TEACHING MATERIAL GUIDANCE

1) Title of the material

Pazdan, S.; Kiec, M.; D'Agostino, C. Impact of environment on bicycle travel demand—Assessment using bikeshare system data. Sustain. Cities Soc. 2021, 67, doi:10.1016/j.scs.2021.102724.

https://www.sciencedirect.com/science/article/pii/S2210670721000196

2) Which section of the SUMP it is relevant to?

The authors presented in a scientific article an example of the use of data about the volume of cycling traffic from the bike share system (BSS) and bicycle counters to estimate the influence of weather conditions on the amount of cycling traffic. The factor connected with weather conditions is important in planning measures aimed at encouraging walking and cycling. Besides, data from different counting systems can be used to monitor the effects of improvements for pedestrians and cyclists or people using multimodal transport modes. Therefore, the article can be linked especially to the third, fourth, sixth and eleventh parts of the SUMP circle, which deal respectively with: analyse mobility situation (in particular identify information sources and cooperate with data owners – **subsection 3.1.** but also the analysis of problems and opportunities for all modes of transport - subsection 3.2.), scenario building and joint evaluation (developing scenarios of possible futures - **subsection 4.1.**), set targets and indicators (identify indicators for all objectives – **subsection 6.1.** and agree on measurable targets – subsection 6.2.) and monitor, adapt and communicate (in particular monitor progress and adapt – **subsection 11.1.)**.

3) Which Mobility Manager knowledge this material is the most relevant to?

It is related to Transport and mobility planning (section 1 of the Mobility Manager competencies) especially 1c (understanding of travel behaviour) as well as to Data analysis for mobility planning especially 5a (data collection and analysis) and 5c (traffic demand forecasting).

4) Problem approached and content overview

Problem approach - general understanding of what data can be used to estimate cycling speeds and volumes, how data can be used, what weather conditions affect changes in cycling volumes and what is the impact of different weather conditions on cycling volumes. Cycling volume data collected daily are needed for road safety analysis (estimation of cycling volume as risk exposure), cycling infrastructure planning, design and management (estimation of cycling capacity, calculation of infrastructure capacity, etc.). When planning or designing road infrastructure the traffic volume must reflect the traffic conditions in the long term. Therefore the influence of weather and environmental conditions on the volume of cycling traffic in such analyses is not as important as in the case of road traffic safety or infrastructure management. On the other hand, daily cycling

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is strongly dependent on weather conditions. Daily fluctuations of cycling traffic are 80 % described by weather conditions. Therefore any significant weather changes may have a substantial impact on daily cycling traffic. Cycling data (e.g. speed, cycling volumes) are difficult to obtain and lead researchers and practitioners to plan the implementation of a bike-sharing system (BSS) with models that do not take into account the observed cycling volumes. On the other hand, disaggregated cycling data on an hourly basis are not useful for road safety analysis: accidents are rare and random and would result in null, inflated datasets that are not useful for calibrating predictive models, as is the case for modelling vehicle accidents. Cyclists can travel on the street pavement, sidewalk or cycle infrastructure (bicycle roads), which makes the use of automatic counters difficult. On the other hand, manual measurements are time-consuming, inaccurate and relatively expensive. In recent years an increasingly popular method of estimating traffic parameters is GPS technology. This type of cycling data can be collected from BSSs (but not only) and analysed, but the use of this data in the analysis requires a description of the relationship between trip parameters of BSS users and the actual cycling volume. This relationship can also change depending on environmental and weather conditions. Apart from certain weather conditions, the amount of cycling, as well as the number of BSS trips, can be different during school holidays and public holidays (including weekends) than on other days because of different attitudes and behaviour of cyclists.

5) Who could be interested in this material?

This article is aimed at students and others looking for inspiration for planning sustainable urban mobility measures, taking into account elements that can influence the effectiveness of a measure (in this case cycling measures) in terms of factors to be taken into account when planning measures (the need to ensure data collection for efficiency analysis, monitoring of implementation and the importance of the factor of weather conditions to be taken into account when planning solutions). Students specialised in mobility management will find guidance on which measures to include in urban mobility planning. The measures described can be helpful for those developing and monitoring SUMPs measures.

6) What is worth mentioning as an innovative factor for the reader?

The paper shows how to get the information needed to estimate future cycling infrastructure use concerning climate change and to enable more appropriate management and informed development of transport planning and traffic safety assessments. To obtain practical and transferable results, changes in cycling were estimated based on the coefficient of variation of cycling volumes and the number of trips in the BSS. Previous studies show that the impact of weather differs for different groups of cyclists (different levels of experience and travel motivation, age, gender), but there have been no studies that have assessed the differences in the impact of weather conditions on BSS users and other cyclists. This type of analysis is needed to assess whether changes in cycling resulting from changing weather conditions can be estimated from BSS trip data. The results can be generalised and provide a starting point for planning

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and management of cities facing climate change and provide information about the future use of cycling infrastructure. Besides, modelling the variability of cycling volumes can support the assessment of risk exposure in road safety analysis and management and help to monitor SUMP indicators.

This research study uses a new approach to estimate cycling volumes using data from BSSs and automatic counters. The added value of the study is the use of already available and low-cost resources to reliably estimate cycling traffic volume (in its daily average value and variability depending on exogenous variables), which provides a basis for city-level action planning

7) Limitations

The variability of cycling exposure with weather conditions provides insight into how cycling mobility will change over time with climate change and provides a basis for managing future infrastructure at the city level. It should be noted that the results presented are limited concerning data collection (relatively small sample - 9 locations used to calibrate the model), the problem of autocorrelation that may be commonly observed in cycling volumes (but the data did not allow for adequate inference to account for this problem), the availability of cycling data on a daily rather than hourly basis and therefore large changes in weather conditions during the day could not be accounted for.

Besides, the article does not present other factors that may influence cycling volumes, but weather-related factors should be taken into account when developing the SUMP to plan solutions to reduce this negative impact.

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