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NATIONAL COLLEGE OF PUBLIC
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Open Platform for Enhancing Public Transport Quality of Service (QoS) through Congestion Pricing Strategies and Insurance Telematics

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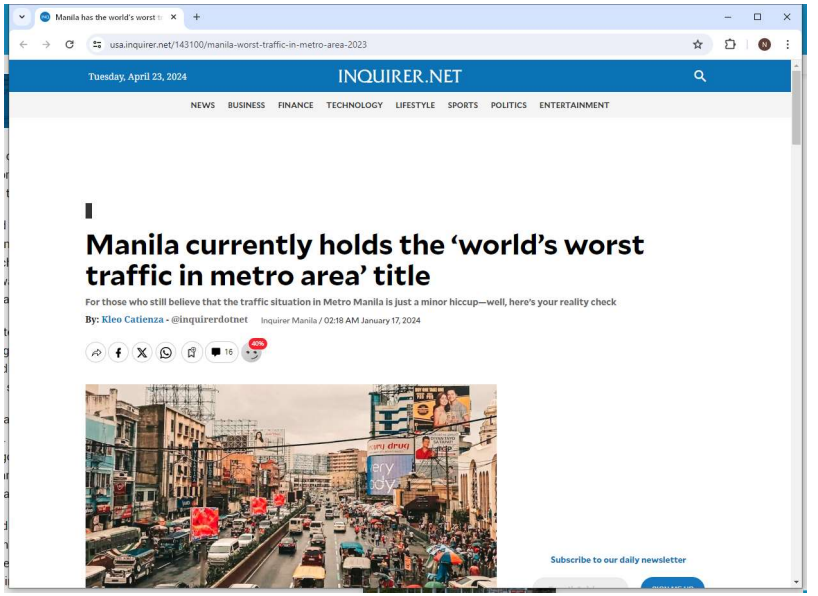
Co-organized and co-sponsored by The International Committee on Global Navigation Satellite Systems and The Philippine Space Agency

Outline

- Background
  - Traffic Congestion
  - Declining public transport demand and quality of service
- Motivation
- Congestion Pricing
- Insurance Telematics
- Initial Field Demo of MADOCA-PPP for Public Transport Applications
- On-going Initiatives
- Next Steps

Background

- Road traffic congestion is a major problem in most cities all over the world
- In developing countries like the Philippines, this brings about serious productivity losses, increased fuel wastage and huge negative impact to the economy
  - In 2011, the University of the Philippines National Center for Transportation Studies (UP-NCTS) estimated the cost of congestion in Metro Manila to be 138 billion pesos a year or about 1.4% of the Philippine economy (UP-NCTS, 2011)
  - A subsequent study by the National Economic and Development Authority (NEDA) and Japan International Cooperation Agency (JICA) in 2014 estimated the economic losses to be 2.4 billion pesos a day

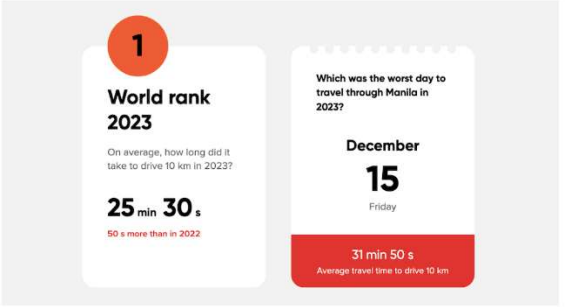


TOMTOM

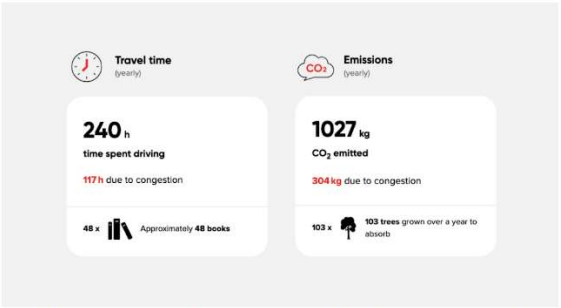
Source: Katienza, Kleo (2024). Manila currently holds the 'world's worst traffic in metro area'. Inquirer.net, January 17. https://usa.inquirer.net/143100/manila-worst-traffic-in-metro-area-2023

Background

- The root causes of traffic congestion in Metro Manila are increasing ownership and use private vehicle, inefficiency of mass transit and inadequate pedestrian facilities (JICA, 2014)
- Government has not provided the right level of investment to address the lack of infrastructure
  - Compared with neighboring countries, the Philippines spends significantly less on public infrastructure at only 2.5 percent of gross domestic product (GDP) in 2012, against the 5 percent average spending in other Southeast Asian countries
- Road traffic congestion in Metro Manila can be assessed based on equitable use of existing road space
  - 78% of the road space is utilized by private vehicles whereas the remaining 22% is used by Public Utility Vehicles (PUV) which serves a majority of travel demand in Metro Manila.



Manila is the world's most congested metro area in 2023 | Screenshot from TomTom Traffic Index

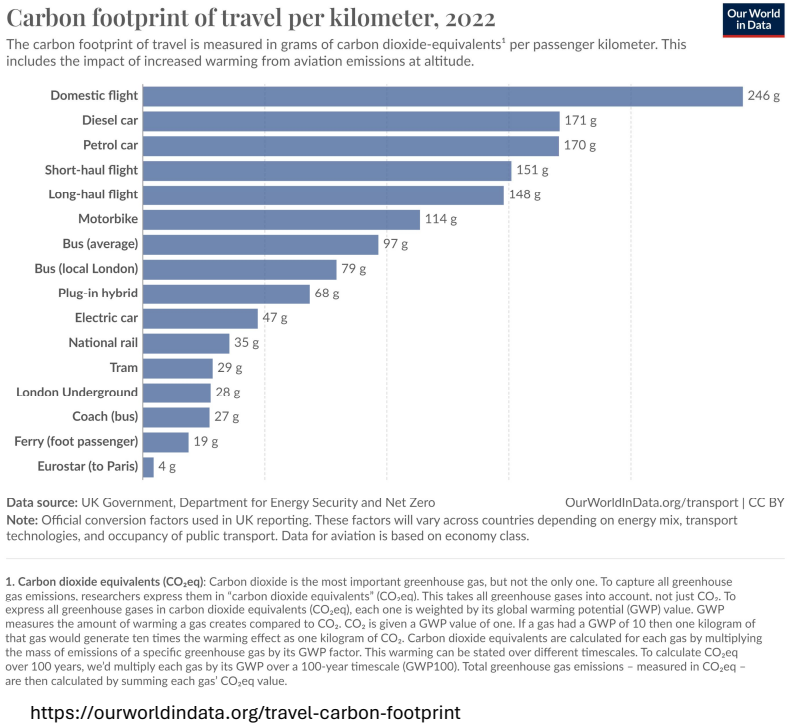


Filipinos spent 240 hours driving and 117 of those were due to traffic | Screenshot from TomTom Traffic Index

Motivation

- There is a need to pursue a policy and open platform where public transport services are given priority over the use of the private car

Source: https://www.reddit.com/r/europe/comments/9i8lv8/yesterday_was_the_world_car_free_day_and_this_is/

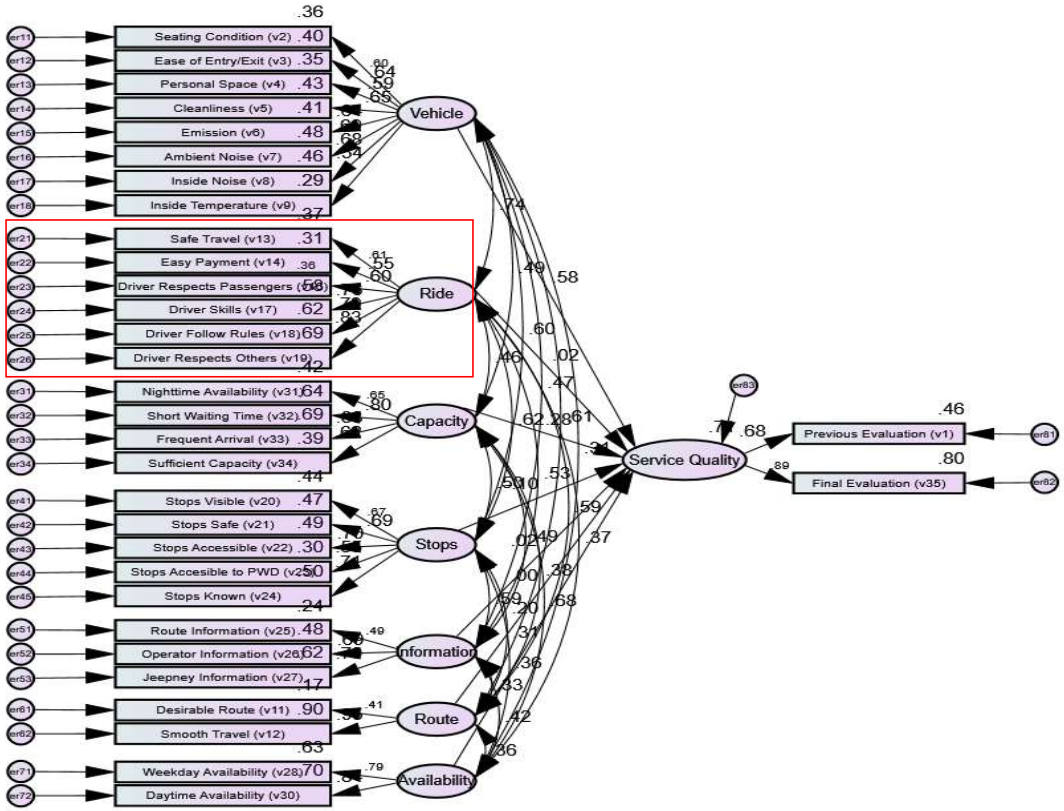


https://ourworldindata.org/travel-carbon-footprint

Public Transport Quality of Service (QoS)

- The perception of service quality of public transport can be analyzed based on several factors:
  - Vehicle Condition
  - Customer Care
  - Reliability
  - Stop's Condition
  - Information Provision
  - Convenience
  - Availability

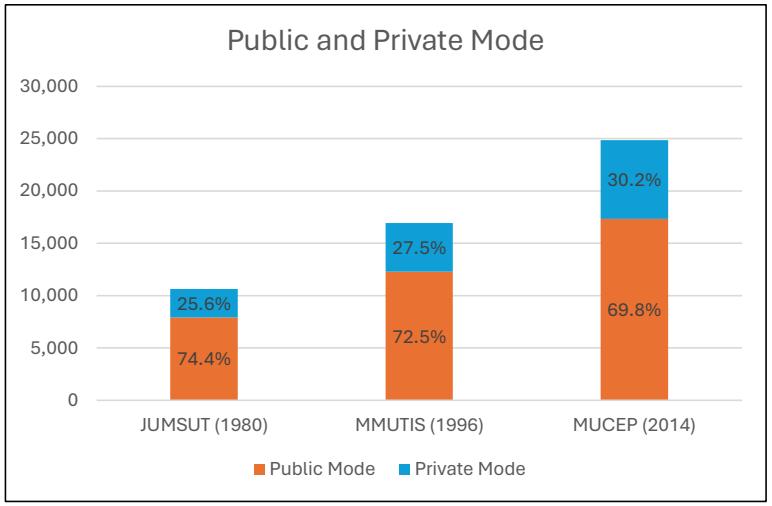
Public Transport QoS Structural Equations Model (SEM)

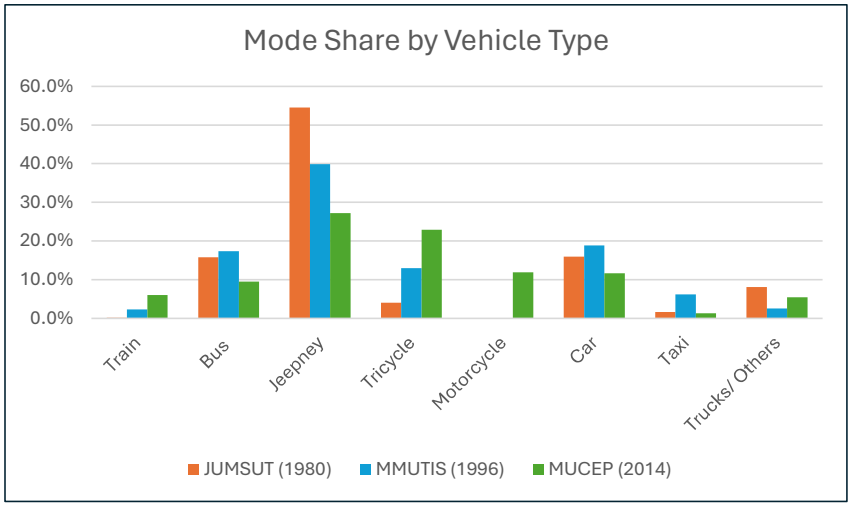


Source: Tiglao, N. C., De Veyra, J. M., Tolentino, N. J., & Tacderas, M. A. (2020). The perception of service quality among paratransit users in Metro Manila using structural equations modelling (SEM) approach. Research in Transportation Economics, 83, 100955. https://doi.org/10.1016/j.retrec.2020.100955

How do we get people to use public transport (again) more?

- Share of public mode has been decreasing
  - Bus usage has decreased from 15.7% in 1980 to 9.5% in 2014
  - Steep decline in jeepney usage from 54.5% in 1980 to 27.2% in 2014
  - Share of trips by rail and tricycle modes are increasing
- In terms of private mode, there has been a drastic increase in motorcycle usage

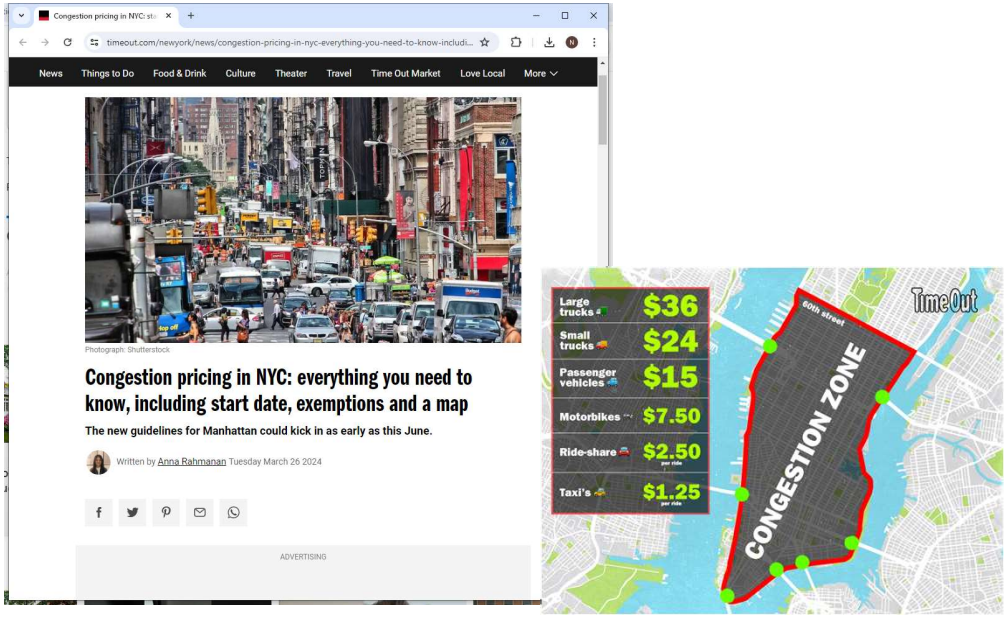


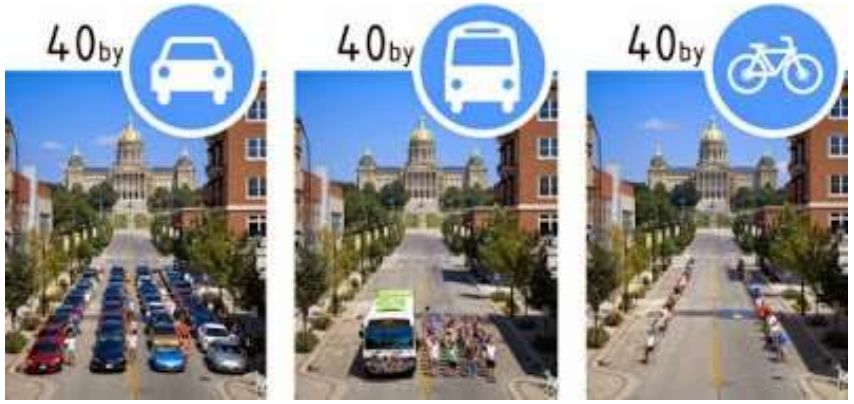


Source: ALMEC (2015). MMUTIS Update and Enhancement Project (MUCEP). Technical Report – Transportation Demand Characteristics Based on MUCEP Person Trip Survey. December 2015.

How do we get people to use public transport (again) more?

- One possible solution is the introduction of a congestion pricing scheme where the use of private car is discouraged over the use of public transport
  - Congestion pricing can be categorized as a Travel Demand Management (TDM) measure which are strategies that promote the effective, efficient and equitable use of existing and renewable resources, as opposed to increasing supply of transport facilities





Source: https://www.craigbailey.net/public-transport/

Source: https://www.timeout.com/newyork/news/congestion-pricing-in-nyc-everything-you-need-to-know-including-start-date-exemptions-and-map-030124
https://rpa.org/work/reports/congestion-pricing-in-nyc

Congestion Pricing

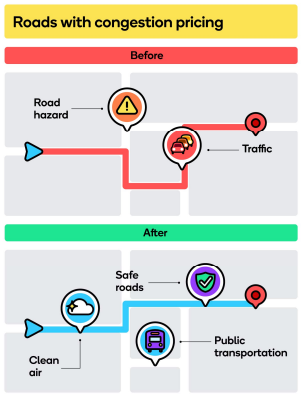
- In the U.S., a study commissioned by the Transportation Research Board (TRB) found that in the aggregate, there is significant support for tolls and road pricing
  - Based on quantitative analysis, this study determined that some important factors influencing public opinion include the type of pricing, the use of tolling revenues, and the clarity of information provided to the public (Zmud & Arce, 2008)
- Multiple forms of congestion pricing have been implemented, including schemes covering the inner city (as in London), a significant part of the metropolitan area (as in Singapore), or a wider, perimeter area (as in Oslo)
  - Other proposals have looked at charging on the basis of such factors as time of day or type of vehicle
- Congestion pricing schemes will need to secure design and start-up funding as well as initial operating funds
  - They will require the installation of sophisticated tracking systems, including electronic facilities and equipment, as well as the placement of cameras
  - The introduction of congestion pricing will also require not only coordination between municipalities or districts in a city or urban region, but also a great deal of political commitment, public acceptance, institutional capacity and education
  - Government must inform important sectors of the population, including motorists, other transport users, community groups, employers, and of course, society as a whole.

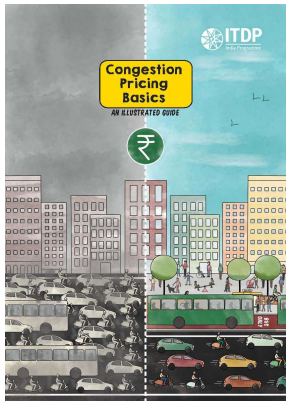
Congestion Pricing Strategies

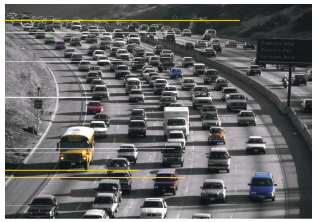
- Transport authorities need to carefully consider the choice of pricing scheme
- Each city is unique in its geography, socioeconomic structure and set of travel patterns, and distinct from cities where congestion pricing has been implemented, such as Singapore or London (Hook & Ferreira, 2004)
- It is important that planners study potential congestion zones and based on a number of factors (e.g., future traffic levels, size, density) and target one or more areas for implementation
- In addition, for maximum effect, thought should be given to combining congestion pricing with other Travel Demand Management (TDM) measures

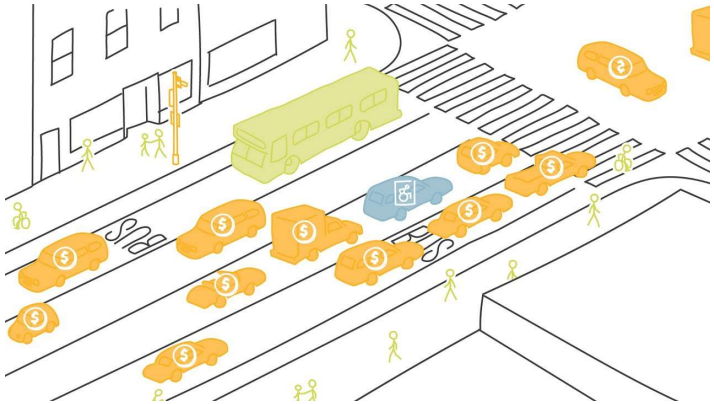
Objectives of Congestion Pricing

- Produce a shift in routes
- Bring a change in the time of travel
- Generate revenue
- Mitigate negative environmental impacts
- Improve quality of life

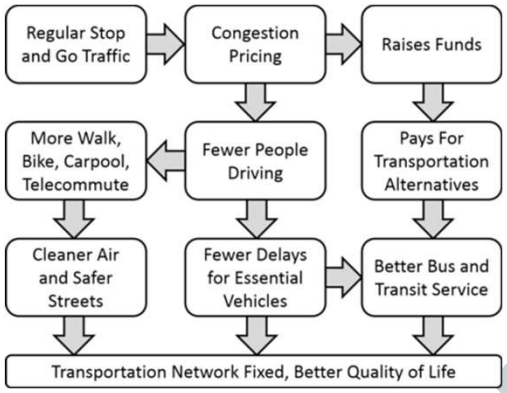








Congestion Pricing Components



Research and Development

Policies

Insurance Telematics

Usage Based Insurance

Technologies

Advocacies

Insurance Telematics

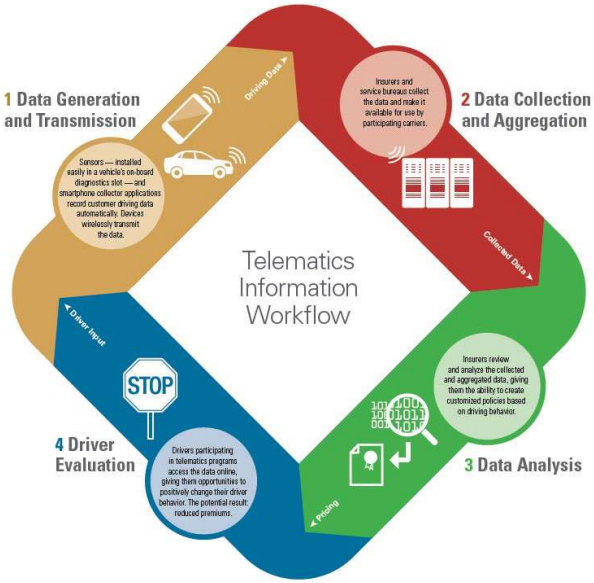
- In Philadelphia, USA, telematics is applied to school buses which helps manage the driving behavior of bus drivers, as well as children/students through installation of cameras on board
  - Hence, if applied to public transportation, not only it will monitor driver behavior but also enforce safety of passengers from untoward incidents or crimes during trip
  - Over time, drivers started not using their phones while they're operating the bus, and being cognizant of their speed, how they make turns, and how hard they hit the brakes
  - School bus contractors can manage their risks much more effectively with the help of telematics
- In Singapore, a bus operator Tower Transit implemented telematics system which improved bus drivers' behaviors on the road
  - From July 2016 to May 2017, from 15%, the percentage of drivers in the "red zone" (deemed to have made unsafe moves) dropped to 2%
  - Over the same period, the accident numbers have fallen by 50%, with "at fault" cases plunging by 70%
  - Tower Transit's telematics system – which tracks vehicle performance in real time via GPS and sensors and is tied to driver incentives

Improving Driver Habits thru Insurance Telematics

Bus and driver data → **Installed telematics device** → **Real-time data capture** → **Data aggregation** → **Driver risk assessment**

- Insurance telematics is the practice of collecting driver and vehicle behavior, analyzing that data, and using it to improve insurer business outcomes
- Help bus companies institute proper staff training programs and retain well-performing bus drivers

- Data can be used to improve policyholder risk modeling, reduce costs, and better attract and retain policyholders



Source: https://www.verisk.com/

Usage Based Insurance (UBI)

- Congestion pricing should be coupled with modernized public transport operations with a performance-based management system
  - Introduction of advanced insurance telematics that monitor public transport operations on a per-lane and per-second basis
  - Well-performing operators/ drivers are rewarded and non-performing ones are disincentivized
- Usage-based insurance (UBI), also referred to as pay-per-mile, pay-as-you-drive (PAYD), or pay-how-you-drive (PHYD), is a type of auto insurance that, depending on the specific insurer's program, can measure how far a vehicle is driven, where it's driven, and/or how it's driven.
  - UBI is often powered by telematics – technology that is available in vehicles using a plug-in device or is pre-installed in the car's network, but can also be available through mobile applications – and provides insurers a range of data, from how drivers are braking and accelerating to their speeds, where they're driving, and for how long they're behind the wheel
  - The data collected gets sent to an insurance company, which can keep track of the distance driven for the basic pay-as-you-go insurance, or more broadly assess the risk profile of a specific driver in order to reward safer drivers with discounts on their insurance.

Benefits of UBI Programs

- Telematic usage-based insurance provides a much more immediate feedback loop to the driver by changing the cost of insurance dynamically with a change of risk.
  - This means drivers have a stronger incentive to adopt safer practices
  - For example, if a commuter switches to public transport or to working at home, this immediately reduces the risk of rush hour accidents

Benefits	Description
Social benefits	Reduce accident frequency and severity; reduce accident response time; track and recover stolen vehicles; establish fault to improve equity in settling claims; reduce driving, pollution, traffic congestion and energy consumption
Economic benefits	Reduce chance of accidents; enhance efficiency of claims processing ; enable early detection and prevention of frauds; enable pricing based on risk profiles
Environmental benefits	Increase use of congestion-free routes and limit vehicle usage; reduce fuel consumption; limit the use of vehicle; improve vehicle maintenance; reduce CO2 emissions
Benefits for insurance providers	Correct risk misclassifications; enhance pricing accuracy; retain profitable accounts; fight fraudulent claims; enable lower premiums; reduce claim costs; differentiate brand
Benefits for users	Reduce premiums; demonstrate safe driving habits following an accident; value-added services (vehicle diagnostics, stolen vehicle recovery, emergency services, teen driver monitoring etc.)

Field Demo Hardware

Magellan Systems Japan (MSJ)

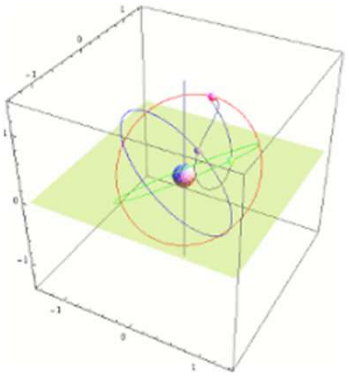
- Model MJ-3008-GM4-QZS
- Multi frequency Multi GNSS Receiver Unit for GPS (L1,L2,L5), QZSS (L1,L2,L5,L6) and GLONASS (G1,G2)
- Precise Point Positioning PPP enabling centimeter class positioning accuracy
- RTK (Real Time positioning by using two units which set in base station and rover)

U-blox

- U-blox NEO-M8T Concurrent GNSS timing modules for GPS, QZSS, SBAS, GLONASS, BeiDou and Galileo constellations
- U-blox ANN-MS-0-005 High performance active GPS antenna with integrated low-noise amplifier (LNA)

Precise Point Positioning (PPP) Technology

- Japanese Quasi-Zenith Satellite System (QZSS) enhance the current availability and performance of GNSS typically over Japan and region centered in the 135° E meridian
- Transmits the L-band experimental (LEX) signal designed to enable high accuracy positioning in real-time and time transfers through transmission of precise corrections
- Capable of delivering high accuracy (centimeter to decimeter-level) point positioning solutions using a single GNSS receiver
- Eliminating the constraints of baseline length and simultaneous observation at both rover and reference stations
- **MADOCA** - **M**ulti-GNSS **A**dvanced **D**emonstration tool for **O**rbit and **C**lock **A**nalysis

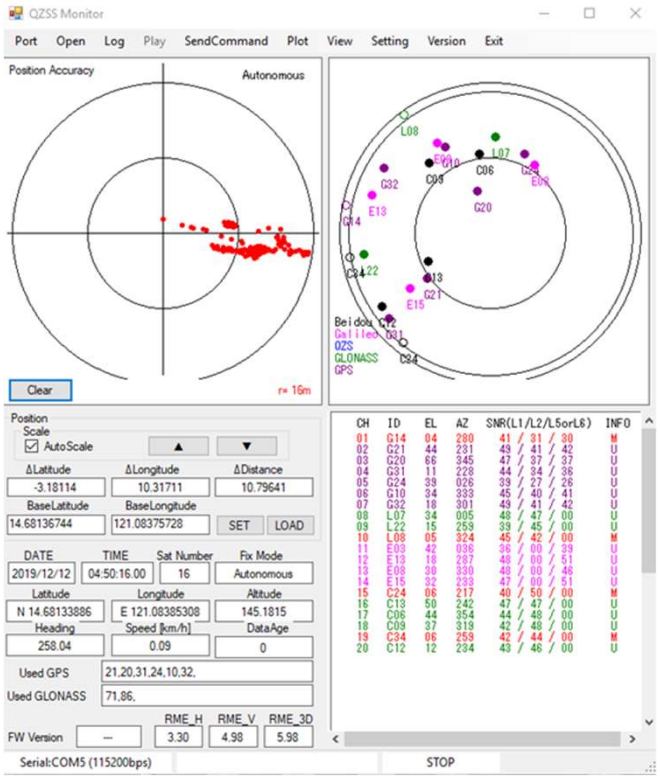


Quasi-Zenith Satellite System (QZSS)

Field Demo Software

[MSJ]

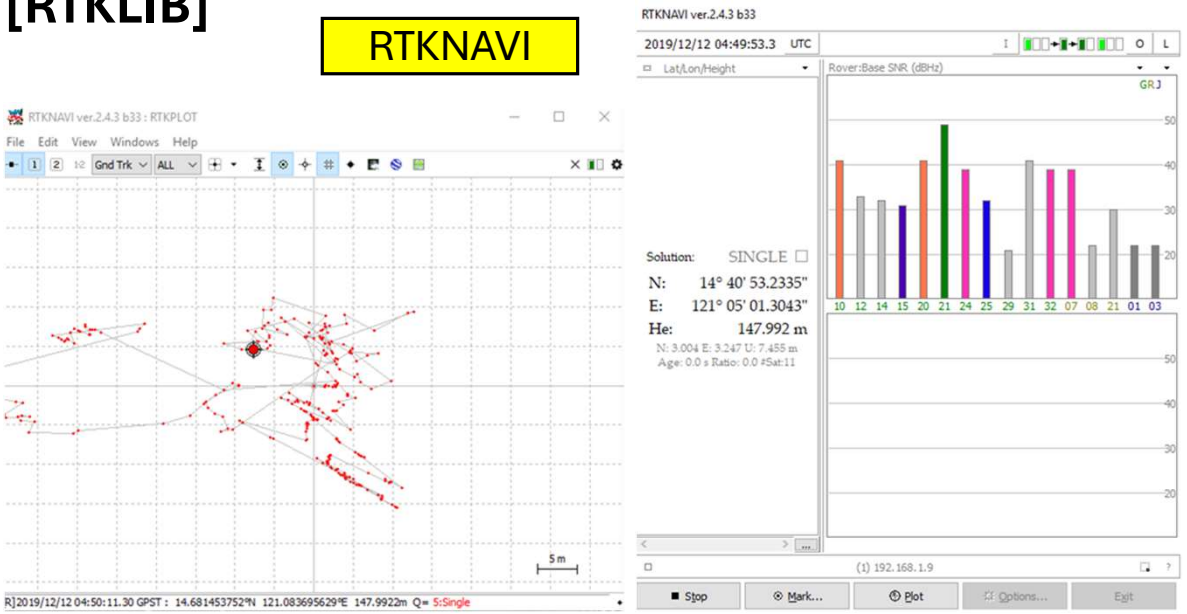
QZSS Monitor



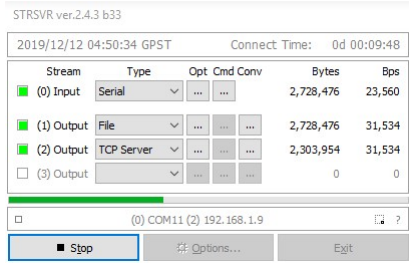
Connected to MADOCA receiver

[RTKLIB]

RTKNAVI



STRSVR



Connected to U-blox NEO-M8T module

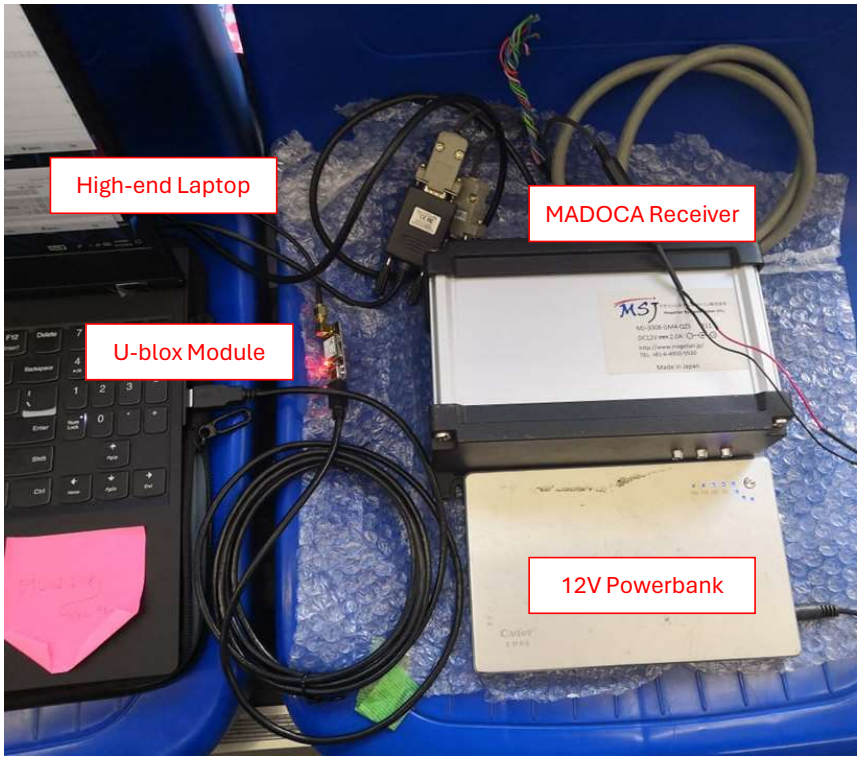
Hardware Setup


Roadview camera


Skyview camera


LEX Receiver Antenna

U-blox Patch Antenna


High-end Laptop

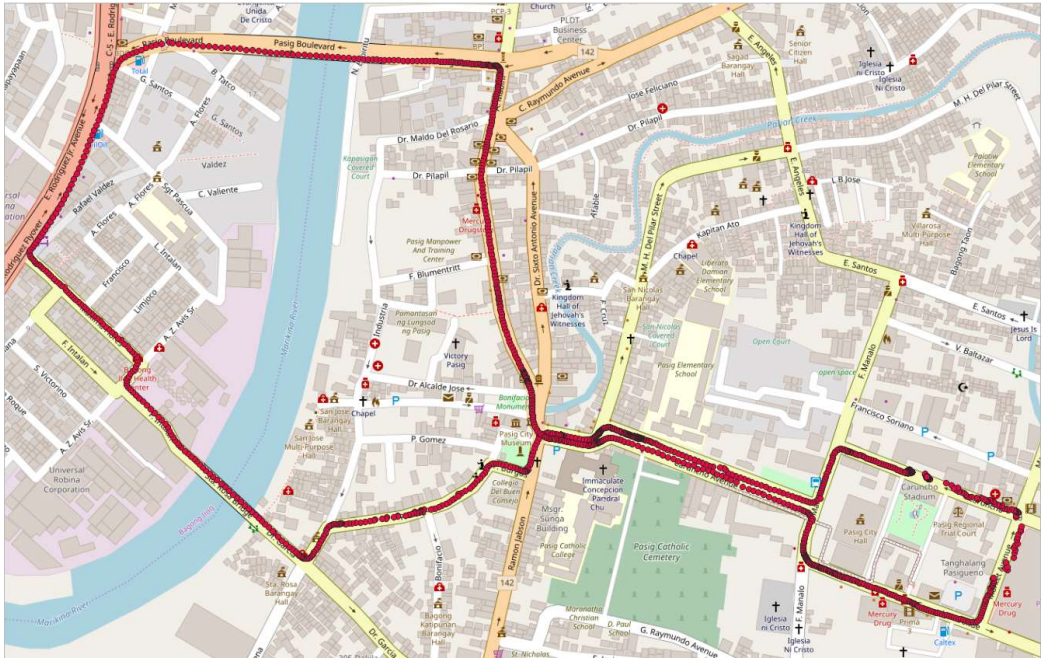
MADOCA Receiver

U-blox Module

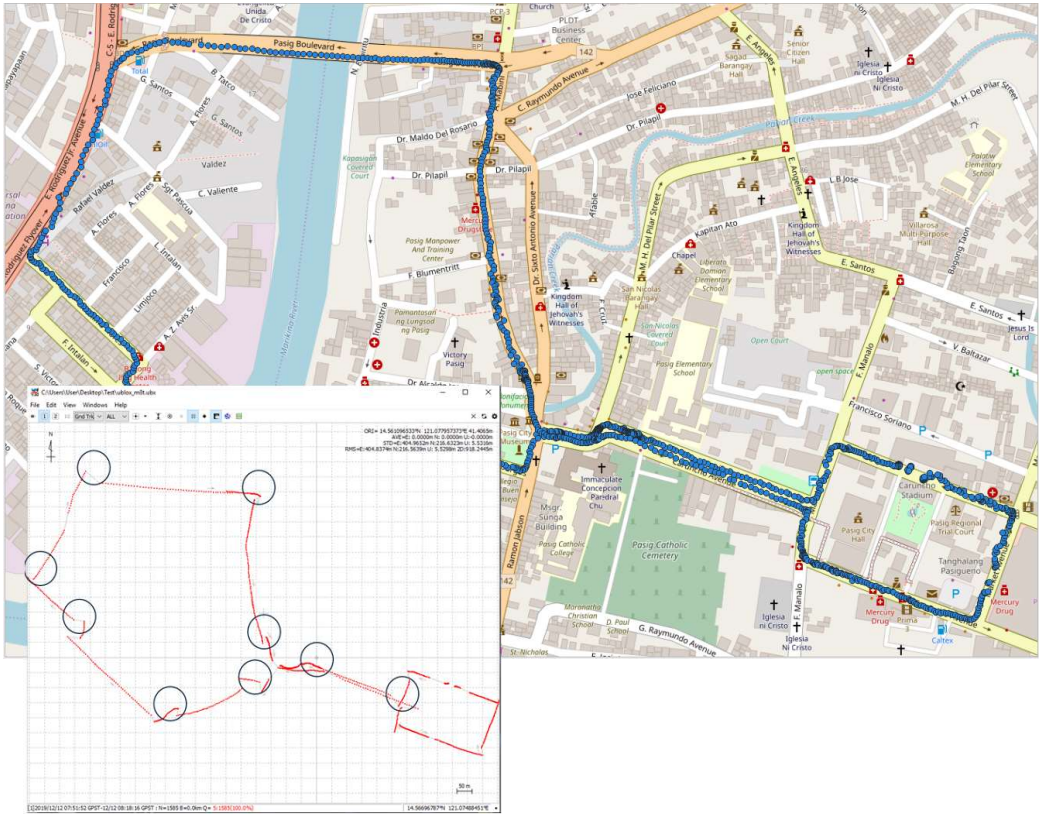
12V Powerbank

Field Demo Results

Precise Point Positioning



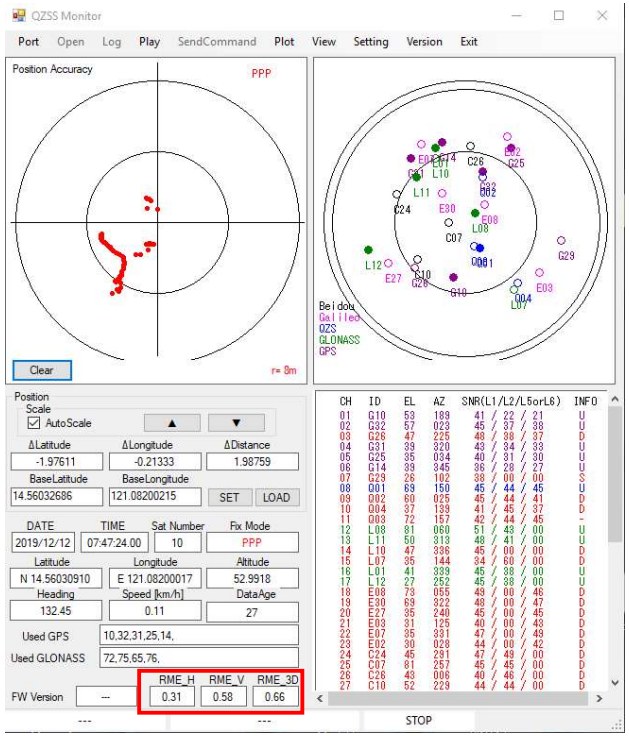
Single Point Positioning

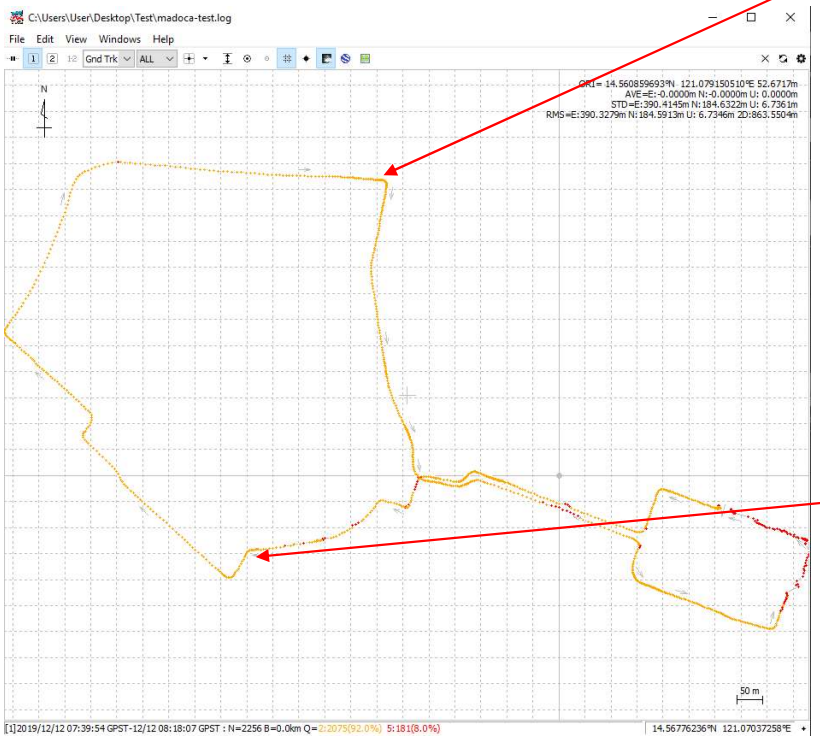


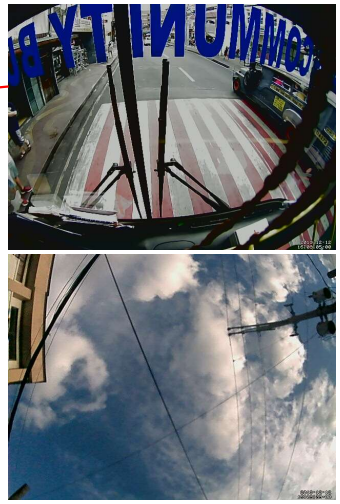
- Susceptible to multi-path errors especially at key intersections

Field Demo Results

Precise Point Positioning using MSJ MADOCA receiver



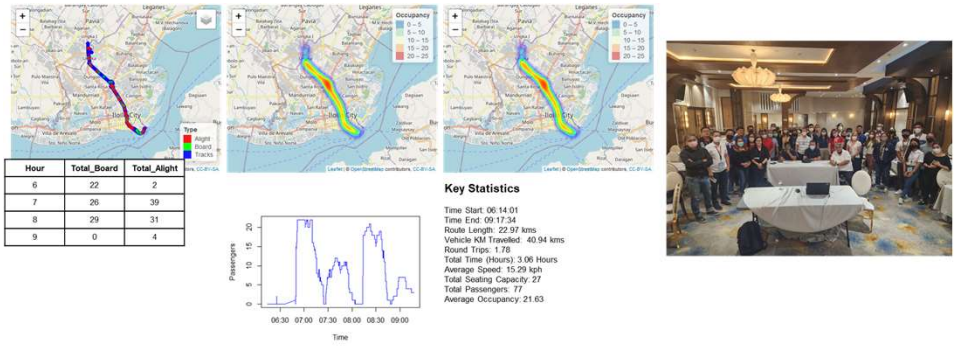


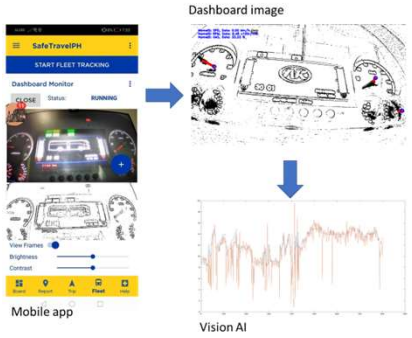


- MADOCA-PPP is able to achieve 3 cm horizontal and 6 cm vertical RMS errors

On-going Initiatives

- Enhancement of the SafeTravelPH Public Transport Crowdsourcing and Information Exchange Platform
  - A mobile application and information-exchange platform that actively engages government, transport industry providers, and passengers in sharing transformative information
  - Intended to provide an open platform for public transport data collection and information exchange
- Research on promotion of eco-driving practices
  - Observed Engine Fuel Rate for Aggressive Driving is 22.03 Liter/Hr while Eco-Driving is 13.03 Liter/Hr, a 41% reduction in fuel consumption
- Development of digitally-enabled collaborative platform for the EDSA Busway





Next Steps

- Research and Development
  - Develop Real Time-PPP platform for monitoring bus units in Metro Manila
  - Establish Virtual Reference Stations (VRS) based on MADOCA-LEX corrections
  - Develop reference design for insurance telematics ecosystem for public transport operations

- Stakeholder Engagement/ Advocacy
  - Develop a quality management framework for improving public transport quality of service
  - Establish quality partnerships with bus operators

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Maraming Salamat po!

(Thank you very much)

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