PARKING AS A TRAFFIC CONTROL MECHANISM – IDEAS AND CONSTRAINTS

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SLIDE 1

PARKING?

TECHNICAL ASPECTS – BUSINESS ASPECTS

DIFFERENT PARTIES – DIFFERENT OBJECTIVES

Retail and Business Operators

Customers

Private Parking Industry

Municipal Authority - Responsibility for Traffic and Parking

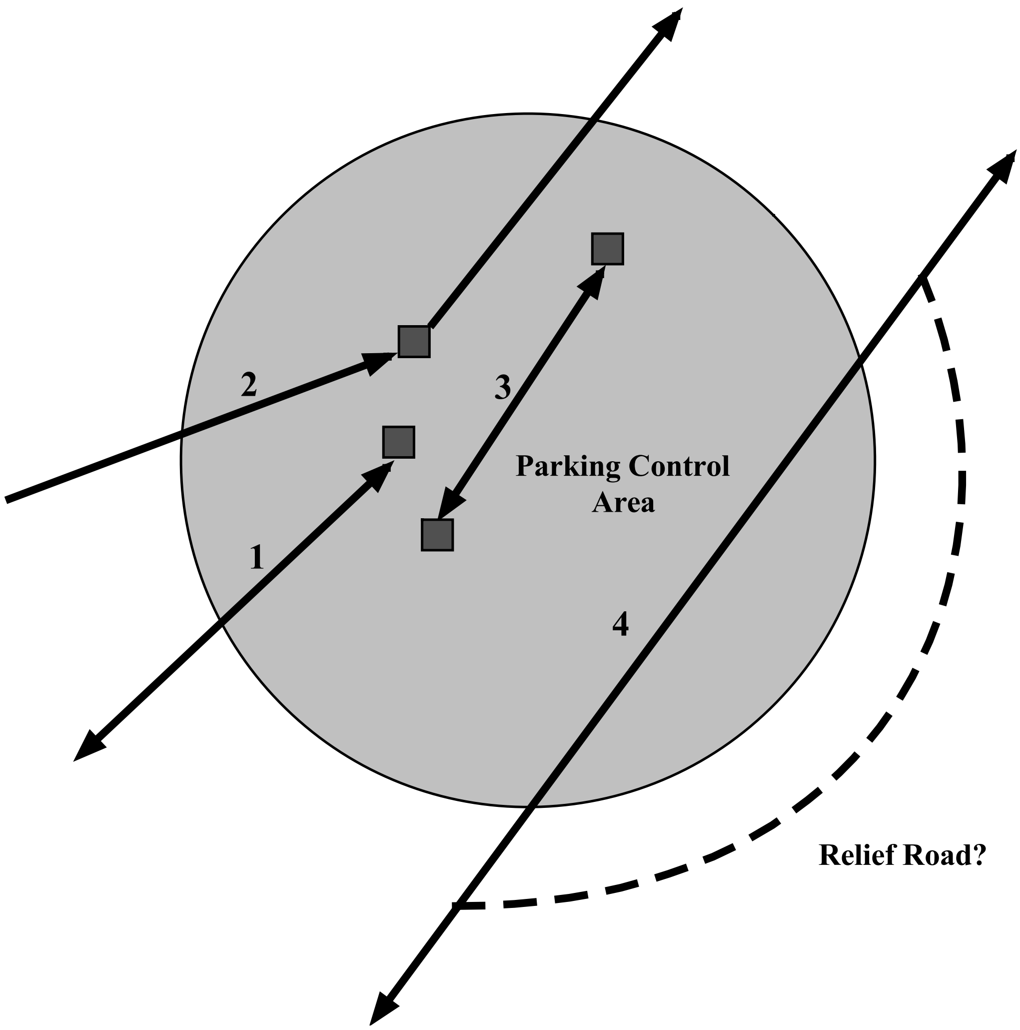
<u>SLIDE 2</u>

URBAN VEHICULAR TRIP CLASSIFICATION

Parking Element - Trip Type 1, 2 and 3

Proportions Depend on City

Trip Type 4



SLIDE 3

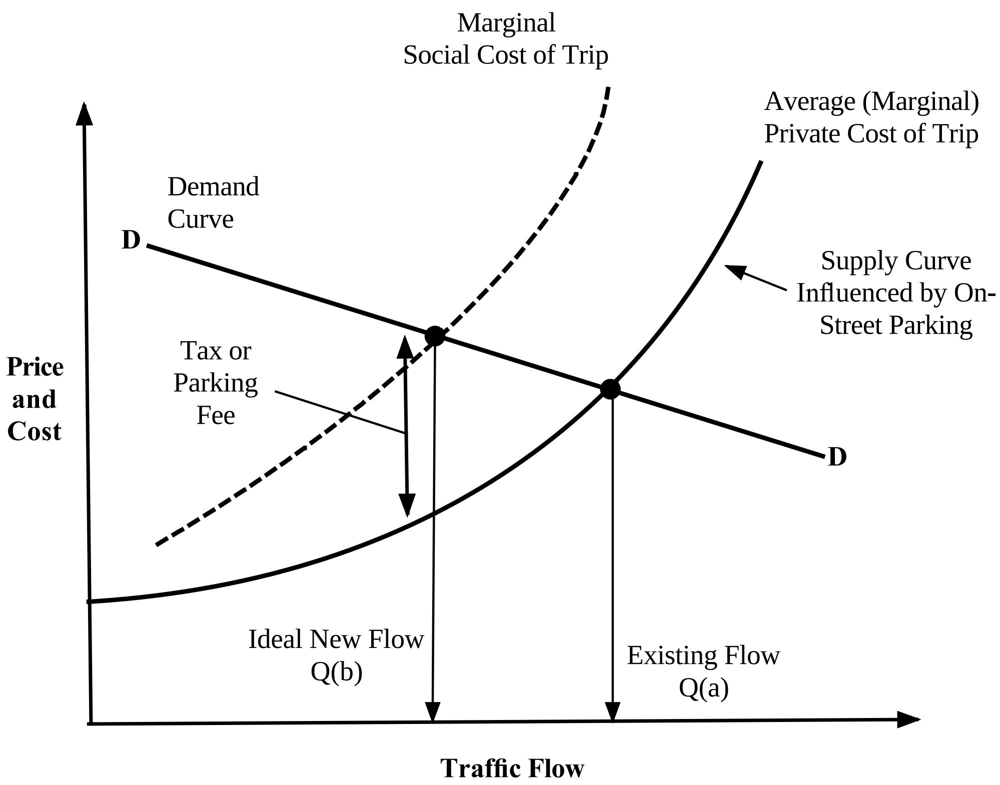
ECONOMIC CASE FOR CONGESTION REDUCTION

Private Costs

Social Costs

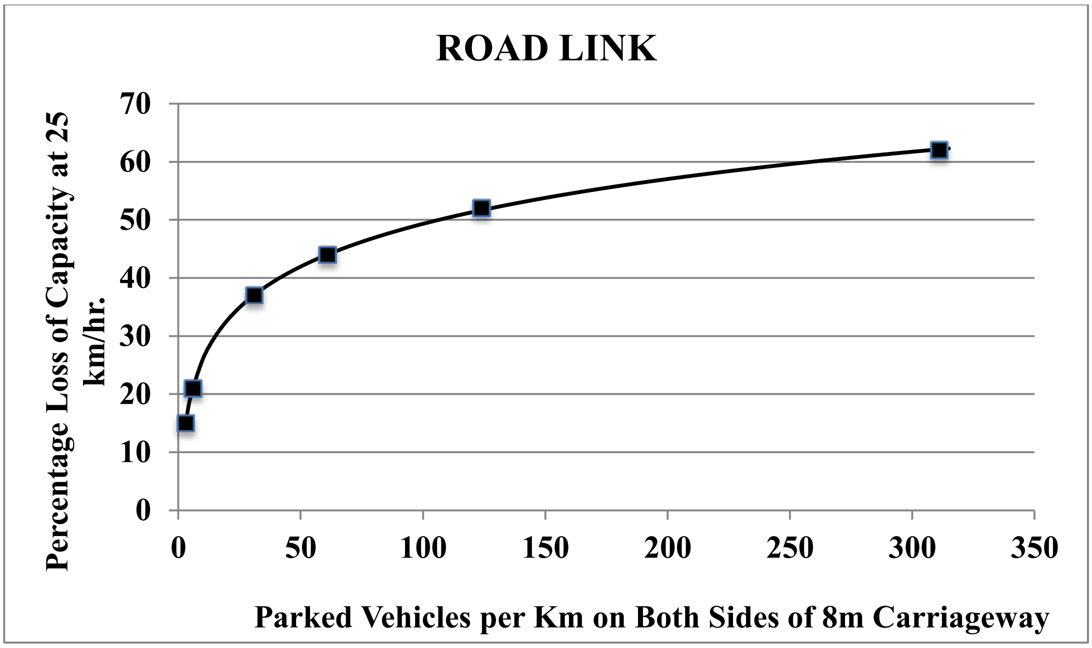
Parking Fees

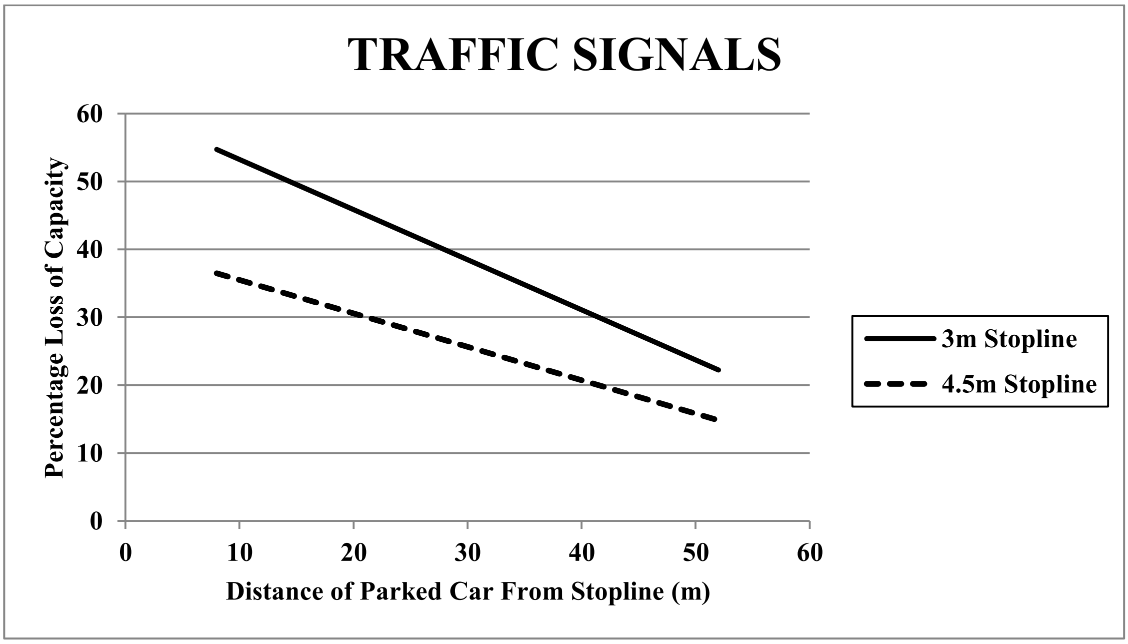
New Equilibrium Point



SLIDE 4

COMPETITION FOR STREET SPACE





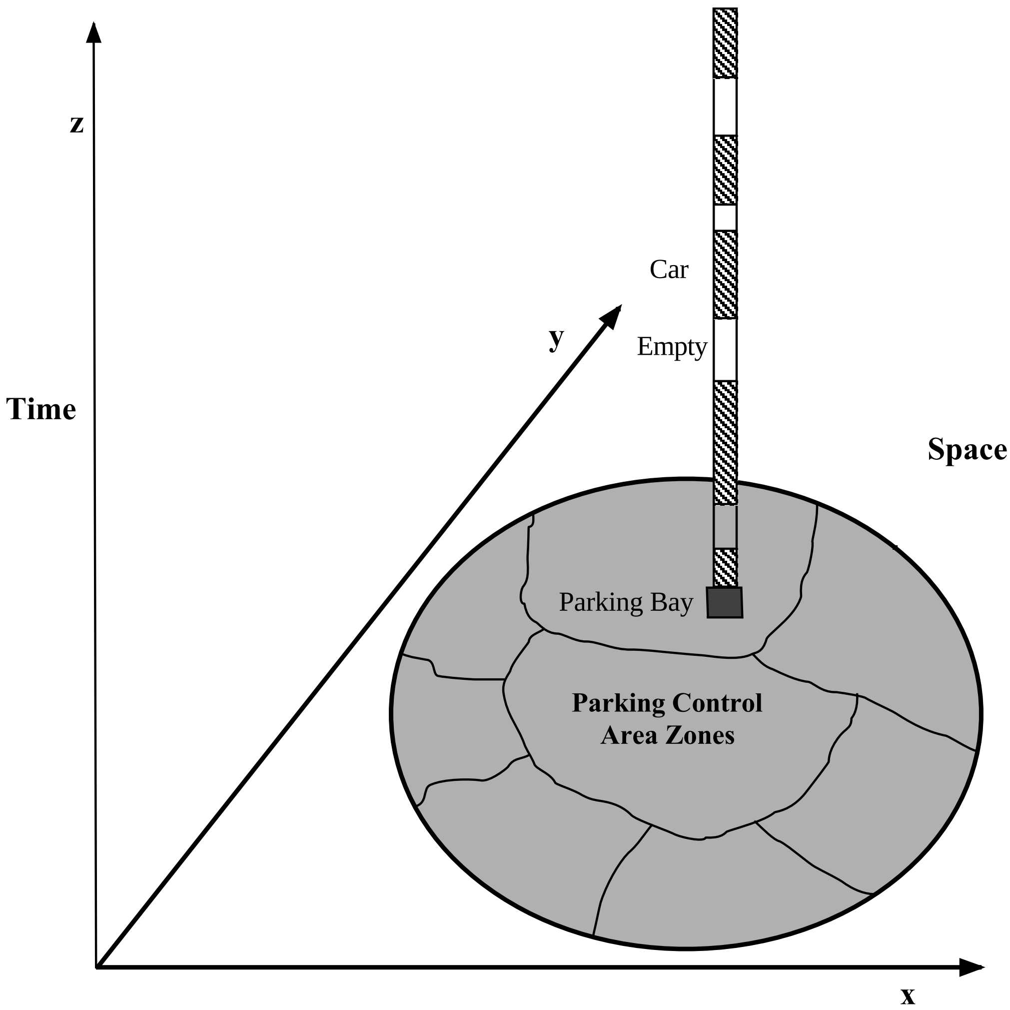
SLIDE 5

TIME AND SPACE ELEMENTS OF A PARKING SYSTEM

Use of Zones

Collection of Event Data – Use of Technology

Creation of Models

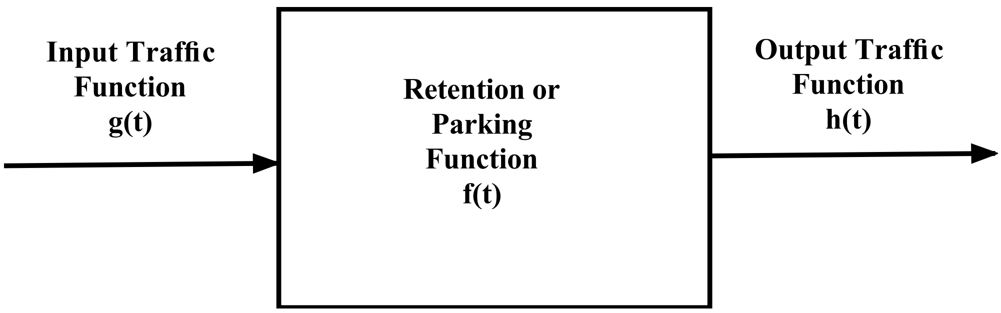


SLIDE 6

PARKING AS INPUT- OUTPUT SYSTEM

Similarity With Other Systems

Portability of Techniques



Hydrology of a River System
Population Studies
Electrical Devices

SLIDE 7

A SIMPLE REPRESENTATION OF A PARKING SYSTEM

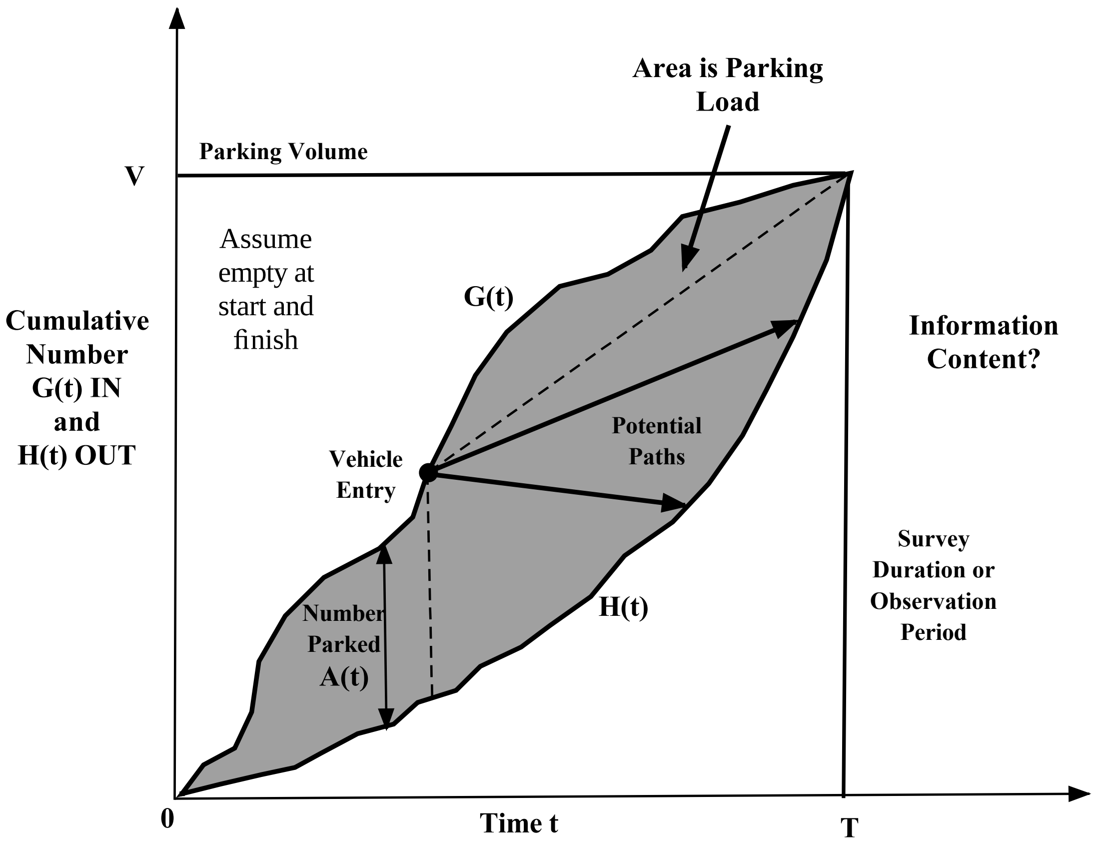
Continuous Functions for Traffic Flows

$$G(t) = \int_0^t g(t)\,dt$$

and

$$H(t) = \int_0^t h(t)\,dt$$

$$\text{Number Parked} = A(t) = G(t) - H(t)$$



SLIDE 8

MEASURES OF PARKING USAGE

Parking Load and Volume

Parking Load = L

$$L = \int_0^T G(t)\,dt - \int_0^T H(t)\,dt$$

Average Parking Duration

Average Turnover

Average Parking Duration = $\bar{t}$

$$\bar{t} = \frac{L}{V}$$

Average Parking Turnover per Space = $\bar{d}$

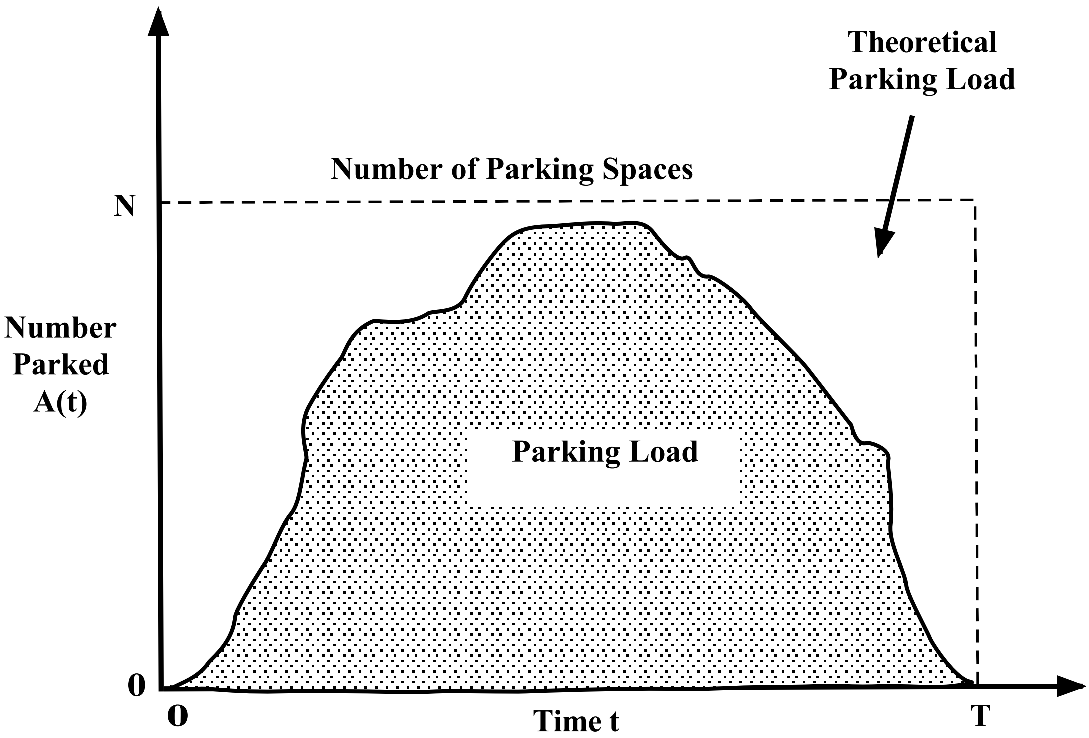
$$\bar{d} = \frac{V}{N}$$

SLIDE 9

PARKING ACCUMULATION DURING A DAY

Use of R Factor

$$L = \int_0^T A(t)\,dt = RTN$$

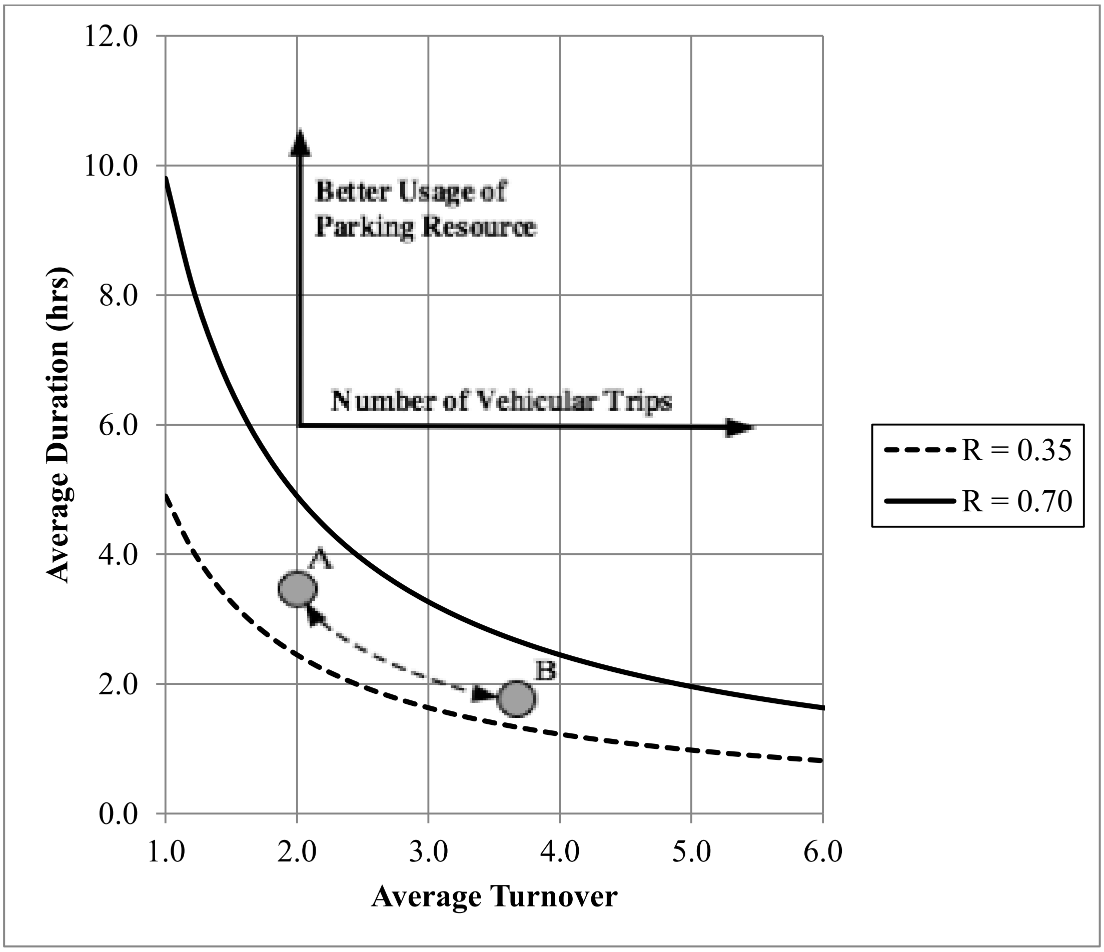


SLIDE 10

ELEMENTARY CHOICES FOR A PARKING CONTROL AREA

Average Duration
or
Average Turnover

$$\bar{t} = \frac{RTN}{\bar{d}N} = \frac{RT}{\bar{d}}$$

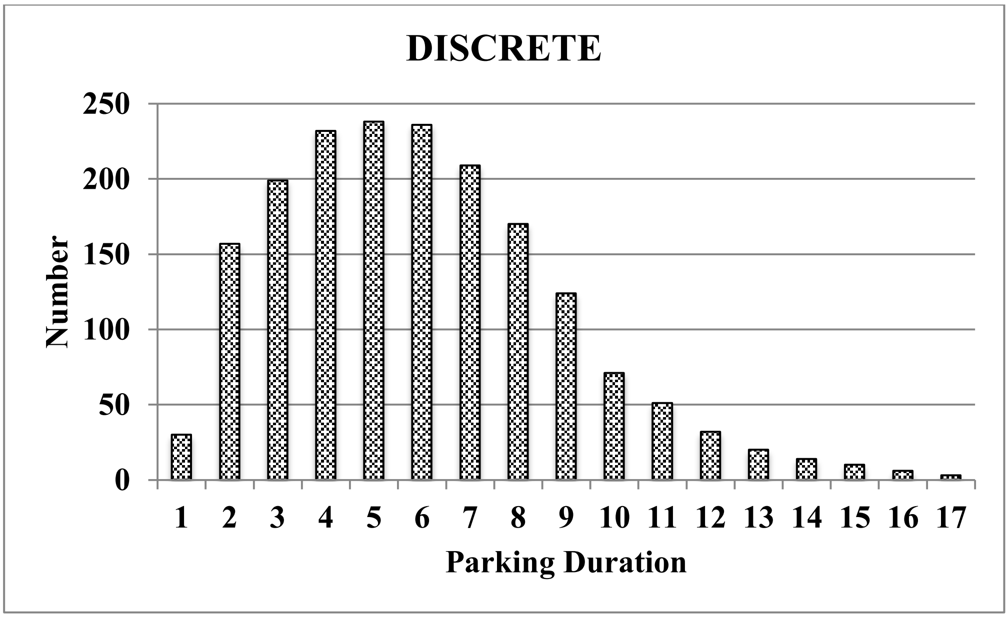


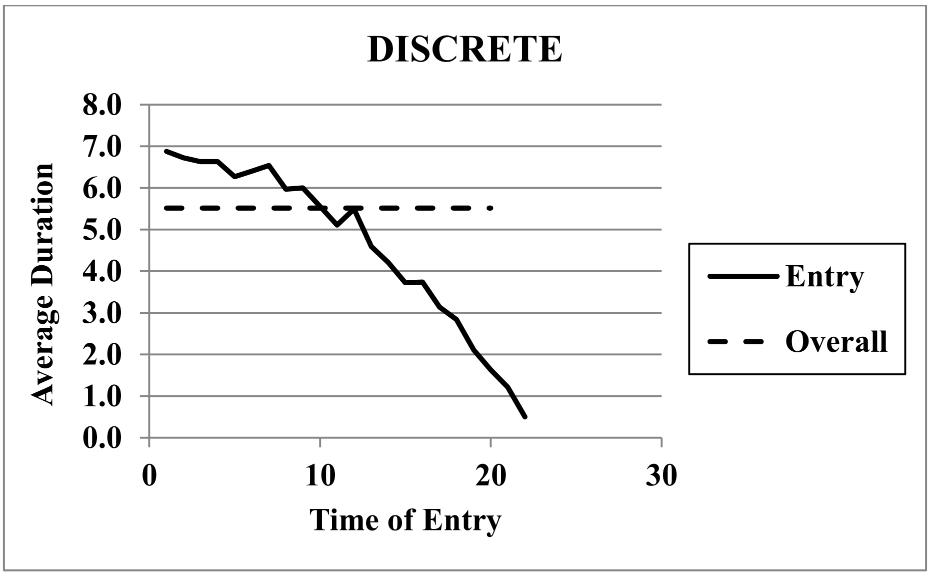
<u>SLIDE 11</u>

MORE SOPHISTICATED MODELS OF TRAFFIC/PARKING USAGE

Continuous or Discrete?

Basic Requirements?





SLIDE 11

SYSTEM IDENTIFICATION

Known
Input G and Output H, where $\mathbf{GP} = \mathbf{H}$

What is P?

Maximum Entropy

Initial best estimate of the matrix **P**

$$\text{Initial Matrix } \breve{\mathbf{P}} = \begin{bmatrix} \breve{p}_{11} & \breve{p}_{12} & \breve{p}_{13} & \breve{p}_{14} \\ 0 & \breve{p}_{22} & \breve{p}_{23} & \breve{p}_{24} \\ 0 & 0 & \breve{p}_{33} & \breve{p}_{34} \\ 0 & 0 & 0 & \breve{p}_{44} \end{bmatrix}$$

where $\breve{\mathbf{P}}\mathbf{E}^{\mathbf{T}} = \mathbf{E}^{\mathbf{T}}$

We want to refine this matrix by some procedure to a value that satisfies the basic matrix equations below.

Initial $\breve{\mathbf{P}}$

—

Final $\hat{\mathbf{P}}$

where $\hat{\mathbf{P}}$ satisfies equations

$$\mathbf{G}\hat{\mathbf{P}} = \mathbf{H}$$

$$\hat{\mathbf{P}}\mathbf{E}^{\mathbf{T}} = \mathbf{E}^{\mathbf{T}}$$

In other words, it has to be done logically in such a way that it is consistent with the accurately recorded entry and exit flows **G** and **H**, and still retains a memory of the initial **P**.

SLIDE 13

IMPACT OF PRICE INCREASE AND/OR TIME CONTROLS

Numbers In and Out

$$\mathbf{B} = \begin{bmatrix} b_{11} & b_{12} & b_{13} & b_{14} \\ & b_{22} & b_{23} & b_{24} \\ & & b_{33} & b_{34} \\ & & & b_{44} \end{bmatrix}$$

Adjustment Factors

$$\mathbf{K} = \begin{bmatrix} k_{11} & k_{12} & k_{13} & k_{14} \\ & k_{22} & k_{23} & k_{24} \\ & & k_{33} & k_{34} \\ & & & k_{44} \end{bmatrix}$$

Array Multiplication

$$\mathbf{B}^{\text{AFTER}} = \mathbf{K}*\mathbf{B}^{\text{BEFORE}}$$

Whole System

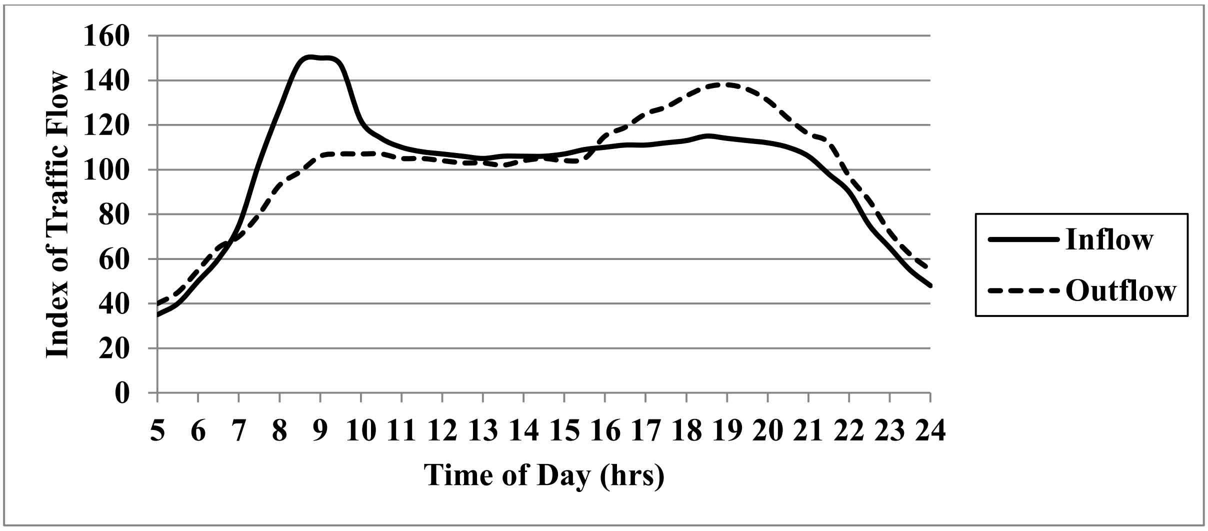
$$\mathbf{B} = \mathbf{K_1} * \mathbf{B_1} + \mathbf{K_2} * \mathbf{B_2} + \mathbf{K_3} * \mathbf{B_3} + \mathbf{K_4} * \mathbf{B_4} \text{ etc.}$$

SLIDE 14

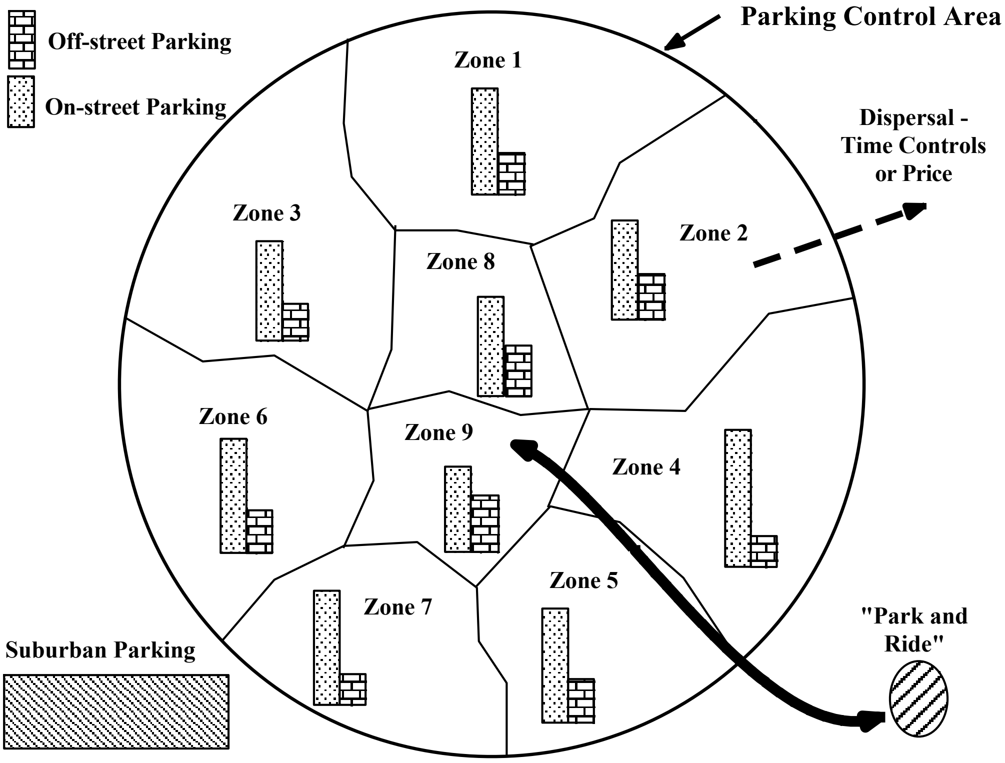
INPUTS TO DECISION PROCESS

Time Profile for Traffic

Do we want to level peaks or achieve an overall reduction?



Spatial Distribution



<u>SLIDE 15</u>

DUBLIN AS A CASE STUDY

Modal Split

Land Use Planning

Parking Inventory

POPULATION	*NUMBER*
City Area	*506,000*
Total Urban Area	*1,045,000*

	ON-STREET PARKING	*NUMBER*	*CONTROL*
CITY	*Controlled On-street Spaces in Urban Area (including CBD)*	*33,000*	*Price and Time Determined by Municipal Authority*
	Gross Revenue	*€26,800,000*	
	Net Revenue	*€22,600,000*	
	OFF-STREET PARKING	***NUMBER***	***CONTROL***
	Multistorey etc, Open to Public	*6,000*	*Price Determined by Operator*
	Private Non-Residential	*7,000 est.*	*None*

	OFF-STREET PARKING	*NUMBER*	*CONTROL*
SUBURBS	*Retail and Office Developments*	*15,000 est.*	*Mostly Free*

Available Controls?

Attainable Objectives?