



# 8<sup>th</sup> International Workshop on Sustainable Road Freight Transport



## Investigating Sustainable Urban Freight Policies for Indian Conditions

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# Introduction

- ❖ Indian cities have intensive roads with narrow streets and a high concentration of people in the city centers for commercial activity and recreational activity.
- ❖ It results in large flows of people going to work, shopping, eating, or visiting tourist sites, with corresponding flows of goods. However, these narrow streets are not appropriately planned for urban freight operation.
- ❖ Commercial vehicles of **large size, slow moving , and highly polluting vehicles** are **forced to stop** in the **middle of CBD areas** for making deliveries, and creates massive traffic problems
- ❖ Urban freight trip activity is typically perceived as a **nuisance**, and urban freight transportation is simply characterized as a **largely unsophisticated state**.

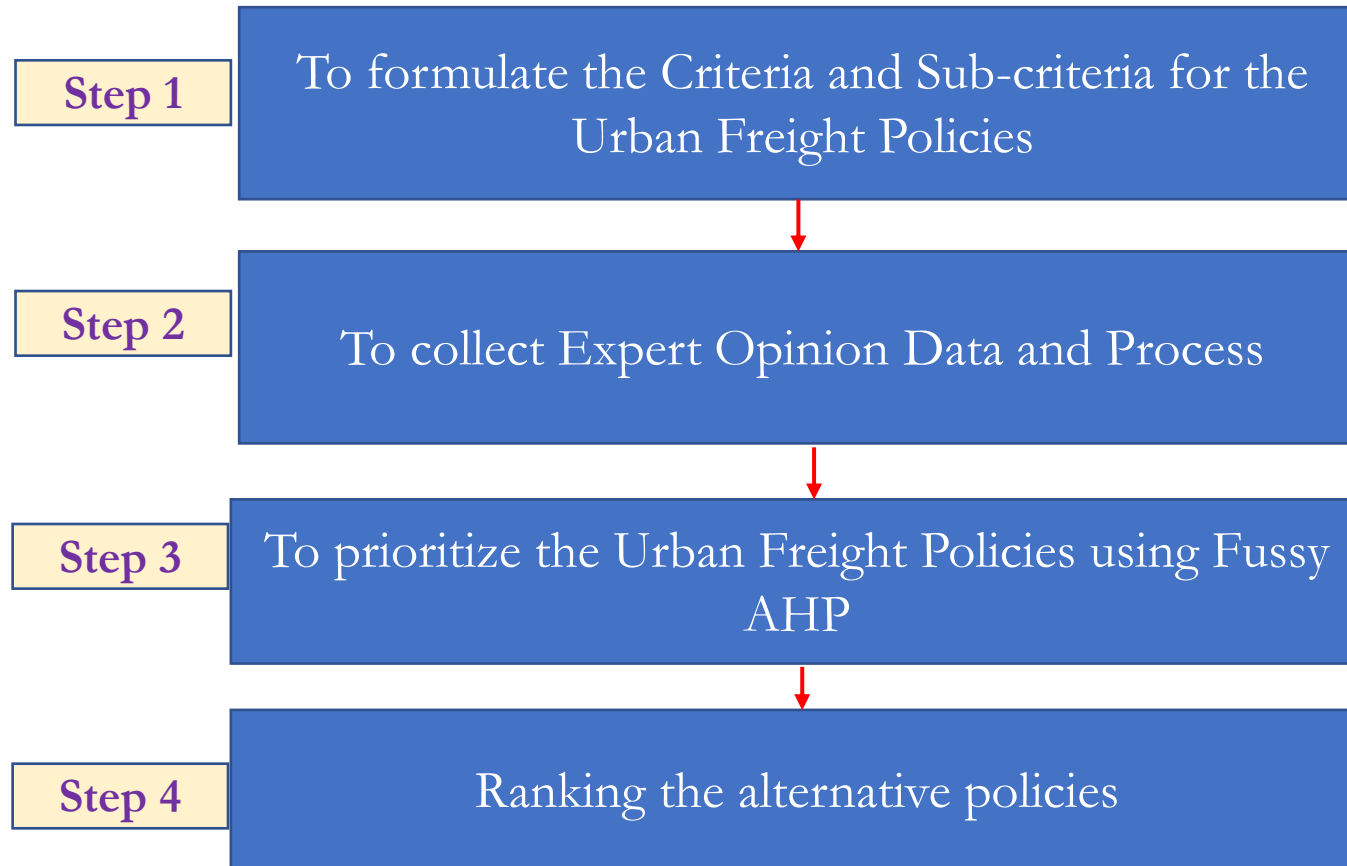


# Urban Freight Policies

- ❖ It is important to consider the urban freight operation for smooth movement of passengers and goods without hammering the city's livability and sustainability.
- ❖ Therefore, it is essential to propose sustainable freight policies based on local city conditions to improve the existing mobility system.
- ❖ The study on sustainable urban freight policies is heterogeneous as it needs to note the contrasting goals and interests of the various urban mobility players.
- ❖ Also, the wider perspective of components such as governance (authorities), the geographic approach of the city, infrastructure facilities, vehicle operators, and economic and environmental characteristics need to be considered to improve and enhance the urban freight system
- ❖ **Effective urban freight policies** need to be proposed by understanding actual field condition of the **interacting agents, robustness of the supply chain characteristics and prediction of travel demand** involved in the urban freight system.
- ❖ **The alternative set** of urban freight policies and solutions are need to be framed and it is required to **prioritize** the policies from **expert's opinion** for **local Indian administration** in better planning and performance of urban freight system.
- ❖ Therefore, a methodological framework was developed to prioritize the effective urban freight policies using the **multiple criteria decision making technique** (Fussy Analytic Hierarchy Process).



# Prioritization of Urban Freight Policies



# Formulation of Urban Freight Policies

The urban freight policies are formulated on four major broader criteria such as **public infrastructure, land use management, access condition and traffic management** from expert opinion and existing

❖ Each broader urban freight criteria are discussed in detail into four sub-criteria policies/solutions.

|                                                              |                          |                                                                                                                                                                                           |
|--------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Local Administration solutions<br>for urban freight activity | 1. Public Infrastructure | <ul style="list-style-type: none"><li>✓ City Terminal</li><li>✓ Outskirts logistics centre</li><li>✓ Medium Duty EV operation</li><li>✓ Logistics improvement of terminal</li></ul>       |
|                                                              | 2. Land use Management   | <ul style="list-style-type: none"><li>✓ Urban Consolidation Center</li><li>✓ Parking space</li><li>✓ Load Zone provision</li><li>✓ U/L bay</li></ul>                                      |
|                                                              | 3. Access Condition      | <ul style="list-style-type: none"><li>✓ Access according to the weight and volume</li><li>✓ Road Pricing/Toll</li><li>✓ Off hour delivery</li><li>✓ Access time windows</li></ul>         |
|                                                              | 4. Traffic Management    | <ul style="list-style-type: none"><li>✓ ITS solution to collect freight data information</li><li>✓ Enforcement</li><li>✓ Automatic Access Control</li><li>✓ Operator Management</li></ul> |



## Expert Opinion Survey

- ❖ Expert opinion questionnaire form was prepared to capture the **suitable alternative urban freight policies for the Indian conditions**.
- ❖ Responses were collected on a **five-point Likert scale** (1 = strongly disagree, 2= disagree, 3= neutral, 4 = agree, and 5 = strongly agree).
- ❖ **Urban freight planners, academic faculties working in transportation planning, and logistics stakeholders** were targeted in expert opinion survey process.
- ❖ The survey was conducted in the month of January, 2021 and a total of **29** responses were obtained from experts.
- ❖ Further, samples were obtained as -readable datasets, and cross-verification was performed.



# Expert Opinion Questionnaire Form

## Prioritization of Urban Freight Policies for the Indian condition

Dear Sir/Ma'am,  
Greetings,

I am Varahan, Ph.D. Research Scholar, C/O. Dr. Marisamynathan S, Transport Engineering and Management Division, National Institute of Technology Tiruchirappalli (NIT T). Presently, working on an urban freight planning and policies project to solve the local freight problems. The attached questionnaire is designed to gain the expert's opinion/view for effective policy suggestion. The questionnaire is fabricated to be easily understandable and time-efficient. Your 2 minutes will be helpful for formulating effective policies for society. Thank you for your valuable time.

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## Prioritization of Urban Freight Measurement Policies for the Indian condition

\* Required

### Expert's Opinion Survey Form for Solving Urban Freight Problem

Type of Profession \*

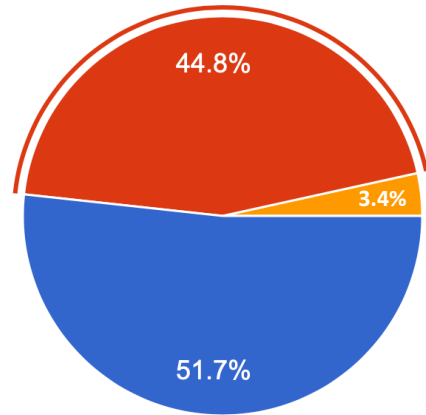
- ☐ Academician
- ☐ Government Field Engineer/Officer
- ☐ Stock Holder/Others

Field of experience (In Years) \*

- ☐ Less than 5 years of experience
- ☐ 5 to 15 years of experience
- ☐ More than 15 years



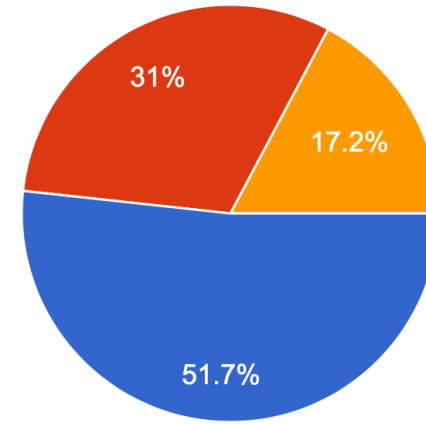
# Analysis Results



Type of Profession

29 responses

- Academician
- Government Field Engineer/Officer
- Stock Holder/Others



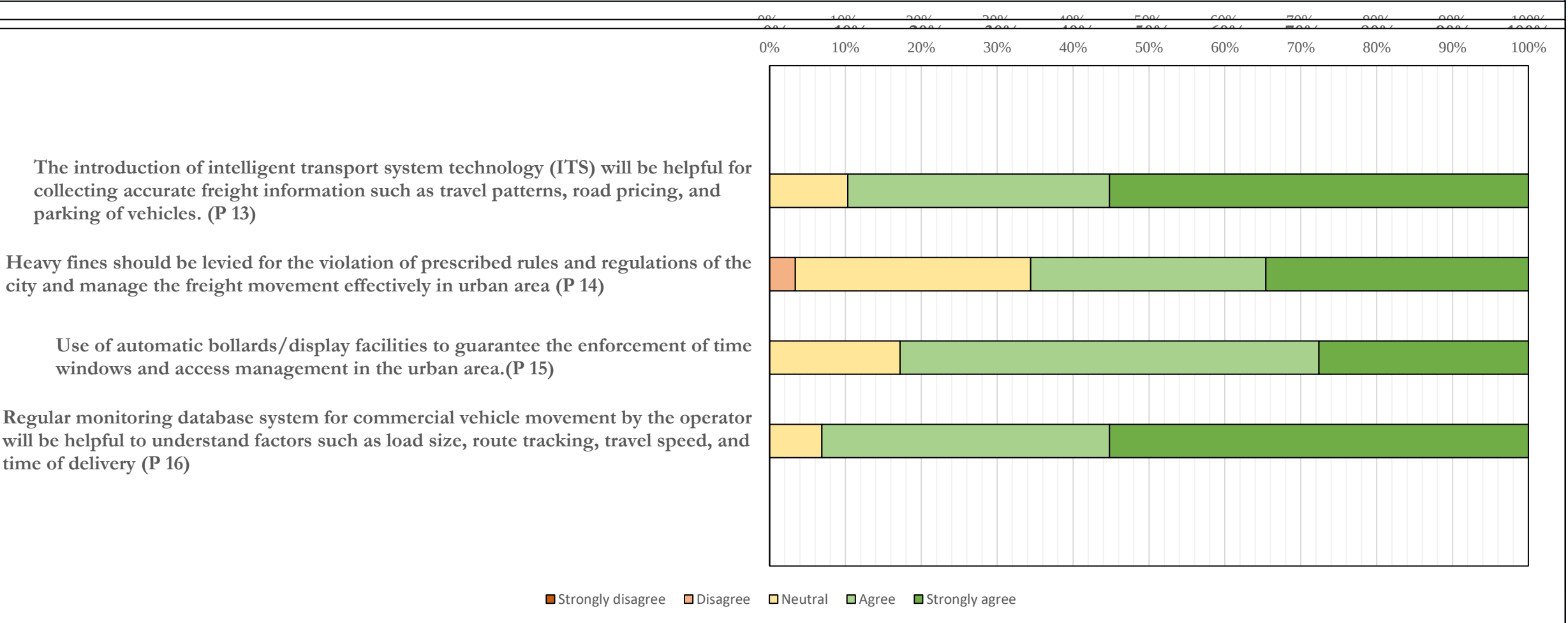
Field of experience (In Years)

29 responses

- Less than 5 years of experience
- 5 to 15 years of experience
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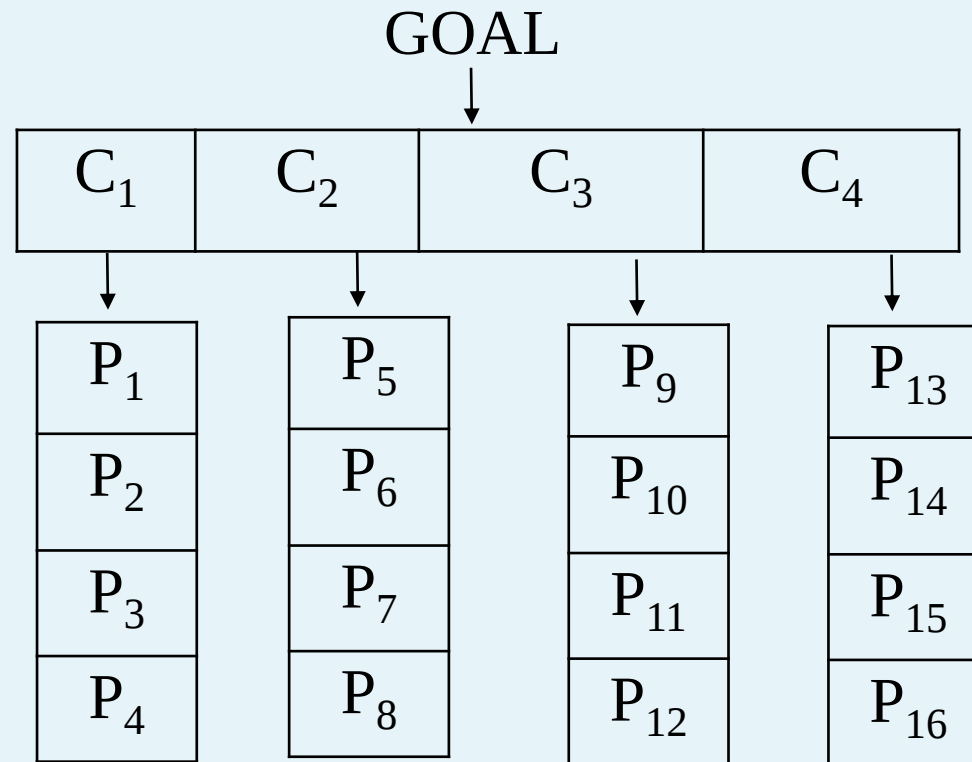


Analysis Results – Confidentiality of Freight Information (C<sub>1</sub>)(C<sub>2</sub>)(C<sub>3</sub>)



## Fussy- AHP Modelling Procedure

The structure of Fussy AHP consists of **number of criteria  $i$  and number of alternatives  $j$** . Each alternative is evaluated in terms of **relative importance and weightage** for each criterion.



# Fussy- AHP Modelling Procedure

Step I. Construct the **pairwise comparison matrix** for the alternatives  $P_1, P_2, P_3$ , &  $P_4$  with respect to the criterion  $C_1$

| Alternative<br>Criterion | $P_1$                    | $P_2$                    | $P_3$                    | $P_4$    | $\sum p_{g_i}^j$                                                                              |
|--------------------------|--------------------------|--------------------------|--------------------------|----------|-----------------------------------------------------------------------------------------------|
| $P_1$                    | $P_{11}$                 | $P_{12}$                 | $P_{13}$                 | $P_{14}$ | $P_{1j} = (l_{1j}, m_{1j}, u_{1j})$ :<br>$j = 1,2,3,4$<br>With $l_{11} = m_{11} = u_{11} = 1$ |
| $P_2$                    | $P_{21} = (P_{12})^{-1}$ | $P_{22}$                 | $P_{23}$                 | $P_{24}$ | $P_{2j} = (l_{2j}, m_{2j}, u_{2j})$ :<br>$j = 1,2,3,4$<br>With $l_{23} = m_{22} = u_{33} = 1$ |
| $P_3$                    | $P_{31} = (P_{13})^{-1}$ | $P_{32} = (P_{23})^{-1}$ | $P_{33}$                 | $P_{34}$ | $P_{3j} = (l_{3j}, m_{3j}, u_{3j})$ :<br>$j = 1,2,3,4$<br>With $l_{33} = m_{33} = u_{33} = 1$ |
| $P_4$                    | $P_{41} = (P_{14})^{-1}$ | $P_{42} = (P_{24})^{-1}$ | $P_{42} = (P_{24})^{-1}$ | $P_{44}$ | $P_{4j} = (l_{4j}, m_{4j}, u_{4j})$ :<br>$j = 1,2,3,4$<br>With $l_{44} = m_{44} = u_{44} = 1$ |

Step II. Calculate the consistency of the pairwise comparison by fussy synthetic extent,

$$F = \sum_{i=1}^4 \sum_{j=1}^4 C_{g_i}^j$$



# Fussy- AHP Modelling Procedure

Step III. Find the weight vector for the alternatives  $P_1, P_2, P_3$ , &  $P_4$ , with respect to the criterion  $i = 1$  by applying Chang's extent analysis

$$\begin{cases} 1 & \text{if } m_2 \geq m_1 \\ 0 & \text{if } l_1 \geq u_2 \\ \frac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)} & \text{otherwise} \end{cases}$$

Step IV. Obtain the weight vectors and relative importance for  $P_1, P_2, P_3$ , &  $P_4$  corresponding to  $d(P_1), d(P_2), d(P_3), d(P_4)$

$$w_{c_1} = (d(P_1), d(P_2), d(P_3), d(P_4)) T$$



# Results – Prioritization of Urban Freight Policies



## Results – Prioritization of Urban Freight Policies

- ❖ Still, based on the expert's opinion, it is suggested that actions related to public infrastructure facilities ( $C_1$ ) require high investments of money. At the same time, they might produce better and more solid results in the future, involve higher economic and social risks
- ❖ Our concluding remarks suggest a path towards better management of existing infrastructures and policies should focus on delivery system, monitoring database system, traffic management, load zone, and parking policy which is highly effective for Indian city.
- ❖ Moreover, a specific policy or combination of policies can be implemented, and all the alternative policies are general and appropriate for any urban area.
- ❖ Also, few urban policies seem to achieve higher degrees of sustainability but actually, end up creating more inefficiency in the overall transport system.
- ❖ Thus, urban freight policies can be implemented based on the degree of suitability and anticipated outcome in the urban area.



# Thank You

