Name and last name: ……

Exercise 2. Trip generation calculation

Introduction

Information about trips carried by thousands of inhabitants of Cracow city were collected during the Comprehensive Traffic Study (Polish: Kompleksowe Badania Ruchu – KBR) conducted in 2013. The data was used to conceptualize a mathematical trip generation model, used in transportation planning. Trip generation model allows to determine number of trips originating and ending in individual travel analysis zones (TAZs).

Trip generation formulas determined for Cracow, which describe the number of started trips (production) and number of ended trips (attraction) are presented below. These formulas were introduced for seven specified trip purposes, which describe the reasons (motivations) behind these trips - for instance trips made from home to work, from school to home, etc. (table 2.).

Explanatory variables in the four-step model describe the influence of TAZ development (number of inhabitants, area of commercial buildings, etc.) on generated trips. They are determined for each TAZ from their land-use properties. Model parameters are fixed (uniform) for whole city.

For instance, the number of trips starting in home-work purpose depends on number of inhabitants in travel analysis zone and respective coefficient, whereas the number of trips ended in this purpose depends on model parameters and multiple explanatory variables, including area of factories and area of office buildings.

Consequently, 14 trip generation formulas were proposed. Number of trips is expressed as a linear function of explanatory variables of travel analysis zone (x_k) multiplied by appropriate parameters a (formula 1.).

$$\begin{aligned} P_i &= \sum_m P_i^m \quad ; \quad P_i^m = a_0 + a_1 x_1 + a_2 x_2 + ... + a_n x_n \\ A_j &= \sum_m A_i^m \quad ; \quad A_j^m = a_0 + a_1 x_1 + a_2 x_2 + ... + a_n x_n \end{aligned} \tag{1}$$

where:

- P, A trip generation (production, attraction) of travel analysis zone (TAZ),
- i, j index of travel analysis zone,
- m trip purpose (tab. 2),
- x_k value of explanatory variable k in given travel analysis zone,
- a_k value of parameter for explanatory variable k (tab.3, tab.4)

Table 2. Basic trip purposes included in trip generation model

No.	Trip purpose
1	home – work (H-W)
2	work – home (W-H)
3	home – education (H-E)
4	education – home (E-H)
5	home – other (H-O)
6	other – home (O-H)
7	no home related (NHR)

Table 3. Formulas to calculate figure of started trips (production) for travel analysis zones in Cracow

Trip purpose *(m)*	Formula
H-W	0.300*[L_MIESZK]
W-H	0.015*[POW_PROD] + 0.002*[POW_MIESZK] + 0.014*[POW_PRZEM] + 0.013*[POW_BIUR] + 0.024*[POW_HANDL]
H-E	0.100*[L_MIESZK]
E-H	0.080*[POW_OSWIAT]
H-O	0.200*[L_MIESZK]
O-H	0.002*[POW_MIESZK] + 0.050*[POW_HANDL]
NHR	0.015*[POW_BIUR] + 0.015*[POW_HANDL]

Table 4. Formulas to calculate figure of ended trips (attraction) for travel analysis zones in Cracow

Trip purpose *(m)*	Formula
H-W	0.019*[POW_PROD] + 0.002*[POW_MIESZK] + 0.019*[POW_PRZEM] + 0.018*[POW_BIUR] + 0.022*[POW_HANDL]
W-H	0.270*[L_MIESZK]
H-E	0.080*[POW_OSWIAT]
E-H	0.100*[L_MIESZK]
H-O	0.002*[POW_MIESZK] + 0.034*[POW_HANDL]
O-H	0.230*[L_MIESZK]
NHR	0.009*[POW_BIUR] + 0.040*[POW_HANDL]

Exercise

Please calculate expected number of starting (production) P_i and ending (attraction) A_j trips in each trip purpose during typical workday in examined travel analysis zone.

Additionally, please determine:

a) in which purposes the highest trip volume(s) are generated,
b) in which purposes no trips are generated,
c) if obtained results are consistent with spatial development of travel analysis zone,
d) which explanatory variable has the most influence upon obtained trip generation,
e) if total number of started and ended trips during the day are equal.

Please describe above observations in brief report (1-2 paragraphs).

Result

Table 5. Daily trip generation

Purpose (m)	Production [trips/day]	Share [%]	Attraction [trips/day]	Share [%]
H-W				
W-H				
H-E				
E-H				
H-O				
O-H				
NHR				
TOTAL				

Report

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