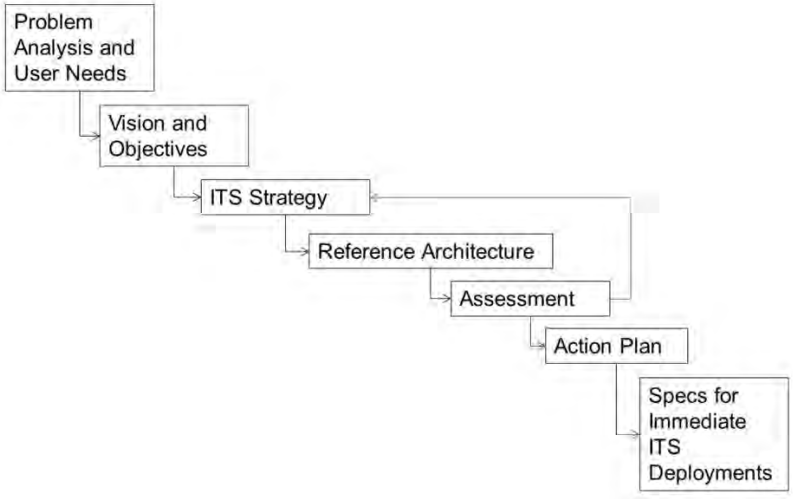
ITS deployment

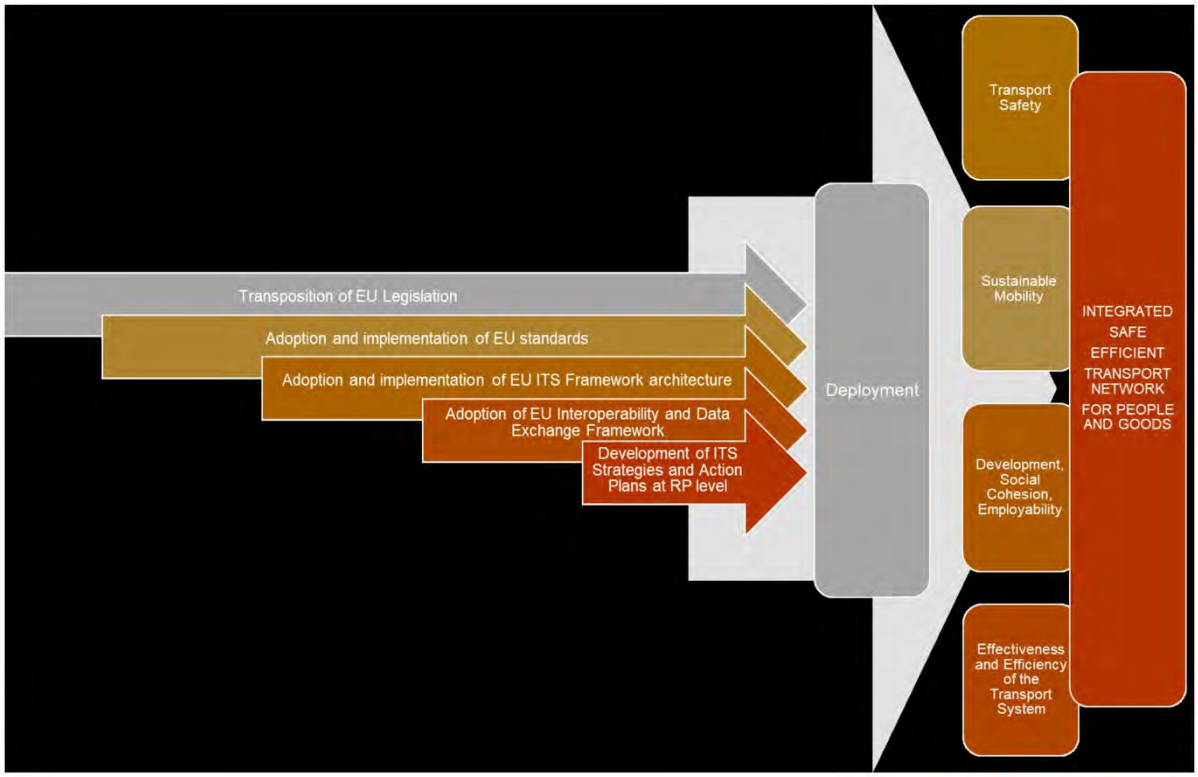
There is no single, common ITS deployment strategy appropriate to address the different needs of countries across the world – with economies in varying stages of development. Local, national, regional and municipal factors will determine whether ITS is an appropriate investment – as well as how it should be designed and deployed. ITS investments almost always involve a wide range of stakeholders and interest groups from the public, private, and non-profit sectors. In some countries, the research, academic and non-profit institutions also play a key role because of the involvement of advanced information and system technologies, and the level of coordination that this requires.



To ensure that ITS is not overlooked in the transport planning process, a well-considered and easily understood ITS Strategy is required that shows the direct links with the national transport strategy. In summary, the reasons for developing an ITS national and/or regional deployment strategy, are to:

- agree the transport policy objectives that intelligent transport will support in practical terms;
- identify specific transport problems, requirements and needs – where ITS can provide more cost-effective solutions than alternative (non-ITS) measures;
- create a common understanding of the role of ITS in short and long-term transport planning horizons;
- define the principles and points of emphasis for the deployment of intelligent transport systems – such as the legal and organisational framework, ITS architecture and standards;
- clarify the roles of the various stakeholders and develop models for joint working and co-operative partnerships;
- outline the priority projects in different ITS domains and the criteria for investment, performance monitoring and impact evaluation – to be included in an ITS deployment programme;
- provide an action plan to give effect to the ITS deployment programme and fulfill the strategy's objectives.

There are many techniques and methods that have been developed to support large-scale integrated system development. However, there are several concepts that have found their way into ITS and provide some amazing value for the ITS developer and implementer.



Source: https://wbif.eu/news-details/completion-eu-funded-strategic-framework-intelligent-transport-systems-western-balkan

There are a number of key concepts that represent the philosophy behind the methodology. The concepts are listed as follows:

- The “what?/how?” cycle;
- Requirements analysis and exploration;
- ITS User Services;
- ITS Market Packages;
- ITS Equipment Packages;
- ITS Future Big Picture.

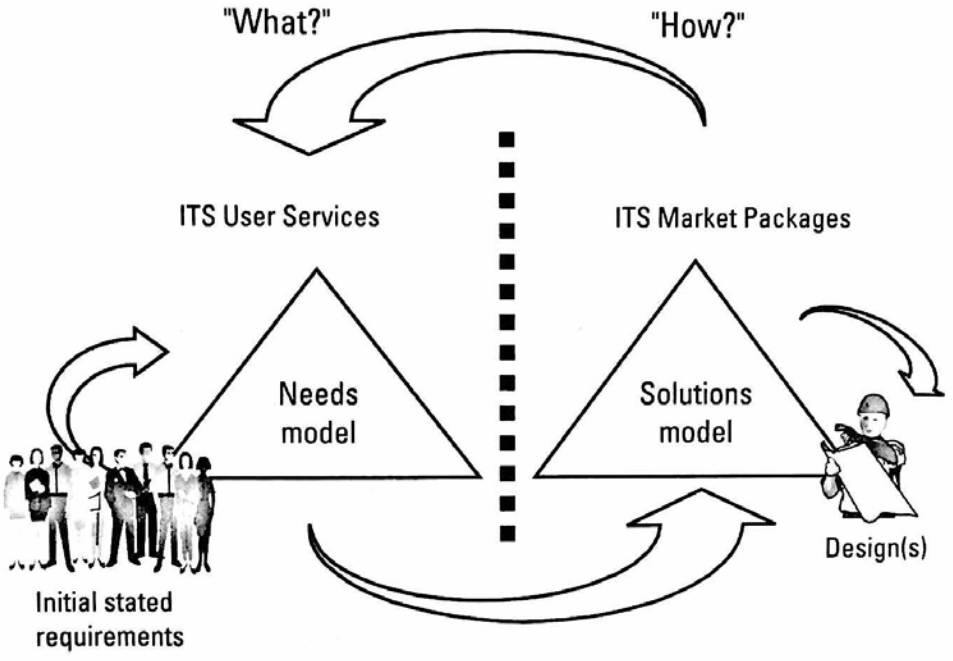
The whole basis for the ITS Cooperative Development Methodology is to ensure that the user gets what he or she wants from ITS. This sounds simple but is probably one of the hardest things to do in ITS. Part of the difficulty revolves around the fact that ITS technologies are relatively unknown and strange to transportation professionals and the general public. Consequently, users not only do not know the answers but often do not know the questions to ask to uncover the required information.

"What?/How?" Cycle

One of the most powerful concepts we have come across in our attempts to improve the process of ITS planning and development is the concept we call the what?/how?cycle. This

involves the deliberate and clear separation of “what?” and “how?” while requirements are being explored at the start of a project. In other words, the users are asked to initially focus on what they want from ITS by agreeing on the problems, needs, issues, and transportation policy objectives to be addressed by a successful ITS implementation. Only when this has been fully discussed and agreed on by all major stakeholders is the second question “how?” addressed. This question relates to the identification and selection of appropriate combinations of ITS technologies to satisfy the previously defined “whats,” or requirements.

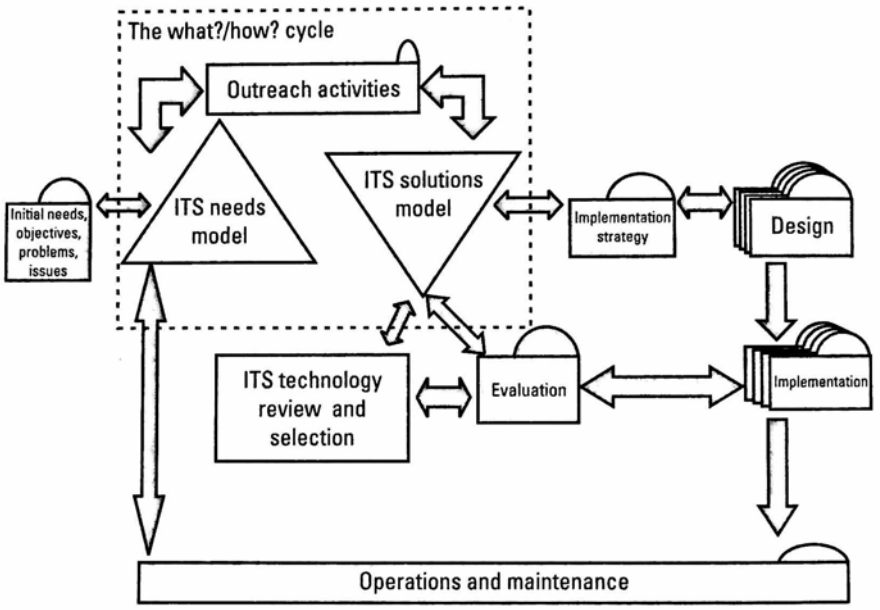
You have probably already guessed that it is not possible to deal with “what?” and “how?” separately for very long. This gets us into a subject we call the what?/how? cycle. Figure illustrates this mechanism.



Source: B.McQueen, J.McQueen. Intelligent Transportation Systems Architectures. Artech House Inc. 1999.

The what?/how? cycle appears to be a feature of many transportation and system development projects. Consequently, the initial “what” defined by the users is altered and enhanced when they are exposed to the initial “how.” The converse is also true in that the potential ITS solutions or “hows” will also change to fit the changing requirements. This could, of course, be viewed as one of those endless circles with no beginning and no end. However, we believe that the most sensible way to enter the circle is from the user point of view. Then, the exit from the circle becomes clear as both requirements and solutions stabilize after a number of iterations.

It follows that systems can be developed more economically and more effectively if time and resources are invested wisely at the beginning of a project through the application of requirements analysis techniques that support the user and the analyst in identifying, understanding, and confirming the user requirements for the system.
Next figure illustrates big picture of the ITS development methodology.



Source: B.McQueen, J.McQueen. Intelligent Transportation Systems Architectures. Artech House Inc. 1999.

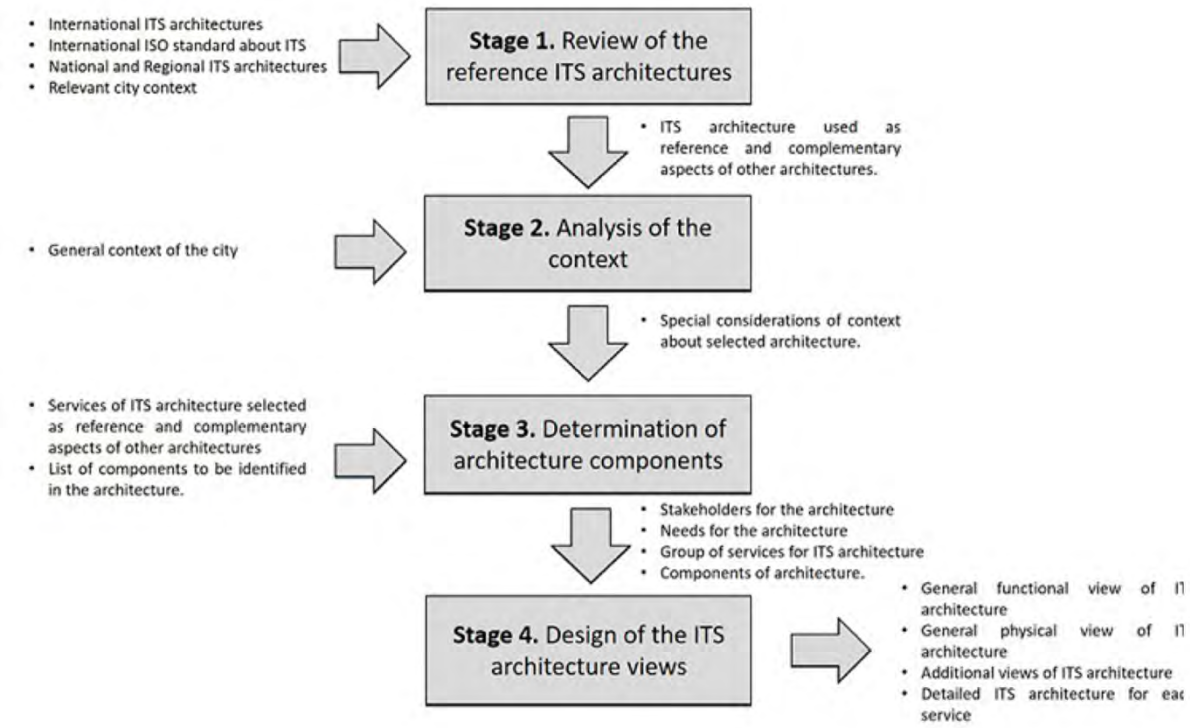
ITS designers can use this model to support and take advantage of the what?/how? cycle to make ITS planning and development as effective as possible. They make use of two models to do this. The first one is the needs model; as its name implies, it captures the needs that are to be addressed and satisfied by the proposed ITS. The needs model supports the what part of the what?/how? cycle. The second one, which is called the solutions model, captures the potential solutions that can be used to address the needs. This supports the how part of the what?/how? cycle.

The ITS needs model captures what you initially and finally want in a concise structured manner, making it easy for the user to explain requirements and for the system developer to understand the dynamics of the evolving requirements picture. It also accommodates changes and modifications, making it easy and desirable for the user to take a flexible approach and cooperate fully with the developer.

The ITS needs model has the following components:

- Initial needs, objectives, problems, and issues;
- ITS Objectives Statement;
- ITS Vision;
- ITS User Services.

As case study an integral flow chart of the methodology for development of city ITS can be presented by four stages.

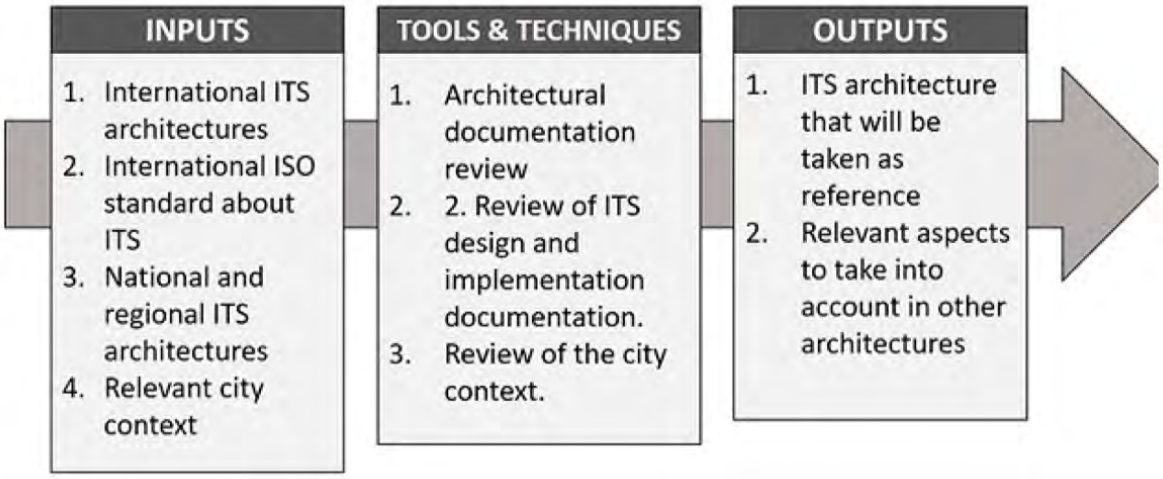


http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0123-30332019000100049

1 stage. Review of reference ITS architectures

At the first stage of methodology, a revision of the next documents must be done: updated versions of representative architectures at international level, standards (proposal of ISO), national architecture, and regional (or city) architectures designed. Service areas, that each reference architectures considers, is one of the comparison factors in the review. Use of a matrix facilitates identification of services included for each architecture, the matrix would have as rows the service areas to be considered and as columns the ITS architectures. The selected service areas to be taken into account will be the sum of the ones that each architecture has, without repeating them. The number of ITS architectures in the matrix will depend on each case, although it is recommended to take into account at least the main international architectures, ISO standard and National architecture.

Objective of this stage of the methodology is to determine a reference ITS architecture by selecting some of the revised proposals, identifying (as a complement) relevant aspects of other reference architectures.



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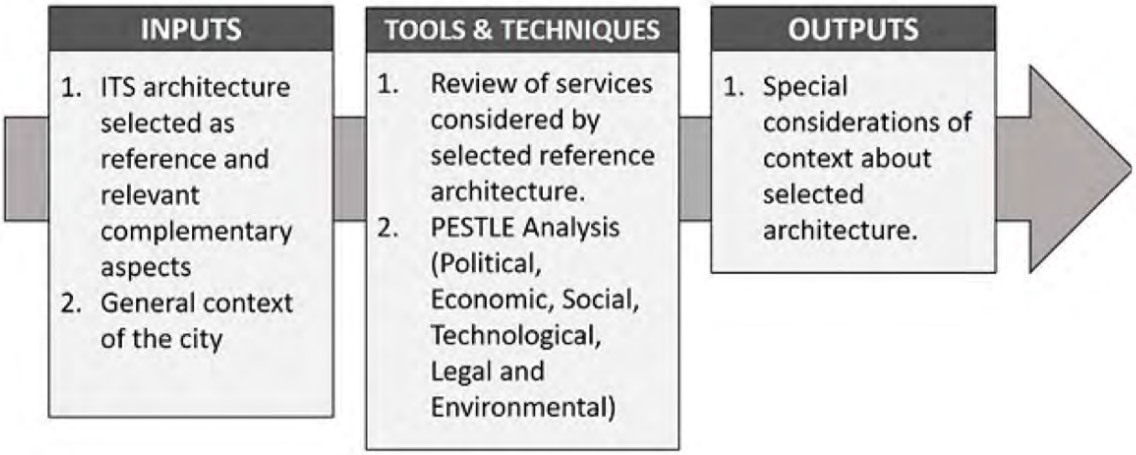
2 stage. Analysis of the city context

Outputs from previous stage are used as inputs to the second stage. Context of the city, other entry in this stage, should be analyzed in a broader sense. In addition to the aforementioned review of services of the reference architecture, a context analysis tool should be used in this stage. As a result of stage, the special considerations of the city context must be obtained.



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3 stage. Determination of architecture components

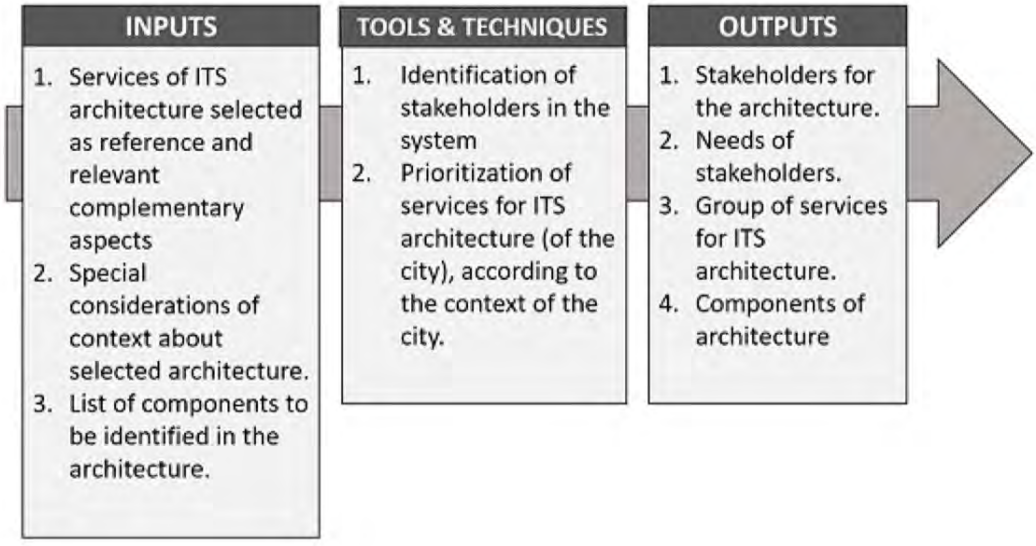
Outputs obtained in stages 1 and 2 are used as inputs in this stage. Additionally, specific components that must be identified to present ITS architecture of the city, should be considered as input to this stage. Some components, which make up the views of ITS architecture of the city, vary depending on the architecture that was taken as a reference. Stakeholders, their needs and services provided are common components in revised

reference architectures, while other elements are particularly used by one or another architecture.

For the identification of stakeholders, it is recommended to review documents such as: history of projects related to mobility and transport in the city, ITS architecture documents in other similar international cities and information provided by local government entities. Once the stakeholders have been identified, it is recommended to evaluate them by analyzing their level of influence and position on a possible ITS for the city, to determine whether or not it is taken into account for the needs analysis.

When determining the stakeholders to consider for the ITS architecture, their needs are determined through interviews, surveys and the help of the previously mentioned documents. Then the needs with the largest number of involved stakeholders and high or medium level of influence will be considered.

With the determined needs, we proceed to identify the specific services (of the areas used in the matrix) that will be taken into account for ITS architecture. The selected services will be a subset of services that the reference architecture has, adding relevant services of other architectures. These selected services must meet the specific needs of the stakeholders. Finally, once the specific services to be provided in the ITS architecture have been determined, the components required in ITS architecture are identified. The specific components to be identified will depend on the ITS architecture selected as a reference.



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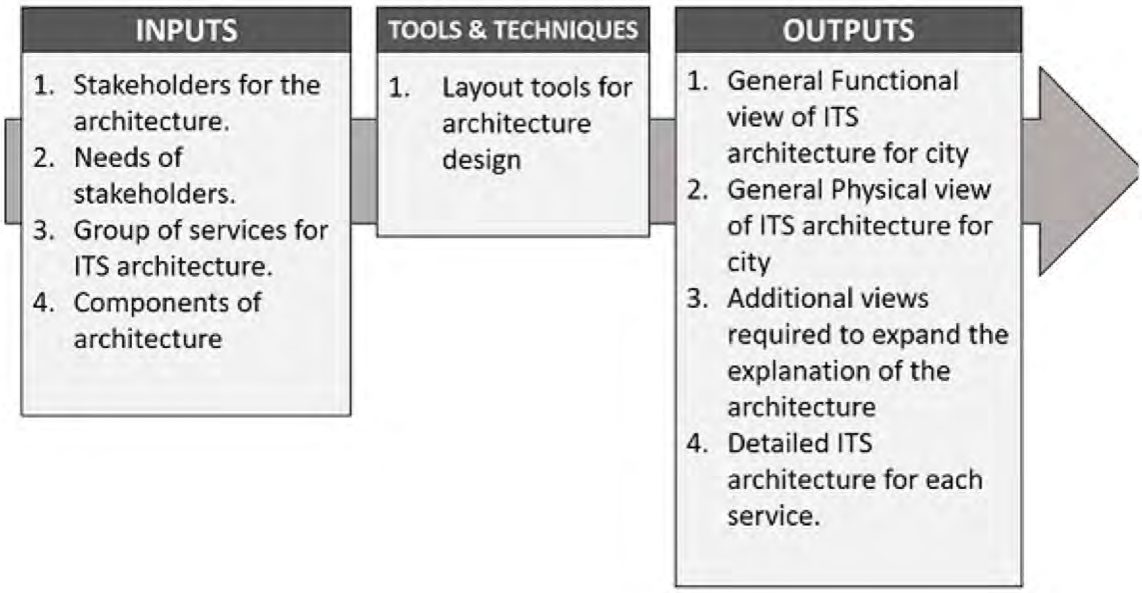
4 stage. Design of the views of the ITS architecture

Outputs of stage 3 are presented in this stage as inputs. A design tool should be used to present the views of ITS architecture. These views can use the type of diagram that uses reference ITS architecture or can use a standard language of systems description.

In addition to views of the general ITS architecture, ITS architectures detailed by each of services must be implemented. The detailed architecture of each services employs a subset of that components.



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Planning an ITS programme

In most countries as traffic volumes increase and the roads get more congested there is pressure on the authorities for better traffic management and control of congestion. Highway authorities, road operators and urban road network managers everywhere need to deliver better road management. This involves all the activities involved in building, maintaining and making best use of the roadway assets.

One of the aims of road management is to ensure that traffic can continue to travel – in a manner that is safe, efficient, reliable and which causes the least damage to the environment. When designing a programme that supports this aim the road operator will need to address a number of practical considerations – such as how to:

- monitor and keep track of traffic and road conditions in the network, day-by-day, hour-by-hour and – on some occasions when there is major disruption – minute-by-minute;
- maximise operational safety and efficiency of the road network including the safety of personnel who have to work on the roads;
- minimise negative impacts of disruption caused by recurring congestion and non-recurring incidents within the road network;

- provide road users with the information necessary to support their decisions on travel and relieve stress while driving.

These are universal issues for road network operations. They are about keeping traffic on the roads running safely and efficiently and taking into account the level of service experienced by the road users.

Typically, the programme will be built on a number of distinct principles that will shape the priorities:

- knowledge: as a basis for investment – to monitor and manage traffic on the network;
- safety and security: to control the traffic and analyse accidents;
- education: to promote and enforce safety on the roads, encourage good driving habits and a high level of compliance with traffic rules;
- vehicle maintenance: to reduce vehicle breakdowns and improve road safety– and so reduce accidents and emergencies; for freight transport a priority may be to improve security against hi-jack and criminal activity as well as road safety;
- rapid response: to incidents – notably in the "golden hour" when lives can be saved and providing information to reduce secondary accidents to lessen inconvenience to other road users.

Role of ITS

ITS can make a positive contribution to these road management objectives. With relatively modest investment (compared with the cost of building a new road) ITS can significantly improve road network operations, optimise the use of available infrastructure, raise revenue and improve road safety. ITS can help to:

- keep track of traffic movements through network monitoring – with the aim of optimising the use of the roadway and the available capacity;
- provide information to road users about hazards and disruption affecting the road network – so they can adapt their travel plans;
- create a reliable revenue stream (through electronic tolling) that supports a forward-looking programme of road investment;
- help improve driver behaviour – for example through:
  - safety and in-vehicle technology that encourages safer driving;
  - encouraging compliance with traffic regulations and developing policies that support better enforcement.

Road users want safe, reliable, and seamless journeys. They are not interested in the geographical boundaries between one transport authority's network and another. This means that transport networks need to be integrated across geographical boundaries between different transport operators and administrations. ITS deployment may be multi-modal, multi-jurisdictional, and in some cases, international. This may involve bringing together local, regional, national road authorities and the operators (which may by concession-holders). (See Integrated Operations)

Most countries engaged in ITS deployment have formal ITS programmes at the governmental level – and/or the non-governmental level through anetwork of National ITS Associations. These programmes aim to promote ITS as a reliable and effective tool for solving transport problems – by ensuring consistency and synergy among ITS projects, continuity of funding, and generating public acceptance and new investment.

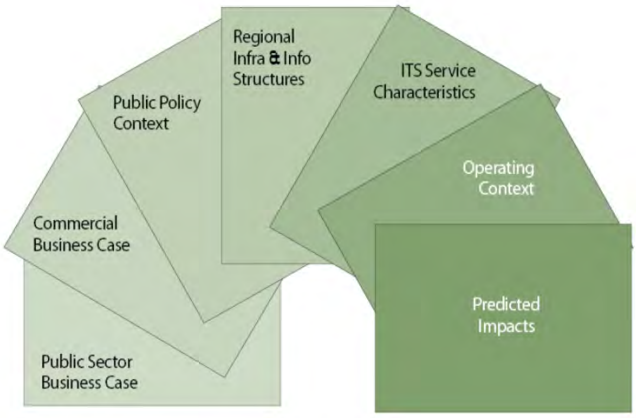
When formulating an ITS programme, priority services need be clearly identified in terms of overall relevance to goals and objectives, scope, requirements, and expected impacts. Priority services need to be "packaged" within clearly defined deployment projects that specify their scope, scale, functional and performance requirements and budget. (See PDF 9201 Hefei City Traffic Management System Case Study) Projects will need to show they meet the criteria for funding by national or international funding schemes. (See Budgeting and Affordability)

Keys to Success

The key to success can be summed up in four simple rules:

- ITS needs to be incorporated into the mainstream transport planning and investment cycles;
- project finance needs to take account of capital investment and ongoing maintenance and operational costs – ideally planned on a whole-life cost basis with an allowance for upgrade;
- private sector knowledge and experience in delivering ITS projects and operating ITS-based services offer an opportunity to fill any skills gap – and private finance can be mobilised through partnerships and out- sourcing;
- ITS needs innovative procurement methods in the public sector – that involve multiple evaluation criteria to award a contract on the basis of best value rather than lowest cost – judged against the essential performance requirements.

The figure below illustrates the different factors that need to be considered when planning a programme of ITS deployment.



Policy perspectives

Road authorities and other public sector stakeholders plan their activities based on policy objectives and priorities. Some are directly transport-related such as road safety, congestion, traffic noise and emissions. Others arise from policy areas and objectives such as industrial competitiveness, climate change, energy sustainability and the information society.

Public sector planning usually involves three different time scales:

- long-term (next 15-20 years) - the long-term vision;
- medium-term (next 4-7 years) - the typical period for a government programme;
- annual planning for the next year - the annual budget.

The planning processes, outlined in the figure below, includes the following stages:

- it usually starts by identifying and prioritising user needs - a process which is informed by consultations with road users, industry and private sector companies, communities and regions, property developers and other stakeholders;
- in the next phase, the policy objectives are prioritised and resources allocated;
- later statges aim to maximise benefits in relation to policy objectives, taking account of the available resources (budget, organisational capacity, staff).

To facilitate planning, public authorities need to create a framework for the socio-economic evaluation and impact assessment of ITS services - and apply it to before and after (ex-post and ex-ante) evaluation of the services deployed.
Investment in ITS by the public sector needs to aligned with public policy and the current objectives for transport and mobility. These may change as the political landscape changes. This will affect the ITS planning phase when policy objectives are prioritised and resources allocated.

Those involved in strategic planning for ITS must keep the political perspective in mind - for example, where privacy concerns could lead to public opposition to an ITS deployment such as the introduction of new tolls and charges, requiring additional measures to protect data security and the privacy of financial transactions. In general, ITS is often “invisible” to the politicians and media until something goes wrong in its deployment, operation or use of ITS.