



INSTITUTO TECNOLÓGICO DE AERONÁUTICA
ENGENHARIA CIVIL-AERONÁUTICA

RELATÓRIO DE ESTÁGIO

UNIVERSITY OF TWENTE.

Enschede - Netherlands, 30/06/2016

Paulo Tiago Carvalho Freitas

FOLHA DE APROVAÇÃO

Relatório Final de Estágio Curricular aceito em / / pelos abaixo assinados:

Paulo Tiago Carvalho Freitas
Aluno

Dr. Ing. Lissy La Paix Puello
Orientador/Supervisor na Empresa/Instituição

Giovanna Miceli Ronzani Borille
Orientador/Supervisor no ITA

Eliseu Lucena Neto
Coordenador do Curso de Engenharia Civil-Aeronáutica

INFORMAÇÕES GERAIS

Estagiário

Paulo Tiago Carvalho Freitas
Engenharia Civil-Aeronáutica

Empresa/Departamento

University of Twente / Centre for Transport Studies

Orientador/Supervisor da Empresa

Dr. Ing. Lissy La Paix Puello

Orientador/Supervisor do ITA

Prof. Giovanna Miceli Ronzani Borille

Período

08/02/2016 a 15/04/2016

Total de horas: 165 horas

I. INTRODUCTION

This report aims to describe that activities developed by the author at the Centre for Transport Studies (CTS) of the University of Twente during the Science without Borders/CNpQ scholarship program in the Netherlands.

II. THE COMPANY

The University of Twente (in Dutch: Universiteit Twente) is located in Enschede, the largest city of the Twente region. Founded in 1961, the university has about 10 thousand students following programs in Engineering, Natural Science, Mathematics and Behavioral Science.

The Centre for Transport Studies (CTS) conducts research in the areas of transport networks, land use and transport interaction, travel behavior and intelligent transport systems. Among the many activities developed by the CTS, the internship was conducted in the project Mobility Panel for the Netherlands (in Dutch: MobiliteitsPanel Nederland or MPN).

MPN is the largest ongoing mobility panel in the world with over 2,000 Dutch households participating and aims to map changes in travel behavior over an extended period of time. With the MPN, researchers could figure out the effect on travel behavior of: changes in people's lives (e.g. birth of a child), purchase of a car and changes in spatial environment (e.g. new train station), for example. So far, the data of three waves have been studied, 2013, 2014 and 2015.

III. ACTIVITIES DEVELOPED

III.1. Summary of internship

The course called "Transport Modelling", attended from November 2015 to February 2016, provided the basic knowledge to perform this internship. During the internship most of the theory studied was applied in a real research situations and were consolidated by practice.

The purpose of the work was to model and analyze the effect on trip behavior of variables concerning the time, spatial, household and personal levels. At the same time, the panel effect on different levels were estimated.

III.2 Literature review

Mobility panel studies have been conducted for many years all over the world, some of the most famous are: Puget Sound Transportation Panel Survey (Seattle region), German Mobility Panel and "Old" Mobility Panel Netherlands.

Using the database from these surveys, many studies have been conducted. The researchers Thomas Golob and Henk Meurs stood out, having many published works about panel surveys for transportation purpose.

The literature review was useful to provide a view of the "state of the art" and confirm or contradict the future results of the project developed.

III.3 Database

The database used in the study was came from the questionnaire and the three-days diaries collected from 2013 to 2015. The questionnaire comprehends information about the participant in different levels: personal (e.g. age, gender), household (e.g. household size, household income), and spatial (e.g. rural or urban area). The diary contains all the trips completed by the respondent,

including trip purpose, distance traveled and mode used. The Table 1 shows the number of participants in each year.

Table 1: Number of respondents in each wave

<i>Year</i>	<i>Number of respondents</i>
2013	3996
2014	5551
2015	3919

III.4 Descriptive statistics

In order to have an overview of the data, a descriptive statistics analysis was conducted using the software SPSS. For instance, Table 2 below indicates that women on average do more trips per days. Other studies have indicated that women are usually responsible for maintenance activities of the household, that is a possible explanation for this effect.

Table 2: Average number of trips per gender

Gender	Average number of trips/day
Male	2.81
Female	3.04

III.4 Mixed logit model

Mixed logit is a highly flexible model that can approximate any random utility model. A mixed logit model can use error components that create correlations among the utilities for different alternatives.

In general, the utility function of a mixed logit model can be written as

$$U_{nj} = \beta x_{nj} + \varepsilon_{nj}$$

where x_{nj} is a vector of observed variables relating to alternative j , β is a vector of fixed coefficients and ε_{nj} is distributed iid value.

In order to have a more consistent model, the mobility of the participants was grouped in four categories:

- j = 0 0 trips/day
- j = 1 1 to 2 trips/day
- j = 2 3 to 4 trips/day
- j = 3 > 4 trips/day

Using the software called "Biogeme", a descriptive choice model was estimated.

IV. CONCLUSIONS

The mixed logit model results obtained will be part of a hybrid choice model that will also include latent variables. It is very satisfying to know that the work developed during the internship will be used as part of a paper to be published.

Furthermore, the experience acquired as being part of an academic international research group provided a great overview about how research in transportation is being developed.