Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

Ticket to KYOTO

WP 3: ELABORATING CO_2 STRATEGIES

Specification for the trip calculator for Public Transport

December 2012

Table of contents

Introduction

Our current lifestyle creates greenhouse gases emissions in a quantity significantly greater than the planet can recycle. These gases then accumulate in the atmosphere and retain more heat than in their natural state. This is called the “additional greenhouse effect”, which causes global warming and alters our climate.

Transport activities are, after the buildings sector, the most important CO_2 emissions in Europe. The behaviour of individuals can influence the trends and help in the fight against climate change. Public transportation, consumes on average five times less energy and emits less greenhouse gas than using a car. This means that choosing public transport can lead to an important decrease in the impact of transport activities.

The goal of the Work Package 3 “Elaborating CO_2 strategies” of the Ticket to Kyoto project is, for each partner, to develop a long term strategy for CO_2 and energy reduction by 2020. These strategies are developed jointly by the partners. To develop them, it is essential to build common tools in order to be able to compare and analyze coherent figures.

This Work Package is composed of two main parts:

- The definition of common and comparable methods for carbon footprint and indicators, so that it becomes possible to trace and give concreteness and visibility to the efforts. Today, CO_2 calculations are very heterogeneous and often insufficient. A direct application will be to develop or improve CO_2 calculators, which are a good tool to alert both staff (commitment at work) and citizens (for their modal choices in transport) to CO_2 consequences.

- The development of strategies for each partner with the benefit of the partnership that works as a quality factor. Stakeholders should be involved in the development of this strategy: local multilevel governments, suppliers, beneficiaries of the project, including end users. The definition of the resources that are needed to implement this strategy is also part of this work.

These strategies are built in order to enable their duplication by any other public transport company. Therefore the elaboration of methods and definitions of indicators are an important part of the Work Package.

Three actions are defined to fill this objective:

- **CO_2 and carbon footprint methods**
  This action will end in the definition of valid CO_2 measure balance methods that can cover all the companies’ activities.

- **Definition and follow-up of common indicators**
  This action will end with the identification of a series of indicators that will allow the company’s CO_2 emissions to be monitored in the longer term. Within the same action, the CO_2 trip calculators for customers will be fine-tuned, so as to be able to provide precise data for CO_2 emissions for different kinds of public transport offers.

- **Provide a longer term CO_2 reduction strategy to each partner**
  Once the trustable method and CO_2 indicators are defined, partners will develop together a strategic CO_2 plan for their organisation. The strategy should cover the CO_2 emissions reduction until 2020.

This report deals with the conception of trip calculators for customers. It will first propose a methodology o monitor the impact of a trip, and then identify the prerequisites to build the tools. The last part will propose specifications to add this calculator to a route planner.

1. Methodology

This document proposes some specifications to develop a trip calculator tool enabling public transport operators to share information about emissions linked to the services they provide, and compare these to emissions by car for the same journey, if the data are available.

The GHG emissions of a transport service shall include both vehicle operational processes and energy operational processes which occur during the operational phase of the lifecycle.

The vehicle operational processes shall include operation of all on-board vehicle systems including both propulsion and ancillary services.

The energy operational processes **should at least include**:

- for fuels: extraction, refining, transformation, transport and distribution of energy at all steps of the production of the fuel used;
- for electricity: extraction and transport of primary energy, transformation, power generation.

The assessment GHG emissions of a transport service **shall not include**:

- direct emissions of GHG at the vehicle level, resulting from leakage of refrigerant gas or natural gas for example;
- processes implemented by external movement devices like elevators and moving walkways;
- processes at the administrative level of the organizations involved in the transport services, like operation of buildings, staff commuting and business trips, computer systems…;
- processes for the construction, maintenance and scrapping of vehicles;
- processes of construction, service, maintenance and dismantling of transport infrastructures used by vehicles;
- non-operational energy processes, like the production or construction of extraction equipments, of transport and distribution systems, of power production plants, etc. so as their reuse, recycle and scrap.

If there is any official regulation, the included or excluded emissions have to be in coherence with the requirements of the country. For instance, currently, in France, the regulation imposes to communicate about carbon dioxide (CO_2).

In other cases, it is recommended to communicate on the following six gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydro fluorocarbons (HFCs), per fluorocarbons (PFCs) and sulphur hexafluoride (SF_6). Those are the gases defined by the Kyoto protocol.

To monitor the emission of a trip, the operator has to split the trip into different legs depending of the characteristics of the vehicles, the type of driving or any other relevant repartition. For public transport, the separation by modes is a good approach to split a trip into segments (legs).

The total emissions of the trip will be the sum of the emissions of each trip segment.

The evaluation of the emissions of a segment is done by multiplying the distance travelled by an emission factor representative of the mode. The most commonly used factor is the emission due to one passenger travelling one kilometre of this segment.

Whatever is the chosen emission factor, it is defined for a period because it is built with mean values of consumption, traffic… If the values are annual energy consumptions, the emission factors have to be updated yearly.

2. Prerequisites

To monitor the emission of a trip, the data to know are:

1. the breakdown of the route into segments and modes, such as walking, tram …
2. an estimation of the distances on each segment,
3. a CO_2 emissions factor value for a reference distance of each segment

The first two points are directly dependent on the route planner of the operator. Each network has its own methodology to evaluate the distance on each segment. It can be:

- real distances,
- distances as the crow flies,
- distances as the crow flies multiplied by a correction factor,

The third point about a CO_2 emissions factor for a reference distance is an added value of the route planner. The partners of the Ticket To Kyoto Project built a set of indicators among which the "CO_2 equivalent emissions due to traction energy consumption per passenger.kilometer (CO_2 geq/pax.km)" is calculated for each mode (see the dedicated T2K report on indicators also available on www.tickettokyoto.eu).

These indicators will be used to provide the CO2 emissions factors for the trip calculator.

To be able to evaluate the CO_2 emissions, the trip calculator has to have access to the distance of the segments for the defined trip. The route planner should be built to allow the trip calculator to have the distance on each segment (by mode for public transport as recommended before).

3. Specifications

From an origin and a destination entered by the user online, the route planner has to deduct a distance run by segments of the trip. Those distances would be an input data of the trip calculator. The following specifications are available for emission factor per passenger.kilometer as they were defined in the set of Ticket to Kyoto indicators.

The trip calculator will monitor the emissions by adding emissions on each segment of the trip. Emissions of each segment are monitored by multiplying its emission factor assessed for the reference period by the distance of the segment. The emission factor is chosen for each segment.

To allow public transport users to have a good understanding of the emissions of their trips and to compare its environmental performance to that of the car, the trip calculator has to be commented with the details of the methodology.

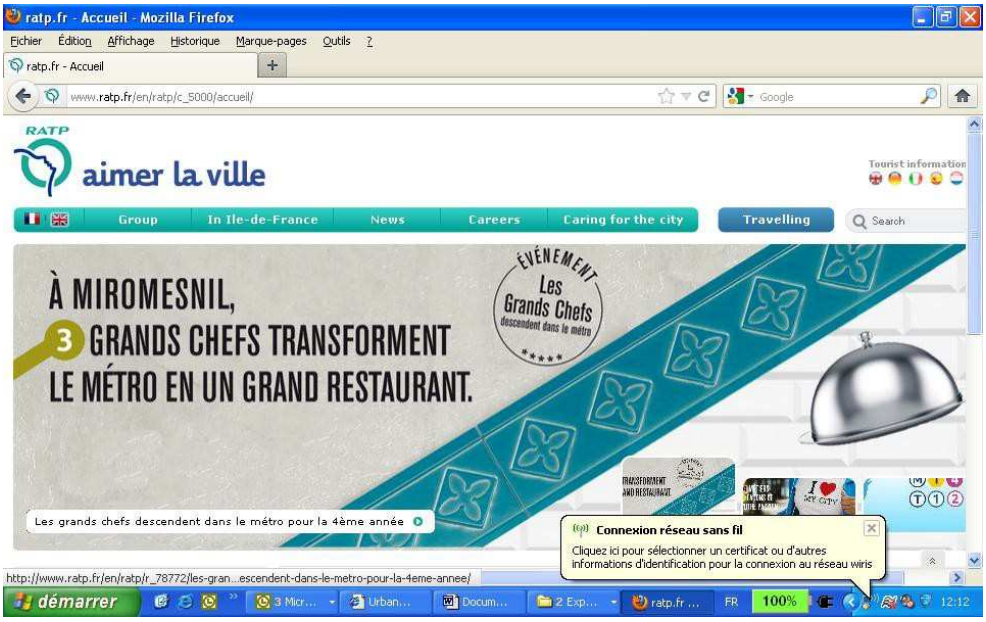
Especially all hypotheses about emission factors and travel distances have to be clearly explained on the website hosting the service. See in Annex 2 the STIB example that explains clearly how a trip calculator works.

Annex 1

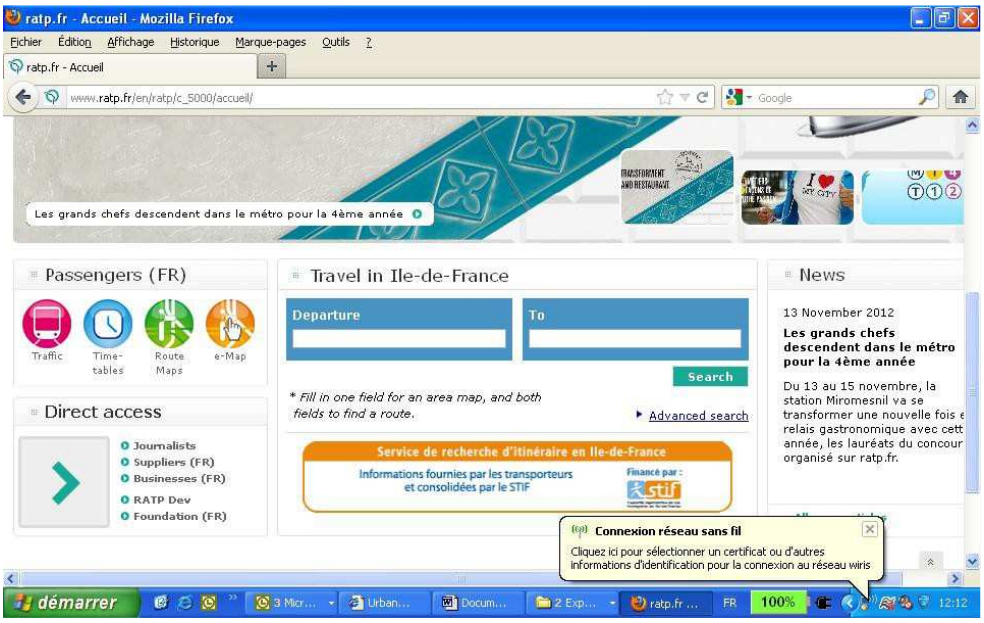
The RATP example

CO2 calculator on www.ratp.fr : Screenshots & method

Home page

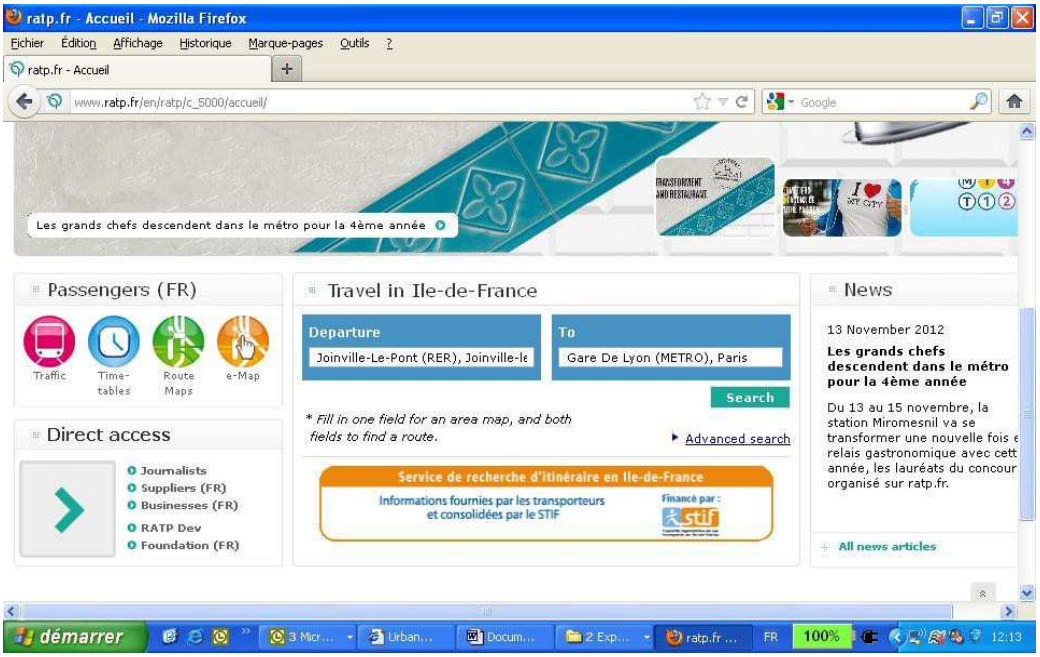


Trip planner on the home page: Travel in Ile-de-France



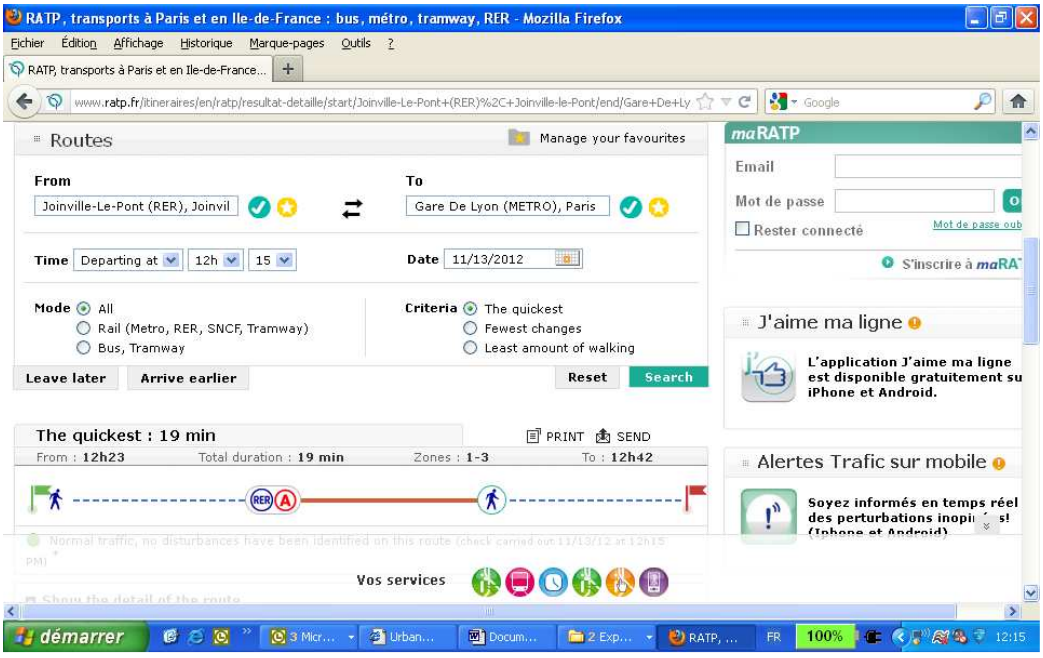
On this page the passenger fills in the origin and the destination of the trip.

Example for the trip from Joinville le Pont to Gare de Lyon (regional train)



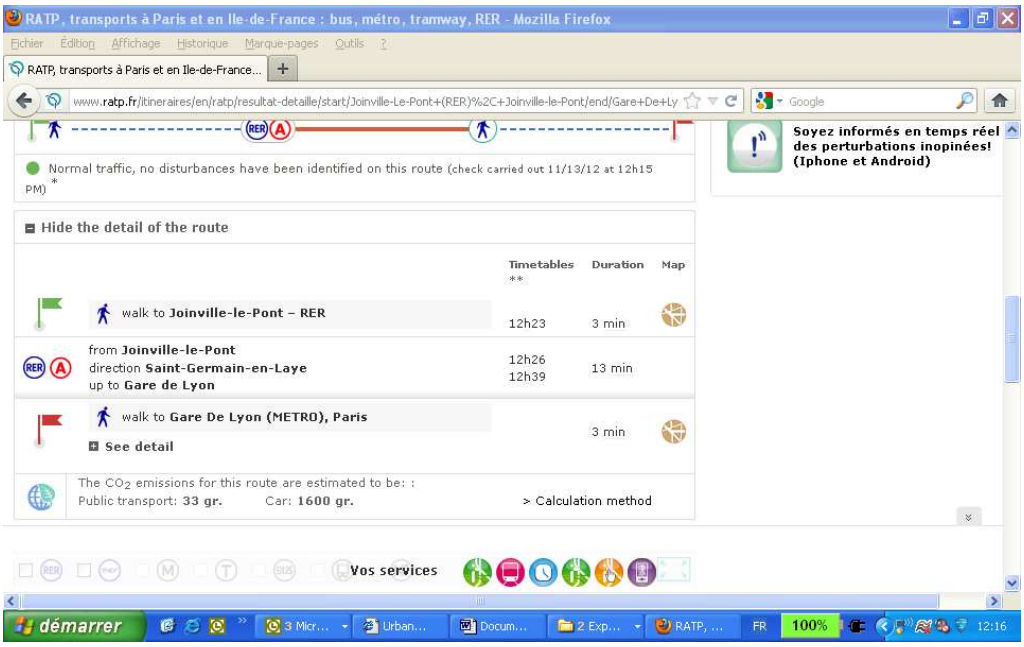
The passenger also chooses the travel option (all, rail only, bus or tramway only) and the time criterion (quickest, fewest changes, least amount of walking).

Summarized result



The summarized results give the used modes (in this case only regional train and walking, which has no impact on CO2 emissions) and the total time to travel from one point to the other.

Detailed result with the CO2 information



The detailed page presents the CO2 impact of the travel. Two values are given:

- the first is the CO2 emissions generated by using the public transport, monitored by using the methodology described previously (distance hypotheses for public transport are distances known by RATP for bus, this means almost real distances and crow flies distances for railway modes),
- the second is the CO2 emissions generated by the same trip done by using the car (distance hypotheses for car are crow files distances multiplied by the correction factor defined for the Ile-de-France Region).

The results presented show the CO2 equivalent emissions due to traction energy for one passenger.

We can read here that this trip done by public transport will emit 33 CO2 geq to be compared to 1600 CO2 geq using a car. This example makes it clear how the choice of the transport mode is important in terms of GHG emissions.

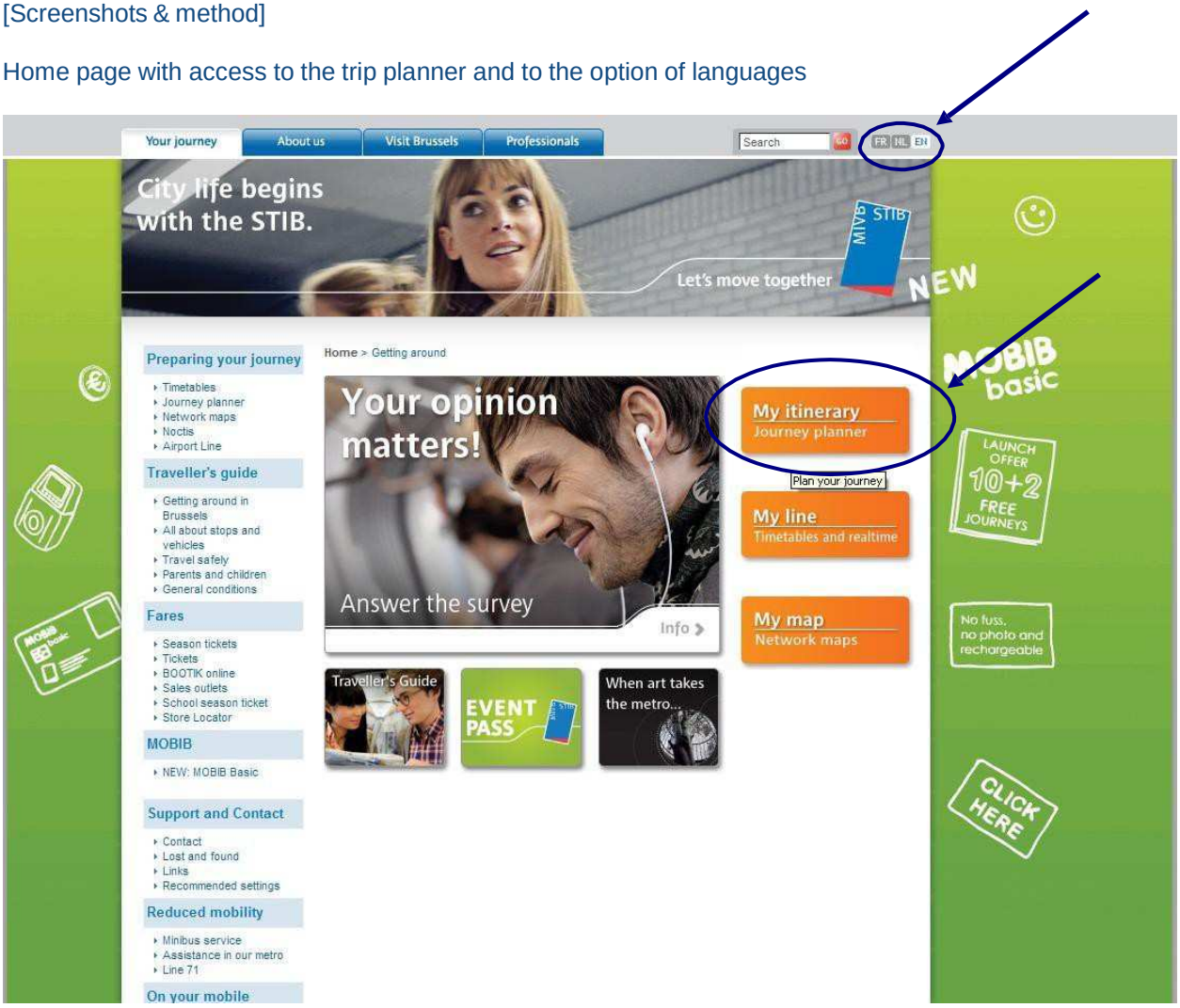
The emissions factors will be soon updated in order to be coherent with the coming regulation in France and results will be then monitored in for CO2 only, not including the five other GHG gases.

Annex 2

The STIB example - www.stib.be

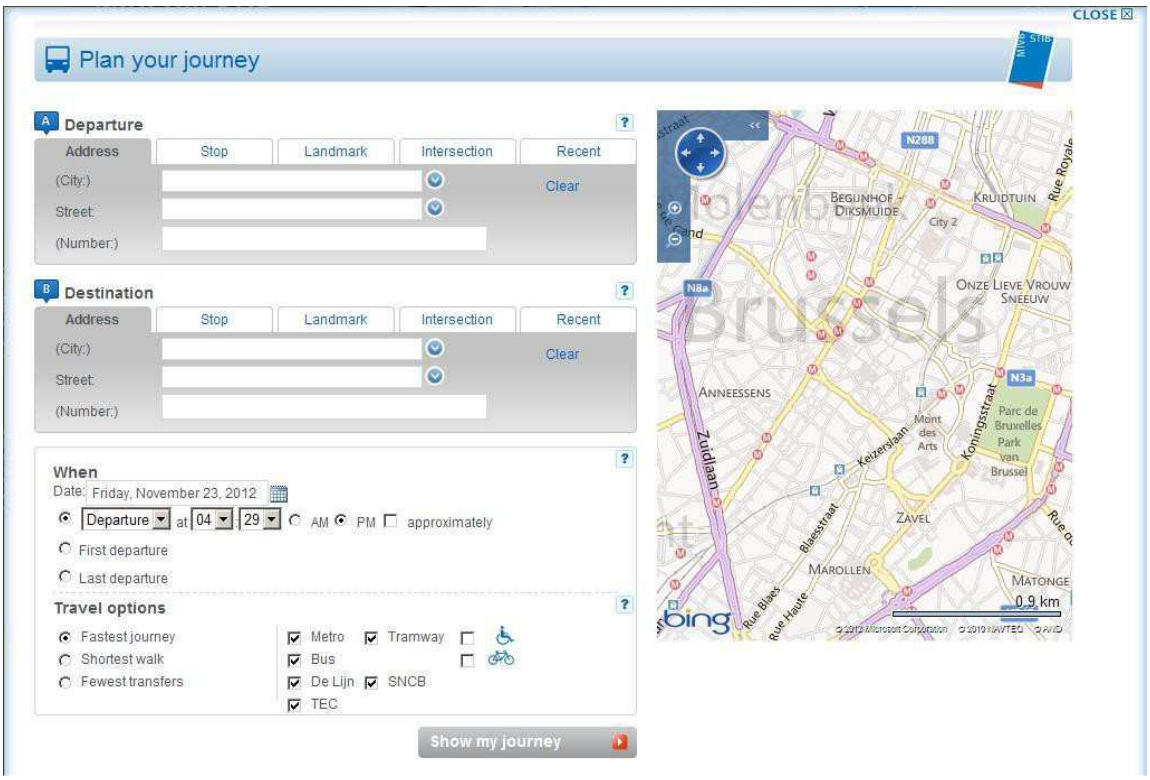
[Screenshots & method]

Home page with access to the trip planner and to the option of languages

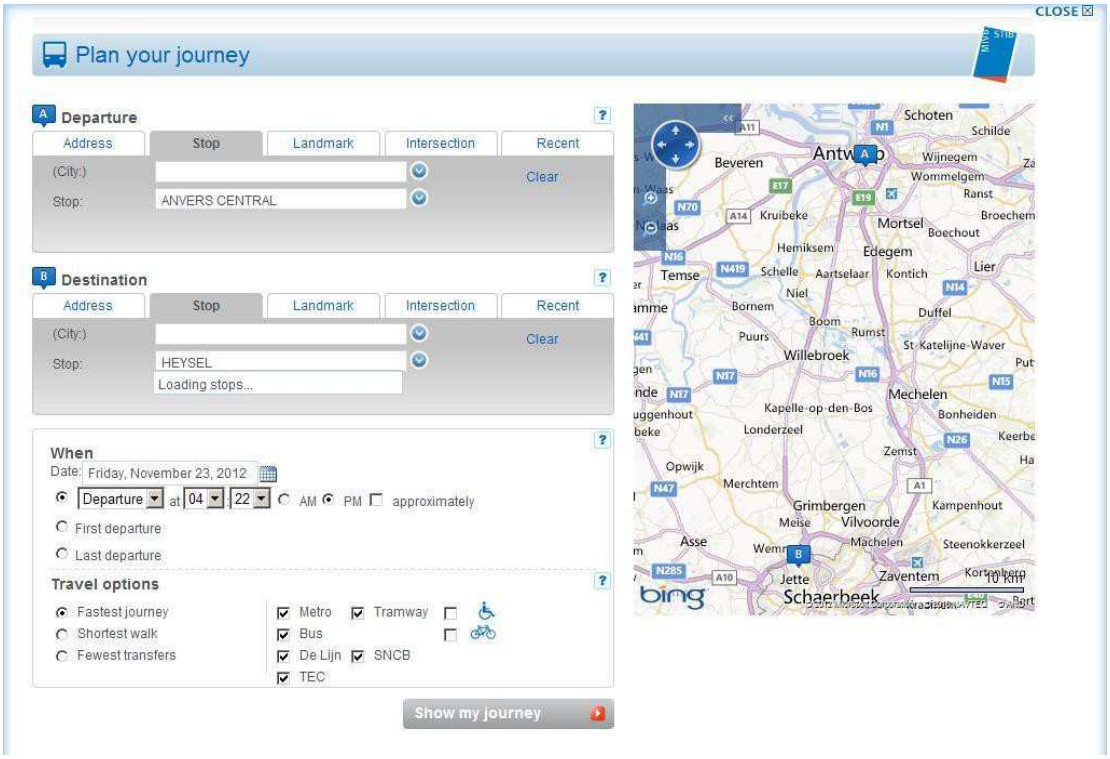


On the page to plan the journey, the passenger fills in the origin and the destination of his trip. He can also choose between several options:

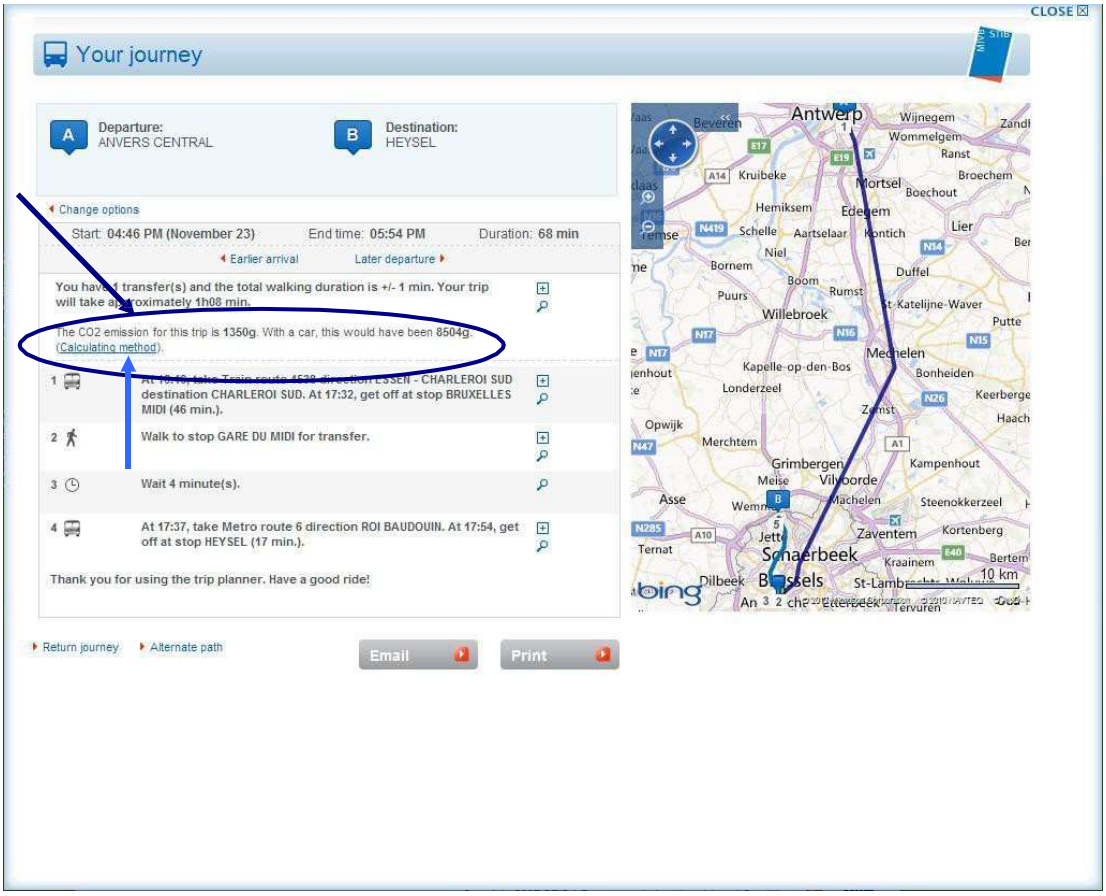
- *Address*: specification of a specific address, name of the stop, a landmark or maybe just street intersection;
- *Time*: specification of date and time he wants to arrive or leave ;
- *Specific travel criteria:* means of transport, other public transport companies, if applicable, reduced mobility requirements, etc.



This tool currently covers the STIB network and the network of the national railways company, SNCB. It is being developed to cover in the nearest future the entire public transport network with De Lijn in Flanders and TEC in Wallonia. That also means that an adaption of the CO_2 emissions factors will be done to include buses and trams of TEC and De Lijn.


CLOSE
Plan your journey
Departure
Address
Stop
Landmark
Intersection
Recent
(City:)
Clear
Stop:
ANVERS CENTRAL
Destination
Address
Stop
Landmark
Intersection
Recent
(City:)
Clear
Stop:
HEYSEL
Loading stops...
When
Date: Friday, November 23, 2012
Departure at 04 22 AM PM approximately
First departure
Last departure
Travel options
Fastest journey
Shortest walk
Fewest transfers
Metro
Tramway
Bus
De Lijn
SNCB
TEC
Show my journey
Schoten
Schilde
Antwerp
Wijnegem
Beveren
Wommelgem
Ranst
Kruibeke
Mortsel
Boechout
Broechem
Hemiksem
Edegem
Temse
Schelle
Aartselaar
Kontich
Lier
Niel
Bornem
Duffel
Boom
Puurs
Rumst
St-Katelijne-Waver
Willebroek
Mechelen
Kapelle-op-den-Bos
Bonheiden
Londerzeel
Zemst
Opwijk
Merchtem
Grimbergen
Kampenhout
Meise
Vilvoorde
Asse
Machelen
Steenokkerzeel
Jette
Zaventem
Schaerbeek
10 km
bing

Result with the CO_2 information



As for RATP, the detailed results page presents the CO_2 impact of the travel with two values:

1. CO_2 emissions generated by using the public transport, calculated using the methodology described hereafter

2. CO_2 emissions generated by the same trip done by using the car

The unit of the result values are " g CO_2/(km*passenger)". This is the CO_2 equivalent emissions due to the traction energy used to transport the passenger during one kilometer.

Emissions factors will be adjusted annually taking into account the evolution of the various indicators. The emission factor of the car is provided by Brussels Regional authorities.

When surfing on the website, passenger can open a link to the summery of the methodology and the emission factors:

*To know the **average amount of CO2** (g) for your journey by public transport, we use the following method: The **length in km of your journey** is multiplied by the **average emission factor of the STIB vehicles per passenger and per kilometer.***

The average emission factors of STIB vehicles are:

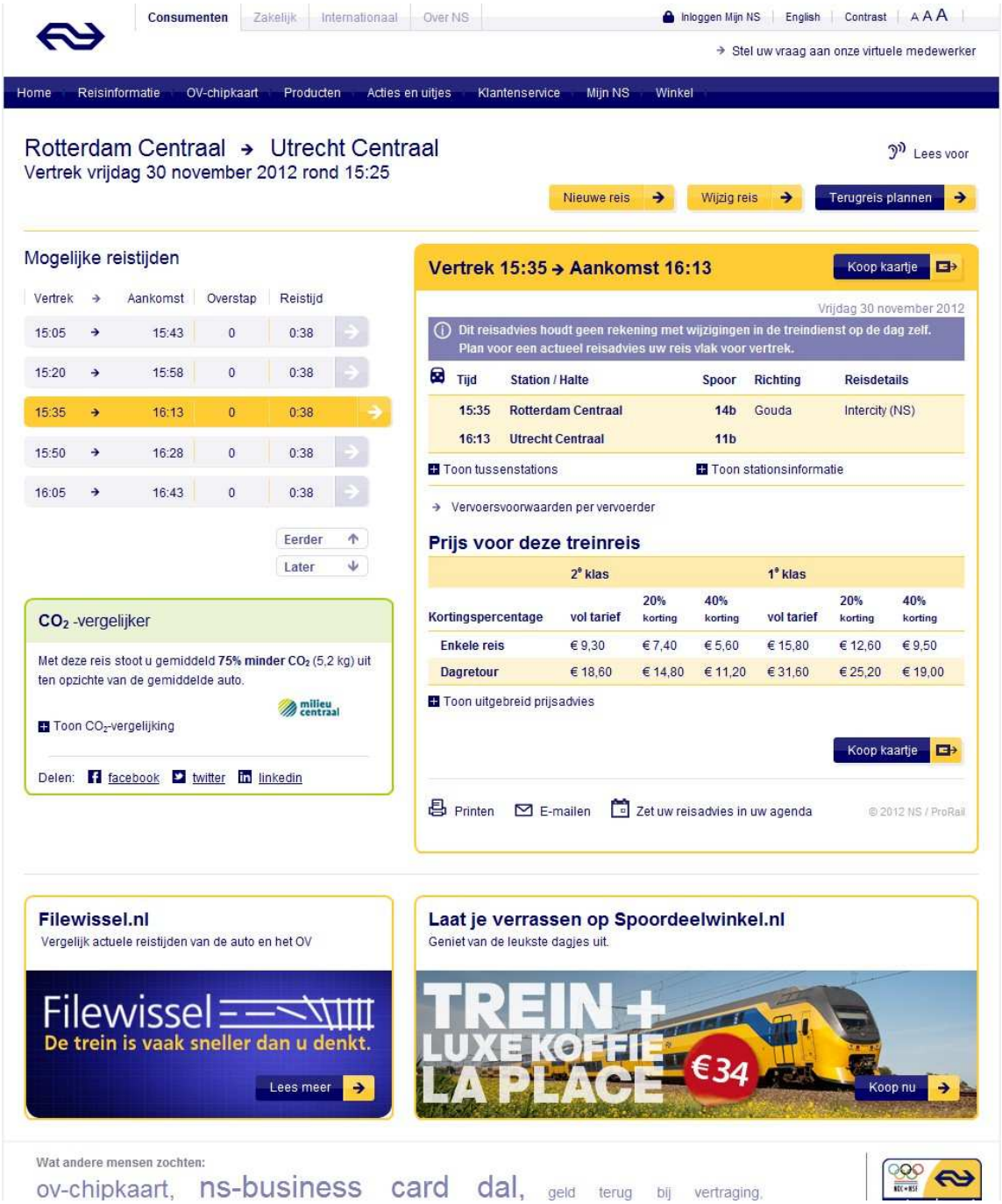
- *Metro: 20g CO_2 /(km*passenger)*
- *Tram: 30g CO_2 /(km*passenger)*
- *Bus: 110g CO_2 /(km*passenger)*
- *Train (SNCB): 26g CO_2 /(km*passenger)*

*The result is compared with the emissions of the same journey by **car**. The **length in km of your journey** is multiplied by the **average emission factor per passenger and per kilometer of a car**.*

*The average emission factor of a car is 158g CO_2 /(km*passenger)*

Annex 3

The NS Dutch Railways example



Consumers | NS business | International Services | Nederlands | Contrast | A A A

Home | About your trip | Arrange and buy | OV-chipkaart | Service

Rotterdam Centraal → Utrecht Centraal

Departure Friday 30 November 2012 about 15:32

Read this

New journey → | Change journey details → | Plan return journey →

Travel times

Departure	→	Arrival	Transfer	Travel time	
15:05	→	15:43	0	0:38	→
15:20	→	15:58	0	0:38	→
15:35	→	16:13	0	0:38	→
15:50	→	16:28	0	0:38	→
16:05	→	16:43	0	0:38	→

Earlier ↑

Later ↓

CO_2 comparison

This journey by train emits an average of **75% less CO_2** (5,2 kg) than the same trip by average car.

milieu centraal

CO_2 emissions for the part of your journey **(56 km)** that is by train:

Train 1.7 kg

Read more about green travel with NS

Comparison to a car trip of **56 km**:

Compact car

Electric	2.6 kg
Hybrid	Car type not (yet) available
Diesel/LPG	6 kg
Petrol	6.9 kg

Mid-range car

Electric	3.4 kg
Hybrid	5.2 kg
Diesel/LPG	7.4 kg
Petrol	8.2 kg

Large car/MPV

Electric	Car type not (yet) available
Hybrid	9.7 kg
Diesel/LPG	9.8 kg
Petrol	11.4 kg

Hide CO_2 comparison

Departure 15:35 → Arrival 16:13

Buy Ticket →

Friday November 30, 2012

This travel advice does not take into account real-time information about the train service. For the latest updates, plan your journey shortly before departure.

Time	Station/Stop	Track	Direction	Journey details
15:35	Rotterdam Centraal	14b	Gouda	Intercity (NS)
16:13	Utrecht Centraal	11b		

Show train stops | Show information about stations

Terms and conditions per carrier

Fare for travelling with OV-chipkaart

	2nd class			1st class		
Discount percentage	Full-fare	20% discount	40% discount	Full-fare	20% discount	40% discount
One-way journey	€ 9.30	€ 7.40	€ 5.60	€ 15.80	€ 12.60	€ 9.50
Same-day return journey	€ 18.60	€ 14.80	€ 11.20	€ 31.60	€ 25.20	€ 19.00

Show more fare information

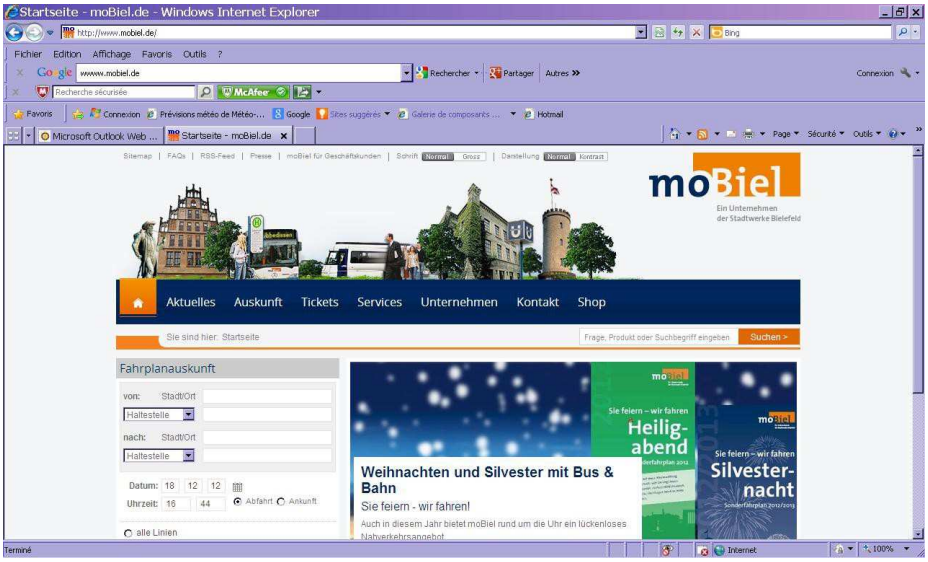
Buy Ticket →

Print | Send | Put the travel advice in your calendar

Annex 4

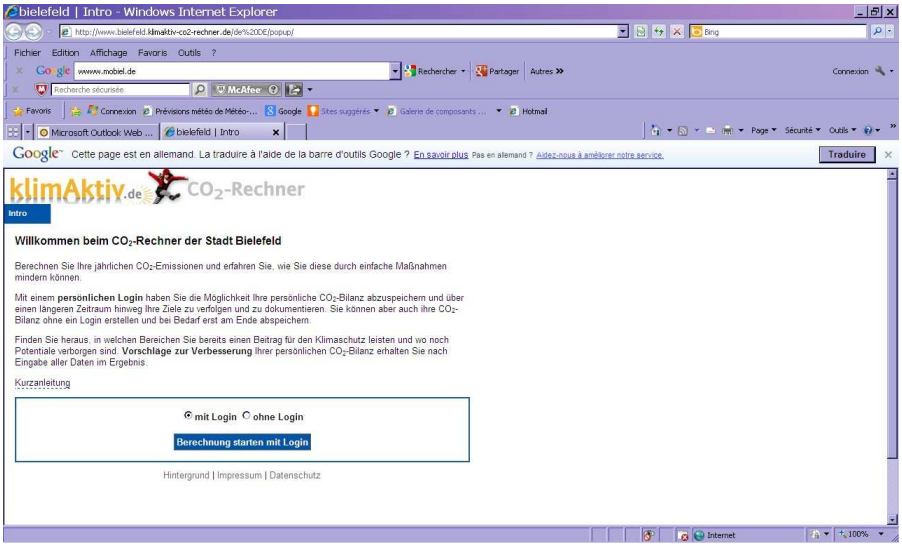
The BIELEFELD example

Information about trips in general - www.mobiel.de



The city of Bielefeld offers the possibility of calculating the individual CO2 balance under this link: www.bielefeld.klimaktiv-co2-rechner.de/de__DE/popup/

The user can survey their own results over a certain period of time. Furthermore, proposals for optimization are given.



Annex 5

Contacts

moBiel

Annekathrin Bode Annekathrin.Bode@mobiel.de

Dr. Martin Tigges Martin.Tigges@Stadtwerke-Bielefeld.de

moBiel GmbH

Otto-Brenner-Straße 242

33604 Bielefeld

Germany

+49 521 51-46 85

RET

Theo Konijnendijk TKonijnendijk@ret.nl

RET

Laan op Zuid 2

Postbus 112

3000 AC Rotterdam

The Netherlands

+31 10 447 6905

TfGM

Lara Melville lara.melville@tfgm.com

TfGM

2 Piccadilly Place

Manchester

M1 3BG

UK

+44 161 244 1733

RATP

Sandrine Bondeux sandrine.bondeux@ratp.fr

RATP

Lac LB71

54 quai de la Rapée

75599

Paris Cedex 12

France

+33 1 58 77 16 39

STIB

Claire Masson massonc@stib.irisnet.be

STIB

Rue Royale 76

1000 Brussels

Belgium

+32 2 515 32 02