FREILOT

Urban Freight Energy Efficiency Pilot

D.FL.5.3 Implementation guidelines &
D.FL.6.3 Deployment barriers and solutions

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Abbreviations and Definitions

Abbreviation	Definition
AL	Acceleration limiter
B	Business barrier
CBA	Cost-benefit analyses
CPU	Central processing unit
DSB	Delivery space booking.
EDS	Eco driving support
EEIC	Intersection Control
ETSI-CEN	European Telecommunications Standards Institute - European Committee for Standardization
HMI	Human machine interface
IP	Internet protocol
L	Legal barrier
Mark	Market barrier
OBU	On board units
Org	Organizational barrier
PPP	Public-private partnership
RFID	Radio-frequency identification
SL	Adaptive Speed limiter
TDM	Transport demand management
Techn	Technological barrier
TMC	Traffic management control

Executive Summary

The current deliverable lists the different deployment barriers that may restrain the large scale adaptation of the business models proposed, pointing actions to be carried out for overcoming future difficulties in the deployment of the technologies.

Firstly, the followed methodology adopted by the consortium for identifying the barriers and proposing solutions is described. The barrier list has been created in two stages, by collecting them during the implementation phase and during the operation phase, after months of pilot testing.

Secondly, the barriers are presented and grouped in the following categories: legal and administrative, technical, organizational, interoperability and business. After grouping the barriers, their relation to the business models is presented, identifying the impacts and the severity of each barrier to each business model and providing the solutions adopted or proposed by the consortium. Implementation guidelines are then reviewed and linked to barriers, providing the solution to overcome or mitigate their effects.

Finally, the barriers' impacts to the business models (i.e. to the Cost Benefit Analyses and to the implementation guidelines) are presented, providing thus a link to the other WP6 deliverables.

The most relevant barrier is the acceptance of this new concept by the involved stakeholders since their active participation is a key issue in the successful implementation of the tested technologies. For achieving this collaboration it is fundamental to prove to each one of the involved stakeholders the benefit they can obtain when using the technologies. This prove of benefits should be done in economic and social-environmental terms, providing on the one side the results of the CBA and on the other side the multi-criteria multi-agent results.

The other barrier is the Cost of equipping roads or vehicles with ITS services. The implementation guidelines give few concrete examples how these costs can be significantly reduced. One example is that road side installations, when adding cooperative functionalities, should be done together with the other work, e.g. maintenance.

1. Introduction

1.1. Scope of the FREILOT project

The basis of FREILOT is the expectation that a 25% reduction of fuel consumption is feasible with the use of FREILOT services in urban environments. In addition to proving the positive environmental benefits an important purpose of FREILOT is to show how these services can become even economically sustainable, preferably without the necessity for public authority subsidies.

In FREILOT five services have been selected for their potential impact to reduce fuel consumption as well as their business potential:

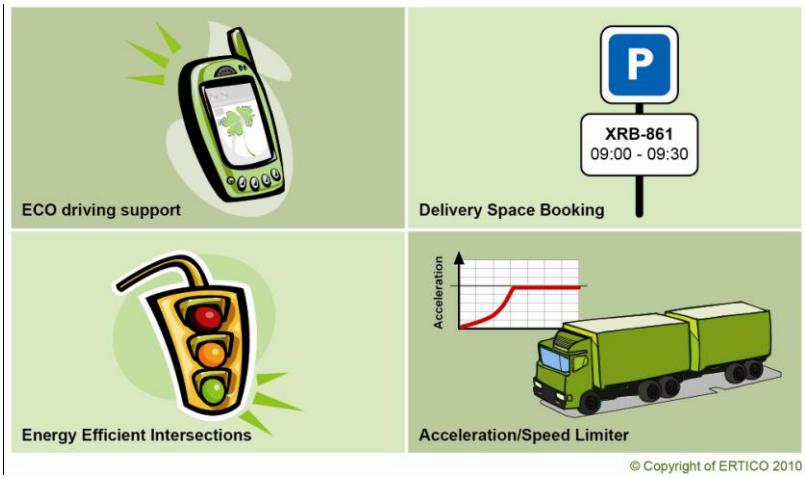

Figure 1: Service domain classification

These domains although different from each other, cover the entire delivery operation scope. FREILOT does not cover the entire supply/logistics chain but is focusing on delivery operations. Its services can improve delivery operations in various areas like management, environmental or economical. Therefore, the selection of the FREILOT services covers all these domains in a complete way. The work performed in the different domains is explained below:

- **Traffic management**
  - Intersection Control Optimised for Energy Efficiency (EEIC): The FREILOT vehicles get moderate priority when they approach the intersection, this increases non stopping and improves the traffic flow and energy consumption. At the same time, they get information about the traffic light phases (when it will be in red, green...) and therefore, drivers can adapt their speed. This facilitates an active collaboration and interaction between vehicles and traffic light management systems, as the drivers could adapt their speed and reduce stops, improving also city's road security.
- **Vehicle**
  - Acceleration and Adaptive Speed Limiters (AL & SL): The solution proposed in FREILOT gives the possibility to define geographical zones to facilitate adaptive vehicle speed or acceleration limitation. This can be done by the fleet operator or by the city council in order to regulate the access and conditions of certain areas of the cities, such as pedestrian streets.
- **Driver**
  - Enhanced "Eco Driving" Support (EDS): The Volvo and Renault Trucks solution adopted in FREILOT, promote efficient driving, reduce emissions and noise pollution by avoiding e.g. rapid acceleration noise and fuel consumption, and thereby also emissions.

- **Fleet management**
    - Delivery Space Booking (DSB): The solution proposed in FREILOT gives the possibility to plan the deliveries, reducing traffic times, improving traffic flow and therefore, reducing energy consumption and working time. This service will make provide the cooperation between city delivery facilities and existing freight vehicles improving the service supplied by the city.

1.2. This document

This document presents an analysis of the identified deployment barriers and solutions for how these can be solved. These solutions are translated into implementation guidelines to project external parties who would like to implement one of the piloted services or the entire FREILOT scheme in their city, on their vehicles, intersections and/or delivery spaces. The first and the most important implementation enabler and guideline is:

- Cooperation between local stakeholders is needed. Intelligent Transport Systems (ITS) are only tools for efficient cooperation between people and/or organisations.

Even though some technical aspect are covered here, the intention of this document is not to provide detailed technical specifications, which are already provided in the deliverables D.FL.2.1 Implementation plan and D.FL.2.2-4 Pilot site prototypes but is intended to provide guidance on what needs to be considered for successful implementation of the FREILOT services. These guidelines address different types of aspects from organisational and business to high level technological.

The deployment barriers and guidelines presented are based on lessons learned from the work in FREILOT project duration.

2. Methodological approach

The primary objective of the current document is to identify the potential barriers that emerge from FREILOT deployment in order to come up with targeted recommendations and guidelines entailing the successful implementation and market penetration of the technological solutions developed in FREILOT Project.

The methodology for identifying the barriers is based on an iterative procedure of the involved partners in the implementation and later operation of the technologies. The barriers' identification took place twice during the project, once after the implementation phase and once after months of operation of the pilot (during the operation phase). After their identification, the barriers were grouped and discussions were held with the involved stakeholders in order to find a consensus on the proposed solutions.

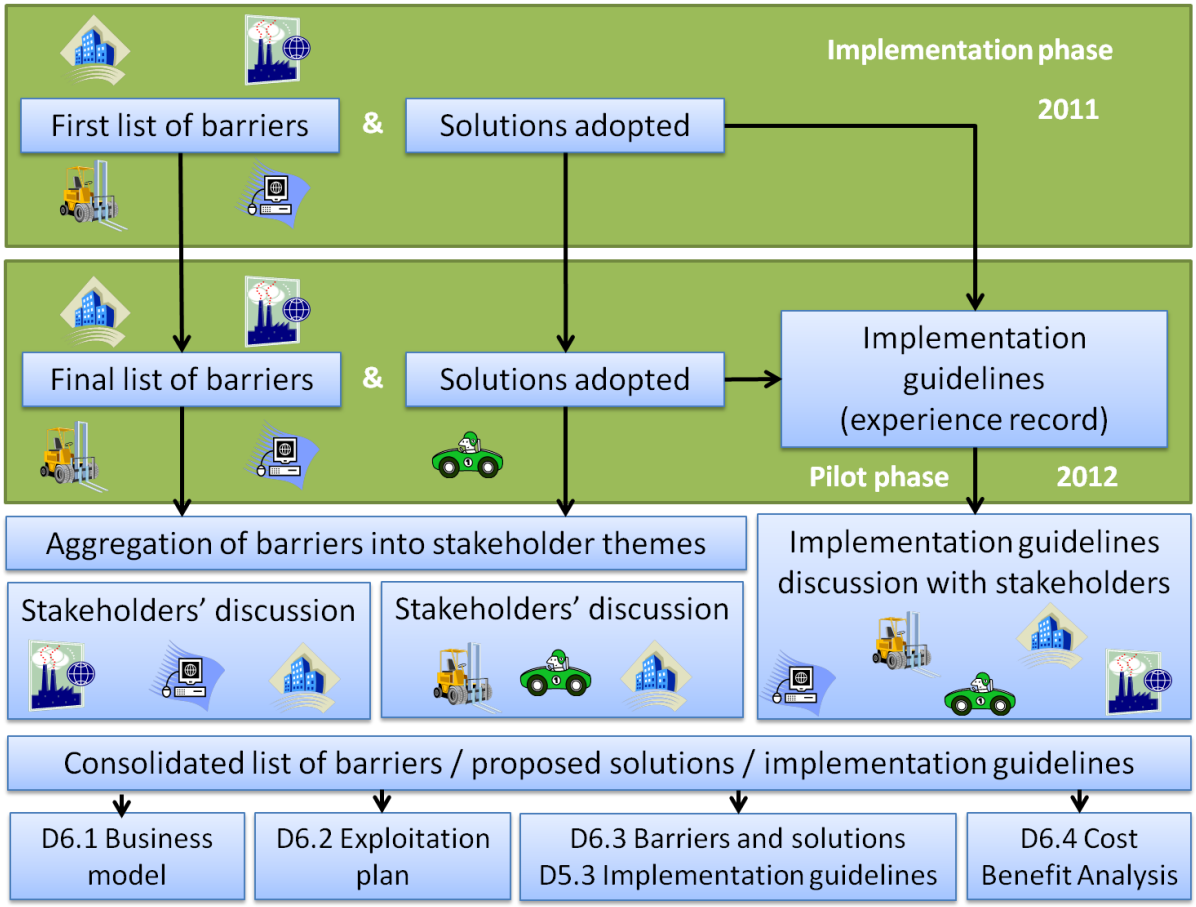

Figure 2: Methodology chart (collection of barriers and discussions for finding consensus on solutions)

The above list formed the basis for the later discussion with the different groups of interests (cities, technology providers and fleet operators). All the barriers were structured into seven themes and related to the business models, identifying for each theme and business model the impact and the feasibility of the solutions proposed. Two meetings were held in order to discuss each theme with the involved stakeholders, a first one with the cities, the drivers and the fleet operators and a second one with the cities and the technology providers. After the detailed presentation of each theme, the participants presented their point of view and proposed solutions for avoiding or reducing the impact of the barriers in the further implementation of the technologies. The proposed solutions were discussed by the other participants, concluding in one or more solutions for each theme where all the parties were satisfied. Finally, a consolidated text was circulated to all the partners for the final feedback prior the elaboration of the deliverable.

The barriers and themes are presented in the following chapters, providing implementation guidelines for the services in form of solutions and evaluating their impact on other WP6 tasks.

3. Implementing the FREILOT scheme

The total FREILOT scheme is a flexible combination of a set of services that can be implemented independent of each other, but also as logical combinations. This chapter provides general guidelines on implementing services. Seen from the infrastructure manager's viewpoint and seen from the logistics operator's viewpoint. These guidelines are the basis for the solutions proposition to each one of the barriers.

3.1. Implementing - from the infrastructure managers viewpoint

Considerations for the infrastructure manager:

- **When I am supplying a service, what can I get in return?** The goal of the FREILOT services is to reduce emissions, which can improve living conditions in cities. At the same time positive effects can be expected on noise levels and in some cases the overall traffic flow. Additionally, an infrastructure manager implementing e.g. intersection priority and/or delivery space booking, can ask from the logistics operators that they drive with an acceleration limiter, speed limiter and provide eco-driving support to their drivers. Other possibilities are vehicles in a certain environmental class or that the fleet operator adapts his route and/or driving time to a preferred route and time of the day.
- **When do I supply the services?** Priority at intersections is not always favourable for the total network. E.g. in Helmond the evening rush hour is not suitable. Priority can be made dependent on the time of the day. Priority as well as delivery space booking can be specified in service classes depending on the network state.
- **Can I make one service dependent on another one?** For instance one can give priority at intersections only to members who have speed limiters and accept the limitation when passing by the intersections. This way you can always be sure that the trucks will not over speed when passing through intersections.
- **Can a new scheme be built on the existing schemes?** Adding new schemes can increase the return on investments. A new scheme should be checked to verify if the same vehicle-to-infrastructure standards used. It might even be possible to build a new scheme as a simple extension to the existing ones.

3.2. Implementing - from the logistics operator viewpoint

Considerations for the infrastructure manager:

- **Can I use the same on-board unit for different services?** More and more fleet operator vehicles are getting overcrowded by new technologies. Ask your supplier which other services can be operated on a certain on-board unit.
- **How fast can I pay off this investment?** Always keep in mind the costs versus. benefits. Very expensive equipment will either require high benefits or a longer pay-off time.
- **Will it support or disturb my drivers in their work?** If there is any risk that a service or a set of services seems too cumbersome and time demanding, it will never be accepted by the customers.

The following chapters present for each technology the list of identified barriers to the proposed in FREILOT business models and the lessons learned in both, general guidelines and most technical advices to the installation of the technologies.

3.3. Implementing services and technologies for Energy Efficient Intersection Control

Energy Efficient Intersection Control (EEIC) as implemented in FREILOT holds a promise of optimising fuel consumption on a road network level. At the same time it is expected to lead to a better traffic flow. Any initiative to address intersection control needs to be driven by city authorities and/or road operators themselves. Following chapter presents FREILOT consortium guidelines and identifies business/policy barriers towards implementing EEIC.

3.3.1. Business/policy barriers identification

As mentioned earlier, the deployment barriers are covering business "show-stoppers". These are focusing on the business model and are technology independent.

- **Priority not allowed:** Giving priority to non-public vehicles is not allowed in some countries (Germany).
- **Priority conflicts**: Giving priority to trucks can cause problems in smaller cities with closely located intersections (One being that the waiting time for traffic in other directions can become too large. Another is that in a congested situation (rush hour) the priority can cause prolonged disturbances in the traffic flow. These problems can happen in any city, depending on the local situation).
- **Non desired effects**: Non-allowed vehicles could take advantage of priority provided for allowed vehicles at intersections. At the same time, green waves for trucks might attract additional through-going traffic to the city.
- **Priority levels:** There are conflicts in the prioritization of the different fleets using the system, sincedifferent kinds of priority levels should be applied to fleet operators, emergency services and public Transport. This creates a conflict of interests between different modes of transport, all willing to have priority.
- **Low market penetration:** There are not enough fleet operators interested and it is very difficult to let them see the benefits of the service.
- **Monopoly issues**: City being dependent on one supplier for FREILOT services could increase the cost of the implementation of the systems.
- **Politic support**: It is a key issue to define how to convince politicians about FREILOT systems and provide them the scheme for the financial means (budget) should they use to invest in the infrastructure?
- **Antagonism issues**: EEIC might be seen as unfair competition: public authority giving priority to some fleet operators, not to all.
- **Installation costs**: Civil installation work is expensive, increasing the cost of the roadside installations.

3.3.2. General guidelines

When a city would like to implement a FREILOT-like intersection control scheme, the following advice should be taken into account:

- **Agree with local stakeholders**. Traffic lights will have to communicate with vehicles in order to be useful. Therefore close cooperation is needed with the local fleet operators who need to see benefits (generally in fuel or time savings) in order to invest in on-board units. This close cooperation should not be maintained only the start-up phase but should be maintained even in the years to come. This will allow for identifying additional optimisation needed of the current service and for discovering new areas of cooperation, supporting deployment of new services.
- **Agree with nearby cities/regions** on implementing the same type of services and technologies. If this is achieved in the right way, the effect will be two-fold. First, the implementations are interoperable so that on-board equipment from a truck coming from city A is interoperable with roadside installations (e.g. traffic lights) in city B. The second effect is that

cities through joint decisions on services and technologies can bring the investment cost down. Higher volumes usually result in lower prices.

- **Use the same technology for different stakeholders.** Consider using the same underlying technologies to support the needs of different stakeholder groups. In Helmond, fleet operator Van den Broek Logistics and the Helmond fire brigade all use the same on-board equipment.
- **Have a long term view.** When deciding on technology and suppliers, always have a long term view. A technology or service provided at lower cost might end up being the most expensive one if you are locked to only one equipment supplier. Cooperative Systems and technologies intend to break that circle through the standardisation work.
- **Open platform – several services on one platform.** When investing in one service, plan to invest in an open platform, which can enable several services. This will also mean that there would be a possibility to reduce the investment costs between different services.
- **Follow standardisation**. If you choose to implement the so called "Cooperative Systems" technologies and services, have in mind that the standardisation is not finalised. Thus there is a need to agree with your equipment supplier(s) on how to deal with evolving standardisation.
- **First set of deployment.** When starting to deploy Cooperative Systems, choose strategic places to equip first. In Helmond that was the main road though the city, where 14 intersections were equipped. This already provided an incentive to the local fleet operator to invest in on-board units.
- **Revolving investment.** When the first equipment is rolled out, the best way to bring down the costs of introducing Cooperative Systems is to include them in the existing intersection revolving scheme. This way the costs can be significantly reduced.
- **Preparing for Cooperative Systems.** One example is when doing road works at intersections consider placing tubes under pavements or roads where cables could be led though.
- **Decide on a scheme: Priority for whom, where and when?** The most important part is to agree with relevant stakeholders, on who should get priority, on which roads and at what times of the day. Remember, technologies and services are only an enabler of your visions, not the vision itself.
- **Consider organisational aspects.** Who will maintain the service, how much will it cost, where does the revenue come from?
- **Maintenance:** The EEIC should be seen as an additional part of the current traffic management. Therefore the same organisation that is operating the traffic lights should operate this service. For other, informative services which do not influence traffic light operation, other service providers/maintainers could be envisioned.
- **Procurement:** Procurement needs to follow currently existing rules and follow practices for open tenders. In the procurement it needs to be specified that the equipment and service providers need to follow the standard developed by ETSI and CEN standardisation bodies under the European Commission mandate **E453.**
- **Operational:** First, there needs to be a clear process for requesting the access to the scheme. There need to be clear rules and processes who could be allowed to access the service, If approved this fleet operator can join the scheme and order OBUs.
- **Cooperation support:** A website to ease the cooperation between different stakeholders is recommended.
- **Overall traffic network performance:** Before implementation can start a simulation should be made to investigate the performance of the systems on the network level, to see the effects of the EEIC on e.g. side traffic and investigate the service boundaries.

3.3.3. Technical aspects

The EEIC service requires an equipped vehicle and equipped road side. FREILOT consortium implantation recommendations are following:

- Vehicle installation
  - **Nomadic device installation.** Follow EU recommendations on how to install nomadic devices safely.
  - **Avoid information overload.** Provide only necessary information to the driver in order to avoid the potential overload.
  - **Vehicle antenna placement.** Placement of antenna in a vehicle is an important aspect from technical range point of view. FREILOT uses windshield antenna but if possible roof-top antenna should be user. The drawback of the roof –top antenna solution is that cabling between the antenna and the on-board unit needs to be considered.
  - **Enhanced positioning.** The requirements on positioning accuracy in FREILOT are not extremely high. Therefore a stand-alone positioning solution, where only GPS data is taken into account is sufficient. For other services, which require higher positioning accuracy integration with the vehicle CAN network would be required.
  - **Antenna choice.** For EEIC type of services using directional antenna is possible. This increased the radio range and through that the communication reach of the on-board unit. Place it behind the windshield if possible as it will be protected from elements such as weather.
  - **Less is better.** If you aim to create your own on-board unit from the off-the-shelf components, have in mind that less external components (e.g. extra cards in the CPUs) is better due to potential vibration issues, which surely will appear in a truck.
  - **Integrate where possible.** Consider how you can integrate as much as possible e.g. displays. Most of the professional fleet vehicles have numerous on-board units already, thus getting in a new display might not be that easy.

- Road side installation

  Considering road side installations following advices can be given
  - Antenna placement:
    - **Free line of sight.** The communication range will heavily depend on the free line of sight. Intersections where it is not possible to place the antenna in location with free line of sight will experience degraded functionality
    - **Recommended height:** From the pilot experience we can recommend a height of around 6 meters above the ground for placing the antenna
    - **Cabling:** Cabling is a major issue, try to integrate it with other maintenance/installation work where possible.
  - Road side controller
    - **Internet connection:** IP network is recommended for logging and for easy upgrade of the systems remotely
    - **Sensor thinking:** Cooperative Systems are an additional sensor from the road side controller point of view. Therefore integrate them in the same way as other sensors and make sure that they follow the same rules as so that safety is always guaranteed.
    - **Temperature:** In some road side unit controllers temperatures can vary significantly. Therefore if you are planning to use off-the-shelf components, ensure that they can survive in an environment where temperatures may vary from -30 to +60 degrees

- Router
  - **Configuration free.** The routers should not require any configuration while being installed. This will allow easier installation and start-up of the operation.
  - **Cable length.** Length between router and antenna should be max 100 meters due to Ethernet constrains. In FREILOT, antenna is mounted directly on the box so length is 1 meter, this reduces cable losses.
  - **One cable.** The FREILOT installations have been simplified since only one cable is used between the router and the antenna. Power-over-Ethernet is the solution.

Additional points from the user point of view:

- **Automatic start-up/shut-down:** Make it simple to power up and shut down the system. Try to make it as automatic as possible so that driver is not forced to perform additional work.
- **Conceptual countdown.** Giving advice on driving speed when approaching an intersection is generally not a good idea. The speed advice functionality does not know how many other vehicles are in front. Therefore, providing the driver with a conceptual countdown is better. This will also enhance the EEIC functionality operating on traffic lights using vehicle actuated control as a apart of dynamic traffic management.
- **Switch off the countdown few seconds before green.** In this way, the driver will be urged to look up to the real traffic light.
- **Safety first.** In order to discourage the drivers from over-speeding implement automatic shut-down of the priority function when over-speeding.
- **Human Machine Interface:** Looking at the screen might be annoying for the drivers, therefore on-board units that can allow “speech advice” to the drivers might be preferred.
- **Driver training:** The drivers need to receive training on how to use the system, what to expect etc. It needs to be clear to all drivers that they cannot expect priority in 100% of cases.
- **Feedback:** If the priority cannot be given, the information should be sent to the driver with a motivation Why the priority cannot be given.

3.4. Implementing acceleration-, adaptive speed limiters and eco-driving support

The acceleration limiter and the speed limiter systems require implementation on the vehicle electrical control unit and engine management system and can therefore be performed only by a vehicle manufacturer. The actual implementation will be different between vehicle brands (e.g. Volvo Trucks and MAN) but even from one vehicle brand (e.g. Renault Trucks) the implementation of these functionalities will most likely need to be amended between different vehicle/engine models. Since these parts of the vehicle are very specific, providing detailed implementation guidelines from one manufacturer to another is not possible. Here, a set of recommendations is presented. Other vehicle manufacturers might want to implement other solutions.

3.4.1. Business/policy barriers identification

- **Multimapping for AL**: Several settings of FREILOT services work better with Euro 6 trucks (multi-mapping) while in lower categories will work in a single map configuration.
- **Low penetration rate for AL**: Acceleration limiter is not allowed on engines earlier than Euro 6.
- **Back-office management**: Back-office must be common to all truck manufacturers if zones are defined by the cities.
- **Slower market penetration for the invehicle technologies:** These services cannot be transferred to other manufacturers because they are closely linked to the truck electronics architecture and vehicle characteristics.
- **User acceptance**: Fleet owner and driver acceptance: can be seen as unacceptable reduction of (on-time delivery) and (longer days).
- **Economic sustainability**: There is the risk that pay back will be too long.
- **Market definition**: There are difficulties to industrialize such systems if the market isn't large enough. The fuel economy must not only be focused on the urban areas (where fuel consumption is low in relation to the total fuel consumption) but on a complete cycle.
- **Drivers acceptance to AL**: The AL functionality should be intuitive and requires no additional work.
- **Drivers adaptation to SL**: There is a need for a learning process for the SL. In the future the drivers will be more and more used to this functionality and the HMI will be adapted.
- **Drivers information**: It is important to minimise the amount of input to the driver provided by the EDS functionality. HMI is of special importance as well.
- **Political support**: There is a low number of distribution vehicles and there is a cost pressure on this type of vehicles. If these costs could be balanced by other incentives, e.g. priority at intersections, then this could be an economically viable service. But not otherwise.
- **Antagonism issues**: How can cities ban vehicles that are not fitted with such equipment (not defined by regulations)? It may be seen as a barrier to trade by the manufacturers that cannot provide this kind of solutions.

3.4.2. General guidelines

- **Consider safety always first.** The two functionalities (Acceleration and Adaptive Speed Limiters) aim at reducing fuel consumption but this may never negatively impact road safety. In certain situations accessing full acceleration or higher speed than set by the speed limiter might be necessary. Therefore it is recommended that the driver has the possibility to “override” the systems.
- **Consider using kick-down functionality.** In FREILOT truck drivers are able to override these two functionalities through “kick-down” functionality on the accelerator pedal. The “kick-

down" functionality is available on the market from most vehicle manufacturers and is believed to be a very intuitive way for truck drivers to override the acceleration and speed limiters.

- **Visual feedback.** In addition to the kick-down functionality, visual feedback to the driver can be useful. The FREILOT implementation of the acceleration limiter contains an icon in the instrument cluster which indicates when the functionality is in use. The speed limiter contains a message about the current speed limit.

- **Digital maps.** The Adaptive Speed Limiter functionality should be based on input from digital maps in order to achieve Europe wide functionality of this service. For the FREILOT implementation this was not possible due to practical reasons, but in order to optimise the potential area of use, digital maps which include legal speed limits should be used. eHorison will be used. The cities would have possibilities to enter new speed zones into these maps.
- **Acceleration limiter levels.** The acceleration limiter functionality should provide the possibility to fleet operators to choose settings for the acceleration limiter functionality based on their needs. In FREILOT this is done through calibration done by the Volvo/Renault expert after a test drive with fleet operators. The calibration would be done by the vehicle manufacturer but not for a specific truck fleets.
- **Give possibility to choose different levels of acceleration limiter.**
- **Different fleet operators have trucks from different vehicle manufacturers.**
- **Implementation in local languages.** One of the strongest requirements from the fleet operators taking part in the pilot has been that all information should be provided in local/ National languages.
- **Avoid driver overload.** As with any in-vehicle system it is important to remember that the system should not bring extra information overload.

3.5. Implementing delivery space booking

Technologies and services for managing delivery spaces can be very simple. The real challenge of this service is to get wide acceptance for the implemented service and that users continue using it even after initial period of a few months. In order to achieve that the following guideline is useful:

3.5.1. Business/policy barriers identification

- **Legal issues**: Booking of public spaces for private use or to private entities or individuals is not possible (for example in Lyon and Germany)
- **Functional issues**: Double Lane Parking in Lyon is allowed, and might be more attractive to truck drivers than parking on a delivery space, even when booked and free.
- **Enforcement needed**: If other users use the delivery places, the system will not work. There is a need to guarantee that the delivery spaces are not used by not authorized users through enforcement.
- **Functional issues**: The parking machine for the delivery space booking in Bilbao is not exactly the same as the existing one and needs an adaptation of functionality combining both operations - (normal parking and delivery space booking). This hybrid machine can take too long to drivers to register because they might have to wait for parking users to pay.
- **Negative image for the citizens**: Some periods of the day might not be used (afternoons) and the spaces can be empty all the time.
- **Management issues:** The booking period is set for 3 months (fix), when changes are performed in the booking companies could be forced to rearrange their internal delivery process, routes. At the same time, the reservations of the slots are not prioritized by use (the fastest access to the web site at the beginning of the trimester has the advantage).
- **Compatibility issues:** Different cities will have different service providers.
- **Low penetration rate:** Small fleet operators can be out of the scope of the project.
- **Political support:** How to convince politicians about FREILOT systems. What financial means (budget) should they use to invest in the infrastructure?.
- **High implementation costs:** The cost of each delivery space is too high for future implementations. Civil installation work is very expensive and varies from city to city. This could be a key factor for future installations in some cities.
- **Fleet operators' acceptance:** Although fleet operators accepted and provided positive comments for the system, the real use of the system was far away from the initial interest shown. At the same time, there are not enough fleet operators interested and it is very difficult to let them see the benefits of the service.

3.5.2. General guidelines

- **Time-limit bookings.** Of course the bookings need to be time limited but what we mean here is that the entire booking system should be "emptied" every three months as an example. This will force the users to follow the system closely and at the same time the system will get clean of potential "old and forgotten" bookings.
- **Incentive and disincentive.** Having a possibility to book a delivery space is a very nice incentive. However, with that there should follow responsibility as well. Fleet operators' usage of the booked spaces should be monitored. If there are fleet operators who book but do not use the booked time slots, then there needs to be an agreement between different users that this fleet operator will receive a certain disincentive. One example could be to not allow the fleet operator to make new bookings during a period of two weeks. Reward for the best users. It was well accepted by the users. Slots that are used less by 25%; notification was sent out and if there was no strong opposition then this slot would be taken away.
- **Enforcement is needed.** In order to keep the delivery space free from un-intended use a close cooperation with enforcement needs to be in place. Booking delivery spaces which are

always occupied by private cars provide little benefits to the fleet operator. The key aspect to success. Very much needed for the quality of service. When a booking exists the system needs to ensure that enforcement make 100% sure that the space is available. ICT solutions, such as ANPR could be a good solution for preventing short time infractions but that puts extra costs and technical/legal complexity. When a space is not booked then there should be no enforcement.

- **Consider organisational aspects.** In the same way as for the energy efficient intersection control it is important to answer questions such as: Who will maintain the service, how much will it cost, where does the revenue come from?
- **Where to place the costs.** In FREILOT there are two implementations of the Delivery Space Booking. Both are very useful but there is one clear difference and that is the cost split between stakeholders. In Bilbao more or less the entire implementation cost lies with the "infrastructure" side, with the lights in the road and a delivery space booking machine. The "vehicle" side is a chip card that costs 5 Euro. In Lyon the situation is different, there the system relies more on the on-board DynaFleet or OptiFleet units from Volvo and Renault Trucks.
- **Dissemination is important.** In order for this service to succeed there is a need to have a wide user base. In FREILOT, dissemination through local, regional and national media has proven to be an excellent tool to raise the awareness of the potential users.
- **Public administration needs to be involved in the project** (general remark for this and EEIC). Close cooperation between the city and fleet operators is needed.
- If not already existing a forum between the city and fleet operators should be established in order to discuss even other areas of cooperation. As an example, this wider discussion has resulted in agreement on night time deliveries and multi-use lane (delivery, parking, etc...)

3.5.3.Technical aspects:

- The booking was 30 minutes from the beginning. There needs to be more flexibility in the system. For example booking 10 or 40 minutes should be possible
- The equipped delivery spaces are now being used more as delivery spaces and less as a parking for private cars. The lights are functioning well to make people aware that these are delivery spaces. No quantifiable data but more observations.
- Parking machine: It would be more preferred to use a RFID or another form of automatic vehicle/driver recognition.
- Website is intuitive and liked. For the future there might be an interest to integrate it into the existing fleet management systems
- Inductive loops: If a truck is parked at one space and brings down the back elevator that coverers a part of the second delivery space then the system might believe that the second delivery space is taken as well. Therefore the system needs to be carefully designed to take care of this.
- New road sensors: More cost efficient alternatives are arising, e.g. road sensors which do not require as much road works, e.g. sensors that are powered by batteries and have wifi capabilities, plus other capabilities.
- Both booking in advance as well as on-spot booking should be allowed. Real-time deliveries, e.g. DHL or TNT need to have possibility to use the spaces without pre-booking and if the spaces are available. On the other side, deliveries to shops should be able to book in advance.
- There is a large difference between different delivery types. Put categories here and add some specifics about them... different deliveries require different treatment
  - Packaging sector: The stops of this type of fleet operators are very short and reservation is complicated due to the dynamic behaviour of this type of transporter. Therefore it was agreed that these sector will mainly focused in real time use using the spaces when they are free. Some slots reservation might have sense depending in the location of the delivery space.
  - Bar /Restaurants sector: The use of the reservation for this category seems to be very low and it was agreed that they will try to increase reservations and use them properly.
  - Supermarket sector: The supermarkets were not registering properly their reservations. Therefore, it was agreed that they will always register properly when a reservation was used. Also the food delivery vans were included in the pilot; these vans will mainly use the system in real time bases.
- There needs to be a official sign stating that this is a specific delivery space
- Drivers, fleet operators and enforcement need to be educated in how to use the system.
- The rules for who can join have to be clear, as well as each participants responsibilities.
  - The decision was that any fleet operator delivering in Bilbao and at the specific delivery spaces is welcome to join. However, during an introduction period it is also good to limit the number of access cards to e.g. 3 cards per fleet operator in order to make sure that they are being used. If that is the case then the fleet operator can request more cards.
- User manual and hotlines are needed.
- Construction works need to be well planned in advance. Consider where the power supply will be provided from. The majority of costs in implementing the systems is digging roads.
- There is a need for the solution to be flexible and will not suit all cities. Therefore there is a need to be adaptable and follow the operation and usage of the systems

- Communicate well with the fleet operators
- Improve visibility of DSB vehicles, through e.g. stickers on the trucks so that the enforcement easier can see which vehicles are part of the scheme
- We expect level of infractions to be different in different countries. E.g. in Scandinavia this is not expected to be a problem while in e.g. Mediterrian countries this will be a major point to address
- It needs to be realised that ...The last delivery planning is done by truck drivers, which normally do not participate in meetings. Therefore, their real needs are not always represented by the fleet operators managing directors.

4. Barriers categorisation

The barriers are technological or non-technological impediments that might prevent or restrain the implementation of the proposed Business Models. There is the necessity of identifying the barriers and proposing solutions for overcoming them or reducing their impacts on the Business Models. The barriers are grouped in five categories, described next.

4.1.Initial recording and categorisation of barriers

4.1.1. Legal and administrative barriers (L)

Legal and administrative barriers are related to problems in the implementation of the pilot related to legal issues. The Table below shows the barriers identified by the partners (in some cases are case sensitive).

Table 1 Legal barriers presentation

Technology	Legal barriers' description
DSB	Lyon & Germany: Booking of public spaces for private use or to private entities or individuals is not possible
	Lyon: Double Lane Parking is allowed, and might be more attractive to truck drivers than parking on a delivery space, even when booked and free
	Enforcement: Guarantee that the delivery spaces are not used by not authorized users
EEIC	Giving priority to non-public vehicles is not allowed in some countries
AL	Acceleration Limiter Is not allowed on engines earlier than Euro 6

4.1.2.Technical barriers (Techn)

Technical barriers are related to technical problems or issues identified by the partners, and are depicted in the Table that follows.

Table 2 Technical barriers presentation

Technology	Technical barriers' description
DSB	The parking machine for the delivery space booking in Bilbao is not exactly the same as the existing one and needs an adaptation of functionality combining both operations - (normal parking and delivery space booking)
AL	Several settings of FREILOT services work only with Euro 6 trucks (multi-mapping)

4.1.3. Organizational barriers (Org)

Organizational barriers are composed by the problems in the management of the services, the role definition and the economical distribution of costs and revenues (value chain of the business model). Organizational barriers per type of technology are described in the Table below.

Table 3 Organizational barriers presentation

Technology	Organizational barriers' description
DSB	Some periods of the day might not be used (afternoons) and the spaces can be empty all the time
	The booking period is set for 3 months (fix), when changes are performed in the booking companies could be forced to rearrange their internal delivery process, routes.
	The booking is set for 3 months, although it is not used
	The reservations of the slots are not prioritized by use (the fastest access to the web site at the beginning of the trimester has the advantage)
	A hybrid machine can take too long to drivers to register because they might have to wait for parking users to pay
EEIC	Giving priority to trucks can cause problems in smaller cities with closely located intersections (One being that the waiting time for traffic in other directions can become too large. Another is that in a congested situation (rush hour) the priority can cause prolonged disturbances in the traffic flow. These problems can happen in any city, depending on the local situation).
	Non-allowed vehicles could take advantage of priority provided for allowed vehicles at intersections
	Different kinds of priority systems for fleet operators, emergency services and public Transport
	Conflict of interests between different modes of transport, all willing to have priority
	Green waves for trucks might attract additional through-going traffic to the city
SL	Back-office must be common to all truck manufacturers if zones are defined by the cities

City systems (General)	Identification of the entity responsible to run and finance the back office after pilot

4.1.4. Market and interoperability barriers (Mark)

Market and interoperability barriers are related to problems and difficulties in the industrial adoption of the technologies by other companies not participating in the pilot tests. The barrier in this case is linked to the necessity of equipping all trucks and cities with technologies that may not exist for every truck or city and provide them with interoperability when travelling along Europe. The barriers identified by the partners are shown in the following Table.

Table 4 Interoperability barriers presentation

Technology	Interoperability barriers' description
In-vehicle technologies	These services cannot be transferred to other manufacturers because they are closely linked to the truck electronics architecture and vehicle characteristics
	FREILOT scheme is not accepted by all truck manufacturers because a common system definition has not been agreed
City technologies	Different cities will have different service providers

4.1.5. Business barriers (B)

Business barriers are related to problems with the actors' acceptance of the systems (drivers, fleet operators, truck manufacturers...). They need to be convinced that by using FREILOT technologies they will save fuel and time while improving the environmental image of the company. The identified barriers are listed below.

Table 5 Business barriers presentation

Technology	Business barriers' description
DSB	Small fleet operators can be out of the scope of the project
	Although fleet operators accepted and provided positive comments for the system, the real use of the system was far away from the initial interest shown
DSB & EEIC	There are not enough fleet operators interested and it is very difficult to let them see the benefits of the service
EEIC	City being dependent on one supplier for FREILOT services

EDS	Performance depends on driver acceptance; if the system gives too many advices, the driver won't follow them.
In-vehicle technologies	Fleet owner and driver acceptance: can be seen as unacceptable reduction of mobility
	Risks that pay back will be too long
Fleet operator	The fuel economy must not only be focused on the urban areas (where fuel consumption is low in relation to the total fuel consumption) but on a complete cycle
	Increase their work volume as they must control more features
Traffic operators	Extra work to be done by traffic operators
Drivers	Solutions might not be accepted by the drivers due to extra work or technological issues
Truck manufacturers	Difficulties to industrialize such systems if the market isn't large enough

Politicians are a very important actors to be convinced by the business model since the city will be responsible for two of the technologies. Apart from that they are responsible for the policy applied to the trucks equipped with FREILOT technologies. They must be convinced that their investment will benefit fleet operators, drivers and citizens while improving the environmental image of the city. Thus the main challenges and barriers faced on a **political level** are described in the following Table.

Table 6 Political barriers presentation

Technology	Political barriers' description
DSB	The cost of each delivery space is too high for future implementations. Civil installation work is very expensive and varies from city to city. This could be a key factor for future installations in some cities
DSB & EEIC	How to convince politicians about FREILOT systems. What financial means (budget) should they use to invest in the infrastructure?
EEIC	Might be seen as unfair competition: public authority giving priority to some fleet operators, not to all
	Civil installation work is expensive; this increases the cost of the roadside

	installations
General issues	How can cities ban vehicles that are not fitted with such equipment (not defined by regulations)? It may be seen as a barrier to trade by the manufacturers that cannot provide this kind of solutions
	Additional cost for Cooperative Equipment is very difficult to be accepted, especially in times of cost savings by public authorities

4.2. Examination of barriers in relation to FREILOT business scenarios

The barriers listed above are related to the different Business Models described in the Deliverable 6.1, and presented below in order to relate them to the above questions.

This section lists the 6 selected business scenarios, which are organised in two groups:

1. **Single scenarios**: each service is studied independently with the exception of Acceleration and Adaptive Speed limiters which are considered as one (see Limiter Scope below) since they have very similar implementations and structure. Single scenarios analysis will also identify weak and strong points of each service and try to find complementary solution in the other services.

    a. **Energy efficient intersection control (EEIC) - Single scenario I**

    b. **Eco-driving support (EDS) - Single scenario II**

    c. **Delivery space booking (DSB) - Single scenario III**

2. **Combined scenarios**: the combined scenarios proposed are 4, and their potentiality and market orientation are the following:

    a. **Limiter scope (LS) - Combined scenario I**: this scope will combine the acceleration and adaptive speed limiter services, which will automatically operate on the vehicle engine and directly commercialized by the truck manufacturers. Due to the similarity of commercialization requirements (resources, technology, customer segment) a combined business case will avoid a duplication of resources and cost. However, the business cases related to these scenarios could also be applicable to each service individually.

    b. **Vehicle scope (VS) - Combined scenario II**: this scope includes limiter scopes plus Eco driving support. These are the three FREILOT services, which are executed in the vehicle and therefore will be interesting to fleet operators as target customers.

    c. **Cooperative scope (CS) - Combined scenario III**: this scope includes vehicle scope and energy efficient intersection control. EEIC service is based on cooperative systems, which is an emerging technology with huge commercialisation possibilities. Also, eco-driving service could be easily integrated within the existing EEIC on-board unit in order to minimise costs and maximise efficiency. Finally, the limiter scope will be a perfect safety supplement to the EEIC as they will limit speed and acceleration to these vehicles and prevent over speed situations.

    d. **Total scope (TS)** – Combined scenario IV: this scope intends to test the combination of all FREILOT services, where maximum efficiency should be achieved.

3. Scenarios	EDS	EEIC	DSB	SL	AL
EDS	X				
EEIC		X			
DSB			X		
LS				X	X
VS	X			X	X
TS	X	X	X	X	X
CS	X	X		X	X

Table 7: Scenarios definition vs applied technologies

Due to the fact that the business models are based on the use of some of the tested technologies, all the questions related to each technology will affect all the scenarios taking into account this technology.

Technology	Deployment barriers	Business scenarios affected
EEIC	• Giving priority to non-public vehicles is not allowed in some countries **(L)** • Giving priority to trucks can cause problems in smaller cities with closely located intersections **(Org)** • Non-allowed vehicles could take advantage of priority provided for allowed vehicles at intersections **(Org)** • Different kinds of priority systems for fleet operators, emergency services and public Transport **(Org)** • Conflict of interests between different modes of transport, all willing to have priority **(Org)** • Green waves for trucks might attract additional trough-going traffic to the city **(Org)** • Green waves for trucks might attract additional trough-going traffic to the city **(B)** • There are not enough fleet operators interested and it is very difficult to let them see the benefits of the service **(B)** • City being dependent on one supplier for FREILOT services **(B)** • How we convince politicians about FREILOT systems **(B)** • Might be seen as unfair competition: public authority giving priority to some fleet operators, not to all **(B)** • Civil installation work is expensive, this increases the cost of the roadside installations **(B)**	Single scenario I Cooperative scope Total scope
DSB	• DSB in Lyon and Germany – Booking of public spaces for private use or to private entities or individuals is not possible **(L)** • DSB - Enforcement: Guarantee that the delivery spaces are not used by not authorized users **(L)** • DSB in Lyon - Double Lane Parking is allowed, and might be more attractive to truck drivers than parking on a delivery space, even when booked and free **(L)** • The parking machine for the delivery space booking in Bilbao is not exactly the same as the existing one and needs an adaptation of functionality combining both operations - (normal parking and delivery space booking) **(Techn)** • DSB - Some periods of the day might not be used (afternoons) and the spaces can be empty all the time **(Org)** • DSB - The booking period is set for 3 months (fix), when changes are performed in the booking companies could be forced to rearrange their internal delivery process, routes. **(Org)** • DSB - The booking is for 3 months, although it is not used **(Org)** • DSB - The reservations of the slots are not prioritized by use (the faster access to the web site at the beginning of the trimester has the advantage) **(Org)** • DSB - A hybrid machine can take too long to drivers to register because they might have to wait for parking users to pay **(Org)** • DSB -Small fleet operators can be out of the scope of the project **(B)** • DSB - There are not enough fleet operators interested and it is very difficult to let them see the benefits of the service **(B)** • DSB - Although fleet operators accepted and provided positive comments for the system, the real use of the system was far away from the initial interest shown **(B)** • DSB - How to convince politicians about FREILOT systems **(B)** • DSB - The cost of each delivery space is too high for future implementations. Civil installation work is very expensive and varies from	Single scenario III Total scope

	city to city. This could be a key factor for future installations in some cities **(B)**	
EDS	• EDS performance depends on driver acceptance; if the system gives too many advices, the driver won't follow them **(B)**	Single scenario II Limiter scope Vehicle scope Cooperative scope Total scope
AL	• Several settings of FREILOT services work only with Euro 6 trucks (considered as multi-mapping) **(Techn)**	
AL, SL, EDS	• In-vehicle technologies - These services cannot be transferred to other manufacturers because they are closely linked to the truck electronics architecture and vehicle characteristics **(Mark)** • In-vehicle technologies - FREILOT scheme is not accepted by all truck manufacturers because a common system definition has not been agreed **(Mark)** • Drivers: the solutions might not be accepted by the drivers due to extra work or technological issues **(B)** • Fleet operators: Increase their work volume as they must control more features **(B)** • In-vehicle technologies - Fleet owner and driver acceptance: can be seen as unacceptable reduction of mobility **(B)** • Traffic operators: Extra work to be done by traffic operators **(B)** • In-vehicle technologies: Risks that pay back will be too long **(B)** • In-vehicle technologies - These services cannot be transferred to other manufacturers because they are closely linked to the truck electronics architecture and vehicle characteristics **(Mark)** • In-vehicle technologies - FREILOT scheme is not accepted by all truck manufacturers because a common system definition has not been agreed **(Mark)**	

Table 8: Barriers' classification into scenarios and technologies

5. Recommendations for coping with deployment barriers

5.1.Key issues and proposed solutions/initial recommendations

After the identification phase, the barriers were grouped for further discussion with the involved stakeholders. This grouping can be expressed in the following 7 questions:

1. How will the other technological companies (not participating in the FREILOT project) develop their own systems?
2. Who will run the back office?
3. How to improve the drivers and fleet operators' acceptance?
4. How to improve the technology providers' acceptance?
5. How to improve the politicians' acceptance?
6. How to solve the policy problems?
7. How to avoid the negative collateral effects of the EEIC?

How will the other technological companies (not participating in the FREILOT project) develop their own systems?

In order to involve operators using other trucks or other cities with other technology providers, increasing importantly the penetration of the technologies, standards and guidelines on the systems are provided in the implementation Work Package (WP2). These guidelines present to other operators the standards of the systems, providing them with the opportunity of developing similar technologies that will have similar fuel savings and emission reductions.

This barrier will be overcome by presenting the development of similar services to all technology builders.

Who will run the back office after the pilot and who will pay for it?

During the pilot each system developer run the back office of the tested system, but after the pilot there is the need for a unique body in each city running the back office. For the in-vehicle systems the back office will define the zones and the speed limitations, but the other architecture issues will be managed by each truck manufacturer in cooperation with the fleet operators. For the city systems there is a need for a back office managing the DSB places and the EEICs, while defining the zones for the SL and the speed limitations of each zone. The interoperability of the systems must be provided by a standardized platform and system, where the use of standards will give to everyone the possibility to connect. There is also the necessity for enforcement, control methods are needed, such as policy control, third parties or automatic control (cameras).

The economic viability of a private back office must be proved. There is the need for a common back office in order to avoid multiple agreements and requirements by the different back offices of the different cities trucks are visiting. Standard set of rules and formats should be developed and defined on national level for all cities wanting to join the FREILOT scheme in order to avoid large number of local arrangements. Each city must collaborate in the definition of the zones, speed limits, DSB places and other staff, but the back office must be run by a private company or a PPP scheme. Since the financial benefits of the systems apply only to fleet operators, they should be involved in the financing of the installation and maintenance of the technologies. The cities can pay the initial investment (short term), but not the maintenance (long term). The European Commission must provide rules on how to manage the back offices, in a pan-European back office systems definition.

Different schemes were provided by the partners for the back office:

- If each back office of the whole country is managed by one company, scale economies for a private company managing the DSB of all the cities will apply (always avoiding monopoly).
- Another solution for funding is to give the back offices to already existing services paid by the cities (parking places and traffic lights management), scale of economy for the cities.

- Finally, there is a possibility of a unique stakeholder for all systems and zones (D2D routing with all services included).

In order to assist in the management of the DSB places taking advantage of the experience created in the pilot, there is the necessity of developing a manual on how to manage the DSB places with the Spanish and French experiences. The booking (DSB) procedure (long term booking, FIFO booking) makes it difficult to manage the places. A priority ranking based on the real use of the places and the environmental characteristics of the truck should be implemented.

One of the incentives for the fleet operators and drivers is the provision of policy policy benefits to environmentally friendly trucks or impediments to non environmentally friendly trucks, but policy changes are very difficult to apply. In some European and Dutch cities they have environmental zones, where only environmentally friendly trucks can enter, but FREILOT trucks could enter also if they prove low emission rates. Finally, the possibility of asking the retailers and no the fleet operators and drivers to use only environmentally trucks will have better results.

This barrier will be overcome by developing Business Models where the Cost Benefit Analyses' results will attract private companies.

Drivers and fleet operators' acceptance

In order to increase the market penetration the obtained results must convince small companies and self-employers for using the "city" systems (DSB and EEIC). A drivers' point of view (rather than a fleet operators' point of view) can make this task easier, by taking into account the extra work for fleet operators and drivers. Since sharing the machine with car users may cause them time important losses, other technologies such as Bluetooth or WIFI technologies should avoid extra work and save time.

Fleet operators are not interested in the DSB service, as it is reflected by the use of the systems during the pilot. In order to convince them about the benefits, fuel saving must be proved, but also a tax reduction could be applied to them by the cities (also environmental zones commented above).

This barrier will be overcome by proving to drivers and fleet operators the benefit of the services.

Technology providers' acceptance

In order to assure the large-scale development of the technologies, the FREILOT business models must convince technology providers that there is a big market for these products. In the case of the in-vehicle systems the solution proposed by the partners is to adapt the technologies to long haul trucks. In the case of the EEIC technology, standards for cooperative systems must be provided by the Commission.

In the case of the in-vehicle systems, different solutions were provided for overcoming this barrier:

- Adapt the technologies to long haul trucks (largest market than the urban distribution).
- Make them compatible with other driver supports.
- Adapt price to savings (incentive) for reducing the payback period.
- A good system calibration will assure their acceptance.

Politicians' acceptance

The role of the politicians is very important in the large-scale implementation of the FREILOT technologies, from the back office management to the promotion of new policies for favouring trucks equipped with FREILOT technologies. Different ideas were proposed by the partners:

- Added value of the system (ambulances, fire brigade…) will favour the support of politicians to the implementation of the technologies.
- Due to the low usage of the system at off peak periods, DSB places could be used for other purposes during off peak hours, enforcing the business model.

The cost of the systems implementation is a key issue for the politicians:

- RFID antennas are too expensive and additional cost for cooperative equipment will be difficult to be accepted by authorities. For the pilot collaborative systems were used.
- The integration of ITS solutions in the standards specifications and in the mobility policy is proposed.
- In order to avoid the installation costs of the EEIC technologies, they could be installed at the same time they are executing maintenance works.
- By using one system for multiple services the workload is reduced.
- Civil works for the installation of DSB places are very expensive, also the adaptation of the current machines for hybrid possibilities (parking and delivery) is very expensive (30.000 €). Other technologies (wireless) should be considered, integrating these services within a more complex solution, but reducing costs.
- The DSB is only justified in large cities. Its maintenance can be paid by large commercial stores (they are already paying in France and Spain for private parking places), or by grouping smaller stores. An alternative is to ask the city to invest in the DSB places and then rent them. Economic studies (payback period, IRR…) will justify the investment and the renting prices.

This barrier will be overcome by showing social and environmental benefits (also collateral benefits) to politics and society in general.

Policy

Policy issues are very important for convincing users. Providing FREILOT technology users with advantages will improve the penetration rate and assure the increment in the usage of the technologies. There are some questions related to this issue:

- How can the cities ban trucks that are not equipped with these technologies?
- Giving priority to non-public vehicles is not allowed in some countries due to unfair competition (public authority giving priority to some fleet operators).
- How to book public places for private users or to private entities or individuals?

For solving the above questions the partners proposed the following:

- Positive results of the project should prove the benefits for modifying the legal framework.
- Consider freight as public service.
- Allow the booking of spaces for specific private activities (car sharing had the same problem and it was solved).
- Define environmentally friendly trucks and provide them with privileges.
- Show other advantages (e. g. safety, ambulances, fire brigades…)

An important policy issue is to ask the EC to accept and promote further the FREILOT technologies.

Negative collateral effects (EEIC)

Some negative collateral effects have been identified by the partners when testing the EEIC:

- Giving priority to trucks can cause problems in smaller cities with closely located intersections.
- EEIC: Non-allowed vehicles could take advantage of priority provided for allowed vehicles at intersections.
- The green waves created by the trucks will attract additional trough-going traffic to the city.

For solving the above questions simulation tests could be performed prior the installation of the EEIC, evaluating the impacts to the entire network. The creation of low speed green waves will not be attractive for other users. Finally, only trucks with origin or destination within the city will obtain priority.

In relation to the above question, cities should be involved, at least on a high level by setting criteria for inclusion of companies in the back-office activities. Another angle (and for the future the most

sustainable) would be to have a perfect traffic monitoring system and traffic management system in place: the city will then be able to decide how to prioritize, by means of traffic scenario's, depending on certain conditions (peak-hour, weather-conditions, events….).

5.2. Recording and classification of initial recommendations and solutions

The above solutions are rewritten here for each one of the barriers categories presented in chapter 4.

5.2.1. Solutions for legal and administrative barriers

Legal and administrative issues are the most important aspect of the project since the support of the authorities is a key factor for the success of the project.

For the in-vehicle technologies, acceptance of the drivers and fleet operators will be guaranteed if there is a strong legislation supporting environmentally friendly trucks and providing them with privileges in the urban areas.

For the DSB, the collaboration of the politicians is absolutely needed for guaranteeing the success of the implementation of the business plans. Politicians must support the use of the DSB places; the legal framework must be adapted in order to promote the use of the DSB parking places. If there is the possibility of double parking, a big part of the transporters will not use the DSB places, at the same time, if there is not the possibility of booking public places for private use DSB schemes cannot be implemented.

For the EEIC there is a conflict in some countries when providing priority to non-public vehicles.

Positive results of the project should prove the benefits for modifying the legal framework (considering freight as public service or allow the booking of public spaces for specific private activities). Also other advantages (e. g. safety, ambulances, fire brigades, private use at off peak hours…) must be shown to politicians in order to favor the support of politicians to the implementation of the technologies.

5.2.2. Solutions for technical barriers

The barrier related to the AL system is not a real barrier, the question is that Euro 6 trucks will take advantage of all the potential of the system, while earlier trucks will not use all the characteristics of the system.

An important technical issue is the parking machines that will be used in the DSB places, since the parking machine for the delivery space booking cannot be exactly the same as the existing ones and needs an adaptation of functionality combining both operations - (normal parking and delivery space booking). The adaptation of existing machines will reduce importantly the cost of the system, but for each installation technical question will be solved in this direction. In order to save time when sharing the machine with other uses there is the possibility of using Wi-Fi technologies.

In the case of the EEIC there is a need for a definition on standards on cooperative systems at European level. Standarisation is progressing both for the communication mechanisms used and for application specific messages.

Standardization of the technologies is a general question that must be solved at a European level.

5.2.3. Solutions for organizational barriers

The most important organizational barrier is the city systems back office management. Different formulations have been proposed, from a unique back office for all systems and the whole country (d2d trip management) until the addition to existing back offices (traffic lights and parking companies). Once the back office scheme is chosen, there is a necessity of finding a trust body for organizing and managing it (maybe a bank), identifying added value to the provided services (income from other sources or other use of the places in off peak periods) in order to attract private investment and interests for managing the back office.

The in-vehicle systems don't need a back office since it will be provided by them to the fleet manager as added value to the systems installation. The only system that will communicate with the city back

office is the SL, since the city is the responsible of defining the zones and the speed limits.

Organizational questions of the DSB places are very important for its success. Guidelines will be provided in the operational deliverable in order to guide and provide tips to future DSB implementations from our experiences in Bilbao and Lyon.

In the case of the EEIC there is a need for a hierarchy priority definition on traffic lights (ambulances, fire-brigades, buses, trucks…). In network controlled systems as used in Helmond this is solved by assigning a weight to each type of vehicle. The higher the total weight found for a direction the more priority it will get. There is also the necessity of assuring to the cities that no trucks will be attracted to go through the city by the system. This last question is solved providing priority only to trucks with origin and/or destination within the city, avoiding additional trough-going traffic to the city.

5.2.4. Solutions for market and interoperability barriers

Market and interoperability barriers are related to problems and difficulties in the industrial adoption of the technologies by other companies not participating in the pilot tests. The barrier in this case is linked to the necessity of equipping all trucks and cities with technologies that may not exist for every truck or city and provide them with interoperability when travelling along Europe. This question will have impact on the Business plans since it will delay the implementation of the systems to a larger market share, reducing the grade of penetration in the first period of the Business plans. In order to provide other companies not participating in the FREILOT project with the indispensable knowledge for developing the systems, standards and guidelines on the systems are provided in the implementation Work Package (WP2). These guidelines present to other operators the standards of the systems, providing them with the opportunity of developing similar technologies that will have similar fuel savings and emission reductions, and will satisfy the hypothesis done by the Business plans.

An important issue on this matter of the in-vehicle technologies is that the FREILOT scheme is not accepted by all truck manufacturers because a common system definition has not been agreed. There is a need for a unique and common definition of eco driving support, acceleration limiter or speed limiter.

There is a need for regulation of standards for urban distribution of goods.

5.2.5. Solutions for business barriers

It is very important to provide all the involved actors not only with positive results, but with strong arguments in favour of the implementation of the technologies. Drivers, fleet operators, cities and truck manufacturers must be convinced by the FREILOT results (both evaluation and business models) that the tested technologies will provide them with benefits when implementing the proposed business plans.

The first actor of the proposed business models is the technology builders, to whom FREILOT can help in proving the benefits of the commercialization of the tested technologies, assuring them a good market penetration. In the case of the in-vehicle systems, the application of the technologies with small modifications to long haul trucks will justify their investment and posterior commercialization of the systems. The EEIC solution using cooperative technology is helped by its ability to support other services on the same equipment.

The following actor is the fleet operator, to whom FREILOT have to show the real fuel savings of each technology in relation to the extra work that implies. It is very important to prove them that there will not be negative effects, such as mobility reduction when using the technologies.

Finally, FREILOT results must convince the drivers (many of them “fleet operators” of small companies with one truck) that the use of the proved technologies will provide them with important benefits.

For the cities the most important barrier is the cost of the technologies implementation, but a correct business plan will show them the economic viability of the project.

5.3. Evaluating solutions with respect to business models deployment

In this paragraph the proposed solutions and recommendations for dealing with the aforementioned barriers are evaluated in terms of feasibility, transferability and applicability in a qualitative manner.

Barrier	Giving priority to non-public vehicles is not allowed in some countries
Business Model	Single scenario I
Impact	No applicability of the Business models or potential reactions from other transport operators, associations in modifying the legal framework
Barrier severity (1:low -5:high)	2
Other factors that influence (locality, conditions)	Barrier is met only in certain countries and so its importance is limited
Implementation guideline/solution	Modification of the existing legal framework after public consultation in order to facilitate the implementation of the BMs and the acceptance of the involved stakeholders.
Risk/Cost of solution	1
Other factors that influence (locality, conditions)	Problem of local character – strong local authorities could resolve better
Related theme and stakeholder	5 Politicians

Barrier	Giving priority to trucks can cause problems in smaller cities with closely located intersections
Business Model	Single scenario I
Impact	Worsen traffic conditions and increase drivers' reactions
Barrier severity (1:low -5:high)	3
Other factors that influence (locality, conditions)	Under certain conditions, the negative impacts could surpass the benefits
Implementation guideline/solution	Adopt traffic management strategies – TMC creation in order to reduce negative effects or impacts of the implemented services.
Risk/Cost of solution	2 - 5 (depends on the solution selection)
Other factors that influence (locality, conditions)	The problem depends on local traffic demand and conditions
Related theme and stakeholder	1 Technological companies

Barrier	Non-allowed vehicles could take advantage of priority provided for allowed vehicles at intersections
Business Model	Single scenario I
Impact	This could be acceptable provided the existence of a TMC
Barrier severity (1:low -5:high)	1

Other factors that influence (locality, conditions)	No serious reactions are expected in sites of application
Implementation guideline/solution	Adopt traffic management strategies (if needed) in order to reduce negative effects or impacts of the implemented services.
Risk/Cost of solution	1
Other factors that influence (locality, conditions)	In many cases this would not constitute a problem
Related theme and stakeholder	7 Negative collateral effects

Barrier	Different kinds of priority systems for fleet operators, emergency services and public Transport
Business Model	Single scenario I
Impact	Priority conflict at intersections
Barrier severity (1:low -5:high)	4
Other factors that influence (locality, conditions)	Cities with TMC already in use have advantage – cooperation and reaching to agreements between agencies is necessary
Implementation guideline/solution	The most important part is to agree with relevant stakeholders, on who should get priority, on which roads and at what times of the day. Remember, technologies and services are only an enabler of your visions, not the vision itself.
Risk/Cost of solution	1-4 (depending of the TDM strategies selected)
Other factors that influence (locality, conditions)	Cooperation activities do not entail significant costs
Related theme and stakeholder	6 Policy

Barrier	Conflict of interests between different modes of transport, all willing to have priority
Business Model	Single scenario I
Impact	Problems in coordination and cooperation between authorities
Barrier severity (1:low -5:high)	3
Other factors that influence (locality, conditions)	In cases where Central Authority does not exist, conditions worsen
Implementation guideline/solution	Arrange common activities, meetings – develop cooperation. The most important part is to agree with relevant stakeholders, on who should get priority, on which roads and at what times of the day. Remember, technologies and services are only an enabler of your visions, not the vision itself.
Risk/Cost of solution	1
Other factors that influence (locality, conditions)	Cooperation and joint activities could act as a catalyst for reaching to agreements
Related theme and stakeholder	6 Policy

Barrier	Green waves for trucks might attract additional trough-going traffic to the city

Business Model	Single scenario I
Impact	More congestion in the equipped roads
Barrier severity (1:low -5:high)	2
Other factors that influence (locality, conditions)	There might be traffic increase only in the short term
Implementation guideline/solution	Priority will be provided only to trucks with origin or destination in the city
Risk/Cost of solution	1
Other factors that influence (locality, conditions)	Most probably, no additional measures will be necessary
Related theme and stakeholder	7 Negative collateral effects

Barrier	There are not enough fleet operators interested and it is very difficult to let them see the benefits of the service
Business Model	Single scenario I
Impact	Low market penetration will increase cost and make the service unattractive
Barrier severity (1:low -5:high)	5
Other factors that influence (locality, conditions)	Critical factor affecting all potential cases
Implementation guideline/solution	Better marketing and promotion activities of the product. Presentation of benefits to actors. Agree with local stakeholders and nearby cities/regions in order to offer a better influence region to fleet operators. Use and open platform in order to integrate several services on one platform and make it more attractive to fleet operators.
Risk/Cost of solution	2
Other factors that influence (locality, conditions)	Should be linked with identifying the potential 'customer segments' of each technology
Related theme and stakeholder	3 Drivers and fleet operators

Barrier	City being dependent on one supplier for FREILOT services
Business Model	Single scenario I
Impact	Higher prices - making service unattractive
Barrier severity (1:low -5:high)	3
Other factors that influence (locality, conditions)	Rather unlikely for the European market
Implementation guideline/solution	Standardization. Use of an open platform with several services for promoting the existence of more suppliers.
Risk/Cost of solution	1
Other factors that influence (locality, conditions)	Special agreements could be promoted
Related theme and stakeholder	

Barrier	How we convince politicians about FREILOT systems
Business Model	Single scenario I
Impact	No mobilization from state, refuse public involvement
Barrier severity (1:low -5:high)	5
Other factors that influence (locality, conditions)	General issue
Implementation guideline/solution	By attracting the interest of public opinion at first, showing them "collateral benefits". Consider organisational aspects and show them to the interested stakeholders together with the CBAs in order to convince them that the scheme is mature and ready to be implemented.
Risk/Cost of solution	3
Other factors that influence (locality, conditions)	Dissemination activities and advertisements will be necessary
Related theme and stakeholder	5 Politicians

Barrier	Might be seen as unfair competition: public authority giving priority to some fleet operators, not to all
Business Model	Single scenario I
Impact	Public (drivers) and authorities reactions
Barrier severity (1:low -5:high)	1
Other factors that influence (locality, conditions)	General issue but not critical in cases where TMC are already in use
Implementation guideline/solution	Social and environmental benefits should be emphasized since the citizen is the final beneficiary of the services.
Risk/Cost of solution	1
Other factors that influence (locality, conditions)	Proper reasoning will curve reactions
Related theme and stakeholder	6 Policy

Barrier	Civil installation work is expensive, this increases the cost of the roadside installations
Business Model	Single scenario I
Impact	Higher costs - making service unattractive
Barrier severity (1:low -5:high)	4
Other factors that influence (locality, conditions)	May differ due to (local) installation costs and local economic conditions
Implementation guideline/solution	Take advantage of maintenance works for installing the systems. The EECI should be seen as an additional part of the current traffic management. Therefore the same organisation that is operating the traffic lights should operate this service. For other, informative services which do not influence traffic light operation, other service providers/maintainers could be envisioned.

Risk/Cost of solution	2
Other factors that influence (locality, conditions)	Local organization and planification
Related theme and stakeholder	4 Technology providers

Barrier	In-vehicle technologies - These services cannot be transferred to other manufacturers because they are closely linked to the truck electronics architecture and vehicle characteristics
Business Model	Single scenario II + Combined scenario (limiter scope)
Impact	No wide penetration of services - make services unattractive
Barrier severity (1:low -5:high)	5
Other factors that influence (locality, conditions)	Depends on the number of manufacturers who could use the services and their market position
Implementation guideline/solution	Strong BMs will increase the interests of other companies in developing similar services.
Risk/Cost of solution	2-4 (in relation to the difficulty for compatibility)
Other factors that influence (locality, conditions)	Compatibility could be targeted to specific key players (with large market position)
Related theme and stakeholder	1 Technological companies

Barrier	In-vehicle technologies - FREILOT scheme is not accepted by all truck manufacturers because a common system definition has not been agreed
Business Model	Single scenario II + Combined scenario (limiter scope)
Impact	No wide penetration of services - make services unattractive
Barrier severity (1:low -5:high)	1
Other factors that influence (locality, conditions)	Linked with previous impact / could be overcome in course
Implementation guideline/solution	Consensus and standardization on services' specifications should be achieved at European level.
Risk/Cost of solution	2-4 (in relation to the difficulty for compatibility)
Other factors that influence (locality, conditions)	Compatibility could be targeted to specific key players (with large market position)
Related theme and stakeholder	1 Technological companies

Barrier	Drivers: the solutions might not be accepted by the drivers due to extra work or technological issues.
Business Model	Single scenario II
Impact	No wide acceptance - unattractive service
Barrier severity (1:low -5:high)	2
Other factors that influence (locality, conditions)	Technological applications are increasing in every day uses

Implementation guideline/solution	AL: The functionality should be intuitive and requires no additional work. SL: There is a need for a learning process. In the future the drivers will be more and more used to this functionality and the HMI will be adapted. EDS: It is important to minimise the amount of input to the driver. HMI is of special importance as well. As with any in-vehicle system it is important to remember that the system should not bring extra information overload.
Risk/Cost of solution	2-Jan
Other factors that influence (locality, conditions)	Depending whether extra bonuses are required
Related theme and stakeholder	3 Drivers and fleet operators

Barrier	Fleet operators: Increase their work volume as they must control more features
Business Model	Single scenario II
Impact	Higher operational costs - No wide acceptance
Barrier severity (1:low -5:high)	2
Other factors that influence (locality, conditions)	Prove that direct and indirect benefits to actors are higher than the operative costs of the services.
Implementation guideline/solution	Prove direct and indirect benefits to actors.
Risk/Cost of solution	2
Other factors that influence (locality, conditions)	Demonstrate the environmental sensitivity of the people
Related theme and stakeholder	3 Drivers and fleet operators

Barrier	In-vehicle technologies - Fleet owner and driver acceptance: can be seen as unacceptable reduction of mobility
Business Model	Single scenario II
Impact	No wide acceptance
Barrier severity (1:low -5:high)	1
Other factors that influence (locality, conditions)	Local educations of stakeholders
Implementation guideline/solution	In FREILOT this has not been a real barrier. In FREILOT truck drivers are able to override these two functionalities through “kick-down” functionality on the accelerator pedal. The “kick-down” functionality is available on the market from most vehicle manufacturers and is believed to be a very intuitive way for truck drivers to override the acceleration and speed limiters. Give possibility to choose different levels of acceleration limiter

Risk/Cost of solution	2
Other factors that influence (locality, conditions)	Demonstrate the environmental sensitivity of the people
Related theme and stakeholder	3 Drivers and fleet operators

Barrier	Traffic operators: Extra work to be done by traffic operators
Business Model	Single scenario II
Impact	Complaints of employees
Barrier severity (1:low -5:high)	1
Other factors that influence (locality, conditions)	Only in cases where TMC systems do not exist
Implementation guideline/solution	Already existing services can take the management of the services taking advantage of the already existing infrastructure and services chain
Risk/Cost of solution	1
Other factors that influence (locality, conditions)	Adjust to EU policy guidelines
Related theme and stakeholder	2 Back office

Barrier	In-vehicle technologies: Risks that pay back will be too long. Fast return on investment is important for fleet operators
Business Model	Single scenario II + Combined scenario (limiter scope)
Impact	No significant economic returns - make services unattractive
Barrier severity (1:low -5:high)	5
Other factors that influence (locality, conditions)	Applies for all manufacturers
Implementation guideline/solution	Always keep in mind the costs versus. benefits. Very expensive equipment will either require high benefits or a longer pay-off time. Provide other benefits (e. g. tax discounts) to fleet operators in order to reduce pay back.
Risk/Cost of solution	2
Other factors that influence (locality, conditions)	Risks and Socioeconomic issues should be assessed in detail in each different case
Related theme and stakeholder	4 Technology providers

Barrier	DSB in Lyon and Germany – Booking of public spaces for private use or to private entities or individuals is not possible
Business Model	Single scenario III
Impact	Service is not allowed under some national regulations
Barrier severity (1:low -5:high)	2
Other factors that influence (locality, conditions)	Applies only to specific states or cities – impacts of local character

Implementation guideline/solution	Modification of the existing legal framework after service success validation and public consultation in order to facilitate the implementation of the BMs and the acceptance of the involved stakeholders.
Risk/Cost of solution	1
Other factors that influence (locality, conditions)	Problem of local character – strong local authorities could resolve better. Public administration needs to be involved in the project (general remark for this and EEIC). Close cooperation between the city and fleet operators is needed.
Related theme and stakeholder	6 Policy

Barrier	DSB - Enforcement: Guarantee that the delivery spaces are not used by not authorized users
Business Model	Single scenario III
Impact	Use of service by others– not able to commercialize or put in practice due to lack of quality
Barrier severity (1:low -5:high)	4
Other factors that influence (locality, conditions)	Applies in all cases
Implementation guideline/solution	Implement a real time specific enforcement service (technological & personal) together with rigorous legal framework with heavy sanctions.
Risk/Cost of solution	1
Other factors that influence (locality, conditions)	Technological solutions could also provide solution to this barrier (RFID). Enforcement is needed
Related theme and stakeholder	5 Politicians

Barrier	DSB in Lyon - Double Lane Parking is allowed, and might be more attractive to truck drivers than parking on a delivery space, even when booked and free
Business Model	Single scenario III
Impact	Current practice is convenient – difficult to change attitudes
Barrier severity (1:low -5:high)	1
Other factors that influence (locality, conditions)	Applies only to specific cases – impacts of local character
Implementation guideline/solution	Creation of a rigorous legal framework and policing measures in order to facilitate the implementation of the BMs and the acceptance of the involved stakeholders.
Risk/Cost of solution	2
Other factors that influence (locality, conditions)	There may be reactions from the drivers (but only in specific cases). Public administration needs to be involved in the project (general remark for this and EEIC). Close cooperation between the city and fleet operators is needed.Provide incentives and disincentives for using the offered services.

Related theme and stakeholder	6 Policy

Barrier	The parking machine in Bilbao needs an adaptation of functionality combining both operations - (normal parking and delivery space booking) (Techn)
Business Model	Single scenario III
Impact	Service cannot be provided with existing technology
Barrier severity (1:low -5:high)	1
Other factors that influence (locality, conditions)	Local character
Implementation guideline/solution	Technological and cheaper solutions should be assessed with an estimation of 30.000€ investment.
Risk/Cost of solution	2
Other factors that influence (locality, conditions)	In cases where the investment costs increase, thorough CBA should be executed in advance
Related theme and stakeholder	1 Technological companies

Barrier	DSB - Some periods of the day might not be used (afternoons) and the spaces can be empty all the time
Business Model	Single scenario III
Impact	Suboptimum use of the infrastructure, bad image for the citizens.
Barrier severity (1:low -5:high)	2
Other factors that influence (locality, conditions)	Local character – related to local transport demand
Implementation guideline/solution	Consider organisational aspects. Adaptation of the service to the real demand – decrease of benefits . After a certain period real parking needs should be evaluated. When the use rate is very low other activities like car parking can be implemented (efficient use of infrastructure).
Risk/Cost of solution	2
Other factors that influence (locality, conditions)	After the ‘mapping’ of demand, the spaces could be ‘restricted’ only for certain hours within the day
Related theme and stakeholder	6 Policy

Barrier	DSB - If the booking is for 3 months (fix), when a new partner wants to use the system, it will affect the management process of all the companies that are currently using the delivery space booking system.
Business Model	Single scenario III
Impact	Difficulties in introducing the system to the market
Barrier severity (1:low -5:high)	1
Other factors that influence (locality, conditions)	Majority of similar issues will be resolved after implementation

Implementation guideline/solution	Contracts and agreements should be flexible and allow certain modifications for 'new' players. Also a methodology should be implemented that priorities good users.
Risk/Cost of solution	2
Other factors that influence (locality, conditions)	The method of 'compensation' could be used in cases where modification of the terms is required
Related theme and stakeholder	2 Back office

Barrier	DSB - The booking is for 3 months, although it is not used
Business Model	Single scenario III
Impact	Not good use of service
Barrier severity (1:low -5:high)	1
Other factors that influence (locality, conditions)	Majority of similar issues will be resolved upon implementation
Implementation guideline/solution	Slots that are not used should be cancelled by user or administrator
Risk/Cost of solution	1
Other factors that influence (locality, conditions)	In this case agreement is easier to be reached (it is in the interest of both parties). If there are fleet operators who book but do not use the booked time slots, then there needs to be an agreement between different users that this fleet operator will receive a certain disincentive. One example could be to not allow the fleet operator to make new bookings during a period of two weeks. Reward for the best users. It was well accepted by the users. Slots that are used less by 25%; notification was sent out and if there was no strong opposition then this slot would be taken away.
Related theme and stakeholder	2 Back office

Barrier	DSB - The reservations of the slots are not prioritized by use (the faster access to the web site at the beginning of the trimester has the advantage)
Business Model	Single scenario III
Impact	Functional detail which entails difficulties in the service provision
Barrier severity (1:low -5:high)	1
Other factors that influence (locality, conditions)	General issue – expected to be resolved upon implementation
Implementation guideline/solution	More dynamic slot management policy giving priority to efficient users will increase the interests in the services and their performance levels.
Risk/Cost of solution	2
Other factors that influence (locality, conditions)	Perhaps reservations request should be collected and evaluated every 2 hours.
Related theme and stakeholder	2 Back office

Barrier	DSB - A hybrid machine can take too long to drivers to register because they might have to wait for parking users to pay
Business Model	Single scenario III
Impact	Creation of time delays and frustration to drivers
Barrier severity (1:low -5:high)	3
Other factors that influence (locality, conditions)	General issue – expected to be resolved upon implementation
Implementation guideline/solution	Advance electronic solutions should be evaluated and tested – RFID or smartphones.
Risk/Cost of solution	3
Other factors that influence (locality, conditions)	Highly depends on the easiness of technology implementation
Related theme and stakeholder	4 Technology providers

Barrier	DSB -Small fleet operators can be out of the scope of the project
Business Model	Single scenario III
Impact	Restricted market penetration
Barrier severity (1:low -5:high)	4
Other factors that influence (locality, conditions)	Depends on the market position of small operators for each country
Implementation guideline/solution	A general strategy after mapping the total service demand should be formulated -evaluating users by efficiency. Make more attractive the services to small fleet operators.
Risk/Cost of solution	2
Other factors that influence (locality, conditions)	The service should be continually evaluated by a designated authority
Related theme and stakeholder	3 Drivers and fleet operators

Barrier	DSB + EEIC - There are not enough fleet operators interested and it is very difficult to let them see the benefits of the service
Business Model	Single scenario III
Impact	Restricted market penetration
Barrier severity (1:low -5:high)	5
Other factors that influence (locality, conditions)	General barrier
Implementation guideline/solution	In order for this service to succeed there is a need to have a wide user base. In FREILOT, dissemination through local, regional and national media has proven to be an excellent tool to raise the awareness of the potential users. A comprehensive marketing plan should be developed – DSB Bilbao.
Risk/Cost of solution	2
Other factors that influence	The identification of the needs of all potential customer segments

(locality, conditions)	is necessary
Related theme and stakeholder	3 Drivers and fleet operators

Barrier	DSB - Although fleet operators accepted and provided positive comments for the system, the real use of the system was far away from the shown interest
Business Model	Single scenario III
Impact	Restricted market penetration
Barrier severity (1:low -5:high)	5
Other factors that influence (locality, conditions)	General barrier
Implementation guideline/solution	System must be adapted to users' needs. Incentive and disincentive. Having a possibility to book a delivery space is a very nice incentive. However, with that there should follow responsibility as well. Fleet operators' usage of the booked spaces should be monitored. If there are fleet operators who book but do not use the booked time slots, then there needs to be an agreement between different users that this fleet operator will receive a certain disincentive. One example could be to not allow the fleet operator to make new bookings during a period of two weeks. Reward for the best users. It was well accepted by the users. Slots that are used less by 25%; notification was sent out and if there was no strong opposition then this slot would be taken away.
Risk/Cost of solution	2
Other factors that influence (locality, conditions)	The identification of the needs of all potential customer segments is necessary
Related theme and stakeholder	3 Drivers and fleet operators

Barrier	DSB + EEIC - How we convince politicians about FREILOT systems
Business Model	Single scenario III
Impact	Political cost
Barrier severity (1:low -5:high)	5
Other factors that influence (locality, conditions)	
Implementation guideline/solution	Public administration needs to be involved in the project . Politicians could be persuaded after the demonstrated market's interest or their political objectives. Prove the collateral benefits.
Risk/Cost of solution	3
Other factors that influence (locality, conditions)	The social benefits of the systems and technological solutions must be described
Related theme and stakeholder	5 Politicians

Barrier	DSB - The cost of each delivery space is too high for future

	implementations. Civil installation work is very expensive and varies from city to city. This could be a key factor for future installations in some cities
Business Model	Single scenario III
Impact	Difficult to implement due to high costs
Barrier severity (1:low -5:high)	5
Other factors that influence (locality, conditions)	General barrier
Implementation guideline/solution	Use of extensive CBA and risk analysis techniques – reduce costs by sharing tool machines and other services like car parking Investigate where the works on making intersections cooperative can be done at the same time, thus sharing amount and costs of the civil work. Where to place the costs. In FREILOT there are two implementations of the Delivery Space Booking. Both are very useful but there is one clear difference and that is the cost split between stakeholders. In Bilbao more or less the entire implementation cost lies with the “infrastructure” side, with the lights in the road and a delivery space booking machine. The “vehicle” side is a chip card that costs 5 Euro. In Lyon the situation is different, there the system relies more on the on-board DynaFleet or OptiFleet units from Volvo and Renault Trucks.
Risk/Cost of solution	2
Other factors that influence (locality, conditions)	Risks and Socioeconomic issues should be assessed in detail in each different case
Related theme and stakeholder	4 Technology providers

Barrier	Several settings of FREILOT services work only with Euro 6 trucks (considered as multi-mapping) (Techn)
Business Model	Combined scenario (limiter scope)
Impact	Restricted market penetration
Barrier severity (1:low -5:high)	4
Other factors that influence (locality, conditions)	Severity depends on the EURO 6 market and number
Implementation guideline/solution	Euro 6 is coming very soon and the work should be focused on that. Retrofitting is possible but would not be cost efficient. Adaptation to Euro 5 trucks has been proved during the project.
Risk/Cost of solution	2-4 (in relation to the difficulty for compatibility)
Other factors that influence (locality, conditions)	Compatibility could be targeted to specific key players (with large market position)
Related theme and stakeholder	1 Technological companies

Barrier	How can cities ban vehicles that are not fitted with such equipment (not defined by regulations)? It may be seen as a barrier to trade by the manufacturers that cannot provide this kind of solutions
Business Model	All
Impact	Not acceptance by some of the fleet operators.
Barrier severity (1:low -5:high)	5
Other factors that influence (locality, conditions)	Local regulations
Implementation guideline/solution	FREILOT systems are not based on certification thus it is not a possibility to limit some benefits to only FREILOT vehicles. But these positive incentives could be given to vehicles with Euro 5 or 6. For speed limiter this could be easier.
Risk/Cost of solution	
Other factors that influence (locality, conditions)	Local policy for fleet operators.
Related theme and stakeholder	5 Politicians

Barrier	More and more fleet operator vehicles are getting overcrowded by new technologies.
Business Model	Single scenario II + Combined scenario (limiter scope)
Impact	Lower acceptance by fleet operators or drivers.
Barrier severity (1:low -5:high)	5
Other factors that influence (locality, conditions)	
Implementation guideline/solution	Ask your supplier which other services can be operated on a certain on-board unit. Services should be provided in standard platforms of formats (e. g. android or IOS).
Risk/Cost of solution	1
Other factors that influence (locality, conditions)	
Related theme and stakeholder	3 Drivers and fleet operators

The analysis aims at providing some useful insights to the more detailed Cost Benefit Analysis of the Business Cases, highlighting important issues, barriers, characteristics that should be taken into account and thus making the 'Barriers identification process' more complete.

6. Impacts on deployment plan and CBA

Some of the identified barriers will have an impact on the deployment plan and the CBA results. The principal problem is the delay in the implementation of the technologies due to both legal and interoperability issues. The legal issues are related to the city systems (DSB and EEIC), while the interoperability issues affect all the technologies.

In some cities it will be necessary to change the legal framework in order to promote the use of the technologies (especially for the DSB places). These changes will need time and will probably have detractors, for example if the city council bans the double line parking in a city where it was traditionally permitted the truck drivers will have a strong opposition to the measure.

In relation to the interoperability of the systems, as commented above, it will be a delay in the further penetration of the technologies since not all the truck manufacturers have developed the tested systems. The FREILOT project will provide them with guidelines on how to develop the systems, but there will be the need for an investment (time and resources) for developing the systems before their commercialization.

This delay in the implementation of the technologies needs to be taken into account in both the CBA and the deployment plan. The impact of this delay will be a lower market penetration of the technologies during the first period, where only trucks and cities equipped by the partners involved in the project will have the possibility of acquiring the technologies. After this first period all trucks and cities will have the possibility of being equipped with FREILOT technologies and the market penetration will increase significantly. A good approach for taking into account this two-phase penetration is to take into account that only a part of the fleet of trucks or some cities will have the possibility of acquiring the technologies in the first phase.

7. Conclusions and recommendations

The main conclusion is that the actors of the urban freight delivery play a crucial role in the successful implementation of the technologies. The project should provide them with data and facts for convincing them that the correct use of the technologies will be beneficial, in economic terms for fleet operators and in environmental and social terms for the citizens.

The document present general guidelines learned while implementing the technologies, but also when testing them, providing a full set of key elements and details for the optimum implementation of the systems. Also technical guidelines and tips are provided for the physical installation of the systems and their maintenance.

The business barriers identified by the participating partners are listed, categorised and discussed. Different themes are presented and developed, presenting the views of the key stakeholders for the affronted during the project barriers. The results of this discussion are also presented for each group of barriers, merging the point of view of the different stakeholders in technical, organizational, market, business and legal aspects.

Finally, the implementation guidelines and the business barriers are merged in the final chapter, presenting for each barrier the impact and the solution adopted or proposed while identifying the related business model and the responsible actor. The impacts are evaluated in relation to their severity, presenting specific comments to each impact. The solutions proposed are evaluated in terms of applicability and also comments on this applicability are presented.