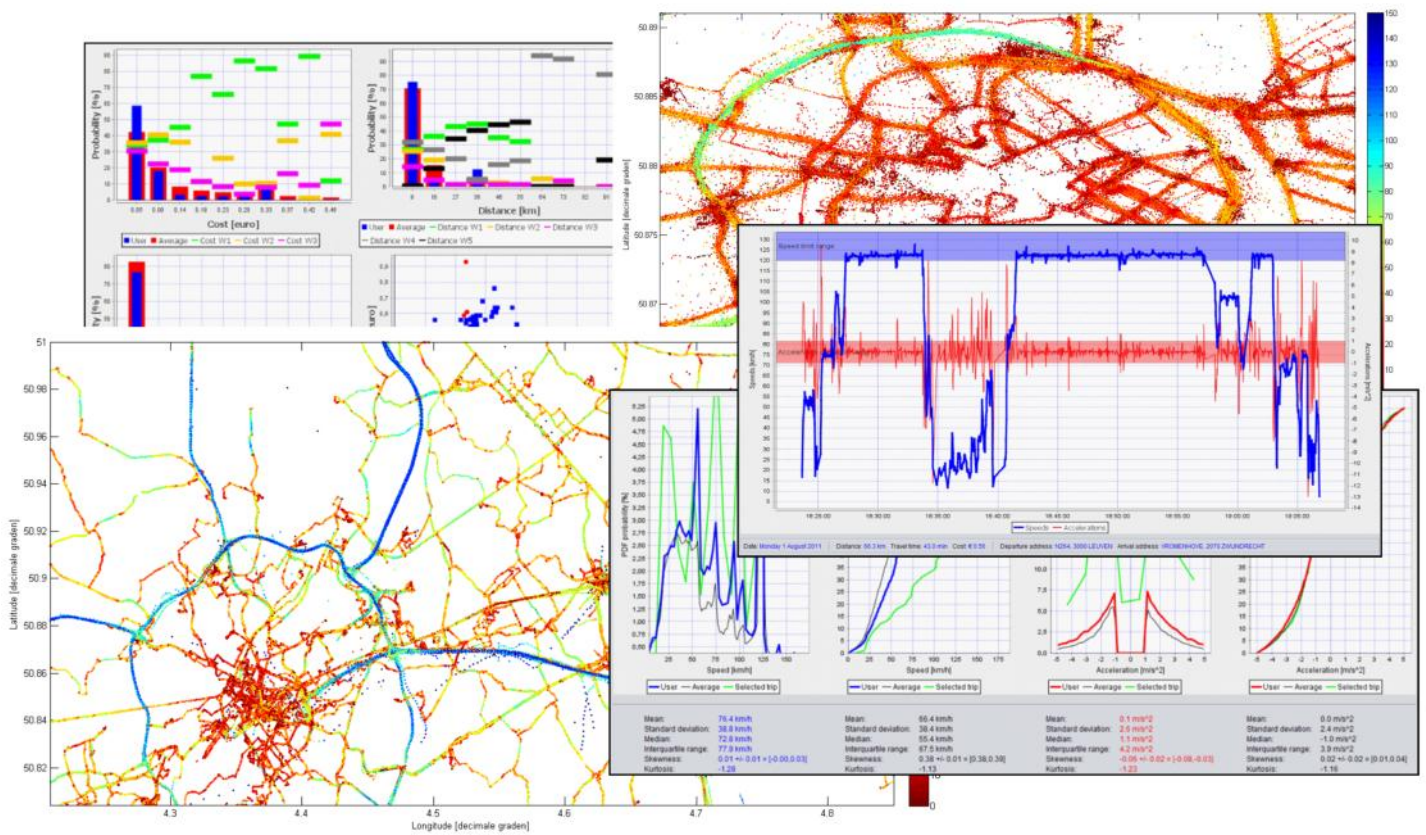




TRANSPORT & MOBILITY LEUVEN



Data Enrichment Group



Introduction

Dear Sir/Madam,

Thank you for taking the time to review our company portfolio related to our data enrichment activities. Transport & Mobility Leuven is an influential private research and consultancy company, founded as a spin-off from the Katholieke Universiteit Leuven and the Dutch research institute TNO. We combine both the developments in the academic world, as well as regional, national, and European policies. All our applied research is done in transport-related domains such as energy, environment, traffic and ITS, safety, spatial planning, and effects on society in general. It is our mission to help society by offering scientifically sound advice. For this, we rely strongly on a wide range of quantitative research methods, some of which are developed and integrated in our data enrichment group.

In the remainder of this brochure you can find some introductory information on the activities of our data enrichment group, followed by a brief overview of some of the products we developed and for which we believe Transport & Mobility Leuven can be a valuable asset for your company. The brochure ends with an overview of the key staff members involved and some facts and figures on Transport & Mobility Leuven as a company.

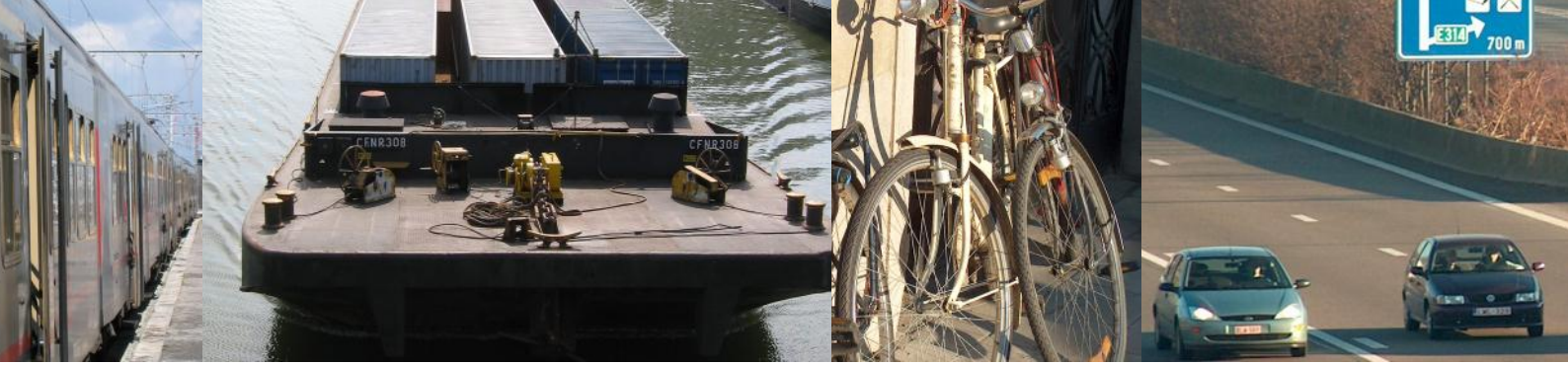
As such, this portfolio of research activities offers a broad look into the different domains where important societal advancements can be made.

We kindly invite you to meet with us so we can identify future opportunities to work directly with you and fully utilise our compounded knowledge from previous projects.



Sincerely,

Transport & Mobility Leuven
Griet De Ceuster, MSc
Managing Director



Data Enrichment

Discovering Patterns for Business Opportunities

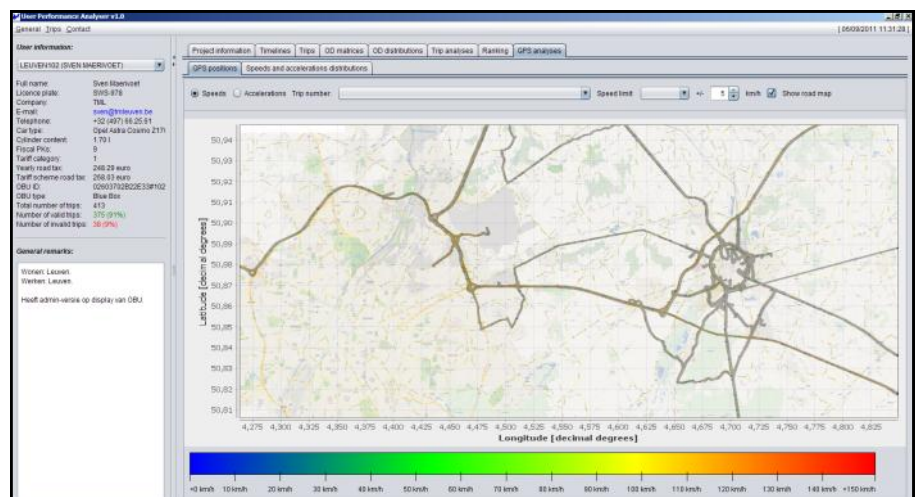
Data enrichment is one of the important steps in the research activities for several projects performed by Transport & Mobility Leuven. As we are often confronted with administrations and private companies asking us to identify future issues and opportunities, the need for dedicated data analyses becomes more prominent. This is the case when looking at the micro level of mobility (dealing with driver behaviour), as well as the meso and macro levels (trip planning and long-term mobility planning, respectively). The objectives of these types of projects make it necessary to manipulate data in such a way that an understanding of the underlying structures within the data emerges.

To this end, we have the necessary tools and means to deploy different methods that allow us to effectively reach such a more profound understanding of project-specific problems in the context of our B2B services. These methods include the use of in-house tools to enhance data mining, the merging of different databases from various domains in the fields of transport and mobility, and the creation of data synergies.

In order to remain at the forefront in the competitive world of data enrichment, we continuously develop and advance our knowledge and tools. We do this by actively following and publishing in different scientific journals, as well as by monitoring the most recent advances in both the public and private sectors. Furthermore, our company plays an important role in assisting different players in the domain of transport and mobility, such as European, national, and regional administrations, as well as major private companies. As a result, Transport & Mobility Leuven has developed itself into a specialist that links theoretical findings with practical knowledge.

Please contact us for more information. We take great pride on our services and would be happy to assist you in finding new opportunities in the future world of mobility that is shaped today!

You can find examples of some of our previously successful business cases on the following pages.





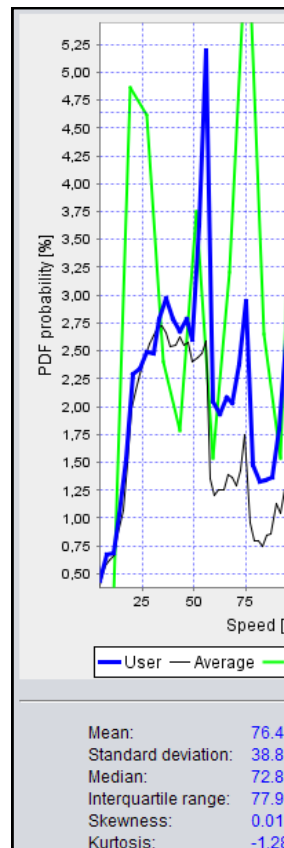
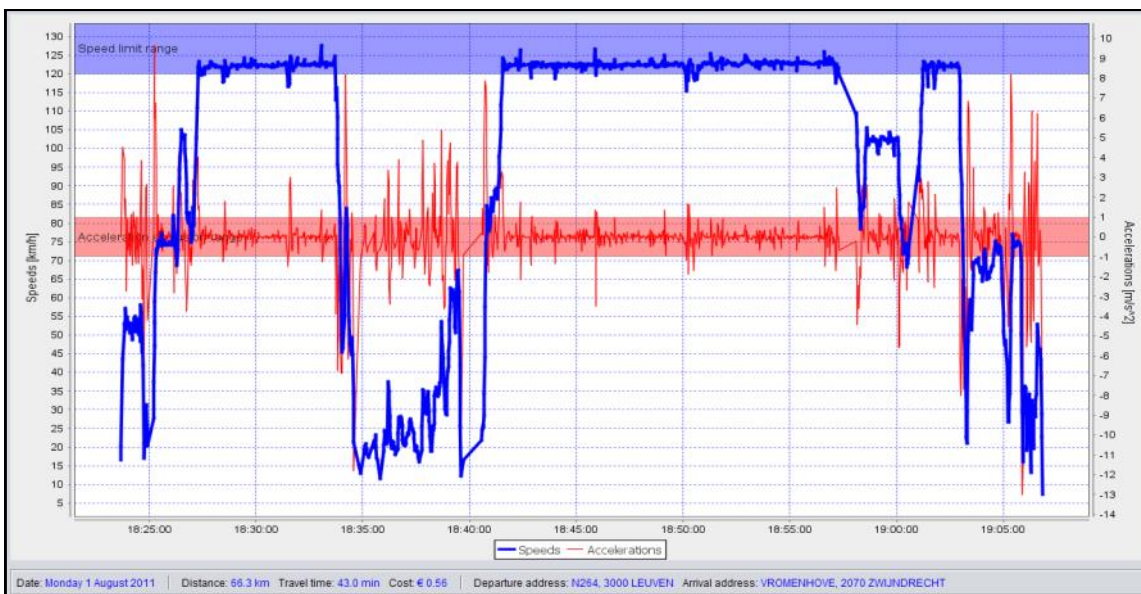
Driver Behaviour

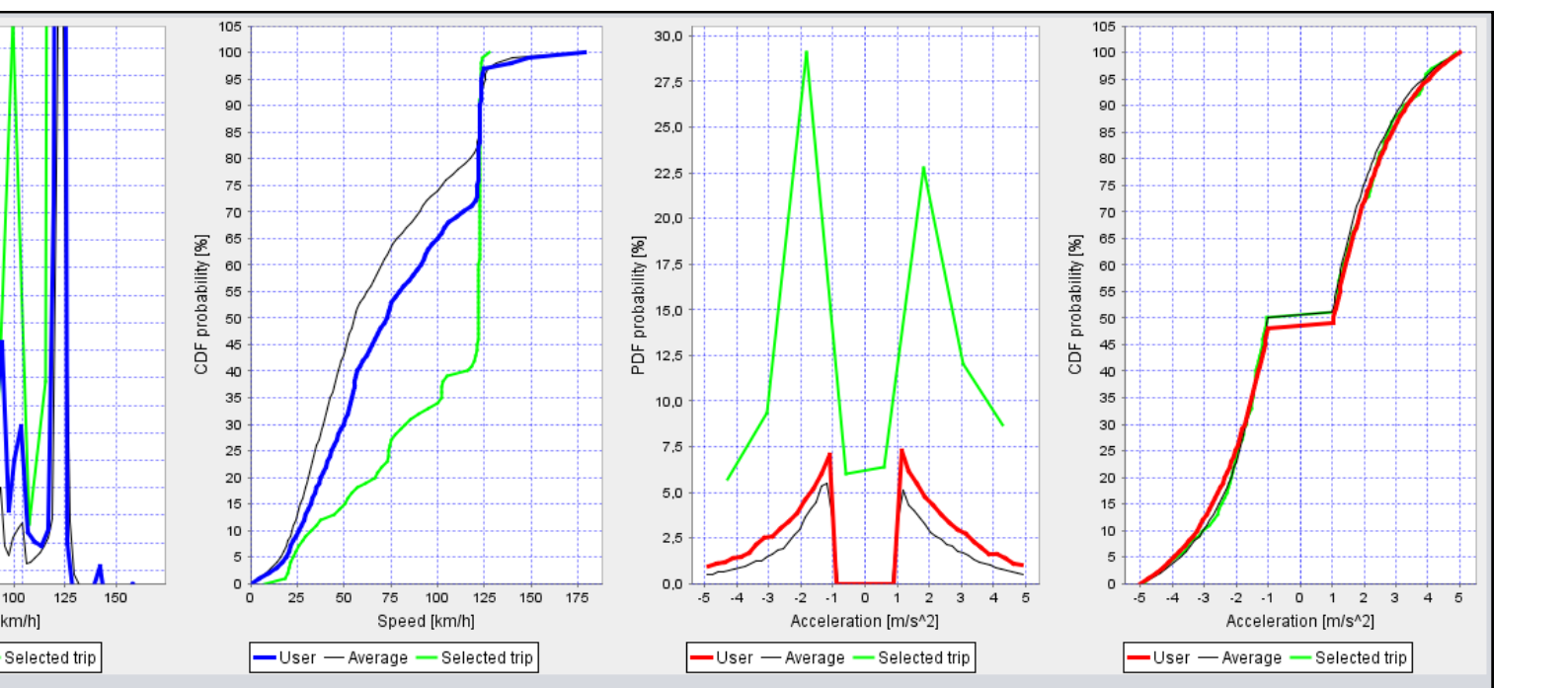
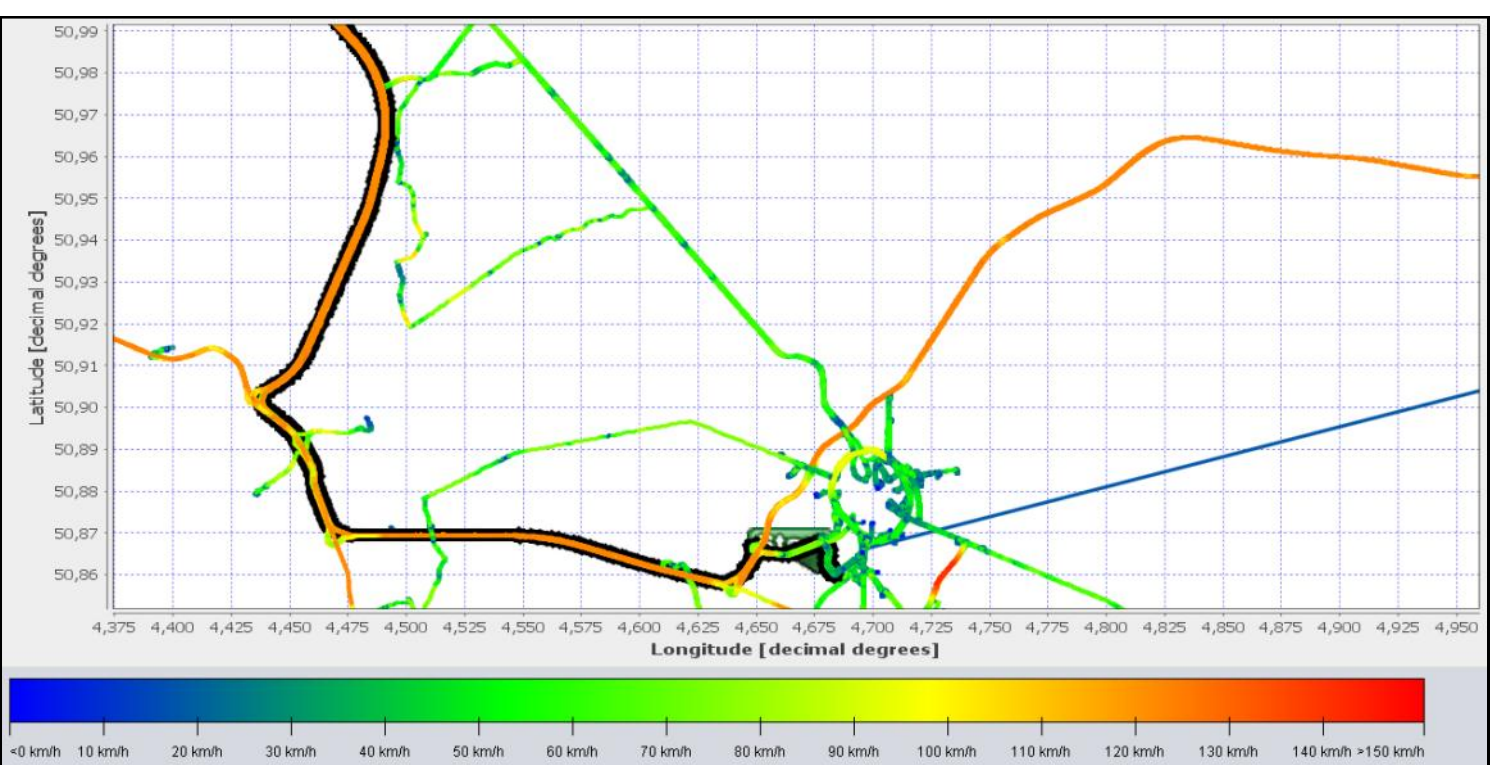
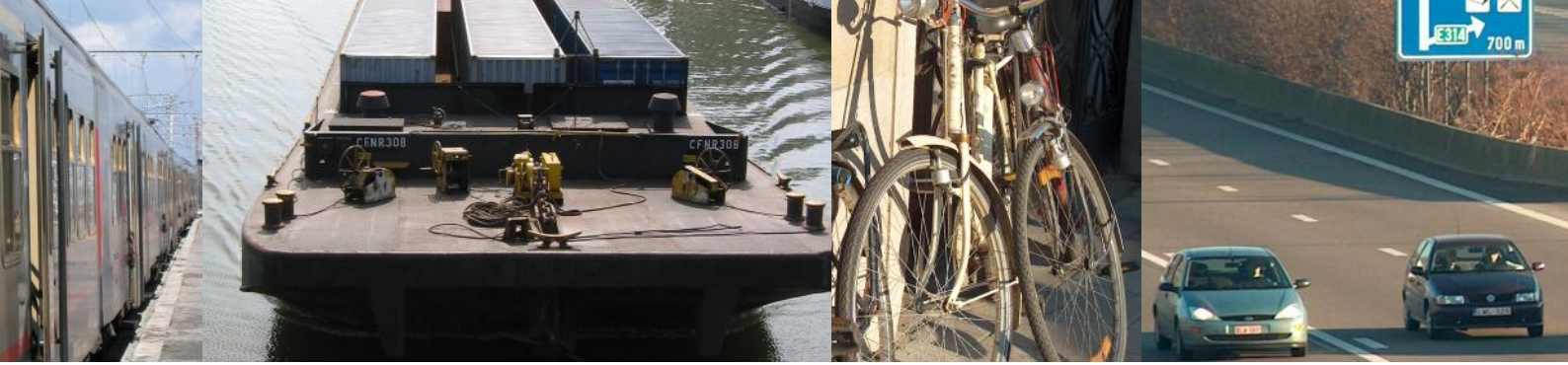
Detailed Speed and Acceleration Analyses

Detailed information about vehicles' speeds and accelerations can be used in different ways by private companies. A common example is the recent push towards eco-friendly driving. For this purpose, relevant measurements are gained through, for example, GPS tracking devices that provide high-frequency position information. Such a data source is rapidly becoming more accessible by means of in-vehicle integration of GPS devices.

However, we can easily find other applications for this data. Emerging speed and acceleration pattern information is highly relevant for the automotive industry. We can even help to enhance consumer satisfaction and brand loyalty by linking these patterns with other aspects such as: wear and tear, engine and transmission technology, vehicle steering input, et cetera. Another surplus is gained by merging the patterns with other data sources, such as traffic density information, insurance data, or weather forecasts.

Simultaneously, speed and acceleration patterns can be used by planning offices, insurance companies, infrastructure providers, public transport services, et cetera as benchmark data for future projects aimed at improving mobility and safety. The integration of significantly-sized real-life databases that can be linked with other data sources, offers a major step stone for the development of technologies, infrastructures, legislations, ... that have a high level of face validity.





<p>km/h</p> <p>km/h</p> <p>km/h</p> <p>km/h</p> <p>+/- 0.01 = [-0.00,0.03]</p>	<p>Mean: 66.4 km/h</p> <p>Standard deviation: 38.4 km/h</p> <p>Median: 55.4 km/h</p> <p>Interquartile range: 67.5 km/h</p> <p>Skewness: 0.38 +/- 0.01 = [0.38,0.39]</p> <p>Kurtosis: -1.13</p>	<p>Mean: 0.1 m/s²</p> <p>Standard deviation: 2.6 m/s²</p> <p>Median: 1.1 m/s²</p> <p>Interquartile range: 4.2 m/s²</p> <p>Skewness: -0.06 +/- 0.02 = [-0.08,-0.03]</p> <p>Kurtosis: -1.23</p>	<p>Mean: 0.0 m/s²</p> <p>Standard deviation: 2.4 m/s²</p> <p>Median: -1.0 m/s²</p> <p>Interquartile range: 3.9 m/s²</p> <p>Skewness: 0.02 +/- 0.02 = [0.01,0.04]</p> <p>Kurtosis: -1.16</p>
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Mobility Patterns

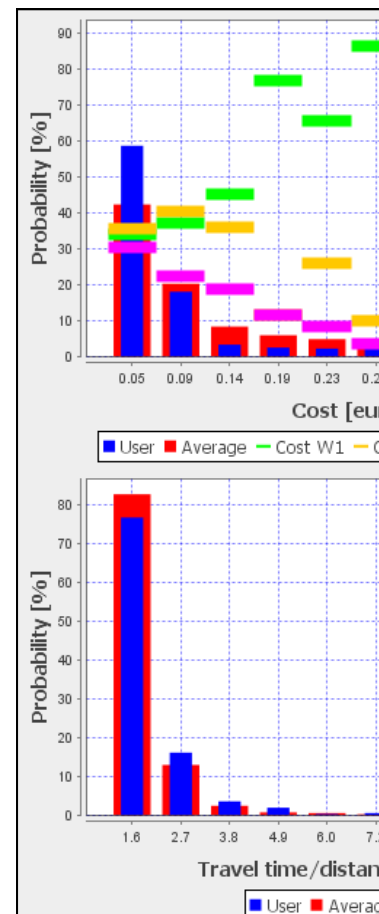
Analyses of Large-Scale Travel Behaviour

Guaranteeing a high level of mobility in the future will be one of the most demanding tasks for both public and private companies. Recently, different types of data sources such as road-side detection devices and on-board units in vehicles have become available to researchers on a large scale. This has significantly advanced the possibilities we have in investigating the movements of large groups of vehicles, or even the movements of specific groups of users during specific time intervals (days, weeks, years).

Today, it has become possible to create large databases containing real-life origin-destination matrices, trip chain information, travel speed information, et cetera. This specifically allows for the construction of driver, driver type, and trip profiles.

This type of information makes it possible for companies and the public administrations to better position themselves in a changing mobility environment and more actively create and develop a future (business) strategy based on strong quantitative data.

Trip number	Departure address	Arrival address	Date	WE	Time	Distance	Cost	Travel time
20110820000000041217	3360 (VLINDERLAAN, KORBEK-LO)	3010 (DIESTSESTEENWEG, KESSEL-LO)	20/08/2011	WE	17:53	4 km	€ 0.06	8 min
20110820000000041215	3010 (TIENSESTEENWEG, KESSEL-LO)	3010 (NO ROAD NAME, KESSEL-LO)	20/08/2011	WE	17:39	1 km	€ 0.01	3 min
20110820000000041213	3010 (ATELIERSTRAAT, KESSEL-LO)	3010 (TIENSESTEENWEG, KESSEL-LO)	20/08/2011	WE	17:22	3 km	€ 0.05	7 min
20110820000000041205	3000 (WADUKT, LEUVEN)	3010 (DIESTSESTEENWEG, KESSEL-LO)	20/08/2011	WE	15:44	8 km	€ 0.12	23 min
20110819000000041189	3010 (WERKHUIZENSTRAAT, KESSEL-LO)	3001 (WAVERSEBAAN, HEVERLEE)	19/08/2011	WE	17:42	6 km	€ 0.12	10 min
20110818000000041153	2840 (ANTWERPSESTRAAT, REET)	3001 (WAVERSEBAAN, HEVERLEE)	17/08/2011	WE	22:47	54 km	€ 0.64	32 min
20110817000000041137	3001 (WAVERSEBAAN, HEVERLEE)	3010 (WERKHUIZENSTRAAT, KESSEL-LO)	16/08/2011	WE	09:11	7 km	€ 0.10	13 min
20110814000000041051	3010 (DIESTSESTEENWEG, KESSEL-LO)	3001 (WAVERSEBAAN, HEVERLEE)	14/08/2011	WE	14:44	9 km	€ 0.14	12 min
20110814000000041049	3000 (TERVUURSEVEST, LEUVEN)	3010 (DIESTSESTEENWEG, KESSEL-LO)	14/08/2011	WE	11:59	5 km	€ 0.08	7 min
20110803000000040085	3010 (DIESTSESTEENWEG, KESSEL-LO)	3001 (WAVERSEBAAN, HEVERLEE)	03/08/2011	WE	17:50	6 km	€ 0.12	8 min
20110803000000040069	3001 (NAAMSESTEENWEG, HEVERLEE)	3010 (WERKHUIZENSTRAAT, KESSEL-LO)	03/08/2011	WE	13:36	6 km	€ 0.09	9 min
20110803000000040057	2070 (DORP-OOST, ZWIJNDRECHT)	3001 (WAVERSEBAAN, HEVERLEE)	03/08/2011	WE	01:04	65 km	€ 0.56	36 min
20110802000000040055	3000 (N254, LEUVEN)	2070 (BINNENPLEIN, ZWIJNDRECHT)	02/08/2011	WD	19:19	62 km	€ 0.49	35 min
20110802000000040053	3010 (MARTELARENLAAN, KESSEL-LO)	3001 (WAVERSEBAAN, HEVERLEE)	02/08/2011	WD	18:02	3 km	€ 0.07	8 min
20110802000000040049	3001 (NAAMSESTEENWEG, HEVERLEE)	3010 (WERKHUIZENSTRAAT, KESSEL-LO)	02/08/2011	WD	14:28	5 km	€ 0.07	9 min
20110802000000040025	2060 (VERBRANDENDIJK, ANTWERPEN)	3001 (WAVERSEBAAN, HEVERLEE)	02/08/2011	WE	01:45	64 km	€ 0.56	28 min
20110801000000040007	3000 (N254, LEUVEN)	2070 (VROMENHOVE, ZWIJNDRECHT)	01/08/2011	WE	11:45	56 km	€ 0.56	43 min
20110801000000039995	3010 (DIESTSESTEENWEG, KESSEL-LO)	3001 (WAVERSEBAAN, HEVERLEE)	01/08/2011	WE	11:23	6 km	€ 0.13	10 min
20110801000000039977	3000 (TERVUURSEVEST, LEUVEN)	3010 (WERKHUIZENSTRAAT, KESSEL-LO)	01/08/2011	WE	11:54	5 km	€ 0.09	7 min
20110801000000039975	3000 (CELESTIJNENLAAN, LEUVEN)	3001 (WAVERSEBAAN, HEVERLEE)	01/08/2011	WE	11:24	2 km	€ 0.04	4 min
20110801000000039973	3001 (NAAMSESTEENWEG, HEVERLEE)	3000 (LUZERENMOLENSTRAAT, LEUVEN)	01/08/2011	WE	10:55	3 km	€ 0.05	9 min
20110801000000039965	2060 (VERBRANDENDIJK, ANTWERPEN)	3001 (WAVERSEBAAN, HEVERLEE)	01/08/2011	WE	09:10	64 km	€ 0.56	36 min
20110731000000039963	2070 (DORP-OOST, ZWIJNDRECHT)	2070 (DORP-OOST, ZWIJNDRECHT)	31/07/2011	WE	22:98	1 km	€ 0.00	1 min
20110731000000039961	3001 (NO ROAD NAME, HEVERLEE)	2070 (VROMENHOVE, ZWIJNDRECHT)	31/07/2011	WE	20:31	65 km	€ 0.48	39 min
20110731000000039953	3000 (L'AJARDENSCHEDIJNDEL, LEUVEN)	3001 (WAVERSEBAAN, HEVERLEE)	31/07/2011	WE	11:56	5 km	€ 0.09	8 min
20110731000000039949	3300 (ZUIDELINGSESTRAAT, TIENEN)	3010 (DIESTSESTEENWEG, KESSEL-LO)	31/07/2011	WE	02:10	26 km	€ 0.24	21 min
20110730000000039944	3010 (DIESTSESTEENWEG, KESSEL-LO)	3300 (ZUIDELINGSESTRAAT, TIENEN)	30/07/2011	WE	16:55	19 km	€ 0.19	25 min
20110730000000039939	3001 (TERVUURSEVEST, HEVERLEE)	3010 (DIESTSESTEENWEG, KESSEL-LO)	30/07/2011	WE	16:40	5 km	€ 0.07	9 min
20110730000000039935	3000 (N26, LEUVEN)	3001 (WAVERSEBAAN, HEVERLEE)	30/07/2011	WE	13:55	7 km	€ 0.12	14 min
20110730000000039919	3001 (NAAMSESTEENWEG, HEVERLEE)	3010 (DIESTSESTEENWEG, KESSEL-LO)	30/07/2011	WE	03:27	6 km	€ 0.10	10 min
20110729000000039911	2060 (BLANCHELOERLAAN, ANTWERPEN)	3001 (WAVERSEBAAN, HEVERLEE)	29/07/2011	WE	18:52	63 km	€ 0.56	40 min
20110729000000039907	2070 (BINNENPLEIN, ZWIJNDRECHT)	2070 (VROMENHOVE, ZWIJNDRECHT)	29/07/2011	WE	17:38	1 km	€ 0.00	2 min
20110729000000039905	9140 (HOOCKAMERSTRAAT, TEMSE)	2070 (BINNENPLEIN, ZWIJNDRECHT)	29/07/2011	WE	15:44	19 km	€ 0.00	28 min
20110729000000039899	3001 (WAVERSEBAAN, HEVERLEE)	9140 (HOOCKAMERSTRAAT, TEMSE)	29/07/2011	WE	15:44	75 km	€ 0.56	69 min
20110729000000039893	6870 (NO ROAD NAME, AWENNE)	3001 (WAVERSEBAAN, HEVERLEE)	29/07/2011	WE	14:32	125 km	€ 0.12	87 min
20110729000000039885	6950 (RUE DES MASBOURG, NASSOGNE)	6950 (RUE DE LAHOUT, NASSOGNE)	29/07/2011	WE	11:24	1 km	€ 0.00	5 min
20110729000000039877	5580 (RUE DE SAINT-HUBERT, WAVREILLE)	6870 (FOURNEAU SAINT-MICHEL, AWENNE)	29/07/2011	WE	01:16	77 km	€ 0.00	84 min
20110729000000039871	6870 (RUE DU FOURNEAU SAINT-MICHEL, AWENNE)	5580 (PLACE DU ROI ALBERT 1ER, ROCHEFORT)	29/07/2011	WE	20:57	47 km	€ 0.00	41 min
20110729000000039833	6870 (N849, ARVILLE)	6870 (FOURNEAU SAINT-MICHEL, AWENNE)	29/07/2011	WE	00:57	7 km	€ 0.00	6 min
20110727000000039829	6870 (RUE SAINT-MICHEL, SAINT-HUBERT)	6870 (PLACE DU MARCHAIS, SAINT-HUBERT)	27/07/2011	WE	20:50	1 km	€ 0.00	3 min
20110727000000039805	6870 (RUE DE LA FONTAINE, SAINT-HUBERT)	6870 (FOURNEAU SAINT-MICHEL, AWENNE)	27/07/2011	WE	05:45	8 km	€ 0.00	8 min
20110727000000039803	6870 (RUE SAINT-MICHEL, SAINT-HUBERT)	6870 (PLACE DU MARCHAIS, SAINT-HUBERT)	27/07/2011	WE	05:31	1 km	€ 0.00	7 min
20110726000000039787	6950 (RUE DE LAHOUT, NASSOGNE)	6870 (FOURNEAU SAINT-MICHEL, AWENNE)	26/07/2011	WE	16:33	6 km	€ 0.00	21 min





Road User Charging

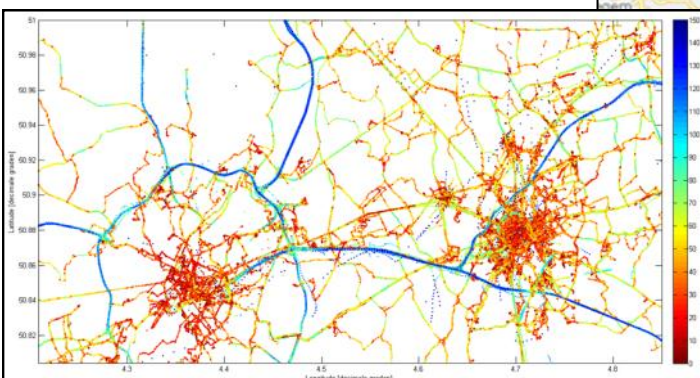
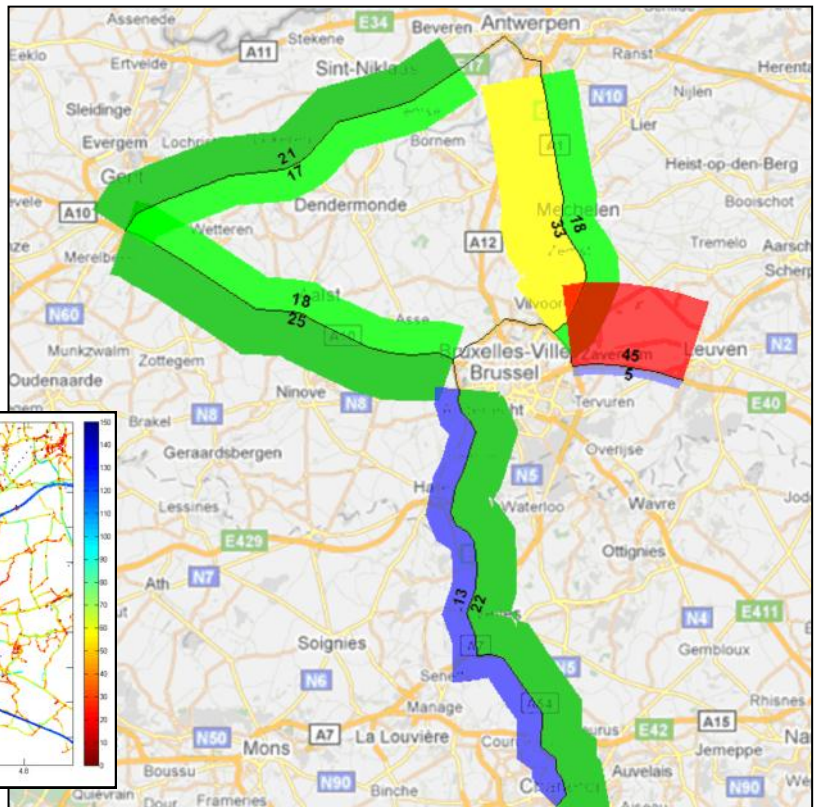
Impact of Intelligent Tolling Schemes

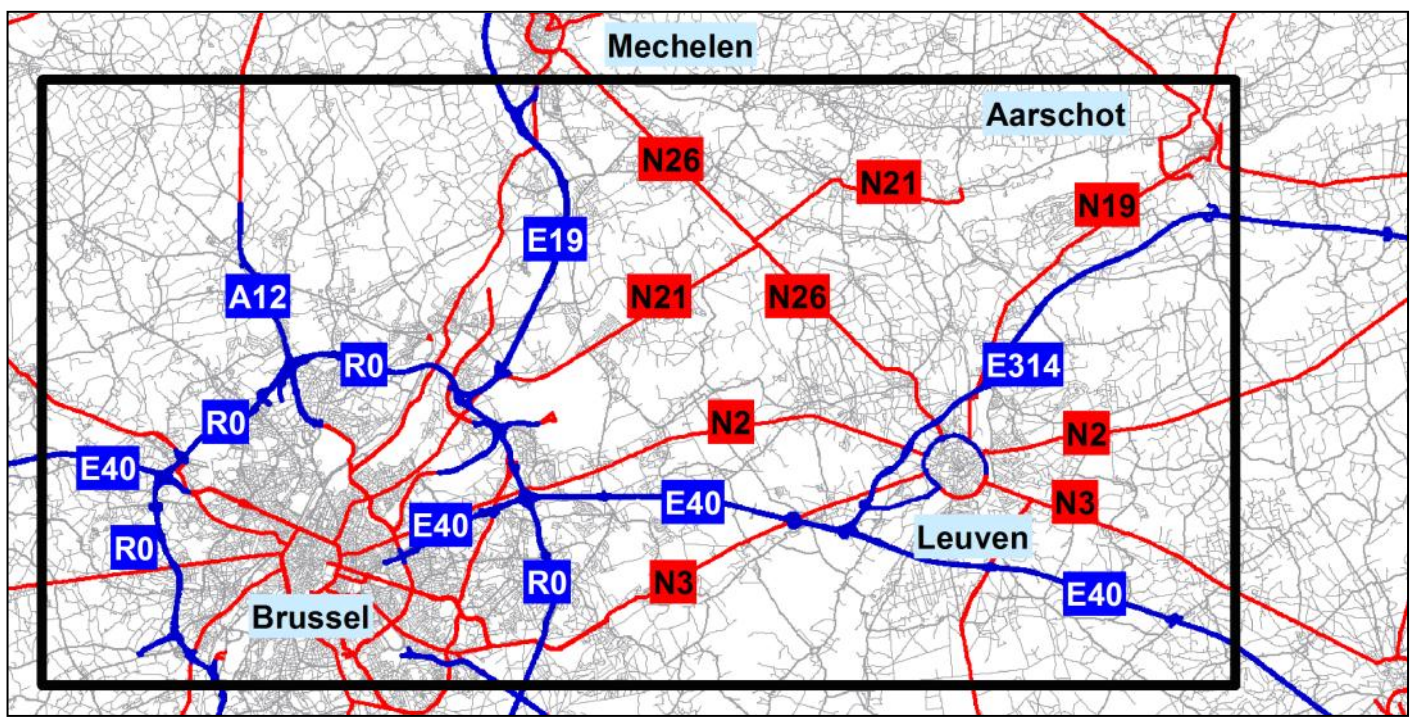
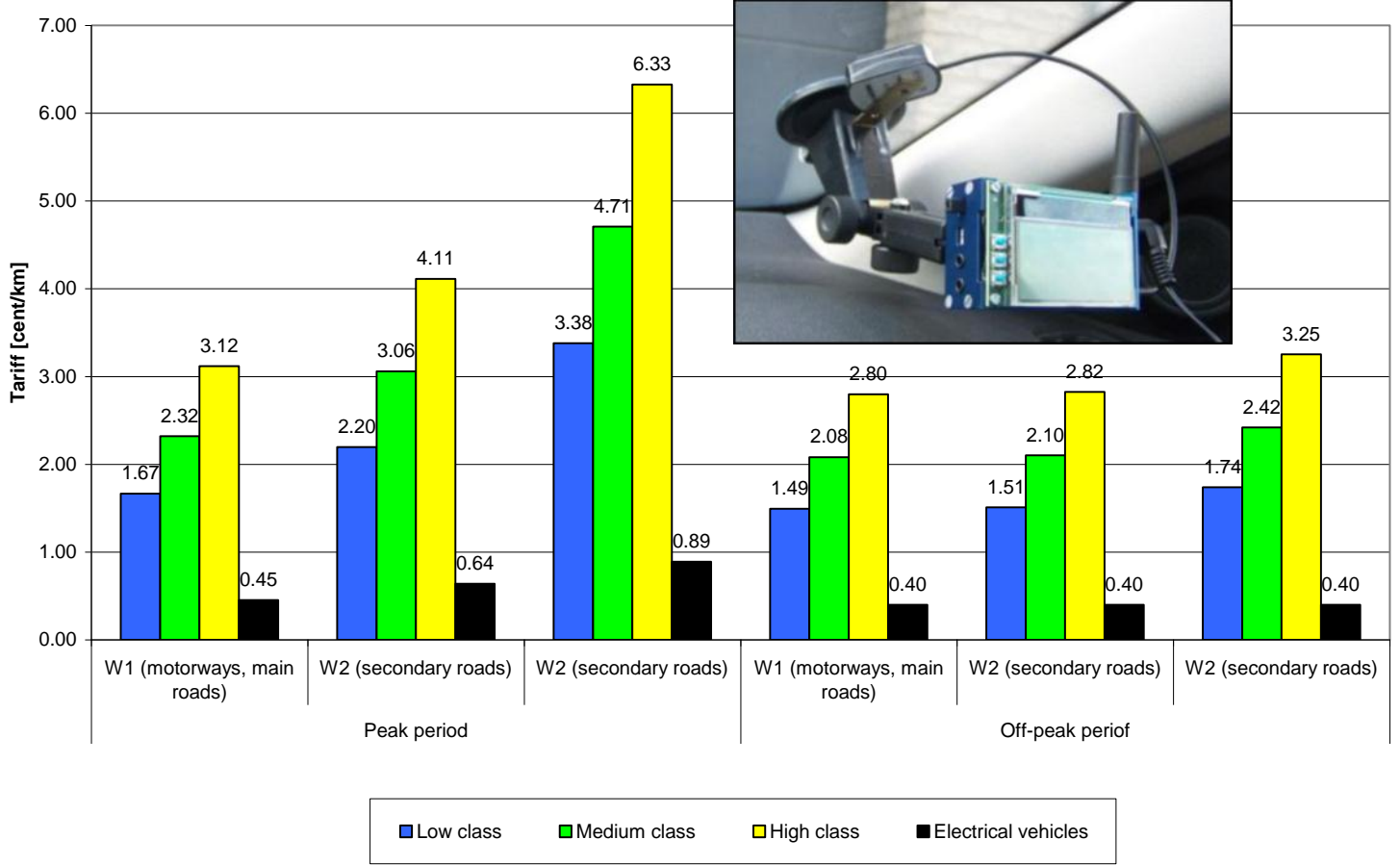
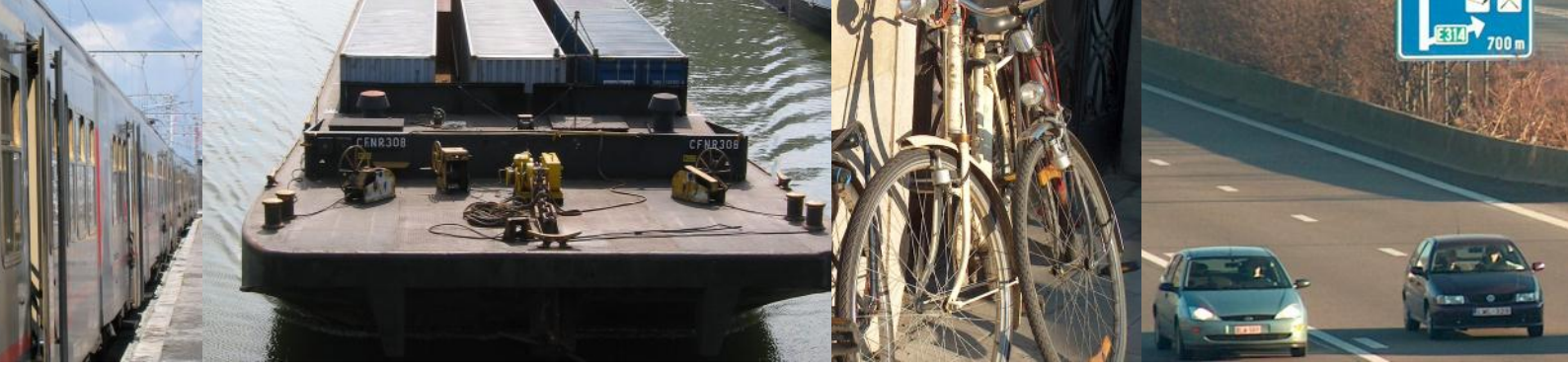
In light of road charging for passenger cars, the usage of an on-board unit (OBU) becomes much appreciated. In order to make the system intelligent, we can use time and location-based information from the vehicles themselves. As such, it is possible to have a technological solution that can, e.g., calculate the cost per kilometre based on the type of the vehicle (engine capability, emissions, ...), the time instant of driving (morning or evening rush hour, or the off-peak period), the position of the vehicle (motorway, secondary or local road, city centre, ...), or other parameters.

The market potential of such a solution is quite huge, as is testified by several local tests that are already underway and in which

Transport & Mobility Leuven is an active participant. From the definition of appropriate road charging schemes, to providing useful feedback on route guidance to the driver on the road, advising congestion avoidance (e.g., the identification of areas in time and space of structural congestion), and assessing the impact of the implementation of large-scale road charging, both for passenger cars and for trucks.

Companies can directly benefit from this information, as it allows their employees to reduce the amount of time lost due to congestion. Employers can even try to encourage flexible working hours and working at home, so as to minimise these travel time losses, consequently improving its public relations.



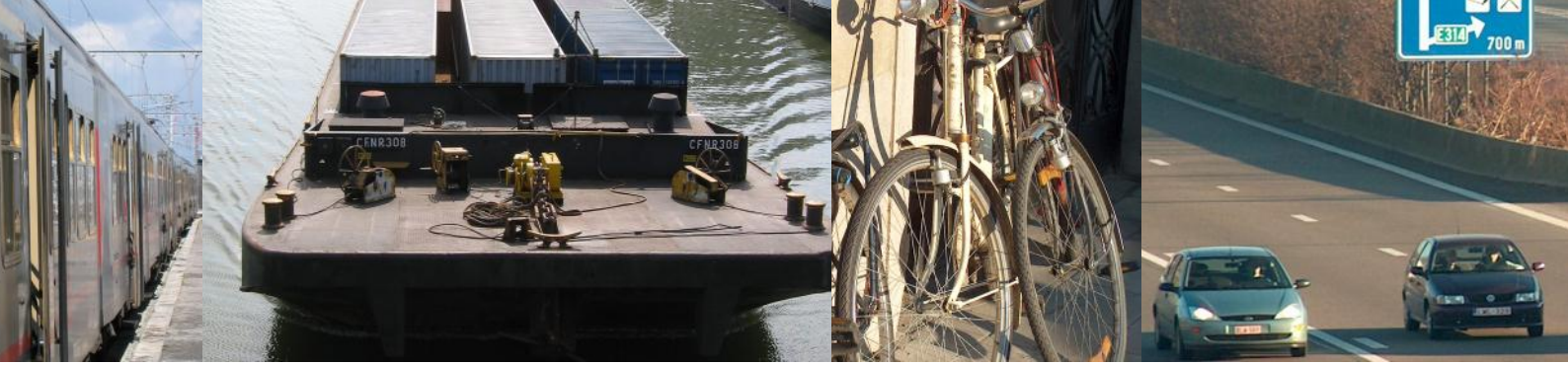




In the News

Together with a consortium of private companies, Transport & Mobility Leuven launched a showcase on 21 April 2010, demonstrating the potential of on-board units for road user charging, eCall, and other value-added services. The project involved probe vehicles that drove from Brussels to Leuven, using various routes and thereby showing different pricing schemes, depending on the type of vehicle, the used roads, and the time of day. We launched a final press conference on 15 February 2012, attracting a lot of attention. The project showcased just one of many possibilities for which our data enrichment group is excellently-skilled, mixing the right combination of traffic and transportation theory, economic and social behavioural analyses, and mathematical and physical models.





Our Clients

Knowledge institutions:

Katholieke Universiteit Leuven
Universiteit Antwerpen
Vrije Universiteit Brussel
Universiteit Gent
Université Catholique de Louvain
TNO (Nederland)
Kennisinstituut Mobiliteit (KIM)
Duke University (USA)

Governments & administration:

Gemeente Molenbeek, Roosendaal, Haven Antwerpen, Stad Antwerpen, Stad Brussel, Stad Gent, Stad Hasselt, Stad Leuven
Agentschap Economie, Agentschap Infrastructuur, Agentschap Wegen en Verkeer, BIM, BHG, Vlaams Gewest, Waals Gewest, Dept. Economie, Dept. Financiën en Begroting, Dep. LNE, Dept. MOW, Dept. RO, FOD Binnenlandse Zaken, FOD Mobiliteit en Vervoer, FOD Volksgezondheid, FOD Wetenschapsbeleid, Infrabel, ISVAG, De Lijn, Mobiliteitscel, NIRAS, NMBS, VITO, VIWTA, Vlaams Parlement, VMM, VIL, VIM, IWT, IBBT, Provincie Limburg, Provincie Vlaams-Brabant, Projectgroep Schelde, NV De Scheepvaart, NV Zeekanaal EC DG CLIMA, EMPLOY, ENERGY, ENTR, ENV, INFISO, MOVE, REGIO, TREN, EuropeAid, ERA-NET, European Parliament, Eurostat, IPTS, JRC IPTS, STC, FP5, FP6, FP7
ADEME, AVV (The Netherlands), Oslo (Norway), Dept. of Transport (UK), Min. Equipements (France), Min. Verkeer en Waterstaat (The Netherlands), Nederlandse Ambassade, Provincie Zeeland, Vialis

Private companies & organisations:

3V, ACEA, AEGPL, Agoria, Airbus, BBL, Be-Mobile, Carrefour, CER, ECMT, ECSA, FEBIAC, FLOW, Forum 2020, Friends of the Earth, Gaz de France, Greenpeace, IBM, INDIGOV, Instituut Wegtransport, Interreg, ITIS Holdings, Knack, NXP, Promotie Short-Sea Shipping Vlaanderen, Thurn & Taxis, Toyota, Touring, UNIZO, Vivium, VOKA, VSV, World Bank, Telecom Operators



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deg@tmleuven.be




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economics and pricing
European research
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our tools
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EMMOSS
TREMOVE
WCM and NODUS
fleet prediction tool
ERICCO
cost-benefit analysis
spatial and social impact
seminars and courses
academic seminars
training courses

Data Enrichment Group

Discovering patterns for business opportunities

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To this end, we have the necessary tools and means to deploy different methods that allow us to effectively reach such a more profound understanding of project-specific problems in the context of our B2B services. These methods include the use of in-house tools to enhance data mining, the merging of different databases from various domains in the fields of transport and mobility, and the creation of data synergies.

In order to remain at the forefront in the competitive world of data enrichment, we continuously develop and advance our knowledge and tools. We do this by actively following and publishing in different scientific journals, as well as by monitoring the most recent advances in both the public and private sectors. Furthermore, our company plays an important role in assisting different players in the domain of transport and mobility, such as European, national, and regional administrations, as well as major private companies. As a result, Transport & Mobility Leuven has developed itself into a specialist that links theoretical findings with practical knowledge.

“Because smart is the new sustainable!”