A Simulation Model for Analyzing Traffic and Environmental Impacts from Heavy Vehicle Movement in Urban Areas

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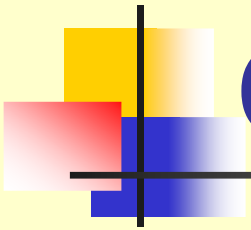
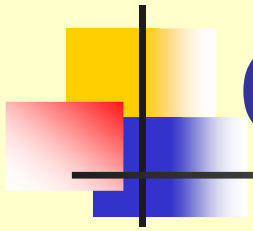


Objective

- Examine the impacts of heavy goods vehicle traffic in the Athens downtown area
- Evaluate alternative proposals for improving traffic conditions



Outline

- Traffic regulations description
- HGV circulation characteristics
- Methodology
- Alternative simulated scenarios
- Traffic and Environmental impacts
- Result Analysis - Scenario Evaluation
- Conclusions

Traffic regulations

- Internal Ring (arterials surrounding Athens downtown area – vehicles in respect with number plates)
- Blue Zone (area within the internal ring – No HGV)
- Commercial Triangle (part of downtown area – no vehicles)

HGV circulation characteristics

- Most of the vehicles entering or moving around the Athens downtown area are light trucks
- Main types of goods transported to the Athens downtown area → fuel and food supplies
- Main types of goods transported within the Athens downtown area → food supplies
- Large number of trucks are empty when circulating in the Athens downtown area.
- Overall only a fragment of the total capacity of trucks crossing the Athens downtown area is actually used

Methodology

- Simulation process for alternative scenarios impact evaluation (inclusion of internal ring)
- Impact Assessment through change in average speed
- Simulation after demand distribution:
  - Regarded perceived user cost
  - Parameters of perceived cost→ travel time and distance travelled
  - Assignment using “all or nothing” method

Alternative simulated scenarios

- Do nothing
- Smaller limits than the existing area, limited by wide streets, easily memorized by the truck drivers and controlled by the police
- Larger limits than the existing area, includes areas with extensive traffic problems because of heavy vehicle traffic
- Application of the existing Blue Zone with real enforcement of its restrictions
- Abolition of the Blue Zone (3 sub-scenarios)

+ no change in the existing restriction hours for the supply businesses

Traffic Impacts (1/2)

Alternative scenarios	Within Blue Zone	Within the Internal ring	Limits of Blue Zone
Scenario 1	+ 11 %	+ 0.8 %	- 4.3 %
Scenario 2	+ 16 %	+ 7.8 %	- 7.1 %
Scenario 3	+ 11 %	+ 1.1 %	- 4.7 %
Scenario 4	**Percentage change of speed within Blue Zone in comparison with the Do-Nothing Scenario**		
	Increase of trucks percentage by 50% - 5.54 %	Doubling of trucks percentage - 7.23 %	Quadrupling of trucks percentage - 8.53 %

Traffic Impacts (2/2)

Alternative Scenarios	Within the Blue Zone		Within the Internal ring	
Do Nothing Scenario	12.85		20.90	
	Without restrictions	With restrictions	Without restrictions	With restrictions
Scenario 1	11.87	13.31	20.90	21.07
	Without restrictions	With restrictions	Without restrictions	With restrictions
Scenario 2	13.11	15.21	20.90	22.53
Scenario 3	14.26		21.13	

Environmental Impacts

- Estimation of air pollutant related to traffic (HGV and other vehicles)
- Estimation of air pollutants using CORINAIR and COPERT methodologies (Eggleston et al, 1993; Ahlvik et al; 1997)
- Parameters of the estimation →average speed, vehicles size and age
- Air pollutants for each mode as well as each mode's contribution to air pollution

Result Analysis (1/2)

- Significant changes in traffic and environmental conditions
- Application of the Blue Zone
  - Increase of the average speed, in the Blue Zone and the Internal Ring, though the increase of speed in the Internal Ring was less on average than in the Blue Zone
  - Decrease of average speed in the roads surrounding the Blue Zone, in all the examined scenarios

Result Analysis (2/2)

- Most benefits in traffic → Scenario 2
  - 16% increase of average speed in the Blue Zone area
  - 7.8% increase of average speed in the area of the Internal Ring
  - Significant environmental benefits especially in secondary roads

Scenario Evaluation (1/2)

- **Types of impacts investigated**

- Traffic impacts within the limits of the Blue Zone
- Environmental impacts within the limits of the Blue Zone
- Traffic impacts in the Internal Ring
- Environmental impacts in the Internal Ring
- Socioeconomic impacts
- Ability of Comprehending
- Ability of Enforcing

Scenario Evaluation (2/2)

- **Multi-criteria Analysis**

Criterion	Scenario 1	2	3
Traffic impacts in Blue Zone	2.5	1	2.5
Environmental impacts in Blue Zone	2.5	1	2.5
Traffic impacts in Internal Ring	3	1	2
Environmental impacts in Internal Ring	2	1	3
Socioeconomic impacts	1	3	2
Ability to comprehend	1	3	2
Ability to enfoce	1	3	2
	1.859	**1.859**	**2.288**

Conclusions (1/2)

- Most favorable→ Scenarios 1 & 2
- Proposed scenarios can contribute positively to the traffic and environmental conditions
- The proposed scenarios must be incorporated in an overall approach for the management of the Athens Metropolitan area transportation system
- Quantification of the total influence by incorporating the rest of interventions to the transportation system

Conclusions (2/2)

- Integrated plan for patrolling the limits and the area of the Blue Zone
- Effective penalty system
- Sufficient and clear marking of the examined area

- Adoption of the proposals might lead to a more friendly system of Heavy Goods Transportation in the Athens downtown area, both for traffic and environment