

# Freight-on-Transit: A Systematic Review Centered on Freight Needs, Methods, and Real-World Implementation

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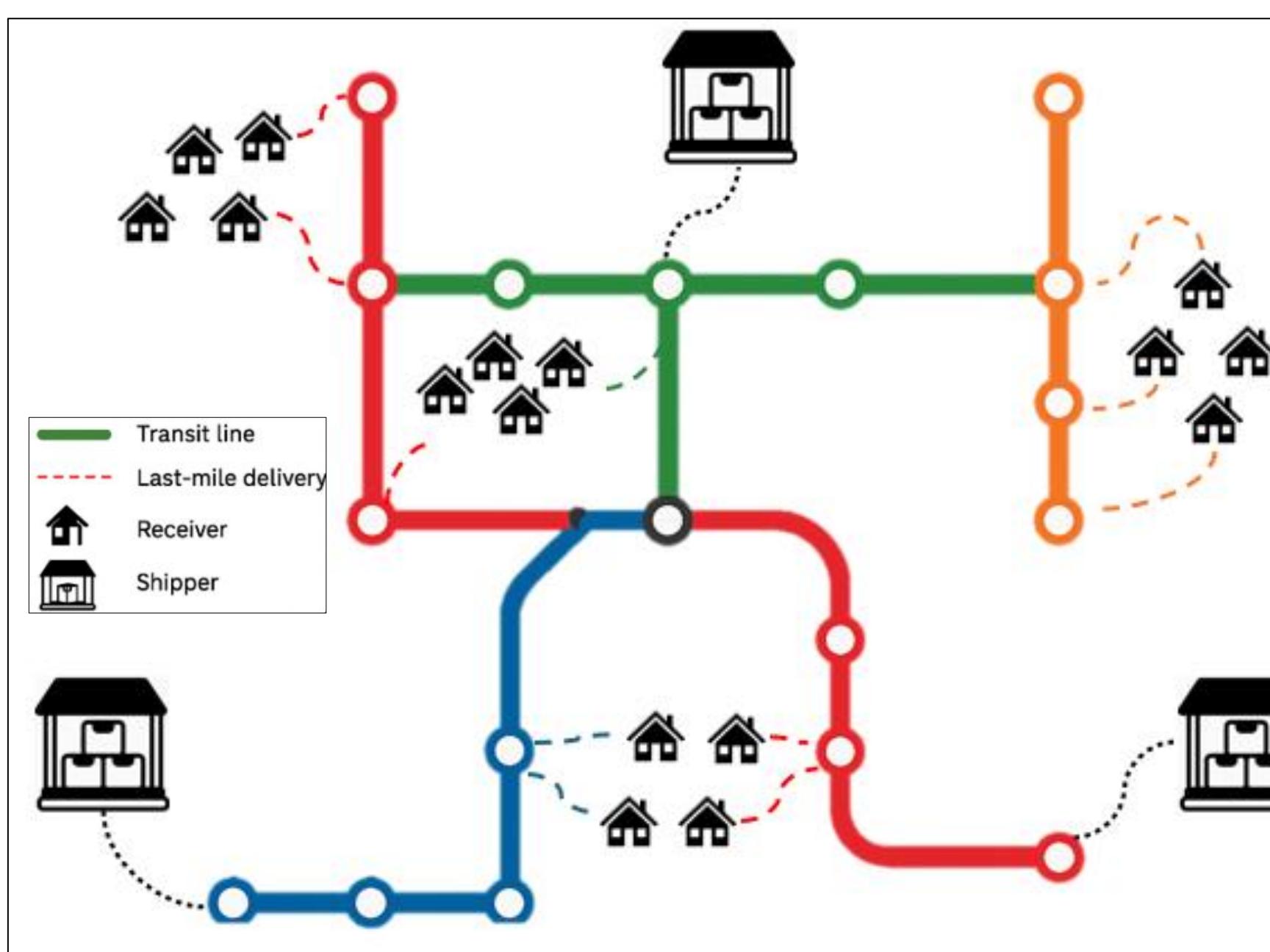
## Motivation

- Freight transportation plays a critical role in sustaining the economic and social vitality of cities.
- Transportation systems face spatial constraints that limit infrastructure expansion and complicate freight movement in dense city centers.
- Freight on Transit (FOT) has emerged as a strategy to improve last-mile logistics, reduce congestion, and support environmental goals.
- Current literature has focused on how to optimize the public transit system, often ignoring freight considerations that are needed to assess feasibility and scalability.

## Research Goal

- Systematically synthesize existing FOT research to identify dominant methods, analytical domains, and operational strategies used across studies.
- Highlight freight-relevant dimensions that condition the operational feasibility of FOT systems.
- Identify implementation barriers and gaps related to institutional coordination, regulation, and operations to inform future research and policy design.

## FOT System



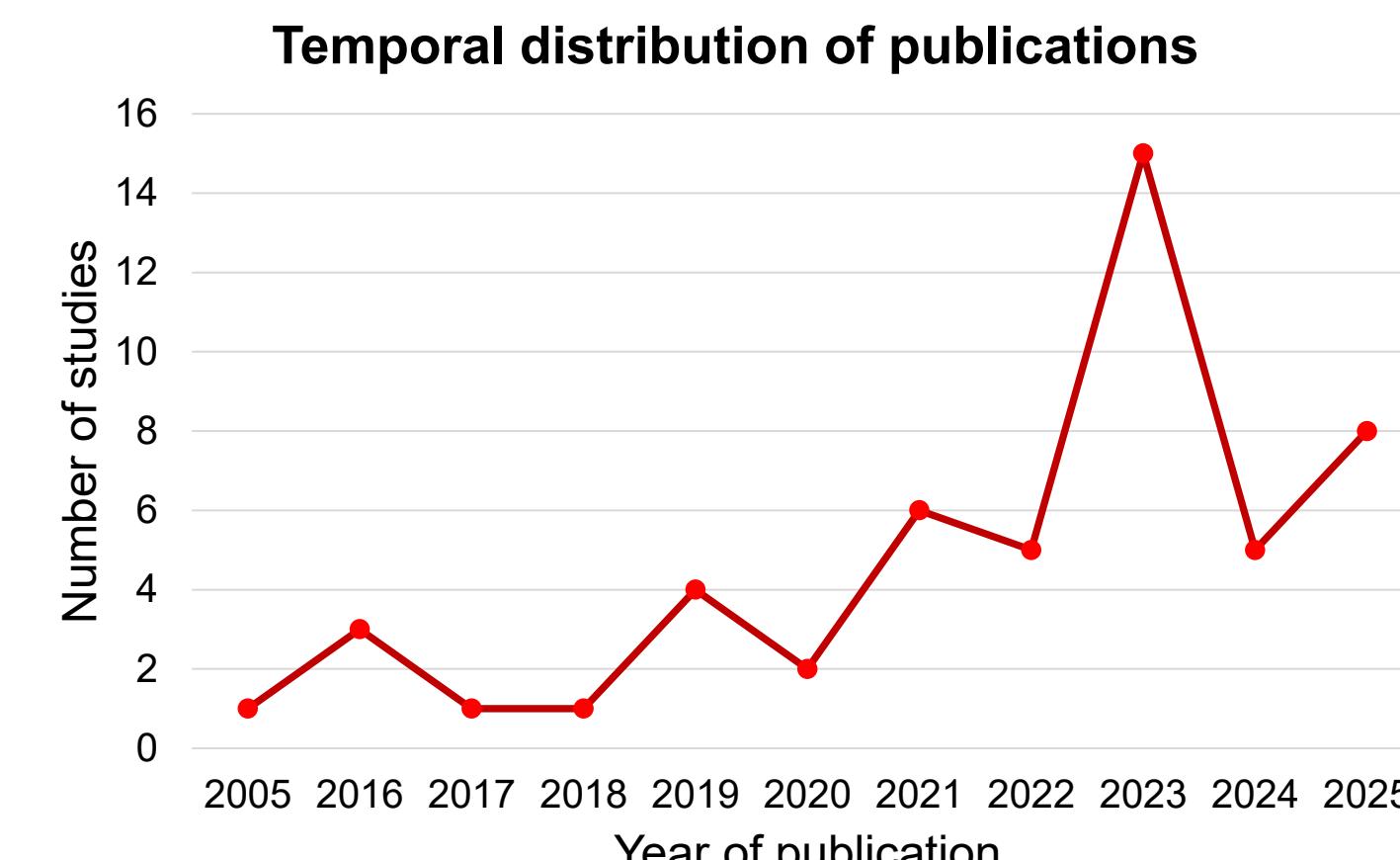
Goods are transferred from shippers to the public transit network at selected stops, transported along transit routes, and subsequently delivered to receivers through first- and last-mile distribution.

## Methodology: PRISMA

This research adopts the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology to ensure procedural rigor and transparency. Using Boolean operators, 455 initial records were identified. After the screening process, 51 studies were included in the review.

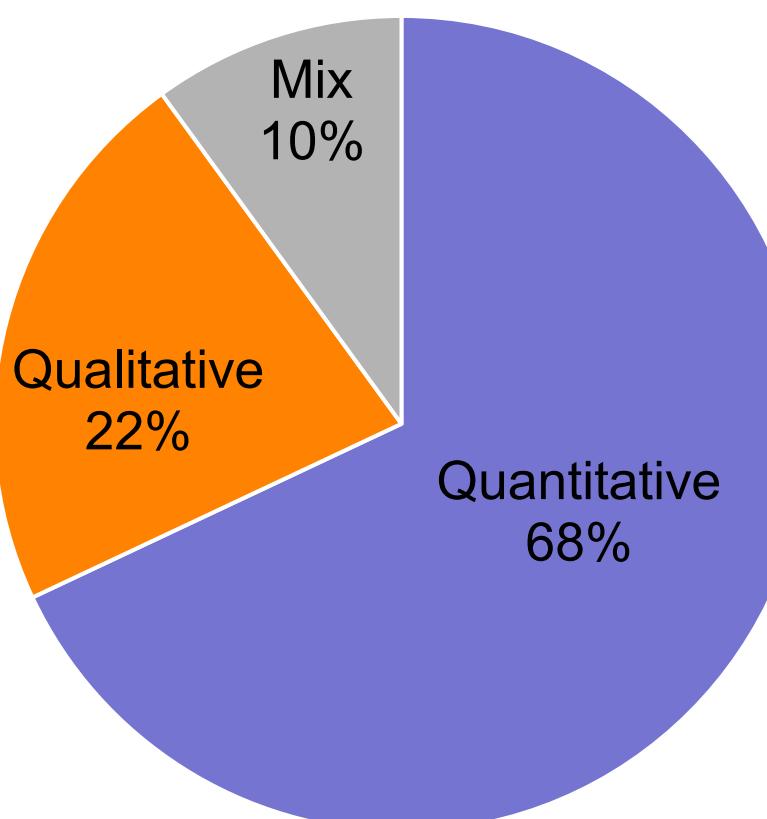
- Inclusion criteria:
  - Relevance to FOT.
  - Impact Evaluation.
  - Publication Quality.
- Exclusion criteria:
  - Language.
  - Irrelevant Focus.
  - Incomplete Documentation.
  - Duplicated records.
  - Non-peer-reviewed Sources.

## Results: Study year and Methods

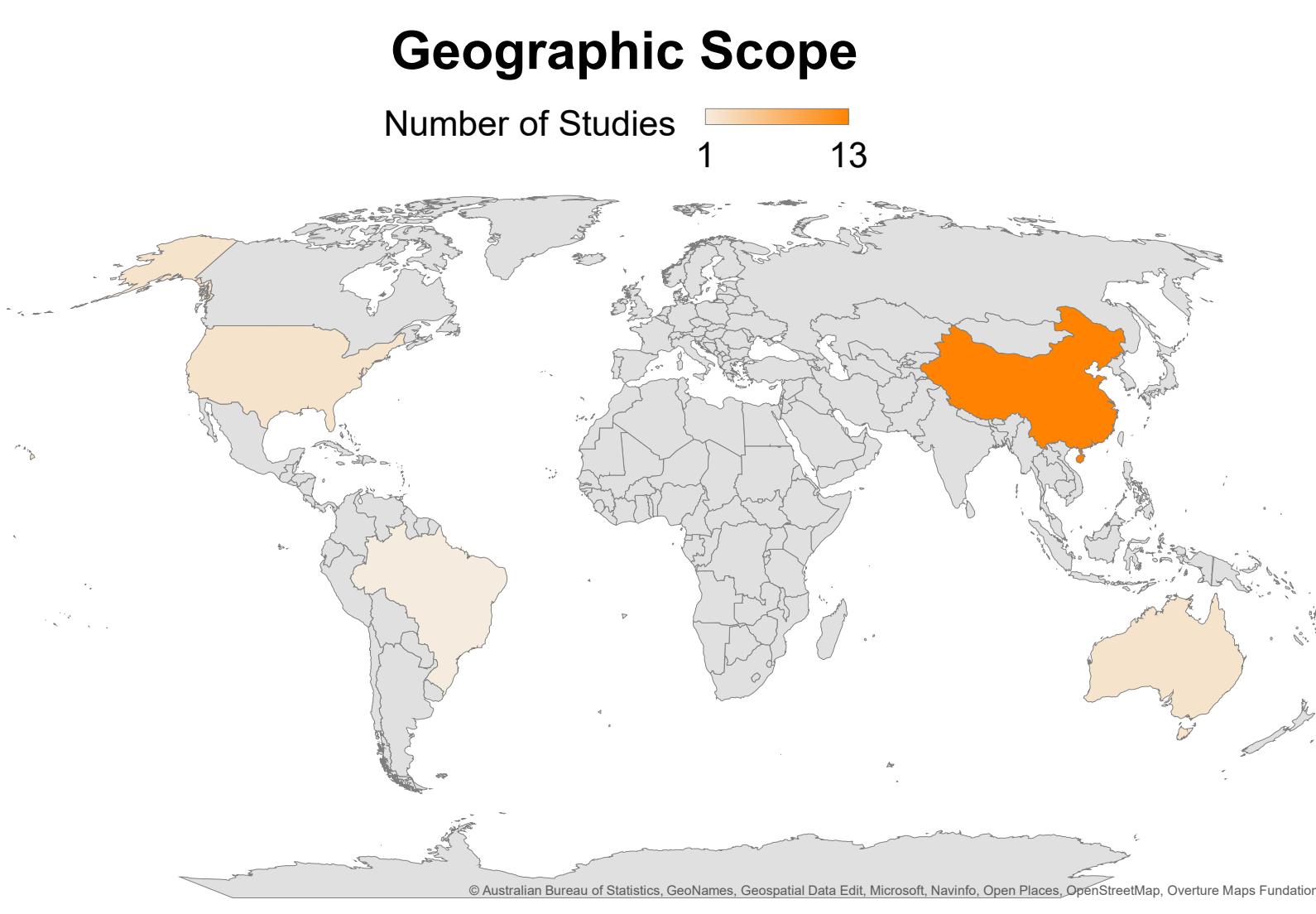


This pattern reflects the growing academic and practical interest in FOT as an innovative solution to the spatial constraints.

## Methodological approach



Quantitative research on FOT predominantly relies on mathematical programming frameworks to model resource allocation, routing, scheduling, and network design problems

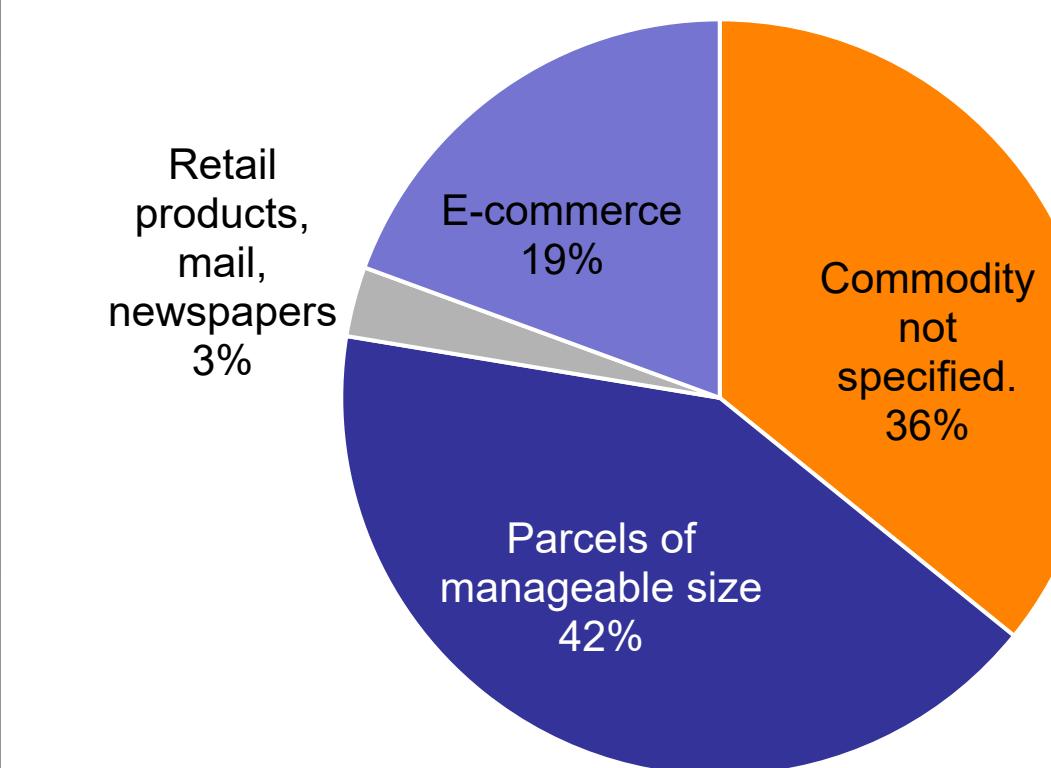


## Results

### Key Findings:

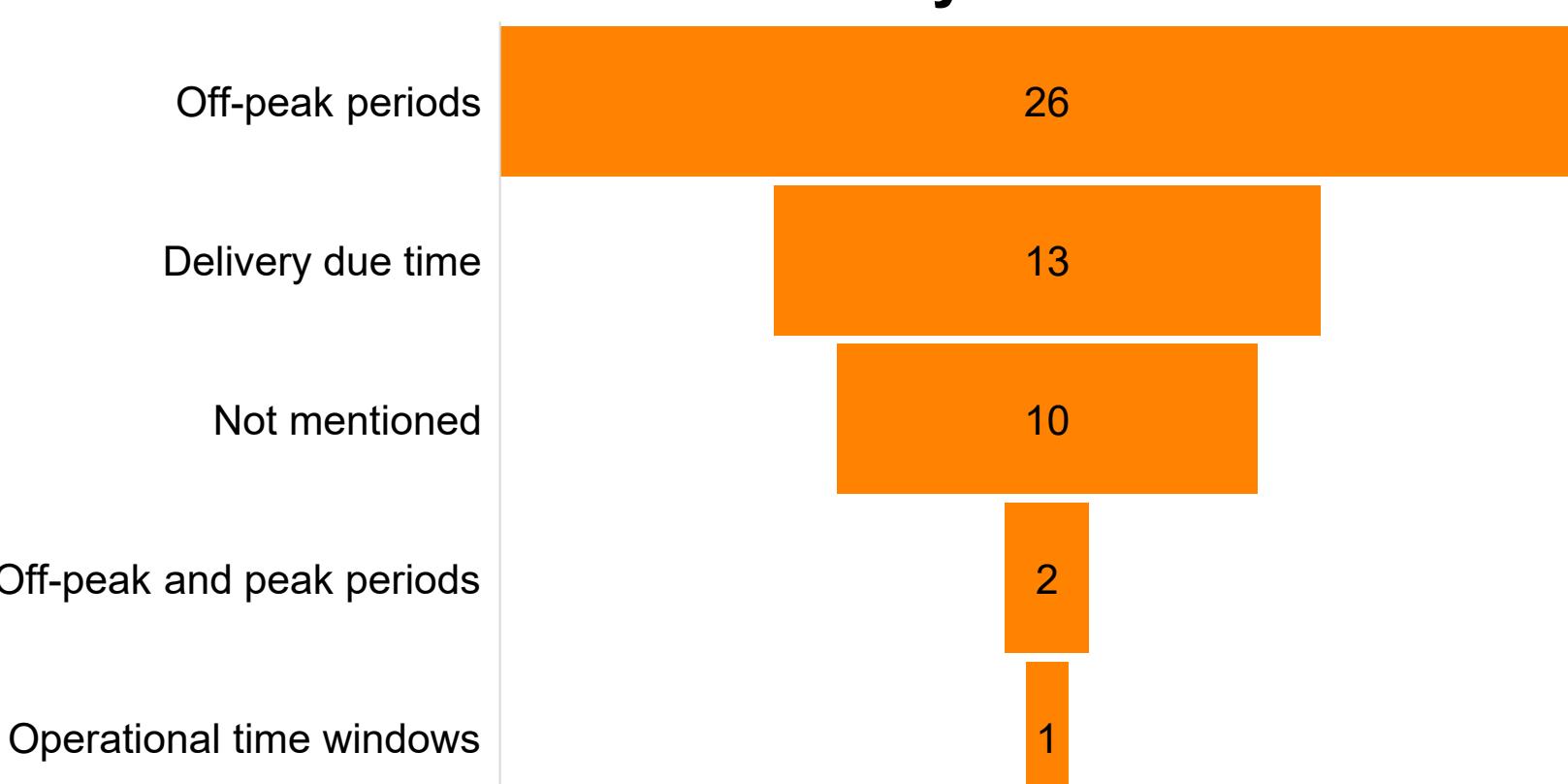
- Technical feasibility is well established, particularly when operational conditions are carefully managed.
- Shared-use strategies deliver the strongest operational gains, especially off-peak freight use of metro systems and mixed passenger-freight bus services, yielding cost reductions, improved vehicle utilization.
- Benefits remain highly sensitive to capacity allocation, station constraints, coordination mechanisms, and infrastructure design, with institutional and operational risks limiting scalability without targeted planning.

### Commodity Type



Even when “parcels” is the most common term used to describe the transported goods, there is no commodity specification in 78% of the studies.

### Time of day



## Conclusions

- FOT systems are operationally feasible and beneficial, delivering cost, congestion, and emissions reductions while preserving passenger service when capacity, scheduling, and routing are properly managed.
- Current research emphasizes technical optimization, but real-world scalability depends on institutional coordination and explicit treatment of freight-specific parameters such as commodity type and delivery timing.
- Context-sensitive policies are essential, particularly those supporting off-peak freight operations, standardized parcels, stakeholder collaboration, and infrastructure adaptation in high-density environments.

Ignoring freight-related constraints can compromise safety, capacity, and passenger service reliability, whereas clearly defined parcel eligibility and off-peak delivery windows enable feasible, scalable, and context-sensitive FOT implementation.