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POST COVID
FLEET AUGMENTATION ANALYSIS

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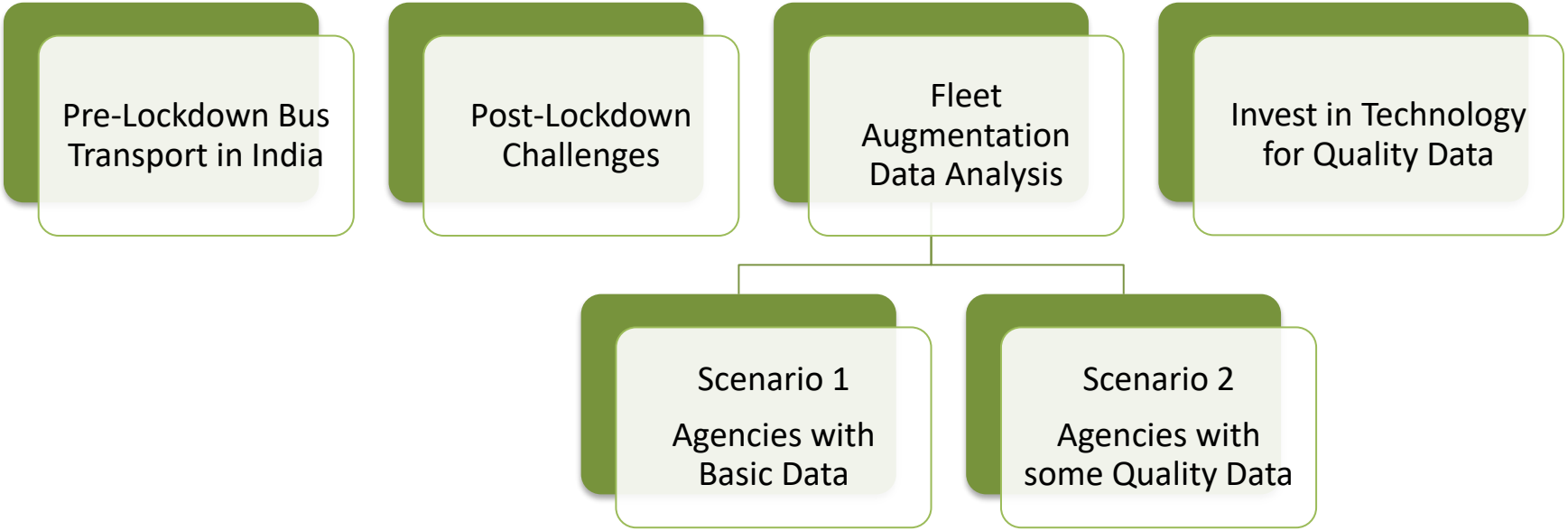
OUTLINE


Pre-Lockdown Bus Transport in India
Post-Lockdown Challenges
Fleet Augmentation Data Analysis
Invest in Technology for Quality Data
Scenario 1
Agencies with Basic Data
Scenario 2
Agencies with some Quality Data

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PRE LOCKDOWN
BUS TRANSPORT IN INDIA

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PASSENGER TRANSPORT IN INDIA

Passenger transport in India is enabled by roadways, railways, airways and waterways.

Share of transport sectors in the total passenger kilometres performed in 2012-13

- **85%** - Roadways
- **13%** - Railways
- **2%** - Airways & Waterways

Share of modes in roadways segment

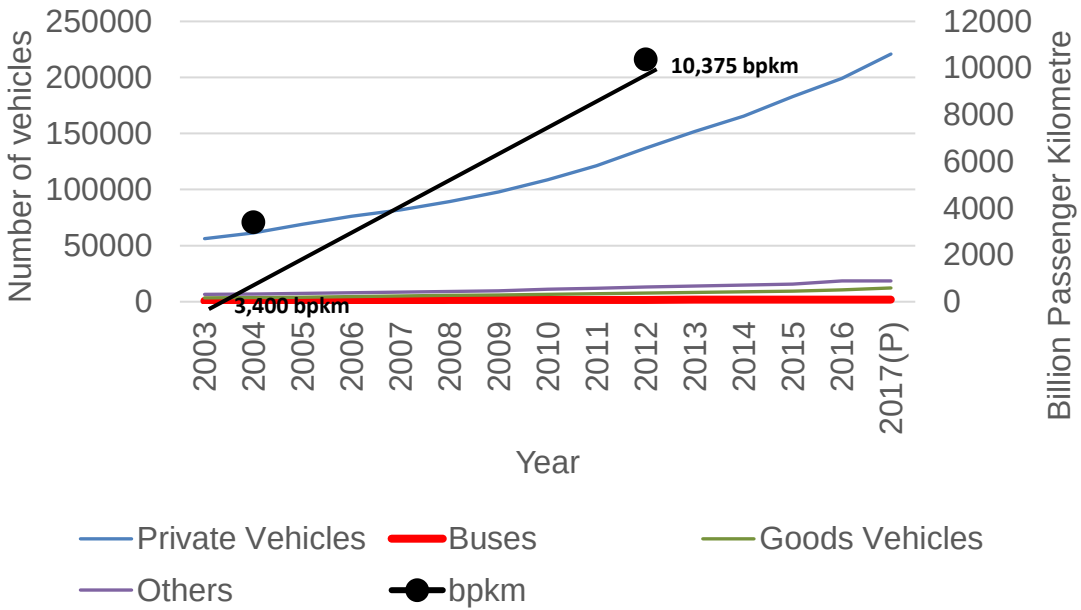
- **85%** - Buses
- **15%** - Other modes

Buses are the predominant mode of public transport in India

Source: CRISL | Railway | Aviation | CIRT

PASSENGER TRANSPORT DEMAND IN INDIA

However, growth of bus systems is not proportionate to the growth in transport demand.



15% growth in passenger traffic

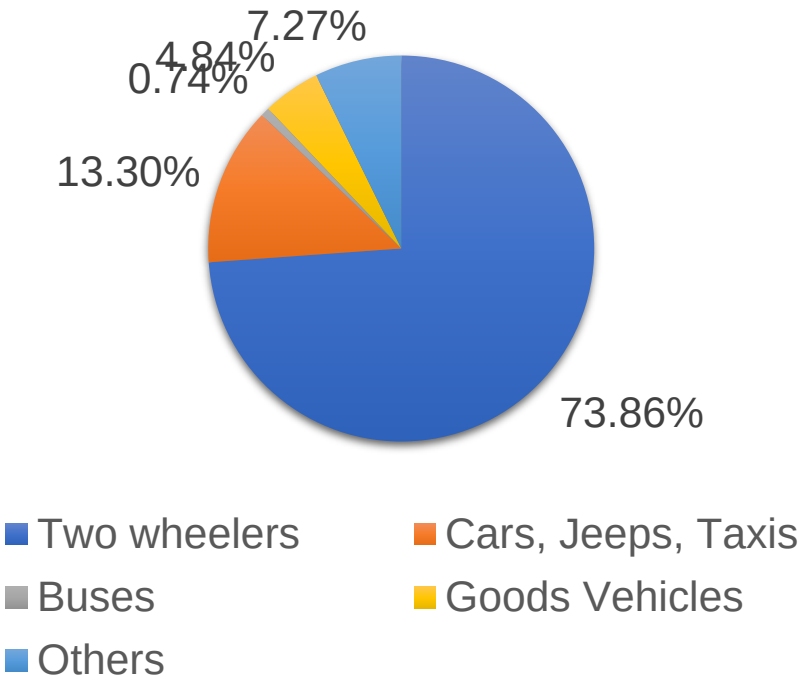
Vs

7% growth in bus fleet

The demand supply gap has led to operations of overcrowded, uncomfortable and unsafe buses reducing their attractiveness to public and resulting in a **shift towards travel by personal vehicles**

Source: Annual Report 2018-19, Ministry of Road Transport and Highways

LOW SUPPLY OF BUSES



- 87% - personal vehicles
- **0.74% - buses**
- **0.06% - public buses**

Source: Annual Report 2018-19, Ministry of Road Transport and Highways

UNSAFE OVERCROWDED BUSES

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POST LOCKDOWN CHALLENGES

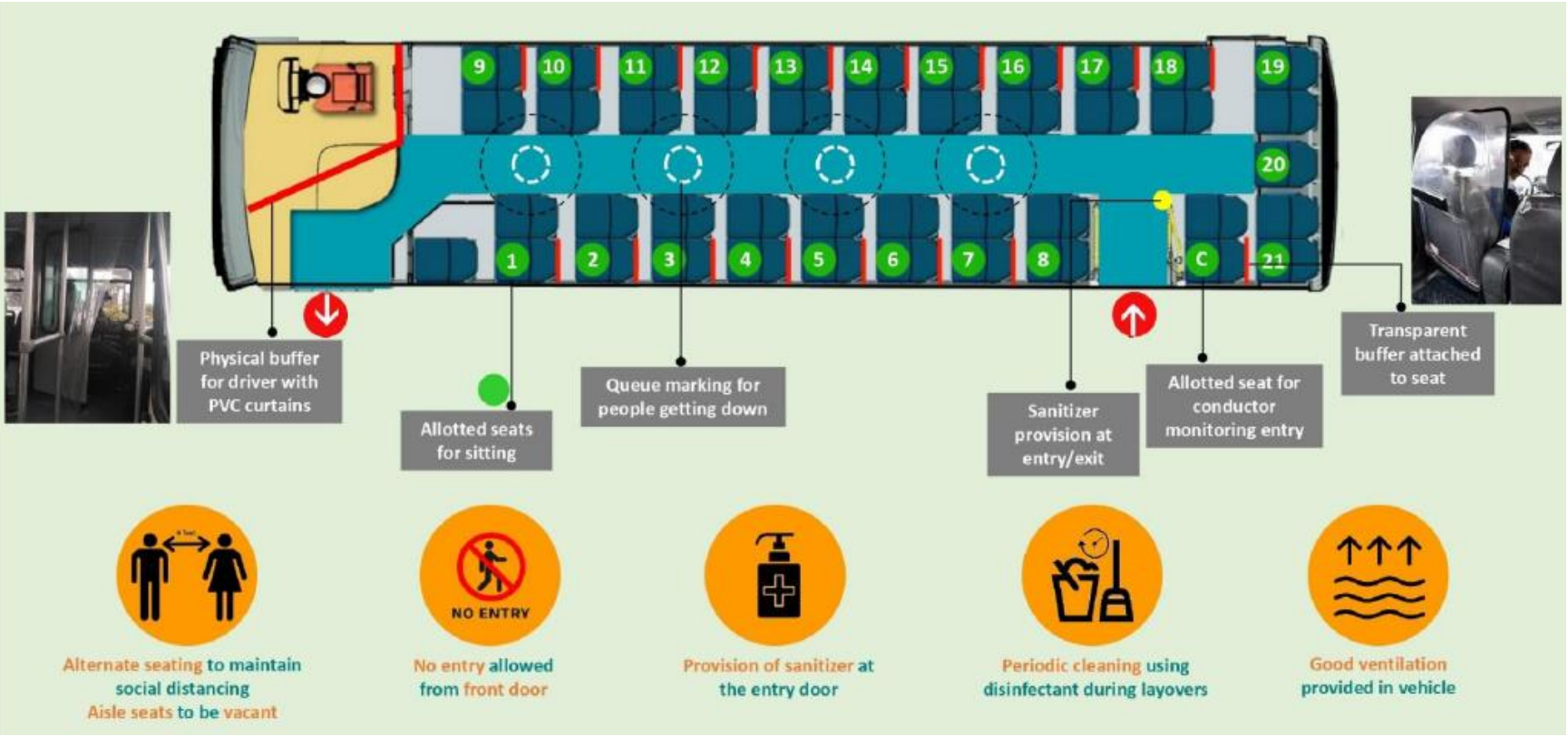
POST-LOCKDOWN CHALLENGES

Revenue

Costs

Image Source: Deccan Herald

POST LOCKDOWN CAPACITY AND MEASURES



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FLEET AUGMENTATION DATA ANALYSIS

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RIDERSHIP VS OCCUPANCY – EXAMPLE 1

Stop Id	Stop Sequence	Boardings	Alightings	Bus Occupancy
1001	1	20	0	20
1002	2	7	2	25
1003	3	0	5	20
1004	4	5	0	25
1005	5	0	4	21
1006	6	6	2	25
1007	7	2	2	25
1008	8	4	4	25
1009	9	0	8	17
1010	10	6	3	20
1011	11	5	8	17
1012	12	0	17	0
		55	**55**	

Ridership

55

Max Occupancy

25

RIDERSHIP VS OCCUPANCY – EXAMPLE 2

Stop Id	Stop Sequence	Boardings	Alightings	Bus Occupancy
2001	1	15	0	15
2002	2	7	0	22
2003	3	5	0	27
2004	4	5	0	32
2005	5	0	4	28
2006	6	0	2	26
2007	7	2	2	26
2008	8	4	4	26
2009	9	0	5	21
2010	10	3	3	21
2011	11	1	8	14
2012	12	0	14	0
		42	**42**	

Ridership

42

Max Occupancy

32

TRIPS NEEDED @ 25 POST-LOCKDOWN CAPACITY

Measure	Ridership	Max Occupancy	#Trips Needed Based on Ridership	#Trips Needed Actual
Example 1	55	25	3	1
Example 2	42	32	2	2

Ridership Vs. Occupancy

Trip & stop level ridership is needed to estimate the occupancy

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FLEET AUGMENTATION DATA ANALYSIS

Scenario 1 – Agencies with Basic Data

METHODOLOGY

1. Estimate load factor per hour
   #Trips per hour / Average #Trips per day
2. Estimate Pre-Lockdown demand
   #Trips * Capacity * Load Factor
3. Estimate Post-Lockdown demand
   Pre-Lockdown Demand * Reduction Factor
4. Estimate Post-Lockdown Trips
   Post-Lockdown Demand / Reduced COVID Capacity

METHODOLOGY CONTD.

5

Estimate Additional Trips Required

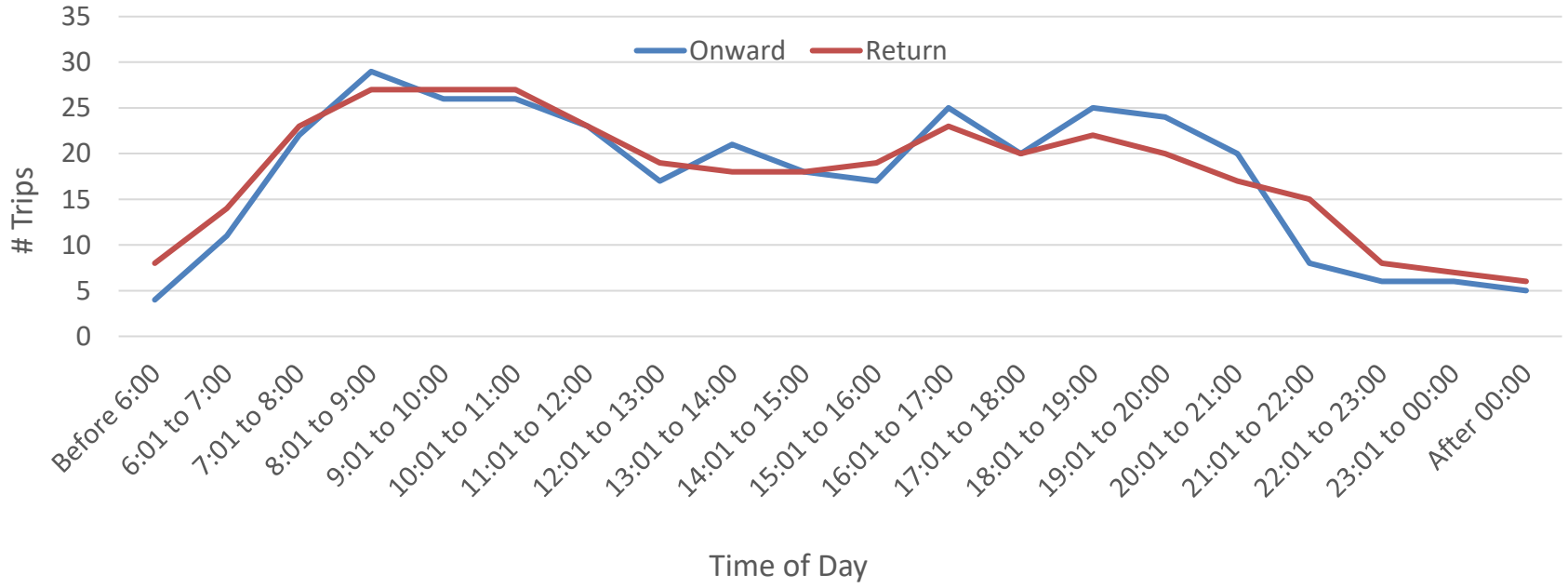
Post-Lockdown Trips – Pre-Lockdown Trips

6

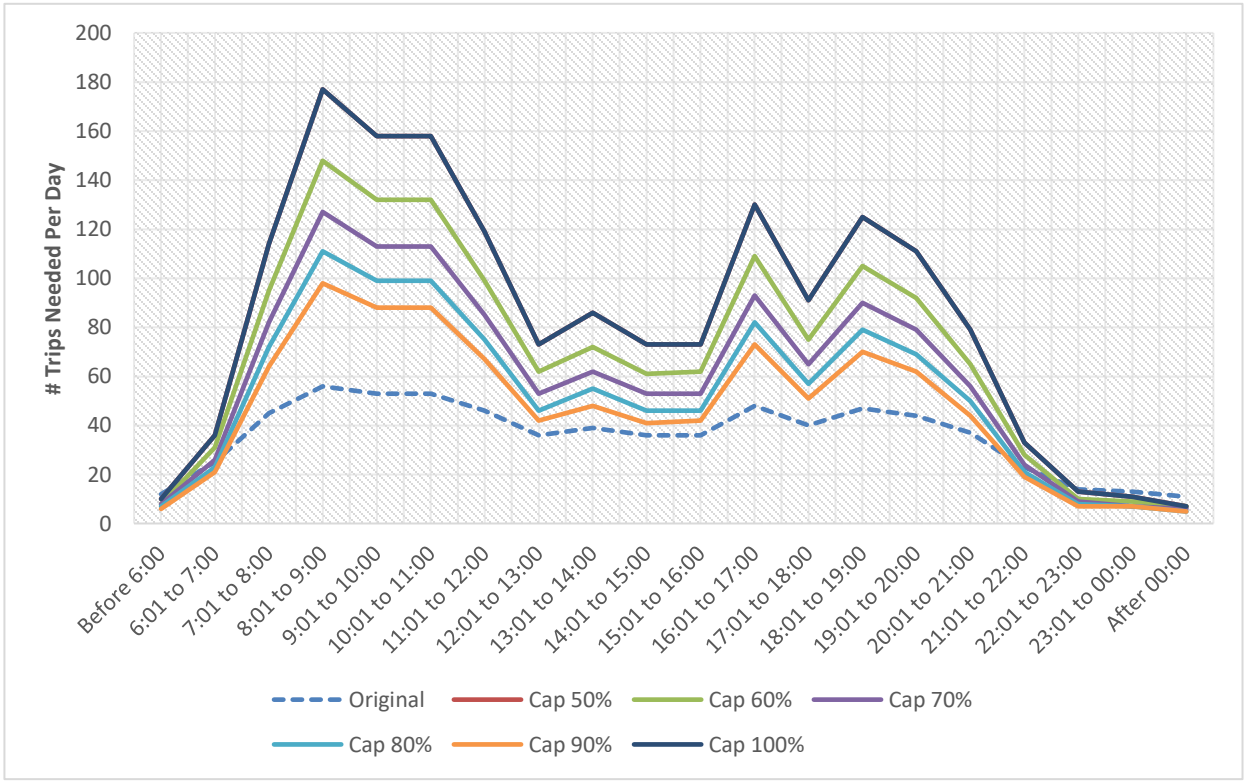
Estimate Additional Fleet Required

Additional Trips / Avg. #Trips per Bus per Day

BUS SCHEDULES / FREQUENCY

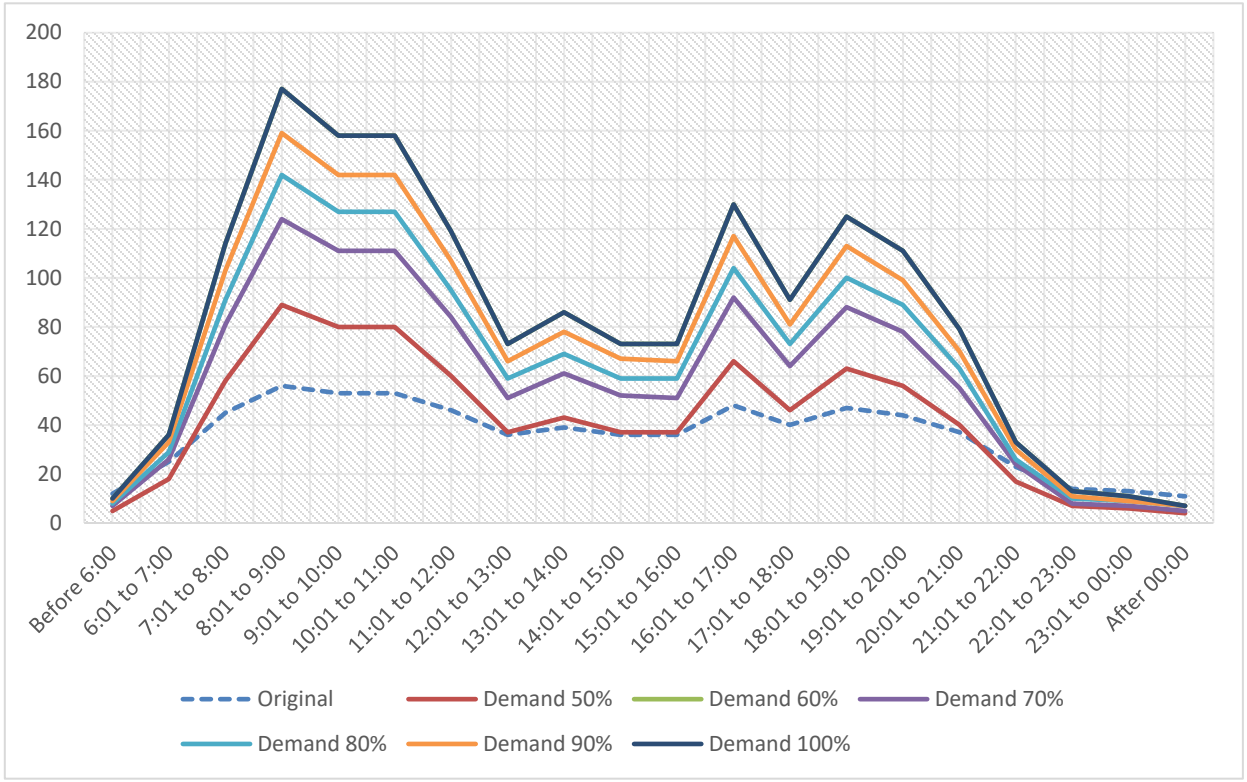


SENSITIVITY ANALYSIS (SUPPLY)



Number of trips required at pre-lockdown demand and various post-lockdown capacities.

SENSITIVITY ANALYSIS (DEMAND)



Number of trips required at varying post-lockdown demand at 50% pre-lockdown capacity.

SCENARIO 1 SUMMARY

- Assumes # trips and load factor are proportionate
- Not accurate
- Gives general sense of post-lockdown need
- Various demand and supply sensitivities
- No other optimization analysis can be done
- Leasing / running more than required services or buses results in additional cost to the agency

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FLEET AUGMENTATION DATA ANALYSIS

Scenario 2 – Agencies with some Quality Data

METHODOLOGY

Stop Id	Stop Sequence	Boardings	Alightings	Bus Occupancy
2001	1	15	0	15
2002	2	7	0	22
2003	3	5	0	27
2004	4	5	0	32
2005	5	0	4	28
2006	6	0	2	26
2007				26
2008				26
2009				21
2010				21
2011	11	1	8	14
2012	12	0	14	0
		42	**42**	

Max Occupancy
32

1. Use ETM data to calculate pre-lockdown max occupancy for each trip (max occ)

2. Calculate Percentage of dysfunctional or Non-ETM buses (non-ETM%)

3. Estimate Post-Lockdown ETM Trips
Pre-Lockdown Occupancy (max occ) / Reduced COVID Capacity

4. Estimate Post-Lockdown non-ETM Trips
Post-Lockdown ETM Trips * non-ETM%

METHODOLOGY CONTD.

5

Estimate Additional Trips Required

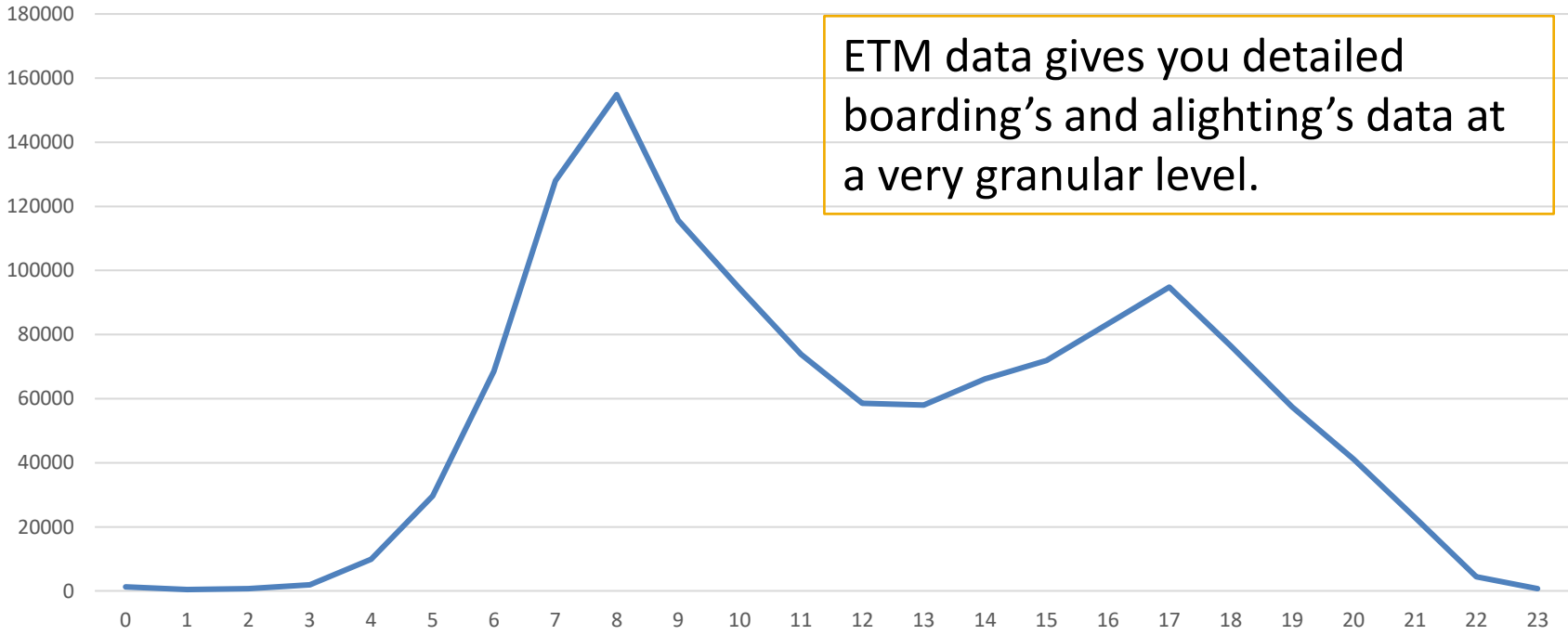
Post-Lockdown Trips – Pre-Lockdown Trips

6

Estimate Additional Fleet Required

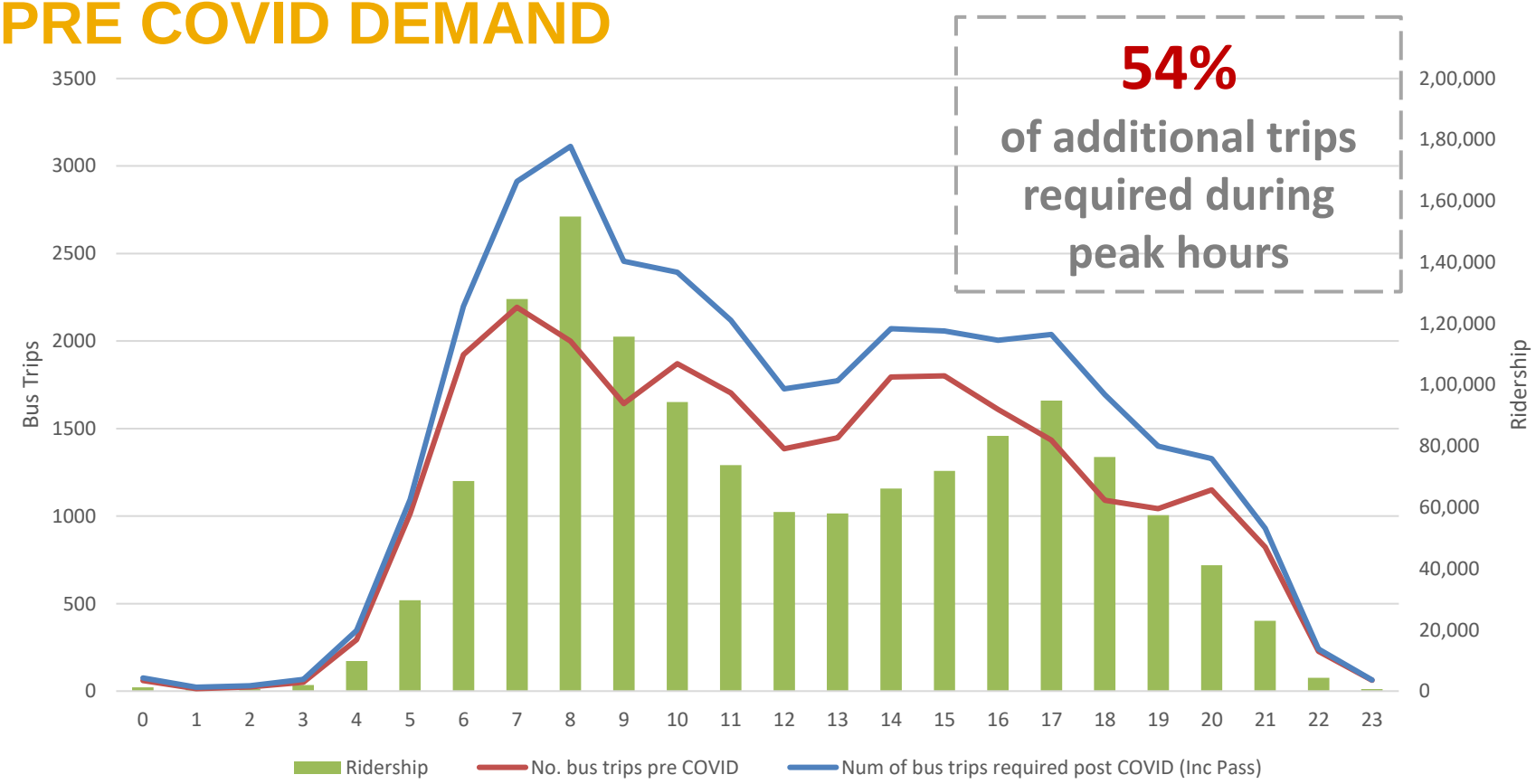
Additional Trips / Avg. #Trips per Bus per Day

RIDERSHIP BASED ON ETM DATA

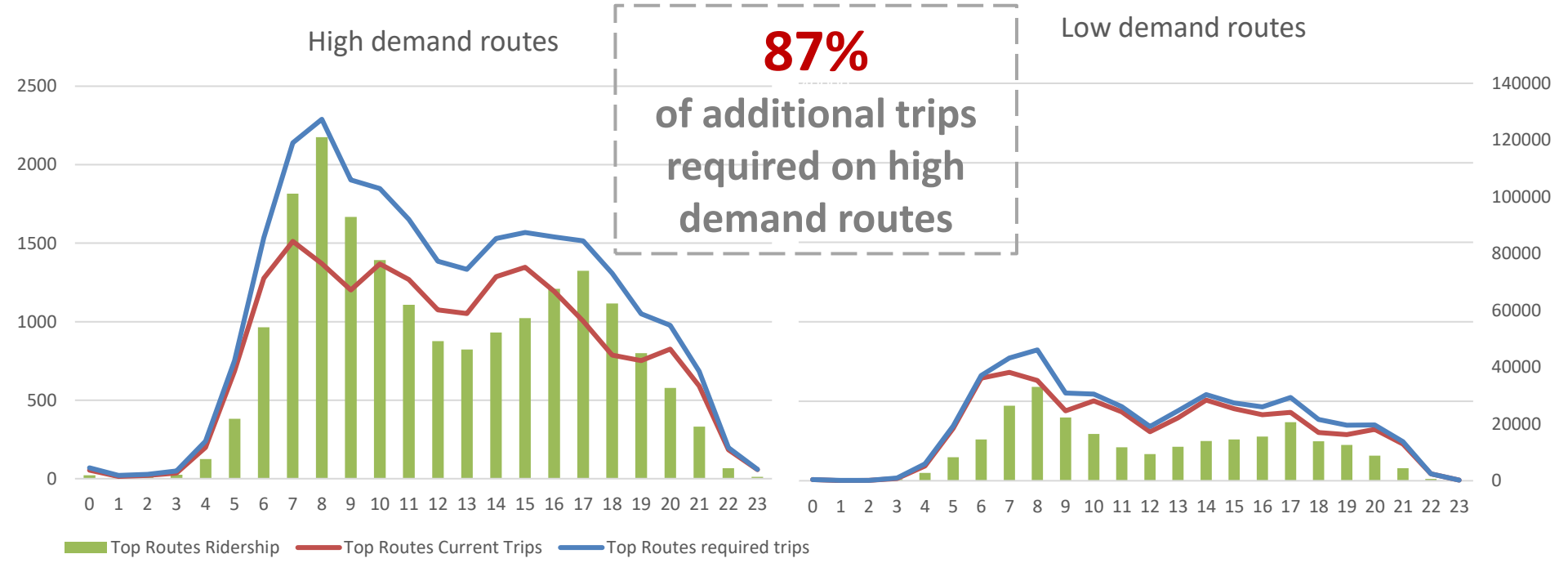


ETM data gives you detailed boarding's and alighting's data at a very granular level.

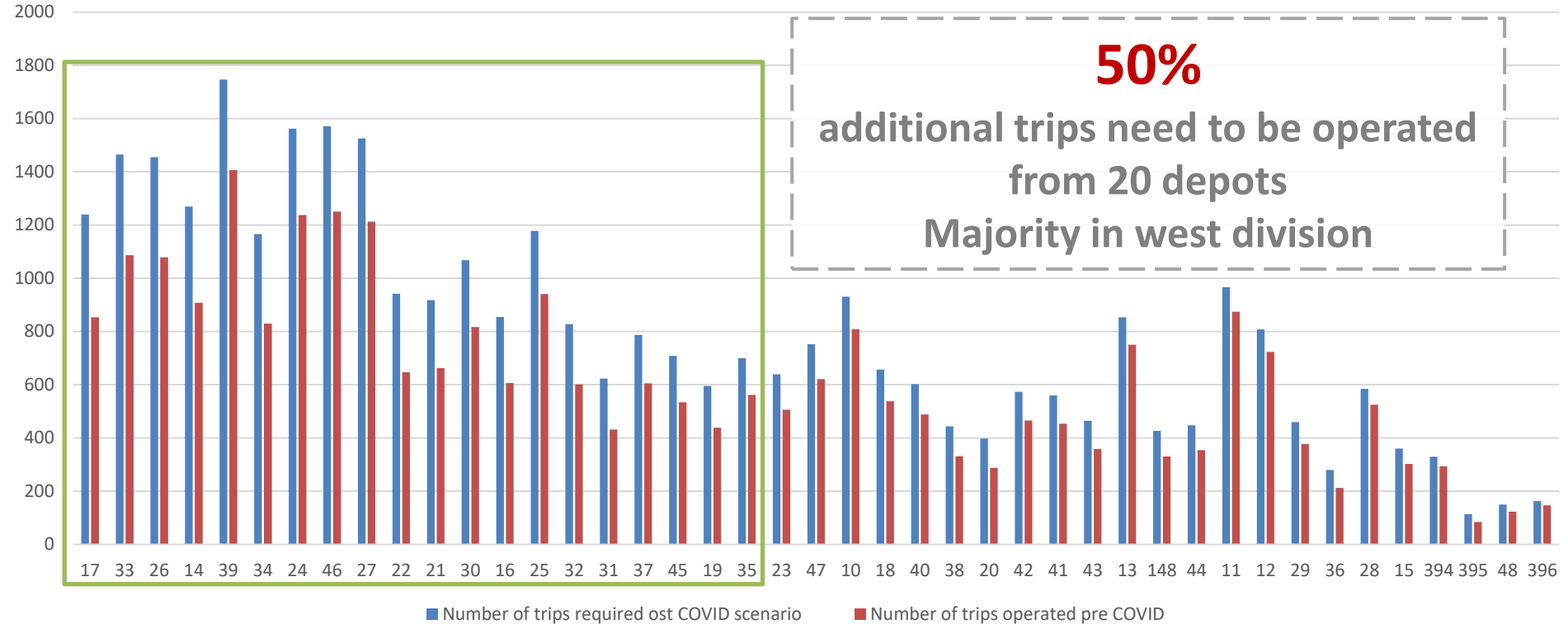
NETWORK LEVEL GAP IN SUPPLY COMPARED TO PRE COVID DEMAND



GAP IN THE REQUIRED SERVICES FOR HIGH AND LOW DEMAND SERVICING ROUTES



DEPOT LEVEL ASSESSMENT



50%

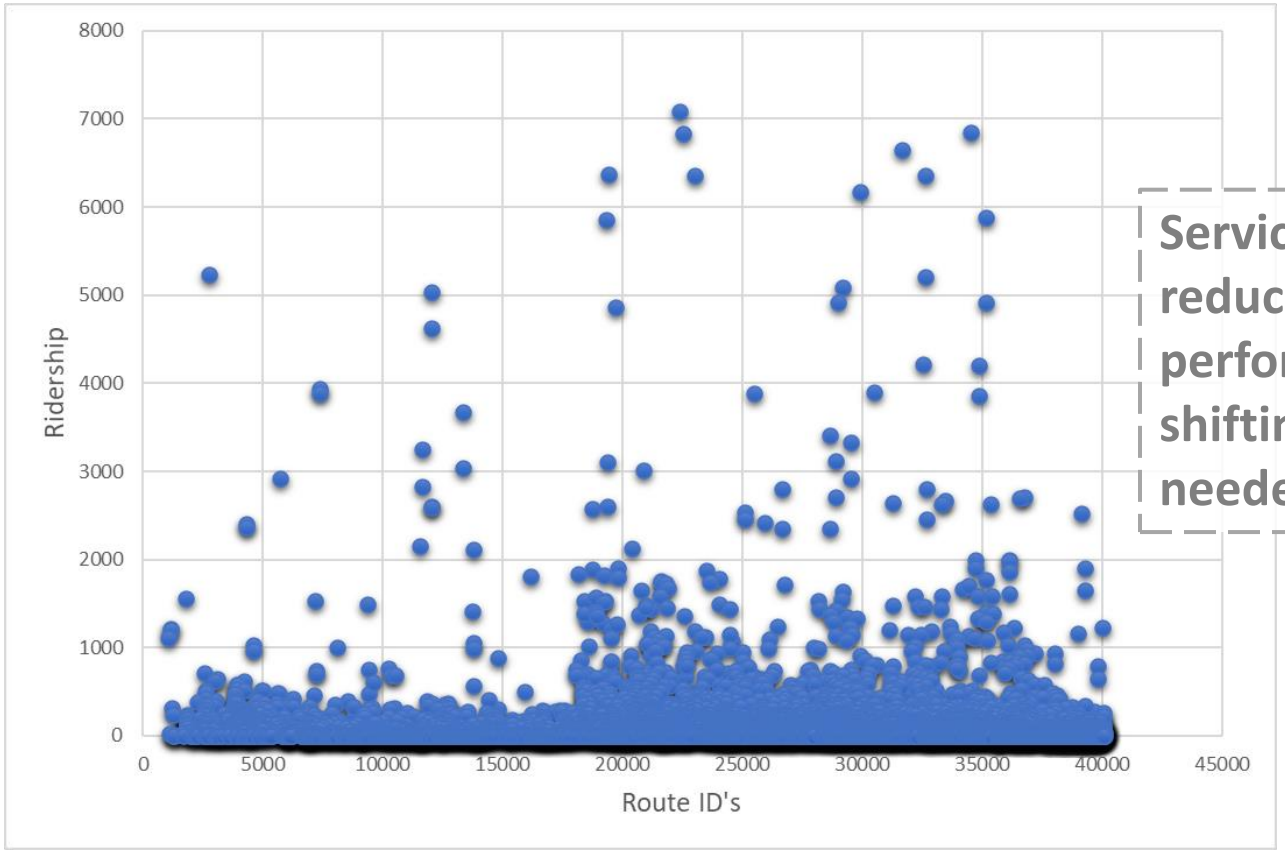
additional trips need to be operated from 20 depots

Majority in west division

SENSITIVITY ANALYSIS

@25 Passengers/bus	**28 to 44%** More bus trips	**9 to 10** Trips/bus/day
@30 Passengers/bus	**18 to 30%** More bus trips	**8 to 9** Trips/bus/day
@35 Passengers/bus	**11 to 21%** More bus trips	**8 to 9** Trips/bus/day

RIDERSHIP BY ROUTE



Services can be optimized by reducing frequency on non – performing routes and shifting the supply to much needed routes

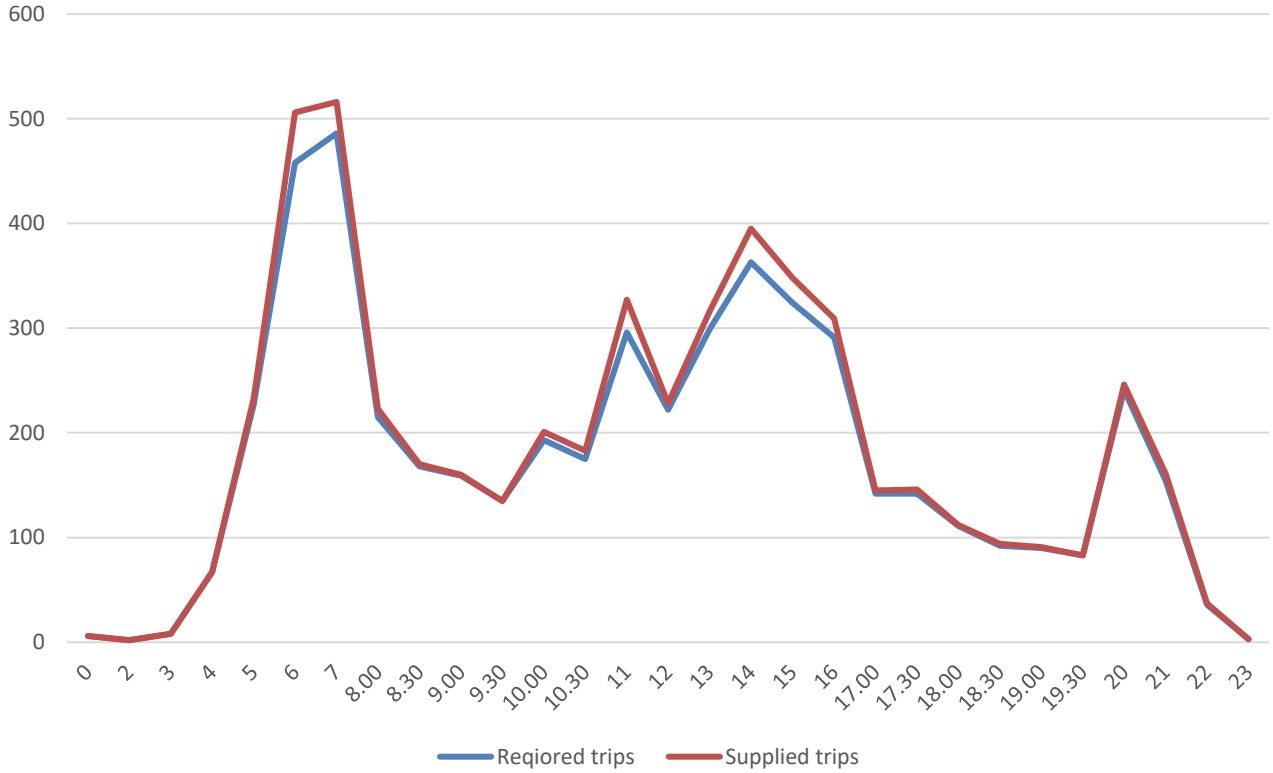
OVERSUPPLIED ROUTES

439

Bus trips can be re-routed to high demand routes

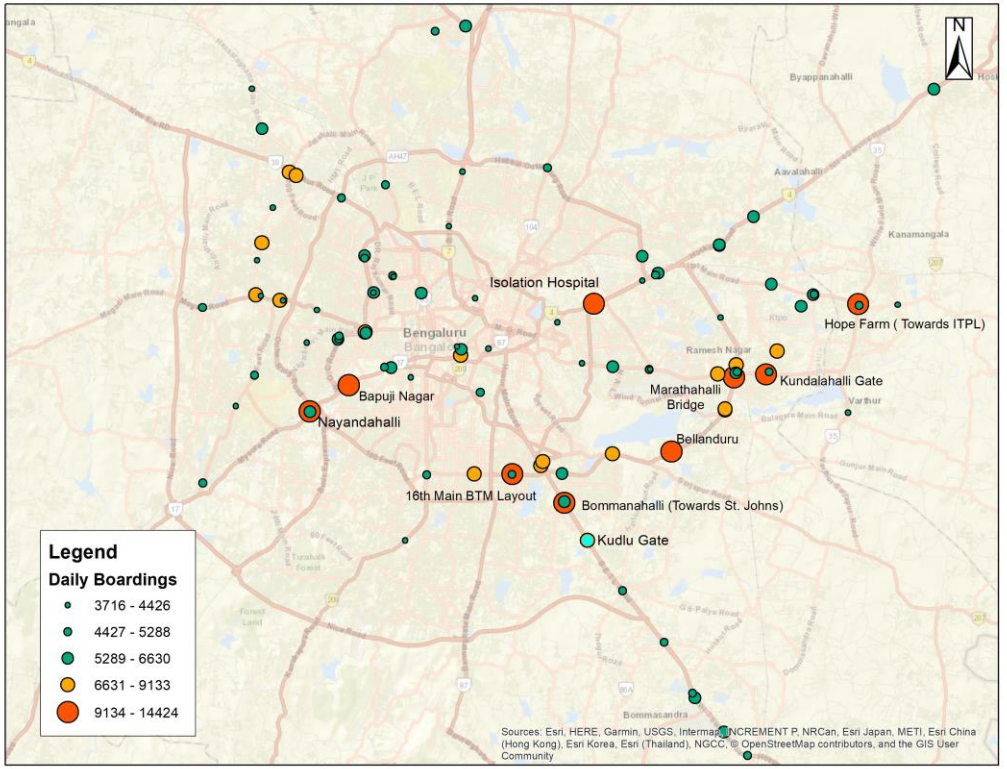
263

From oversupplied low demand routes



BUS STOPS THAT REQUIRE INTERVENTION

Identifying stops with higher boarding and alighting activity can help focus post-lockdown efforts and improve safety of passengers and operators



SCENARIO 2 SUMMARY

- Analysis is based on actual ridership data
- Gives realistic sense of post-lockdown need
- Various demand and supply sensitivities
- Data driven optimization to improve post-lockdown services possible with limitations
- Assumptions are required if agencies do not have 100% ETM data or do not capture pass riders

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INVEST IN TECHNOLOGY FOR QUALITY DATA

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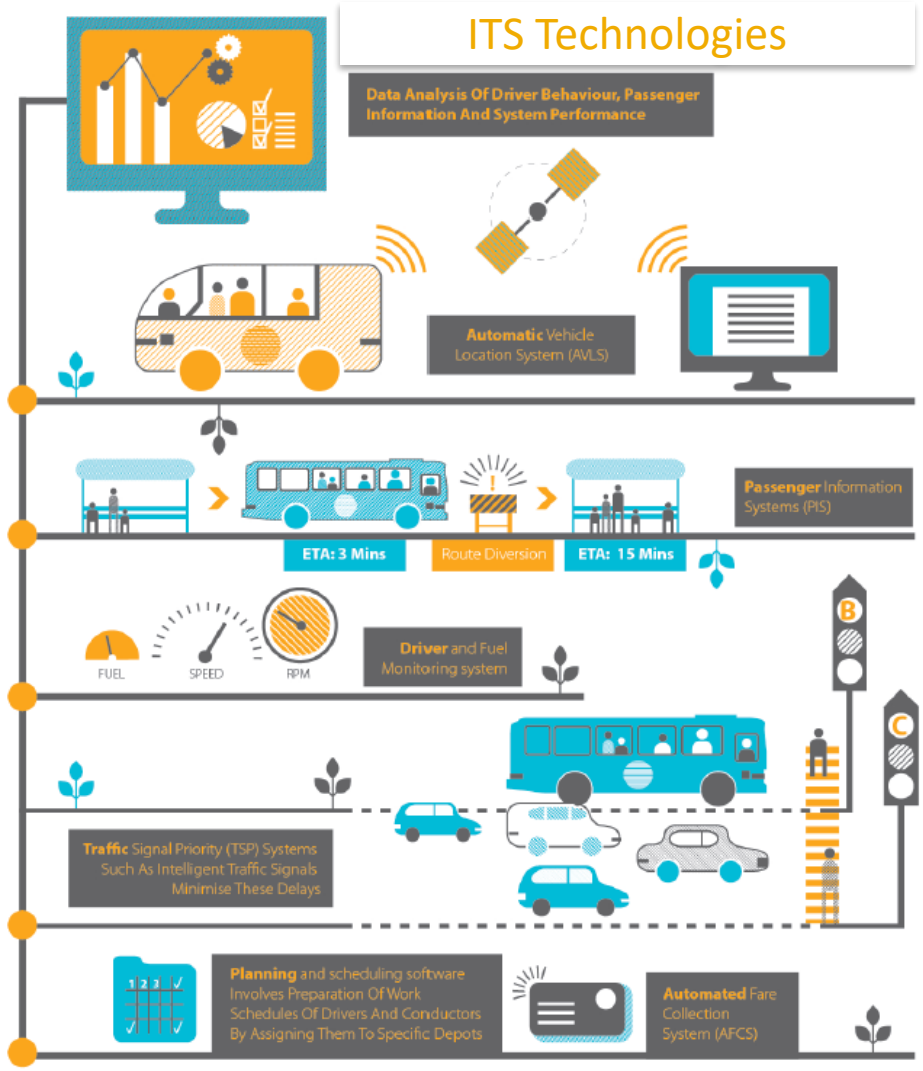
ITS Technologies



- AUTOMATIC VEHICLE LOCATION SYSTEM
- PASSENGER INFORMATION SYSTEM
- DRIVER & FUEL MONITORING SYSTEM
- PLANNING & SCHEDULING SOFTWARE
- TRANSIT SIGNAL PRIORITY
- AUTOMATIC FARE COLLECTION SYSTEM

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THANK YOU

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