IMPACT OF SPATIAL PLANNING ON SUSTAINABLE TRAFFIC SAFETY; BELGIAN SITUATION ANALYSIS

(Project MD/01/041)

Task B : Traffic impact of land use in relation to road infrastructure

In this work package, the surrounding land use of accident locations was used as starting point to identify high risk land use zones. Using only accidents on numbered roads in this case would have created a systematic error, since most accidents involving vulnerable traffic are located on unnumbered roads. Therefore, the scope of this analysis was to examine all the accidents with casualties, not just the accidents on numbered roads. Further analysis of the risk levels of different land uses in relation to the types of road infrastructure and traffic was used to identify the carrying capacity of land uses.

TASK 1. Development of a consistent database on land use environments

Land use environments were classified based on the classes used in the spatial land use plans. These plans are digitally available for the entire country, but adaptations after 1991 to the original plans were recorded differently for the three regions. For this study the land use classes best representing the real land use, as recorded on topographic maps and/or aerial photography, were used. Some land use classes had to be reclassified in order to represent the entire country uniformly.

Scope
This exercise was performed for the entire country.

Method
GIS overlays, relational database techniques, remote sensing.

Data processed
Digital version of spatial plans from the regional land use administrations, digital road map of Belgium (route systems of the Regional Administration, used with the BLNET digital network bought for the Booster Programme on Transport and Mobility (1991-1995), scanned topographic maps, digital orthophoto's.

TASK 2. Development of a consistent database on road infrastructure and on its use

Similar to the digital spatial plans, digital road maps related to road and accident databases were available in the administrations, but neither the base maps, nor the route systems and links with descriptive databases was the same. The relevant data were extracted from the different databases and linked to one road map for the entire country.
The Walloon and Flemish Public Roads Department appeared to follow a similar approach for the location of accidents on numbered roads, but had developed routines to correct some mistakes. BIVV/IBSR had its own methods

for data correction. The three methods were compared and brought together, in order to retain the highest possible number of accidents for further analysis. For the location of accidents on local roads, new routines were developed.

Methodology
GIS dynamic segmentation and overlay techniques.

Data processed
NIS accident statistics, Mobgis, ROUTENAT, scanned topographic maps.

Scope
All land use categories, all roads, all accidents (1991-1998).

TASK 3. Identification of high risk land use areas and carrying capacity of land uses

Methodology
Overlay the created maps and statistical analysis of the distribution of accidents.

Scope
Originally, the objective was to perform the analysis for the entire country. However, the research was performed for case studies instead, because:

- the location method of accidents on unnumbered roads required calibration;
- the interpretation of results required knowledge of the local situation;
- the accident data covered a period of 7 years, during which the land use and the road infrastructure and traffic characteristics changed. An analysis of the effect of measures taken (car free cities, traffic plans, bicycle networks, ...) on the location of accidents, and on their characteristics, appeared to be appropriate.

The first case study was the city of Mechelen. The local analysis of the land use characteristics was performed for an engineering thesis in architecture.
A second case study was carried out for the city of Brussels.
The third case study was the Eastern part of the Province of Brabant-Wallon.

TASK 4. Examination of the traffic impact of different land uses

Methodology
The objective of this task was to examine the traffic generated by different land uses, and to analyse their road safety effect. The tool for the analysis of the traffic flows were the multi-modal transport models from the previous Booster Programme Transport and Mobility, and the regional administrations. Unfortunately, the output of the multi-modal transport models appeared to be

unfit for the analysis of the traffic composition required for the *examination of the traffic impact of different land uses*. Non motorised road users are not well represented, traffic composition of motorised vehicles is insufficiently classified, the statistics used for traffic generation could not be linked to land use categories. These regional models were therefore considered to be generalised for further use.

Instead of using the more generalised transport models, the analysis focused on the evolution of land use and traffic measures and their impact on road safety during the examined period. This was done in depth for Mechelen and to a smaller extend for the two other cases.

TASK 5. Identification of the vulnerability of roads to land use induced traffic

Methodology
The method for identification of black zones, developed by UCL in task A, was tested for Mechelen. The results of the linear clustering methods were compared to spatial clustering techniques. The analysis was performed in GIS. Clusters with high accident rates, based on different approaches, were examined in terms of the influence of network characteristics and in terms of the surrounding land use characteristics.

Scope
Mechelen

TASK 6. Identification of the impact of land uses in one area on the safety of other areas

Methodology
For Mechelen, the effect of some land uses on surrounding land uses was detected. More case studies are required in order to systematise the conclusions.

Data analysed
results of tasks 3 and 4

Scope :
Mechelen

Results of the KUL research team

Digital road map related to descriptive database of road characteristics and linked with a relational accident database.
Report of the analysis of high risk land use/road and traffic type combinations in a metropolitan city, a regional city, and a region with combined urban, suburban and rural characteristics. Analysis of the safety effects of the traffic measures and of the land use developments in an urban and a suburban environment.

Additional results
Refinement of the methods used to correct accident records from the NIS.
Operational location technique for location of accidents on secondary and local roads.

Significant stages
The most significant stage of this research was the first systematic location of NIS road accident records for 7 years, for an entire city. Concentration of accidents in specific land use zones and relocations through time of high-risk areas on local roads were significant. These results determined the further orientation of the research: to examine important changes in mobility and land use developments in relation to the evolution of accidents.

Importance of the results
The location technique starting from the digital road network, and accident records using intersection or address data, can be used for a wide range of spatial analyses in addition to accident locations. The tool dramatically reduces the need for manual location.
Currently, in Flanders, local and provincial authorities are working on a systematic location of accidents. The case studies of Mechelen and Brussels clearly demonstrate the power of GIS techniques for the analysis of policy effects on safety.

Robustness of results (networks, testing)
The results of the case study of Mechelen were confronted with the results of a parallel research project of Langzaam Verkeer" on liveability. Safety is a partial indicator of the liveability indicators developed. The findings appeared to be compatible.
The results were validated through a local analysis of a sample of the land use zones with high numbers of accidents in a thesis of student in architecture

Diffusion of results
Aside from technical papers, the results of this analysis are currently used for the development of the Mobility Plan of Flanders, and for the Monitoring System developed by the Mobility Cell of the Flemish Department of Environment and infrastructure.

Perspectives

The findings for Mechelen, and the preliminary findings for Brussels clearly demonstrate that there is a significant relation between road accidents and the balance between land use and road / traffic characteristics. The case study approach has allowed us to analyse the trends, and the safety effect of policies. More case studies are required in order to generalise the results. Time requirements for the location of accidents on unnumbered roads is an important barrier to this end.
The distribution of accidents on local roads appear to present special accident patterns in transitions zones: transitions between road and traffic types, and transitions between land uses. This aspect should be further examined, along with “neighbour” effects of land uses, such as open spaces in suburban areas, industry nearby housing areas,…
Comparison of these results with the results on liveability of neighbourhoods, performed by Langzaam Verkeer, shows that a neighbourhood approach to traffic safety could be further elaborated. The multi-modal transport models don’t provide enough data on unmotorised road users for the analysis of accidents in urban areas. Other modelling techniques were examined for the liveability analysis which seem to provide a better approximation of the risk factors for these road users.

Publications:

T. Steenberghen, L. Albrechts, Dufays T, Thomas I., Cuypers C. (1998) “Impact van Ruimtelijke Ordening op Duurzame Verkeersveiligheid; Analyse van de Belgische situatie; Activiteitenverslag 30/06/98”. Heverlee. 14 pp.

T. Steenberghen, L. Albrechts, Dufays T, Thomas I., Cuypers C. (1998) “Impact van Ruimtelijke Ordening op Duurzame Verkeersveiligheid; Analyse van de Belgische situatie; Activiteitenverslag 23/12/98”. Heverlee. 71 pp.

T. Steenberghen, L. Albrechts, Dufays T, Thomas I., Cuypers C. (1999) “Impact van Ruimtelijke Ordening op Duurzame Verkeersveiligheid; Analyse van de Belgische situatie; Activiteitenverslag 30/06/99”. Heverlee. 66 pp.

T. Steenberghen, L. Albrechts, Dufays T, Thomas I., Cuypers C. (1999) “Impact van Ruimtelijke Ordening op Duurzame Verkeersveiligheid; Analyse van de Belgische situatie; Activiteitenverslag 23/12/99”. Heverlee. 191 pp.

Gulinck, H. , Diependaele, A., Wijffels, A., Dufourmont, H., Honnay, O., Wagendorp, T., Adriaensen, F., Steenberghen, T., Dufays, T., Antrop, M. en I. Claes. 1999. Versnippering. Achtergronddocument MIRA-1999. Vlaamse Milieumaatschappij.

T. Steenberghen, L. Albrechts, Dufays T, Thomas I., Cuypers C. (2000) “Impact van Ruimtelijke Ordening op Duurzame Verkeersveiligheid; Analyse van de Belgische situatie; Activiteitenverslag 15/07/00”. Heverlee. 56 pp.

Presentations at conferences (with integral publication in proceedings)

K. Maesen, T. Steenberghen, T. Dufays “Impact of spatial planning on sustainable traffic safety, the mix of different transport modes as explanatory element (case study on the city of Mechelen)”, VeloModial2000 conference, 19-22 juni 2000.
T. Steenberghen, T. Dufays "Spatial Planning and Traffic Safety: GIS study of the city of Mechelen (Belgium)", fourth GIS for historical cities European conference, 10-12 mei 2000.
T. Steenberghen, T. Dufays "Impact van Ruimtelijke Ordening op duurzame verkeersveiligheid; Analyse van de Belgische situatie" op de AM FM GIS-dag 16 maart 2000; AM FM GIS-news mei nr 17, p10-11.
T. Steenberghen, T. Dufays "Impact van Ruimtelijke Ordening op duurzame verkeersveiligheid; Analyse van de Belgische situatie", DWTC-congres, 2 maart 2000.
T. Steenberghen, T. Dufays. (1999) “Impact of spatial planning on sustainable traffic safety, Belgian situation analysis”. Second European Road Research Conference, 7-9/6/1999. 14 pp.

Participation in commissions

- Representation of Belgium in COST 332 project “TRANSPORT AND LANDUSE POLICIES”