



CITY LOGISTICS

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Sustainable Transportation within the Framework of Green Deal - SPHERE

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1. INTRODUCTION



Evolution of Urban Supply

Historical Context

Problems of supplying cities with goods and removing materials from urban areas have always existed. They were solved depending on the level of economic, cultural, and technological development.

Delivery of goods is necessary for urban life and business activities. It supports economic growth and development.

Efficient freight transport improves the competitiveness of cities. It creates jobs and income, but it also causes negative effects on the city.

Modern Challenges

In conditions of global competition, cities try to develop efficient transport systems to support economic growth.

Better and more environmentally friendly logistics systems help cities become more competitive.

A large part of goods flows starts or ends inside cities. Because of that, urban logistics is very important for modern cities.

Dimensions of Urban Freight Transport

2/3

of goods flows

Two-thirds of all goods flows start or end in central city areas

1-2%

of city area

The city center (CBD) creates about one-third of all freight movements

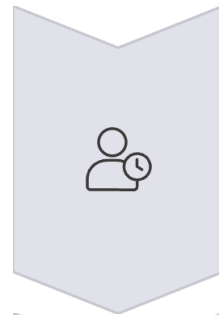
10K+

freight vehicles

Tens of thousands of freight vehicles operate daily in large European cities

Research shows that freight transport is very important in cities, especially in central zones. This trend is expected to continue.

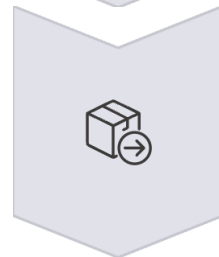
Drivers of Freight Transport Growth



JIT Strategy (Just-In-Time)
Low inventory and precise delivery timing



E-commerce
Growth of online shopping and home delivery



High Costs
Urban freight transport is expensive in terms of time and money

Modern trends require more frequent deliveries of smaller quantities. This increases transport costs.

Transformation of City Freight Gates

Medieval Period

Ports, harbors, and markets were main entry points for goods. Example: Bruges had a "water hall" where ships delivered goods.

1

Industrial Era

Development of road, rail, and air transport created transfer points where goods change transport mode.

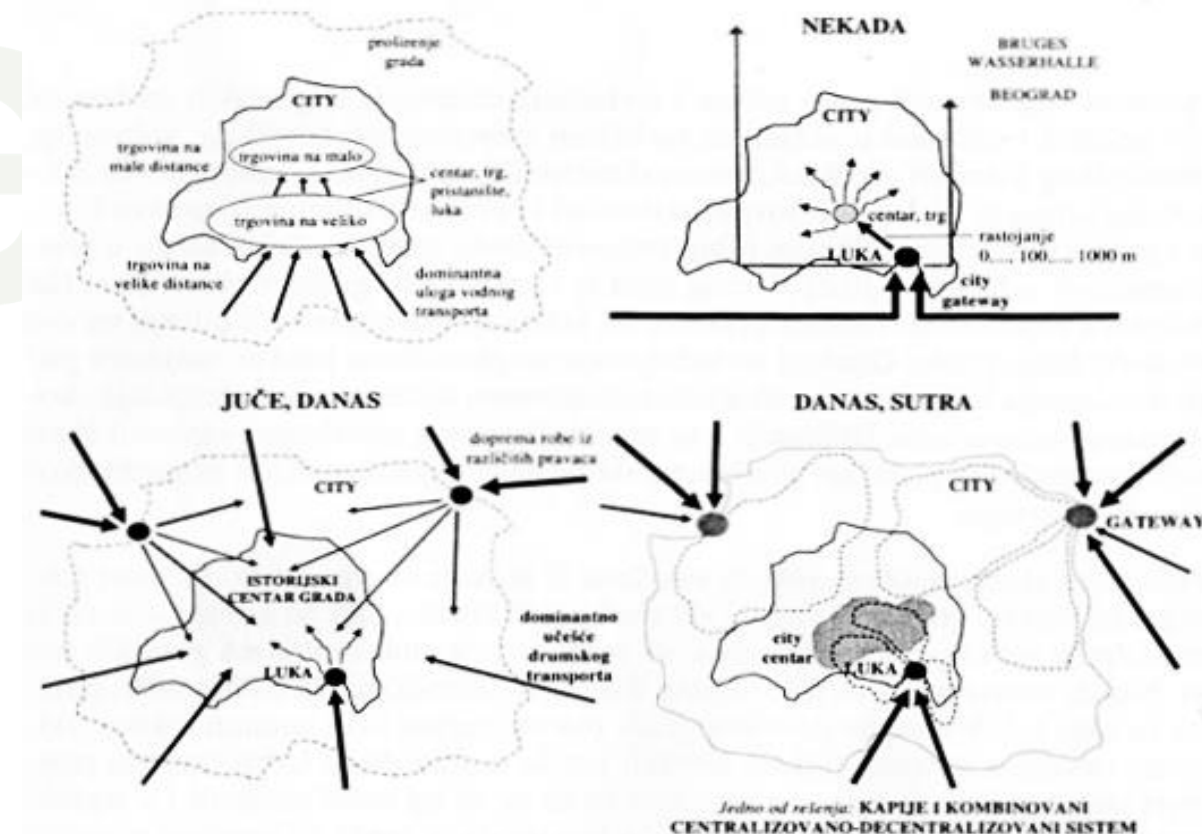
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Modern Period

The stopping points of flows are shifted toward peripheral zones and terminals, from which goods, in consolidated shipments within micro-distribution, are delivered to users in central urban areas.

3

Procurement of goods, storage, and distribution are important functions in urban structures. During the evolution of urban structures, these functions have also changed their forms and physical components, adapting to technological and social changes



Dominance of Road Transport

In transport chains, the initial and final transport operations to and from users are mainly carried out by road transport. Since most flows begin or end in urban areas, road transport therefore has a dominant share in these environments, with a large number of unnecessarily duplicated empty trips.

The large share of road freight transport and the impacts it has on the quality of life and the functioning of the city are driving research aimed at finding new solutions for logistics and goods distribution. In order to understand the scale of the problem, as well as the possibilities and importance of new trends in urban logistics, it is useful to know the volume of road freight transport

- ❏ Key problem: A large number of unnecessarily duplicated and empty trips by road freight vehicles create significant economic and environmental problems in urban areas.

Residents' Demand for Goods

Annual Consumption

According to research in developed European countries, the needs of one urban resident for consumer goods exceed one ton per year

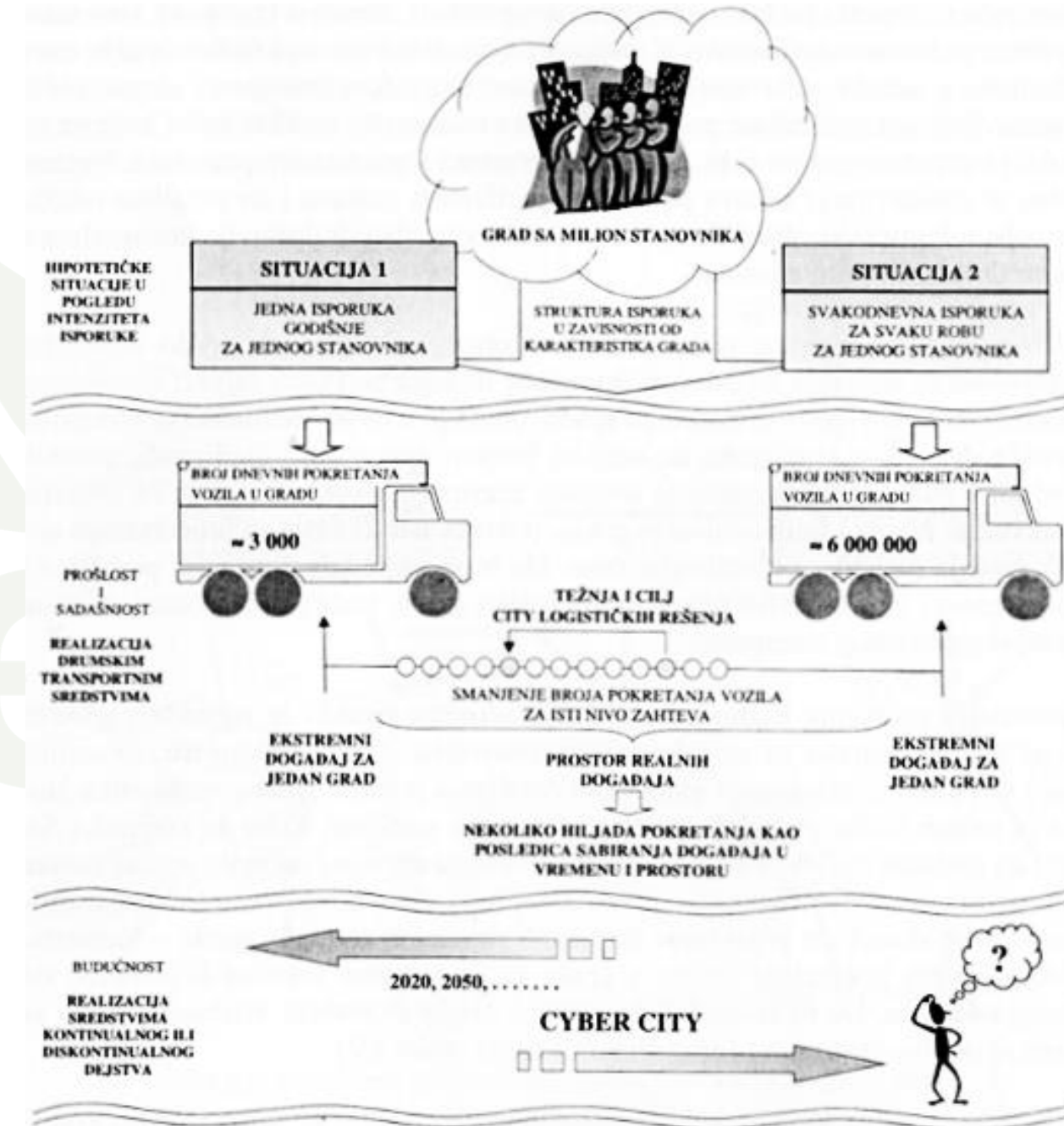
Distribution

Goods reach consumers in various ways, most commonly through retail facilities located in all spatial structures of the city

Daily movement

The number of daily vehicle trips in a city is a variable that depends on many factors and on the structure of deliveries.

The scale of the urban freight transport problem can perhaps be best understood by analyzing the supply needs of the population. Due to the daily demand for a wide range of goods, a large number of road freight delivery vehicles are set in motion.



Extreme Delivery Situations

Situacija 1: Optimalna Konsolidacija

Jedna tona za jednog stanovnika isporučuje se samo jednom godišnje, jednim dostavnim vozilom. Za milionski grad to znači oko **tri hiljade vozila dnevno**.

- Maksimalna konsolidacija isporuka
- Minimalan broj pokretanja vozila
- Najveća efikasnost transporta

Situacija 2: Individualizovana Isporuka

Svakodnevno, prema potrebi, za svakog stanovnika, za određenu vrstu robe pokreće se posebno dostavno vozilo. Za milionski grad to znači **nekoliko miliona vozila dnevno**.

- Potpuna individualizacija
- Maksimalan broj pokretanja
- Najniža efikasnost transporta

From the perspective of today's living conditions, technology, and supply chain organization, these two situations are not realistic; however, they certainly define the boundaries within which real events take place. Real events tend toward Situation 1 due to the need to transport as much goods as possible to one destination, one recipient.

Faktor Sabiranja Zahteva

Princip Konsolidacije

Srećom, jedno dostavno vozilo ne prevozi robu samo jednom stanovniku ili jednom domaćinstvu. Realnost je posledica niza faktora, a jedan od najznačajnijih je **faktor sabiranja logističkih zahteva u vremenu i prostoru** po principu delimičnog usaglašavanja ponude i tražnje.

Na taj način se broj potrebnih dostavnih vozila u funkciji zadovoljenja zahteva svih stanovnika jednog grada svodi na angažovanje nekoliko miliona vozila godišnje, odnosno nekoliko hiljada dnevno.

Potencijal Optimizacije

U postojećim sistemima robnog transporta u gradovima, nisu iskorišćene mogućnosti optimizacije i konsolidacije robnih tokova pri distribuciji robe i područje logistike predstavlja polje na kome je još uvek moguće ostvariti značajne efekte racionalizacije.

City logističke koncepcije idu u pravcu potpunog usaglašavanja ponude i tražnje što se često naziva i totalnom konsolidacijom.

Partial Approach to Planning

Individual solutions

The problem of planning goods transport and the movement of goods to and through urban areas in many cities has been addressed in a partial and individual manner, depending on the requirements and characteristics of the companies to which the research referred and for whose needs it was conducted..

Lack of Comprehensiveness

Optimal solutions were sought for individual economic entities, rarely for one of their groups or for several of them, and it can be said never for all groups, for all participants in the socio-economic life of the city, or for the city as a whole.

Lack of Data

In most cities, there is no data on freight transport, and there are no comprehensive studies. Only one quarter of European cities have one or more departments that deal with logistics issues on a full-time basis.

📌 **Key Problem:** Each participant in the urban freight transport system tends to solve their own problems. In most cases, these solutions are, from the perspective of social and economic efficiency, far from optimal.

Historical Development of Research

Before the 1970s

Little research on urban freight transport. Traditional approaches without systematic study.

1

2

After 1970s

Major changes in the implementation of logistics activities and increased interest in the negative environmental and social impacts of freight transport..

Last Decade

Increasingly, in professional and scientific circles, the problems of goods, material, and freight flows in urban areas are being discussed..

3

Key changes in logistics



Centralization

Distribution and logistics systems have changed significantly. There has been an increase in centralization in the production, storage, and sale of goods.



Chain control

The structure of supply chains has been significantly changed, especially in large companies that have increased control over supply chains and the distribution of goods.



Delivery Frequency

The delivery of goods has changed with a tendency toward higher frequency of smaller quantities per delivery, which has led to an increase in the number of small freight vehicles.



Sustainability

The level of interest in the environment and urban transport systems is continuously increasing, and it is widely recognized that a new urban sustainability policy is necessary..

There has been a significant expansion of service activities in the last 10–20 years, which has resulted in an increase in the movement of service vehicles in the city. A better understanding of the goods and service demands of urban activity generators is necessary for the sustainability and economic competitiveness of cities.

Characteristics of City Logistics Flows



Partiality

City logistics flows are characterized by partiality and spatial dispersion of generators, which requires coordinated approaches to problem solving.



Diversity

Diversity in terms of the structure of logistics chains and the frequency of a larger number of smaller deliveries characterizes urban logistics systems



Dynamics

The dynamic and stochastic nature of flows requires flexible and adaptive logistics systems



Operators

The majority of these flows within the urban area are carried out by logistics systems of freight forwarding, trade, service, industrial, and other companies.

The problems and complexity of logistics in urban environments have led to the development of different city logistics concepts. Solutions to city logistics problems vary and are consistent with the actual structure of the city, logistics systems, and logistics flows.

Modern City Logistics Solutions



Nove Tovarne Jedinice

Razvoj novih tovarnih jedinica prilagođenih urbanim uslovima



Ekološka Vozila

Hibridna i električna vozila, cargo tramvaji



Robno-Transportni Centri

Logistički terminali i intermodalni transportni lanci



Podzemni Sistemi

Inovativni podzemni sistemi transporta



Kooperacija

Koordinacija i kooperacija između učesnika



ITS Sistemi

Inteligentni transportni sistemi



Regulativa

Regulativne mere i politike

Mnoga rešenja su predmet stalnih istraživanja i testiranja u okviru pilot projekata širom sveta. City logistički terminal je jedno od mogućih rešenja optimizacije robnih tokova koje privlači posebnu pažnju zbog značajnih efekata u racionalizaciji tokova.

City Logistics Terminal



Concept and Importance

A city logistics terminal is one of the possible solutions for optimizing freight flows. Terminals as a concept attract attention because they provide significant effects in rationalizing supply flows and removing cargo from urban areas.

The decision-making process for the development of a terminal requires a set of quantitative and qualitative inputs based on which decision-makers assess the success and investment risk of a city logistics terminal project.

Modeling the city logistics process under conditions where a terminal exists is one way to quantify the relevant parameters needed for decision-making.

Key Hypotheses for Terminal Development

Demand Consolidation

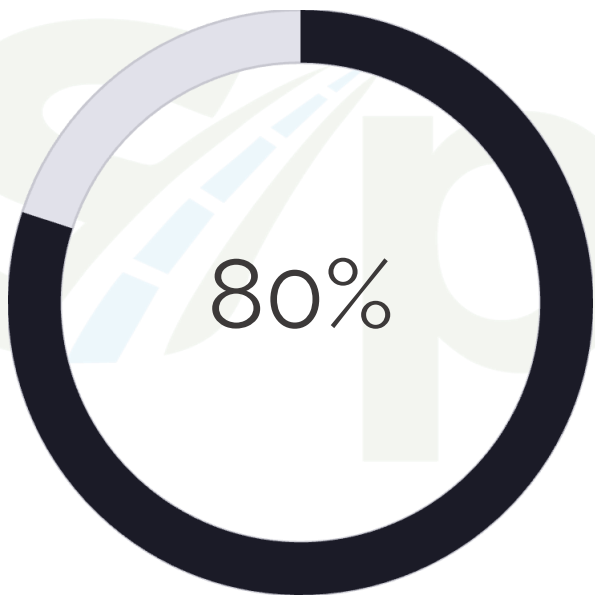
By consolidating demand in time and space, investments in unnecessarily duplicated logistics systems for transport, warehousing, etc. can be reduced.

Concentration of Generators

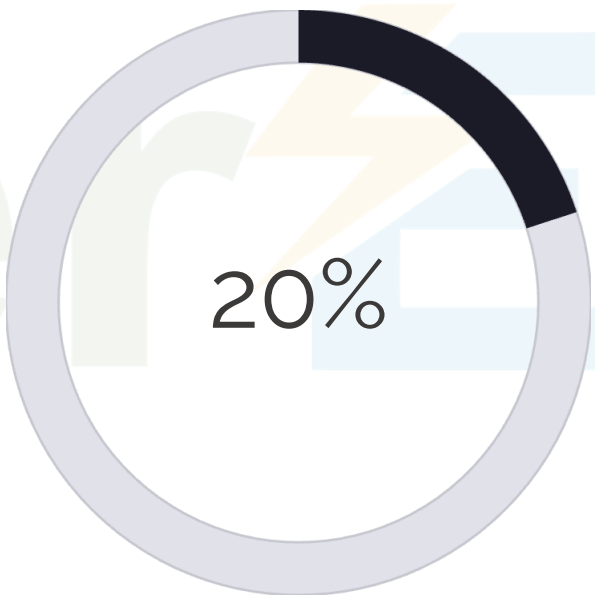
A large number of flow generators in a city are concentrated in certain subzones or along transport corridors, which enables unified, consolidated servicing.

Frequent Deliveries

Facilities, as generators of logistics flows, require frequent and small deliveries during a single day. Deliveries of less than 1 m³ in size are predominant.



Vehicle Movements



Delivered Goods

80% of vehicles in operation deliver only 20% of the transported goods.

Potential for consolidating demand and reducing vehicle movements.

Additional Hypotheses and Assumptions

- Cooperation and consolidation

The cooperation and consolidation of flows from multiple independent suppliers within urban areas is an issue that has so far been studied from the perspective of terminal location and technological, economic, and environmental effects. A lack has been identified of a strategic model that would serve as a basis for decision-making on terminal development, based on risk assessment for a neutral logistics provider.

- Different results

Cooperation in the field of city logistics among different participants, in certain situations, produces different results and benefits for individual participants in the cooperation.

- Strategic approach

The distribution logistics system for multiple users should be viewed strategically over a longer time horizon. At the same time, it is possible to model processes over shorter daily intervals in order to dimension the capacities of the terminal subsystems, i.e., distribution..

- Homogeneity of Demand

Today, in city logistics cooperation, companies from the same as well as different sectors are joining together, provided that there is some aspect of homogeneity of demands for consolidation in time and space (homogeneity in terms of technology, form of goods, route, delivery zone, delivery time, transport mode, etc.).



Thank you