Project title (NL): Voor consumenten bruikbare mobiele kaarten op de juiste schaal

Project title (UK): Usable (and well scaled) mobile maps for consumers

Management summary

Today we see a huge increase of the use of geo-information in mobile devices, illustrating the need of society both in the professional and consumer markets. All current solutions are based on static copies that are stored on the mobile device. This makes dynamically adapting the map to new information and to the changing circumstances of the user impossible. With the availability of high bandwidth wireless connections (such as UMTS) better, more dynamic, solutions are possible: The server generates a proper, up-to-date map of the region of interest at the right level of detail for display and adjusted to the needs of the user. For a mass market (consumers of mobile maps) the human factors aspect is very important. The currently available mobile maps solutions still have insufficient user-interfaces. Extremely important is the issue of context as the user gets 'lost' very easily on the small mobile displays when zooming and panning. Based on a selection of use cases (navigation, tourist support, etc.), User-Centered Design techniques will be applied to develop small prototypes / simulations and the interaction and the quality of the maps in these prototypes / simulations will be evaluated.

Leading party

Organization:	TU Delft – Onderzoeksinstituut OTB,
Based in:	Delft (The Netherlands)
Name, title and initials of officer with authority to sign:	prof. dr. P.J. Boelhouwer, managing director OTB research institute
Legal form:	University
Chamber of Commerce no.:	- registered in: -
Leading party is (enter x as applicable):	X registered for VAT 0 exempt from VAT
Bank account number:	54.4385.543
Bank:	ABN-AMRO

Contact person

Name: Peter van Oosterom

Project consortium

State below the names of all consortium partners and their role as lender/implementer/user

1.	TU Delft - OTB	lender/implementer
2.	ITC	lender/implementer
3.	TNO Defense, Security and Safety	lender/implementer
4.	ESRI	lender/implementer/user
5.	LaserScan	lender/implementer/user
6.	Municipality of Amsterdam	lender/user
7.	ANWB	lender/user
8.	Mobile hardware company (to be selected)	lender/implementer/user

Social relevance

State which obstacles and/or challenges in social and/or economic issues are being addressed.
Today, we see a huge increase of the use of mobile maps (mobile phones, car navigation systems, pda's, gps receivers with maps etc.), illustrating the need of society both in the professional and consumer markets. All current solutions are based on static copies of maps at the client side. This has several disadvantages: the copies are limited in size (e.g. only a specific region, and not the whole world), limited in up-to-dateness (the date the copy was produced), limited in the available scales (level of details, at best there are different copies for different scales) and limited with respect to integrating maps (geo-information) from multiple sources. In summary, the current mobile map solutions are not dynamic and the user interfaces are insufficient.

Provide details of the social and/or economic benefits of executing the project.
Emerging mobile communication networks enable scenarios in which the geo-information does not need to reside at the client, but can also be dynamically obtained from the original source (a server in the network). Also, multiple sources can be dynamically combined with this architecture. This will enable the development of more mobile applications, which are based on up-to-date geo-information, presented at the right level of detail (scale). These applications have the potential to open up the mass market in the use of geo-information (e.g. tourism).

Provide arguments for why the project cannot be carried out without a Bsik grant.
Until today no variable scale system does exits despite the obvious advantages for the user (including human factors aspects, such as overview maintenance, context-driven presentation and readability). Some initial theoretic ideas have been described ('Variable scale topological data structures suitable for progressive data transfer: the GAP-face tree and GAP-edge forest' by Peter van Oosterom in Cartography and Geographic Information Science, Vol. 32, No. 4, 2005, pp. 331-346), but this is still initial research and no single organization has been able to realize such a solution. A Bsik RGI supported consortium of leading research and development organizations, together with a number of end user organizations and human factors specialists, could force a breakthrough and realize prototypes of systems with truly dynamic variable scale mobile maps.

State how the research strategy takes account of the requirements imposed by the application area on the envisaged knowledge and technology.
The whole research project is driven by a number of use cases. The project starts with detailed analyses of these use cases. The two categories of use cases will now be described in a little more detail:

Use case 1 'service to citizens': The municipality of Amsterdam maintains large sets of geo-information for the benefit of their citizens (e.g. current addresses and topographic maps, but also future plans of the city development, location of all kinds of government and commercial facilities, entertainment, tourist attractions). The first use case is aimed at the citizens to open up the huge treasures of (geo-)information by offering an advanced, attractive and effective mobile applications; an specific example now follows.
Within the Municipality of Amsterdam the department of "Stadstoezicht" is responsible for the surveillance for the parking licenses in the city districts. Amsterdam is covered by different parking zones. Each parking zone corresponds with different parking rates and a lot of exceptions for special areas (e.g. shopping streets), days (e.g. Sunday) and time-periods (e.g. market-days or shopping-nights). The information of parking areas is displayed

at street corners on road signs and parking ticket machines. The department of Stadstoezicht plans to introduce the provision short time parking licenses by telephone. A car driver supplies a parking-provider his license plate number, the parking area and the time he intends to park. Also by supplying a nearby address the parking zone can be determined automatically. In a central database is registered that the vehicle has a parking license for this specific period and for this specific area. A new opportunity for the driver is to indicate the position of the car on a map on his mobile device (telephone, PDA, TomTom) and to determine in which parking zone the parking lot is located. Furthermore he can be supplied with information about the parking zone boundaries and also for instance with the information about cheaper parking areas in the neighborhood. For this application city maps with a wide range of scalability are essential in which detailed large scale map, showing site details (e.g. site of the street and the parking lots), is combined with small scale maps.

Use case 2 ‘mobile tourist information’: The ANWB is the leading Dutch publisher of tourist information in the Netherlands. Examples of publications are city guides, hotel/restaurant directories and street guides both on print and the Internet. Although print publications are still important, the ANWB envisions a strong growth of the use of mobile devices for tourist information. This is especially related to the expectation that future mobile devices will have localization capabilities available (e.g. GPS). Also the possibility of mobile devices to publish actual (real-time) tourist/traffic information on a map is expected to lead to intensive use of the medium for this kind of information.
The ANWB is already active in the market for mobile publications with a mobile Internet site published a.o. via i-mode, Vodafone Live! Current experiences with mapping software are disappointing. The ANWB is therefore looking for better solutions that among other things resemble the experience of using a printed map. Important factors for this experience are seamless and rapid zooming and panning. In order to publish real-time tourist information it is also essential that the foreseen solution is based on a client-server environment.
The ANWB supports several categories of tourists (pedestrians in urban or nature environments, cyclists, car drivers, boats, etc.), with dynamic access to geo-information: the traveling infrastructure network (including up-to-date information of the status: available/closed, busy/quiet), relevant landmarks (and related descriptive information), navigation support to tourist destination or route, etc.

For both use cases a number of different geo-information sources have to be combined. Further, the user wants to work at different levels of detail: first an overview of the environment, next a more detailed representation of a selected area and finally, if needed, all available geo-information. Due to the limited capabilities of the displays of the mobile devices, this ‘switching’ between levels of detail is very important. Current mobile user interfaces do not provide easy navigation within and between such layers and hardly support the maintenance of the user’s situation awareness.

Demonstrate that the project objectives are supported by those with a demand for the knowledge, or end-users.
The two consortium partners, the municipality of Amsterdam and the ANWB, represent two huge categories of end-users: citizens and tourists. In addition ESRI, LaserScan, and the foreseen mobile hardware company (to be selected) is interested in this mobile map market only because it means business for them (that is selling their software and devices to users). Without a belief in this market these companies would not invest (and participate in this project). The specific use cases make the demands of this huge future market more tangible.

If the project is a continuation of earlier projects: demonstrate the innovative component of the extension.
The project could not be classified as an extension of earlier projects, although it is related to several other projects. See the section 'Securing knowledge and communication' describing these relationships in more detail.

Demonstrate how the results of this project can be generalized for use in other situations
The project tries to find solutions for multiple/vario-scale representations of geographic information and interaction with the consumers via mobile devices with context-aware, easy to use, interfaces. Clearly, the 'final' solution for the generalization problem (multiple-scale issue) will be hard to obtain (as many researchers all over the world have been working on this problem for several decades). However, also partial solutions or improvements for the generalization problem will be beneficial for nearly all GIS applications (and not only the mobile ones). The obtained results will not only be crucial for the success for the use cases of the municipality of Amsterdam and the ANWB, but also for all other kinds of mobile 'consumer GIS' applications. In fact, also mobile 'professional GIS' will benefit for the improved support of variable scales and a better user interface.

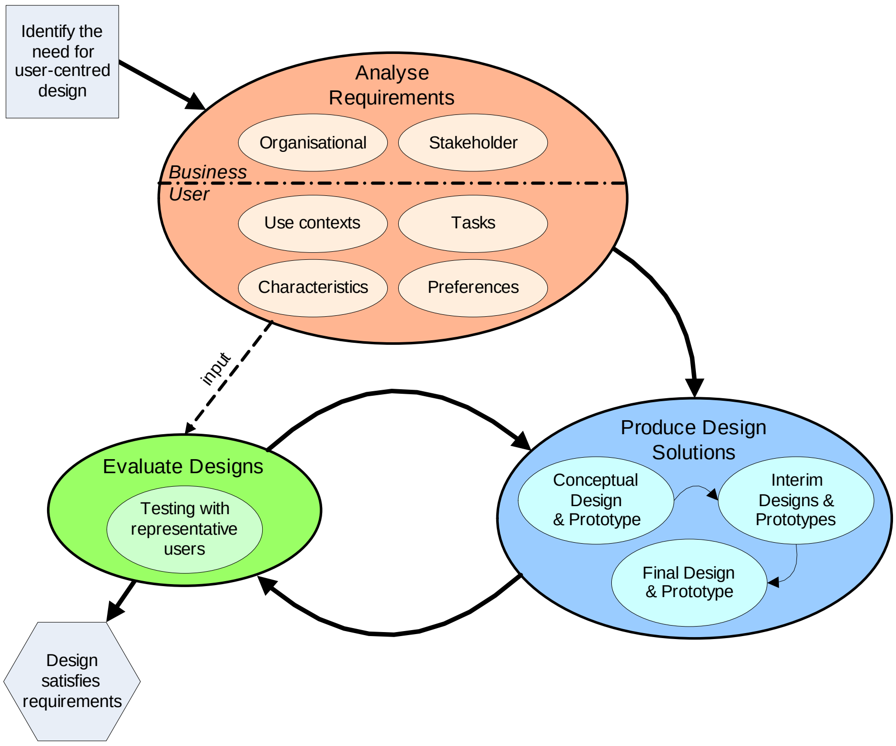
Scientific quality

State which scientific issues the project addresses
Two major scientific challenges lie ahead for this project. The first one is related to automatic generalization, a 'classic problem' in geo-information visualization, which has been solved only partly. Also specific conditions apply for this generalization, making it even more difficult: it should be dynamic (that is only the most detailed representation is maintained and all other requested representations are dynamically derived in an efficient manner) and suitable for progressive transfer (sending additional details to the client, which can be used to refine the initial more coarse representations). The second large challenge of this project is related to the human factors aspect of mobile applications. Working with geo-information is not the primary task of the user: it is a 'secondary' task supporting the primary goals of the user. This means that the user can only pay limited attention to the mobile device as the primary task will require most attention. Further, our intended users are not geo-information specialists, and will show a large diversity in capabilities and needs for the usage of geo-information in mobile settings. The challenge is to dynamically tailor the human-computer interaction to the user and momentary usage context; e.g. allowing quick access to specific details and supporting adequate browsing behavior when needed. Personalization is a new possibility to improve the accessibility of the mobile services for a diversity of users.

Summarize the state of the art in the discipline underlying the project.
Partial solutions are available for the two main challenges (1. multi-scale/generalization and 2. usable mobile map interface/adaptive context). However, these are not sufficient and research is on going. Further, with respect to progressive transfer in a server-client communication good solutions are available for raster maps, but not for vector maps.

Provide arguments for the innovative content of the envisaged technology and/or scientific research.+ Provide arguments for selecting the given R&D approach rather than alternatives. + State the extent to which the selected approach will lead to the development of the envisaged knowledge and/or technology and/or skills.
The illustration below shows the nature of the user-centred design process that will be executed for both use cases. Illustration taken from C.P.J.M. van Elzakker & K. Wealands, 2006 (forthcoming), Use and Users of Multimedia Cartography. In: W. Cartwright; M.P.

Peterson & G. Gartner (editors), Multimedia Cartography Edition 2. Chapter 33. Berlin etc.: Springer Verlag.:



The intention is to support the growing number of mobile GI-applications with effective level of detail (lod) visualizations in a connected (wireless internet, e.g. UMTS) client-server setting. At the server side there should be support for producing the information according to the requested specifications (based on task analysis) and at the requested level of detail (before transmitting this to the client, probably via GML). The principle should also be based on progressive transfer. It could very well be that one of the project results is that the current standard OGC/ISO protocols (such as WFS) have to be extended in order to deal with the lod aspects. The progressive transfer/generalization approach has the following advantages:

- user gets very quickly a rough representation (and this is refined until the optimal level is reached for the given lod/display)
- when the users zooms in, additional detail is sent (and available information is re-used and does not have to be sent again)

State the contribution made by the project to RGI's research ambitions.
See section ‘Contribution to RGI objectives’ and Appendix 6 Senter milestones.

Indicate whether and, if so, how the project is compatible with European research programmes, such as the EU's sixth framework programme.
The directive of the European Parliament and the Council establishing an infrastructure for spatial information in the Community (Inspire; see http://www.ec-gis.org/inspire/) {SEC(2004) 980} indicates that for many geo-information themes multi-scale (several level of details) are required. Artcole 13.3 states ‘The implementing rules shall be designed to

ensure consistency as between items of information which refer to the same location or between items of information which refer to the same object represented at different scales.' It is still unclear how this can be realized within Inspire. Therefore the result of this project may be contributed to Inspire.
The generalization (multi-scale) aspect of this project is related to the European AGENT project (Esprit LTR/24939) and it's successors. Since the AGENT project finished Laser-Scan has led a consortium of National Mapping Agencies (known as Magnet and comprising NGI Belgium, IGN France, KMS Denmark and OSGB) in refining the algorithms and architecture. Further refinement has taken place with the AdV project in Germany where a 1:10k ATKIS data model has been generalized to 1:50k. This has led to the distinction between model generalization and cartographic (or visualization) generalization. In model generalization the emphasis is on reproducibility and typical processing times are measured in days for a whole country. This represents a major advance over weeks or months required in the current process flow. The mobile location consumer paradigm will require an alternative framework to access data dynamically based on context.
With respect to the mobile use of geo-information, this project will use the results from the European project Geospatial info-mobility service by real-time data-integration and generalization (GiMoDig, see http://gimodig.fgi.fi/), but now with strong focus on consumer applications and server-client progressive refinement approaches. Therefore, this implies a larger 'human factors' aspect (User-Centered Design, task analysis) in the research, as shown in the diagram above.

Indicate whether and, if so, how you cooperate with international partners or use international databases.
Besides the cooperation mentioned above (Inspire, Magnet en GiMoDig organizations) and the international partner within the consortium (LaserScan and the mobile hardware company, to be selected) other intensive cooperation's are foreseen. An example of this is Oracle, as this is most likely one of the server platforms within the project. Good working contacts with Oracle do exist in the project RGI-011 (3D topography).

Plan of action

Objective: Describe the project objectives and state the scope of the project
Mobile devices (such as pda's, mobile phones, etc.) are perfect test cases for generalization as the displays are usually quite limited (and require very extreme generalization in combination with interaction, zoom-in/out, switch layers on/off, query for thematic attributes of selected objects, etc), especially for consumer applications. This project belongs half to the theme 'Infrastructure' (providing solutions for dynamic, up-to-date, multi-scale geo-information server solutions) and half to the theme 'Consumer GIS' (providing consumers with usable, well-scale mobile maps).

Activities and division of tasks: summarize the activities to be performed and show how the activities are divided among the members of the project team. + Planning and phasing: present a clear plan stating at least the following: commencement date, most important milestones, go/no go decision points, the critical path, delivery dates of intermediate and final results and total elapsed time. The minimum planning detail is quarters per calendar year. + SMART result (SMART: Specific, Measurable, Acceptable, Realistic, Time-framed). Summarize all intermediate and final results and tangible deliverables to be produced during the life of the project. It is important that the emphasis is on results (output, nouns) and not on activities (input, verbs).
The project will be executed from 2nd quarter 2006 until the end of 2008 (2 years, 9 months). There will be two main researchers: one full time post-doc (focus on multi-scale technology

aspects) and one half-time researcher (focusing on the usability aspects). In addition, there will be several staff members (of the different project partners) involved: delivering their expertise to the project in an effective manner (depending on the role this could be use cases, technology, research, test environments, etc.).

In the overview below the *deliverables are in italic*, the required capacity is indicated for every partner is days, and the partner mentioned in bold is the work package leader. All work packages are more or less sequential (with limited overlap) with exception of work package 0 (management and coordination) which is a more or less a continuous activity (in parallel with the other work packages). The project is organized in a number of work packages (phases) following a sound, iterative human-centered design methodology (incorporating Universal Accessibility approaches):

WP 0: Management and coordination (month 4, 2006 – 12, 2008)
- coordination of all project activities, *set up website*
- organization of meetings, incl. *reports and minutes* (internal and external)
- progress control
- tuning between packages
- providing the central administration
- contact point (*status reports and financial overview*) between the project and the program office of RGI.

Capacity: ITC (10), TNO (10), A'dam (0), ANWB (0), ESRI (0), LS (0), HW (0), **TUD** (70)

WP 1 'preparation' (month 4-9, 2006)
- user, task, context and use case analyses
- analyse business and user requirements for both use cases
- analyse and describe in *report (with UML diagrams)* use contexts, tasks and user characteristics and preferences with respect to mobile maps and the required lod/scale
- functional requirements
- *report with user requirements* (incl. the crucial human factors aspects)
- study relevant literature (*report*)
- investigate available technology (*report*)
- complete consortium with hardware partner(s)
- present results in *seminar*
- produce initial *scientific paper* and *professional paper* and *public paper*

Capacity: ITC (25), **TNO** (87), A'dam (15), ANWB (15), ESRI (10), LS (3), HW (8), TUD (80)

WP 2 'prototype development' (month 10, 2006 – 6, 2007)
- translate the requirements into generic *system design*
- develop initial variable-scale geo-information server-side *prototype S1*
- adapt communication protocols (WFS, GML) for progressive transfer *prototype P1*
- develop initial client: GUI with access to functionality, geo-information visualization (symbol sets) *prototype C1*
- use generic platform to develop prototype for use case 1 'citizens' *S11,P1,C11, report*
- use generic platform to develop prototype for use case 2 'tourists' *S12,P1,C12, report*
- produce technology oriented *scientific paper* and *professional paper*

Capacity: ITC(11), TNO (22), A'dam (2), ANWB (2), ESRI (50), LS (20), HW (20), **TUD** (190)

WP 3 'evaluation of first prototypes' (month 7-12, 2007)
- develop *plan to test the user experience* (applying user experience sampling tools to assess usability, situation awareness and trust)
- select a representative group of users and some "extremes" (e.g. elderly, novices, …)

- use the prototype to *execute the tests* with real users
- summarize in *report and paper the results* of the user experience test
- provide suggestions for system improvements in same report mentioned above
- present results in *seminar*
- produce user experience evaluation *scientific paper* and *public paper*

Capacity: **ITC** (21), TNO (83), A'dam (12), ANWB (12), ESRI (10), LS (3), HW (8), TUD (64)

WP 4 'Improved prototypes' (month 1-6, 2008)

- based on evaluation of first prototypes
- based on further research
- improve the generic system framework design and describe in *report*
- realize improved framework (server, protocol, client side) *protoypes for S2, P2 and C2*
- realize the improved prototypes of the same two use cases: two sets of working prototypes *S21/P2/C21* and *S22/P2/C22* (protocol is the same)
- produce initial *scientific paper* and *professional paper* and *public paper*

Capacity: ITC(10), TNO (20), A'dam (2), ANWB (2), ESRI (46), LS (20), HW (10), **TUD** (185)

WP 5 'evaluation of improved prototypes' (month 7-12, 2008)

- improve user experience *test plan* (if needed)
- repeat (improved) test plan
- compare the results with initial prototypes and describe in *report*
- prepare decision for user related organizations (Amsterdam, ANWB) how to continue after the project (offering services)
- investigate for the geo-ICT vendors how to include the new functionality into their products after the project (initial marketing plan)
- present results of project in *seminar*
- summarize main achievements, but also indicate open problem in *final report*
- produce initial *scientific paper* and *professional paper* and *public paper*

Capacity: ITC (27), **TNO** (50), A'dam (6), ANWB (6), ESRI (15), LS (4), HW (4), TUD (105)

Risk control: describe the possible risks to the project execution and state the measures to be taken to control these risks.
The following table presents an overview of identified risks. Measures are proposed including an estimated chance of occurrence and a quantification of the negative effect on the project (scaled form 1=low to 5=high). The last column presents the risk as the multiplication of chance and effect (chance * effect).

Risk	**Measures**	**Chance**	**Effect**	**Risk**
Selecting and appointing good postdoc in time	Early start with pre-selection of candidates. More energy attracting candidates. If all fails, increase involvement of other staff until postdoc has been attracted	3	3	9
Solution for multi-scale geo-information not realistic	Start basic prototype developments as soon as possible and detect difficults early on. Look for alternatives, if not available then a more modest approach must be applied	3	4	12
Slowing down of consortium partners	Postpone deadline when possible, increase capacity	3	3	9
Hardware constorium partner not found	Approach several hardware partners in parallel (Currently: Blackberry, HP, Samsung, more possible; eg TomTom). If all fail proceed without and buy mobile equipment.	2	3	6
Mobile man-machine interface with too limited	Hardware developments continue and at the end of the project more mature devices will be available (if still insufficient:lower ambition and realise prototypes)	4	2	8
Lack of consensus in project consortium	Focus on results. Via good preparation get agreement on and commintment for projectplan. Put ambitions into perspective.	2	4	8
Execeding budget because of insufficient time planning	Prioterise	3	5	15

Quality assurance: describe the measures to be taken to guarantee the quality of the process, the results, the deliverables and the dissemination of knowledge.
The project leader will be responsible for the overall quality of the output (scientific papers, prototypes, website, reports, meetings and symposia). The normal standards of international scientific peer reviewed journals will independently assess the quality of the submitted papers (and to a lesser extend this also applies to papers selection for symposia). The project manager will provide for coordination and tuning of project activities and deliverables. Quality of project management will be guaranteed by experienced project manager (Elfriede Fendel) with a very good track record in managing both national and international projects undertaken by different consortia.

Consortium: justify the composition of the project consortium and, if applicable, the engagement of parties from outside the consortium
The role of the different consortium partners:

- TU Delft (one full time postdoc for 3 years, 3 months per year additional researcher and 1 month per year professor): project leader and providing expertise on topics such as Geo-DBMS, network protocols, generalization, and positioning.
- ITC (Professor and researchers): providing scientific (map use) expertise and input in the human factors research, mainly together with TNO; providing scientific input from the RGI-002 generalization project (DURP 'generalization of base maps for physical plans').
- TNO Defense, Security and Safety (one user-experience researcher for 6 months per year, and 2 month per year senior human-computer interaction researchers: human factors specialists and providing tools for user experience sampling)
- ESRI (2,5 months per year; first year mainly research coordinator, second and third year mainly technical consultant): important GIS vendor both active in mobile app's and some generalization, Research will be based on ArcGIS Server technology. The goal for ESRI NL will be improving the way clients and servers communicate via the Mobile Application Development Framework (based on smart client technology) using generalization technologies on the server and caching technologies in the client. Second, ESRI NL can test if open standards like GML and WFS can be used in an interoperable mobile environment. Software will be provided during the project as offered in the full RGI program. It will further be investigated how ESRI Inc, will be involved in this project.
- LaserScan Laser-Scan (2 months for Years 1 and 2: System Architect for contribution to use case and generic system design; 1 month for Year 3 Product Management) Laser-Scan is the leading player in automated generalisation techniques having participated with IGN France, the Universities of Zurich and Edinburgh in the ESPRIT funded AGENT project, a three-year, 48 man-year collaboration funded by the EC (Esprit LTR/24939). Laser-Scan will provide (1) expertise on the importance of topology in generalisation to manage the spatial data quality; (2) input to the generic system design with particular reference to the issues raised by the dynamic re-querying of the server; (3) participation in the product management output framework.
- Municipality of Amsterdam (average effort per year is between 0.5 and 1 month) will provide use case and test environment (data, users) for citizens.
- ANWB (average effort per year is between 0.5 and 1 month): the Dutch Automobile/ tourist organization: provide tourist use case and test environment (data, users).
- Mobile hardware company (expected efforts about 1 month per year): communication, displays, positioning, etc. This position is still open in consortium, some options are Blackbarry, Samung, HP, TomTom,..

Securing knowledge and communication

Describe all activities for transferring and embedding the knowledge developed within the project and describe the division of tasks within the project consortium.
The partners in the project (universities, research institute, soft- and hardware companies and users) guarantee a good interaction that will enable the development of small prototypes/simulations and the evaluation of them. The (Interim) results of the project will be communicated via publications in professional papers (e.g. Vi Matrix, GeoInfo and ANWB) and scientific journals (e.g. International Geographical Information Science and International Journal of Applied Earth Observation and Geoinformation) and via presentations on (inter)national conferences. All publications (reports, etc.) will be open for the public via a website that will contain an up-to date recording of relevant project information and

publications. Finally the consumers of mobile maps will benefit from the outcomes of the project. It will be investigated whether users (arbitrary citizen and tourists) could volunteer to participate in the project. This could happen after publishing a popular article in the mass media, which includes an attractive call to participate.

If applicable, describe the envisaged approach to marketing the project results
The commercial partners have included an investigation into potential commercialization within their product line (see role description ESRI and LaserScan). This activity will be stimulated within the consortium.

If applicable, describe the supplementary agreements made for intellectual property and the associated restrictions on the disclosure of project results
All knowledge within the project will be made public via (formal) publications (a.o. via the project website). Consortium partners have the advantage of early access and in-depth knowledge as they have created the new knowledge.

Relationships: Identify any existing relationships with other projects within Ruimte voor Geo-Informatie, with other Bsik programmes and with other national or international research initiatives
This project has an important relationship with the current other project within Bsik RGI with a generalization component (RGI-002, Generation and use of base maps for integrated querying of digital physical development plans). The RGI-002 project studies the possibility of automatically generalizing base maps from framework data to support physical plans at different scales and consists for the main part of two PhD studies. The project focuses on the technical challenge of enabling the web for user-specific generalization of these base map data. The overall goal will be the development of a service architecture for generalization, which can be utilized within a user-friendly web-portal. As a result users will be able to zoom in and out on the thematic data (physical plans) while the base map adjusts to the appropriate scale with appropriate content using generalization techniques. The generalization solutions of this project will be based on usability engineering and a user-centred design. This will yield insight into demand-driven possibilities of framework data as opposed to the traditional supply-driven availability of framework data. The context is different some of the basic underlying generalization principles may be shared.
RGI-116: Exploration of innovations in geo-standards for SDI: This project aims at the active participation in standardization in geo-information. During the course of our project we will use standards as much as possible; especially in the context of the communication protocol and possibly extension of the current standards for scale/resolution aspects. Here we can provide valuable input to the programme that pursues standardization.
Positioning is also a relevant aspect for mobile maps, but outside the primary focus of this project. Therefore there are direct links with LBS and positioning projects to reuse and apply their results; for example RGI-026 (LBS-24-7) and RGI-150 (3D positioning infrastructure within built environment)
Another related project is RGI-232 GeoInfoNed. This project has also an important geo-database server R&D component and experiences will be exchanged. However, there is less (no) focus on the variable scale aspect (which this project may deliver to RGI-232) and the same is true for the mobile client aspects (e.g. progressive transfer).
Finally for applications outside the consumer markets the technology may also be very useful. Therefore the results in this project may be used for professional mobile geo-information applications; for example disaster or risk management (RGI-239 Open Risc Management Platform for supporting the repression of calamities), but many more professional applications are imaginable.

Contribution to RGI objectives

Indicate the size of the project's contribution to RGI's mission, objectives and milestones and to solving its research problems with reference to the five guiding objectives (see Appendix 4)

RGI objective	**Contribution to proposed project**
More demand-driven	The use cases of citizens and tourists are the starting point of this project. Their demands are translated into geo-information data and system support needs. The research and resulting prototypes are evaluated with these requirements. Enabling end-users mobile access to dynamic, up-to-date, geo-information at the proper level of detail, via good user-interfaces, will support the change from a supply to a more demand-driven geo-information market
A freer flow of knowledge	Due to the fact that geo-information is now better accessible also from mobile platform at the proper scales (with dynamic, up-to-date content) will remove some current obstacles in the flow of properly scaled geo-information to users.
More cohesion	The project is standards based, and intends to dynamically combine multiple sources of geo-information not by displaying everything on top of each other, but taking first the required level of detail of the users as a starting point and then al relevant sources will then be coherently provided by the variable-scale server at the same detail level.
More innovation	The challenges ahead are huge: both with respect to realizing a variable scale system (in server- mobile client context) and investigating the human factor aspects of a potentially mass application of geo-information on mobile platforms. This proposed consortium is in a good position to enforce the required breakthroughs.
Greater awareness	Using increasingly popular mobile platforms to bring geo-information the users in order to support their primary tasks will raise the awareness of the availability of the geo-information treasures maintained by different organizations.

Appendices

1. *Detailed budget in accordance with accompanying spreadsheet*
2. *CV of the intended project leader*
3. *CVs of the key researchers*
4. *Scientific references: publications, posters, prizes, etc.*
5. *Social references: projects, applications, partners, etc.*
6. *Contribution of project to Senter milestones in accordance with accompanying table*
7. *Copies of the quality certificates of all consortium partners*