Transport Telematics & Transport RTD Programmes

INTERCEPT Project (TR 5004)

INTERMODAL **C**ONCEPTS IN **E**UROPEAN **P**ASSENGER **T**RANSPORT

Barcelona*Bremen*Bristol*Alkmaar

FINAL REPORT

Version 3.0

Status: Final

EUREP/BTSA/WP01/FRv3.0

November 2001

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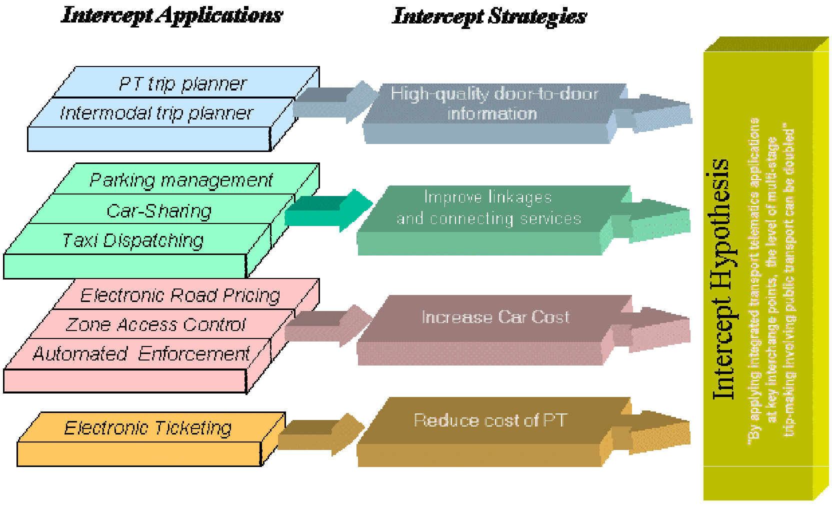
TR 5004 INTERCEPT

INTERmodal Concepts in European Passenger Transport

INTERCEPT HAS DEVELOPED, INTEGRATED AND DEMONSTRATED A SERIES OF MEASURES, CONFIGURED TO SUPPORT STRATEGIES FOR PROMOTING INTERMODALITY (SEE FIGURE).



Setting the Scene

Higher service densities, together with effective car restraint, enable Public Transport (PT) to reasonably compete with the private car for central-urban trips. But, in urban hinterlands, services need to be adequately linked (park&ride, PT+taxi, PT+bike, PT+car-sharing...) to provide an effective intermodal door-to-door alternative to the car. Measures that improve PT operations - especially information systems that help travellers find their way through the complex choice of mode combinations – are also part of this tool-box for promoting intermodality.

Three sites (Barcelona, Bremen and Bristol) set out to demonstrate travel behaviour and user acceptance impacts having in mind the complexities of building and evaluating multiple (packaged) measures.

Approach

The combination of measures trialed at each site was determined by local commitments to further improve the state-of-the-art of measures – applied as strategies within the INTERCEPT framework (see figure): Bristol as a lead city for road pricing, Bremen and Barcelona having advanced operational experience of car-sharing and access control, respectively. Door-to-door public transport information was a key action at all sites, and was implemented to a common specification; Internet-based (enabling the interconnection of servers + integration of linked service content), with text plus graphics solutions (i.e.: helping the user enter/ transfer/ exit the network).

Responses from a total of over 600 travellers were evaluated, using a panel survey (common set of core questions) supplemented by site-specific surveys and transaction data analysis to meet the needs of the local stakeholders (operators and authorities).

Results and Achievements

High levels of acceptance of the common public transport trip planner are recorded; the percentage of respondents at each site stating that they would either definitely or probably use this application in the future range between 70% and 90%. Graphics were highly rated - verifying the need for visual guidance. At different sites, the percentage of respondents stating that the application had helped them use a better public transport service was

between 8% and 10%.
Measured travel impacts have partially proved the project hypothesis about travel behaviour (see Fig.); the tool-box achieved reductions of up to 10% in car-use, and larger increases for certain targeted modal elements such as multi-stage public transport *under certain conditions* (see Del. 8.1).
Results from the panel surveys show increases in multi-stage public transport mode shares (up 3.6% from 36.3% in Bremen, and up 4.6% from 2.3% in Bristol). These results show that the hypothesis is more easily proven at sites where the initial multi-modal share involving public transport is low. It also shows that good information and linkage services can improve intermodal share even without implementing restraint. The results for Bristol show that the package of measures also promoted ride-sharing and walking mode shares. Also, the reductions in car usage achieved for the trip planner sub-sample (5.0% down from 37.7%) was improved when this "carrot" is combined with the "stick" of road pricing (sub-sample car mode share down 12.8% from 62.1%).
Sample characteristics depend upon the method of recruitment and the geographic coverage of the trial. The most extensive trial was of a prototype Intermodal Trip Planner (ITP) covering 57 of the 163 municipalities of metropolitan Barcelona. The recruited sample had the longest av. trip lengths (31km) and lowest use of the Internet (20%) - comparative descriptors for the other sites being 10-20km and 50% Internet use (Bristol) and 10km and 90% Internet use (Bremen). Panel deterioration in Barcelona meant that impacts were achieved only for the Park&ride ticketing measures (a 7% switch from car to park&ride was retrospectively declared by respondents). The Bremen demonstration of ITP linked the cambio car-share and Taxi Ruf Bremen taxi webs to the public transport servers - showing solutions for combined modes using vector-based data (map solutions especially used for irregular journeys). Cambio has already achieved call-centre cost savings as Internet bookings surpass 10%. (see web-site for links).

Conclusions and Plans for the Future

The base level mode share has to be taken into account when assessing impacts. Mapping, interconnection and better search techniques show how the Internet supports door-to-door high-quality public transport information. To fully deliver on intermodality, linkage services (park&PT, taxi+PT, car-sharing) must be integrated. All sites are now integrating interactive walking /cycling elements - heralding a new level of interaction for multi-modal mobility home-pages.
Efforts are being made to implement ITP at a wider regional level – since this is where mode share impacts may be maximised. The superiority of the private car can only be "beaten" by interconnected services.

Contact Details

Project Name:

INTERCEPT- INTERmodal Concepts in European Passenger Transport

Research Area:

Transport RTD & Telematics Applications Programmes

Timescale:

1.12.98- 30.05.01

Budget:

Overall cost:3.067.291 ECU
European Commission contribution: 1.500.000 ECU

Keywords:

Intermodality; Information ; Transport; telematics, mobility services

Key Project Participants:

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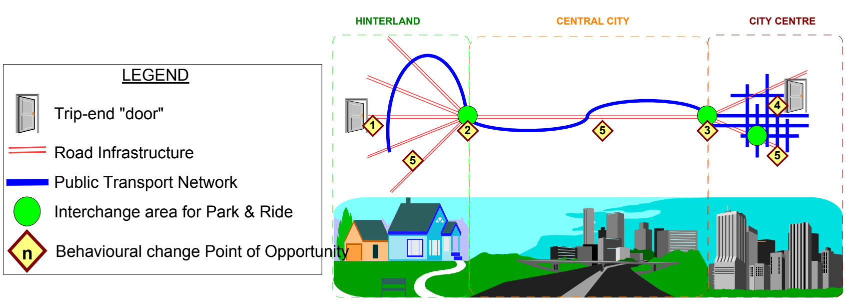
1. SETTING THE SCENE

Urban areas can be categorised into three concentric area according to **the relative level of supply of private and public transport**:

- City centres, where on-street parking is controlled, (and car access may also be controlled) and where public transport supply is most dense and frequent;
- Central city areas where public transport supply and car parking opportunites offer similar levels of supply, and
- Hinterland areas, where public transport supply is low, and populations have grown to be dependent upon cars for access.



APPLICATIONS BY POINT OF OPPORTUNITY:

<1> At home applications: Internet trip planner, booking service

<2> <3> En-Route applications: En-route trip planner, Park & Ride ticketing and booking

<4> <5> At destination applications: City centre car-sharing, parking and access control management

Figure 1 INTERCEPT scheme for urban intermodality demonstration

With this scheme in mind, INTERCEPT has developed, integrated and demonstrated a series of measures to support strategies for **promoting passenger intermodality in urban areas**. The logic of the tool-box can be illustrated through a couple of examples:

- Most European cities are interested in increasing the level of car restraint in central areas. As the restraint area increases in size, the traveller needs combinations of public transport services in order to make door-to-door journeys using alternatives to the car. Hence, interchanges and public transport network products (eg: integrated ticketing) are needed to make the alternative effective.
- In hinterland areas, the population density is often insufficient to support a high supply of public transport. Services therefore need to be organised that enable travellers to efficiently interconnect with the public transport network. The integration of linkage services (park&ride, PT+taxi, PT+bike, etc.) helps to provide an effective intermodal door-to-door alternative in such cases.

This scheme was used as an initial reference to decide which measures to group together, and where (in the city regions) to apply the combined services. A finding from various previous projects (eg. MIRO, 1995; TTR, 1998; CONCERT-P, 1999; PRIMA, 2000) is that **road pricing restraint** can be more acceptable when the “stick” is implemented **as part of a package that includes incentives**. Whilst the integration of measures as a package can be desirable for improving acceptance, it adds to the complexity of the demonstration. (Not only is there more risk that some element is not implemented /functions incorrectly but, also, the evaluation task of deciphering the relative contributions of different elements to the overall impact becomes more complex). The packaging of strategies had to be carefully realised as we set about **“configuring the tool-box”.**

The various design concepts and strategy development were applied to sites in three European cities (Bristol, Bremen and Barcelona) that have quite **different baseline conditions** and yet - at the same time – are **typical of urban contexts across Europe**. The definitions for the City Centre and Urban Area are an important factor when comparing the baseline data. Barcelona has a much larger City Centre (11km^2) compared to Bremen (3km^2) and Bristol (1km^2). Whilst the Urban Area for Barcelona (225km^2) is smaller, when compared to Bremen (326km^2) and Bristol (289km^2), the hinterland of this metropolis covers an additional 885km^2. Figure 3 shows the baseline modal split comparisons for the Urban Areas.

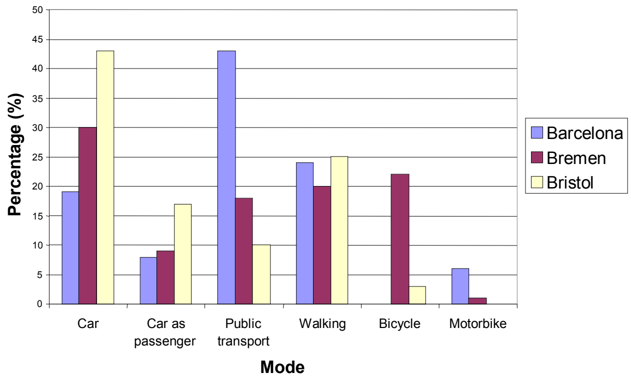


Figure 2 - Percentage modal split in individual cities for all journeys (figures for Urban Areas)

The three cities show clear **differences in modal split**. Bristol shows the greatest dependence on the car. Bremen has a significant cycle mode share. Barcelona, whilst having approximately 3 times as many cars as Bremen and Bristol, has the greatest public transport mode share; it also has a higher level of parking management.

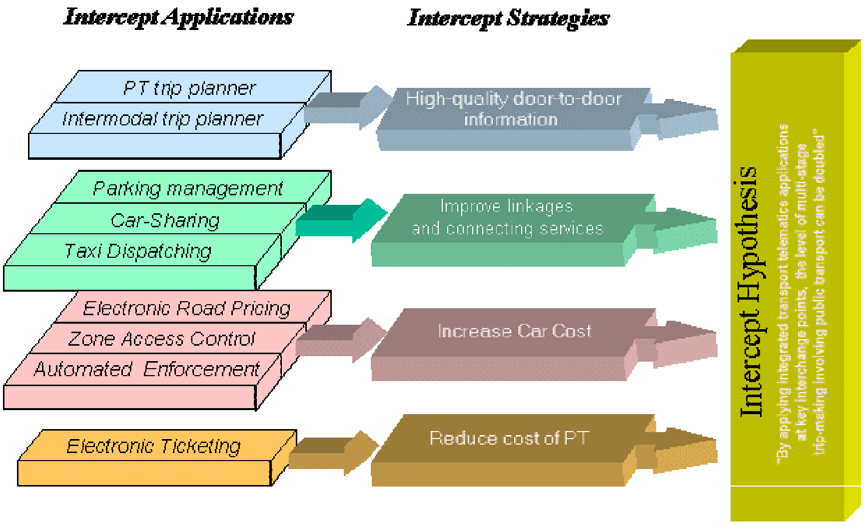


Figure 3 Tool-box showing configuration of measures, strategies and impacts hypothesis

The **combinations of measures** trialed at each site were determined by **local commitments to** further **improve the state-of-the-art of measures** – applied as strategies within the **INTERCEPT framework, Figure 3**. **Information systems help travellers understand and make complex choices of PT mode combinations.** They are fundamentally important for the promotion of intermodality. Integration work was also inspired by the research finding that "no site yet exists offering **drivers and public transport information** such that users receive details **side-by-side for a specified journey**", Lyons & McDonald, 1998.

2. APPROACH

2.1 MISSION

The project mission has been to:

"Encourage - by example - the implementation of intermodal door-to-door transport solutions in European cities, to INTERCEPT car usage as close as possible to its source"

INTERCEPT has investigated the following travel behaviour hypothesis:

"By applying integrated transport telematics applications at key interchange points, the level of multi-stage trips involving public transport can be doubled"

The site partners thus set out to demonstrate travel behaviour and user acceptance impacts having in mind the complexities of building and evaluating multiple (packaged) measures.

The prototype applications can be accessed via the project web-site which also provides further descriptions of the work summarised below (www.btsa.es/intercept).

2.2 COMMON INTERNET TRIP PLANNER DEVELOPMENT

Internet-based, public transport trip planner applications already existed – partially - at two of the sites when INTERCEPT started at the end of 1999:

- A graphics-based application giving door-to-door solutions for combinations of bus, metro and rail covered 11 central municipalities of Barcelona (not the hinterland),
- A text-based application gave stop-to-stop bus and tram solutions for the city of Bremen - with a connection, via EFA, to regional bus and train solutions.

It was decided to **improve Internet-based trip planner solutions** for the following reasons:

- Internet penetration rates (at over 25% of households, and experiencing rapid growth) were considered high enough to achieve a sufficient sample size for impacts assessment – assuming that the applications demonstrated support existing browsers (Netscape Communicator, Microsoft Explorer).
- Various techniques have come available that enable the interconnection of servers. Not only is a distributed architecture favoured for seamlessly connecting public transport queries/solutions across administrative boundaries, it is needed to connect public transport with the linkage service content (parking, taxi and car-sharing operators).
- The State-of-the-art Review (Deliverable 3.2) identified self-service trip planning as a more cost-effective solution (than call-centres).

The initial focus was on developing **a common specification for the public transport content**. It was agreed by the site lead partners (Bristol City Council, Free Hanseatic City of Bremen and Barcelona Tecnologia S.A.) that:

- a door-to-door solution was required (ie: that address gazeteers had to be incorporated for Bristol – where work started from scratch),
- click-on-map queries should be supported
- text plus graphics solutions should be given (i.e.: helping the user enter/ transfer/ exit the public transport network), and that
- "arrival/departure", "return journey" and "earlier/later" options should be supported (the Bremen site already incorporated these search features, but the Barcelona site did not – since the initial coverage did not extend beyond the urban area where bus frequencies were high).

The work at the Bremen and Barcelona sites integrated different linkage services into the original public transport searches - such that a variety of intermodal door-to-door solutions have been demonstrated (see site descriptions below). **INTERCEPT has thus transformed this public transport trip planner into an Intermodal Trip Planner** (ITP) product.

2.3 COMMON IMPACT ASSESSMENT

A **common validation approach** was designed to provide benefits at two levels:

- The site level – for measuring the **differential impacts of measures** from the tool-box, implemented in various combinations **at each site**.
- The project level – for measuring - and making valid **comparisons about - impacts across the sites**, based on common data.

Application	City	Target Group	Sample Size	Survey Tool
Intermodal Trip Planner (ITP)	Barcelona	Car drivers in metropolitan corridors	255 recruitment 140 before 5 after	Panel
		Internet users	100	Non-panel
ITP	Bremen	Internet users (inc. Cambio, PT, Taxi users)	152 before 100 after	Non-panel Panel
		Recruitment survey	192	Non-panel
Public transport trip planner	Bristol	PT / Car users	130 (64 + 66)	Panel
		Stakeholders	20	Non panel
Park & ride ticketing	Barcelona	Car drivers in corridors (knowing about park&ride)	130	Non-panel
Taxi Ruf	Bremen	Taxi Drivers		Non-panel
Road User Charging	Bristol	Car drivers on M32/ ARR corridor	200	Panel
Electronic ticketing & ITP	Bremen	Cambio members		Non panel (on-line)
Total (exploited)		Panel: Non-panel: Total:	300 300 600	

Table 1 INTERCEPT survey inventory

The common validation started by agreeing the **impacts** that could be used to test the project hypothesis. From the anticipated impacts, a set of **indicators** was developed to measure changes travel behaviour. A **common set of questions** (plus an agreed coding scheme) were then defined, based on these indicators, covering:

- Sample characteristics (demographic, lifestyle and travel patterns)
- Mode split for number of journeys
- Attitudes and perceptions (trip planner applications)

The common questions were implemented as part of a **panel survey** - before and after/during the demonstration of the trip planner measure at each of the 3 sites. **And non-panel surveys** were also realised to obtain responses to local measures (measures demonstrated in more than one demonstration phase), or the survey including the common questionnaire was extended to examine site-specific interests (multiple measures in a single demonstration phase).

Responses from a total of 600 travellers were evaluated, see Table 1. Transaction data analyses were also carried out to meet the needs of the local stakeholders (operators and authorities). It is noted that no impact assessment was carried out at the Alkmaar site, where work was stopped prior to implementation of the extension of zone acess control – this matter is explained in Appendix C.

2.4 BRISTOL: ROAD-USER CHARGING WITH HIERARCHICAL TARIFFS + P.T.TRIP PLANNER

Bristol is a lead UK city investigating **road user charging** under a UK national framework that has recently introduced legislative changes to support authorities implement such schemes. Through the INTERCEPT project an Electronic Road Pricing (ERP) trial was undertaken in Bristol and South Gloucestershire to gain a better understanding of the **behavioural responses** to charging on an urban radial motorway and orbital route to the north of the city. New developments in INTERCEPT included a **variable charging hierarchy** according to the use of the HOV lane and P&R.

The aim of the trial was to see whether the use of road pricing measures could stimulate a proportion of the regular drivers on the M32 and Avon Ring Road to mode shift, either to a more rational use of their car, use of a combination of modes or a switch to public transport. The options available to the participants in the trial were as follows:

- Ride sharing, which attracted a reduced toll;
- P&R using an edge-of-centre car park, with links to the shopping and business districts provided by a minibus service;
- Public transport use, which was subsidised as part of the total reward gained by changing behaviour;
- A reduced off-peak option thereby stimulating time of travel changes in the second phase.

In this manner, participants were encouraged to consider the different stages and links in their trip and the possibility of combining modes.

The **trip planning demonstration project** in Bristol involved developing from scratch a door-to-door bus jouney planner including two local authorities (Bristol City and

South Gloucestershire Councils) embracing the urban area and northern hinterland.

The application was developed with a high graphical interface, and uses specifically designed mapping developed as part of a collaborative trial with the Ordnance Survey the UK national mapping organisation. The bus trip planner provides information with regard to the following basic criteria: route and service availability; time of day requirements and journey time (i.e. which route is fastest).

The application was developed by BTSA for access via both a web browser (from a PC) and from on-street kiosks, the latter being introduced through parallel Council initiatives to broaden access to the Internet.

2.5 BREMEN: INTERMODAL TRIP PLANNER, TICKETING, CAR-SHARING + TAXI DISPATCHING

In Bremen the use of environmental friendly means of transportation is fairly high compared to other German cities and to the INTERCEPT partner cities. This is mainly caused by a great share of bicycling in the mode split while car usage has been constant throughout the last years. As there are alternatives to private car usage (namely packaged services) potential exists for increasing the use of those modes of transportation that are more environmental friendly than individual car usage. Since increasing car traffic volumes - and especially commuter traffic by car – has disastrous effects on city life and the environment, there is an urgent need to make alternatives more attractive and more easily accessible.

Taxis are considered as an important means of transportation when the public transport solution is relatively poor (e.g. in areas or times of low service frequency or restricted accessibility). They give travellers extra flexibility. In combination with public transport a high degree of mobility and a good alternative to individual car ownership is provided. Bremen already had advanced operational experience in CarSharing (CS). CS in Bremen has been officially eco-labelled and has an ongoing co-operation not only with public transport and taxi but also with a car-rental company to serve peak demands. To ensure customer satisfaction some previous investigations had been carried out on smart-card access to vehicles (intelligent on-board computer or intelligent lockers) to ease vehicle access. A huge increase in CS membership, numbers of season-ticket card holder, PT trips and reduction in private car-ownership had been achieved by an intermodal customer-orientated smart-card based offer of CarSharing and Public Transport (AutoCard Plus, part of the European project ZEUS).

The INTERCEPT project strategy for Bremen was to make public transport, CarSharing and taxi much easier and better accessible for the user. This was achieved by introducing demand-orientated measures. These facilitate the use of environment-friendly modes of transportation with a special focus on providing better pre-trip information.

The strategies applied at the Bremen site were:
1. Improving the electronic timetable information service (door-to-door itineraries)
2. Enhancing pre-trip information (compare and combine public transport, CarSharing, and taxi for individual journeys)

3. Simplifying the use of public transport by providing an alternative - and in the long run a substitute - for cash-based ticketing (electronic ticketing with common smart-card)
4. Offering ‘tailored’ taxis, which is orientated to the special needs of the customer
5. Making ordering and payment easier for cambio clients.

These strategies are supported by the use of telematics, mainly through a rich improvement of electronic timetable information systems and through the use of smart card based technologies. The aim was not only to make the use of these transport modes more convenient for the existing users, but also to gain new customers and in particular to attract car drivers.

Communication and information are important factors in modern mobility. Combined timetable information was considered to be the optimal way of finding out when buses and trams leave, where transfers are necessary and whether the same route can be travelled by other means of transport (such as bicycle, taxi or by foot). A trip planner for regional public transport (Elektronische Fahrplanauskunft - EFA) was already existing before the INTERCEPT Project started. However, this trip planner was confined to stops of PT only. Within the INTERCEPT project, a dynamic intermodal system was implemented, linking to the taxi organisation (integrating taxi as part of an itinerary, pre-ordering of taxis) and the CS provider cambio (best PT solution to reach a CS location). The system architecture of the new trip planner application should be capable to integrate future extensions (like a brokerage system based on client-server technique). Additional to text-based trip solutions, graphical guidance was made avialable (maps) – to visualise the inquired journey.

2.6 BARCELONA: INTERMODAL TRIP PLANNER, PARK&RIDE + ACCESS CONTROL ENFORCEMENT

Trip planner application	*Date*	*Area (sq. km.)*	*Population*	*Nº of municipalities*	*Public car park spaces*
(Already existing) Public transport www.tmb.net	1997	225	2,563,499	11	-
Parking guidance www.onaparcar.bcn.es	1999	99	1,643,542	1	106,443
ITP Intermodal Trip Planner (www.btsa.es/ruta-optima)	2000	1,114	3,660,672	57	111,713

Table 2 Trip planner development – Barcelona site

The trip planner development started by building the road network and car park database for a parking guidance application covering the city area. Some 460 off-street car parks are included, with a common presentation profile agreed by the main parking operators (SABA, SMASSA) and the city parking association (Gremi d’aparcaments de Barcelona). The **parking guidance** application was loaded on the Municipal server in Spring 2000.

The **park&ride ticketing** product was installed during the Spring of 2000 at 2 new stations selected by the rail operator RENFE-Cercanias (Vilanova and Mollet). This high-coercitivity magnetic ticket gives the motorist access to a guaranteed parking space at the parking interchange, plus onward travel on RENFE trains for a supplement of 6 € on the monthly rail pass or 1.2 € on the 10-trip ticket. These installations, plus 3 existing park&ride interchanges, were **incorporated in the extension of the ITP** road network database, and the park&ride search algorithms were modified. **Hybrid kiosks** were installed at station interchanges to support consultations en-route.

The goegraphic extension of coverage of the trip planner coincided with the implementation of unified public transport ticketing for the Barcelona metropolis. Of the two corridors targeted for the trial, one had implemented the new tariffs – the other had not when demonstration took place in Spring 2001. Apart from the public transport tariffs, the parking behaviour recorded in the first survey was used to create profiles to realise **personalised cost-based and time-based searches** for the following modes:

- Combinations of bus, metro and rail public transport
- Park&ride (rail / metro-based)
- Driving to off-street car parks (toll and parking fees included, motoring costs according to vehicle type).

The ITP prototype consists of a **portal containing the registered profiles, plus** the intermodal trip planner application (i.e.: **browser level connections to servers** that compute the public transport itineraries and the routes to car parks, plus Javascript to integrate and present the intermodal solutions). The search is seamless for the user.

A series of technical developments were realised to **automate access control enforcement** in the city centre. Detection of incidents **using digital video** was successfully demonstrated at an entry to one of the controlled access zones already in operation (Winter 2000 / Spring 2001). The trial was designed to show how digital video could be used to record illegal entries, to measure the number of illegal entries and to show how such data could be up-loaded to the control centre using ISDN. Additional trials were realised aimed at achieving a new form of kerbside access control for the Central Business District (CBD); here, the grid structure of the road network is not amenable to zone access control implementation. On-street parking using two-way radio communications was trialed. Camera vision object-tracking was demonstrated as a laboratory prototype (see D 6.1). The Municipality has recently initiated a trial of a loop-based sensor for automatic detection of on-street parking over-stays.

Survey 1, Autumn 2000, had two objectives; to recruit a panel for assessing the ITP, and to retrospectively analyse the impact of park&ride ticketing. **Survey 2** (panel after survey, Spring 2001) achieved a low response (Internet access for drivers was low, questionnaires were too long, password access was unpopular - see D8.1). The ITP was evaluated by a **third survey** (of Internet users, Summer 2001).

3. RESULTS & ACHIEVEMENTS

3.1 TRAVEL IMPACTS

3.1.1 Validation of the hypothesis

Measured travel impacts have partially proved the project hypothesis about changes in travel behaviour; the tool-box has **achieved reductions of up to 10% in car-use**, and larger increases for certain targeted modal elements such as multi-stage public transport *under certain conditions.*

Table 3 illustrates travel impacts measured for trip planner applications at the Bremen and Bristol sites. Table 4 illustrates the differential travel impacts for the Bristol site for segments participating in the ERUC Electronic Road-User Charging trial and those participants in the road charging trial who also had access to the bus journey planner.

Mode Split Trip Planner	Car	Ride sharing	P&R	Public Tpt (multi-stage)	Public Tpt (single-stage)	Pedal cycle	Walk	Motor cycle	Total
Before	37.7	10.8	1.8	2.3	33.9	10.3	1.4	1.8	100
After	32.7	17.7	0.3	6.9	26.1	7.2	7.5	1.6	100
Change	-5.0	6.9	-1.5	4.6	-7.9	-3.1	6.1	-0.2	-
Mode Split ERUC	**Car**	**Ride sharing**	**P&R**	**Public Tpt (multi-stage)**	**Public Tpt (single-stage)**	**Pedal cycle**	**Walk**	**Motor cycle**	**Total**
Before	62.1	25.5	2.0	0.5	4.0	3.0	0.0	3.0	
After	49.2	29.9	0.0	2.7	5.5	9.1	0.3	3.2	
Change	-12.8	4.5	-2.0	2.2	1.5	6.1	0.3	0.3	

Table 3 Cross-site evaluation of mode share impacts (Adapted from Deliverable 8.1)

Mode Split BREMEN	Car	Ride sharing	P&R	Public Tpt (multi-stage)	Public Tpt (single stage)	Pedal cycle	Walk	Motor cycle	Cambio	Other	Total
Before	10.9	4.9	3.7	36.3	15.9	21.4	0.9	2.3	0.6	3.2	100
After	11.8	5.0	1.3	39.8	17.9	17.7	1.8	1.0	0.6	3.2	100
Change	0.9	0.1	-2.4	3.6	2.0	-3.7	0.9	-1.3	0.0	0.0	-
Mode Split BRISTOL	**Car**	**Ride sharing**	**P&R**	**Public Tpt (multi-stage)**	**Public Tpt (single-stage)**	**Pedal cycle**	**Walk**	**Motor cycle**			**Total**
Before	37.7	10.8	1.8	2.3	33.9	10.3	1.4	1.8			100
After	32.7	17.7	0.3	6.9	26.1	7.2	7.5	1.6			100
Change	-5.0	6.9	-1.5	4.6	-7.9	-3.1	6.1	-0.2			-

Table 4 Differential mode share impacts - Bristol site (Adapted from Deliverable 8.1)

The results show **increases in multi-stage public transport mode shares** (up 3.6% from 36.3% in Bremen, and up 4.6% from 2.3% in Bristol). These results show that the hypothesis is more easily proven at sites where the initial multi-modal share involving public transport is low. The results for Bristol show that the package of measures also promoted ride-sharing and walking mode shares. The reductions in car usage achieved for the trip planner sub-sample (5.0% down from 37.7%) was improved when this "carrot" is combined with the "stick" of road pricing (sub-sample car mode share down 12.8% from 62.1%).

The degraded response to the Barcelona panel survey meant that travel impacts could only be measured in terms of respondents' **retrospective declarations**. The results concern the impact of the park&ride ticketing, and suggest that **a 7% switch to park&ride** (from driving all the way to the destination) is obtained. The park&ride mode share for the surveyed commuters increases from 38% to 45% (the hypothesis is not validated in this case since the park&ride usage is already high for the sample). The survey result is **supported by ticket transactions** registered at the parking entries during May of 2000 and 2001, which show considerable usage and growth; the average highest-hour occupancy at Vilanova increases from 90% to 112%, and for Mollet the levels rose from 23% to 36%.

The mode shift measurements recorded support the hypothesis that multi-stage trip making involving public transport has more than doubled in Bristol, and shows an increase in Bremen and Barcelona where there was a very high rate for the surveyed samples in the first place. In Bristol, **where the trip planner was demonstrated in tandem with a road user charging trial, the amount of multi-stage trip making involving public transport is higher for the group influenced by both elements of the toolbox**. This supports the view that integrated packages of transport measures have additional benefits, and that this approach also applies to telematics applications.

Considerable efforts were undertaken to achieve a sufficient panel response at each site (target numbers aimed to achieve 5% changes in impacts, with 95% confidence – see D4.1). Over 40,000 leaflets were distributed to households during the recruitment phase in Bristol (200 users participated in the road-user charging trial). Questionnaires were distributed via the roadside to 9,000 drivers in Barcelona – but this was insufficient to generate a significant panel response. The Bremen approach of recruitment via the Internet achieved a higher response – this approach was later adopted for Barcelona.

In spite of the efforts made, the limitations of the sample size need to be taken into account when interpreting the results – as well as the fact that only short-term effects can be measured using panel surveys applied to demonstrations. The common questions have helped illuminate the differences in the participant samples and this helps to explain the results in a qualitative way (mode split, trip length and Internet access differences are highlighted – see D8.1). Whilst samples recruited via the Internet have increased the level of response, such respondents are more likely to have higher levels of education, etc., and care needs to be taken if the results are to be extrapolated to the total population.

3.1.2 Insights regarding Road-User Charging tariffs

The Bristol INTERCEPT trial adds to the insights and findings of the previous CONCERT-ELGAR project (CONCERT-P, 1998). The previous trial was undertaken along a radial corridor with relatively good public transport alternatives – high density of bus services, rail route with local stations, and a Park & Ride service with bus priority lanes. In comparison, INTERCEPT has tested corridors with **a lower level of public transport offer** and has considered **both radial and orbital trips**. The headline results of the trials are detailed in Table 5.

	Modal Change From Solo Car Use	
Mode	CONCERT-ELGAR	INTERCEPT
Park & Ride	6.9%	0%
Public Transport	6.4%	7.9%
Ride Share	1.0%	0%
Cycle/Walk	0.8%	2.3%
Total Modal Change	15.1%	10.4%

Table 5 Comparison of CONCERT-ELGAR and INTERCEPT (Phase 1) Behavioural Responses to Charging Trials in Bristol (After Deliverable 9.1)

The charging regimes of the CONCERT-ELGAR and INTERCEPT (phase 1) trials were broadly comparable with headline charges of £2.50 (1998 prices) and £3.00 (2000 prices) respectively. In both trials participants received full refunds for switching to bus or rail services and charges were halved for ride sharers. Park & Ride usage was free for CONCERT-ELGAR participants (£1.80 additional reward per return trip), and a high quality purpose-built edge of City facility served the trial corridor. For the INTERCEPT participants the only Park & Ride option was an edge of centre car park with a shuttle bus service, the use of which attracted a small charge discount (£1.00 for lone drivers, £1.50 for ride sharers).

Figure 4 Electronic Road Pricing gantries, Bristol, where innovative trials of hierarchical tariffs have promoted intermodality (After Deliverable 7.1)

In many respects the quality of the public transport alternative for **the INTERCEPT trial is more representative of corridors in the UK city** than that of the previous research – hence providing a more transferable result. Furthermore, the second phase of demonstration quantified the impacts of charging solely during the peak-hours; spreading outside the two-hour peak (07.00 – 09.00) was measured to increase by 3% to 27% of the flow between 06.00 and 12.00.

3.1.3 Automatic detection of illegal entries to Controlled Access Zones

Previous project demonstrations have shown that zone access control can reduce traffic in sensitive historic areas (CONCERT-P, 1999). However, in order to achieve a city-wide impact upon restraint in Barcelona, the access control zones would have to be installed on the primary roads, would have to handle more restrictive access rules applied to more vehicle classes (see D7.1 Transfer study) and, consequently, would need an automated means of enforcing illegal entries. In INTERCEPT an entry of an operative access control zone was equipped to determine whether **digital video** was able **to automatically record the level of illegal entries**.

Over a period of 137 days 3816 images were recorded. The average recording time per image was 5.0 seconds (the video collects evidence of passing a red light plus the subsequent entry movement such that the best frame for number plate recognition is captured), at 3.6 MB/video clip. The daily average number of recorded incidents was 27.8, and manual inspection of images for a week-long period were used to quantify the types of detected incidents – illegal entries and exits via the entry lane – as well as other types of incident. From this analysis, it is estimated that **the level of illegal entries is around 20 per day**.

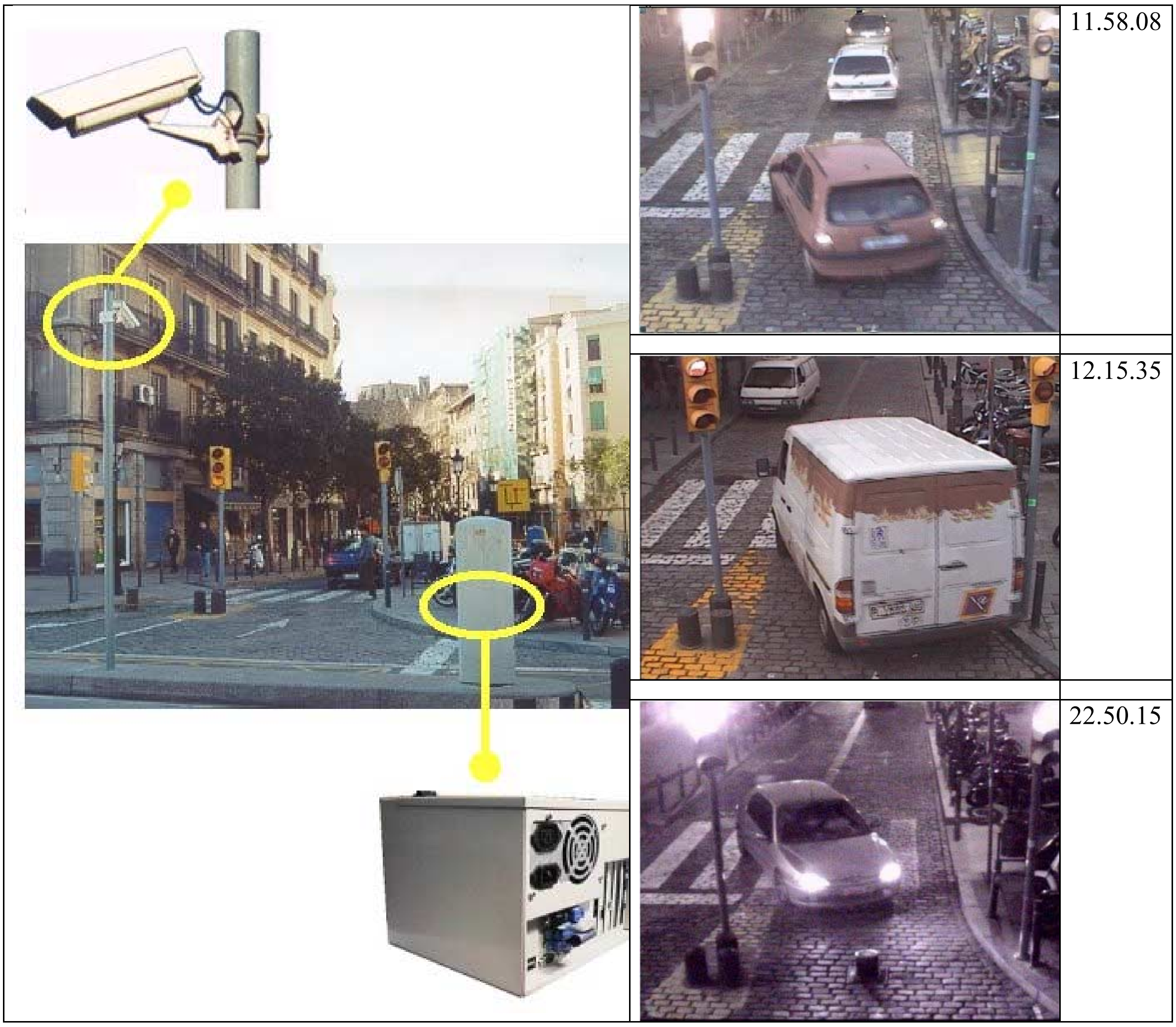


Figure 5 Automated enforcement of access control, Barcelona; roadside configuration and example recordings (Adapted from D7.1)

3.1.4 The effect of trip planners on transport use

In order to help assess the impacts on travel of the common trip planner application, survey participants were asked to judge the effect the trip planner had been having on their use of transport. In both Bremen and Bristol **between 8% and 10% of respondents stated that the planner had helped them use** a better public transport service. Examples were **quicker, more direct or more frequent services**. These are all instances of how (without any changes in infrastructure or frequency) the provision of information can actually improve the overall public transport service. In addition to this, it was found that 7% of participants in the Bristol sample had made new public transport trips - effectively using the mode more. This is measured from a lower baseline than was the case in Bremen, where the high existing level of use may explain the lower number of new public transport journeys made as a result of having the trip planner.

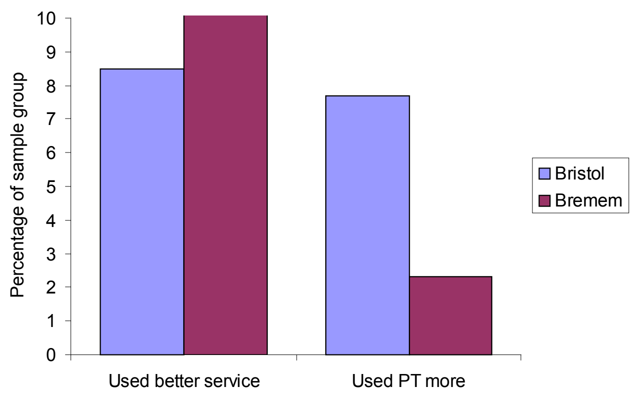


Figure 6 The effect of the trip planner on transport use (After D8.1)

3.2 User Acceptance & Implementation

3.2.1 High-quality public transport trip planning

User acceptance of "high-quality" public transport trip planning (i.e.: door-to-door, graphics and text-based solutions via Internet) has been surveyed at all three sites (samples of at least 100 participants per site). Figure 7 summarises the results, and shows that similar patterns of acceptance are achieved in all cases. The level of positive **end-user acceptance is high, and has motivated the stakeholders to develop definite plans for implementation**.

The site-to-site differences in ratings are attributed mainly to differences in the sample characteristics. Intranet tests (Bristol and Barcelona for public transport, and Bremen and Barcelona for intermodal trip planning) had shown similar response times (D6.1). Perceptions regarding the speed of response were generally favourable. The single rating of response speed for Bristol showed that only 10% of users rated the speed to be "poor"; this compares to 11% of Barcelona respondents who considered the time to display the costs/times table to be "poor" or "fairly poor", and to 28% of Bremen respondents who considered the time to show timetable information to be either "slow" or "very slow" (the latter being only 3%) – see D8.1 for further details.

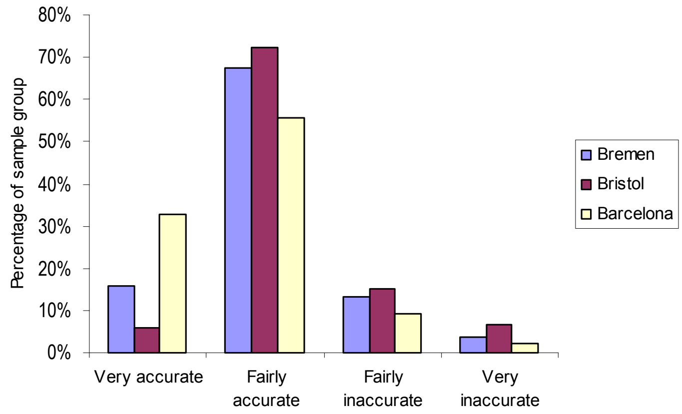


Figure.7 Perceived ratings of accuracy of Internet public transport trip planners having common map/text display and door-to-door searches (After D9.1)

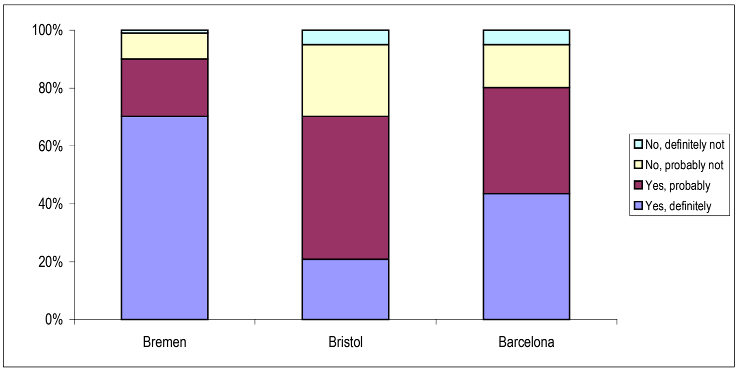


Figure 8 Disposition to use the public transport trip planners in the future (After Deliverable 8.1)

The ratings of features varied across the sites; **24-hour access** was most highly-rated by Barcelona respondents, the **ability to print-out solutions** was the principal attraction for Bristol respondents (followed by 24-access via Internet), and the **improved input (by address)** option was the highest-rated improvement by Bremen respondents. Figure 8 shows that the majority of respondents were disposed to use the applications in the future – with highest ratings for occasional trips.

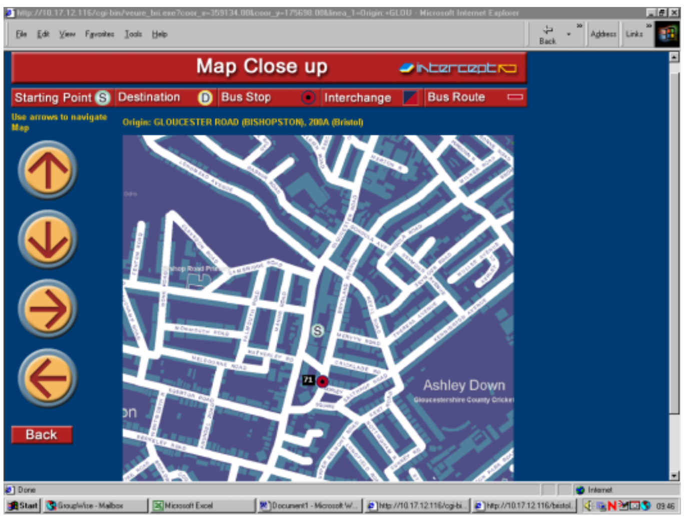


Figure 9 The Bristol Bus Journey Planner was developed by BTSA for Bristol City Council in collaboration with First Bristol Buses and the Ordnance Survey

INTERCEPT **facilitated the trial of a new Internet digital mapping product** by the Ordnance Survey that is now nationally available to UK authorities having a Service Level Agreement.

3.2.2 Intermodal trip planning

The trip planner demonstrated in Bremen, based on a core collaboration between BSAG (bus & tram operator) and mdv (ITP supplier), was innovative in various respects. For example, the **solution is painted on the maps using vector data** (rather than bitmaps) incorporating specific address locations. More fundamentally, INTERCEPT **integrates road network databases** supporting the linkage modes (taxi-stops and car-sharing locations registered as points-of-interest, cycling and walking access is calculated and displayed), and this, together with server interconnections. Together with server interconnections, this establishes an **intermodal trip planner** with real **address-based, door-to-door solutions**, Figure 10.

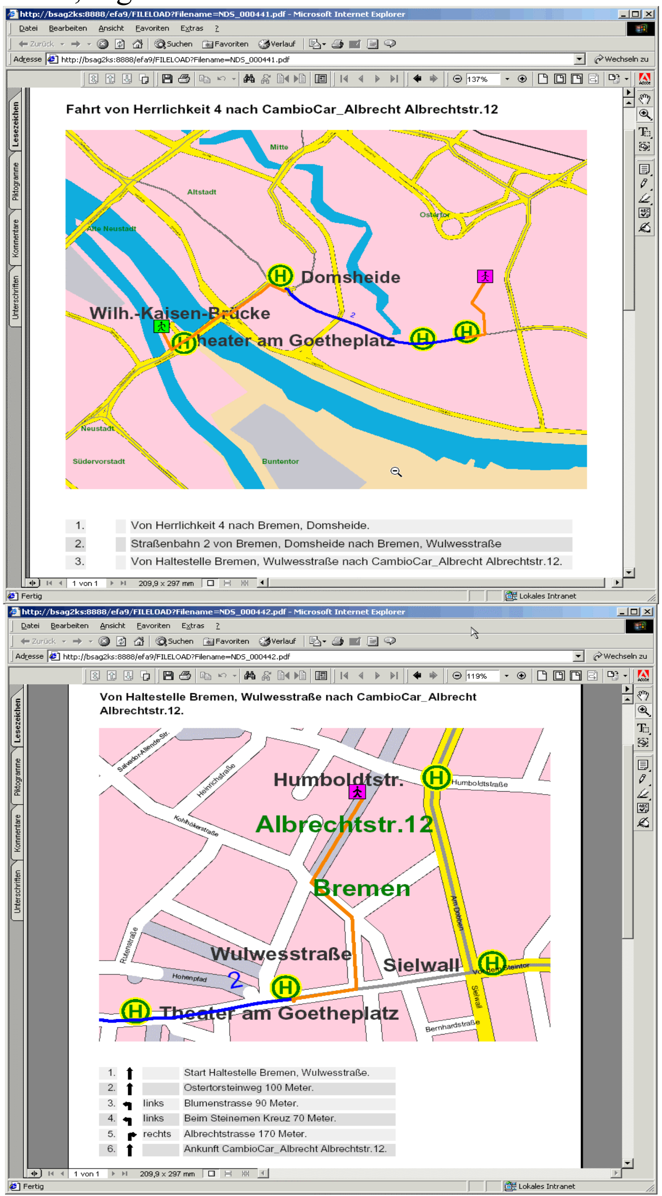


Figure 10 Bremen Intermodal Trip Planner map-based solutions (After D9.1)

Top: Solution for the entire trip including footpaths and PT (tramline)

Bottom: Solution for the trip end (tram stop to CS-location) displaying footpath and tram line

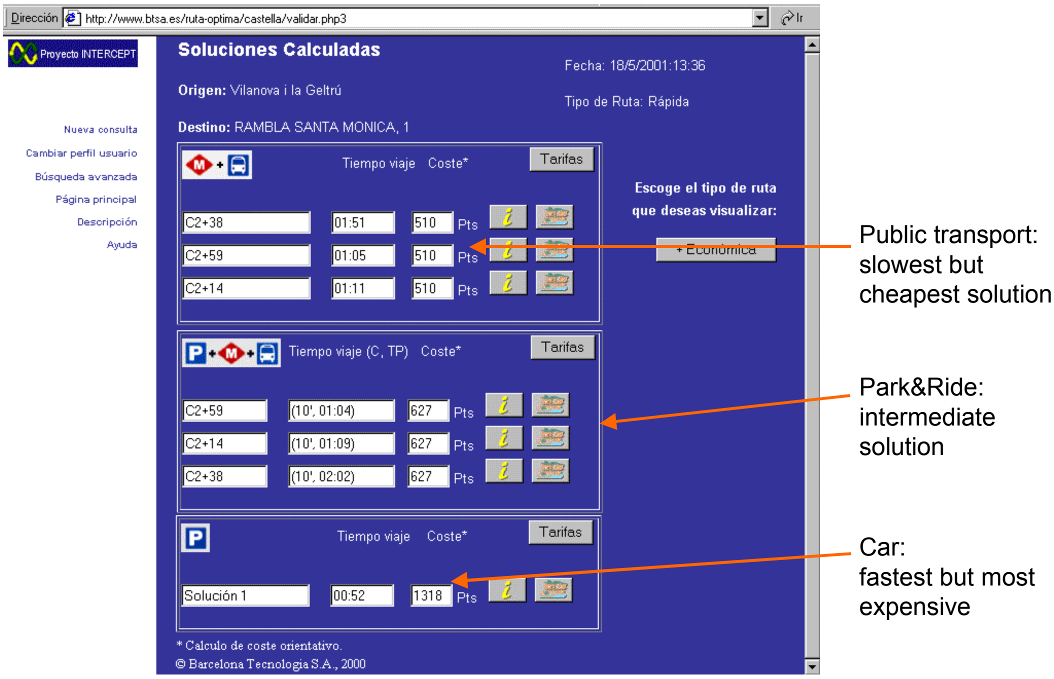


Figure 11 Intermodal trip planner, Barcelona - offering driver and public transport travel times and costs side-by-side for a specified journey

Covering a much larger area (than previous applications), the Barcelona ITP prototype was generally able to generate one or more solutions for the different modes; for car, 97% of requests; for public transport, 85% of requests; and for park&ride (for which supply is geographically –limited) 80% of requests. The **travel times of the searches are generally lower for car options than for public transport (even if the motoring costs are usually higher)** – see Figure 11. The demonstration shows that X-frame scripting (Hayes et. al., 2000) can be used to interconnect "friendly" servers, and that the challenge set by Lyons and McDonald is technically possible – but there is reticence from public transport operators to such an unconditioned, intermodal comparison. For the third survey, participants were pre-set with cost-based searches (the criterion that most favours public transport); the majority of respondents stated that better intermodal information would help them make more use of public transport. **Less than 5%** of respondents considered that the presentation of intermodal information would make them **less likely to use public transport**. The respondents (87% of whom have access to a car) agreed and disagreed in equal numbers to a statement asserting that personalised information about road congestion could tend to promote car usage.

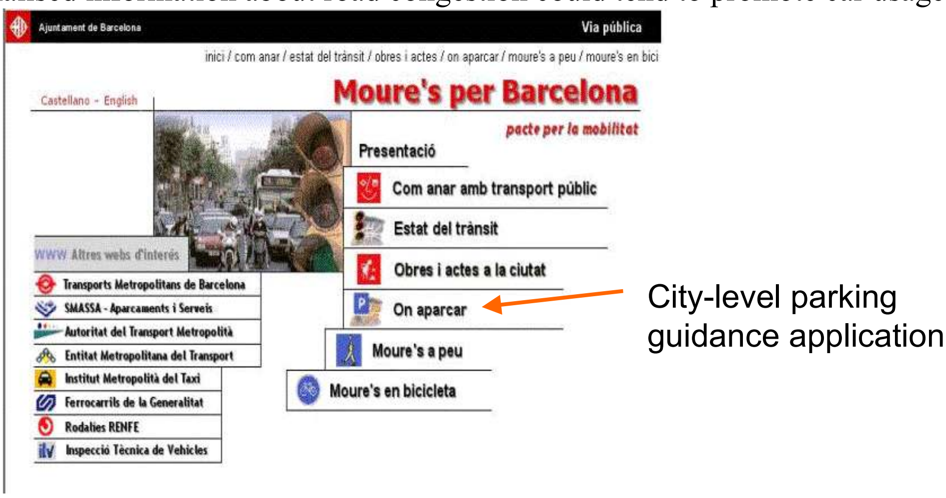


Figure 12 Parking guidance forms part of Barcelona Municipality's mobility home-page

The parking guidance application – the element that captures car travellers' trip-ends – now forms part of the Municpality's award-winning mobility home-page (El Pais, 2001), where it is consulted by 3,500 users per month (IMI; www.bcn.es/estadistiques/).

3.2.3 Improved linkages & connecting services

INTERCEPT has improved the way that travellers connect with public transport. Whilst some of these improvements are reflected in the information systems, other improvements consist of equipment developments and infrastructure implementations - and these cover:

- Park&ride (ticketing)
- Car sharing
- Profile-based taxi dispatching, and
- Ride sharing.

3.2.3.1 Park&ride ticketing

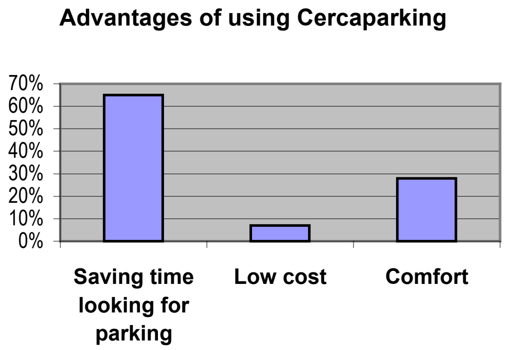


Figure 13 Customers' perceptions of park&ride ticket demonstrated in Barcelona

Time-savings are the main benefit perceived by the respondents (65% of responses) and the appreciation that a guaranteed parking space improves the journey comfort (less anxiety of missing the train connection). Those respondents who did not already use the park&ride ticket were asked if they would use such a service if it were installed at the station closest to their trip origin; 47% stated that they would then use such a service.

3.2.3.2 Car-sharing

There are 46 car-sharing locations in Bremen. INTERCEPT has helped automate the service that the operator – cambio - provides by developments relating to smart cards and the Internet. In addition to the integration with the intermodal trip planner, the Internet developments involved the provision of an on-line booking facility at www.cambio.com. This is proving popular – already handling over 10% of bookings – and enables the provider to save on call-centre costs. The first part of the smart card development concerned an interoperability agreement with the cities of Aachen, Köln and Niedersachsen; this established the platform (more than 6000 members) for intelligent locker developments such as "key-less access" with personal smart card, "instant access" via voice connection at the car-sharing locations, and auto-transmission of trip-data to the booking centre for accounting.

Figure 14 Intelligent lockers provide "instant access" to the Cambio car-sharing scheme in Bremen

3.2.3.3 Profile-based taxi dispatching

Smart cards also play a role in Bremen's plans to promote taxi usage as a complment to public transport (eg: for trips where distance to next PT-stop or CS-station is too long, or where a traveller has special needs). The taxi and the taxi driver have profiles that are stored on the smart card and this information – together with GPS-based location information is used to realise an intelligent taxi-dispatching. Some 475 taxis of the Taxi Ruf operator – plus those of Taxi Bielefeld - have been equipped with the system (faulty GPS installations and provision of a more powerful transmitter being the main problems overcome) and driver training is underway.

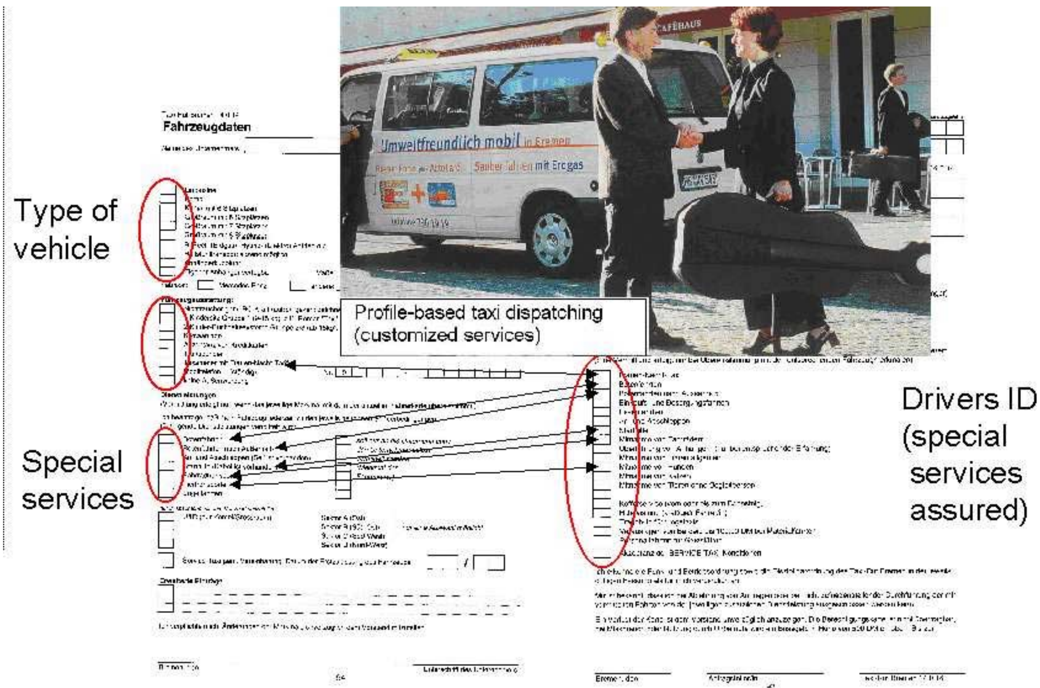


Figure 15 Profile-based taxi dispatching responds to travellers with special needs, Bremen

In March 2001 Taxi Bielefeld – having the smaller taxi fleet – switched the dispatching system to fully automatic mode. The experiences – up to date – verify the intended impacts:

- less agents dealing with driver-communication
- less numbers of empty rides or wrong orders transmitted
- more convenience for dispatching agents and drivers

3.2.3.4 Ride-sharing (car-pooling)

The High Occupancy Lane (HOV) lane installed on the Avon Ring road in Bristol (see Figure 4) provides significant journey time savings for ride sharers (up to 20 minutes in the morning peak hour). This facility was made permanent and extended during the INTERCEPT project. A high level of ride sharing has been monitored on the corridor (30%) this is a high baseline compared to the local average of 80% of solo drivers on a typical corridor. HOV is nationally recognised as an important policy tool in UK Government guidance, and the scheme is one of only two that have so far successfully been put into operation in the UK.

3.2.4 Electronic ticketing

Integrated ticketing within the region of Bremen has been under field test (one bus line plus one tram line, serving one-fifth of the daily transportation of passengers) for electronic ticketing based on the Geldkarte electronic purse - since June 1999. Over a six month period, some 22,843 tickets have been issued – surpassing the target by 24.2%. Surveys with customers show that 81% would like the scheme to be extended to all lines. The standard trialed in Bremen has been agreed for nation-wide standard on electronic ticket for PT ("DF_Fahrschein") by VDV (Association of German Transport Operators), the German Banking Credit Committee (ZKA) and the German Railway (Deutsche Bahn AG).

4. Conclusions & Future Plans

A mix of IT supply companies and local authorities have collaborated to realise the INTERCEPT intermodal tool-box, and this also leads to a variety of proposed lines for exploitation of the results, Table 6.

Title of exploitable result	Category	Partners (result owners) involved
0 Intermodality tool-box	C	BTSA, BCC, FHB
1 Enhanced Internet public transport trip planner	A/C	BTSA (IT expertise) & BCC (local authority)
2 Hybrid (Internet/Intranet) kiosk	A	2.1 BTSA (developer/supplier) 2.2 BCC (authority – concessionaire)
3 Intermodal trip planner 3.1PT + park&ride, cost-based search 3.2 Car-based, time-based search part	 C B/C	 TMB (server-owner) BTSA (IT developer/expertise)
3 Intermodal trip planner 3.3 Multi-modal trip calculation with itp 3.4 Multi-modal mapping in combination with itp (intermodal trip planner)	 C C	 BSAG, mdv BSAG, mdv
4 Park&ride ticketing	A/C	BTSA (IT developer/expertise) & public transport operators with transport planning authority
5 Electronic Ticketing (et)	A/C	BSAG ChipCard specification (open code) accessible for all potential users.
6 Standardised technical platform incl. Chipcard-acceptance between the companies, direct call (location to call-centre) + on-board computers.	A	Cambio, INVERS
7 Www.CambioCar.Com Internet reservation and intermodal tripplanning	A	Cambio
8 Profile-based taxi-dispatching	A/C	Taxi-Ruf Bremen
9 Zone access control with digital video automated enforcement	A/C	BTSA (developer/supplier) & Roads Traffic Authority
10 Applying a hierarchy of tariffs using electronic road user charging equipment	C	Bristol City Council, South Gloucestershire Council, Q-Free ASA

Table 6 Summary of INTERCEPT exploitable results (from TIP – see D91, Annex 2)

Eleven exploitable results are identified in the Technology Implementation Plan (TIP). It has not been always possible to categorise the result into a single category (A= commercial, B=non-exploitable, C=commercially interesting but requiring further exploitation, possibly with other partners). This occurs because of the different perspectives of partners, because of the multiple nature of the tool-box developments, and because elements are at different development stages at different sites. Eight of the results are considered to be fully or partially exploitable as commercial activities. One result is identified as not being exploitable (on-line comparisons of car and public transport travel times could favour car usage - such that this integration should only be considered for controlled segments such as parking subscribers or after further information management). Nine of the results are categorised as requiring further exploitation in future collaborations / projects. Future plans are discussed under four headings to synthesise the lines described in the TIP.

4.1 Successful Configurations of the Intermodality Tool-box

There are many possible ways of developing an intermodality tool-box. The developments realised and the measures demonstrated represent choices that take into account the time and resource constraints of this type of project. Thus, only certain combinations of the tool-box have been demonstrated. The way that the sites have configured the demonstrations to successfully deliver quantified impacts is a common, basic result that provides insights into:

- The effects of different combinations of measures.
- The effects of different measures that are European lead examples (eg: road pricing, and car-sharing) and the different levels of underlying mobility infrastructure (eg: park&ride spaces)
- The importance of the characteristics of sample participants in demonstrations.
- The importance of the geographic coverage of the demonstration.

As such, the practitioner cannot "buy" this overall result "off-the-shelf". Rather, it is an integrative result. S/he has to use it like a "road map". Starting with the Internet trip planner for public transport of her/his city, INTERCEPT offers guidance on how to improve public transport information and realise service linkages and restraint measures so as to make the alternatives to car usage as attractive as possible. (The reported impacts indicate that the inclusion of effective restraint measures can be likened to the "power" in "power tools").

4.2 PUBLIC TRANSPORT -> INTERMODAL TRIP PLANNING

The provision of high-quality public transport trip planning is validated as being a key requirement for intermodal decision-making. Delivering such information via the Internet is considered to be a cost-effective option (compared with call-centres). Exploitation lines concern the extension of coverage (hinterland areas) and enhancements that embed the public transport trip planner within a more intermodal trip planner product (multi-modal mobility home-page), Table 7.

Public transport trip planner:	Implementation	Further development
Barcelona • Internet	Agreement for 20 municipalities	20+ extension under discussion XML-based interchange
Barcelona • Kiosk	Staff usage (TMB IP network) + BTSA's OHNET! Kiosk network	Kiosk-Based Web New interchange standards
Bristol • Internet	City-level trip planner as part of mobility home page	SW Trip Initiative XML-based interchange
Bristol • Kiosk	20 kiosks deployed in city centre configured for trip planner	Increased geographical coverage of kiosks throughout city
Bremen • Internet • Kiosk	Intermodal TP for Bremen (new services in EFA developed in INTERCEPT) Kiosks use the same server structure	Intermodal TP for Bremen region (VBN) integrating foot and bicycle paths plus user-dialogues to influence PT and TP planning

Table 7 Summary of exploitation lines for public transport trip planner applications

The respondents in Barcelona consider the need to include the bus services for the hinterland as being the most important improvement to be made, Figure 16.

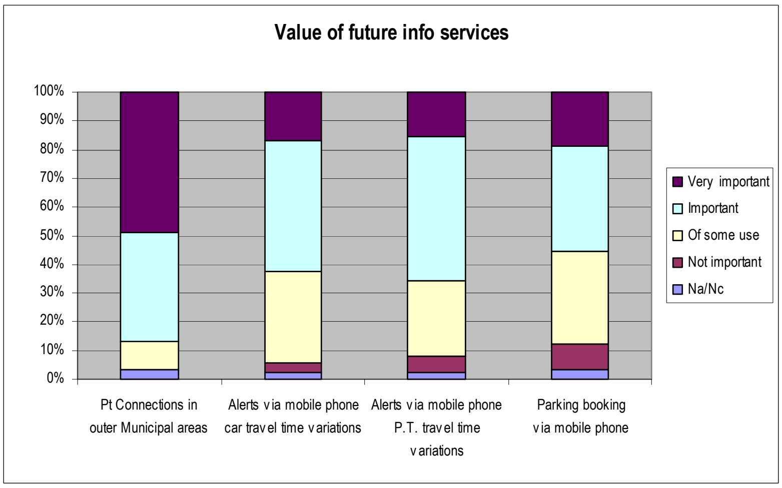


Figure 16 Ratings of possible future service improvements (Barcelona)

An important achievement in this respect is the agreement made in March 2001 between IMI (the Municipal web-master), EMT (planning authority) and TMB (trip planner owner) to extend to application from 11 to 20 municipalities and incorporate all additional bus operators within this area. Figure 17 lists the municipalities and shows other enhancements such as the cookie-based personalisation (the development work has been realised by BTSA). A wider extension is anticipated via a tender to be issued by ATM, the unique planning authority for transport in the metropolitan region – and it is recommended that this incorporates the park&ride search feature of the demonstrated intermodal trip planner.

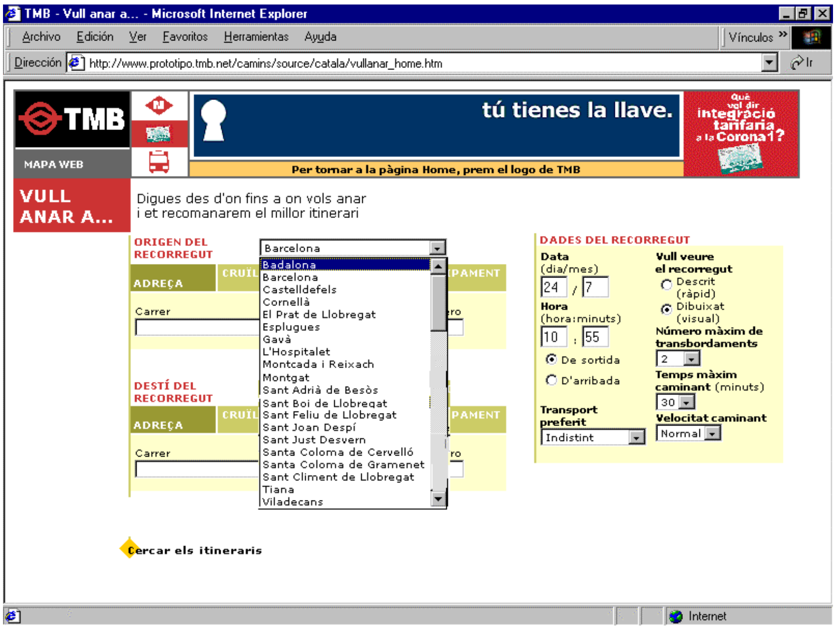


Figure 17 Extension of the Barcelona public transport trip planner (from 11 to 20 municipalities) is already underway (Source: TMB)

Both user and stakeholder feedback highlighted the benefit of additional features for the INTERCEPT journey planner, although interestingly views on the importance of possible enhancements varied. The stakeholders surveyed (representatives of local authorities, transport operators and key interest groups) favoured in particular the development of a multi-modal public transport trip planner including rail information, identification of accessible buses and fare information over a wider geographical area. Although these features were also highly rated by the panel of local residents they were particularly interested in the provision of real time information on congestion levels and public transport delays and cancellations. It is considered that in cost/benefit terms the progression towards a multi-modal trip planner would provide better returns than the provision of real time data; deployment of the Bristol trip planner will occur through links to Council's IT in the Community strategy and other kiosk-based initiatives.

The development of the Bremen trip-planner is a model within the regional transport co-operation. The system of GIS-data for the Bremen trip-planner is co-ordinated with the VBN and the DB-owned regional bus-operator WEB – using the coming standard of the DB (to allow a high standard of integration). At the recent meeting of EFA/DIVA user-group in Linz/Austria in March 2001 experiences gained within INTERCEPT have been presented. It has been agreed that the intermodal concept of the Bremen "version" will be standard for all future trip planning systems represented by the user-group. In April 2001 a regular user and developer meeting was held in Stuttgart discussing the necessary further development and implementation work for making the new features standard - the follow up meeting will be in Mannheim in June continuing this process.

Figure 18 Hybrid kiosks have been installed at metro interchanges and rail parking interchanges (source: BTSA)

The TIP articulates the hybrid (Internet / Intranet) kiosk network that BTSA has developed (exploitation currently based on coin-revenues for internet connection; average pay-back of 3 years), and the company's interest in collaborating with other kiosk suppliers to establish the critical mass required for publicity revenue exploitation (see D9.1).

The product Intermodal Trip Planner (ITP) is well described in the commercial documentation of the IT supply company, mdv, (see www.mentzdv.de/en/produkte/efa.htm). The reader can readily obtain a first impression of how the ITP product is built up from layers of data describing the network offer for each means of travel and the points of interconnection (transition) that enable the traveller to pass from one mode to another

Two contrasting approaches have been adopted in building the demonstrations of ITP at the sites of Bremen and Barcelona. The Bremen approach adopts the public transport operator's perspective to "add in" the parts of other layers that can facilitate improved access to the bus, tram and rail network (namely, taxi-dispatching and car-sharing). The Barcelona approach develops the road network into a parking guidance application and demonstrates how drivers' trip-ends can be used to generate comparative solutions for driving, park&ride and public transport (combinations of rail, metro and bus).

D9.1 describes the inter-connection of mobility operators for Bremen and exploitation plans for Bremen Region, the perspectives for business development in Barcelona, the prospects for transferring the ITP product to other sites, and the possible synergies between ITP development and portals for car-orientated travellers.

One of the issues considered by the IT supply companies was the interconnection of the trip planners of the different sites. It was agreed that XML (eXtended Mark-up Language) techniques offer the best means of doing this. However, the development work was not realised due to the other project commitments. Now, as the authorities initiate work on adding walking and cycling content (NICE, 2000 and Civitas projects) and other linkage services, the need for secure interconnection of servers is expected to be sufficient to justify the programming effort (for regional content integration). The value of the integration of intermodal applications is seen to be more evident to public policy-makers than individual travellers. It is local authorities who will therefore have to support ITP development. Funding should be sufficient such that high-quality (individual search-based) applications are built for the linkage modes.

Integration with car travel info service(s) must be contemplated in the longer term, since these are the potential intermodal travellers - initial guidance is given in D9.1. Although public transport operators are known to be reticent about on-line comparisons with the car, it is recognised that there are advantages:

- intermodal applications will only convince car-orientated travellers to select alternatives if the service offers content that attracts such travellers, and
- The potential for using revenues from car traveller information services to cross-fund ITP developments offers funding possibilities that can accelerate depolyment. (D9.1 presents a model based on personalisation of travel information via mobile and fixed Internet that is estimated to achieve a positive operational cash-flow in Year 4, and a pay-back by Year 8).

4.3 LINKAGE SERVICES

Real alternatives to driving must be available – this has been demonstrated in Barcelona where the number of parking interchanges in the corridors is limited (see Table 2). The TIP identifies the need to interconnect the park&ride ticket product with the new (magnet ticket-based) unified public transport tariffs that will become fully operational at the end of 2001. This offers additional benefits to users (a network product, rather than a point-to-point product), and the opportunity should be taken to increase the supplementary tariffs that achieved a high acceptance in the demonstration.

The Car-Sharing operator Cambio is a result of the former StadtAuto merging with operators in Cologne and Aachen during the life-time of the INTERCEPT project. Cambio has started a joint venture with a partner in Belgium, and further efforts to promote interoperable car-sharing in Europe are led by the IST take-up initiative TOSCA – Technical and Organisational Support for Car-Sharing. ATC Bologna will use the developed telematics technology and the experience gathered in Bremen. Furthermore, the TOSCA follower cities of Strasbourg, Barcelona and Bucharest will benefit from the INTERCEPT experience.

The INTERCEPT project also has been a basis for the MOSES project (Mobility Services for Urban Sustainability). As part of the 5th Framework Programme key action' City of Tomorrow and Cultural Heritage' the MOSES project deals with the further development of Car-Sharing services and the integration into urban development. The MOSES project is co-ordinated by Bremen with the partner sites of Stockholm, London, Walloon region, Genoa, Turin, Palermo and with UITP. These sites plan to start or extend Car-Sharing services. With UITP a more general co-operation of PT and Car-Sharing shall be shaped.

In the upcoming months the co-operation between Taxi Bielefeld and Taxi Ruf Bremen is expected to lead to a full implementation of profile-based taxi dispatching. These operators are in contact with other taxi operators (Taxizentrale Münster e.G, and Taxi-Funk Berlin) to transfer the system developed in INTERCEPT.

4.4 CAR RESTRAINT

The key behavioural changes demonstrated in INTERCEPT reinforce the view that quality alternatives need to be in place prior to the introduction of any road-user charging scheme, both to ensure local acceptability and to achieve the scheme's objectives of reduced car use (through intermodal switching). During the lifetime of the project, the UK Government has passed legislation empowering local authorities to introduce road-user charging. Bristol City Council is one of the authorities leading the initiatives to introduce road-user charging – with the Local Transport Plan clearly establishing that such an implementation must be linked with a package that improves public transport alternatives including the implementation of light rail. Unlike some UK cities, Bristol supports the use of telematics solutions for road-user charging. The Council will be utilising the INTERCEPT results for the development of the road user charging scheme outlined in the Local Transport Plan and linked to the EC supported PROGRESS project.

Progress has also been made in extending the implementation of "SICAV" access control technology in Barcelona (gates installed in the city have increased from 30 to 50) during the project. Product certification achieved during the project will assist in securing distribution agreements for EU and accession countries - Deliverables.6.1 and 9.1 provide further details. Interestingly, the successful demonstration of automated detection of illegal entries based on digital video (estimated at 20 illegal entries per day per main entry gate) has reduced the Municipal concerns about this type of infringement. With increased confidence in video as an enforcement technology, the Municipality has awarded a pilot project for red-light enforcement (at 7 junctions) to BTSA in March of this year. The Municipality is keen to demonstrate to citizens that their initiative to enforce infringements is motivated by safety interests; a red-light scheme is expected to achieve 50% reduction in accidents based on results achieved elsewhere (D9.1). The application of automated enforcment for access control is – nonetheless – of interest to the Municipality in terms of piloting a "clean zone" concept as part of the Civitas project MIRACLES (under such scheme, the automated enforcement would be linked to the promotion of low-emission goods deliveries).

4.5 TOWARD A NETWORK-WIDE IMPLEMENTATION

For European cities, car dependence is higher, and the public transport offer *less* intensive, for the hinterland areas. It follows that the application of the intermodal tool-box needs to be applied at the metropolitan or regional level for it to have greatest effect. INTERCEPT has realised demonstrations that include parts of the site hinterlands – but only partially. Nevertheless, the results clearly show that it is at the regional level that operators and authorities need to interconnect their Internet-based tool-box offer. The partners recognise that the tool-box has been only partially built. Several of the exploitation plans and collaborations sought in the TIP are aimed at involving organisations *at the demonstration sites* so as to improve the tool-box development at the *regional* level.

5. Contact Details

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APPENDIX A: COVER PAGES OF DELIVERABLES

Transport Telematics & Transport RTD Programmes

INTERCEPT Project (TR 5004)

INTERMODAL **C**ONCEPTS IN **E**UROPEAN **P**ASSENGER **T**RANSPORT
Barcelona*Bremen*Bristol*Alkmaar

DELIVERABLE 3.1:

REPORT ON USER NEEDS (& TOOL-BOX SPECIFICATION)

Version 3.1

Status: Final version for delivery

Authors: S. Hayes, P.Egea, J-M. Morales & E. Segarra, BTSA
A. Lieberum & S.Rauner, ecolo
T. Parker, TTR
R. Belderbos, THOLE

Pages: 83

DEL/BTSA/WP 03/Del.V.3.1/9-99

September 1999

Transport Telematics & Transport RTD Programmes

INTERCEPT Project (TR 5004)

INTERMODAL **C**ONCEPTS IN **E**UROPEAN **P**ASSENGER **T**RANSPORT

Barcelona*Bremen*Bristol*Alkmaar

DELIVERABLE 3.2:

REPORT ON STATE-OF-THE-ART OVERVIEW AND INTERCEPT DEVELOPMENTS

Version 1.2

Status: Final

Authors: S. Hayes, P. Egea, BTSA
S. Rauner, ecolo
Tom Parker, TTR

Pages: 83 + 10

DEL/BTSA/WP 03/Del.3.2V.1.2/9-99

September 1999

Transport Telematics & Transport RTD Programmes

INTERCEPT Project (TR 5004)

INTERMODAL **C**ONCEPTS IN **E**UROPEAN **P**ASSENGER **T**RANSPORT

Barcelona*Bremen*Bristol*Alkmaar

DELIVERABLE D4.1

VALIDATION PLAN

Version 4.5

Status: Final version for delivery to EC

Authors: Guy Hitchcock (TTR)
Tom Parker (TTR, Bristol)
Simon Hayes (BTSA, Barcelona)
Andreas Lieberum (Ecolo, Bremen)
Lars Mosch (KPC, Alkmaar)

DEL/TTR/WP 04/D4.1/V4.5/10-99

October 1999

Transport Telematics & Transport RTD Programmes

INTERCEPT Project (TR 5004)

INTERMODAL **C**ONCEPTS IN **E**UROPEAN **P**ASSENGER **T**RANSPORT

Barcelona*Bremen*Bristol*Alkmaar

DELIVERABLE 5.1:

REPORT ON CONCEPTS / SYSTEMS ARCHITECTURE OF DEMONSTRATORS

Version 2.0

Status: Restricted, Final

Authors:
P. Davis, BCC,
H. Mentz, Mdv,
T. Parker, TTR,
R. Beldenbros, THOLE,
S. Hayes, J.M. Morales, P. Egea, A. López, BTSA

Pages: 88

DEL/BCC/WP 05/Del.5.1 V.1.5/5-2000

May 2000

Transport Telematics & Transport RTD Programmes

INTERCEPT Project (TR 5004)

INTERMODAL **C**ONCEPTS IN **E**UROPEAN **P**ASSENGER **T**RANSPORT

Barcelona*Bremen*Bristol*Alkmaar

DELIVERABLE 6.1:

VERIFICATION REPORT

Version 2.0

Status: Final (with draft Peer Review)

Authors:
J-M. Morales, S. Hayes, P. Egea, J. Crespo, M. Portavella, BTSA
H.Mentz, T, Lohbronner, Mdv
, Q-Free
S. Rauner, ecolo
P. Davis, BCC

Pages: 110

DEL/BTSA/WP 06/Del.6.1v2.0/11-2000

November 2000

Transport Telematics & Transport RTD Programmes

INTERCEPT Project (TR 5004)

INTERMODAL **C**ONCEPTS IN **E**UROPEAN **P**ASSENGER **T**RANSPORT

Barcelona*Bremen*Bristol*Alkmaar

DELIVERABLE 7.1:

IMPLEMENTED DEMONSTRATORS INCLUDING TRANSFER STUDIES

Version 3.1

Status: Final version for delivery

Authors: Rauner, Lieberaum ecolo
Davis, Smith BCC
Parker TTR
Hayes, Segarra, Morales BTSA

Pages: 54 (excluding annexes)

DEL/FHB-BTSA/WP 07/Del.7.1v31/04-2001

April 2001

Transport Telematics & Transport RTD Programmes

INTERCEPT Project (TR 5004)

INTERMODAL **C**ONCEPTS IN **E**UROPEAN **P**ASSENGER **T**RANSPORT

Barcelona*Bremen*Bristol*Alkmaar

DELIVERABLE D8.1

FINAL VALIDATION REPORT

Version 2.0

Status: Final (Post Project Final Review)

Authors:
Guy Hitchcock, Tom Parker, Mark Glaysher, Natalie Grohmann, TTR
L. Inglada, O. Gascon, J-M. Morales, S. Hayes, E.Segarra, BTSA
Pete Davis, Lucy Smith, BCC
Henning Koch, Uni-Bremen

DEL/TTR/WP08/D8.1v2.0

July 2001

Transport Telematics & Transport RTD Programmes

INTERCEPT Project (TR 5004)

INTERMODAL **C**ONCEPTS IN **E**UROPEAN **P**ASSENGER **T**RANSPORT

Barcelona*Bremen*Bristol*Alkmaar

DELIVERABLE 9.1:

EXPLOITATION PLAN REPORT (incorporating TECHNOLOGY IMPLEMENTATION PLAN at Annex 2)

Version 1.5

Status: Deliverable Draft (Final for delivery to EC)

Authors: Angusto, Hayes, Montllor, BTSA
Rauner, ecolo
Davis, BCC
Parker, TTR

DEL/BTSA/WP 09/Del.V.1.5/7-2001

July 2001

APPENDIX B DISSEMINATION MATERIALS

to be added

APPENDIX C – CONTRACT MANAGEMENT INFORMATION

CONTRACT AMENDMENTS

INTERCEPT was realised with one full amendment to the contract, followed by a letter amendment. Both amendements extended the time duration of the project by 3 months. Overall the project was completed in 30 months. Under Amendment 1, resources were transferred from the original IT supply partners and the Alkmaar site to the Bremen site, enabling new IT sub-contractors to join the project.

PARTNERS

Following Amendment 1, the Consortium was composed of the following partners:

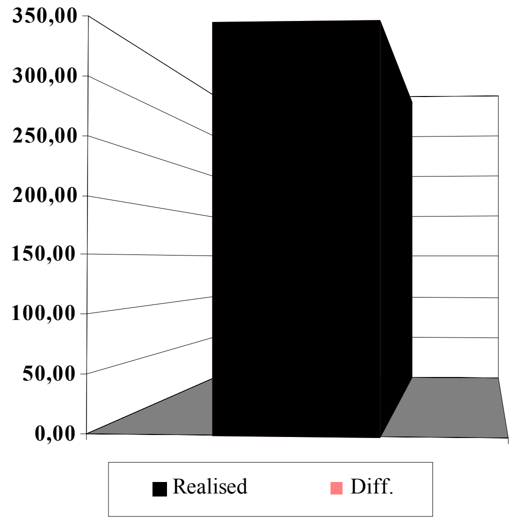
Co-ordinator	C1: Barcelona Tecnologia S.A. (BTSA), C2: Bristol City Council (BCC), C3: Freie Hansestadt Bremen (FHB), C4: Thole Parkeersystemen B.V Enshede Holland (THOLE) A1.1: Societat Municipal d'Aparcaments i Serveis, S.A. (SMASSA) A2.1 South Gloucestershire City Council (SGC) A2.2 First Bristol (FB) S1.2, S2.1 Transport and Travel Research (TTR) A3.1 cambio GmbH A3.2 Taxi-Ruf Bremen Association A3.3 Bremern Straßenbahn AG (BSAG) S3.1 Invers GmbH S3.2 Atron Electronic GmbH S3.3 Höft & Wessels AG S3.4 Scheidt & Bachmann GmbH S3.5 Ecolo, Ecology and Communication GbR S3.6 Fa. Gefos S3.7 Fa. Heedfeld S3.8 Mentz Datenverarbeitung GmbH (mdv) S3.9 Verkehrsverbund Bremen Niedersachsen S 3.10 Weser Ems Busverkehr GmbH S 3.11 University of Bremen

BUDGET

EC funding was 1.5 M euro, representing 49% of the total budget.

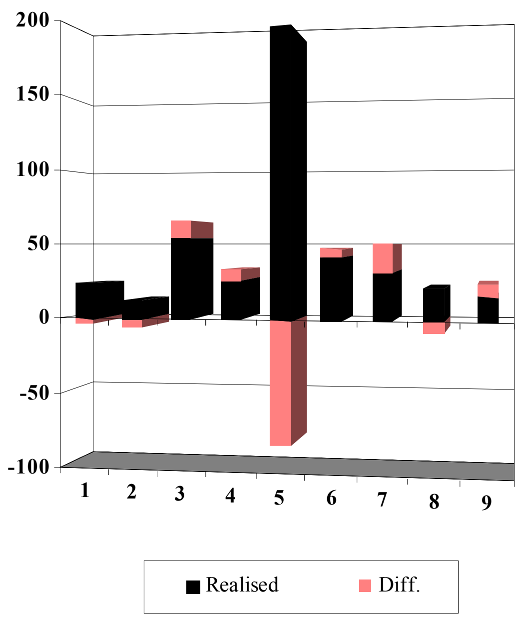
Overall, according to EC Cost Statements and Reporting, the project has been concluded 12.6% over budget (this excludes reporting costs in the two months after contract termination), see Figures below.

OVERALL



Up to May'01	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	Total
Realised	*23,4*	*13,05*	*54,25*	*26,2*	*192,15*	*41,55*	*31,85*	*21,35*	*16,25*	*420,05*
Planned	*20,6*	*7,9*	*65,04*	*33,04*	*110,46*	*46,86*	*49,83*	*14,95*	*24,42*	*373,09*
Diff.	***-2,8***	***-5,15***	***10,79***	***6,8***	***-81,69***	***5,307***	***17,98***	***-6,4***	***8,168***	***-46,96***

By WPs



To the main overspend on demonstration in WP5, there are smaller overspends on WP2 (external activities) and WP8 (Validation). The former is due to the rebuilding of the web-site (on top of previous workshops and publication activity). The latter is due to the effort required to obtain survey responses, and to integrate the work of the three sites into a common framework.

The overspend for WP5 was reported in the 2000 Review and in a Supplementary Report produced following the Review 2000. Overspends during the last period of the project were reported in the Annual Project Review 2001 report.

WORK AT THE ALKMAAR SITE

The objective for the Alkmaar site was to geographically extend the existing (decentralised) zone access control scheme, and to demonstrate the benefits of operation based upon a centralised system (improvements in fault diagnosis, maintenance and handling of special cases requesting access).

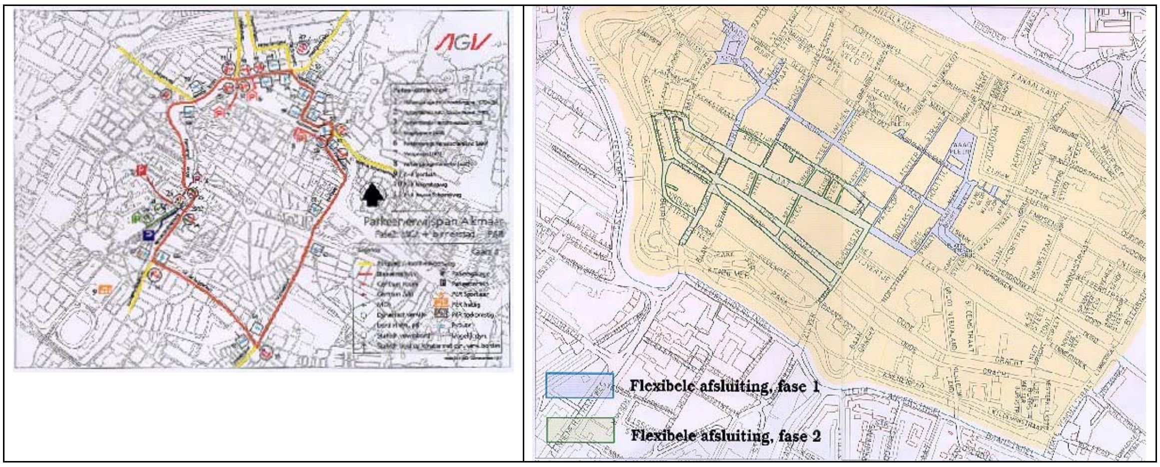


Figure showing Zone Access Control in Alkmaar; existing roadside equipment (left) and the proposed extension of the controlled zone (right)

Surveys were carried out at various points to determine the volume of vehicles, the distribution of vehicle entries across the day, and to determine the purpose for which the vehicles require entry. The surveys quantified the total average daily entry flow (some 4,000 vehicles per day) and estimated the entry level after implementation to be some 1,000 entries per day. The preparatory work quantified a five-fold increase in the number of card-holders (from 100 cards with the existing decentralised system to 1,000 card-holders). This work formed the basis for choosing a centralised system (able to facilitate an automated maintenance of gates and card white lists).

This work was reported in Deliverable 3.1. An initial plan for validation was also drawn up and was presented in Deliverable 4.1.

The Municipality had to negotiate the timetable of access rules with new sets of interest groups and traders. The discussions identified the need for new parking rules for the controlled border area (on-street parking in the centre was only allowed at specific spaces – in the extended area, only residents were to be allowed to park on-street). Discussions then took place with the Municipality to determine who would be responsible for cards management (dealing with claims from residents / delivery operators) and to decide how the control centre would be integrated into the existing centre where traffic police manage off-street car parking. Alkmaar Municipality decided to accommodate a number of parking related matters in a Parking Department, established in early 2000. These tasks included the management and maintenance of the flexible barriers in the town centre, and hence required additional systems integration work to be carried out.

Development and implementation work was then carried out along two lines:

i) improvements were introduced to the gates of the **original** zone,
ii) THOLE collaborated with Siemens and the Municipality to integrate the software in the control centre such that the bollard management system could be operated using the same system used to control the on-street and off-street parking systems.

Improvements to the original zone

The existing control system was relatively simple. Following review, and in order to comply with national requirements concerning the logging of transactions in case of incidents with automatically-controlled bollards, the following technical improvements were made:

1. New VRI (Verkeers Regel Installatie- Traffic Control Installation) terminals were installed at Canadian Square entry, and ISDN-based communications were established with the control centre, (independent software supplying online status reports).
2. Coordination by the emergency services was established without the intervention of the parking incident room.
3. Signal light fixtures with reduced height were installed.

The first two of the faxed circuit diagrams relate to the improvements at terminals to achieve improved logging and centralised control (see figures 1, 2 below).

In parallel with the upgrading of the original zone equipment, technical review, a lot of time was dedicated to defining the area for the extension of the system. THOLE supported the Municipality in determining the technical consequences of the negotiations related to the public consultation, and in realising the communication campaign with residents of the zone that was finally agreed for (de Laat zone – see Deliverable 5.1, Annex 4).

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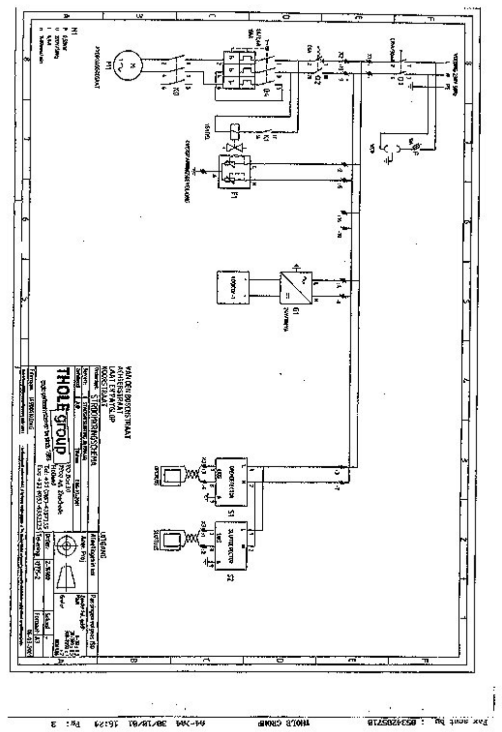
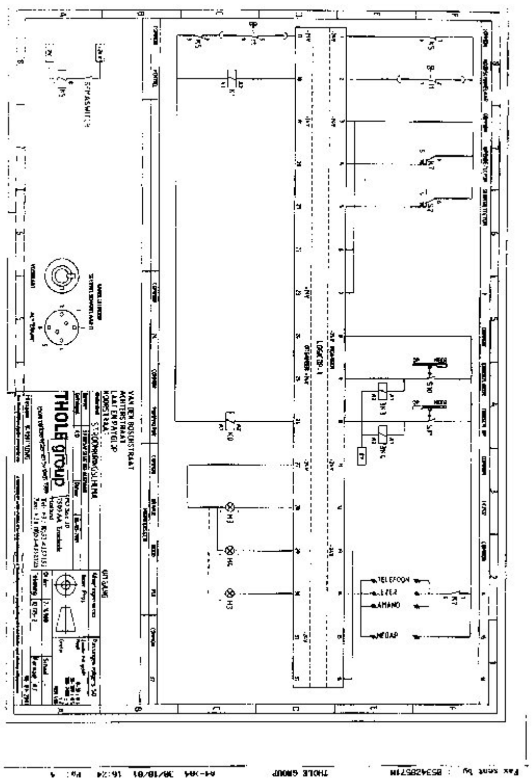


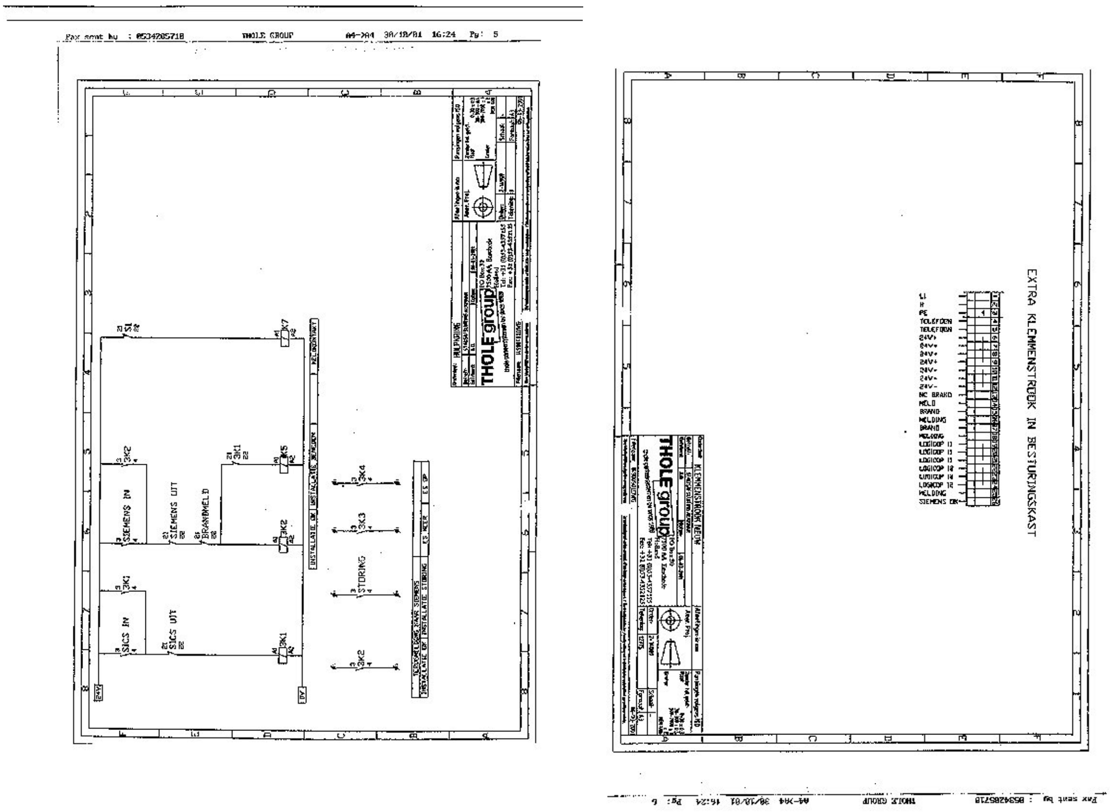


Figures 1 and 2 Circuit Diagrams for centralised control gates

Systems integration

The parking control systems were operating using a system suplied by Siemens. The municipality instructed THOLE to collaborate with Siemens to realise an initial integration of the off-street parking and access control systems (based upon the Canadian Square installation). This initial integration was successfuly completed (the Municipality was able to see the improvements of the centralised operation).

The latter two of the faxed circuit diagrams relate to the integration achieved with the Siemens system (see figures below)



Figures 3 and 4 Circuit diagrams for integration of access management and parking control software

The supplier, THOLE, could not complete the full demonstration involving the extension of the zone due to complications during the tender process, and due to the explosion of a fireworks factory close to the company's base in Enschede, as was reported in the Supplementary Report, December 2000). In spite of the difficulties, the installation that was realised is now in operation and working well.

DELIVERABLES

Although the EC funding was not increased during the lifetime of the project, additional documentation was required, namely:

Deliverable 3.2 State-of-the-art review
Deliverable 9.2 Recommendations Report

This documentation was additional to the original list of deliverables:

Reference number	Title	Date due (acc. Amdt 1, & letter amdt))	Date submitted
Del.3.1	Report on Users' Needs	Mar '99	(v2.2) 12-04-99 (v3.2) 22-09-99
Del. 3.2	Report on State-of-the-Art Overview & INTERCEPT developments	Sept. '99	(v1.2) 22-09-99
Del. 4.1	Validation Plan	May '99 Sept '99	(v0.4) 21-05-99 (v4.5) 29-10-99
Del. 5.1	Concepts & Systems Architecture	July '00	(v2.0) 05-05-00
Del. 6.1	Verification report	July '00	(v2.0) 04-12-00
Del. 7.1	Implemented demonstrators including Transfer Studies	Feb. '01	(v3.1) 27-4-01
Del. 8.1	Final Validation Report	Apr '01	(v1.0) 15-05-01 (v2.0) 18-07-01
Del. 9.1	Exploitation Plan	May '01	(v1.5) 18-07-01
Del. 9.2	Recommendations Report	Sept.'01	(v.1.0)