can be used by any transit agency where route based ETM data is available to use as an input.*
- *It uses an open-source software Power BI Desktop.*

What can E-TRAM do?

Input Files

1. ETM data (Daily)
2. Transit stop sequence (Daily)
3. Supporting files:
   - Route description
   - Transit stop details
   - Vehicle type
   - Corridor details

E-TRAM Outputs

1. Demand-supply gaps for each route
2. Ridership build-up trend
3. O-D patterns of passengers along the route as well as at city level
4. Drivers' and conductors' performance report
5. Routes overlaps on major corridors

Decisions

1. Route level frequency in peak & off-peak hours
2. Change in service types i.e., express, limited services
3. Route curtailment/extension
4. Development of infrastructure facilities at major boarding alighting (BA) locations

E-TRAM – Power BI Report

Analysis sheets of E-TRAM

Cover Page

E-TRAM

ETM based Tool for Route Analysis and Monitoring

E-TRAM *is prepared by CoE-UT, CRDF, CEPT University as part of Trivandrum Route Rationalisation project under SMART-SUT, GIZ. E-TRAM is a tool to monitor the routes' operational performance which helps to take decisions on service frequency, route modification, curtailment, types of service. Additionally it also identifies major boarding/ alighting stops, major OD pattern which helps agency to introduce new express/ limited stops services and building infrastructure facilities. This is an open source tool which can be used by any transit agency where route based ETM data is available to use as an input.*

Version - 1, July-2021

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Contents:

1. Overall Summary:

Presents the overall daily ridership & revenue, average daily ridership & revenue, passengers/ bus/ day, average load factor and passenger category.

2. Route Performance:

For a specific day, it presents the route level ridership, revenue, and the operational performance such as Load Factor and Passengers/ Bus/ Day.

It helps to identify routes with poor/ average performance and warrents for some intervention to improve efficiency for those routes. Those interventions could be frequency changes, route curtailment, route extension, alignment modification etc.

3. Route Performance Trend:

For a specific route, it presents the trend of ridership, revenue and operational performance such as load factor and Passengers/ Bus/ Day.

It helps to identify the routes with continuous poor/ average performance based on criteria. For any new route, it presents the performance for few days which aids to decide on any type of intervention/ improvement such as frequency changes, route curtailment, route extension, alignment modification etc.

4. Temporal Ridership Distribution:

It presents the overall temporal distribution of passenger demand as well as distribution at route level for 30 min (4.1) and 60 min (4.2) time interval.

Temporal Distribution of passenger is important to understand for each route to plan the different frequency for different time period of day (peak/ off-peak). Depending upon the demand pattern of each route, frequency can be planned to meet the Demand-Supply effectively for any time of the day.

5. Boarding-Alighting and Line Loading:

It is very important representation of BA and line loading profile for each route (by direction) for specified time interval (5.1) as well as by trip level (5.2).

This helps to understand the BA pattern on the route by time period which helps to identify the sections with Demand-Supply mismatch. It also aids to take decision on route curtailment, extension, route alignment modification and the change in service type (express/ regular) etc.

6. Line Loading:

It is representing the line loading profile for a route (by direction) by time period.

This helps to understand the line loading variation along the route by different time interval which helps authority manage the supply based on the demand for section of the route.

7. BA at stops and OD demand:

It presents the boarding and alighting at stops for selected routes by time interval Graphically (7.1) as well as on Google map (7.2). Additionally, it presents the same for selected routes.

It aids to identifies the major stops for selected route/s by time period which would help authority to take decision on terminals/ interchange facility development. It also identifies the Origin and Destination for selected route/s. It also helps to take decision for change in service type based on OD pattern of route.

8. Speed and Travel Time

It presents the average speed and travel time of a route by category for specific time period.

It aids to compare schedule travel time and actual travel time of route which helps to modify the schedule.

9. Driver-Speed Analysis:

It presents the average speed of bus drivers for selected route for specified time period.

It helps authority to assess the driver's performance on a route across different drivers.

10. Conductor-Revenue Analysis:

It presents the revenue by each conductor for specific routes for selected days and time.

It helps authority to analyse the revenue collection by conductors on same route to assess conductor performance towards collection.

11. Overlap Summary:

This function is designed specific to the city of Trivandrum. It shows the number of routes overlapping on radial corridors along with the percentage of overlap.

It helps authority to analyse the total number of routes overlapping on radial corridors, which will help to take decision on minimising the overlap with an intent to improve operational efficiency.

12. Percentage Overlap:

This function is also designed for the city of Trivandrum in continuation to previous function. It gives the list of routes overlapping on radial corridor/s along with the percentage of overlapping length.

It helps authority to decide which route can be realigned to minimize overlapping.

Recommendations and Operational Performance Benchmark

Recommendation: Headways of all proposed routes in Trivandrum are designed based on demand estimated on routes. It is highly recommended to start operating these routes with recommwnded headways for peak and off-peak hours in route rationalisation study.

1. Headway standards

- A. Trunk routes
  - a. Peak hours - 1 min to 10 min
  - b. Off peak hours - 5 min to 30 min
- B. Other routes
  - a. Peak hours - 5 min to 30 min
  - b. Off peak hours - 20 min to 60 min

2. Daily Load Factor

- A. Trunk routes - 0.6 to 0.8
- B. Other routes - 0.3 to 0.6

3. Passengers/ Bus/ Day for weekday

- A. Trunk routes - 500 to 750
- B. Other routes - 250 to 500

4. Earning per Km (EPKM) for weekday

- A. Trunk routes - > Rs.30/km
- B. Other routes - Rs.15 to Rs.30

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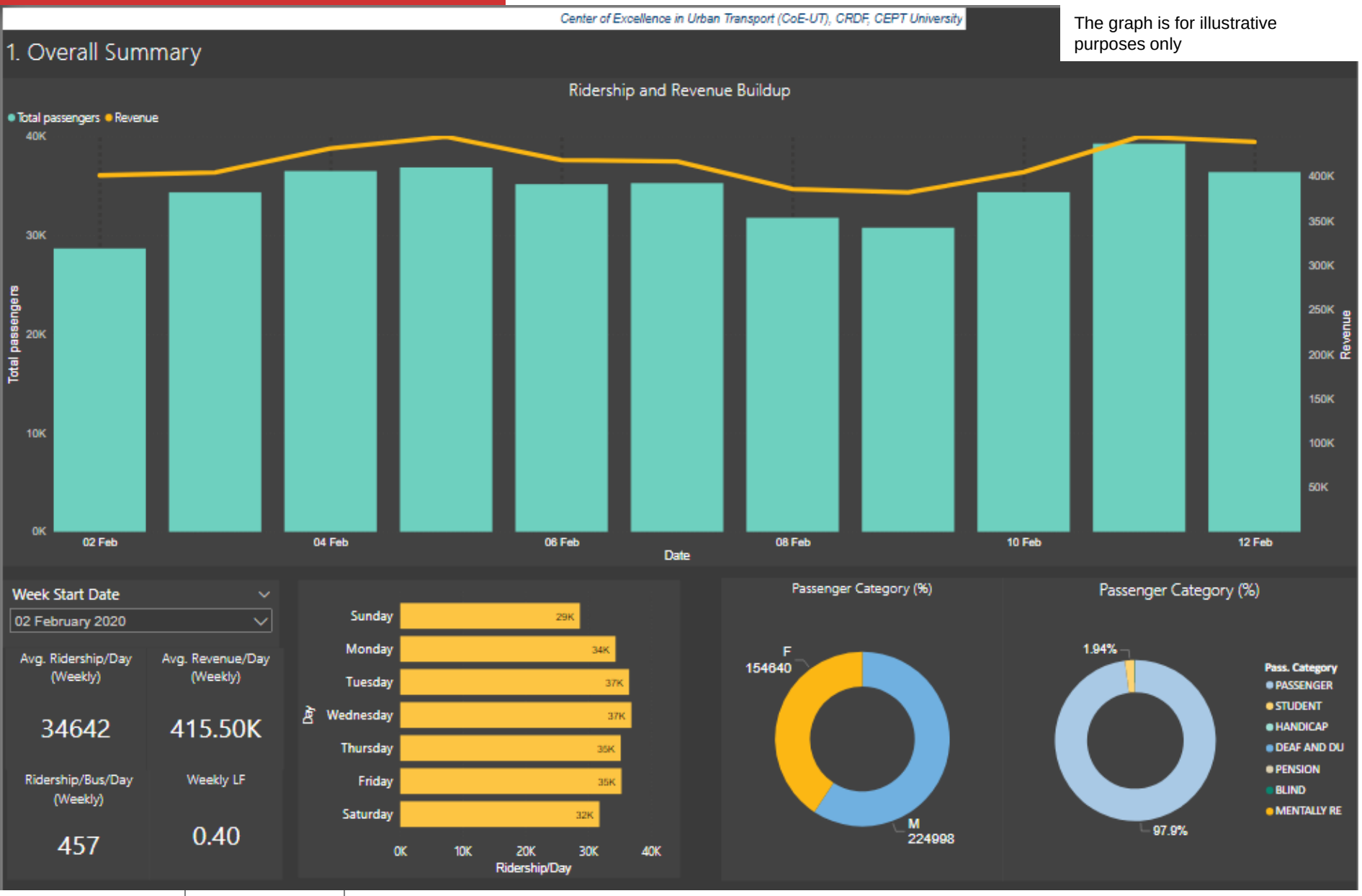
Report 1: Overall Summary (System Level Dashboard)



The graph is for illustrative purposes only

Contents/Visuals

1. Overall daily ridership & revenue build-up for study area
2. Weekly average passengers/bus/day
3. Weekly average load factor
4. Average passenger category (pass type and ticket types) as well as for selected day.

Purpose

1. To give an overall view of the transit system in the study area

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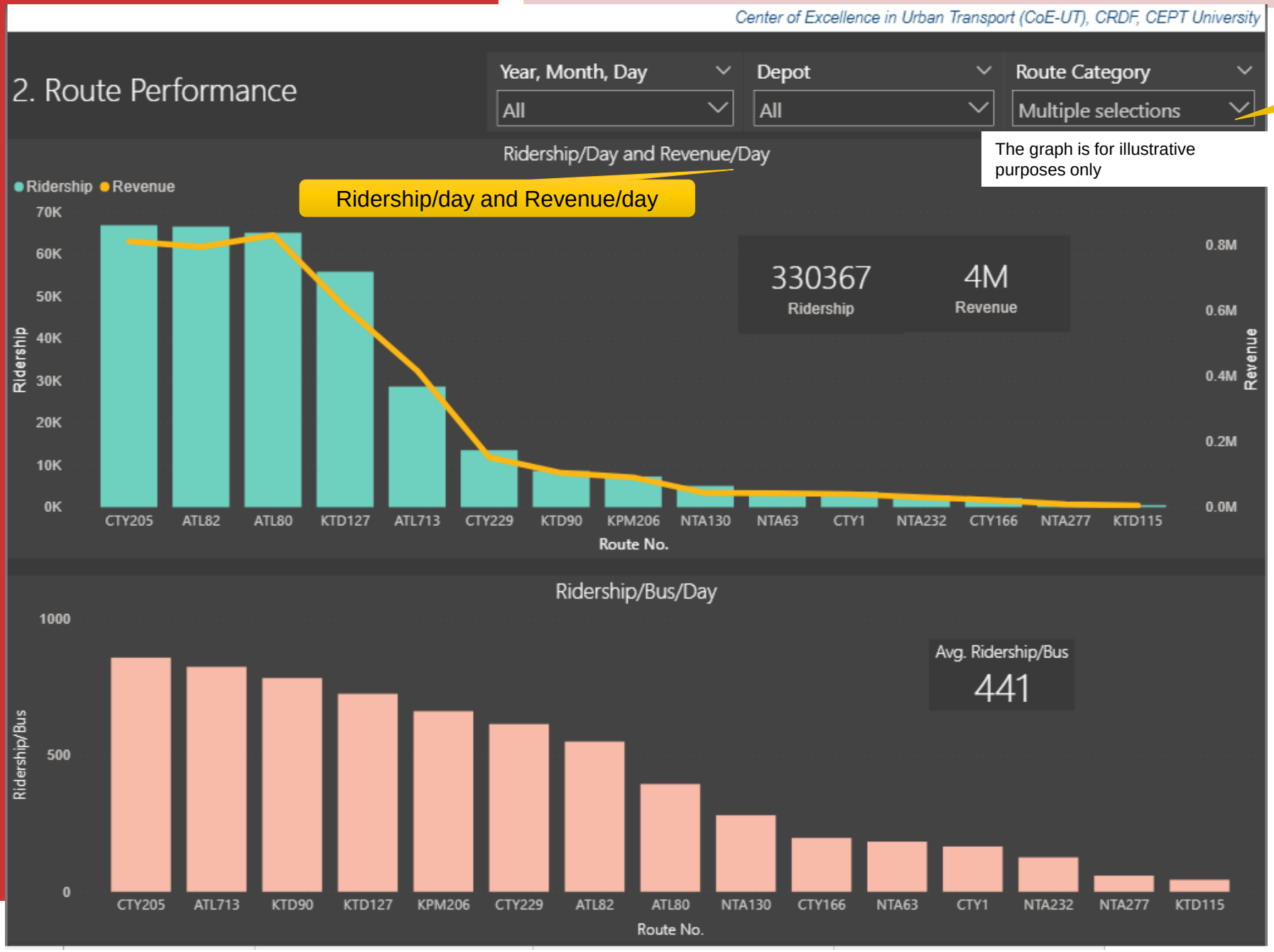
Report 2: Route Performance for selected day/s



Trunk, Feeder & Complementary routes.

The graph is for illustrative purposes only

Ridership/day and Revenue/day

Contents/Visuals

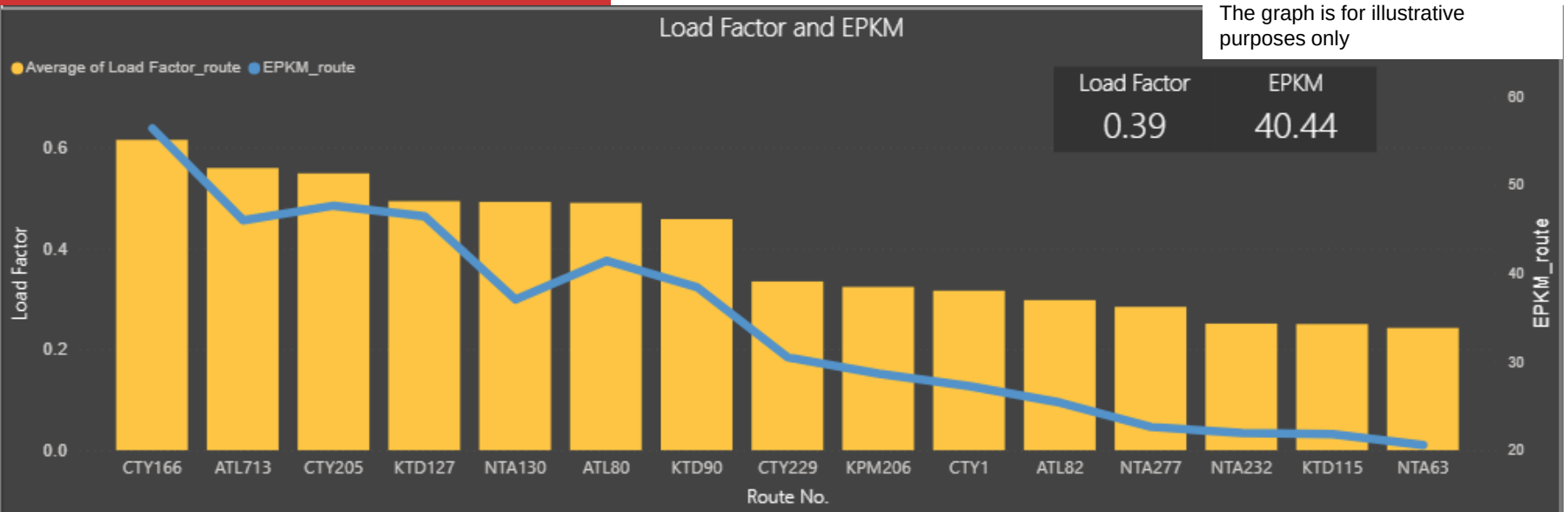
1. Average and individual route ridership and revenue
2. Average and route wise ridership per Bus/Day

Purpose

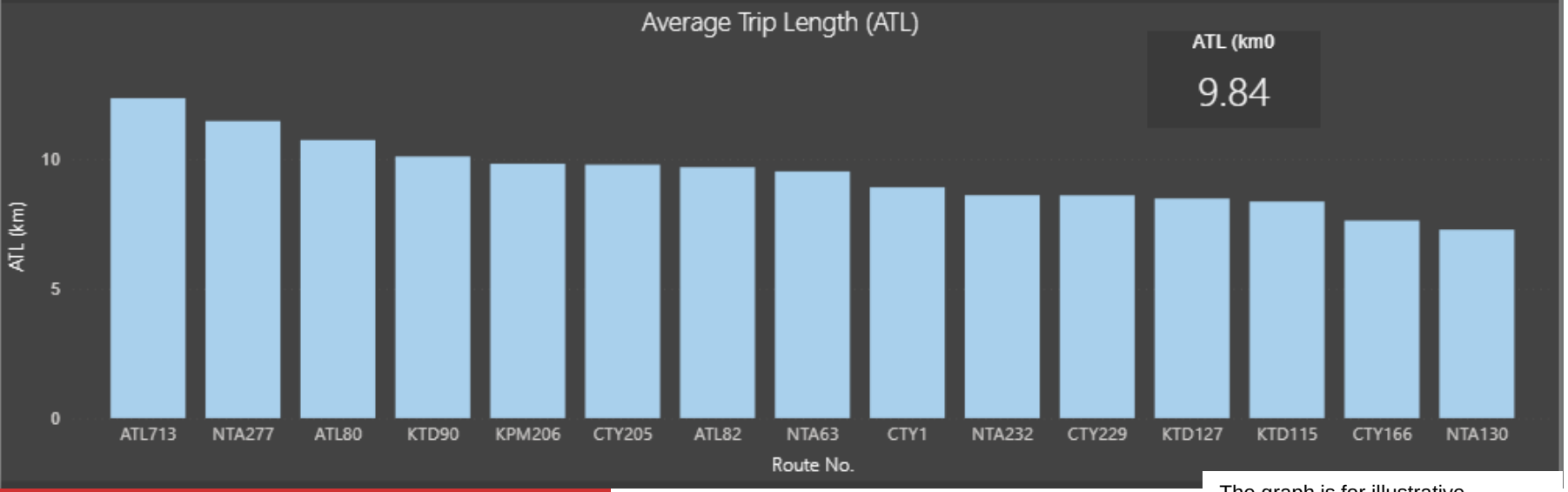
1. Helps to identify the routes with poor performance

E-TRAM

Report 2: Route Performance for selected day/s



The graph is for illustrative purposes only



The graph is for illustrative purposes only

Contents/ Visuals

1. Overall and route wise load factor, Earnings per Kilometre (EPKM)
2. Average Trip Length (ATL) in KM

Purpose

1. Helps to identify the routes with poor performance

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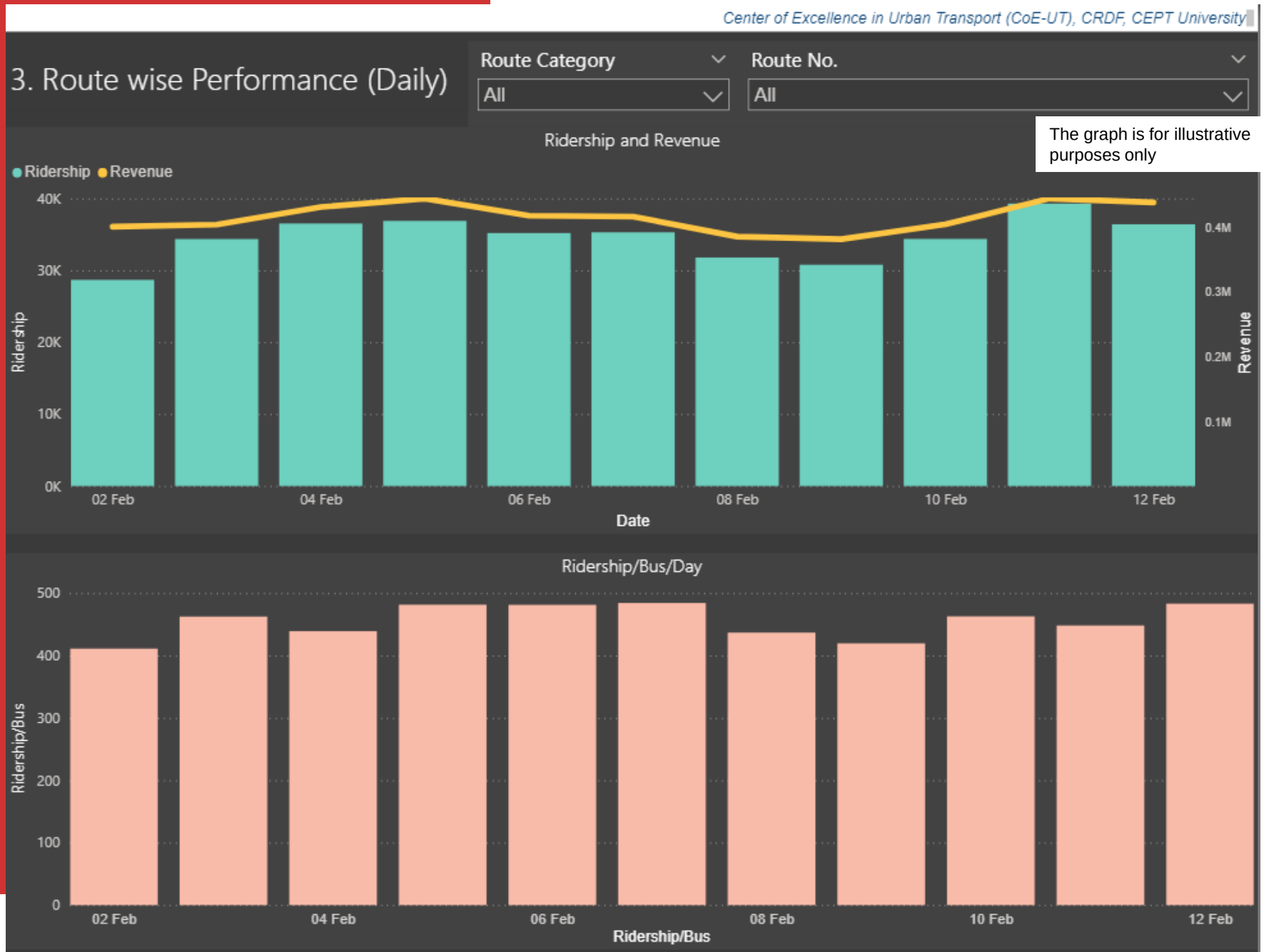
Report 3: Route wise performance build-up/trend (for selected route/s)



Contents/Visuals

1. Ridership and revenue trend
2. Ridership/bus/day trend

Purpose/ Decisions

1. Based on previous report - ***Route Performance for selected day/s*** observe the trend of identified routes to see its performance.

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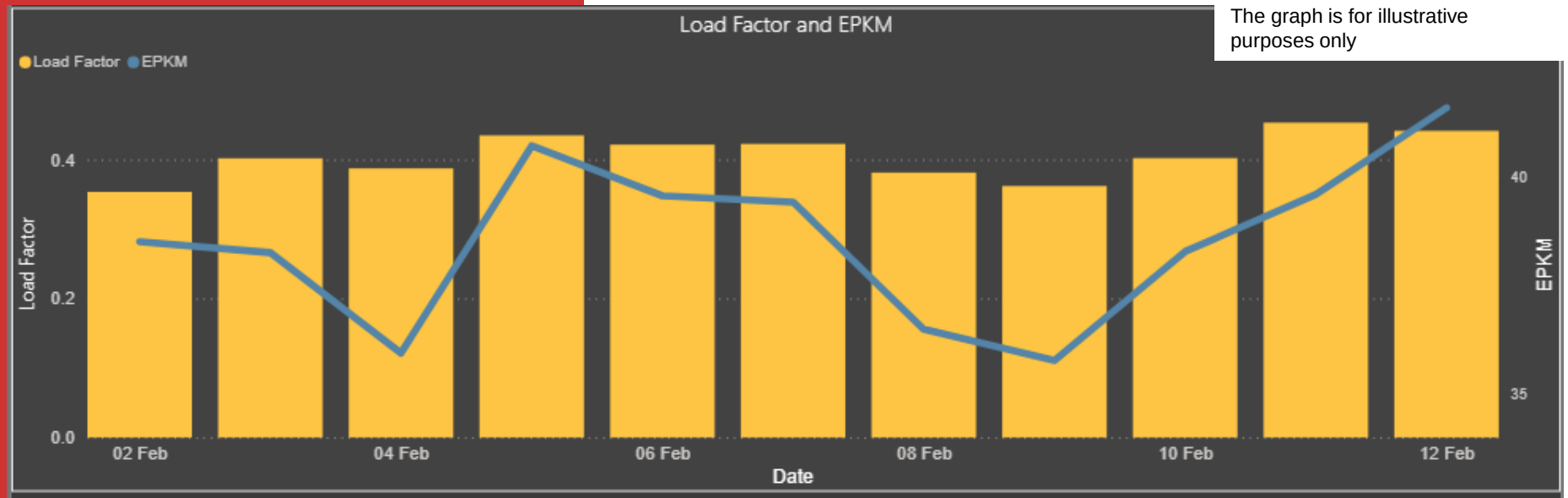
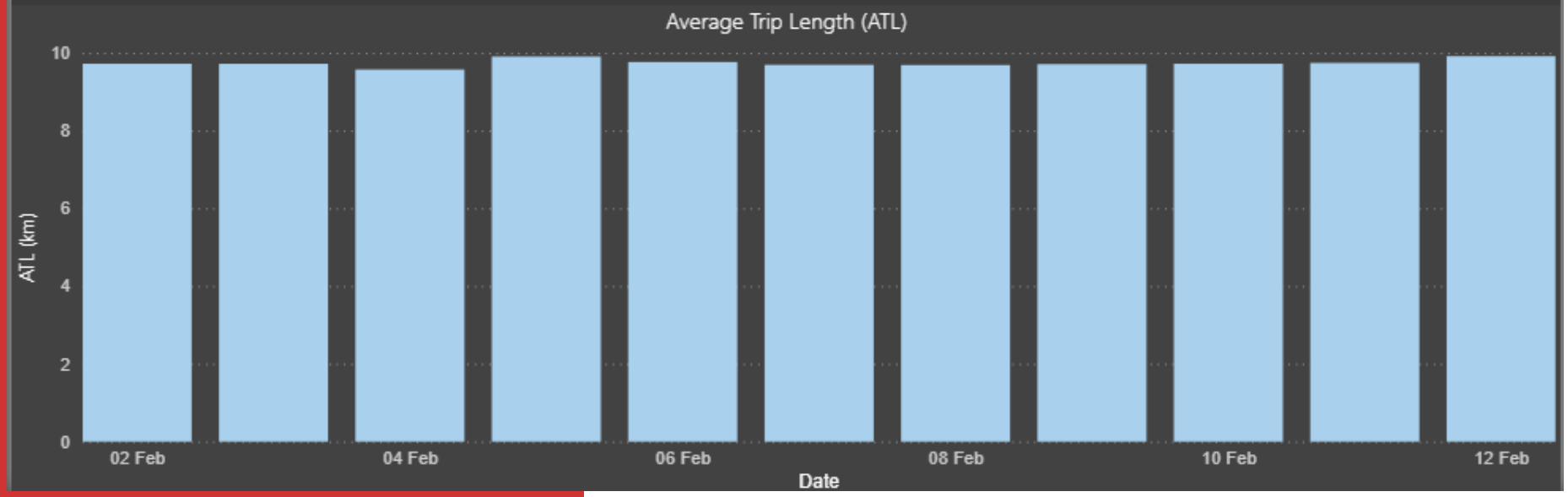
Report 3: Route wise performance build-up/ trend (for selected route/s)

The graph is for illustrative purposes only





Contents/Visuals

1. Load factor and EPKM trend
2. Average Trip Length (ATL)

Purpose/ Decisions

1. Based on previous report, observe the trend of identified routes to see its continuity of performance.

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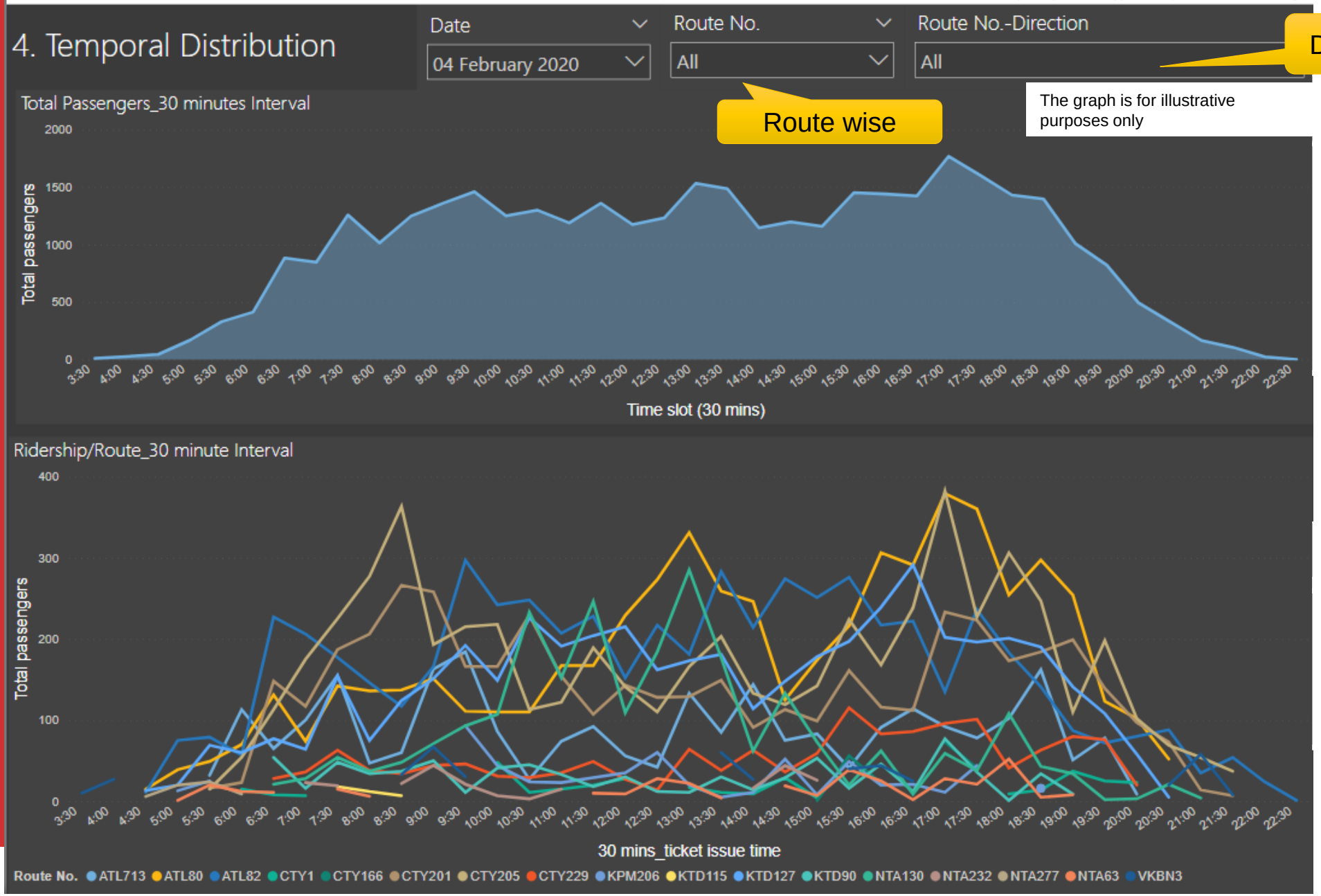
Report 4: Temporal Passenger Distribution (for 30min)

Center of Excellence in Urban Transport (CoE-UT), CRDF, CEPT University



Contents/Visuals

1. Overall (for all routes) temporal passenger distribution (30 minute interval)
2. Route/s level temporal distribution (30 minute interval)

Purpose

1. To identify peak/off peak hours for weekdays/weekends.

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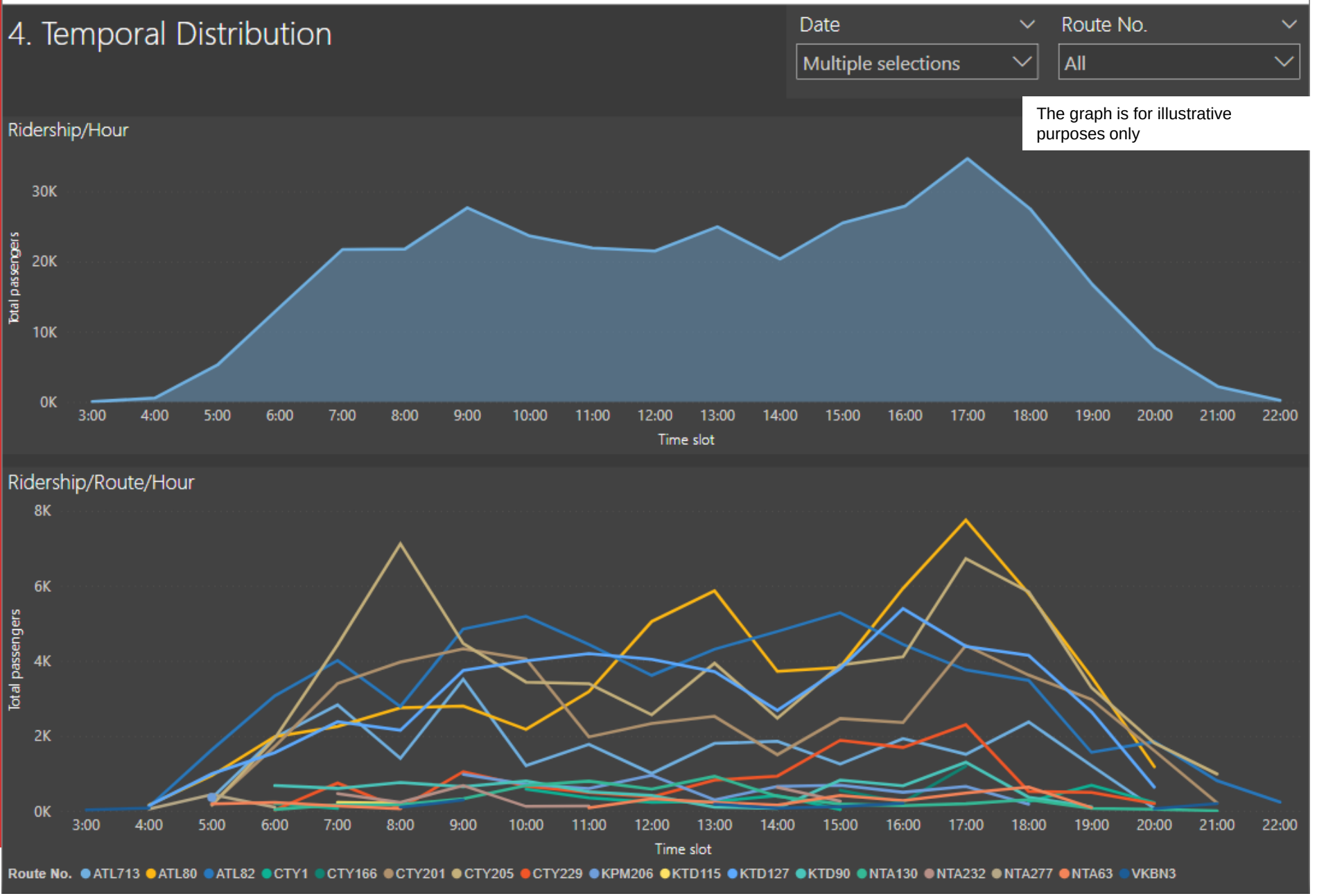
Report 4.1: Temporal Passenger Distribution (for 60 min)

Center of Excellence in Urban Transport (CoE-UT), CRDF, CEPT University



Contents/Visuals

1. Overall (all routes) temporal passenger distribution (60 minute interval)
2. Route/s level temporal distribution (60 minute interval)

Purpose

1. To identify peak/off peak for weekdays/weekends.

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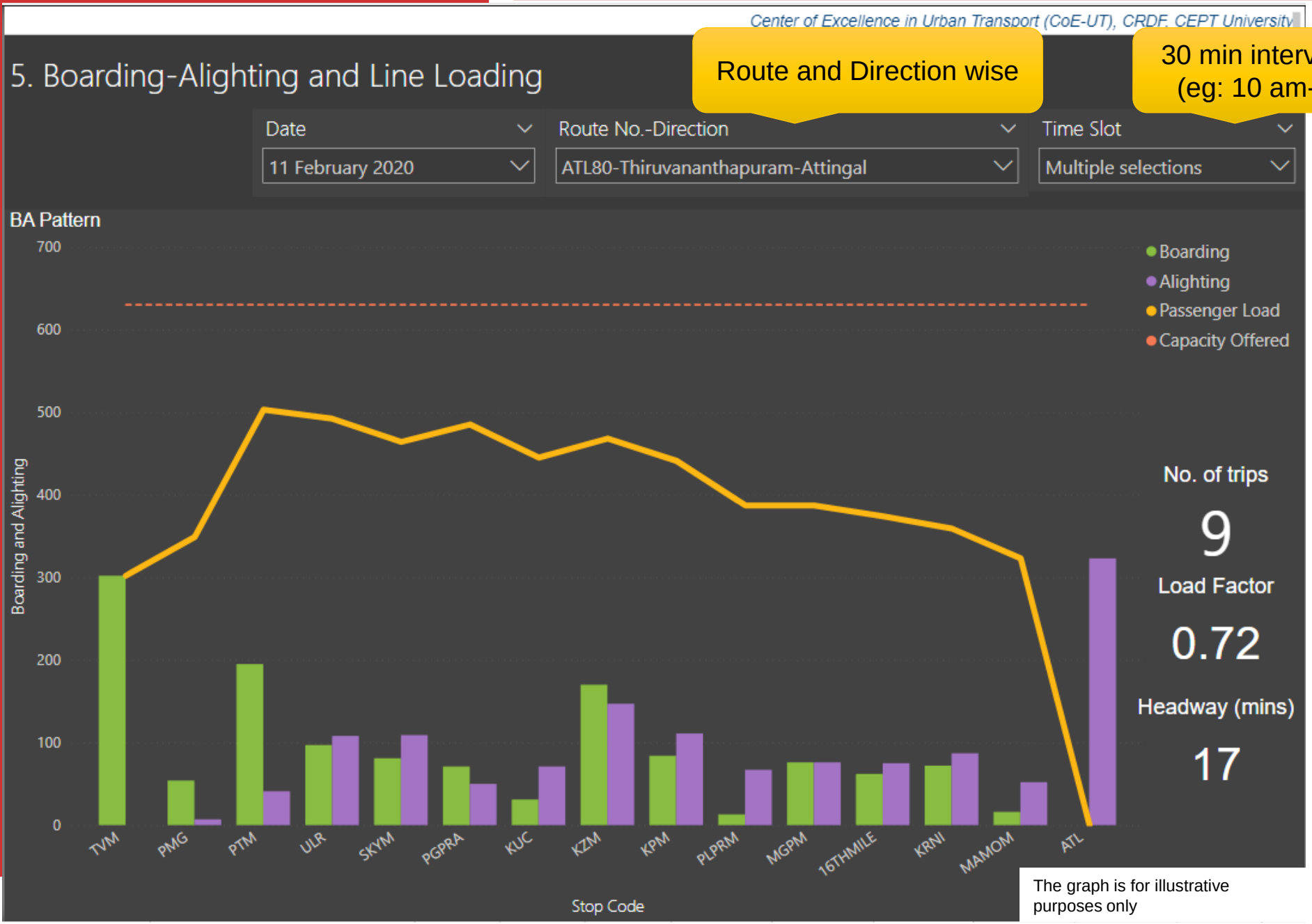
Report 5: Boarding Alighting and line loading (for specific hour/s for specific day/s)



The graph is for illustrative purposes only

Contents/Visuals

1. Boarding – Alighting, passenger load (line loading) and capacity offered for a route for a specific time period

Purpose

1. To decide changes on frequency of services to meet demand supply.
2. To take decision on express/limited service/shuttle service
3. To take decision on curtailment of route, change in service type, shuttle service for certain time of the day etc.

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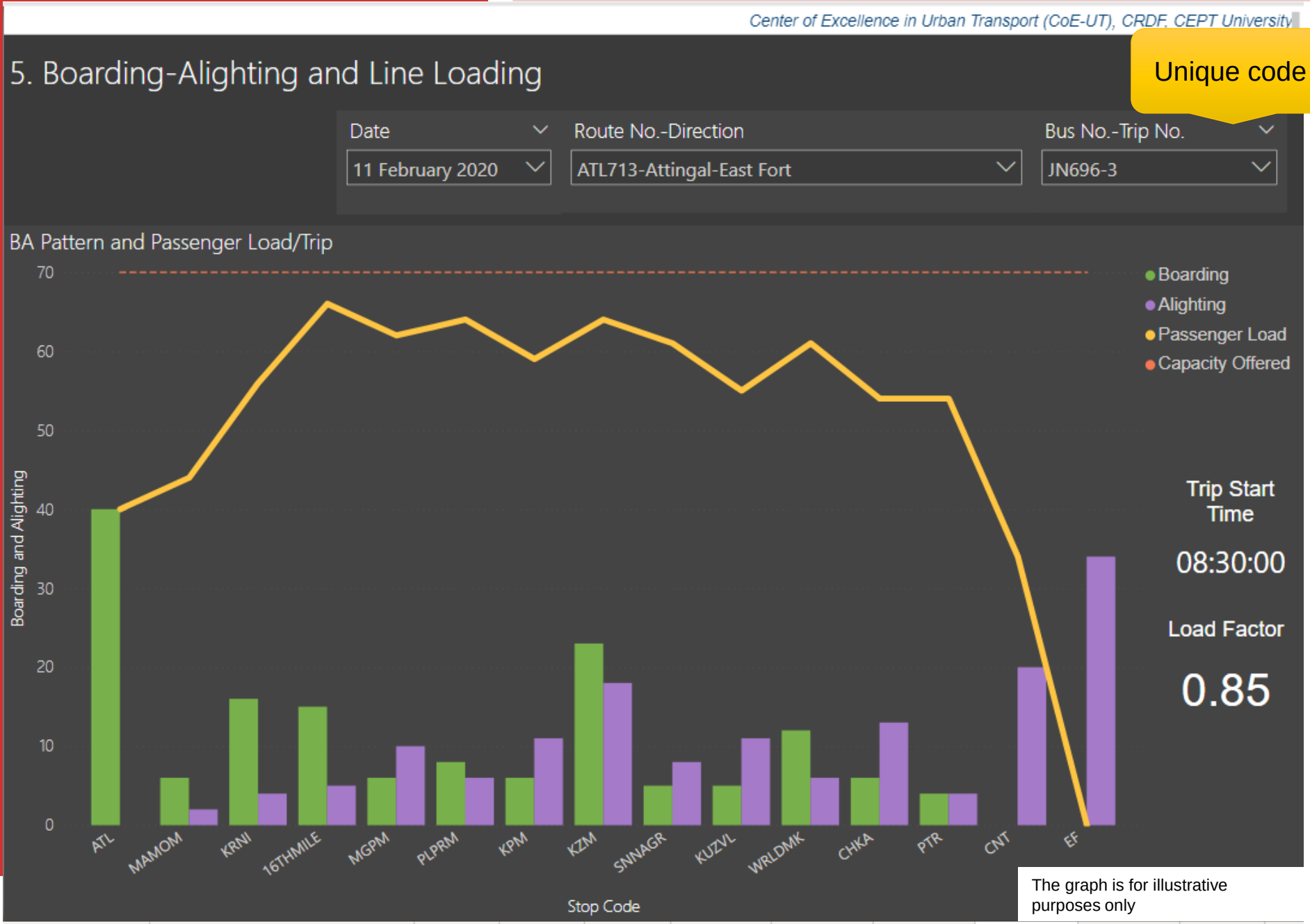
Report 5.1: Boarding Alighting and line loading (for individual trip for specific day)



The graph is for illustrative purposes only

Unique code for each trip

Contents/Visuals

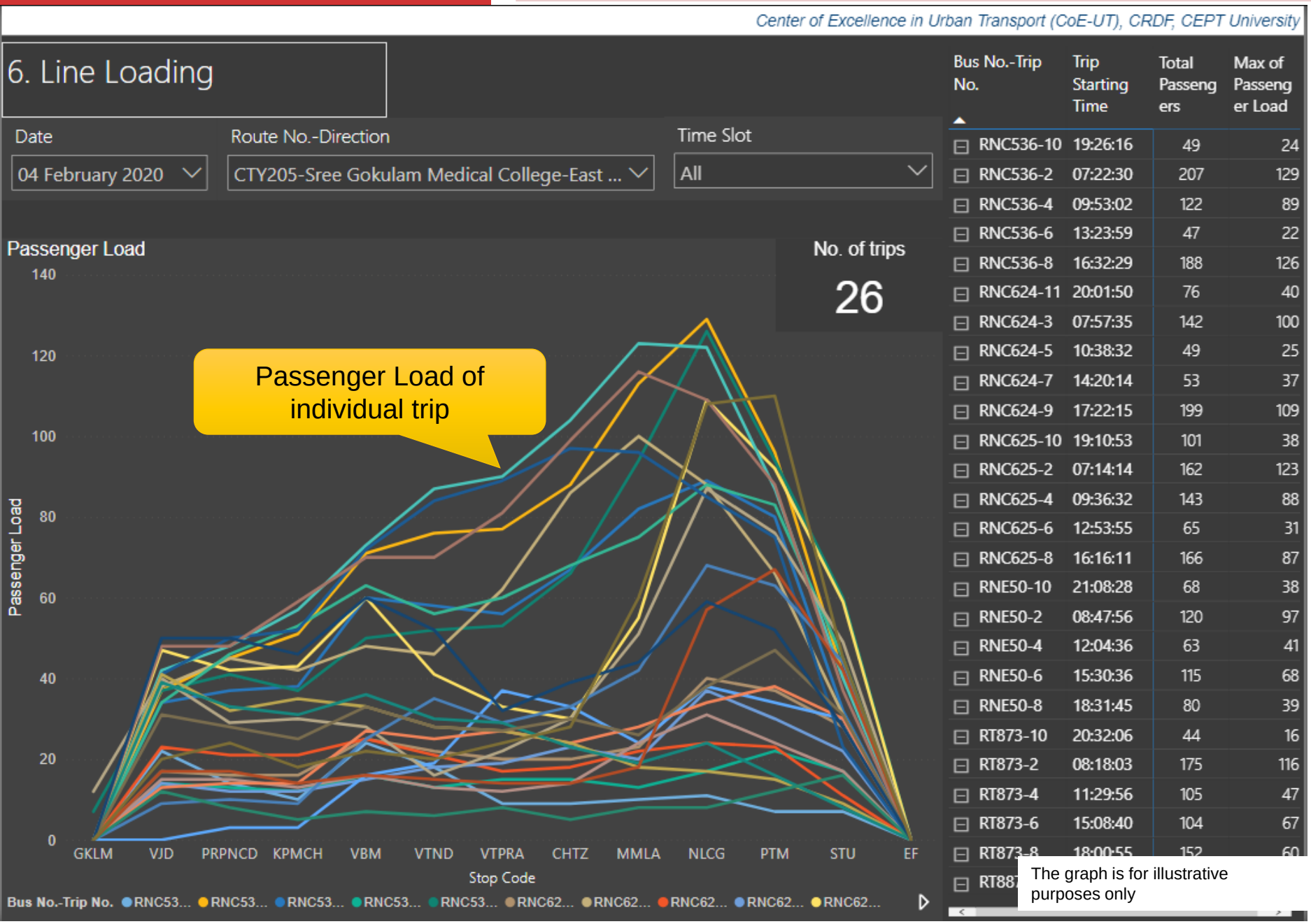
1. Boarding – Alighting, passenger load (line loading) and capacity offered for a trip along a route

Purpose/ Decisions

1. To decide changes on frequency of services to meet demand supply.
2. To take decision on express/limited service/shuttle service
3. To take decision on curtailment of route, change in service type, shuttle service for certain time of the day etc.

E-TRAM

Report 6: Route wise performance build-up/ trend (for selected route/s)



Bus No.-Trip No.	Trip Starting Time	Total Passengers	Max of Passenger Load
RNC536-10	19:26:16	49	24
RNC536-2	07:22:30	207	129
RNC536-4	09:53:02	122	89
RNC536-6	13:23:59	47	22
RNC536-8	16:32:29	188	126
RNC624-11	20:01:50	76	40
RNC624-3	07:57:35	142	100
RNC624-5	10:38:32	49	25
RNC624-7	14:20:14	53	37
RNC624-9	17:22:15	199	109
RNC625-10	19:10:53	101	38
RNC625-2	07:14:14	162	123
RNC625-4	09:36:32	143	88
RNC625-6	12:53:55	65	31
RNC625-8	16:16:11	166	87
RNE50-10	21:08:28	68	38
RNE50-2	08:47:56	120	97
RNE50-4	12:04:36	63	41
RNE50-6	15:30:36	115	68
RNE50-8	18:31:45	80	39
RT873-10	20:32:06	44	16
RT873-2	08:18:03	175	116
RT873-4	11:29:56	105	47
RT873-6	15:08:40	104	67
RT873-8	18:00:55	152	60
RT887			

The graph is for illustrative purposes only

Contents/Visuals

1. Passenger loading (line loading) pattern along a route for all trips during a specific time period during the day

Purpose

1. Identify the difference in passenger load patterns (line loading) for peak/off peak hours for a route
2. To support decisions on change in frequencies and route curtailments/extensions

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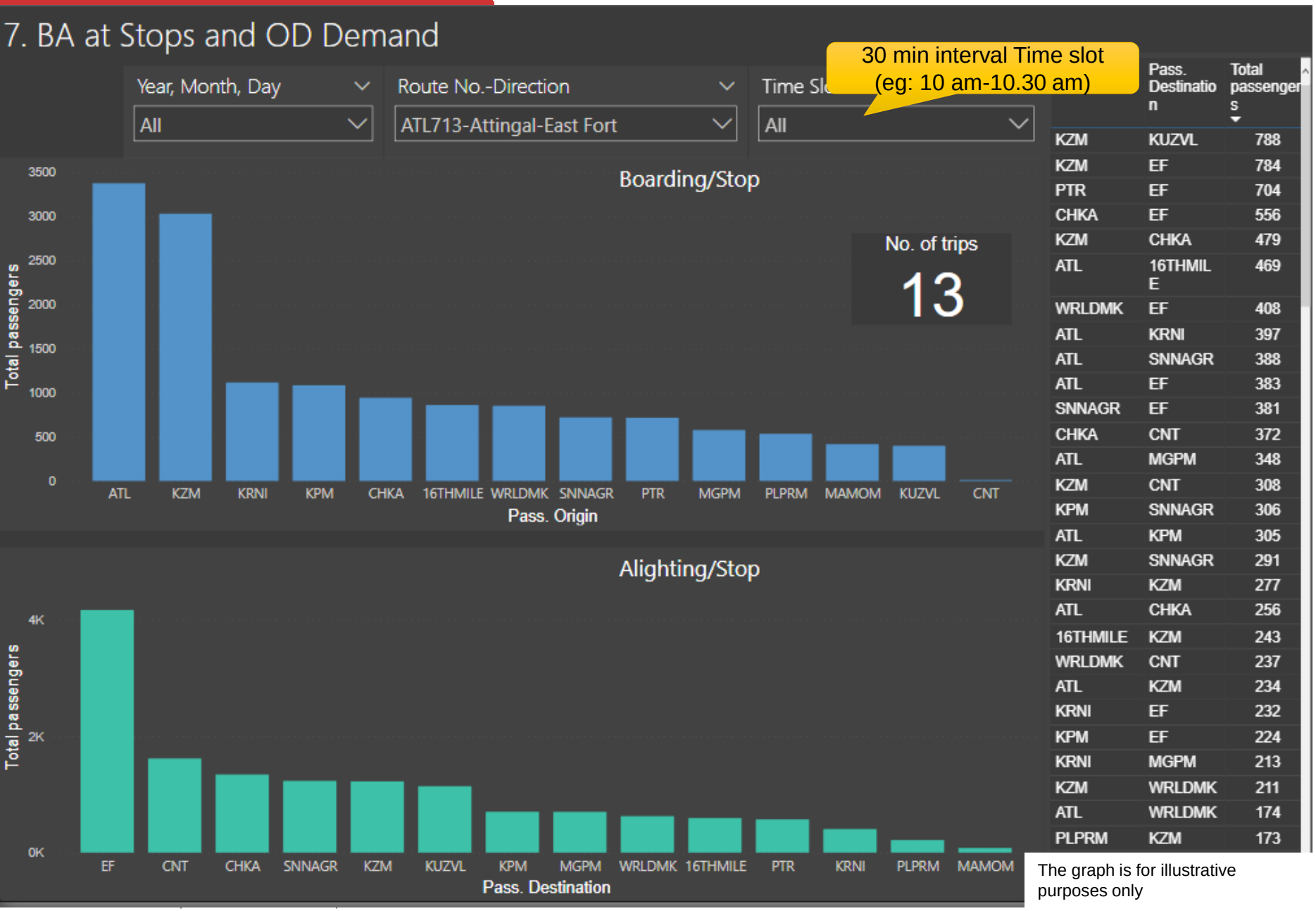
E-TRAM

Report 7: Stop level Boarding Alighting and O-D pattern (for route/s and its direction)



	Pass. Destination	Total passengers
KZM	KUZVL	788
KZM	EF	784
PTR	EF	704
CHKA	EF	556
KZM	CHKA	479
ATL	16THMILE	469
WRLDMK	EF	408
ATL	KRNI	397
ATL	SNNAGR	388
ATL	EF	383
SNNAGR	EF	381
CHKA	CNT	372
ATL	MGPM	348
KZM	CNT	308
KPM	SNNAGR	306
ATL	KPM	305
KZM	SNNAGR	291
KRNI	KZM	277
ATL	CHKA	256
16THMILE	KZM	243
WRLDMK	CNT	237
ATL	KZM	234
KRNI	EF	232
KPM	EF	224
KRNI	MGPM	213
KZM	WRLDMK	211
ATL	WRLDMK	174
PLPRM	KZM	173

The graph is for illustrative purposes only

Contents/Visuals

1. Transit stop level boarding and alighting representation along with Origin Destination (OD) pattern

Purpose

1. Helps transit agency to take decision on development of infrastructure facilities at a stop level.
2. Identify major OD patterns - helps to design express/ limited stop service.

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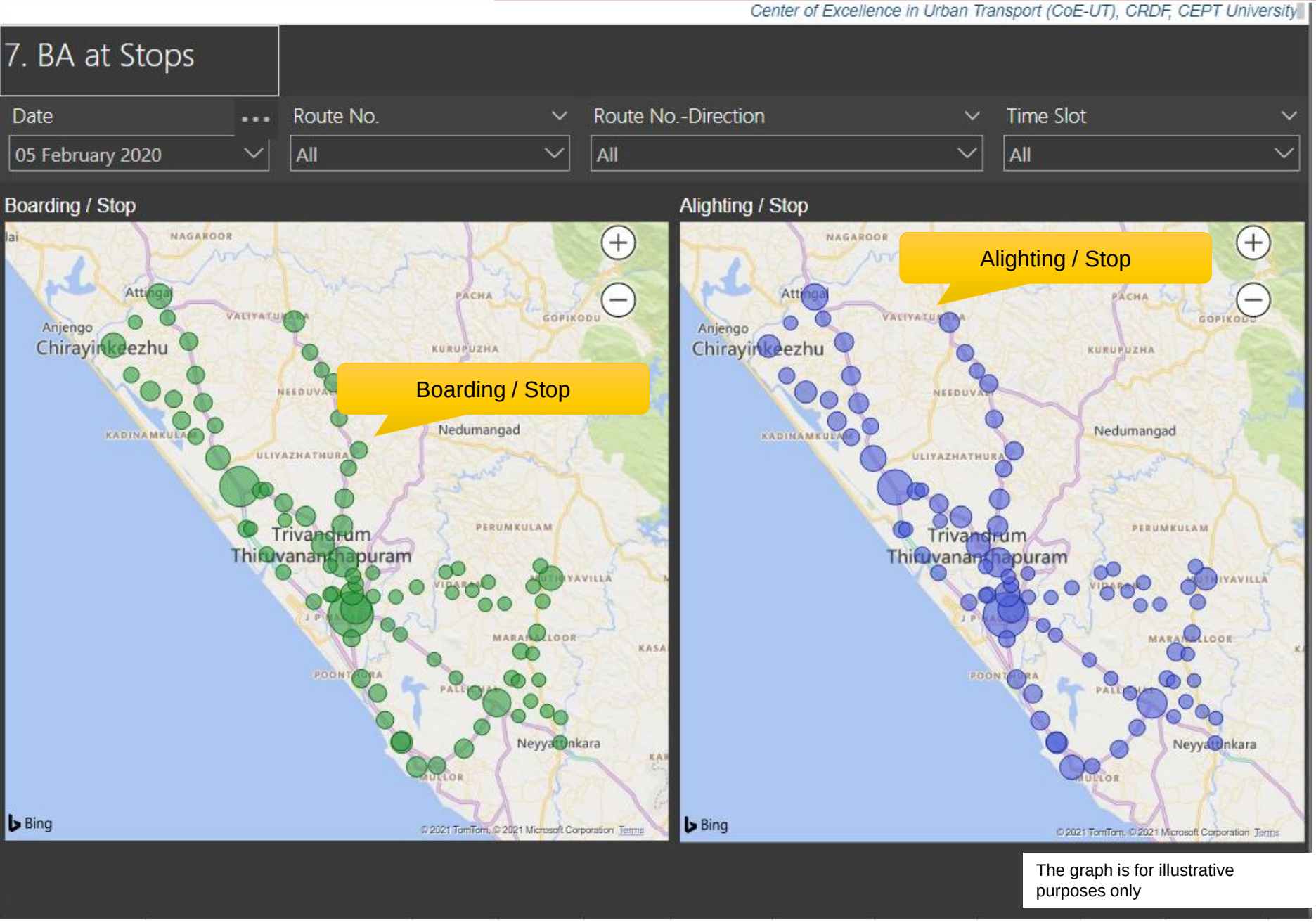
E-TRAM

Report 7: Stop level Boarding Alighting and O-D pattern (for route/s and its direction)



The graph is for illustrative purposes only

Contents/Visuals

1. Represents the Boarding and Alighting on google map.

Purpose

1. Helps agency to take decision on infrastructure facility development at a stop level.
2. Identify major OD pattern, helps to design express/ limited stop service.

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Report 8: Speed and Travel time

The graph is for illustrative purposes only

Contents/Visuals

1. Illustrate the speed along a route for a day.

Purpose

1. It aids to compare schedule travel time and actual travel time of route which helps to modify the schedule.

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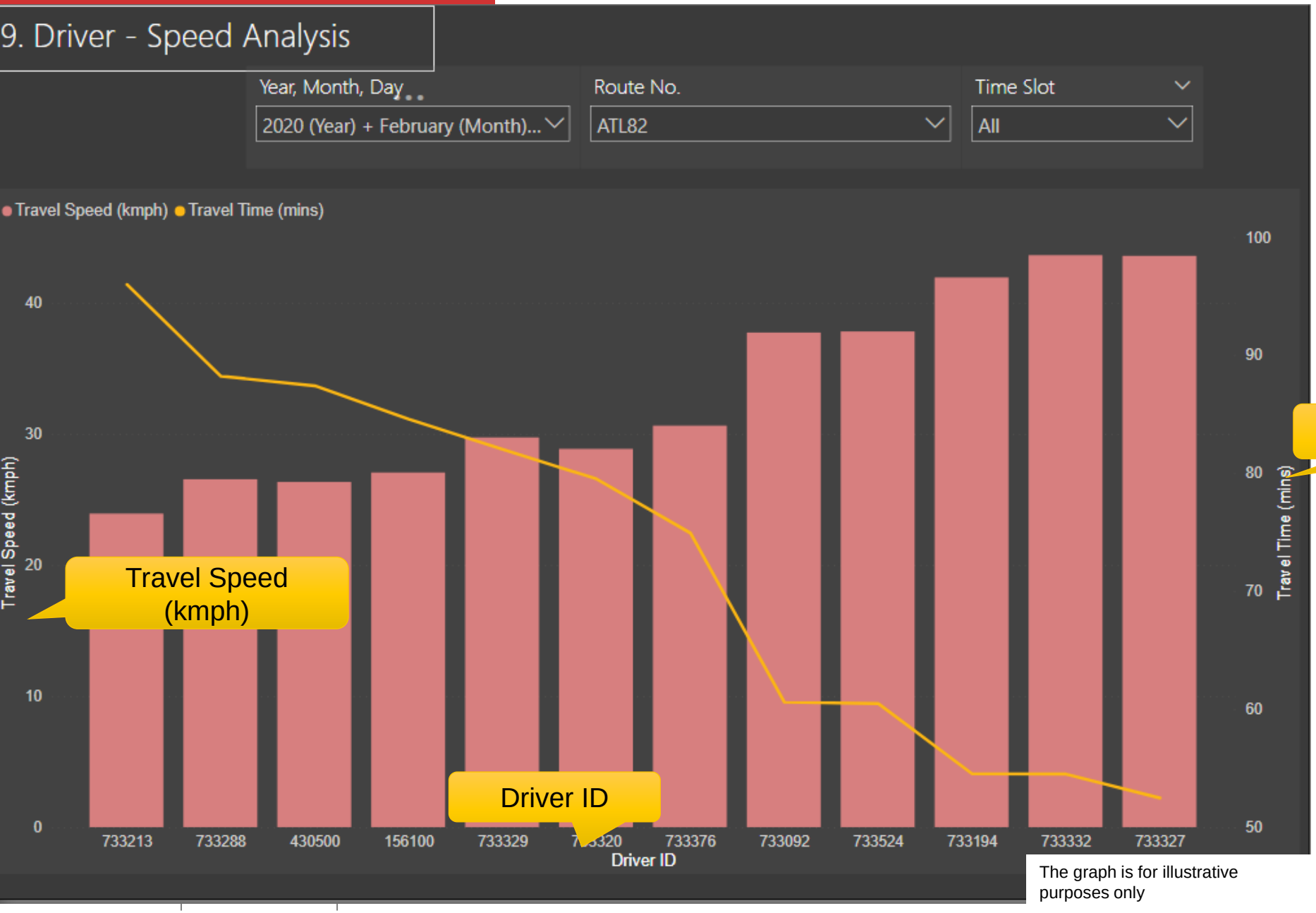
Report 9: Driver – Speed Analysis



The graph is for illustrative purposes only

Contents/Visuals

1. Travel time and Travel speed of drivers along each route for a specific time period in a day

Purpose

1. Helps to analyse the performance of drivers

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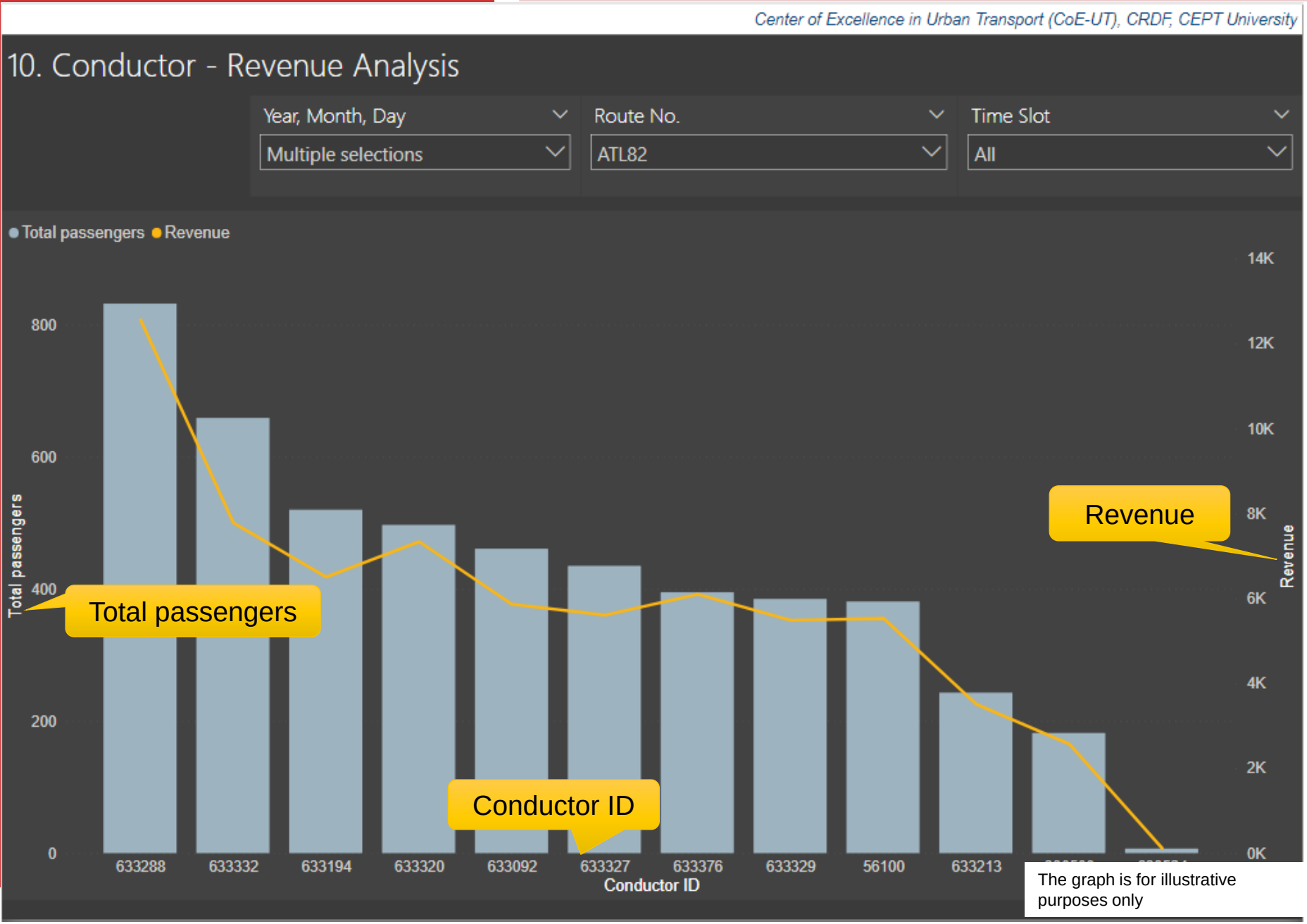
Report 10: Conductor – Revenue Analysis



Contents/Visuals

1. Illustrate the revenue collected by each conductor along a route

Purpose

1. Helps to analyse the performance of the conductor

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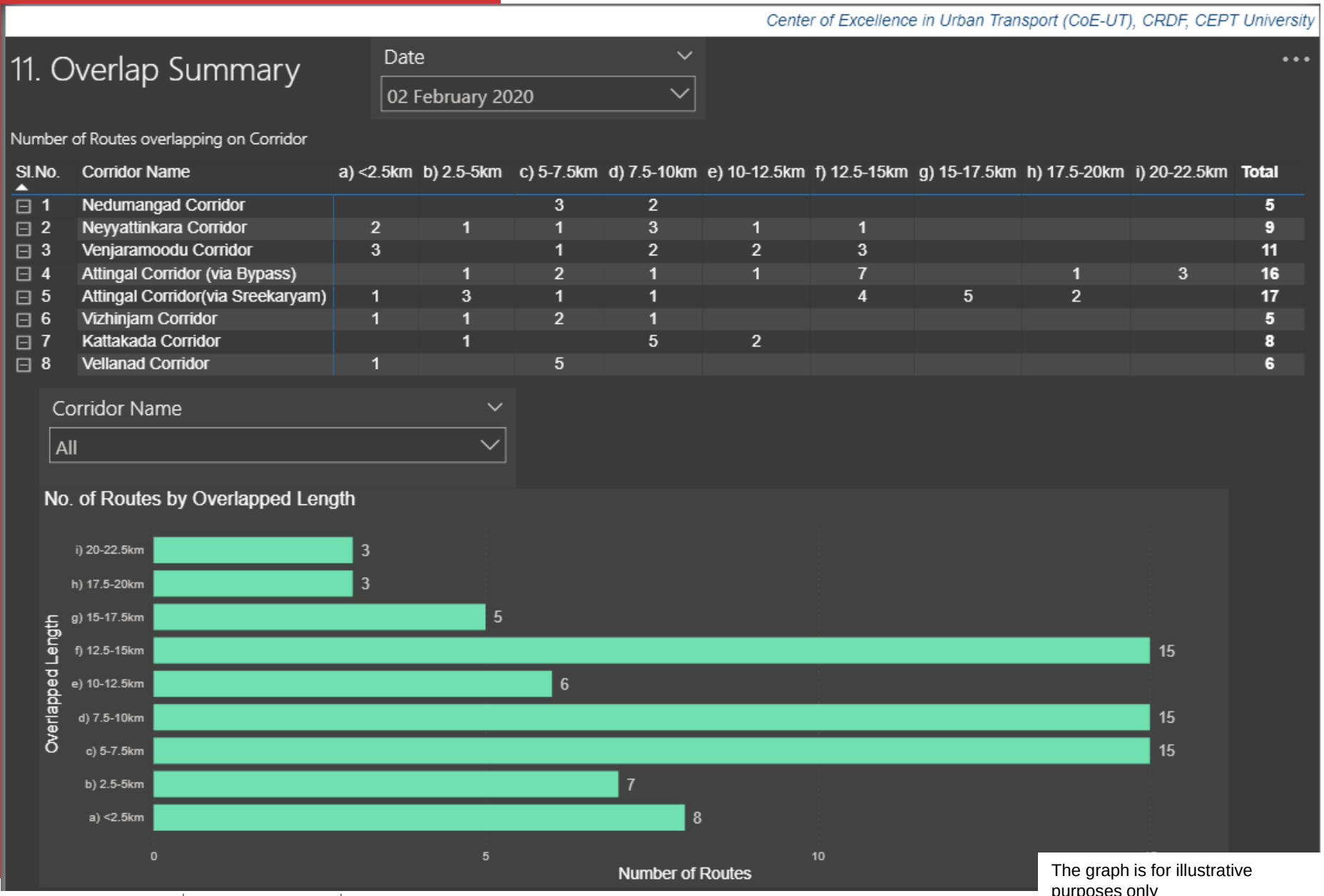
Report 11: Overlap Summary



Sl.No.	Corridor Name	a) <2.5km	b) 2.5-5km	c) 5-7.5km	d) 7.5-10km	e) 10-12.5km	f) 12.5-15km	g) 15-17.5km	h) 17.5-20km	i) 20-22.5km	Total
1	Nedumangad Corridor			3	2						5
2	Neyyattinkara Corridor	2	1	1	3	1	1				9
3	Venjaramoodu Corridor	3		1	2	2	3				11
4	Attingal Corridor (via Bypass)		1	2	1	1	7		1	3	16
5	Attingal Corridor(via Sreekaryam)	1	3	1	1		4	5	2		17
6	Vizhinjam Corridor	1	1	2	1						5
7	Kattakada Corridor		1		5	2					8
8	Vellanad Corridor	1		5							6

The graph is for illustrative purposes only

Contents/Visuals

1. No. of routes overlapped along each corridor

Purpose

1. To minimise the overlap with an intent to improve operational efficiency.

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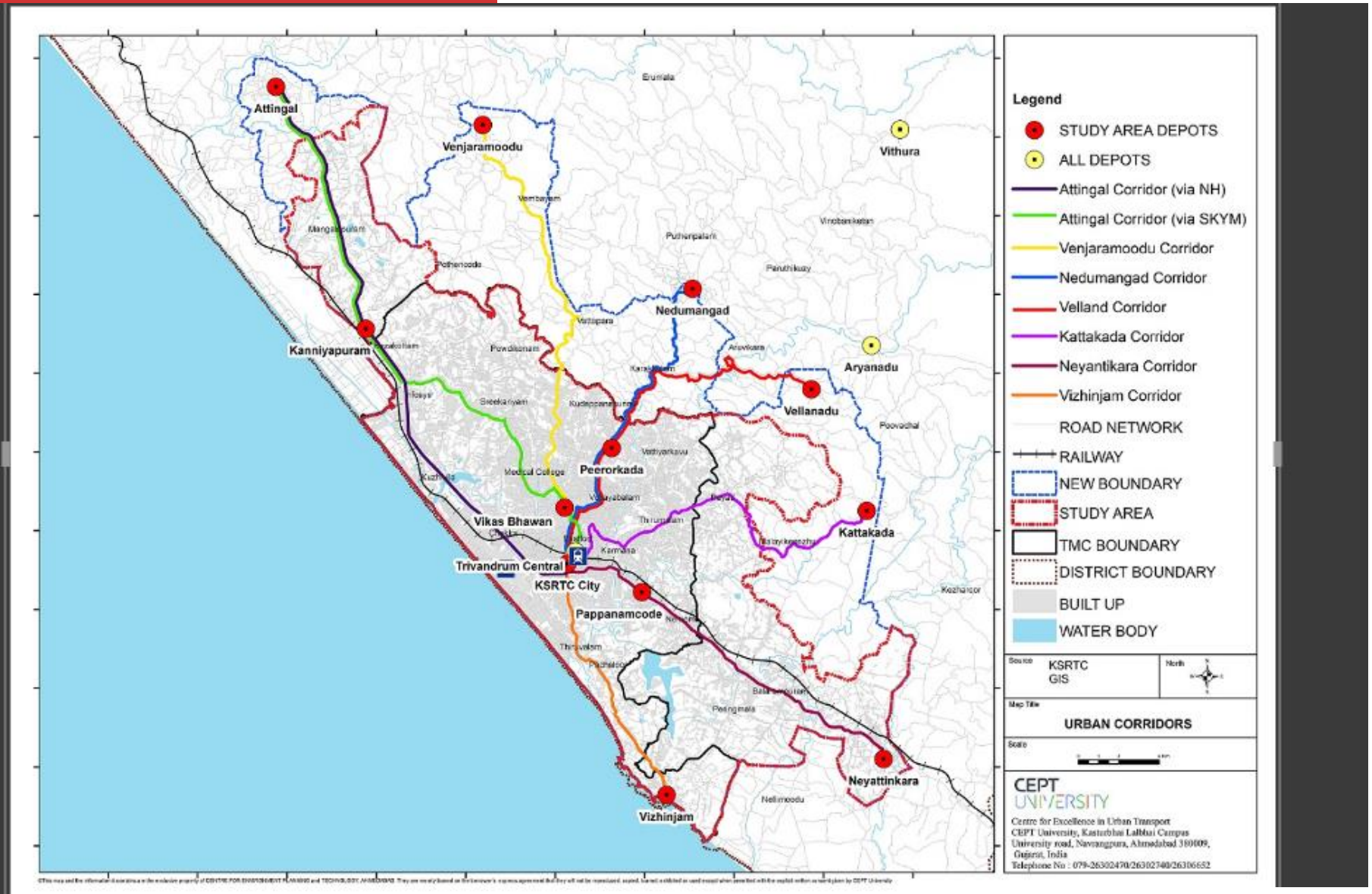
Report 11: Overlap Summary



The graph is for illustrative purposes only

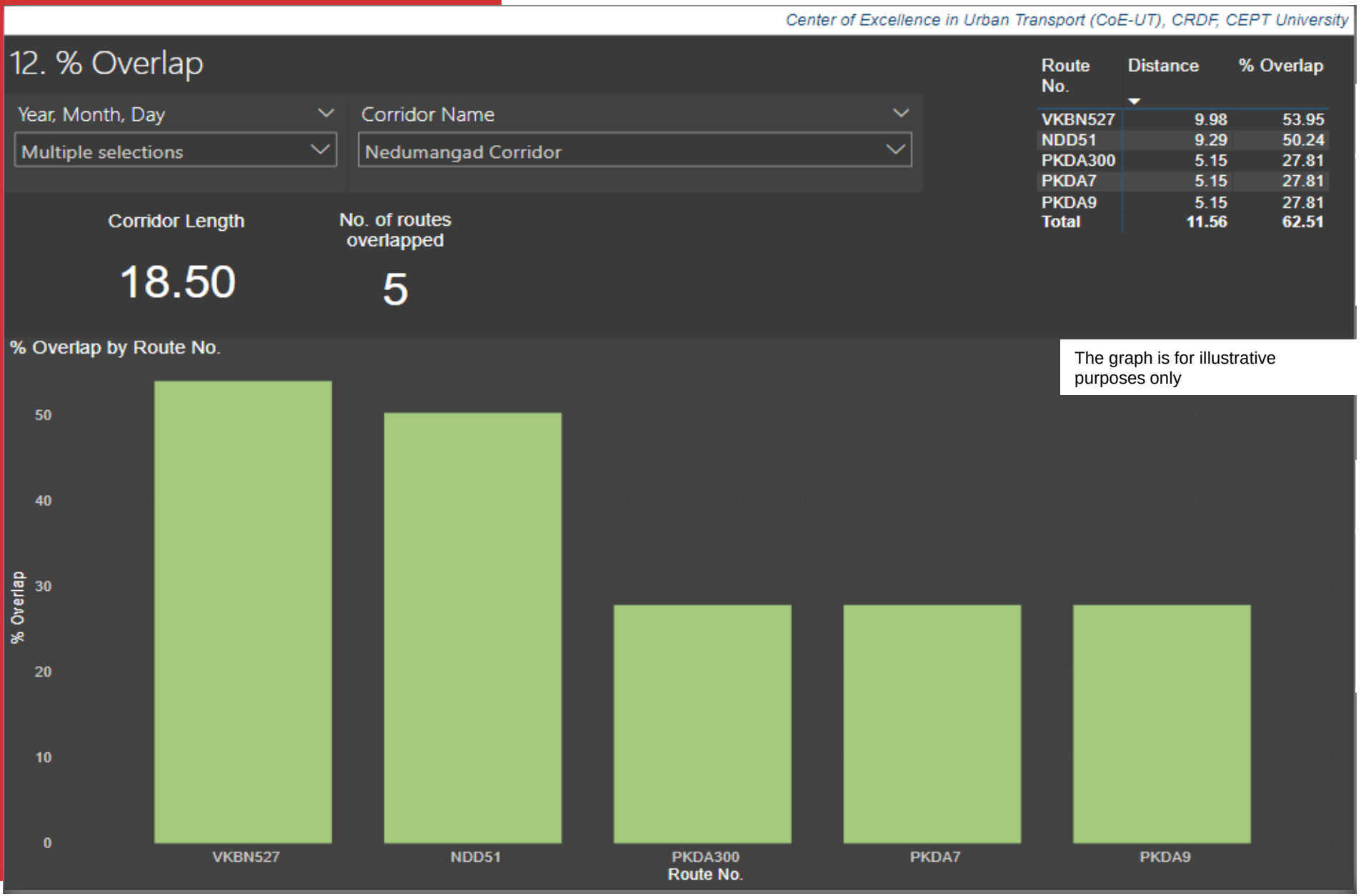
Contents/Visuals

1. Static map of all corridors in study area

Purpose

1. To support decisions on change in schedules, frequencies and route curtailments/extensions

Report 12: Overlap Analysis



The graph is for illustrative purposes only

Contents/Visuals

1. Percentage overlap of routes in each corridor

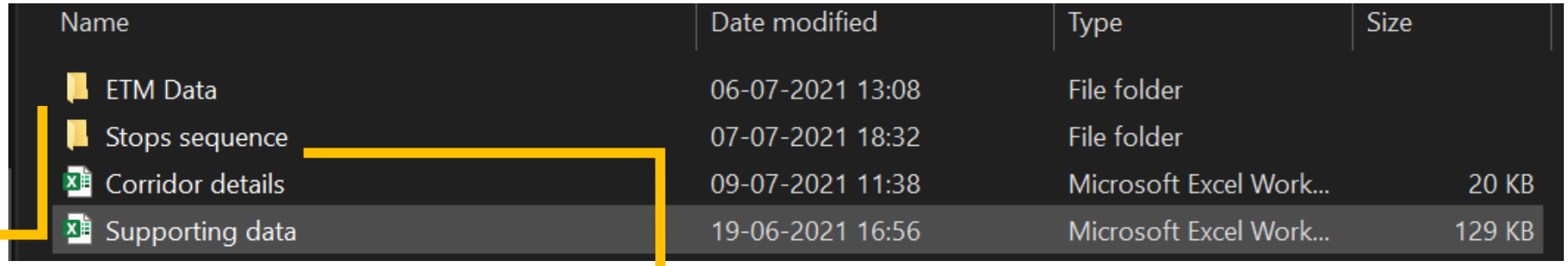
Purpose

1. It helps authority to decide which route can be realigned to minimize overlapping.

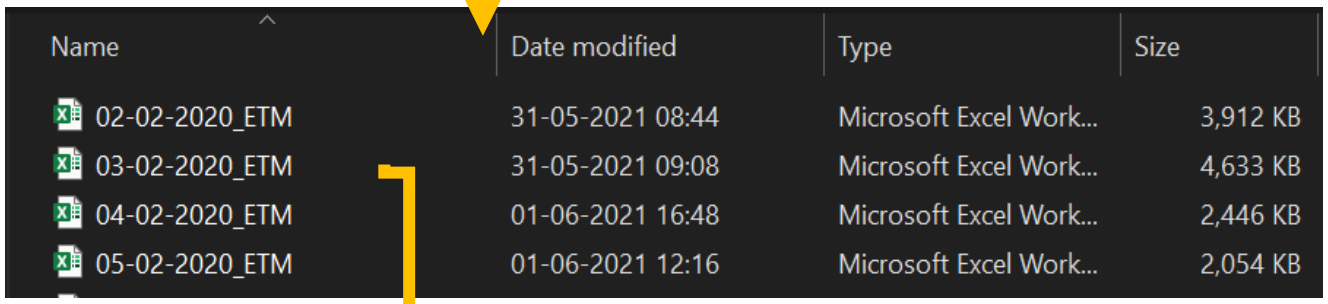
Input Data Structure

Input data structure showing required data sets

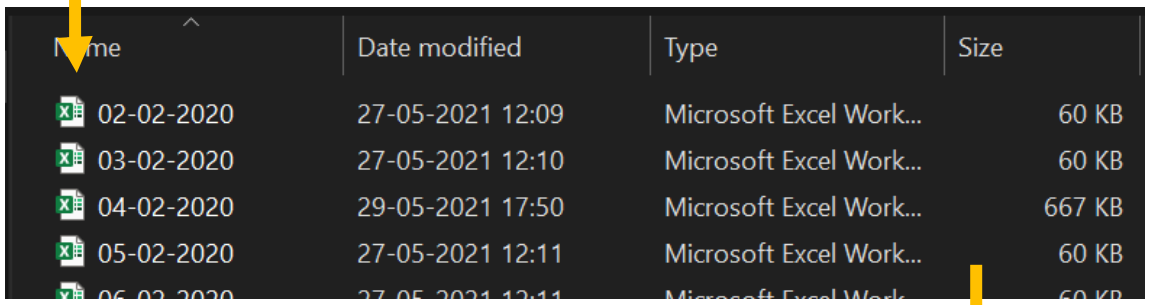
Input Folder Structure



Name	Date modified	Type	Size
ETM Data	06-07-2021 13:08	File folder	
Stops sequence	07-07-2021 18:32	File folder	
Corridor details	09-07-2021 11:38	Microsoft Excel Work...	20 KB
Supporting data	19-06-2021 16:56	Microsoft Excel Work...	129 KB



Name	Date modified	Type	Size
02-02-2020_ETM	31-05-2021 08:44	Microsoft Excel Work...	3,912 KB
03-02-2020_ETM	31-05-2021 09:08	Microsoft Excel Work...	4,633 KB
04-02-2020_ETM	01-06-2021 16:48	Microsoft Excel Work...	2,446 KB
05-02-2020_ETM	01-06-2021 12:16	Microsoft Excel Work...	2,054 KB



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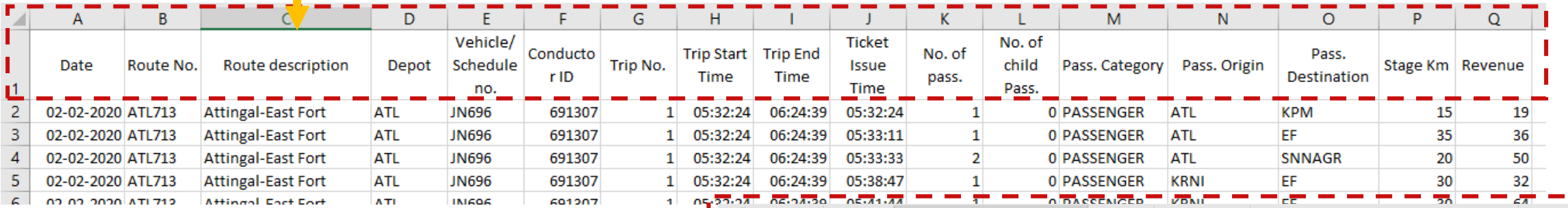
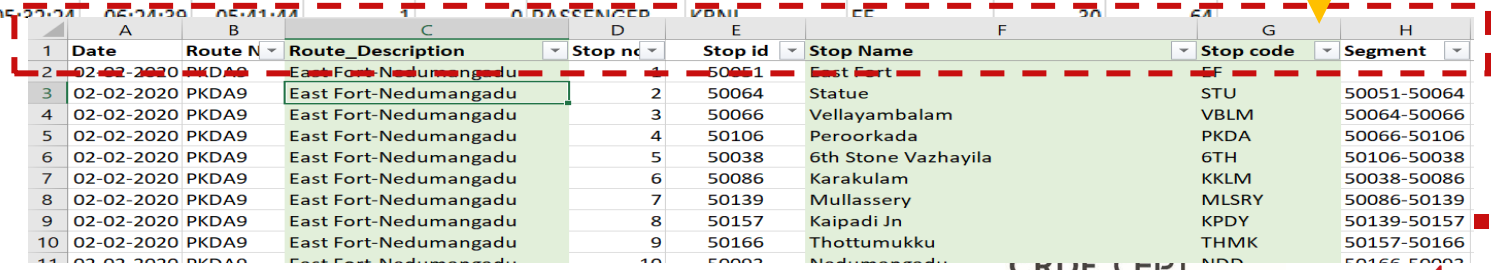
03-02-2020	27-05-2021 12:10	Microsoft Excel Work...	60 KB
04-02-2020	29-05-2021 17:50	Microsoft Excel Work...	667 KB
05-02-2020	27-05-2021 12:11	Microsoft Excel Work...	60 KB



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Date	Route No.	Route description	Depot	Vehicle/ Schedule no.	Conductor ID	Trip No.	Trip Start Time	Trip End Time	Ticket Issue Time	No. of pass.	No. of child Pass.	Pass. Category	Pass. Origin	Pass. Destination	Stage Km	Revenue
2	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:32:24	1	0	PASSENGER	ATL	KPM	15	19
3	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:33:11	1	0	PASSENGER	ATL	EF	35	36
4	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:33:33	2	0	PASSENGER	ATL	SNNAGR	20	50
5	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:38:47	1	0	PASSENGER	KRNI	EF	30	32



	A	B	C	D	E	F	G	H
1	Date	Route N	Route_Description	Stop no	Stop id	Stop Name	Stop code	Segment
2	02-02-2020	PKDA9	East Fort-Nedumangadu	1	50051	East Fort	EF	
3	02-02-2020	PKDA9	East Fort-Nedumangadu	2	50064	Statue	STU	50051-50064
4	02-02-2020	PKDA9	East Fort-Nedumangadu	3	50066	Vellayambalam	VBLM	50064-50066
5	02-02-2020	PKDA9	East Fort-Nedumangadu	4	50106	Peroorkada	PKDA	50066-50106
6	02-02-2020	PKDA9	East Fort-Nedumangadu	5	50038	6th Stone Vazhayila	6TH	50106-50038
7	02-02-2020	PKDA9	East Fort-Nedumangadu	6	50086	Karakulam	KKLM	50038-50086
8	02-02-2020	PKDA9	East Fort-Nedumangadu	7	50139	Mullassery	MLSRY	50086-50139
9	02-02-2020	PKDA9	East Fort-Nedumangadu	8	50157	Kaipadi Jn	KPDY	50139-50157
10	02-02-2020	PKDA9	East Fort-Nedumangadu	9	50166	Thottumukku	THMK	50157-50166

ETM Data Format

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Date	Route No	Route description	Depot	Vehicle/ Schedule no.	Conductor ID	Trip No.	Trip Start Time	Trip End Time	Ticket Issue Time	No. of pass.	No. of child Pass.	Pass. Category	Pass. Origin	Pass. Destination	Stage Km	Revenue
2	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:32:24	1	0	PASSENGER	ATL	KPM	15	19
3	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:33:11	1	0	PASSENGER	ATL	EF	35	36
4	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:33:33	2	0	PASSENGER	ATL	SNNAGR	20	50
5	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:38:47	1	0	PASSENGER	KRNI	EF	30	32
6	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:41:44	1	0	PASSENGER	KRNI	EF	30	64
7	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:42:39	1	0	PASSENGER	16THMILE	MGPM	2.5	10
8	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:50:11	2	0	PASSENGER	PLPRM	SNNAGR	7.5	20
9	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:55:01	1	0	PASSENGER	KPM	EF	20	23
10	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:57:32	2	0	PASSENGER	KPM	EF	20	40
11	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:59:16	1	0	PASSENGER	KZM	CNT	15	19
12	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	05:59:41	1	0	PASSENGER	KZM	EF	17.5	21
13	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	06:00:17	2	0	PASSENGER	KZM	EF	17.5	36
14	02-02-2020	ATL713	Attingal-East Fort	ATL	JN696	691307	1	05:32:24	06:24:39	06:04:05	1	0	PASSENGER	KZM	KUZVI	5	10

Stop sequence Format

	A	B	C	D	E	F	G	H
1	Date	Route N	Route_Description	Stop no	Stop id	Stop Name	Stop code	Segment
2	02-02-2020	PKDA9	East Fort-Nedumangadu	1	50051	East Fort	EF	
3	02-02-2020	PKDA9	East Fort-Nedumangadu	2	50064	Statue	STU	50051-50064
4	02-02-2020	PKDA9	East Fort-Nedumangadu	3	50066	Vellayambalam	VBLM	50064-50066
5	02-02-2020	PKDA9	East Fort-Nedumangadu	4	50106	Peroorkada	PKDA	50066-50106
6	02-02-2020	PKDA9	East Fort-Nedumangadu	5	50038	6th Stone Vazhayila	6TH	50106-50038
7	02-02-2020	PKDA9	East Fort-Nedumangadu	6	50086	Karakulam	KKLM	50038-50086
8	02-02-2020	PKDA9	East Fort-Nedumangadu	7	50139	Mullassery	MLSRY	50086-50139
9	02-02-2020	PKDA9	East Fort-Nedumangadu	8	50157	Kaipadi Jn	KPDY	50139-50157
10	02-02-2020	PKDA9	East Fort-Nedumangadu	9	50166	Thottumukku	THMK	50157-50166
11	02-02-2020	PKDA9	East Fort-Nedumangadu	10	50093	Nedumangadu	NDD	50166-50093
12	02-02-2020	PKDA7	East Fort-Vattappara	1	50051	East Fort	EF	
13	02-02-2020	PKDA7	East Fort-Vattappara	2	50064	Statue	STU	50051-50064
14	02-02-2020	PKDA7	East Fort-Vattappara	3	50066	Vellayambalam	VBLM	50064-50066

Corridor Details

	A	B	C	D	E	F	G	H	I
1	Sl.No.	Corridor No.	Corridor Name	Length_Corridor	Stop No.	Stop Code	Stop Name	Segment	Distance
2	1	1	Nedumangad Corridor	18.5	1	50051	East Fort		0
3	2	1	Nedumangad Corridor	18.5	2	50590	Over Bridge	50051-50590	0.527795
4	3	1	Nedumangad Corridor	18.5	3	50064	Statue	50590-50064	1.045389
5	4	1	Nedumangad Corridor	18.5	4	50110	Cantonment	50064-50110	0.758837
6	5	1	Nedumangad Corridor	18.5	5	50487	LMS Jn	50110-50487	0.538952
7	6	1	Nedumangad Corridor	18.5	6	50027	Museum	50487-50027	0.552503
8	7	1	Nedumangad Corridor	18.5	7	50066	Vellayambalam	50027-50066	0.667083
9	8	1	Nedumangad Corridor	18.5	8	50106	Peroorkada	50066-50106	3.226138
10	9	1	Nedumangad Corridor	18.5	9	50816	Vazhayila Palam	50106-50816	1.423033
11	10	1	Nedumangad Corridor	18.5	10	50038	6th Stone Vazhayila	50816-50038	0.768425
12	11	1	Nedumangad Corridor	18.5	11	50086	Karakulam	50038-50086	1.919249
13	12	1	Nedumangad Corridor	18.5	12	50028	8th Stone (Thaikkavu)	50086-50028	0.916447
14	13	1	Nedumangad Corridor	18.5	13	50076	Azhikode	50028-50076	0.961135
15	14	1	Nedumangad Corridor	18.5	14	50029	10th Stone	50076-50029	2.270535
16	15	1	Nedumangad Corridor	18.5	15	50093	Nedumangadu	50029-50093	2.564726
17	16	2	Neyyattinkara Corridor	20	1	50051	East Fort		0
18	17	2	Neyyattinkara Corridor	20	2	50056	Karamana	50051-50056	2.191696
19	18	2	Neyyattinkara Corridor	20	3	50246	Neeramankara	50056-50246	0.985262

Supporting Data

Route description

	A	B	C	D	E
1	Route_Code	Route	Route_description	Route Length	Route Category
2	ATL103	TVM-KTRPRMB	Thiruvananthapuram-Kataparmbu	40.1762	Trunk
3	ATL103	KTRPRMB-TVM	Kataparmbu-Thiruvananthapuram	40.1762	Trunk
4	ATL111	TVM-VKLAT	Thiruvananthapuram-Varkala Temple	61.7966	Trunk
5	ATL111	VKLAT-TVM	Varkala Temple-Thiruvananthapuram	61.7966	Trunk
6	ATL113	TVM-ATL	Thiruvananthapuram-Attingal	50.9129	Trunk
7	ATL113	ATL-TVM	Attingal-Thiruvananthapuram	50.9129	Trunk
8	ATL116	TVM-ATL	Thiruvananthapuram-Attingal	39.1701	Trunk
9	ATL116	ATL-TVM	Attingal-Thiruvananthapuram	39.1701	Trunk
10	ATL197	TVM-KLBM	Thiruvananthapuram-Kallambalam	48.6468	Trunk
11	ATL197	KLBM-TVM	Kallambalam-Thiruvananthapuram	48.6468	Trunk
12	ATL198	TVM-ATL	Thiruvananthapuram-Attingal	38.6637	Trunk
13	ATL198	ATL-TVM	Attingal-Thiruvananthapuram	38.6637	Trunk
14	ATL227	TVM-VKLAT	Thiruvananthapuram-Varkala Temple	55.8518	Trunk
15	ATL227	VKLAT-TVM	Varkala Temple-Thiruvananthapuram	55.8518	Trunk
16	ATL30	TVM-VKLA	Thiruvananthap		
17	ATL30	VKLA-TVM	Varkala-Thiruva		
18	ATL69	TVM-VKLAT	Thiruvananthap		
19	ATL69	VKLAT-TVM	Varkala Temple-		

Vehicle Type

	A	B	C
1	Vehicle no./ Schedule No.	Veh. Type	Veh. Capacity
2	RT343	Standard	70
3	JN179	Standard	70
4	RT265	Standard	70
5	JN224	Standard	70
6	JN176	Standard	70
7	RT939	Standard	70
8	RT966	Standard	70
9	RT839	Standard	70
10	RT428	Standard	70
11	RT837	Standard	70
12	RT983	Standard	70
13	RPA136	Standard	70
14	RSC932	Standard	70
15	RAC937	Standard	70

Stop List

	A	B	C	D	E
1	Codes	Final_Abbr	Final_Name	Latitude	Longitude
2	50295	10THS	10th Stone	8.6703817	77.15133
3	50029	10TH	10th Stone	8.589180994	76.99588
4	50273	26TH	26th Mile Stone	8.7092375	77.11705
5	50431	28THM	28 th Mile Market	8.7871627	76.77753
6	50275	29TH	29th Mile Stone	8.7208587	77.12547
7	50276	30TH	30th Stone	8.7349893	77.12059
8	50278	31ST	31st Stone	8.741502099	77.12134
9	50277	32ND	32nd Stone	8.7438179	77.12451
10	50297	4THS	4th Stone	8.6755651	77.1592
11	50310	5TH	5th Stone	8.6803748	76.96768
12	50298	6THS	6th Stone	8.674744201	77.152
13	50038	6TH	6th Stone Vazhayila	8.552617793	76.97615
14	50296	8THS	8th Stone	8.6715623	77.15208
15	50028	8TH	8th Stone (Thaikkavu)	8.570600193	76.98778
16	50759	AKLM	Aakkulam	8.5221009	76.90533
17	50841	AARTKZI	Aarattukuzhi	8.450253	77.20436
18	50786	AYRVLYTM	Aayiravally temple	8.453251717	76.96841
19	50796	AZMLAT	Aazhimala Siva Temple	8.3631099	77.01447
20	50707	ADVCHNPR	Adavachanpara	8.536097299	77.09576
21	50540	ADTRA	Adimalathura	8.3567298	77.01766

Things to remember while updating input data:

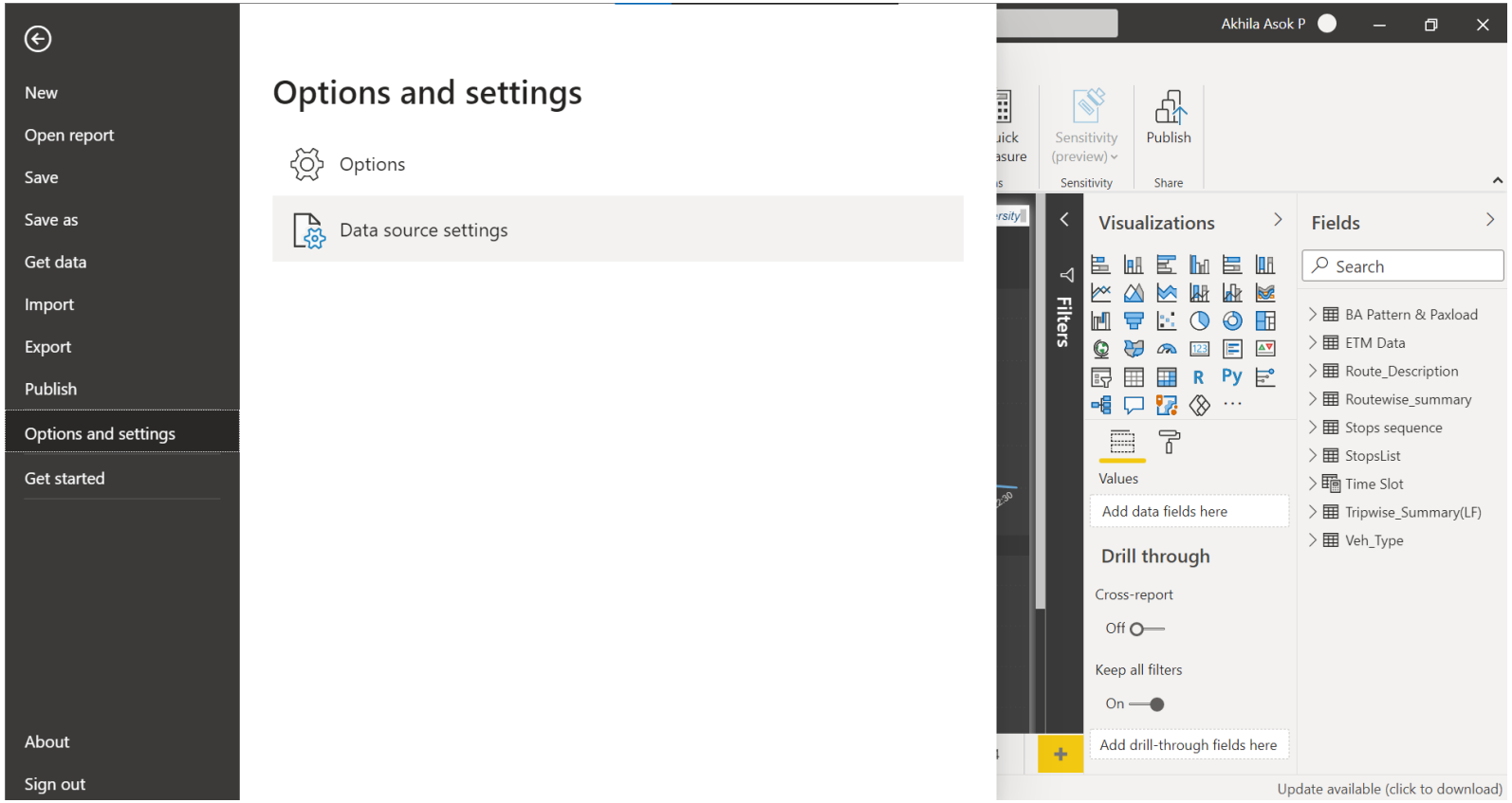
1. Should not rename any input data file
2. Each column has its purpose, so must not interchange, delete or rename any column from the specified format
3. Operator should ensure that the date column in ‘ETM data’ and ‘Stop sequence’ is filled appropriately
4. If the stop sequence is same as previous day, then you may copy the same data set to the next day, but ensure that sheet name and the column A is updated to the current date in the following format: ‘dd-mm-yyyy’ (eg. 02-05-2021).
5. ‘ETM data’ and Stop sequence’ are direction wise data, so the route description column should be entered with the correct origin-destination pair.
6. If any data is missing for any particular day, keep it blank and don’t delete the entire column.
7. Should avoid unnecessary space/gaps in the text while entering the input data
8. Should ensure that the stop sequence is correct along each route and corridor
9. The stop sequence should be entered separately for up and down direction
10. Stop code, stop abbreviation and stop name should be unique for each stop

Power BI Installation

Power BI Installation including input data settings

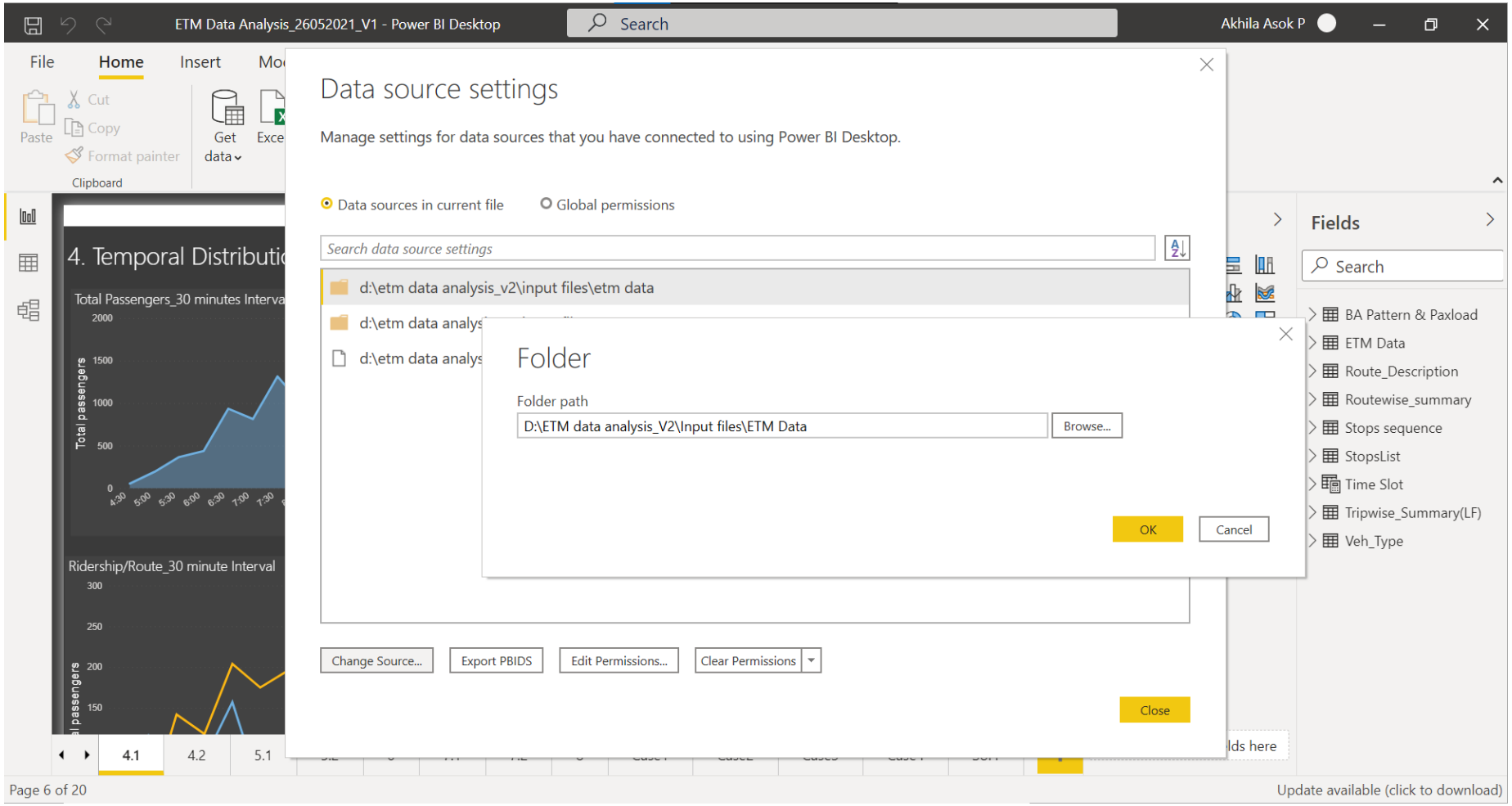
Power BI Installation:

1. Download and install Power BI Desktop from the following Link: https://powerbi.microsoft.com/en-us/downloads/
2. Download and extract the zip file into any specific folder (Do not rename any folder or file in it)
3. Open .pbix file after finishing Power BI installation
4. Select Data source settings from File
   File → Options and settings → Data Source setting



Power BI Installation:

5. Select the input data location on your system by clicking Change source.



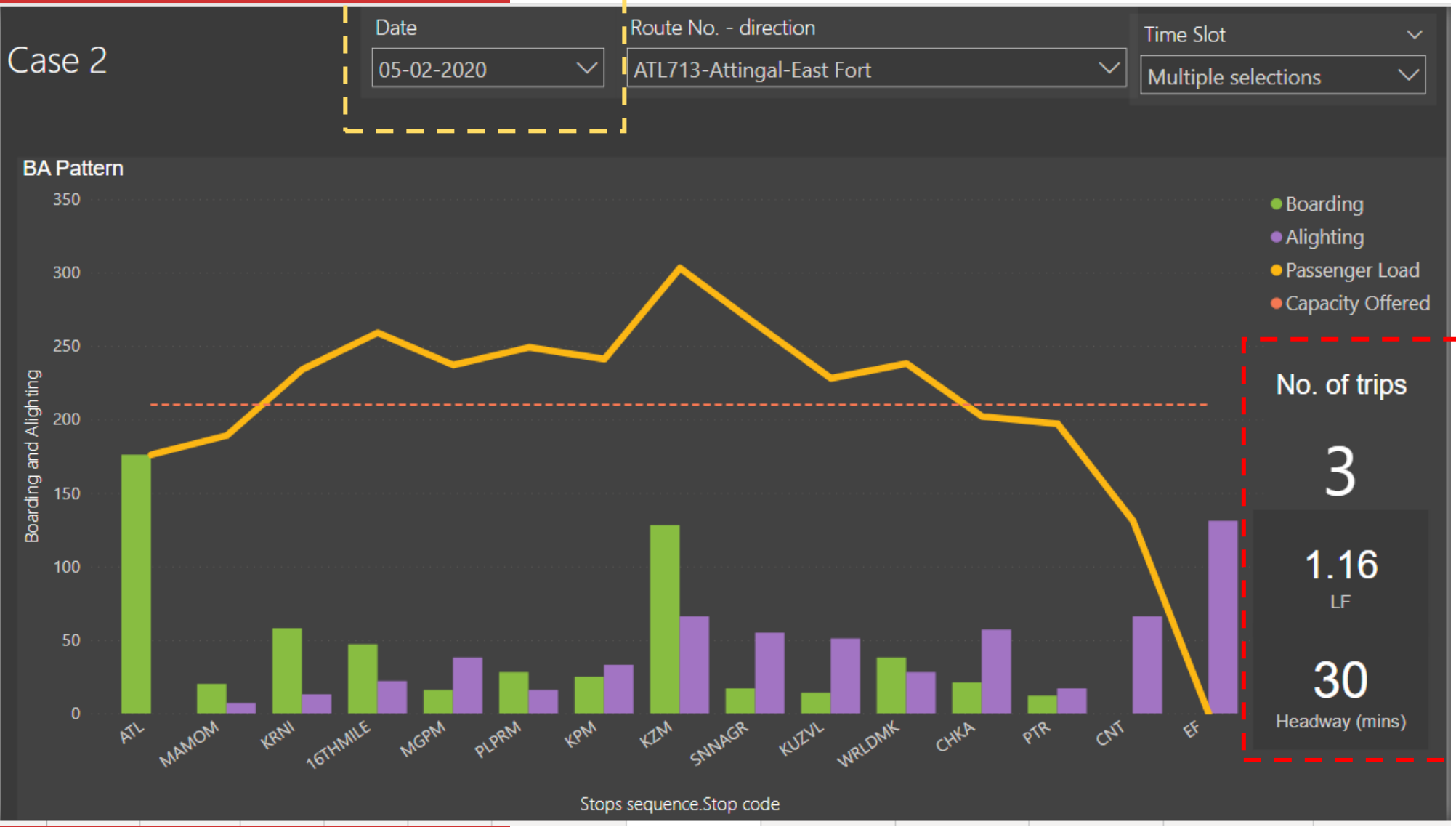
6. Change all 4 sets of input data location and enter OK

Problem Identification and Solution

Identifying problems and possible suggestions to improve Load Factor

Case 1

Under Supply



Problem Details:

- Full day LF: 0.67
- This route is having high Load factor only during Morning Peak Hours (7 am to 10 am)

Suggestion:

1. Try scheduling more number of trips by reducing the headway

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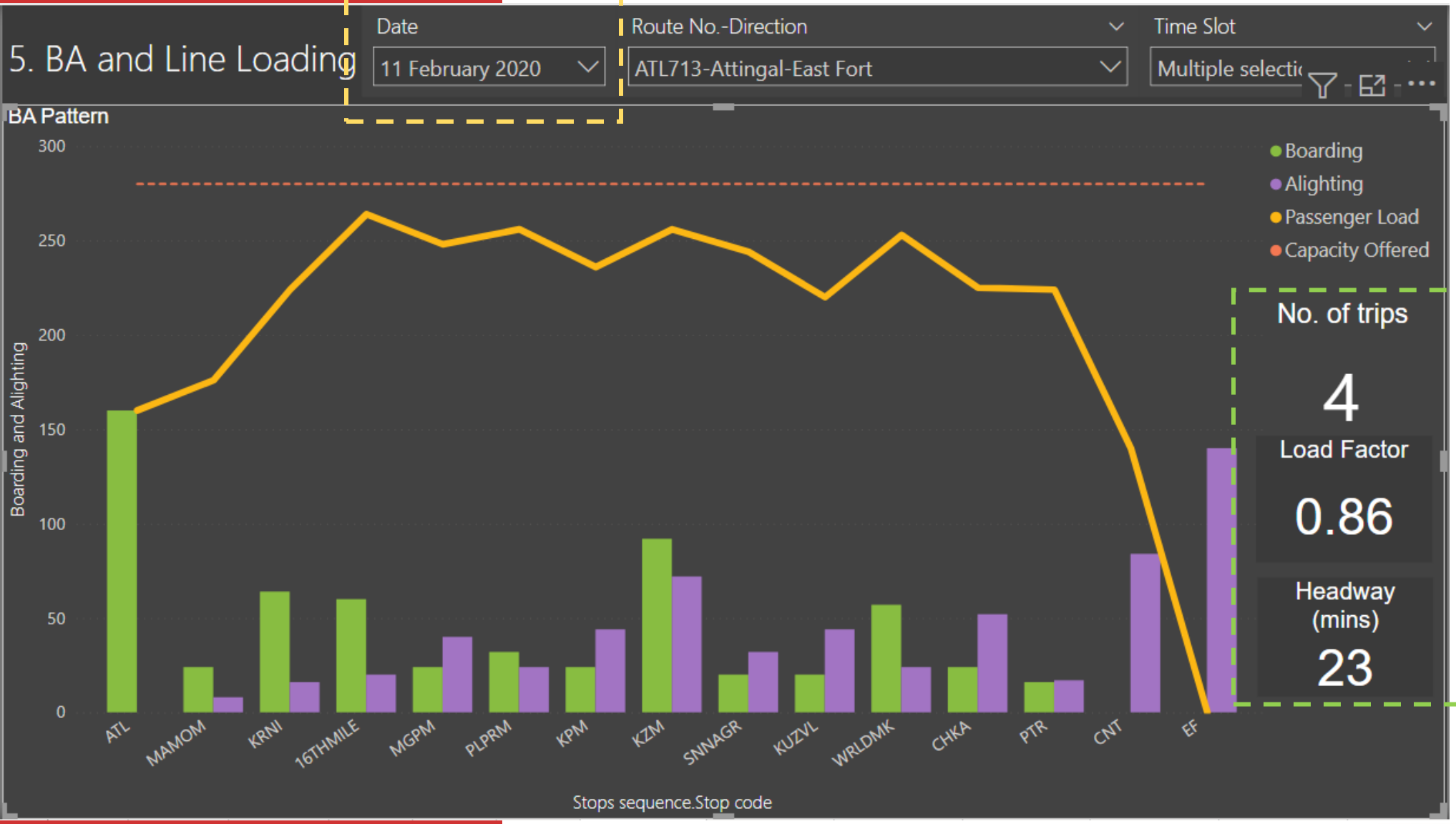
Case 1 - Solution

Under Supply



Action:

- Scheduled more number of trips

Parameters	Case 1	Solution
No. of trips	**3**	**4**
LF	1.16	0.86
Headway (mins)	30	23

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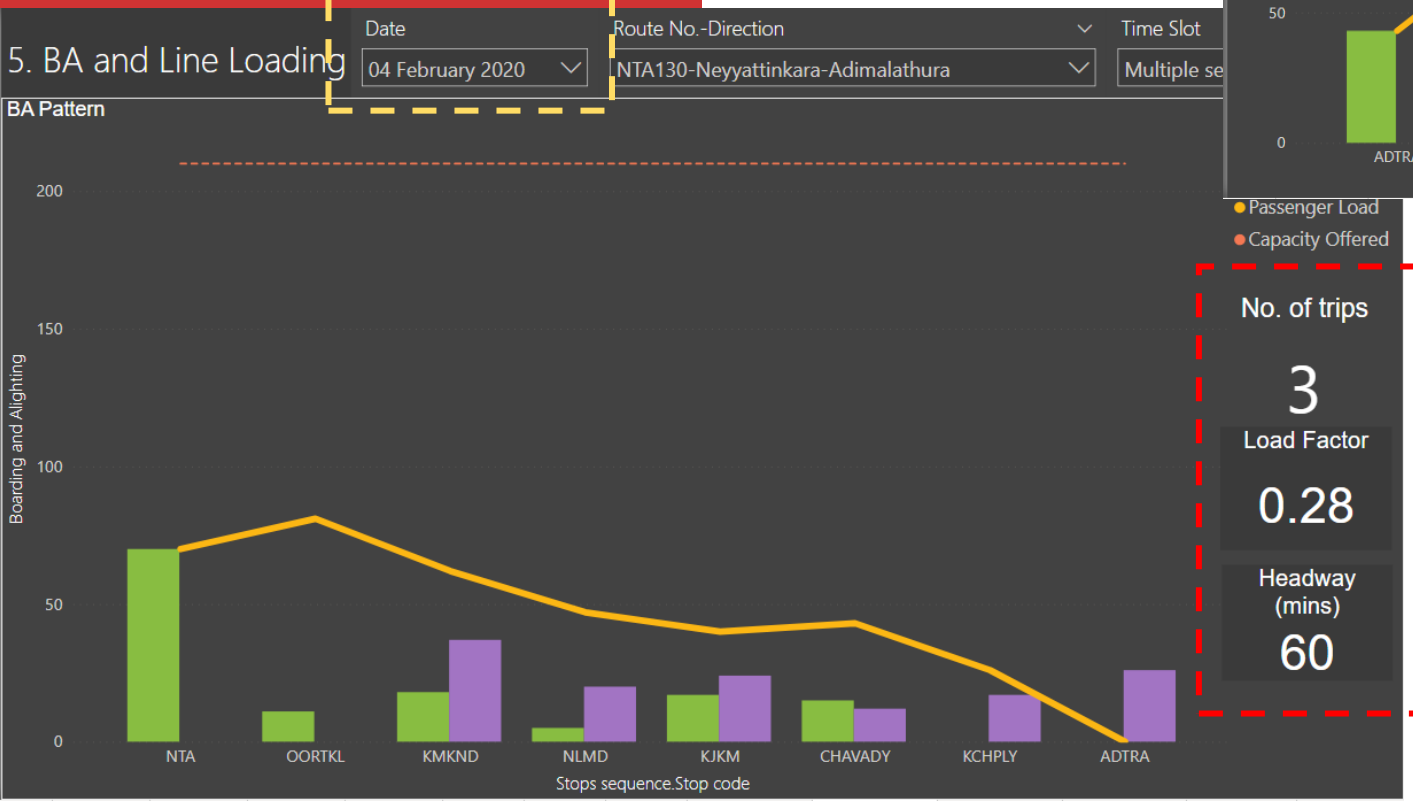
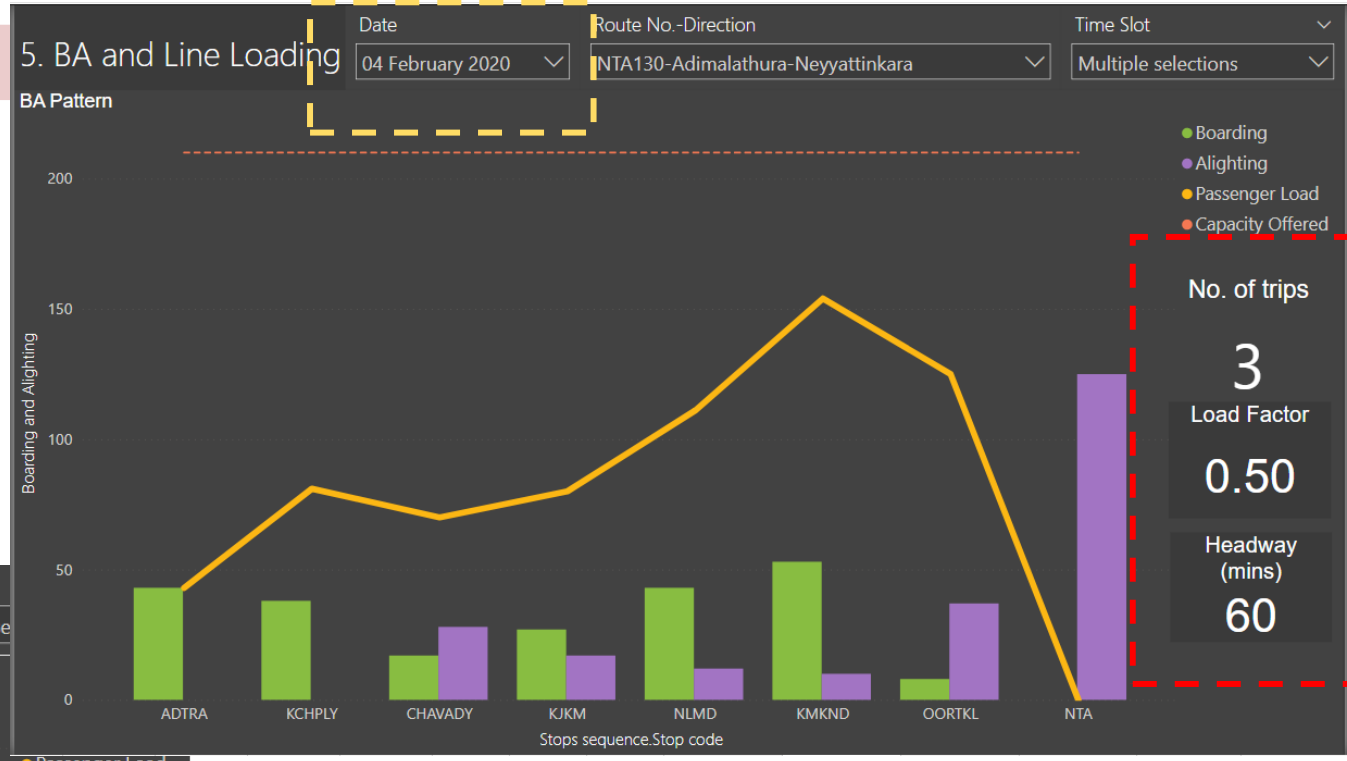
Case 2

Over Supply





Problem Details:

- Along this route, full day LF < 0.6
- Here we selected the graph for morning peak hour (7 am to 10 am)

Suggestion:

1. Since headway is 60 mins, it won't be appropriate to increase the headway further
2. We can reduce the supply offered by changing the type of bus

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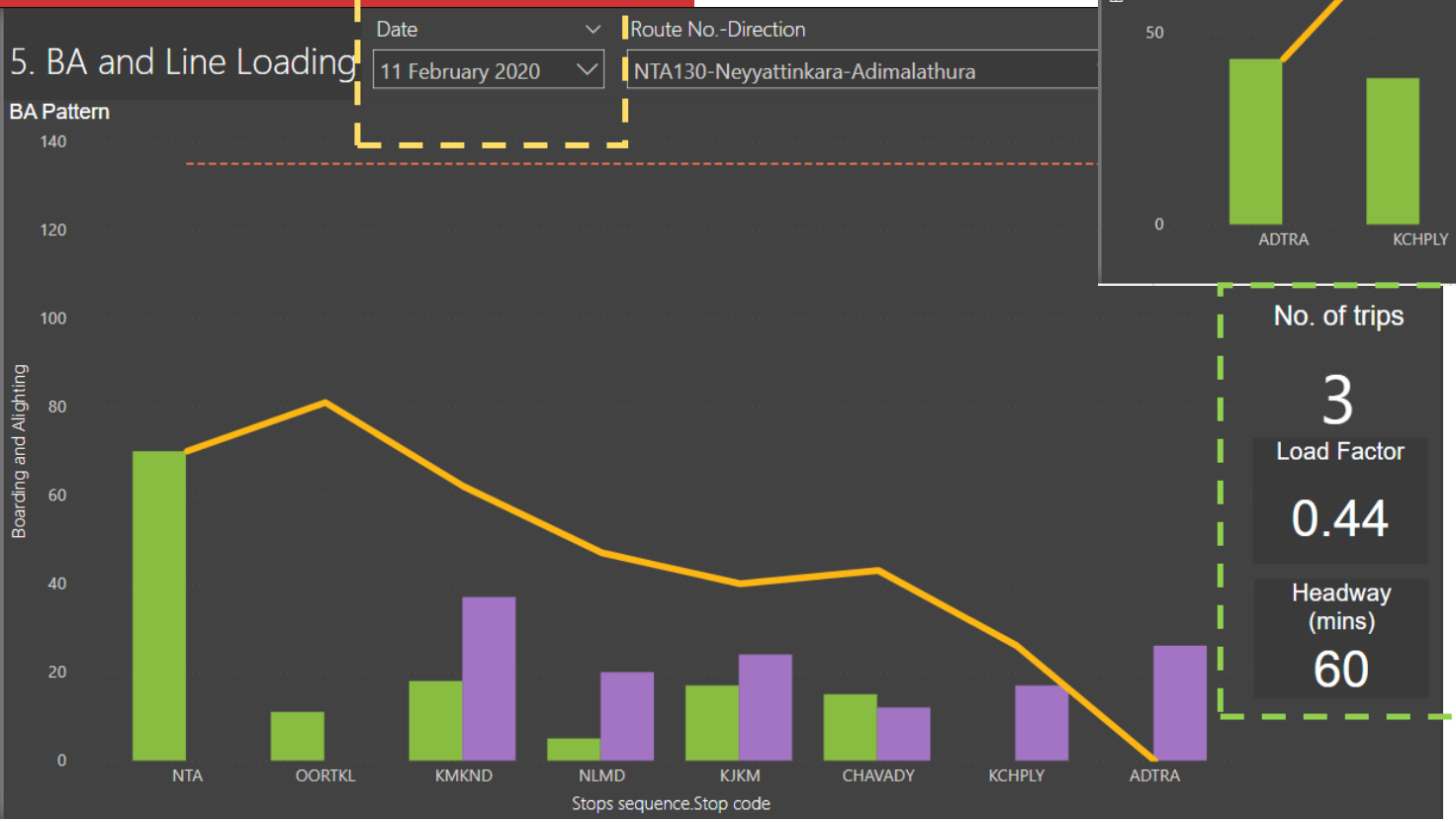
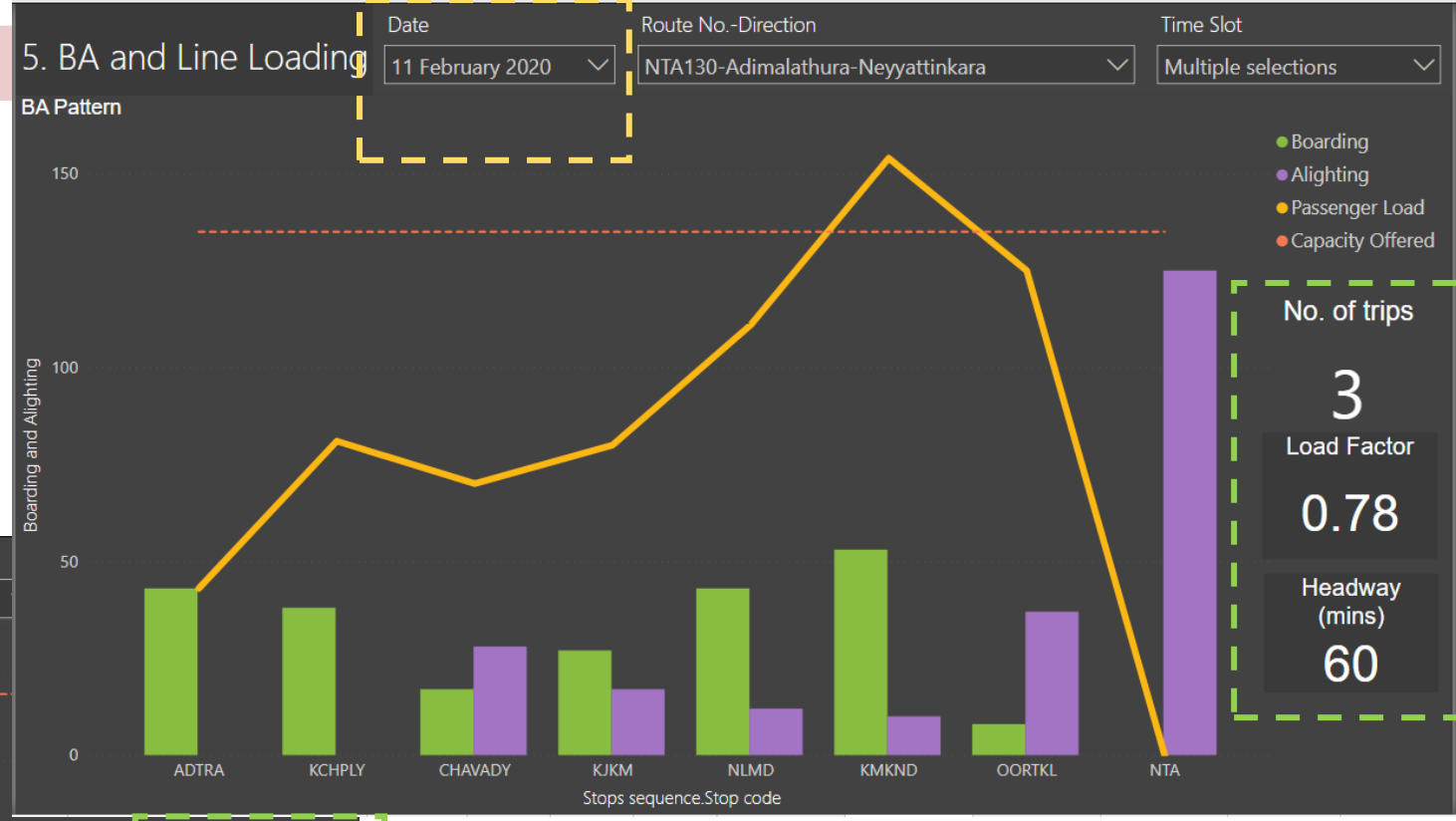
Case 2 - Solution

Under Supply

Action:

- Scheduled more number of trips





Parameters	Case 2	Solution
Capacity of bus	70	45
No. of trips	3	3
LF	0.50	0.78
Headway (mins)	60	60

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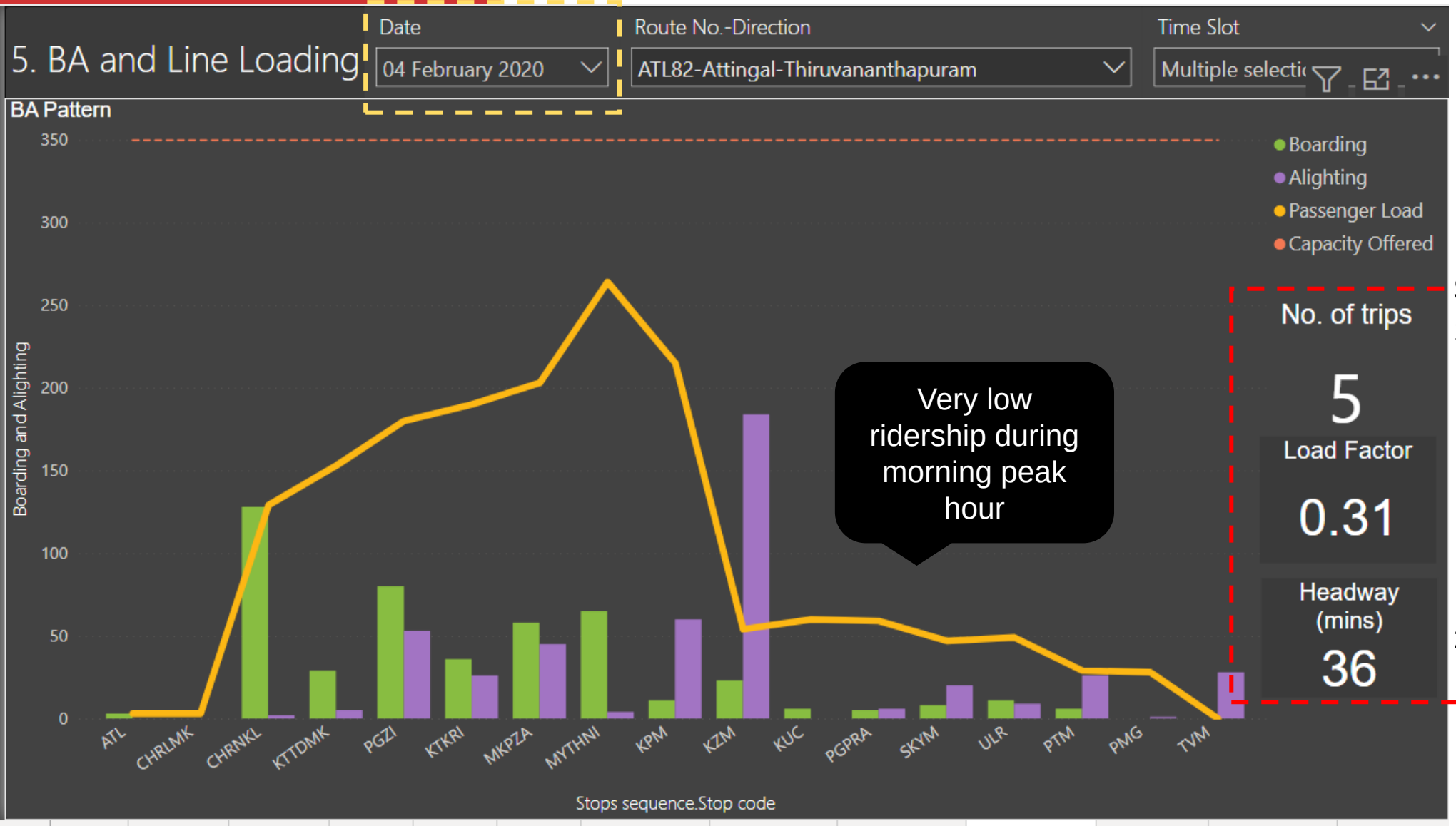
Case 3

Over Supply and Route Curtailment



Problem Details:

- Full day LF < 0.6
- During morning peak hours(7 am to 10 am), very less demand is plying over to tail end of the route.

Suggestion:

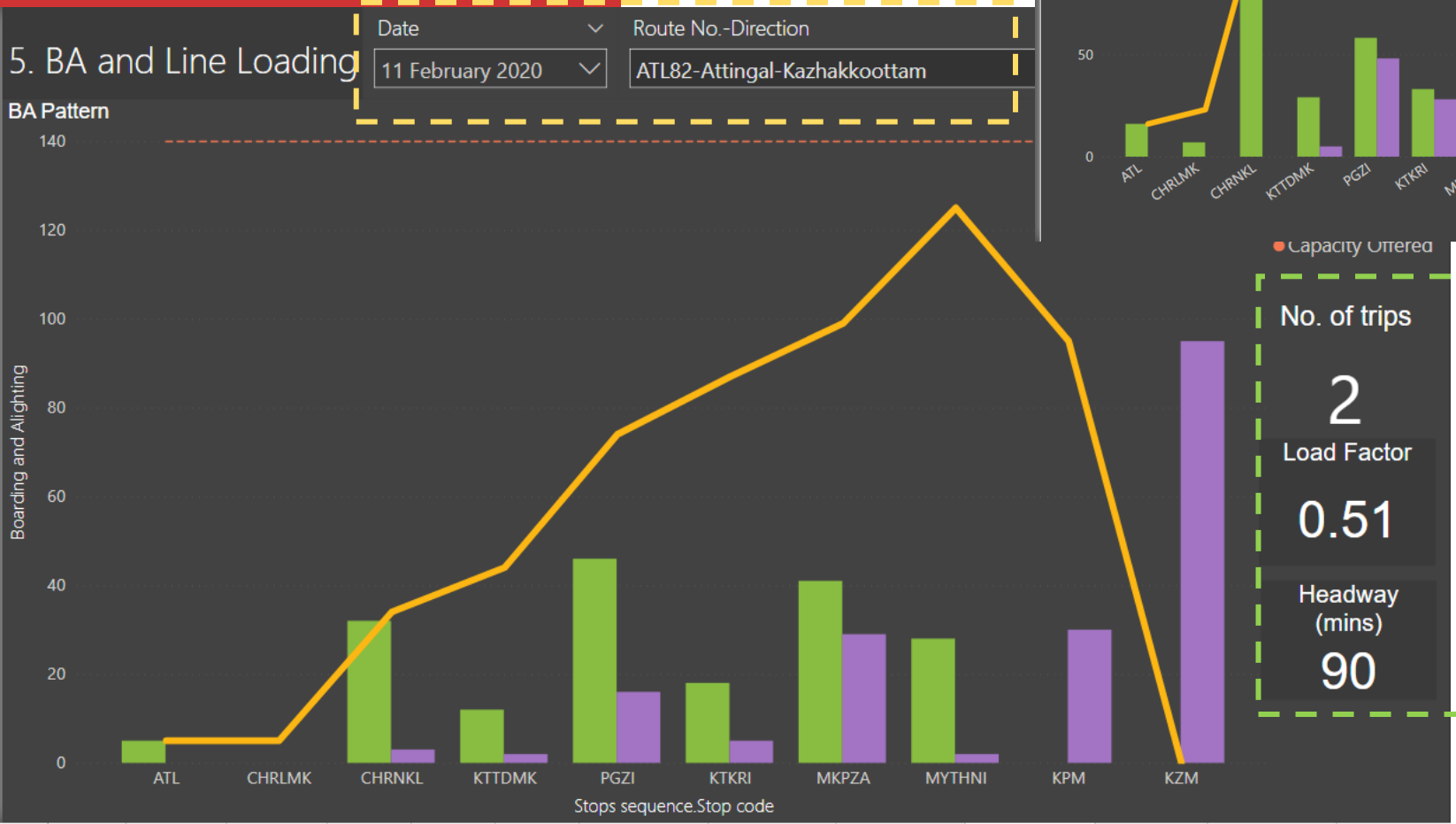
1. If the route is having same pattern for full day, we can curtail the route at KZM, and it is important to ensure the remaining portion is served by some other service
2. If the route is having this kind of pattern only for morning peak, we can curtail alternate route till KZM

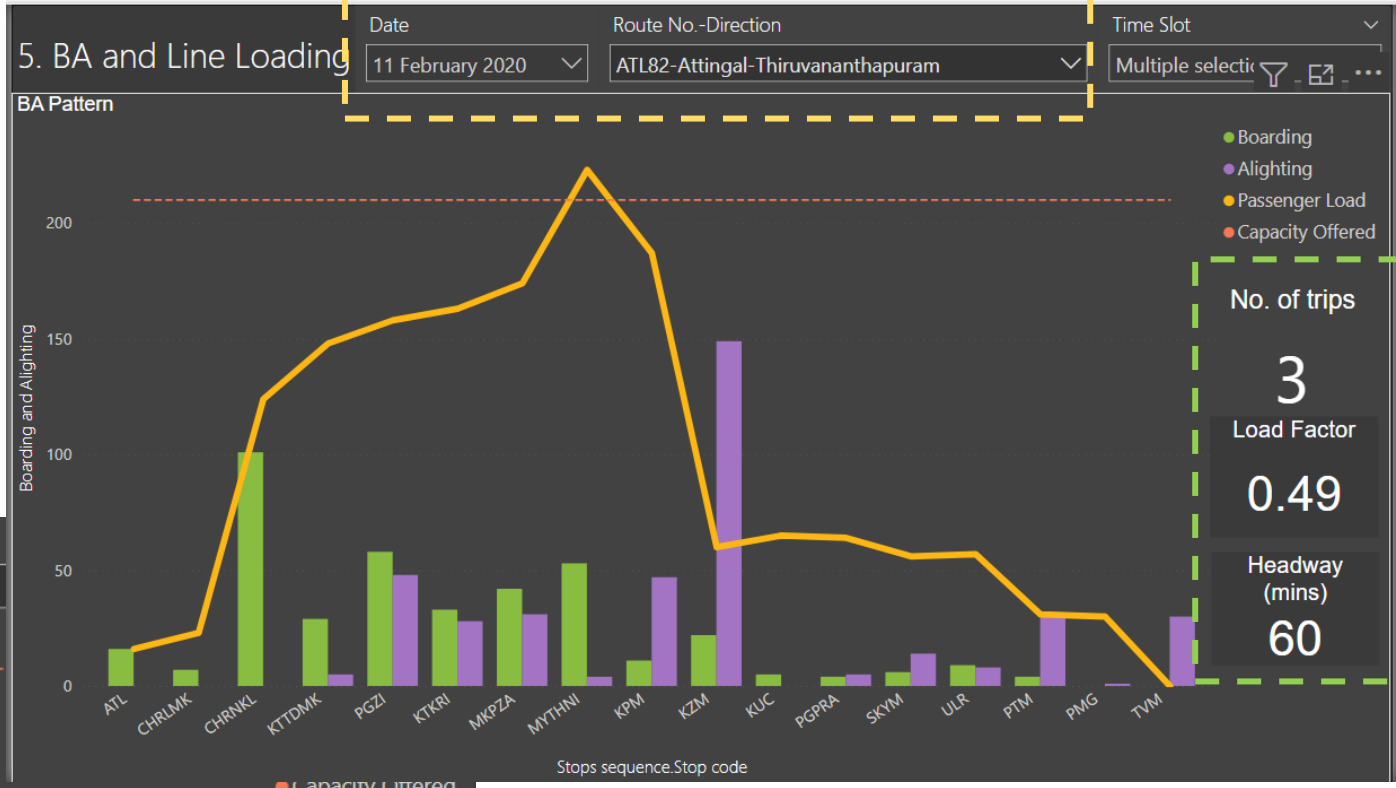
Case 3 - Solution

Over Supply and Route Curtailment

Action:

1. Since, the route is having this kind of pattern only for morning peak, we can curtail alternate route till KZM

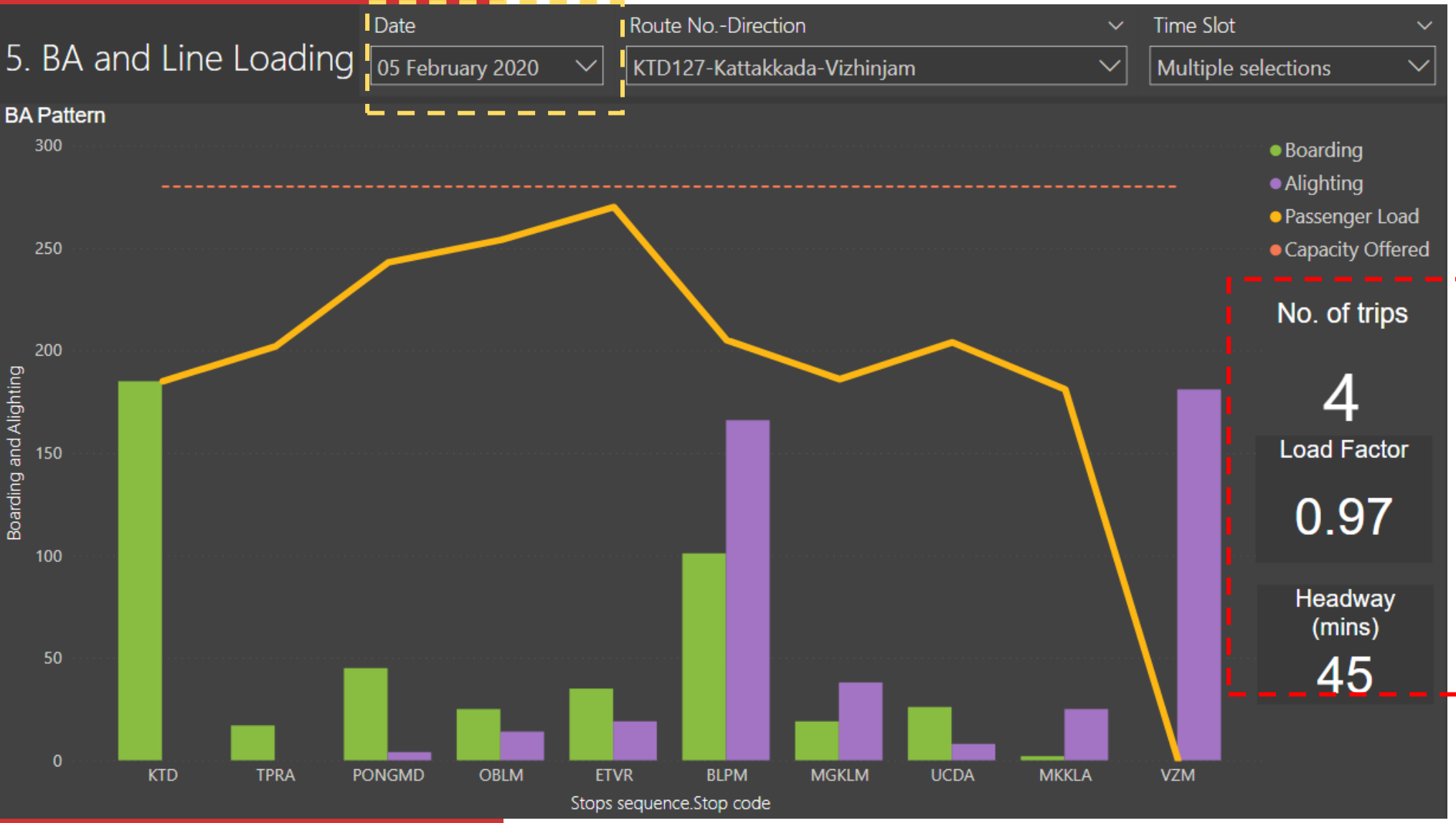




Parameters	Case 3	Solution
No. of trips	**5**	**5**
LF	0.31	0.49
Headway (mins)	60	60,90

Case 4

Potential Express/ Limited Services



Opportunity to improve service

1. This route's performance is fine in terms of LF and headway.
2. It is visible that high demand on 3 stops along this route (Kattakada, Balaramapuram, Vizhinjam)

Suggestion :

1. Schedule alternate trip as Express service

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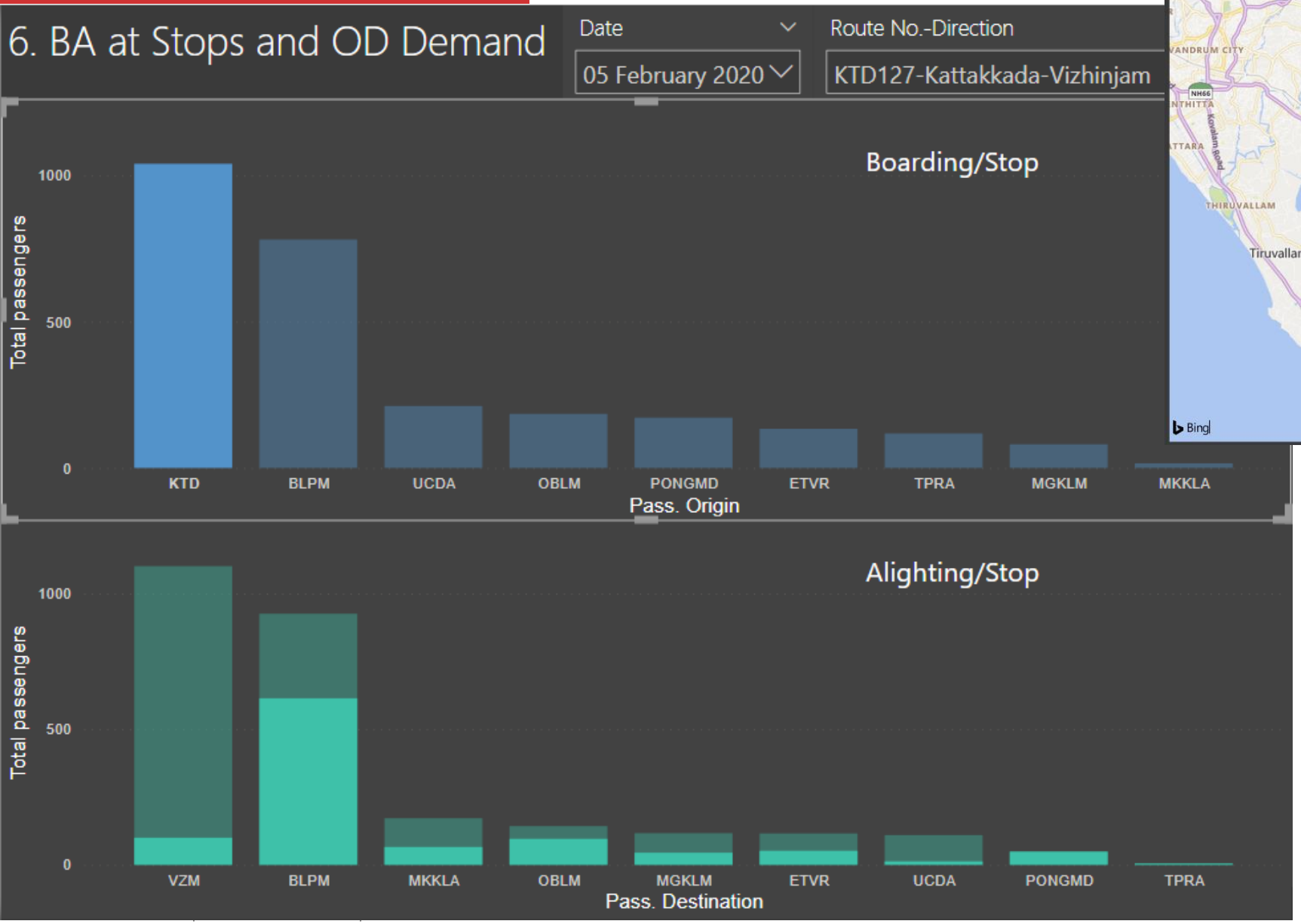
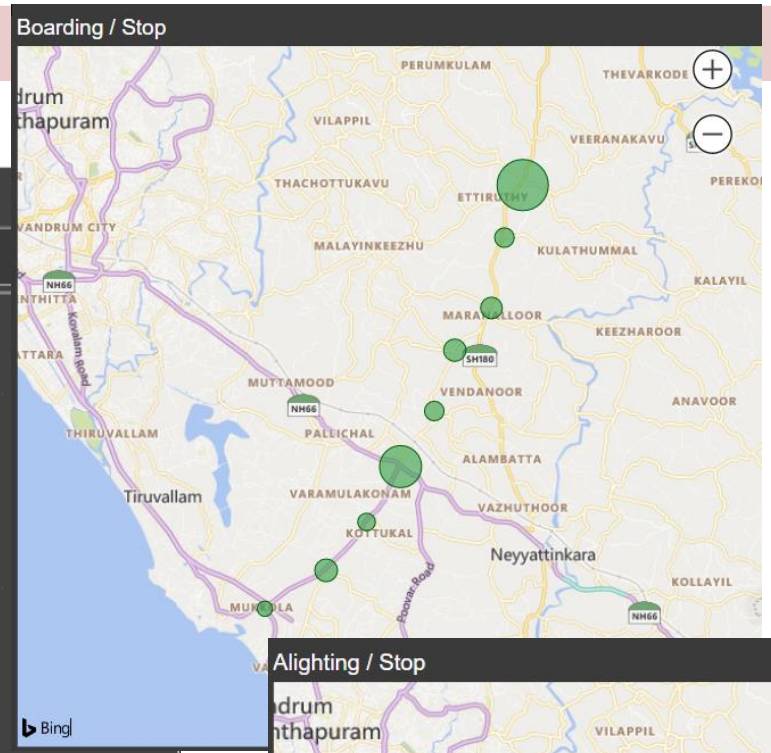
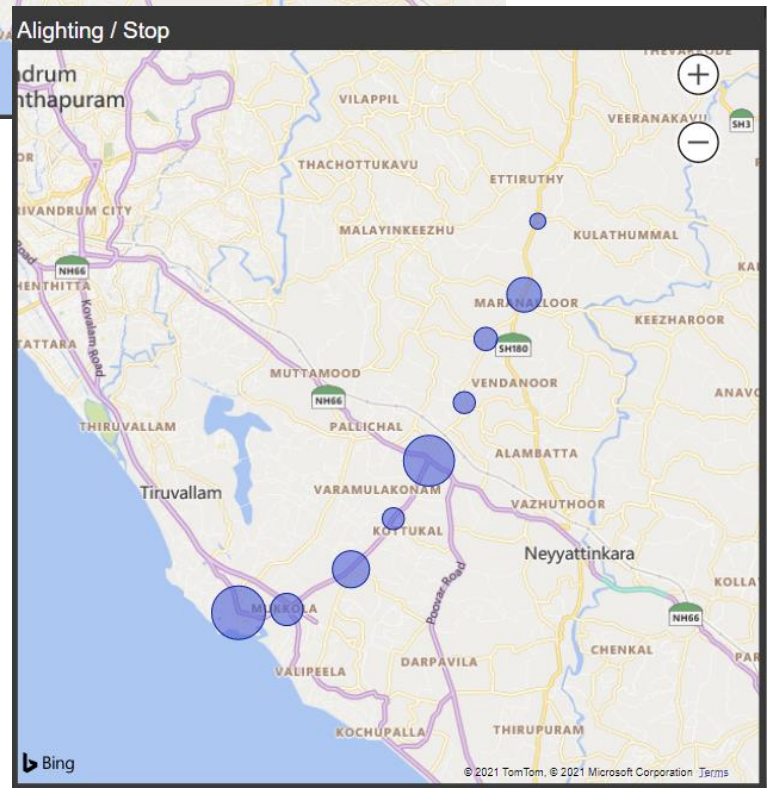
Case 4

Potential Express/ Limited Services

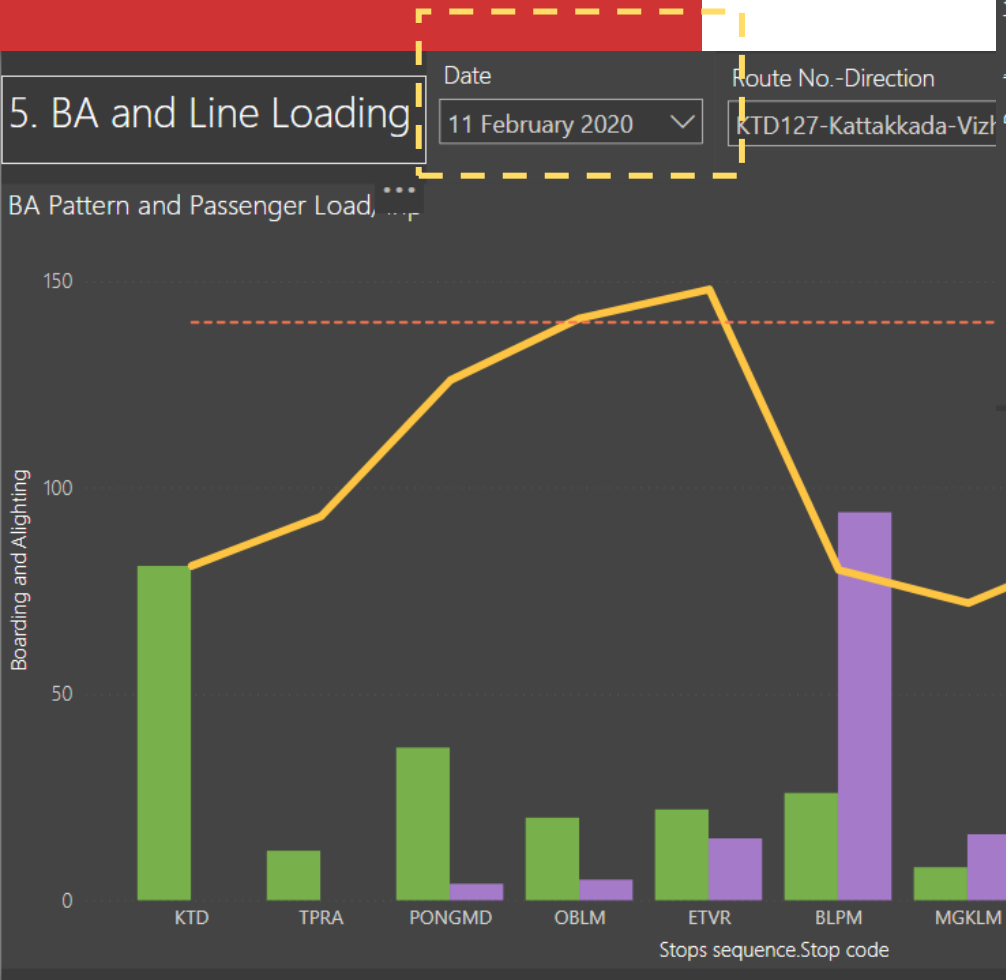


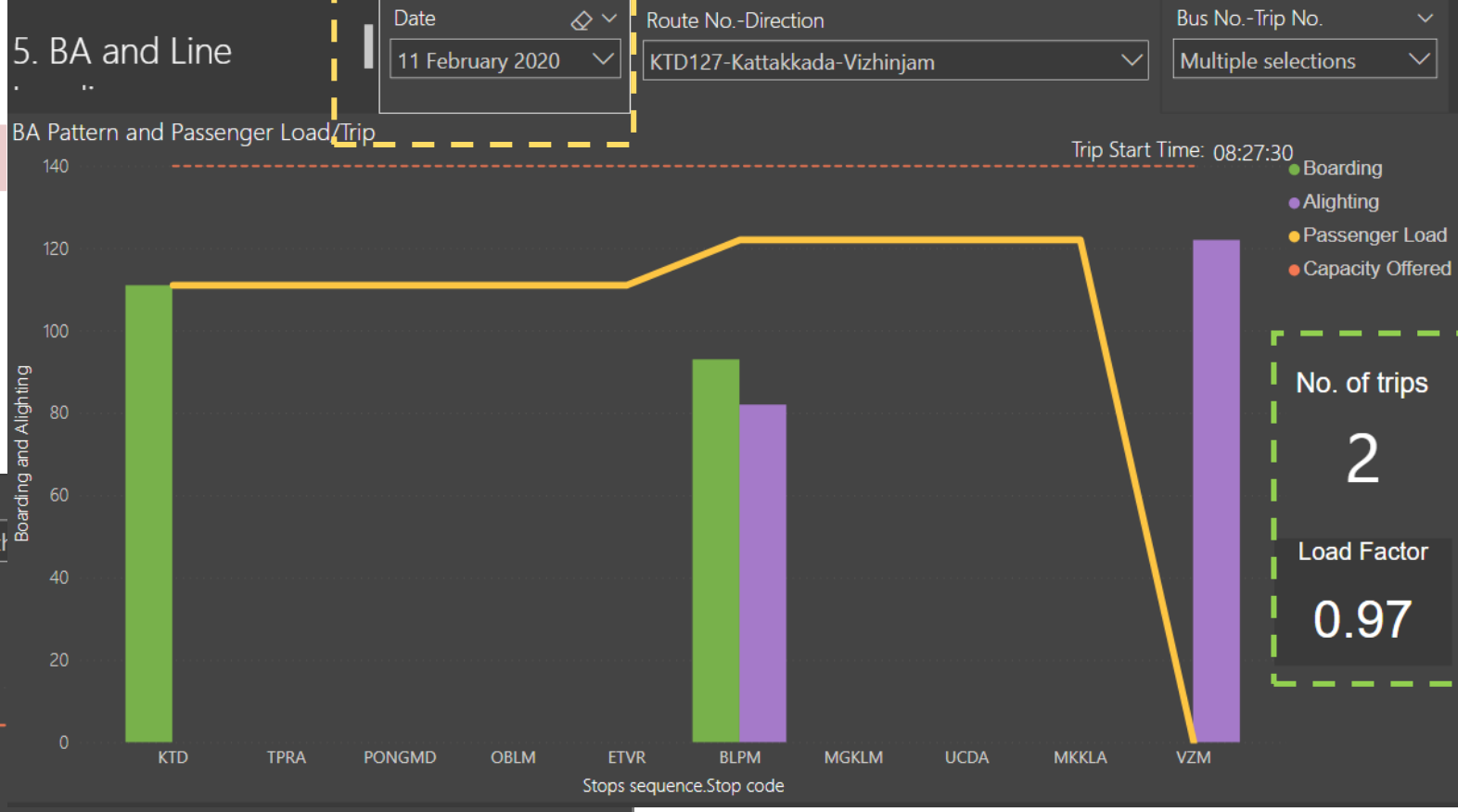




Case 4 - Solution

Potential Express/ Limited Services





Action :

1. 2 trips among 4 trips scheduled as normal service and 2 trips scheduled as express service
2. Load Factor remains same

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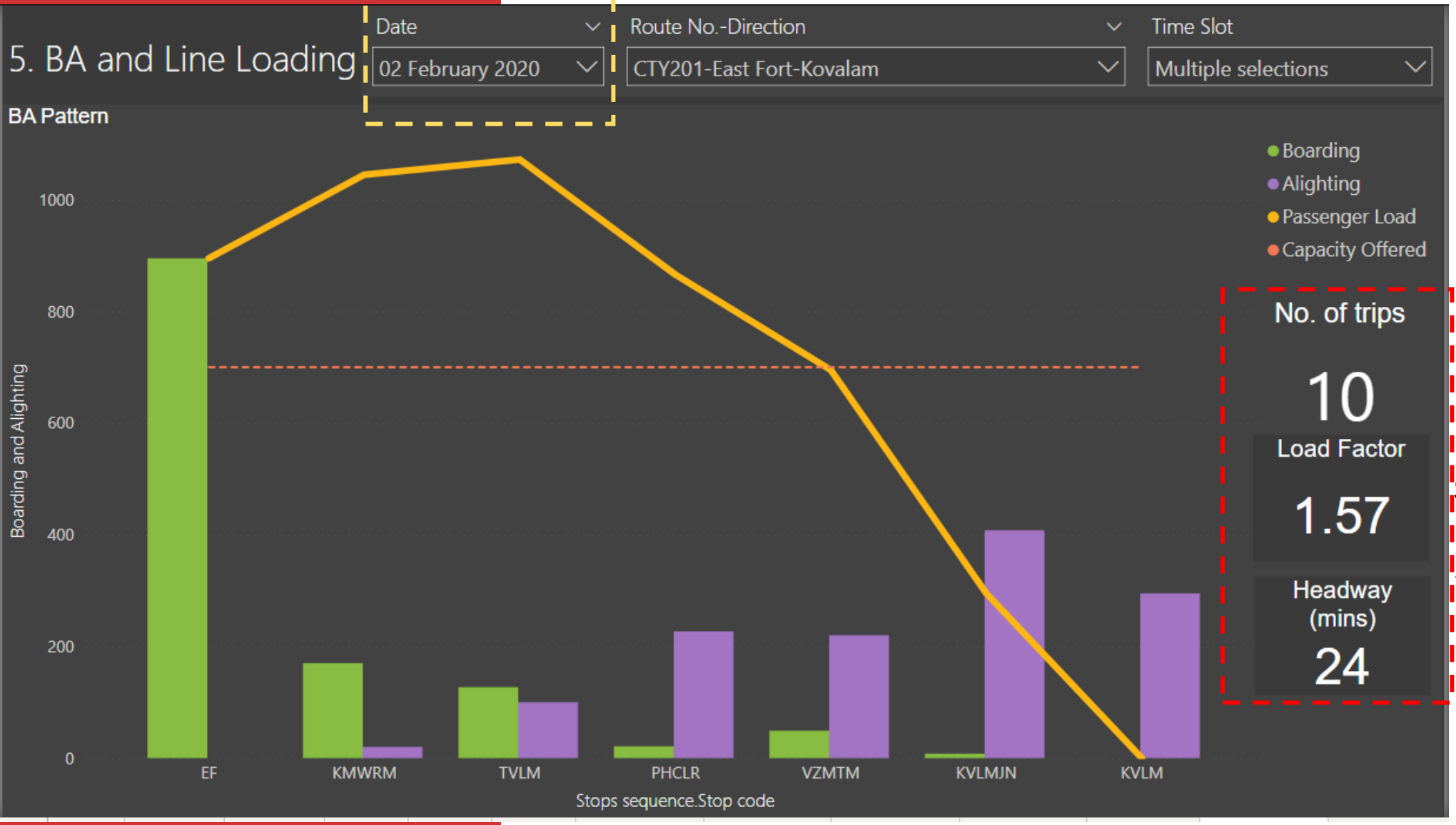
Case 5

High demand on weekend



Problem Details:

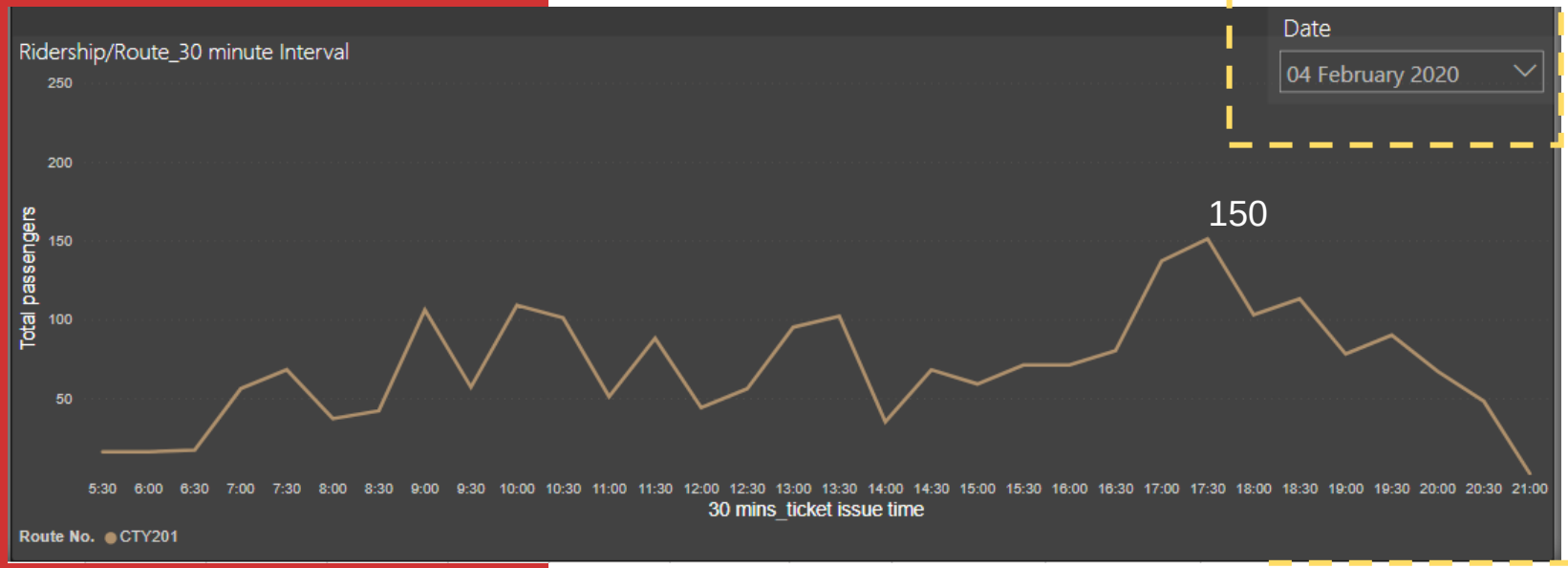
- Full day LF = 0.79
- Since Kovalam is one the major tourist centre in TVM, it is having very high demand on Sunday during evening peak
- Peak period shifted from 4 pm-7pm to 3.30pm-7.30pm

Suggestion:

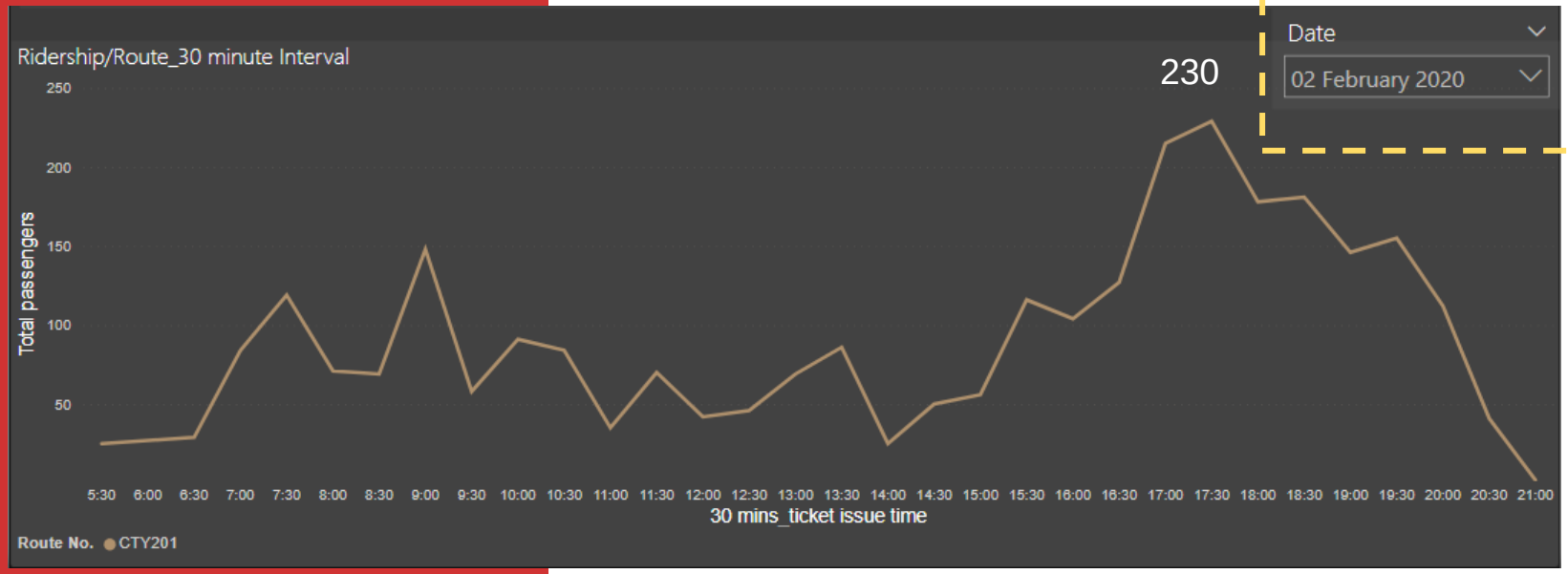
1. Schedule more services in the peak time for such special routes

Case 5

High demand on weekend



Temporal distribution : CTY201 (Tuesday)



Temporal distribution : CTY201 (Sunday)

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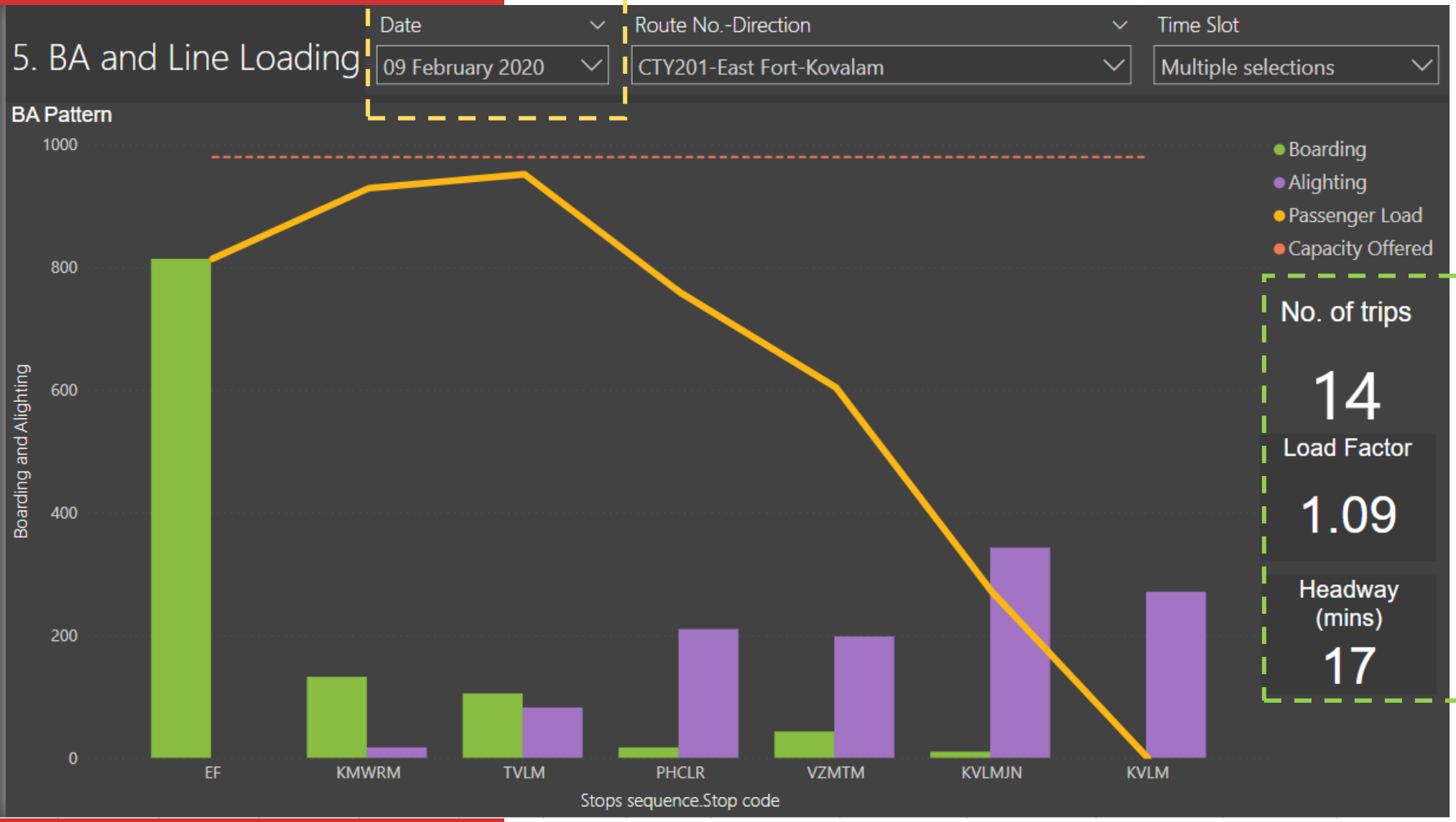
Case 5 - Solution

High demand on weekend



Action :

- Scheduled more services in the peak time (3.30 pm to 7.30 pm)

Parameters	Case 3	Solution
No. of trips	**10**	**14**
LF	1.57	1.09
Headway (mins)	24	17

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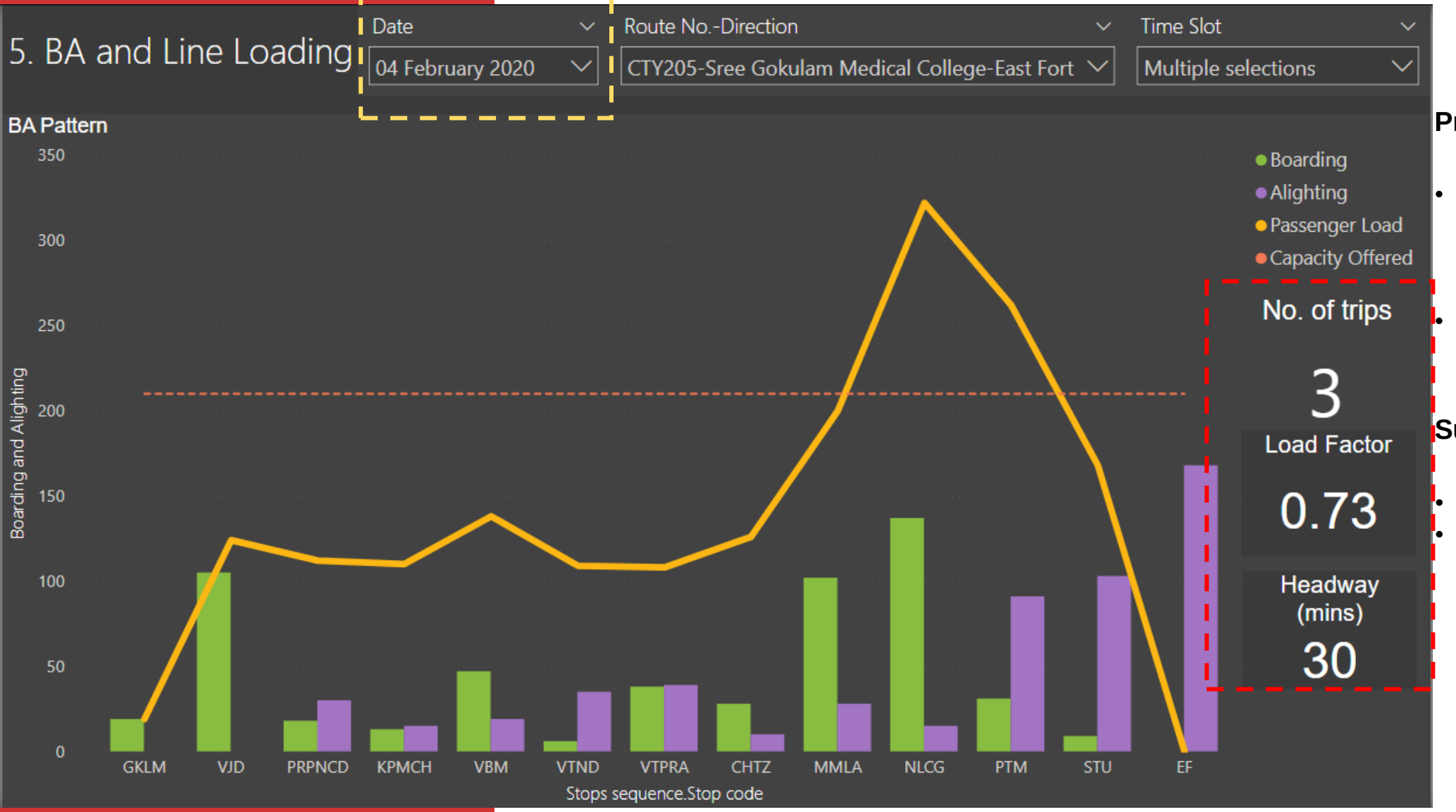
Case 6

School Route and Shuttle Service



Problem Details:

- Even if Overall LF is good, it is visible that High demand from NLCG to EF
- Time slot: 4:00 pm to 5:30 pm

Suggestion :

- Increase no. of trips
- Schedule alternate trips that end at VTPRA and return back to EF during identified peak time.

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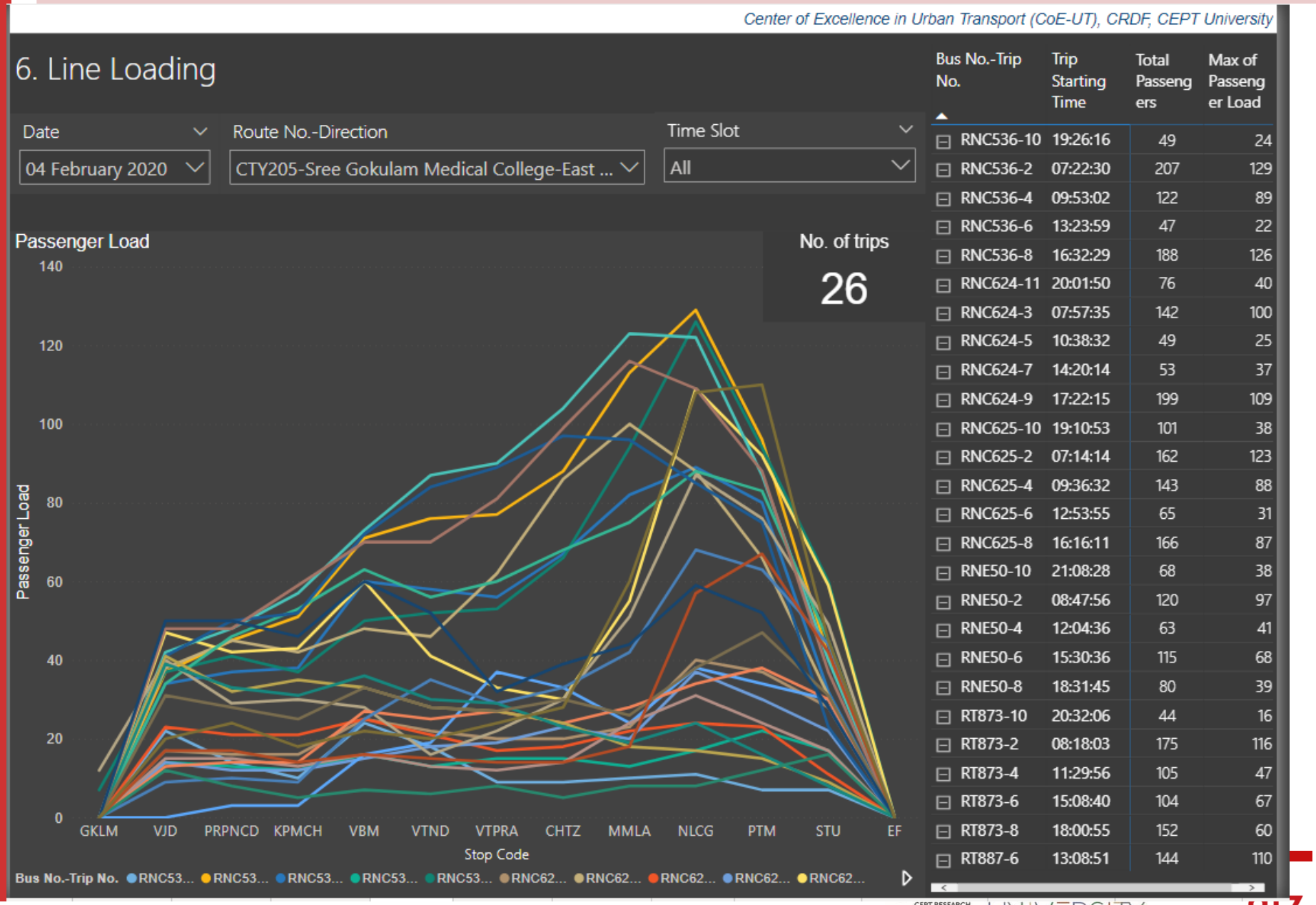
Case 6

1. Trips during school timing are having very high demand from NLCG to EF

School Route and Shuttle Service

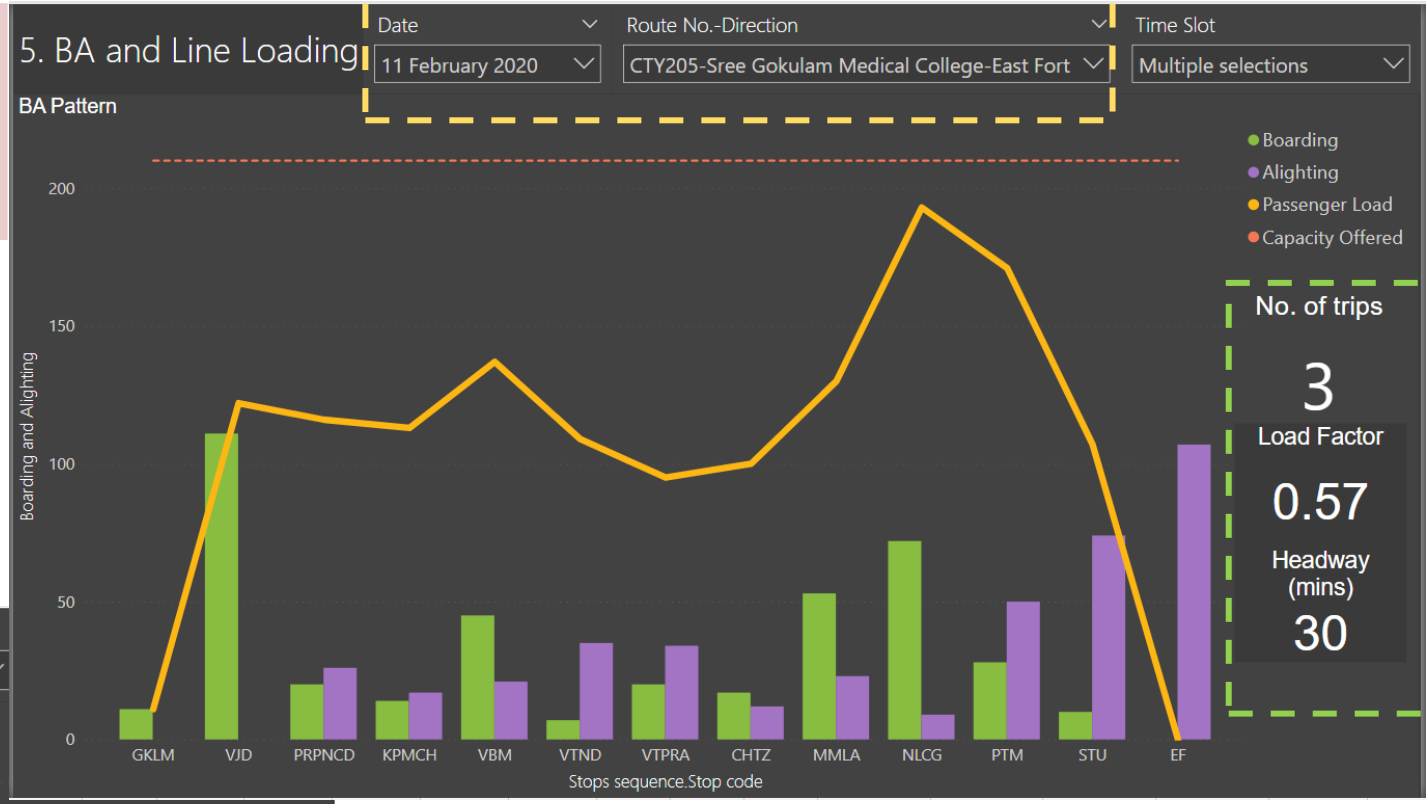


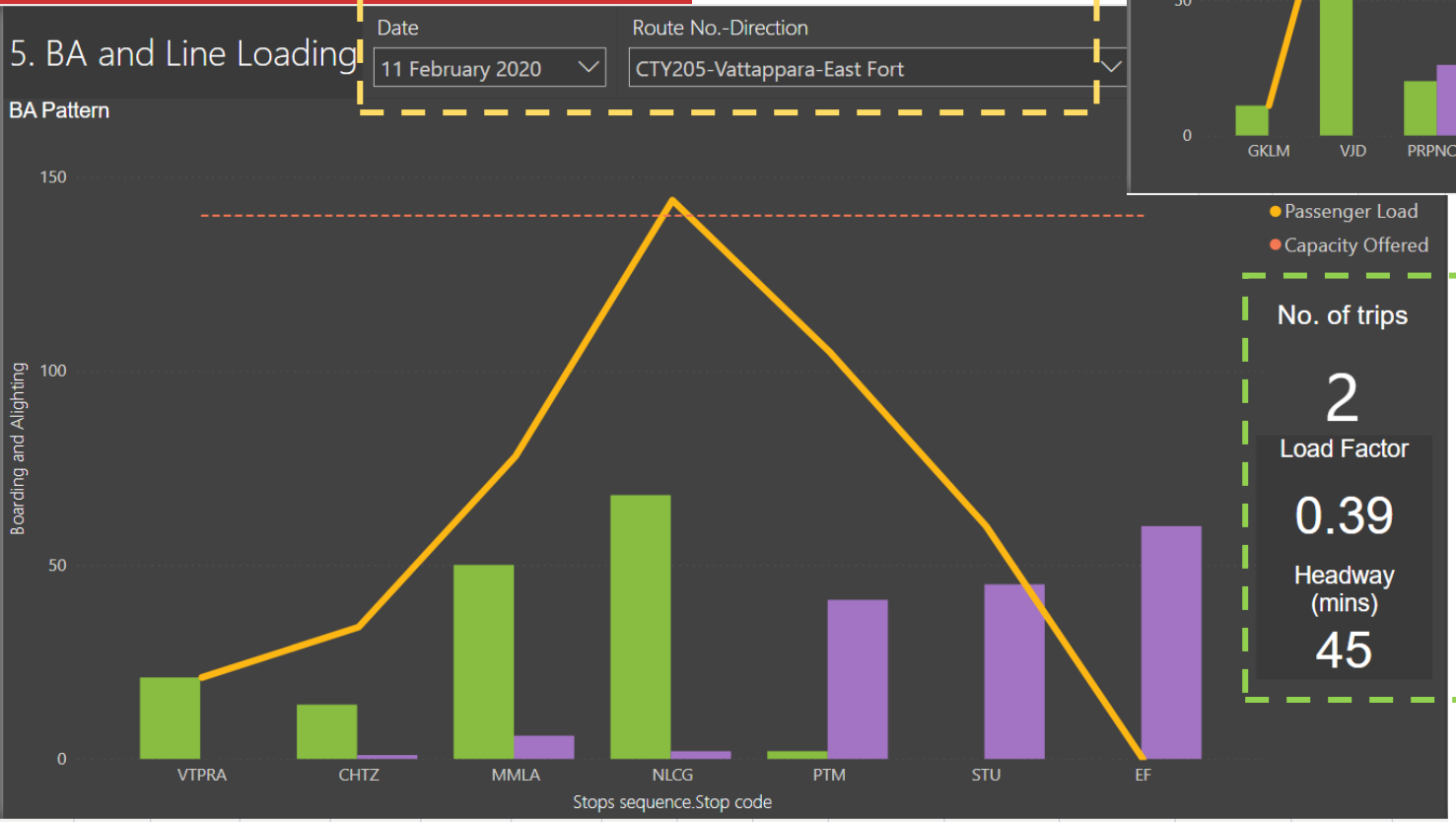
Case 6 - Solution

School Route and Shuttle Service

Action :

- Additional trips are scheduled from VTPRA to EF during peak time





Parameters	Case 3	Solution	
		Same route	Curtailed route
No. of trips	**3**	**3**	**2**
LF	0.73	0.57	0.39
Headway (mins)	30	30	45

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