

What can property owners do for sustainable urban freight? The case of Nordstan shopping mall

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Introduction

- The importance to pay attention to connection between freight and land use, i.e. the way the land is used in urban area directly affects what kind of traffic is going to be attracted to this area.
- Limitation on the city infrastructure which was planned and constructed for decades ago, capacities are not sufficient
- Pricing measures imposed on carriers are much less efficient as expected (Holguin-Veras et al., 2015)
- The focus should be on goods receivers as they the demand generators
- The problems with that: receivers are fragmented, unaware about the negative effects of their logistics activities or don't know how to change that, unaware about their decisive role in the chain.
- The solution could be to engage organisations that reach many goods receivers and help them to re-arrange their logistics activities in a more sustainable way

Influencers in urban freight

- **Influencers or influencing organisations** – norm-setting third-party (i.e. indirect) urban freight stakeholders.
- They engage actively with issues of sustainability and “liveability” (i.e. quality of life) of the urban setting.
- Motivated to enforce the standards of behaviour and attitudes of receivers that in turn leads to pressure on their logistics service providers.
- They are not goods sender, not goods receivers or transport operators, they do not take the ownership of the goods, and sometimes don't see the goods but their activities can influence how goods receivers are managing their goods flows.

MAPPING OF INFLUENCERS

- Actors that bring local businesses together and influences the agenda related to logistical services - for example **Business Improvement Districts (BIDs)**;
- **Property owners** of commercial establishments like offices and shopping malls.
- **Public sector procurement organisations** that group city and local authorities together in terms of their purchasing activity.
- Private sector companies such as **facility management companies** that may work for a range of businesses providing purchasing services and also providing out-sourced activities such as cleaning and catering.

Influencers and influencing organisations

Property owners (shopping malls, offices)



Purpose

- The purpose of this study is to explain the role of influencing organisations in promoting to changing to replenishment practices with lower traffic impacts*
- In particular - the case of shopping mall as an influencing organisation
- How being located in a shopping mall can facilitate the implementation of freight demand management strategies

*Traffic impacts - the decreased number of trips to deliver goods

Method

- Case study – the case of shopping centre Nordstan, located centrally in the city of Gothenburg, Sweden
- The data were collected during the case study performed by the City of Gothenburg investigating possibilities to establish consolidation scheme for deliveries to Nordstan shopping mall, during 2 weeks in 2016
- Data collection method – survey, interviews, observations
- Unit of analysis – the amount of trips generated per week, including deliveries and pick ups
- FTG models are applied in order to understand how economic variables relate to the amount of delivery and pick-up trips to Nordstan

Results

GENERAL INFORMATION

- There are ~200 tenants in Nordstan, response rate ~ 79%
 - Perishable goods retailers (groceries) – 4 observations (3%)
 - Non-perishable goods retailers (shops) – 81 observations (51%)
 - Food services (restaurants and cafes) – 29 observations (18%)
 - Offices – 39 observations (25%)
 - Other services – 4 observations (3%)
 - Other (hotel) – 1 obs.

Table 1 Descriptive statistics of data collected

| Type of establishment | Observations | | Area, m ² | | | Employees, people | | | FTG per week | | |
|--------------------------|--------------|------|----------------------|---------|------|-------------------|---------|------|--------------|--------|------|
| | count | % | Total | Average | % | Total | Average | % | Average | Total | % |
| Non-perishable retailers | 81 | 51% | 59349 | 732,7 | 0,5 | 1252 | 15,5 | 25% | 9,4 | 761,4 | 47% |
| Offices | 39 | 25% | 65544 | 1680,6 | 1,1 | 3392 | 87,0 | 67% | 9,3 | 362,7 | 22% |
| Perishable retailers | 4 | 3% | 3268 | 817,0 | 0,5 | 90 | 22,5 | 2% | 41,8 | 167,2 | 10% |
| Food services | 29 | 18% | 6146,0 | 211,9 | 0,1 | 188,5 | 6,5 | 4% | 8,7 | 252,3 | 15% |
| Other services | 4 | 3% | 662 | 165,5 | 0,1 | 58 | 14,5 | 1% | 10,4 | 41,6 | 3% |
| Other | 1 | 1% | 18000 | 18000,0 | 11,8 | 100 | 100,0 | 2% | 46 | 46 | 3% |
| Sum | 158 | 100% | 152969 | 21607,8 | 14,1 | 5080,5 | 32,2 | 100% | n.a. | 1631,2 | 100% |



AMOUNT OF DELIVERY AND PICK-UP TRIPS BY SECTOR AND PRODUCT TYPE

- **Delivery trip by types of goods:**
 - Perishable goods (food, drinks, flowers, etc.) – 29%
 - Non-perishable goods (clothes, shoes, cosmetics, etc.) – 29%
 - Office supplies and electronics – 28%
 - Other goods – 14%
- The biggest trip attractor is non-perishable sector – accounts for 802 trips/week (47%)
- Offices attracts in average 433,5 trips/week (25%)
- Perishable goods retail and food services account for 11% each



Table 2 The scope of goods and quantity of trips to different commercial sectors

| Type of goods deliveries | Non-perishable retail | | Perishable retail | | Offices | | Food services | | Other services | | Hotel | | All | |
|--|-----------------------|------------|-------------------|------------|--------------|------------|---------------|------------|----------------|-----------|-----------|-----------|-------------|-------------|
| | Count | % | Count | % | Count | % | Count | % | Count | % | Count | % | Count | % |
| Foods and beverages | 54,5 | 7% | 161,5 | 83% | 75 | 17% | 179,5 | 90% | 1 | 2% | 24,5 | 53% | 492 | 29% |
| Ready clothes | 466,5 | 58% | 2,5 | 1% | 26,5 | 6% | 0 | 0% | 2 | 5% | 9 | 20% | 506 | 29% |
| Office supply, IT/equipment, electronics, etc. | 203 | 25% | 7,5 | 4% | 232,5 | 54% | 8,5 | 4% | 15 | 36% | 12,5 | 27% | 478,5 | 28% |
| Others | 78 | 10% | 23,5 | 12% | 99,5 | 23% | 11 | 6% | 23,5 | 57% | 0 | 0% | 240,5 | 14% |
| SUM | 802 | 47% | 195 | 11% | 433,5 | 25% | 199 | 12% | 41,5 | 2% | 46 | 3% | 1717 | 100% |

DELIVERY VEHICLES TYPE BY SECTOR

- **Types of vehicles for goods deliveries to the shopping mall**
 - Heavy vehicles are accounted for around 1/3 of delivery and pick-up trips
 - Light vehicle are accounted for around 40% of trips
- Perishable goods are delivered by mostly heavy vehicles and light trucks/vans (53% and 40%)
- Office deliveries and pickups most likely be done light trucks or van (41%), and bicycles (17%)
- Non-perishable retail goods are delivered by heavy and light duty vehicles (36% and 41%)



Table 3 Delivery vehicles to the establishments to Nordstan

| Type of vehicle | Non-perishable retail | | Perishable retail | | Offices | | Food services | | Other services | | Hotel | | All | |
|--------------------------|-----------------------|-------------|-------------------|-------------|------------|-------------|---------------|-------------|----------------|-------------|-----------|-------------|-------------|-------------|
| | Count | % | Count | % | Count | % | Count | % | Count | % | Count | % | Count | % |
| Heavy truck, > 3,5 t | 277,5 | 36% | 101,5 | 53% | 45,5 | 13% | 70 | 38% | 4,5 | 11% | 25 | 54% | 524 | 33% |
| Light truck/van, < 3,5 t | 319,5 | 41% | 76 | 40% | 150,5 | 41% | 62,5 | 34% | 10,5 | 25% | 21 | 46% | 640 | 40% |
| Car | 23 | 3% | 0,5 | 0% | 49 | 13% | 19 | 10% | 0 | 0% | 0 | 0% | 91,5 | 6% |
| Bicycle | 9 | 1% | 0 | 0% | 61 | 17% | 0 | 0% | 0 | 0% | 0 | 0% | 70 | 4% |
| Not reported | 145 | 19% | 14 | 7% | 57 | 16% | 34 | 18% | 26,5 | 64% | 0 | 0% | 276,5 | 17% |
| SUM | 774 | 100% | 192 | 100% | 363 | 100% | 185,5 | 100% | 41,5 | 100% | 46 | 100% | 1602 | 100% |



TRANSPORT OPERATORS

- More than 200 transport operators that deliver and pick-up goods at Nordstan during 1 week
- Large transport operators (five biggest companies) produce almost 60% of all deliveries and pick-ups
- The results show that different types of establishment tend to have different transport operators, especially for food services and perishable retail goods



Table 4 Transport operators delivering to Nordstan

| Type business | Amount of transporters involved | Observations | Transporters per establishment | Total amount of deliveries | | Amount of deliveries by five big transporters* | |
|--------------------------------|---------------------------------|--------------|--------------------------------|----------------------------|-------------|--|------------|
| | | | | Count | % | Count | % |
| Non-perishable goods retailers | 57+ | 81 | 0,1 | 802 | 46% | 670,5 | 20% |
| Perishable goods retailers | 30+ | 4 | 7,5 | 195 | 12% | 21,5 | 1% |
| Food services | 45+ | 21 | 2,1 | 199 | 11% | 6,5 | 0% |
| Offices | 87+ | 39 | 2,2 | 433,5 | 26% | 268,5 | 8% |
| Other services | 10 | 4 | 2,5 | 41,5 | 2% | 31 | 1% |
| Hotel | 19 | 1 | 19 | 46 | 3% | 16 | 0% |
| SUM | 204+ | 150 | 1,36 | 1717 | 100% | 1014 | 59% |

CONTROL OF DELIVERIES

- 46% of deliveries are managed by central office or chain
- 21% of establishments have their deliveries uncontrolled and 13% - partially controlled
- 70% of non-perishable retailers and 38% of food services establishments have their deliveries controlled by the central office or chain
- 46% of offices don't have control on their deliveries, as well as 29% of restaurants



Table 5 Control of deliveries by the establishments in Nordstan

| Management of deliveries | Count | % | Shops | % | Offices | % | Restaurants | % |
|---|------------|-------------|-----------|-------------|-----------|-------------|-------------|-------------|
| Do not know (0) | 8 | 5% | 2 | 2% | 5 | 13% | 1 | 5% |
| Managed by central procurement, chain (1) | 68 | 46% | 57 | 70% | 2 | 5% | 8 | 38% |
| Controlled/ influenced by recipient (2) | 12 | 8% | 4 | 5% | 3 | 8% | 3 | 14% |
| Uncontrolled by recipient (3) | 32 | 21% | 7 | 9% | 18 | 46% | 6 | 29% |
| Partially controlled and uncontrolled (1, 2, 3) | 19 | 13% | 9 | 11% | 7 | 18% | 1 | 5% |
| Another (4) | 10 | 7% | 2 | 2% | 4 | 10% | 2 | 10% |
| SUM | 149 | 100% | 81 | 100% | 39 | 100% | 21 | 100% |

Freight Trip Generation (FTG) models

In order to understand how economic variables relate to the amount of delivery and pick up trips to Nordstan, we applied FTG models, using physical size of the establishment (we relate to it as area) and the amount of employees (further related as employment) as independent variables.

Table 6 Summary of the results of FTG model

| Commercial sector | Area models | | | | | Employment models | | | | |
|--------------------------------|-------------|----------------|----------------|------------------|------|-------------------|------------------|----------------|------------------|------|
| | Obs. | Const. | Area | Binary variable* | R2 | Obs. | Const. | Emp. | Binary variable* | R2 |
| Offices | 37 | n.a. | 0,43 (7,68) | n.a. | 0,63 | 37 | n.a. | 0,08 (9,06) | n.a. | 0,70 |
| Non-perishable goods retailers | 81 | 6,48 (8,27) | 0,40 (9,19) | n.a. | 0,52 | 81 | 5,73 (7,29) | 0,24 (9,80) | n.a. | 0,55 |
| Food services | 29 | 7,69 (6,14) | 0,99 (2,42) | -6,54 (-2,15) | 0,21 | 29 | 3,32** (1,82) | 1,27 (3,63) | -1,11 (-3,60) | 0,34 |

- **Freight Trip Generations (FTG)** is a sum of FTA and FTP and also trips that involve both goods deliveries and pick-ups; this parameter can be used for the estimation of the traffic congestion generated by certain establishment.
- **Freight Trip Attraction (FTA)** is defined as the number of trips attracted by the establishment during certain time period, for example deliveries of goods.
- **Freight Trip Production (FTP)** is the amount of trips produced by the establishment, for example, sending the goods to another establishments or returns.

Note: Const. denotes the intercept of the model, Emp. denotes the parameter of employees, the parameter for area is in 100m², t-stat parameters are displayed between parentheses under each parameter.

*Binary variable is a variable assigned for fast chains that use the same logistics provider

** For this model the intercept is significant at the 10% level of confidence

Freight trip generation model using area as independent variable

FTG models for food services, shops and offices are following:

Area models:

Offices: $FTG = 0,43 * A_{offices}$

Retailers NP: $FTG = 6,48 + 0,40 * A_{RetailersNP}$

Food services: $FTG = 7,69 - 6,53 * Est_{Fastfood} + 0,99 * A_{Rest}$

For retailers of non-perishable goods, each establishment generates about 6,5 trips every week, plus 0,4 extra trips per 100 m², e.g., a very small establishments generates about 6,5; while a 100 m² generates about 7 trips per week, and a 400 m² generates about 8 trips per week. These functions can also be used to calculate the total number of trips for Nordstan as follows (here the trips generated by non-perishable goods retailers, other service establishments and the hotel are not included):

$$FTG_{Area} = 0,43 \times A_{Offices} + 6,48 \times Est_{RetailersNP} + 0,40 \times A_{RetailersNP} + 7,69 \times Est_{Rest} - 6,53 \times Est_{Fastfood} + 0,99 \times A_{Rest}$$

where

FTG: Freight trip generation (in trips per week),

A: Area of the establishment (100 m²),

A_{offices}: Area of offices (100 m²),

A_{RetailersNP}: Area of non-perishable goods retailers (100 m²),

A_{Rest}: Area of food service establishment (100 m²),

Est_{RetailersNP}: Amount of non-perishable goods retailers,

Est_{Rest}: Amount of food service establishments,

Est_{Fastfood}: Amount food service establishments, grouped together as a “fast food service”

Freight trip generation model using amount of employees as independent variable

FTG (Employment):

$$\text{Offices: FTG} = 0,08 * E_{\text{offices}}$$

$$\text{Retailers NP: FTG} = 7,53 + 0,23 * E_{\text{RetailersNP}}$$

$$\text{Food services (II)*: FTG} = 3,32 - 1,11 * E_{\text{Fastfood}} + 1,27 * E_{\text{rest}}$$

* For this model the intercept is significant at the 10% level of confidence.

For the food services, as it was mentioned previously, the delivery patterns for the group of restaurants (we call them “fast food restaurants”) differ from the rest of establishments. Thus we created a variable that represent the amount of employees in this fast food restaurants.

This model has an interaction effect of employment and fast food restaurants. Meaning that being in a fast food restaurant decreases the effect of business size (measured by number of employees). A restaurant generates a base of 3,3 trips per week plus a number of deliveries that depends on the number of employees, if it is a fast food restaurant it generates 0,16 (1,27-1,11) extra deliveries per week per employee while if it is a regular restaurant it generates 1,27 extra deliveries per week per employee.

$$FTG_{\text{Emp}} = 0,08 * E_{\text{offices}} + 7,53 * Est_{\text{RetailersNP}} + 0,23 * E_{\text{RetailersNP}} + 3,32 * Est_{\text{Rest}} - 1,11 * E_{\text{Fastfood}} + 1,27 * E_{\text{Rest}}$$

where

FTG_{Emp} : Freight trip generation (in trips per week),

E : Number of employees in a typical day,

E_{offices} : Number of employees in offices,

$E_{\text{RetailersNP}}$: Number of employees in non-perishable retailer establishments,

$Est_{\text{RetailersNP}}$: Amount of non-perishable goods retailers,

Est_{Rest} : Amount of food service establishments,

E_{Fastfood} : Amount of employees in food service establishments, grouped together as a “fast food service”,

E_{Rest} : Number of employees in food services in a typical day.

The role of property owners in promoting more sustainable deliveries to the building

- The analysis of data showed that offices generate a lot of deliveries and pick-ups.
 - Around 400 trips/week
 - Second large group of tenants (39 observations)
 - More than 90 different transport operators
 - Offices generate 9,3 trips per establishment per week (7,5 deliveries plus 1,7 pick ups) compared to non-perishable goods retailers with 9,4 trips per week.
- It is decided to focus on office and to understand which organisational initiatives could be implemented at offices with the support of the property owners (shopping mall)
- The survey among the office tenants is going to be conducted in the shopping mall Nordstan (time plan October-November 2019)
- The results of the survey will be used by the shopping mall as a ground for new set of measures that would aim office tenants in order to achieve more sustainable deliveries to Nordstan



Possible organisational initiative that could lead to more sustainable deliveries and pickups (going to be tested by the survey):

- Demand and ordering policies
- To reduce/optimize the number of suppliers
- To try join procurement of some standard goods
- Retiming of deliveries and pick-ups
- Regulating of personal deliveries to work
- Shared collection lockers
- Concierge services
- Use of facility management company (FMC)
- Common post room



Conclusions

- Shopping malls are big freight trip generators
- It is possible to estimate the amount of delivery and pick-up trips based on land use and business size (like area and employment)
- Being located in shopping mall creates opportunities to decrease the amount of delivery and pick-up trips keeping up the service level
- The solution is implementation of organisational initiatives that could be facilitated and promoted by the property owners of shopping mall

Thank you

