27 Januari 2026

SIMULATING PRIVATE SHUTTLE – PUBLIC BUS SERVICE SCENARIOS IN HIGASHIHIROSHIMA: ACCESSIBILITY AND TRAVEL PATTERN IMPACT

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OUTLINE

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- INTRODUCTION
- RESEARCH OBJECTIVES AND QUESTIONS
- CONCEPTUAL FRAMEWORK
- CURRENT TRAVEL PATTERN
- SIMULATION
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Rural Public Transit Crisis

- 85% of rural bus operators below break-even.
- Chugoku region: 60% rail lines revenue < 50% costs.
- Hiroshima Prefecture: 74% municipalities low sustainability.

(WEF, 2020)

Private Shuttle – The Emerging Solution

- Enables employes accessibility and mobility

  (Peker, 2023)

- Addresses underserved geographic areas strategically

  (Ryusuke et al, 2022)

- Connects residential areas to job sites

  (Commute Seattle, 2021)

Potential Challenges: Fragmentation Creates Inefficiency

- Shuttle and public transport operate separately
- Reduced public transit ridership potential
- Operational cost burden on private alone

Closing The Data Gap Through Simulation

- Awareness
  - 83% recognize crisis is urgent
- Data Gap
  - 63% have no benchmarking process
  - 44% have no private operator data
  - Only 1 city has complete stop data

WEF, 2020

Surveys of 23 cities (Local Government)

- Solution
  - MATSim fills the gap
  - Simulates *what-if* scenarios
  - Provides evidence for policy decisions

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Research Objectives and Questions

- To understand how simulated integration of private shuttle and public bus services affects accessibility and travel pattern in Higashihiroshima
- To derive policy insights for sustainable transport integration through scenario comparison

RQ 1. How do current travel patterns of private shuttle compare to public bus in Higashihiroshima?

RQ 2. What are the potential impacts of private shuttle-public bus integration scenarios on accessibility and travel patterns?

RQ 3. What policy recommendations emerge from comparing baseline and integration scenarios?

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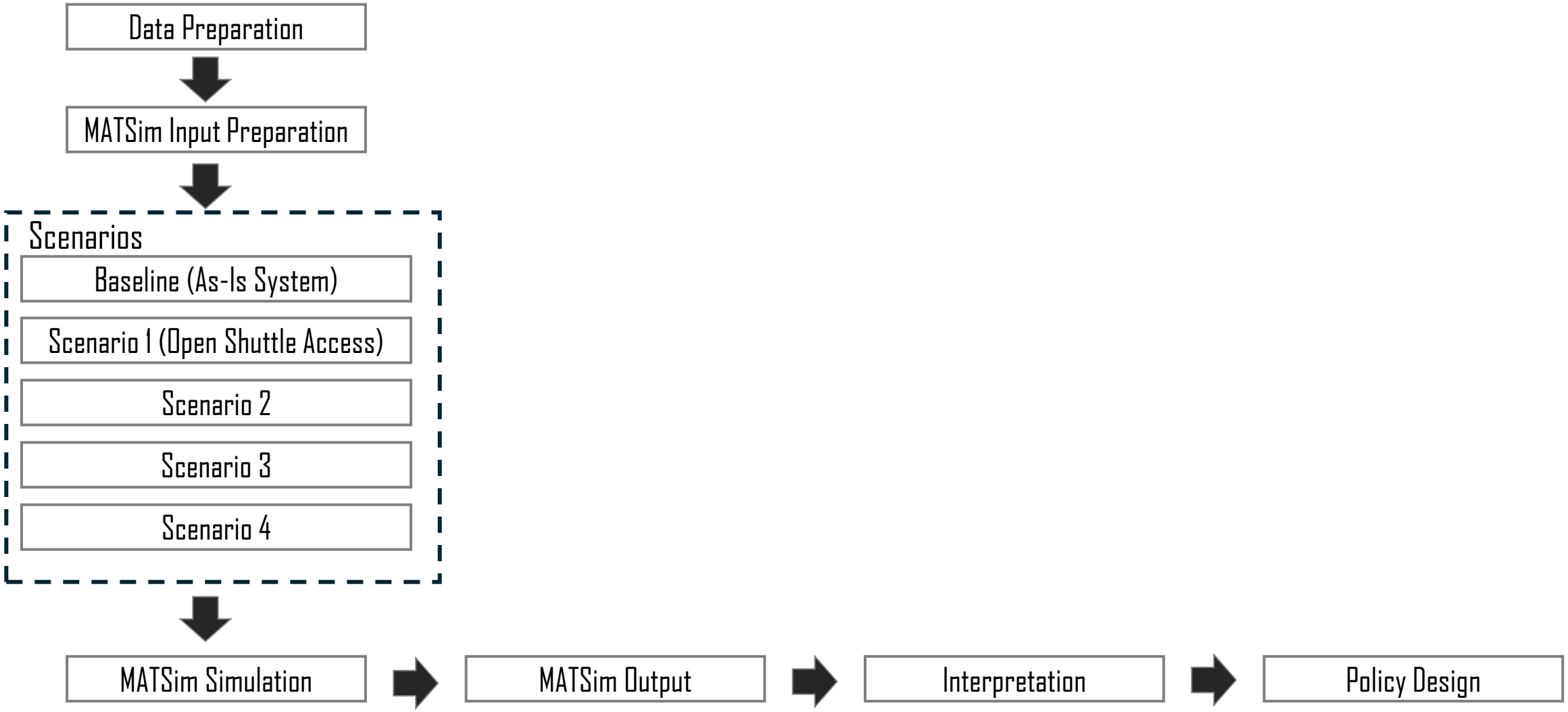
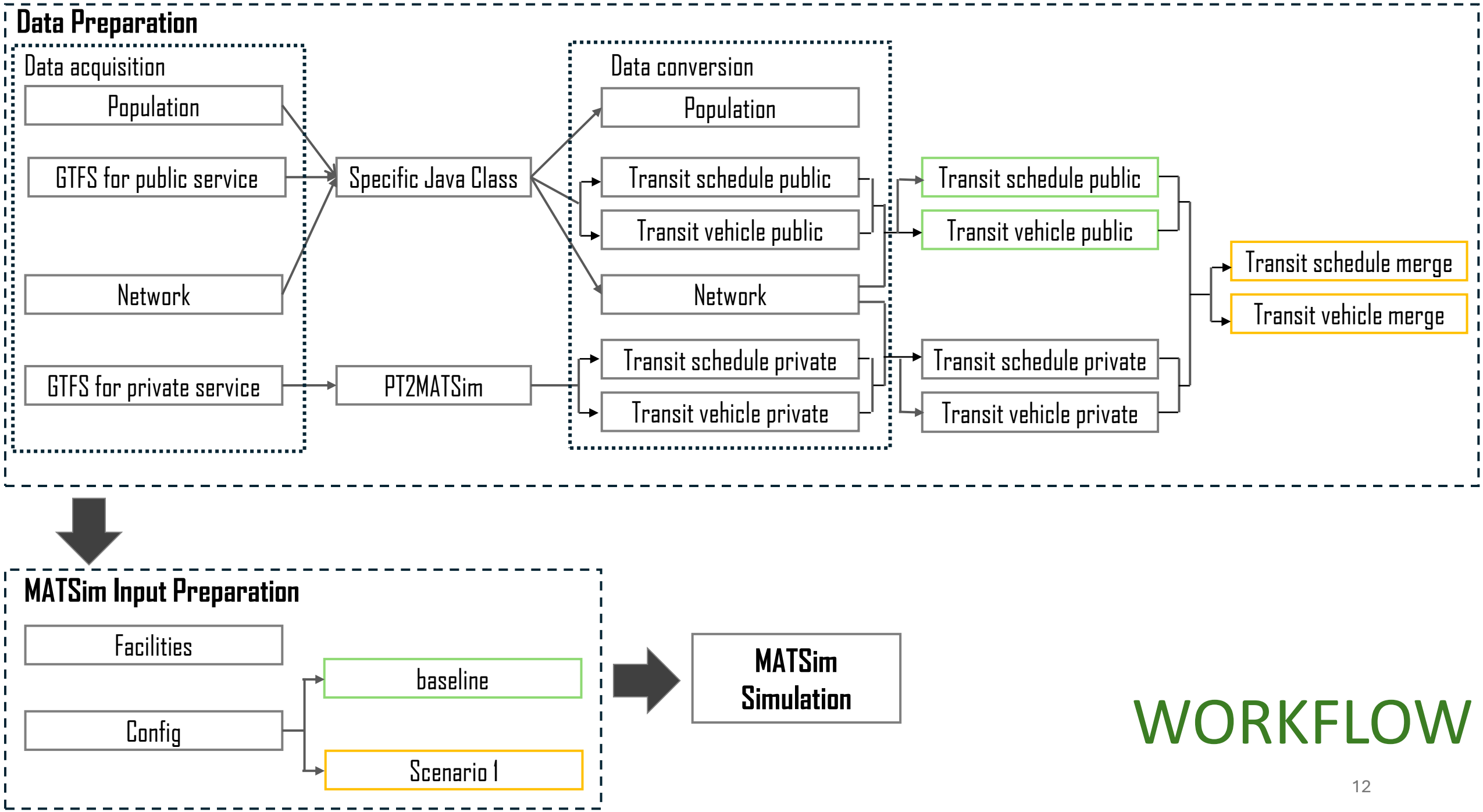
Conseptual Framework




Data Preparation
Data acquisition
Population
GTFS for public service
Network
GTFS for private service
Specific Java Class
PT2MATSim
Data conversion
Population
Transit schedule public
Transit vehicle public
Network
Transit schedule private
Transit vehicle private
Transit schedule public
Transit vehicle public
Transit schedule private
Transit vehicle private
Transit schedule merge
Transit vehicle merge
MATSim Input Preparation
Facilities
Config
baseline
Scenario 1
MATSim Simulation

WORKFLOW

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Private Service (Micron Bus)

GTFS Feed Structure

No	Indicator	Value	Interpretation
1.	Agencies	1 (マイクロンメモリジャパン株式会社)	Single operator (private shuttle)
2.	Routes	1	One main service corridor
3.	Trips	70	Individual daily departure
4.	Stops	23	Total Stops
5.	Shapes	6	Variants of inbound/outbond route alignment
6.	Calendar	2 (平日, 土曜・日曜・祝日)	Weekday and holiday
7.	Calender_dates	22 exceptions	Public holidays and national breaks
8.	Period_covered	2024-05-24 → 2025-12-31	Full service year

Private Service (Micron Bus)

Data Observation

No	Indicator	Weekday	Holiday
1.	Travel Time	31. 5 min	32.4 min
2.	Headway	17 min	69 min
3.	Travel Time per Stop	Mean = 3 min Longest = 14 min	Mean = 2.9 min Longest = 14 min
4.	Trips	56	14

Public Service

GTFS Feed Structure

No	Indicator	Value	Interpretation
1.	Agencies	2 (芸陽バス, 中国JRバス)	Private operators
2.	Routes	40+	-
3.	Trips	3000+	-
4.	Stops	~ 700	-
5.	Shapes	800+	-
6.	Calendar	Weekday / Weekend / Holiday	3 categories
8.	Period_covered	2025	Full service year

Public Service

Inbound/outbond to Micron

No	Id	Travel time (min)	Route distance (km)	Trips per day	First departure	Last departure	Departure time
1.	Geiyo_1400 0	52	26.02	2	07:30:00	09:40:00	07:30:00, 09:40:00
2.	Geiyo_1401 0	52	25.93	5	12:15:00	18:44:00	12:15:00, 13:28:00, 15:58:00, 17:20:00, 18:44:00
3.	Geiyo_1430 0	17	8.86	1	07:29:00	07:29:00	07:29:00
4.	Geiyo_1431 0	19	8.82	1	17:30:00	17:30:00	17:30:00

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RESULT

MATSim Output (100 ITER)

No	Metric	Baseline	Scenario 1	Change
General PT Metrics				
1.	Transit Lines	155	156	1 (+0.6%)
2.	Transit Routes	535	544	9 (+1.7%)
3.	PT Trips per Day	9,929	10,214	285 (+2.9%)
PT Ridership				
4.	PT Boardings	13,555	13,888	333 (+2.5%)
5.	PT Allightings	13,555	13,888	333 (+2.5%)
6.	PT Legs	13,162	13,501	339 (+2.6%)
7.	Unique PT Users	6,424	6,565	141 (+2.2)
PT Travel Time				
8.	Avg Travel Time	19.46 min	19.36 min	-0.10 min (-0.5%)
9.	Avg Waiting Time	10.39 min	10.26 min	-0.13 min (-1.3%)

RESULT

Accessibility Impacts

No	Aspect	Impact
1.	PT Ridership	+2,9% increase
2.	New Transit Users	280 unique persons
3.	Peak Hour Access (AM)	+74 passengers at 7AM
4.	Peak Hour Access (PM)	+64 passengers at 6PM

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Future Task

- Learn how to interpret and visualize simulation result
- Literature Review: Cost-sharing schemes
- Literarure Review: PPP
- Design Simulation Scenarios (adjustable)
  - Scenario 2 : Schedule coordination (synchronized timetable)
  - Scenario 3 : Route optimization (complementary system)
  - Scenario 4

References

- WEF (World Economic Forum). 2020. *Transforming Rural Mobility in Japan and the World*. Geneva: World Economic Forum. https://www3.weforum.org/docs/WEF_Transforming_Rural_Mobility_in_Japan_and_the_World.pdf

THANK YOU