PROPOSED SCHEDULING SCHEME OF JEEPNEY OPERATIONS IN THE CITY OF MANILA, PHILIPPINES

Paper No. SCS11-002

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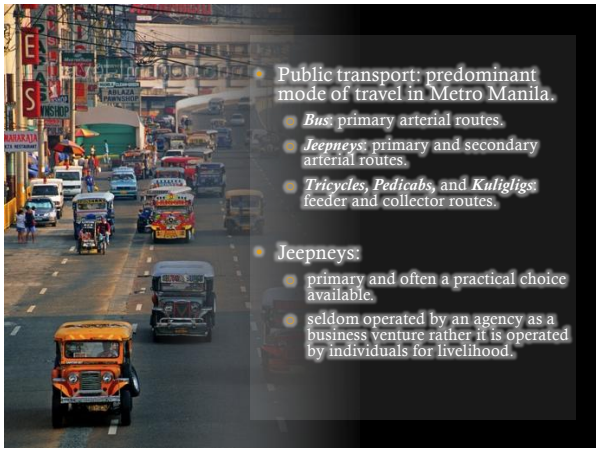
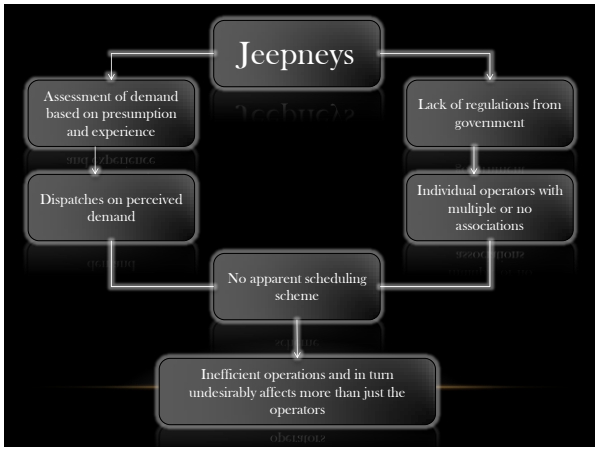
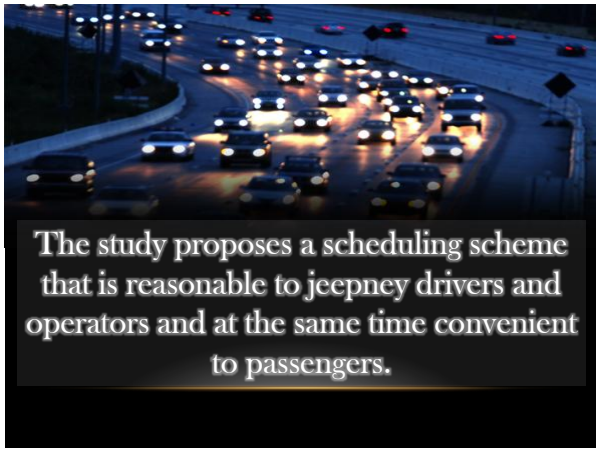
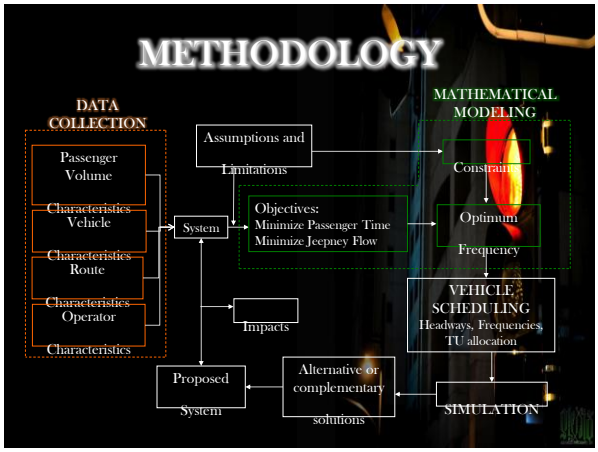


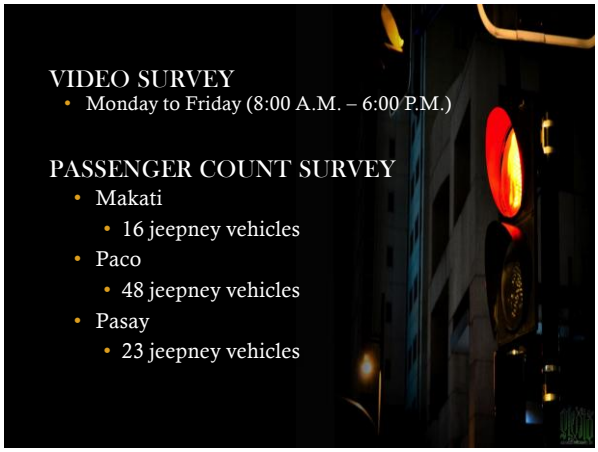
- Public transport: predominant mode of travel in Metro Manila.
  - ***Bus***: primary arterial routes.
  - ***Jeepneys***: primary and secondary arterial routes.
  - ***Tricycles***, ***Pedicabs***, and ***Kuligligs***: feeder and collector routes.
- Jeepneys:
  - primary and often a practical choice available.
  - seldom operated by an agency as a business venture rather it is operated by individuals for livelihood.

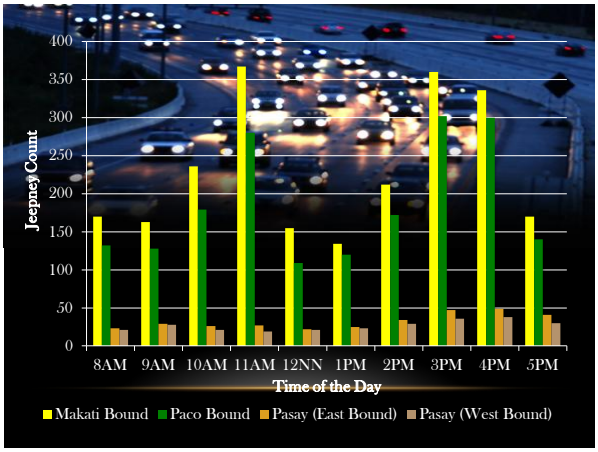


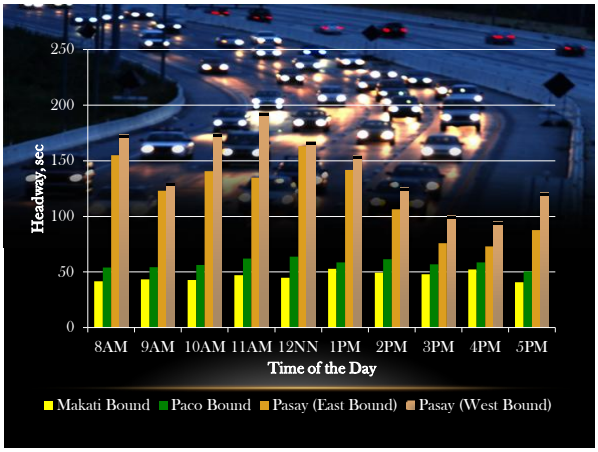


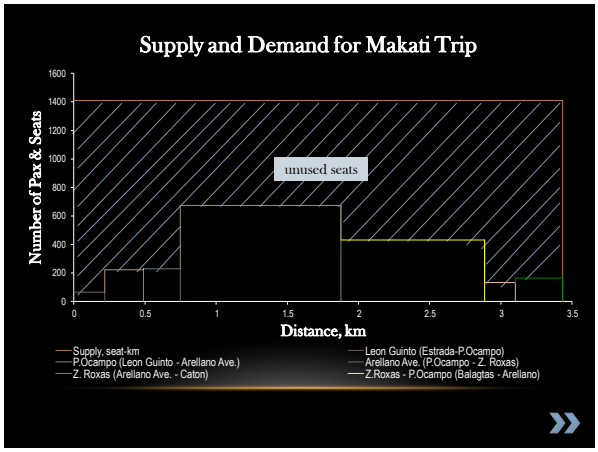
The study proposes a scheduling scheme that is reasonable to jeepney drivers and operators and at the same time convenient to passengers.

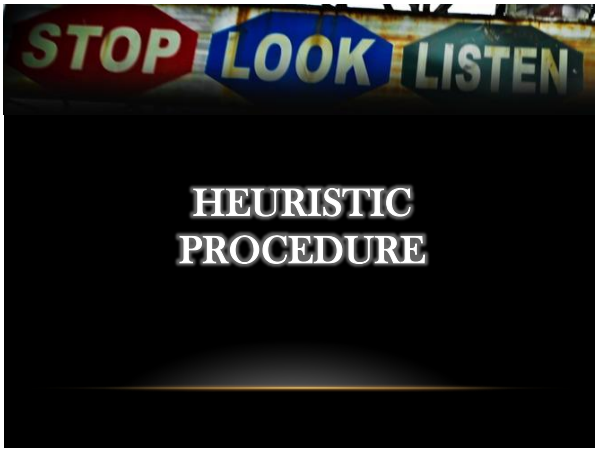

METHODOLOGY
DATA COLLECTION
Passenger Volume
Characteristics
Vehicle
Characteristics
Route
Characteristics
Operator
Characteristics
Assumptions and Limitations
System
Objectives:
Minimize Passenger Time
Minimize Jeepney Flow
MATHEMATICAL MODELING
Constraints
Optimum Frequency
VEHICLE SCHEDULING
Headways, Frequencies, TU allocation
SIMULATION
Alternative or complementary solutions
Proposed System
Impacts

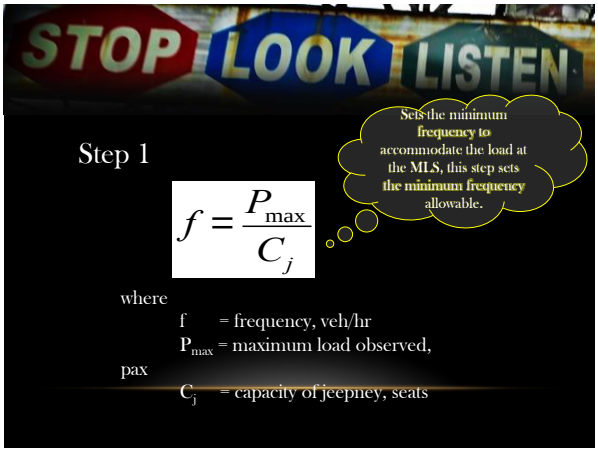

VIDEO SURVEY
• Monday to Friday (8:00 A.M. – 6:00 P.M.)
PASSENGER COUNT SURVEY
• Makati
• 16 jeepney vehicles
• Paco
• 48 jeepney vehicles
• Pasay
• 23 jeepney vehicles

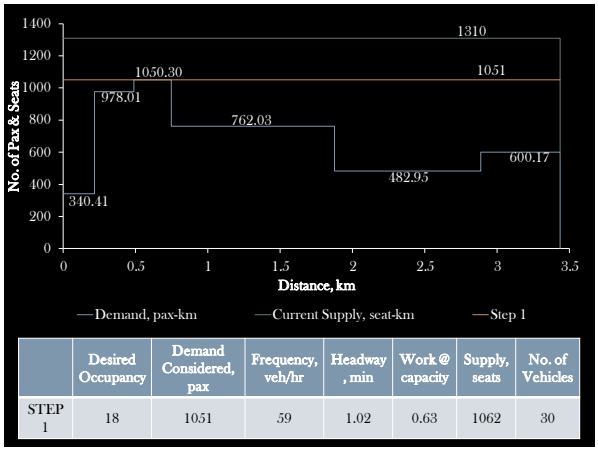

Jeepney Count
400
350
300
250
200
150
100
50
0
8AM 9AM 10AM 11AM 12NN 1PM 2PM 3PM 4PM 5PM
Time of the Day
Makati Bound
Paco Bound
Pasay (East Bound)
Pasay (West Bound)


Headway, sec
250
200
150
100
50
0
8AM 9AM 10AM 11AM 12NN 1PM 2PM 3PM 4PM 5PM
Time of the Day
Makati Bound
Paco Bound
Pasay (East Bound)
Pasay (West Bound)

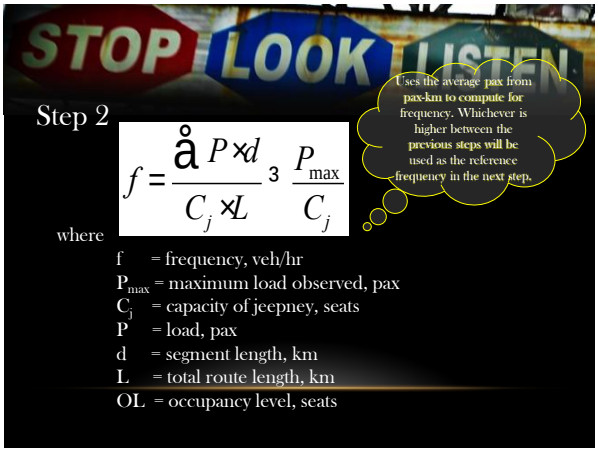








	Desired Occupancy	Demand Considered, pax	Frequency, veh/hr	Headway, min	Work @ capacity	Supply, seats	No. of Vehicles
STEP 1	18	1051	59	1.02	0.63	1062	30



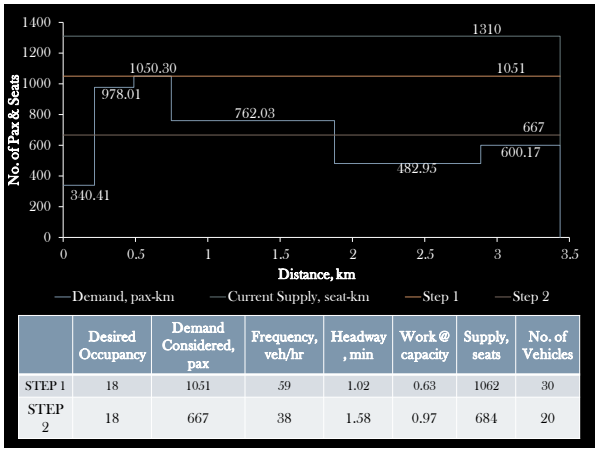
Step 2

$$f = \frac{\sum P \times d}{C_j \times L} \geq \frac{P_{max}}{C_j}$$

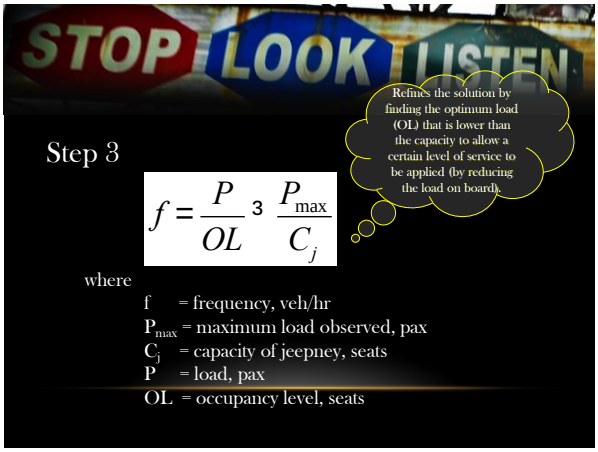
Uses the average pax from pax-km to compute for frequency. Whichever is higher between the previous steps will be used as the reference frequency in the next step.

where

f = frequency, veh/hr
P_{max} = maximum load observed, pax
C_j = capacity of jeepney, seats
P = load, pax
d = segment length, km
L = total route length, km
OL = occupancy level, seats



	Desired Occupancy	Demand Considered, pax	Frequency, veh/hr	Headway, min	Work @ capacity	Supply, seats	No. of Vehicles
STEP 1	18	1051	59	1.02	0.63	1062	30
STEP 2	18	667	38	1.58	0.97	684	20



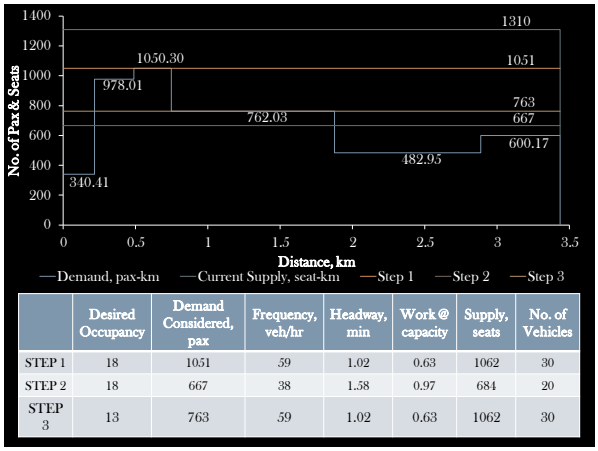
Step 3

$$f = \frac{P}{OL} \geq \frac{P_{max}}{C_j}$$

Refines the solution by finding the optimum load (OL) that is lower than the capacity to allow a certain level of service to be applied (by reducing the load on board).

where

f = frequency, veh/hr
P_{max} = maximum load observed, pax
C_j = capacity of jeepney, seats
P = load, pax
OL = occupancy level, seats



	Desired Occupancy	Demand Considered, pax	Frequency, veh/hr	Headway, min	Work @ capacity	Supply, seats	No. of Vehicles
STEP 1	18	1051	59	1.02	0.63	1062	30
STEP 2	18	667	38	1.58	0.97	684	20
STEP 3	13	763	59	1.02	0.63	1062	30

MAKATI

Time	Current			Proposed		
	Frequency, veh/hr	Headway, min	No. of Vehicles	Frequency, veh/hr	Headway, min	No. of Vehicles
8:00 - 9:00	87	0.690	72	87	0.690	72
9:00 - 10:00	84	0.714	40	33	1.818	16
10:00 - 11:00	84	0.714	30	26	2.308	10
11:00 - 12:00	77	0.779	28	26	2.308	10
12:00 - 1:00	81	0.741	67	33	1.818	28
1:00 - 2:00	69	0.870	23	38	1.579	13
2:00 - 3:00	73	0.822	37	43	1.395	22
3:00 - 4:00	76	0.789	39	59	1.017	30
4:00 - 5:00	69	0.870	50	63	0.952	46
5:00 - 6:00	88	0.682	71	79	0.759	63

PACO

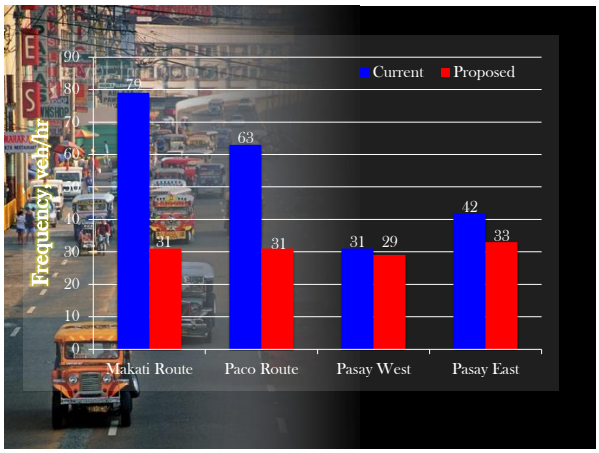
Time	Current			Proposed		
	Frequency, veh/hr	Headway, min	No. of Vehicles	Frequency, veh/hr	Headway, min	No. of Vehicles
9:00 - 10:00	67	0.896	29	31	1.94	14
10:00 - 11:00	67	0.896	32	31	1.94	15
11:00 - 12:00	64	0.938	33	27	2.22	14
12:00 - 1:00	58	1.034	24	30	2.00	13
1:00 - 2:00	57	1.053	29	25	2.40	13
2:00 - 3:00	62	0.968	27	24	2.50	11
3:00 - 4:00	59	1.017	35	32	1.88	19
4:00 - 5:00	64	0.938	46	43	1.40	31

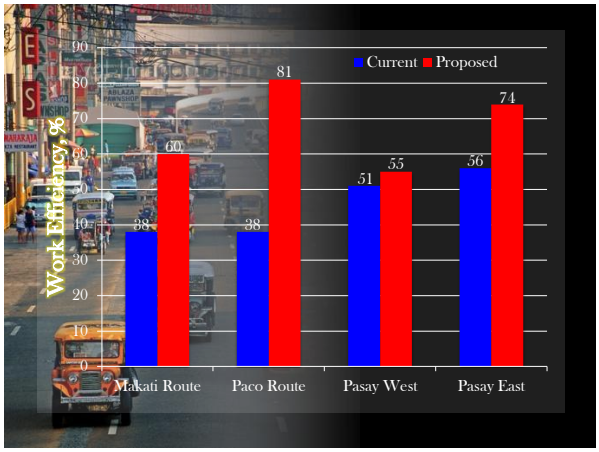
PASAY EASTBOUND

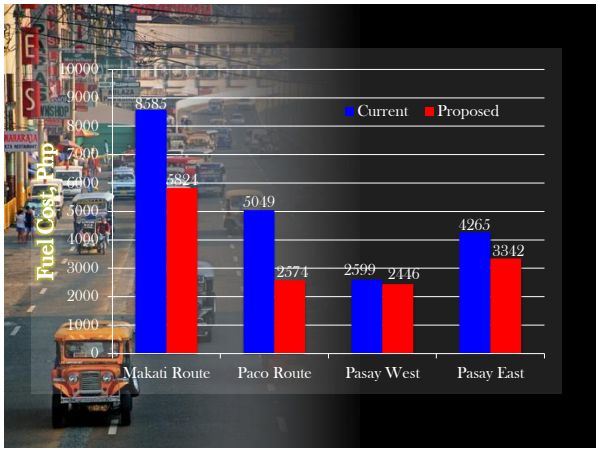
Hour Interval	FREQUENCY		HEADWAY	
	Current Frequency	Proposed Frequency	Current Headway	Proposed Headway
3:00 - 4:00 PM	48	43	1.25	1.40
4:00 - 5:00 PM	50	42	1.20	1.43
5:00 - 6:00 PM	42	29	1.43	2.07
6:00 - 7:00 PM	33	29	1.82	2.07
7:00 - 8:00 PM	35	20	1.71	3.00

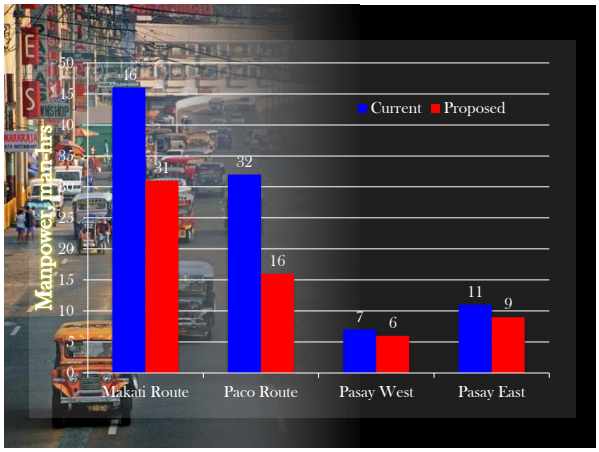
PASAY WESTBOUND

Hour Interval	FREQUENCY		HEADWAY	
	Current Frequency	Proposed Frequency	Current Headway	Proposed Headway
3:00 - 4:00 PM	36	34	1.67	1.76
4:00 - 5:00 PM	38	38	1.58	1.58
5:00 - 6:00 PM	30	29	2.00	2.07
6:00 - 7:00 PM	25	22	2.40	2.73
7:00 - 8:00 PM	23	20	2.61	3.00









	Savings, Php	Fuel Saved, liters	*CO_2 emission from diesel, kg
Makati Route	2761.49	63.12	175.35
Paco Route	2475.19	39.77	110.48
Pasay West	153.92	3.52	9.77
Pasay East	922.76	21.09	58.59

Diesel Carbon content per Liter = 2.778 kg
1 ton will lead to 0.0000000000015° of temperature change

Source:
US Environmental Protection Agency; Office of Transportation and Air Quality

Matthews, D. et al. (2009). The Proportionality of Global Warming to Cumulative Carbon Emissions.

SUMMARY

- It is found that the current configuration of the jeepneys operating in the three study routes provide ***excessive supply of seats*** that is on certain time periods plenty more than the maximum load section.
- In determining the proposed scheduling parameters, applying a lower occupancy load for passengers convenience was considered however due highly irregular load profile the ***optimum frequency at the maximum load section governs***.
- When the proposed scheduling scheme is applied, jeepney ***operating costs (fuel) will be lowered considerably***. Which translates to increase in profit. The increasing price of fuel and the disproportionate increase in fares become another reason to require efficiency in transit operation.
- It would also aid in minimizing the air pollution as a result of minimizing frequency of jeepneys that operate continuously throughout the study area.