Deliverable D1

Baseline Methodology

Main Report

Work Package 1

Public

CODE-TEN
Strategic Assessment of Corridor Developments,
TEN Improvements and Extensions to the CEEC/CIS
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CODE-TEN

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TEN Improvements and Extensions to the CEEC/CIS

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1.1 Scope and study orientation

The scope of WP1 in accordance with the Technical Annex is to "define the baseline structure and identify the tools for the development of the assessment methodology in WP6" (ICCR, 1997a, p. 16).

This scope has led to a number of discussions at the meetings of the CODE-TEN group from which the following principal findings and agreements can be reiterated:

- The baseline structure (or baseline methodology) needs to be "more" than mere assessment in order to deal in an effective way with European transport corridor developments. Thus the baseline methodology as laid down in this report deliverable (CODE-TEN D1) is "both" planning and assessment.

- Among other things, as seen for example from the amount of resources that have been allocated to them, the nine transport corridor cases (in WP2) play a major role in CODE-TEN. The baseline methodology of WP1 shall be worked out so it can support these cases with respect to "real" planning and not just as "methodology testing".

- The baseline methodology shall in its chosen capacity of being "integrative" make use of results from other Strategic Transport research projects.

These demands put on the development of the baseline methodology have given rise to a number of underlying considerations , some of which were already partly paid attention to in the Technical Annex:

- The baseline methodology must be able to be applied in a planning environment characterised by many levels, many stages and many actors that do not necessarily share the same views ("complex" supranational planning).

- The baseline methodology shall be applicable to a wide variety of corridor cases striking a reasonable balance between being "not too general" and "not too specific". In several of the corridor cases where a lot of plan material already exists, it shall be able to make use of this material in a productive and consistent way.

- The baseline methodology shall be able genuinely to approach the planning task both from an engineering-economics "hard" side and from a "soft" side made up of social and political science, as this is seen to enhance its applicability for the task of European supranational transport corridor development.

The CODE-TEN group has decided to organise the corridor planning and assessment methodology around (at least) the answering of the following four basic major questions relating to the whole of or part of a transport corridor development scheme:

1. Is it worth the money ? (*adequacy*)

2. Can the corridor alignment be further improved ? (*dependency*)

3. Can the corridor development scheme be agreed upon and decided (*suitability*), and

4. Will it, given all circumstances, have a good chance of being a success ? (*adaptability*)

The keywords in parenthesis relate to a set of planning guidelines which have systematically been applied to develop the baseline methodology. Specifically, the methodology has been set out as a system of tools named DECODE for mo<u>de</u>lling system for <u>co</u>rridor <u>de</u>velopment, with the idea of the acronym being to "decode" the complexity of the planning inherent in this task. By using structured questions relating to both the "hard" and the "soft" conceptual spheres a corridor plan can be set up, possibly not "optimal" but maybe "satisficing". A variety of different models are or can be involved in the answering of the questions which more technically described will appear as so-called planning tests that need to be carried out. The planning tests made use of in DECODE are the following:

I ***The adequacy test:*** This test examines the socio-economic feasibility of a corridor development alternative (CDA). The CDA concept is tied to a specific corridor and indicates a set of projects and maybe other initiatives and their scheduling to develop the corridor towards a certain target year which tentatively is set to the year 2020. Under the perspective of different development strategies to be pursued and different scenarios to represent images of the future, different CDAs for a corridor can be set up and examined by the use of the DECODE tools. The adequacy test is the test which most resembles conventional transport planning.

II ***The dependency test:*** This test is concerned with the examination of possible improvements in the alignment of projects in a certain CDA. If a corridor study was to start from scratch it may be reasonable to start the process with this test but often projects have already been outlined. Among other things, making use of the new GIS tools available as spatial decision support systems, this test will for several of the corridor cases in CODE-TEN be used to examine already existing project alignments to see whether these can be further improved to better match territorial consequences of accessibility and environmental land-use impacts. This type of analysis can be seen as a cost-effectiveness analysis, whereas the adequacy test above is a cost-benefit analysis (or a multi-critera analysis comprising a cost-benefit ratio for example as one of its criteria).

III ***The suitability test:*** This test addresses issues of whether the CDA from a policy assessment viewpoint has a reasonable chance of being decided upon. Whereas the adequacy and dependency tests concern "objective" issues, this issue and the adaptability test to be described below are more concerned with "subjective" issues. Conventionally, infrastructure planning has refrained from dealing with such issues by making use of models. It is part of the DECODE approach that modelling efforts are also worthwhile in this area and that the overall planning can be supported by an integrated use of different types of model. One issue to be clarified within this test to make up the possibilities for a successful implementation is the institutional framework and the actual decision-makers involved.

IV ***The adaptability test:*** This test is concerned with a practical application of some recent research results concerning development of infrastructure results. The important question dealt with is whether the transport corridor development as it is currently defined in the actual planning process has the potential of being part of a development scheme which now and later will be recognised as successful considering all types of uncertainties. The criteria involved in this test concern robustness and resilience indicating that the good scheme is better than a superior one judged on a “narrow” set of criteria if the good scheme or CDA has an in-built flexibility that makes it the better one to match a broad range of developments in the planning environment.

The planning process foreseen will be referred to as “complex”, as a linear, more conventional process may not apply. The DECODE approach ensures that a necessary set of different dimensions of the planning task are addressed where the individual models made use of may depend on the actual case study resources available, etc. It should be noted that the order of the planning tests (the answering of the basic questions) depends on the actual case and that the answering of one question possibly - at least early on in the process - will lead to reconsideration of another one, and so on. Thus the process is referred to as “self-organising” with the further steps depending on current outcomes. The process may either end in “convergence” (decision to implement a certain CDA) or “divergence” with no agreement possible. Thus the DECODE process is structured around the invoked planning tests combining “hard” and “soft” methodology but is at the same time kept open-ended and search-learn-debate oriented with respect to its concrete application on a case study.

The work on the baseline methodology in WP1 has resulted in an outline of its structure and the content of its process around a number of concepts and methodologies, briefly referred to as the DECODE system of tools. The report on the baseline methodology, however, shall be considered more as a “source-book” for “complex” planning in the given context of European transport corridor planning than as a fixed set of guidelines prescribing more or less exactly how the planning should be carried out. The success with respect to a good result of the planning of a certain corridor needless to say still remains very much with the actual planning team. The DECODE approach, however, opens up the way for the application of a wider methodological basis than normally applied in transport infrastructure planning and for the application of a common set of concepts and assumptions. Consistency in the overall modelling approach is technically obtained by making use of a so-called central forecast scenario and a central set of nested weights.

The DECODE methodology as outlined in the WP1 work makes it possible to begin the further methodological specifications in WP3, about the scenarios to be applied among other things, and the assessment methodology for the spatial and socio-economic impacts in WP4 and the strategic environmental impacts in WP5. Together with the data collection, and the development of the Transport Information System (TIS) and the nine corridor cases in WP2, this will make it possible to carry the planning and assessment methodology as developed in WP1 forward from what is referred to as the stage I methodology to the stage II methodology to be worked out in WP6 of CODE-TEN. Altogether three stages of the methodology are foreseen, with the latter stage III seen as associated with a full-scale planning of a transport corridor, which is beyond the reach of CODE-TEN. Among other things, full-scale planning will demand many more study resources. What is aimed at, however, is that the stage II methodology of CODE-TEN to be laid down in WP 6 - with the manuals and programs worked out in WP 7 and the integration of the research results and the findings in WP8 - can provide a good foundation for the stage III work. This stage III work may be carried out in the near future, if not on all then on some of the corridor cases examined in WP2.

The following section 1.2 gives a description of the work content of WP1 more closely related to the specifications in the Technical Annex. Readers primarily interested in an overview of the concepts and the methodology developed in WP1 are referred directly to the section 10 of this report.

1.2 Work content and disposition

This report presents the work content and outcome of CODE-TEN WP1. In accordance with the Technical Annex (ICCR, 1997a) the objectives of WP1 are:

- to formulate a conceptual framework for corridor developments, among other things taking into account the complexity of current European transport policy making and decision taking, and

- to identify the relevant tools for the development of a suitable assessment methodology which can assist and support policy makers and planners involved in the corridor developments

Elaboration of such a baseline structure has, among other things, made use of inputs from research in other tasks in the Strategic Transport part of the 4th Framework Programme. For the specific purpose of corridor developments within CODE-TEN it has been relevant in this screening process to adjust some of the methodologies and parameters from these research projects. Specifically, as part of the baseline structure, inputs have been worked out for WP2 to WP6 concerning:

- data requirements to be provided by WP2 to WP5 concerning scenarios and impacts of various types (including minimal requirements in terms of data and information from case studies and country policy databases), and

- the comprehensive methodology development to be carried out in WP6, making use, among other things, of the results from WP2 to WP5 to serve as modules and design linkages in the comprehensive methodology.

The output from WP1 consists of this deliverable (D1) in month 6 of the project comprising baseline methodology (baseline structure given as conceptual framework and assessment methodology with inputs for WP2 to WP5). The D1 in its entirety is to be seen as an input to WP6, which concerns the development of assessment methodology, together with the results from WP2 to WP5, see the Technical Annex (ICCR, 1997a, p. 40).

The report is disposed in the following way: After this introduction, section 2 sets out a research context which emphasises the interrelationships between the actual task 35 of CODE-TEN, other research tasks and a suggested set of so-called planning guidelines. The overall methodology to be suggested consists of a modelling system (DECODE) which integrates use of both quantitative and qualitative approaches. The following section 3 presents different concepts to be made use of, while section 4 describes the DECODE planning process. Sections 5, 6, 7 and 8 contain model presentations for each of the four planning themes introduced earlier. The following section 9 describes traffic modelling requirements, and section 10 presents the CODE-TEN baseline methodology in overview. In this final section particular emphasis is given to an inter-linkage of the main concepts that have been defined and used to develop the CODE-TEN baseline methodology.

A set of working papers together with results from a model and data review is presented in a separate Appendix Report. This report also includes some guidelines which have been produced for the corridor case studies to be undertaken as part of WP2. This Main Report together with the Appendix Report make up the D1 deliverable for the CODE-TEN WP1.

2. Research context and outline of DECODE structure

2.1 EU transport corridor development and planning approach

A basic recognition behind the work of WP1 is the complexity of current European transport policy making and decision taking. This complexity together with a possible focal role of corridor development in supranational, pan-European transport infrastructure planning, is addressed in a recent review of current policies for a multi-modal, pan-European transport network (Höltgen, 1997). In comparing a current CEC initiative to define more specific criteria for the integration of seaports, inland ports and intermodal terminals into the existing trans-European transport network (TEN) with the broad, schematic approach for the development of pan-European Transport Corridors in the Central and Eastern European Countries (CEECs), Daniel Höltgen from CEC, DGVII states:

"The comparison illustrates the political, financial and statistical problems inherent in the coordination of an integrated transport network at the pan-European level. Interconnection, interoperability and environmental assessment are key issues. In view of the subsidiarity principle and limited EU funds, the question is raised whether future EU infrastructure policy should aim to provide detailed guidelines for a dense network development, including interchange points. A possible alternative could be to focus on the development of major cross-border corridors by effectively excluding common criteria for local and regional transport networks. ...

The examples from the revision of the TEN guidelines and the development of pan-European Corridors and Areas in the CEECs illustrate two different approaches to, and stages of, infrastructure planning at the EU and pan-European levels. Notwithstanding the need to develop multimodal infrastructure within an enlarged Union, the question remains in what detail infrastructure can usefully be planned and co-ordinated at the pan-European level. The concept of multimodal corridors may help to focus EU measures of co-ordination and financial assistance."

Formally, the complexity referred to above leading to the discussion of the most appropriate approach for pan-European transport infrastructure planning is due to a multi-levelled and multi-staged system comprising a set of actors which only to some extent share views and interpretations. To cope with such complexity[*] in research analysis and later on in the development of methodological guidelines, it is necessary to draw up some demarcations and introduce some concepts. In accordance with the Technical Annex, it is suggested that the "good practice" planning approach is applied as it can facilitate an integrated use of various relevant ongoing/upcoming projects in the Strategic Transport part of the 4th Framework Programme, and can help to identify which research topics (the "missing" parts) need to be included in the CODE-TEN project. For a more detailed description of the "good practice" planning approach and the arguments behind it, see Khisty & Leleur (1997).

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[*] This type of complexity will be seen as one of the factors constituting what will be referred to as the context of <u>supranational planning</u>. In addition to the concrete results demanded of the CODE-TEN project as stated in section 1 above, insights of a more general nature about the possibilities and limitations of supranational planning under current European societal circumstances - hereunder the actual meaning of planning in the given complexity context - can be expected as a kind of spin-off of the CODE-TEN study. Such insights may be of interest also in other than transport contexts by illuminating some aspects of change currently characterising Europe after the overall change to market economy in 1989.

Below a brief operational presentation will be given of the suggested set of planning examinations which in different ways influence each other and treat planning to different perspectives. Thus the good practice planning approach operates with the following four themes which all need to be addressed both analytically and methodologically:

- Adequacy: *Action feasibility* supported, among other things, by an economic test
- Dependency: *Context feasibility* supported, among other things, by an identification and systems test
- Suitability: *Action acceptance* supported, among other things, by a logical and discursive test
- Adaptability: *Context acceptance* supported, among other things, by a robustness and resilience test

The planning process foreseen is different from a traditionally staged ("linear") process. This well-known process, often referred to as the Rational Planning Model (RPM), is relevant mostly for well-defined tasks, for example certain types of sectoral studies in national and/or regional/local planning. The supranational planning process may more adequately be considered as "non-linear" to indicate that actual interpretations of the different stakeholders in the process ("players") determine the further development of the process; as a result the process may stop or continue, in the same or a new perspective, in a convergent or divergent way. Thus the planning process in a complex multi-levelled, multi-staged socio-technical system, can be seen as a process obtaining a kind of self-organising dynamics dependent on certain constituting "events" referred to in the good practice planning approach as <u>planning validity claims</u>. These validity claims are, based on an interpretation into a specific planning context of Habermas's theory of communicative action, of quite different types which necessitate the adoption of different types of planning models[*] when formulating the model set-up for a certain planning task as the corridor development in this case. For the development of the CODE-TEN methodology it has been found useful to apply planning models for all the four planning themes as indicated in Table 2.1.

The indicated <u>adequacy</u> and <u>dependency</u> guidelines point to so-called objectivating attitudes and approaches ("objective" examinations) which address the feasibility of a planning action *per se* and in context. The <u>suitability</u> and <u>adaptability</u> guidelines on the other side point to conformative attitudes and approaches ("subjective" examinations) which address the normative issues of a planning action *per se* and in context. To exemplify: With the EUNET model we can get the answer as to whether a project in a corridor development is good from a socio-economic viewpoint or not. With the corridor model to be developed in CODE-TEN we can test how well it fits into surrounding areas (the model exemplifies what is currently in the GIS literature labelled as a spatial decision support system, SDSS, see for example Wilson et al. (1996)). Both these models are objective and expert orientated, whereas the policy assessment model and the barrier model from the TEN-ASSESS project seek to illuminate a number of aspects relating to policy objectives and various scenarios about the future. These

[*] The term planning model is used in a broad way to indicate both quantitative, numerical models and more qualitative models such as, for example, structured, good advice rules presented as decision trees.

latter two models emphasise the exploration of political and social understanding and acceptance of implementing a certain infrastructure project/corridor development scheme.

Table 2.1 Overview of planning guidelines and CODE-TEN submodels, which are to be applied in a structured, integrative way

Guidelines for planning	CODE-TEN submodels	Types of planning tests	Test parameters	Planning function
Adequacy	EUNET project evaluation model	Economic test	Necessity Sufficiency	Action feasibility
Dependency	CODE-TEN corridor model	Identification and systems test	Compatibility Connectivity	Context feasibility
Suitability	TEN-ASSESS policy assessment model	Logical and discursive test	Rules Values	Action acceptance
Adaptability	TEN-ASSESS barrier model	Robustness and resilience test	Societal development, and Culture	Context acceptance

The subjective approach can supplement the objective approach (and vice versa) by examining relevant questions: Does the project meet the expectations of the citizens and their views about societal development? Does it comply with certain trends in societal development? Seen together the models will produce much more detailed information than in stand-alone applications. Applied in a structured way with specific analyses of inputs and outputs, they may also lead to a “building up” of a certain corridor development programme which due to the complexity involved could not be obtained otherwise. These methodological hypotheses must necessarily be further examined by the actual case studies to be carried out.

2.2 DECODE as an integrative approach

The CODE-TEN project will make use of on-going model work in the Strategic Transport programme, with: 1) the EUNET CBA/MCA model (socio-economic project evaluation), 2) the PAM policy assessment model from TEN-ASSESS Task 32 and 3) the barrier model from TEN-ASSESS Task 36. The “missing” model, the corridor model, is developed within CODE-TEN as a GIS model to set up and evaluate infrastructure (road, rail) locational alignments within a corridor. The corridor model will be designed as an optimising procedure where the best location and alignment is found, given mode specific design constraints, from a least cost type of algorithm. The algorithm will be defined so it can take various parameters into consideration, for example “closeness” to city centres (optimising for example the POINTER index from EUNET WP1, task 1.3) or least environmental damage making use of an area classification system. Another option will be the minimising of construction costs. These parameters, and possible others to be defined, can also enter the model as a weighted set. The corridor model will make it possible to define sound alternatives to be examined in an overall socio-economic way by the use of the EUNET project evaluation model. And it will make it possible to make project redesigns if, for example, the TEN-ASSESS policy assessment model shows bad scores on certain policy areas, or the barrier model, also from TEN-ASSESS, indicates that certain design elements are simply prohibitive for example from a social acceptability viewpoint.

It is recognised that some work must be done for making the different models useful in CODE-TEN. Among other things, data considerations have necessitated modifications and have indicated in some cases the need to define modelling fall-back possibilities. To integrate the four models into a coherent mo<u>de</u>lling system for <u>co</u>rridor <u>de</u>velopment (DECODE) and make the system functional in a way so that it can support the actual planning of a corridor, the four mentioned models must be made operational even under circumstances where some data is either sparse or missing. The less data-demanding models are referred to as L-versions (for "light") of the normal standard versions (S-versions).

In Figure 2.1 the integrative planning and assessment methodology, DECODE, is presented in a research context.

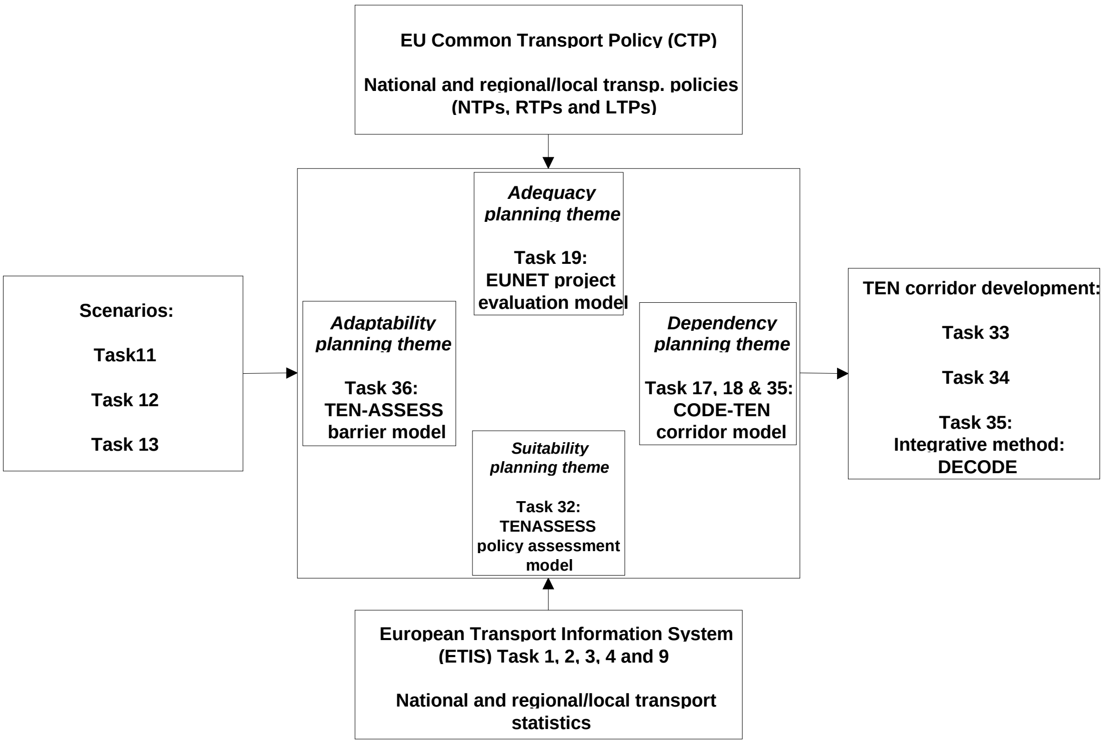


Figure 2.1 Overview of interrelations presenting a research context for the DECODE methodology in CODE-TEN Task 35

One of the important tasks dealt with in the development of the DECODE methodology is the methodological and procedural inclusion of strategic environmental assessment (SEA) (OECD, 1994), (Therivel & Partidario, 1996). Current evidence shows a lack of operational methods and formal requirements both at EU and national levels (Chadwick, 1996) and, furthermore, that SEA is not well integrated into the overall planning process, for example lacking at early stages where projects are formulated (Richardson, 1997). Thus it has been assumed that many of the current issues debated around SEA need to be addressed also in a wider context with the integrative DECODE approach to corridor development.

In section 3 some basic concepts are defined which are needed as part of an operational baseline methodology for the planning of multi-modal transport corridors. The concepts are: EU transport objectives, types of transport initiatives, types of framework variants (used for specific socio-economic evaluation tasks indicating variables and evaluation methods) and corridor development alternatives (CDAs). In the overall methodology the CDAs play an important role as interface (decision element) between the technical and the political spheres of the planning task.

3. Corridor development and planning concepts

3.1 EU Transport objectives

To provide a policy background for the concepts to be introduced a list of EU transport objectives is produced on the basis of primarily two main documents:

- Commission of the European Communities (1992). The future development of the Common Transport Policy, COM (92) 494.

- Commission of the European Communities (1995a). The Common Transport Policy Action Programme 1995-2000. Brussels, COM (95) 302.

The list is based among other things on reviews undertaken within the APAS/Road3 study and working material from the TEN-ASSESS study. Other CEC documents made use of are given as references in the APAS/Road3 study, see chapter 2 of this report (CEC, 1995b).

The listed objectives have been assigned numbers for the purpose of presentation within this study. Some editing, however, has been undertaken to avoid linkage with specific contexts not necessary here, etc. The specification for each objective given in parenthesis is only indicative. Each of the ten objectives have been formulated to represent a particular dimension not covered by the other objectives (ideally they are "orthogonal" to each other).

1. *Maximise transport efficiency* (improved performance and development of each mode and their integration into a coherent transport system, socio-economic feasibility, improved comfort and level of service, etc.)

2. *Improve transport safety* (vehicle and infrastructure safety, dangerous transports, driver education and behaviour, socio-economic feasibility, etc.)

3. *Contribute to environmental improvement* (local air pollution, noise, severance, quality of built environment and landscape, socio-economic feasibility, etc.)

4. *Improve strategic mobility* (accessibility and European networks, nodal points, peripheral areas, missing links, etc.)

5. *Contribute to strategic environmental improvement* (greenhouse gases, ecological damage, use of energy resources, etc.)

6. *Contribute to strategic economic development* (regional economics, spatial planning considerations, etc.)

7. *Contribute to technology-development* (innovation in transport technology and standards, telematics, etc.)

8. *Contribute to implementation of the Single Market* (fair competition and pricing, technical harmonisation, etc.)

9. *Contribute to the social dimension* (equity, working conditions, "Citizens' Network", people with reduced mobility, etc.)

10. *Contribute to the external dimension* (network development and integration, agreements, technical assistance and co-operation, etc.)

It should be noted that these objectives are primarily set out at the Transnational European level and that they can be in agreement/disagreement with specific national and/or local transport objectives. Similarly, objectives can be set up for the national and regional/local level. Differences then occur from: 1) lack of congruence (non-similar objective definitions) for the specific objective, and with similar objective definitions from: 2) different preference strength.

The ten listed objectives necessarily reflect general EU transport objectives, each of which spans a set of operational sub-objectives against which specific impacts can be measured.

Objectives can be met both by implementing infrastructure and technology projects and by implementing specific policies. The numbering in no way reflects any priority of importance, but the ordering reflects that the upper part of the list to a certain degree can be seen as suitable for attainment by the use of projects and the lower part by the use of different types of policies. In the adopted terminology projects and policies together are denominated initiatives.

It is evident that not all objectives have equal importance. This, however, can be taken into account by using an appropriate multi-criteria technique.

The focus in EUNET is on evaluation at project level of inter-urban investment projects, whereas the focus in CODE-TEN is on corridor development implying evaluation at a more aggregate level. In this respect the concept of corridor development alternative (CDA) to be dealt with in section 3.4 becomes relevant. To provide a background for the definition and systematic application of CDAs the concepts of transport initiatives and framework variants as laid down and applied in EUNET can be very useful.

In general the approach taken in EUNET is as follows: For each type of transport initiative (TI) a framework variant (FV) presents the relevant impacts on the basis of the set of CEC transport objectives from the list above. Thus methodologically the FV is important because it lists relevant impacts (and giving measurement and valuation methods) for a certain type of project. The FVs determined in EUNET are to some extent dependent on mode type. Sections 3.2 and 3.3 deal respectively with types of transport initiatives and framework variants which aim at a linking of the CTP objectives with the CDAs that in section 3.4 are derived as sets of projects within a corridor. Section 5 presents specific framework variants which have been set up for CODE-TEN.

3.2 Types of transport initiatives

Transport initiatives are seen as spanning a range of 5 mode orientations (road, rail, waterways, air, inter-modal*) and a range of 4 domain orientations (infrastructure, public transport, ATT, policy). These categories can be differentiated further with regard to geographic context (inter-urban, urban) and scale (large, medium-sized, small). In combination this will produce: 5 x 4 x 2 x 3 = 120 different categories or types of transport initiatives. A number of these, however, are not relevant. Relevant types of transport initiatives (TI) in general are given below. For corridor planning and development the main focus will be in the upper left corner of Table 3.1 for road, rail and infrastructure and for inter-urban initiatives.

Table 3.1 Types of transport initiatives

	INFRASTRUCTURE	PUBLIC TRANS-PORT	ATT	POLICY
ROAD	TI 11: IU, LMS	TI 12: IU, LMS	TI 13: IU, LMS	TI 14: IU, LMS
RAIL	TI 21: IU, LMS	TI 22: IU, LMS	TI 23: IU, LMS	TI 24: IU, LMS
WATERWAYS	TI 31: I, LM	-	TI 33: I, LM	TI 34: I, LM
AIR	TI 41: I, LM	-	-	TI 44: I, LM
INTER-MODAL	TI 51: IU, LMS	TI 52: IU, LMS	TI 53: IU, LMS	TI 54: IU, LMS

Note: A specific TI is determined by mode orientation (road = 1, rail = 2, waterways = 3, air = 4, inter-modal = 5) and by domain orientation (infrastructure = 1, public transport = 2, ATT = 3, policy = 4). For each entrance ("cell") it has been examined whether a geographic subdivision (Inter-urban = I, Urban = U) or a scale subdivision (Large = L, Medium-sized = M, Small = S) is relevant. To exemplify IU, LMS denotes that 2 x 3 = 6 different types appear as relevant within the specific cell. All TI types appearing can then be labelled accordingly, for example a TI concerning a large inter-urban rail infrastructure project as: TI 21-IL and an inter-modal urban small ATT project as: TI 53-US.

In Table 3.1 altogether 82 types of transport initiatives from a general viewpoint are set out as of relevance. The EUNET framework variants developed (one FV per TI), however, concentrate on inter-urban investment projects.

To pay attention, however, to the development of a flexible evaluation system which can later be extended to evaluate other transport initiatives - and then support decision-making and prioritisation among projects belonging to different categories - it has been decided to supplement the EUNET main FVs (in column 1 in Table 3.1) with FVs for some other transport initiatives (columns 2, 3 and 4 in the table).

* Sometimes the terms multi-modal and inter-modal are used interchangeably. This is not the case here as, for example, multi-modal planning is seen as a process of defining a transportation problem in a generic way (that is a non-mode specific manner) and inter-modal planning is a process of identifying the key interactions between two or more modes of transportation where changing the performance or use of one mode will affect another. On this basis only inter-modal is part of the domain categories as a multi-modal project always can be split into an inter-modal project and some residual, mode-specific projects.

On this basis framework variants in EUNET have been worked out for 13 main FVs for infrastructure projects and 3 explorative examples covering some other types of transport initiatives, see Table 3.2. As indicated with the denomination the explorative examples have served to examine the suitability of applying the framework approach set out within the types of infrastructure projects on the other domains.

Table 3.2 EUNET framework variants

PROJECT TYPE	CONTEXT	SIZE	FRAMEWORK VARIANT
1. Road infrastructure project	Inter-urban	Large	11-IL
2. Road infrastructure project	Inter-urban	Medium-sized	11-IM
3. Road infrastructure project	Inter-urban	Small	11-IS
4. Rail infrastructure project	Inter-urban	Large	21-IL
5. Rail infrastructure project	Inter-urban	Medium-sized	21-IM
6. Rail infrastructure project	Inter-urban	Small	21-IS
7. Waterway infrastructure project	Inter-urban	Large	31-IL
8. Waterway infrastructure project	Inter-urban	Medium-sized	31-IM
9. Air	Inter-urban	Major airport development	41-IL
10. Air	Inter-urban	Airport extension and renewal	41-IM
11. Inter-modal	Inter-urban	Large	51-IL
12. Inter-modal	Inter-urban	Medium-sized	51-IM
13. Inter-modal	Inter-urban	Small	51-IS
14. Public transport, urban, small	Urban	Small	12-US*
15. ATT (telematics)	Inter-urban	Medium-sized	13-IM*
16. Policy concerning CO_2 reduction	-	-	14-IU; LMS... 54-IU; LMS*

Note: The framework variants marked with an (*) are explorative examples.

Each of the FVs have been specified in the EUNET WP1 work, see EUNET D10 (NTUA, 1998) and (IFP & COWI, 1997a). All the framework variants are derived from a common structure described in the following section.

3.3 EUNET framework structure

As concerns the structuring of each FV, it is important to adopt a subdivision of impacts which for the defined set of transport initiatives (see Table 3.1) can accommodate the CEC objectives (see section 3.1). The following interpretations have been applied:

1. The first three of the CEC objectives about efficiency, safety and environment have a general design orientation which will prevail for many types of transport investment projects.

2. The next three objectives about strategic mobility, strategic environment and strategic economic development concern objectives which in many cases, with adequate modelling applying for example GIS methodology, can be given spatial/territorial impact representations. In this respect, the CEC UTS (Union Territorial Strategies linked to the Transeuropean Networks) Study can be referred to with its modelling of territorial impacts concerning "cohesion", "sustainability" and "competitiveness" (Chatelus & Ulied, 1996).

3. The last four of the CEC transport objectives are also of a strategic type but of a more general policy nature.

If the term "core" from the APAS/Road3 study (CEC, 1995b) is adopted as an impact category of basic importance for many transport initiatives of the project type, and a "non-core & non strategic" category is defined to comprise project type specific characteristics, the following EUNET subdivision appears, with strategic impacts split into "territorial" and "non-territorial":

- Core impacts (CBA): Basic impacts (A-impacts)
- Non-core, non-strategic impacts (MCA): TI type specific characteristics (B-impacts)
- Strategic, territorial impacts (MCA): Impacts with territorial affiliation (C-impacts)
- Strategic, non-territorial impacts (MCA): Other strategic impacts with no territorial affiliation (D-impacts)

These four impact categories (roughly following: hard & soft non-strategic and hard & soft strategic impacts) constitute the EUNET generic framework with A, B, C and D impacts.

The EUNET framework is suitable for the CODE-TEN assessment methodology with an appropriate CBA/MCA methodology. At the same time it also accommodates the current development of making use of GIS in transport evaluation modelling. Section 5 presents the CODE-TEN framework variants.

3.4 Corridor development alternatives

The concept of a transport corridor can be used as a link between long and short term approaches. According to the Crete Conference taking place in 1994 the corridors are multi-modal, multi-route and multi-national. It is important to note that at the corridor scale the added-value linked to regional co-operation takes its full measure (Chatelus, 1998).

Making use of the concept of transport initiatives, the planning and development of a transport corridor from a general, methodological viewpoint will involve a consistent set of transport initiatives to be carried out. These initiatives can principally be any of the types mentioned in Table 3.1, but for a typical major European transport corridor they will be dominated by inter-urban road and rail infrastructure projects and will include also important interchange points. These initiatives will be characterised by their influence on each other, either as complementing each other as a series in a link for the same mode or as substituting each other where modes (primarily road and rail) are running in parallel and compete for their respective share of the total transport along the corridor. Basically, all transport initiatives in a corridor development programme can be seen as interdependent and with some combinations of initiatives/projects more obviously than others, we will define a corridor development alternative (CDA) as a set of consistent transport initiatives/projects which is worthwhile to implement on the basis of some adopted objectives. On this basis a certain CDA and its premises including a particular scenario is an expression of a particular transport development strategy (TDS) for a given corridor. In brief: TDS = CDA + premises.

To exemplify, the development alternative 3 of a corridor c can in a formal way be indicated as:

$$CDA(c : 3) = \{I_1, ... I_n , ... I_N\} \cong \{P_1, ... P_j, ... P_J\}$$

This simply states that the CDA consists of the interdependent set of N initiatives which can approximately be set equal to the interdependent set of J infrastructure projects. In practice this CDA is almost completely defined by a set of infrastructure projects. This need not always be so and it is highly probable that the actual building up of relevant development programmes for specific corridors will lead to combinations involving both relevant fractions of infrastructure and of non-infrastructure initiatives. In the following, introducing the linkage between the CDA and the framework variants, the CDA will mainly be thought of as a set of infrastructure projects. Other assessment aspects of relevance will be described in section 4, which is about the DECODE planning process in general.

The CDAs considered below span the modes road, rail, waterway, air and intermodal, see Table 3.1.

When evaluating a CDA, it is important to recognise that the overall value to be associated with a CDA cannot simply be constructed as an addition of the values of the individual projects. The synergies that are caused by the interdependence of the projects are very important to capture. For this reason the CODE-TEN methodology is laid down so the single CDA and not its contained projects is the basic unit. The evaluation of contained projects will, however, be an important element making use of the methodology available with the EUNET framework variants.

Another important methodological issue, not the least because of synergy-effects, is the interrelationship between CDA evaluation and surrounding ("global") policies and scenarios, see the research context in Figure 2.1. It is found necessary to deal with this in an operational way both on the supply side (design strategies) and on the demand side (scenarios for actual multi-modal traffic forecasts and impact valuation). The design strategies to be applied consist of a "do-minimum" strategy combined with so-called "pure" and "mixed" strategies where the pure strategies serve to explore the variation space determined by clear-cut single mode policies and the mixed strategies serve to indicate "in-between and balanced" modal strategies. Overall the do-minimum strategy will also make up a base case situation needed as a reference for other strategies. These design strategies will be "multiplied" with a number of scenarios. Preliminarily in this context and based on the results from POSSUM, six scenarios have been chosen to illustrate the methodology (Stead & Banister, 1997, p. 17). Extending the notation above with S_x indicating scenario/reference image no. x we obtain the following CDAs for a corridor c.

CDAs for corridor c based on scenario S_1:

$CDA(c, S_1: 0)$	Base case ("do-minimum") with reference image S_1
$CDA(c, S_1: 1)$	Road strategy with reference image S_1
$CDA(c, S_1: 2)$	Rail strategy with reference image S_1
$CDA(c, S_1: 3)$	Waterway strategy with reference image S_1
$CDA(c, S_1: 4)$	Air strategy with reference image S_1

CDA(c, S_1: 5) Intermodal strategy with reference image S_1

CDA(c, S_1: 6) Mixed road and rail, strategy with reference image S_1

CDA(c, S_1: 7) Mixed road and rail strategy with reference image S_1

....

CDAs based on scenario S_2:

CDA(c, S_2: 0) Base case (“do-minimum”) with reference image S_2

CDA(c, S_2: 1) Road strategy with reference image S_2

CDA(c, S_2: 2) Rail strategy with reference image S_2

CDA(c, S_2: 3) Waterway strategy with reference image S_2

CDA(c, S_2: 4) Air strategy with reference image S_2

CDA(c, S_2: 5) Intermodal strategy with reference image S_2

CDA(c, S_2: 6) Mixed road and rail, strategy with reference image S_1

CDA(c, S_2: 7) Mixed road and rail strategy with reference image S_2

....

CDAs based on scenario S_3:

CDA(c, S_3: 0) Base case (“do-minimum”) with reference image S_3

CDA(c, S_3: 1) Road strategy with reference image S_3

....

Etc.

The above example has assumed that three mixed strategies are sufficient.* To illustrate the systematic approach, however, four pure strategies have been included and with for example four scenarios, it is seen that the total number of CDAs for corridor c will be around 30. This number will be too high for practical studies so suggestions are needed for a “thinning out” process. It is proposed that WP3 where the scenarios to be applied in CODE-TEN are worked out will consider such procedures also to obtain a manageable set of alternatives. Part of this

* The intermodal strategy 5 is mainly concerned with “node” investments whereas 6 and 7 consider “link” investments. A certain CDA, naturally, may be defined to contain both types of investments. The listing of CDAs has primarily been carried out to illustrate some of the systematic considerations that are needed for a corridor to lead to a reasonable set of CDAs.

could be to match certain design strategies with certain scenarios. This examination in WP3 should also include the actual degree of cross-corridor study comparisons that are aimed at.

As a preliminary measure, it has been decided to consider two development scenarios ("quick integration" vs. "slow integration") and two macro-economic scenarios ("high growth" vs. "low growth"). Together this spans four future reference images or study scenarios.

The specific scenario approach to be applied in CODE-TEN will be laid down in WP3 and WP6. It is recognised as part of the WP1 work that the scenario approach to be adopted will have a major role to play with regard to obtaining an overall consistency in the concerted use of the DECODE models.

The following section 4 presents the contents of the DECODE planning process making use of the structure presented in section 2 and the concepts introduced in section 3.

4. The DECODE planning process

4.1 The planning methodology as three stages

A characteristic feature of European transport corridor planning is the complexity involved due to a multi-levelled and multi-staged system comprising a set of actors which only to some extent share views and interpretations. The process is not complicated only because of many actors and different stages. This is also caused also by the actual changing role of the system of European transport corridors. Thus the COST 328 Study has among its conclusions the following observation (Banister et al., 1997, p. 18):

"... The use of the European strategic transport network is in a state of rapid adjustment. The value added ... comes from flexible production processes, new users of the network, out-sourcing and decentralisation, together with fundamental changes in organisation and man-agement processes ... It has been realised that networks are much wider than the physical in-frastructure which is conventionally considered within evaluation."

A process concerned with planning and evaluation of corridor development should be organised and apply methodology which is able to capture concerns and issues such as those raised in the COST 328 conclusions. At the same time, however, there is a need for compatibility with concerns relating to quite specific evaluation issues, for example whether a certain project should be implemented or not. Accordingly, the overall process and its methodology must be able to incorporate a diversity of concerns and issues.

It has been recognised with the structure of the DECODE methodology, see section 2, that such demands on process content and methodology can never be fulfilled by any "linear" process prescribing in operational detail certain activities to be undertaken but that they will necessitate a kind of self-organising planning where contingencies can be paid the attention they deserve considering their possible implications for the planning outcome. In such a type of planning the role of planning becomes much more focused on a proactive understanding of the important events occurring in the process than on an overall mapping and description of the process.

The development of the CODE-TEN assessment methodology will be facilitated by the accomplishment of altogether nine corridor studies (study partners in parenthesis with lead partner underlined):

(a) Moscow-St. Petersburg-Helsinki-Stockholm-Copenhagen (IFP, CTH, SCCTP, VTT, ITS)

(b) Warsaw-Riga-Tallinn-Helsinki 'Via Baltica' (VTT, TTU, WEUG, PLANCO, IFP)

(c) Berlin-Warsaw-Minsk-Moscow-Nizhny Novgorod (PLANCO, WEUG, SCCTP, INRETS, IFP)

(d) Danube waterway (PLANCO, ICCR, KTI, CTC, INCERTRANS, TRT)

(e) Berlin-Praque-Vienna-Budapest-Sofia-Constanta/Thessaloniki (ICCR, PLANCO, KTI, CTC, INCERTRANS, SYSTEMA, ITS)

(f) Salzburg-Ljubljana-Zagreb-Beograd-Thessaloniki (INRETS, CTC, ICCR, SYSTEMA. TRT)

(g) Venice-Triest/Koper-Budapest-Kiev (TRT, KTI, CTC, ICCR)

(h) Mediterranean short-sea shipping (SYSTEMA, IST, INRETS, TRT, INCERTRANS, CTC)

(i) Lisbon-Madrid-Paris-Berlin/Bruxelles(INRETS, IST, PLANCO)

In accordance with the methodology view above and to make the most out of the case studies, it is suggested that the case studies are carried out so they resemble a full planning process, although this will not be possible due to study resources and time constraints. Moreover, it should be noted that an understanding of all process- and methodology aspects can only be obtained by the actual planning being undertaken in full scale. We will refer to such a full scale methodology as being at stage III. The methodology after the completion and interpretation of the case study results will be referred to as methodology at stage II. It is the methodology at stage II that will be formulated and developed in WP6 and that afterwards will be used for the development of the decision support system in WP7. The baseline methodology at stage I in this report will - as a consequence of the methodological considerations - be described as six types of planning activities to be undertaken in connection with the conduct of a case study and in the course of these activities as speculations/simulations around the important planning events. These events are, on the basis of the theory described in section 2, expected to appear in connection with the so-called planning validity claims, with the four different basic types about adequacy, dependency, suitability and adaptability.

4.2 Stage I methodology

Available at the initial phase of the case studies is the following general background information:

- A set of common methodological concepts to be applied for all case studies (D1, Main Report) and a set of operational guidelines (D1, Appendix Report)
- A set of review results where some of the models and data have a background in the actual corridor (D1, Appendix Report)
- Access to the ideas about the integrated database Transport Information System (TIS) including information from all relevant countries on: 1) transport and traffic data; 2) transport policy objectives and areas of action with particular emphasis on the institutional context; 3) specific transport measures and initiatives, including economical and fiscal measures; 4) infrastructure development including combined transport; 5) socio-economic and regional development and 6) environmental policies and measures and environmental indicators (D1, Appendix Report)
- Preliminary ideas about the scenario context (D1, Appendix Report)
- Preliminary ideas about the indicators for spatial and economic impacts (D1, Appendix Report)

- Preliminary ideas about indicators for the spatial distribution of environmental impacts (D1, Appendix Report)

In parallel to the work with the case studies each case study team will feed results back to the teams of WP2 to WP5 that are developing their particular tasks. Both the case studies and the fulfilment of these tasks will lie behind the stage II methodology to be developed in WP6.

The stage I methodology is contained in six types of planning activities. For the sake of maintaining an overview of the process, the detailed methodological information is given in subsequent sections 5-9, with each section covering a particular topic.

Planning activity 1 (PA1): The purpose of this activity is for the specific corridor study to determine a reasonable set of corridor development alternatives (CDAs). The number will depend on the actual study and the global (= for all the case studies) assumptions made. As an introduction to this, it will be necessary for all case team members to simply get to know the corridor and its particular “history”: How has it developed over the years ? - What major investments have been made ? - Where are the most visible needs for upgrading, etc. ? On this basis an inventory should be made of specific policies, data, existing plan material and interviews with key persons could be conducted. Then this material collected should in combination with the general start-up information be used to define the initial CDA set for the corridor.

Planning activity 2 (PA2): The purpose of this activity is to determine the adequacy of considered CDAs. The adequacy examinations concern determination of the socio-economic feasibility of the CDAs. The team can make use of existing studies and/or undertake their own analyses using the methodology described in section 5. As the case studies are not full scale studies, it may be necessary to make use of different assumptions as part of a particular analysis. It is up to each team to optimise their study resources. The content of the activity will depend very much on the particular case. The activity ends with the team deliberating the results and on this basis debating which type of activity should follow.

Planning activity 3 (PA3): The purpose of this activity is to examine the dependency issues aiming at the best possible integration of the sets of infrastructure with the surroundings. This activity may lead to changes in infrastructure alignment and readjustments in the number of alternatives considered. The team can make use of the start-up information and can undertake its own analyses by the use of the methodology described in section 6. It will also be important to incorporate information from the insights obtained in the PAs already undertaken (see Figure 4.1 below). These insights are thought to “mirror” the planning validity claims/important planning events which are only possible to detect in a full scale planning (stage III) methodology. The activity ends with the team debating whether the CDA set should be modified and on this basis which planning type it will be most appropriate to address next given the actual PA insights and results.

Planning activity 4 (PA4): The purpose of this activity is to consider suitability aspects. Whereas PA2 and PA3 can draw on "objective" model answers, the suitability examinations put attention on more "subjective" considerations which, however, are no less important for an overall successful planning. Conventionally, infrastructure planning has refrained from dealing with such issues by making use of models. It is part of the DECODE approach (modelling system for corridor development) that modelling efforts are also worthwhile in this area and that the overall corridor planning can be supported by an integrated use of different types of models. To obtain insights into suitability, the team can make use of the methodology described in section 7. Other sources would also be relevant. One issue to be clarified to make up the possibilities for a successful implementation decision is the institutional framework and the actual decision-makers involved. On the basis of what is assessed and for whom, the set of critical decision makers (CDMs) can then be identified.

Planning activity 5 (PA5): The purpose of this activity, also within the domain of "subjective" issues, is to consider adaptability aspects. Many of the issues (critical success factors, CSFs) as described in the COST 328 Study (Banister et al., 1997) may only surface here ("networks are much wider than the physical infrastructure"). The team shall seek to identify such CSFs and make assessments of the possibilities, risks and uncertainties involved. The team can make use of the methodology described in section 8 but as with PA4 other sources may also be relevant. Where technical questions will be at the forefront in both PA2 and PA3, political and social questions should be treated explicitly in both PA4 and PA5. It must be recognised that politics is important at this level of infrastructure planning (Pearman, 1998). At the same time it should be underlined that the methodology worked out to support the examinations of the subjective issues in no way serves to replace real societal processes. Detection of CDMs in PA4 and CSFs in PA5 may simply be seen as very useful for planners when they seek to address issues which will make a difference.

Planning activity (PA6): This activity addresses the situation where the planning process converges into a condition where agreement about a certain transport corridor development would be both likely and desirable under the actual planning objectives. Or it reaches a condition (blocking) where no such agreement is to be expected; this will be detected by the team as an unsurpassable inconsistency between means and ends. The team task in PA6 consists of giving a survey record of the previous activities and outcomes and an outline of the actual end condition.

The described planning activities may as concerns PA2 to PA5 show up in various orders*. This "non-linearity" is due to the complexity of the task: the number of corridors and their differences, the supranational setting of the planning task, the types and synergies of impacts, the ongoing changes in various planning determinants, the data availability, etc. From a methodological viewpoint this necessitates that both contingent and normative procedures should be applied. This has led to a process with a baseline methodology as illustrated in Figure 4.1, which is a further specification of the structure for the research context shown in Figure 2.1.

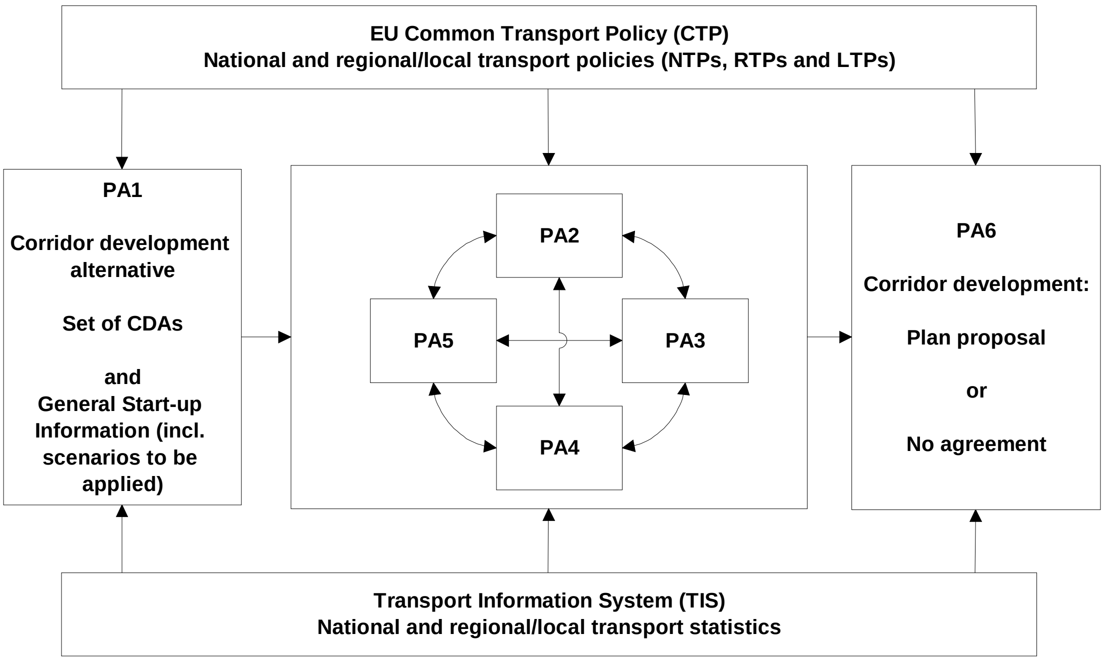


Figure 4.1 The DECODE planning process and methodology

Necessarily, such a process for planning of corridor development will entail a lot of uncertainties which from a methodological viewpoint should be met in the most efficient way. The specific approach adopted makes use of several models which put a strain on study resources. As will appear from the methodological sections 5-9, which follow, much emphasis, however, is given to saving data where possible. This has led to the concept of light L-versions vs. the standard S-versions of the models which means that use will be made of a number of proxy variables. There is no doubt that use of S-versions instead of L-versions would lead to more precise model results. In this type of planning, however, it is considered to be most promising to handle uncertainty by relying on analyses <u>between</u> scenarios and models

* It has been decided to present the PAs in the same order as their underlying type of validity claim has been interpreted from Habermas's theory of communicative action into a planning specific context, see Khisty & Leleur (1997).

instead of applying risk analysis or similar within the scenarios and models (Pearman, 1998). As methodology moves from stage I to stage III for the individual corridors, it may be possible that study resources becoming available will allow more use to be made of the very refined but data demanding capabilities of some of the assessment models in the Strategic Transport part of the EU 4th Framework Programme.

It will appear from the process and methodological suggestions that the individual case teams will be a major influence on the further methodology development from stage I to stage II. This by the way is in close agreement with the share of the CODE-TEN resources that have been allocated to these studies. To get the most out of the case studies, it is important to remember in addition to the corridor planning results that the methodology testing is also a concern. With this in mind the study resources should be optimised in each case. This will mean that application of several model examinations is to be preferred compared to a few but very resource demanding ones. Such model runs should await stage II or III planning. It is recommended also that the individual corridor case reports are carried out on these premises so a wide methodological experience can be made use of when methodology is carried on from stage I to stage II in WP6.

4.3 Consistency in modelling approach

With the necessary flexibility built into the DECODE process to make room for contingency, etc. it is necessary also to ensure that the overall outcome of a DECODE process is consistent, judged on the basis of a set of method premises that can be accepted by the users of DECODE. Such consistency consideration has to take several issues into account:

- Basically DECODE adopts a multiple perspectives approach to planning and assessment by examining the planning issues from (at least) four angles.
- The planning cuts across the policy, programme and project levels and across “hard” and “soft” methodology.
- DECODE comprises models which should not be considered as final at a certain stage but will continue to be developed in parallel with their actual use.
- Depending on data availability, etc. particular methods will be used at levels of varying aggregation.

It has been decided to manage the consistency in the modelling approach by the use of:

∗ A central forecast scenario

∗ A central set of nested weights

The central forecast scenario will provide a basis for further evaluations against a number of future scenarios which can be set out. An immediate role of the central forecast scenario will be to support the case studies in WP2 and to ensure the possibility of making cross-corridor comparisons.

The central set of nested weights ensures that the overall assessment based on all impacts considered is internally compatible and logical (but not necessarily “right”). The set of nested weights provides a hierarchic order which ensures for example that project level impacts, corridor level impacts and programme & policy level objectives are interlinked in a consistent way.

Both the central forecast scenario and the central set of nested weights are primarily internal DECODE method constructs. As such they will serve as a basis for the formulation of the different “front line” scenarios and strategies. Some preliminary ideas and illustrations have been worked out and are presented in the Appendix Report.

5. Examination of action feasibility: *Adequacy*

5.1 Principles and review results

The planning theme about action feasibility deals with the important question of whether a certain corridor development alternative (CDA) has a reasonable socio-economic rate of return. Out of the four different planning themes made use of in DECODE, this adequacy theme is the one most alike conventional project evaluation. The specific approach taken stems from the EUNET project which, among other things, means that strategic impacts are duly considered. The EUNET model, S-version (Tsamboulas et al., 1998) has been reworked to set up a less data demanding L-version.

As mentioned in section 3 about concepts, the EUNET evaluation model is built around the following generic framework consisting of four groups of impacts so that a particular transport initiative (TI) is associated with a particular framework variant (FV):

- Core impacts (CBA): Basic impacts (A-impacts)
- Non-core, non-strategic impacts (MCA): TI type specific characteristics (B-impacts)
- Strategic, territorial impacts (MCA): Impacts with territorial affiliation (C-impacts)
- Strategic, non-territorial impacts (MCA): Other strategic impacts with no territorial affiliation (D-impacts)

The following principles underlie the definition and application of the FVs:

- The basic theoretical principle is that of estimating the welfare gain from a certain investment project (transport initiative) as net benefits dependent upon calculations of consumer surplus and producer surplus (total revenue minus total cost). For road infrastructure investments, however, an approach applying time savings, instead of generalised net user benefits plus revenue, is applied. For a closer description of the principles see (CEC, 1995c, pp. 53-54).
- Emphasis is paid to avoiding double counting which means that impacts in a framework should be genuinely additive (from the upper to the lower part of the criteria sheet).
- All the frameworks presuppose that a traffic model can estimate before and after traffic loads to deliver traffic estimates for the impact models. For each project a suitable influence-area is defined together with parameters needed for forecasting, etc. Traffic modelling requirements are dealt with in section 9 and in section 8 and 11 of the Appendix Report.
- Each of the frameworks have been developed for socio-economic evaluation of either link (road, rail, waterway) or node (air, inter-modal) investments. Neither link nor node investments are, however, isolated events as they may influence other links or nodes (traffic intensity, traffic distribution in time, modal split, etc.). These further impacts are also of importance with respect to the socio-economic evaluation. Supplementary to the calculation of impacts in the actual framework for the investment examined, frameworks should be applied to calculate additional impacts on relevant links and/or

nodes. With no investment cost here, the additional benefits and costs are added in order to complete the socio-economic evaluation (Tsamboulas et al., 1998).

5.2 EUNET Evaluation Model L-version

The frameworks are structured by means of transportation. For each mode the EUNET-L framework is presented as two tables:

- A table presenting the relevant impacts with variables and study level in overview
- A table presenting the associated modelling approach in overview (and the model source and the responsibility for producing guidelines for the corridor teams)

It should be noted that EUNET-S and EUNET-L have identical types of impacts but that they differ with regard to the impact modelling. Furthermore, EUNET-L applies only 5 framework variants whereas Table 3.2 in section 3 about the general EUNET approach shows 13 infrastructure FVs. In EUNET-L only one FV per mode is used which gives the five FVs whereas the project size differentiation as presumed in Table 3.2 leads to the 13 FVs indicated.

Similarly, it should be noted that all A and B-impacts are measured and estimated at the project level while C and D-impacts are determined at the CDA-level.

The measurement/estimation knowledge needed by the corridor teams is given as an operational impact guideline for each impact . As can be seen on the FV tables on the modelling approach each impact has an associated “Model & Source” and a “Guideline Responsibility”.

It is foreseen that a sketch model will be needed in the initial phase of the work with the corridor cases in WP2. This is addressed in the Appendix Report’s section 13.

ROAD

Table 5.1 EUNET-L road framework for corridor development: Variables & Study Level

FV-L 11-I Corridor development	Road infrastructure VARIABLES & STUDY LEVEL	
Impacts	**Variables**	**Study Level**
Core impacts		
A1 Investment costs	Materials, labour, land and property acquisition (including compensation)	Project
A2 System operating and maintenance costs	Structural repairs, carriageway delineation, signing, enforcement of traffic regulations	
A3 Vehicle operating costs	Fuel and oil consumption, tyre wear, vehicle maintenance, depreciation	
A4 Travel time benefits	Working time, home-work time and leisure time	
A5 Safety	Fatalities, severe and slight injuries, damage only accidents	
A6 Local environment	Noise and air pollution, severance	
Non-core, non-strategic impacts		
B1 Driver convenience	Comfort, stress, smoothness	Project
B2 Urban quality & landscape	Visual environment	
Strategic, territorial impacts		
C1 Strategic mobility	Accessibility and networks	CDA
C2 Strategic environment	Greenhouse effect, strategic atmospheric pollution, loss and damage of ecological, historical, archaeological and scientific sites, energy consumption, natural resources	
C3 Strategic economic development	Land use, economic development, employment impact	
Strategic, non-territorial impacts		
D1 Private financial attractiveness	Financial internal rate of return, net present value or equal	CDA
D2 Other strategic policy and planning impacts	Conformity to other strategic policy and planning concerns	

Table 5.2 EUNET-L road framework for corridor development: Modelling approach & Responsibility

FV-L 11-I **Corridor development**	**Road infrastructure** **MODELLING APPROACH & RESPONSIBILITY**	
Impacts	**Model & Source**	**Guideline Responsibility**
Core impacts		
A1 Investment costs	Corridor team	-
A2 System operating and maintenance costs	EUNET (WP3)	PLANCO
A3 Vehicle operating costs	EUNET (WP3)	PLANCO
A4 Travel time benefits	EUNET (WP4)	ITS
A5 Safety	EUNET (WP4)	ITS
A6 Local environment (Air pollution, Noise, Severance)	COMMUTE, EUNET (WP4)	ITS
Non-core, non-strategic impacts		
B1 Driver convenience	-	ITS
B2 Urban quality & landscape	-	ITS
Strategic, territorial impacts		
C1 Strategic mobility	UTS, EUNET (WP5), POINTER Index	WP4
C2 Strategic environment	COMMUTE	WP5
C3 Strategic economic development	Point scale (-5,..,0,..+5) Proxy variables (COWI, 1990) Available studies and expert judgement	IFP
Strategic, non-territorial impacts		
D1 Private financial attractiveness	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	Halcrow Fox
D2 Other strategic policy and planning impacts	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	INRETS

Note 1: The point scales for the strategic impacts indicate that EUNET-L will apply a less rigorous methodology compared to EUNET-S; that is the methodology or assessment principles which will be applicable on sparse data, etc.

Note 2: As concerns Guideline Responsibility it is relevant already at this stage to indicate the partners and the WPs that will be involved. ICCR foresees no problems as concerns resources from these later WPs used earlier than planned in the Technical Annex. These early starts will provide a better basis for the case studies in their initial phases.

Note 3: In EUNET the FVs have been developed into so-called Investment Project Profiles (IPPs) that match the chosen degree of detail and the associated data set in EUNET-S (Tsamboulas et al., 1998). In CODE-TEN the FVs will be represented in many applications by impact sets of a less data demanding type.

RAIL

Table 5.3 EUNET-L rail framework for corridor development: Variables & Study level

FV-L 21-I **Corridor development**	**Railway infrastructure** **VARIABLES & STUDY LEVEL**	
Impacts	**Variables**	**Study Level**
Core impacts		
A1 Investment costs	Materials, labour, land and property acquisition (including compensation), rolling stock	Project
A2 System operating and maintenance costs	Track and structure repair, signalling, rolling stock	
A3 Train operating costs	Fuel/power, crew costs, terminal costs, track costs, depreciation and interest, train planning, administration, advertising and publicity	
A4 Generalised net user benefits	Time savings and quality effects to working, home-work and leisure trips and freight transport, change in fare and shipment prices	
A5 Safety	Fatalities, severe and slight injuries, damage only accidents	
A6 Local environment	Noise and air pollution, severance, vibration	
A7 Revenue	Change in income on passengers and freight	
Non-core, non-strategic impacts		
B1 Public transport facilities	Perception of the facilities while arriving, changing and waiting	Project
B2 Urban quality & landscape	Visual environment	
Strategic, territorial impacts		
C1 Strategic mobility	Accessibility and networks	CDA
C2 Strategic environment	Greenhouse effect, strategic atmospheric pollution, loss and damage of ecological, historical, archeological and scientific sites, energy consumption, natural resources	
C3 Strategic economic development	Land use, economic development, employment impact	
Strategic, non-territorial impacts		
D1 Private financial attractiveness	Financial internal rate of return, net present value or equal	CDA
D2 Technology development	New technology	
D3 Other strategic policy and planning impacts	Conformity to other strategic policy and planning concerns	

Table 5.4 EUNET-L rail framework for corridor development: Modelling approach & Responsibility

FV-L 21-I **Corridor development**	**Railway infrastructure** **MODELLING APPROACH & RESPONSIBILITY**	
Impacts	**Model & Source**	**Guideline Responsibility**
Core impacts		
A1 Investment costs	Corridor team	-
A2 System operating and maintenance costs	EUNET (WP3)	PLANCO
A3 Train operating and maintenance costs	EUNET (WP3)	PLANCO
A4 Generalised net user benefits	EUNET (WP4)	ITS
A5 Safety	EUNET (WP4)	ITS
A6 Local environment	COMMUTE, EUNET (WP4)	ITS
A7 Revenue	EUNET (WP4)	ITS
Non-core, non-strategic impacts		
B1 Public transport facilities	-	ITS
B2 Urban quality & landscape	-	ITS
Strategic, territorial impacts		
C1 Strategic mobility	UTS, EUNET (WP5), POINTER Index	WP4
C2 Strategic environment	COMMUTE	WP5
C3 Strategic economic development	Point scale (-5,..,0,..+5) Proxy variables (COWI, 1990) Available studies and expert judgement	IFP
Strategic, non-territorial impacts		
D1 Private financial attractiveness	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	Halcrow Fox
D2 Technology development	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	ITS
D3 Other strategic policy and planning impacts	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	INRETS

See Table 5.2 notes

WATERWAY

Table 5.5 EUNET-L waterway framework for corridor development: Variables & Study Level

FV-L 31 - I Corridor development	Waterway infrastructure VARIABLES & STUDY LEVEL	
Impacts	**Variables**	**Study Level**
Core impacts		
A1 Investment costs	Materials, labour, land and property acquisition (including compensation). The investment costs include canals, harbours/terminals, electric power stations, locks and barrages and costs of environmental protection measures	Project
A2 System operating and maintenance costs	Regular dredging of river beds, consolidation of canal and river banks, operation and maintenance of locks, pumping installations, operating of the system and income from the generation of electric power, icebreaking, etc.	
A3 Vessel operating and maintenance costs	Costs of ownership and operation incl. depreciation, personnel costs of vessels crew, fuel consumption, repair and maintenance of the vessel etc.	
A4 Generalised net user benefits	Goods: Freight transport (travel time, handling time, access time), changes in shipment prices Passengers: Time savings and quality effects to leisure, working, home-work, changes in fare prices	
A5 Safety	Fatalities, severe and slight injuries, damage only accidents	
A6 Local environment	Air pollution (emission of CO, HC, NOx and SO_2 from vessels), noise and severance (from e.g. canals)	
A7 Revenue	Change in income on freight and passengers	
Non-core, non-strategic impacts		
B1 Urban quality & landscape	Visual environment	Project
B2 Non traffic related functions	Flood protection, water supply and waste water disposal	
Strategic, territorial impacts		
C1 Strategic mobility	Accessibility and networks	CDA
C2 Strategic environment	Greenhouse effect, strategic atmospheric pollution, energy consumption, loss and damage of historical, archaeological and scientific sites, ecological impacts on fauna, flora, etc., e.g. dredging sites	
C3 Strategic economic development	Land use, economic development, employment impact, effects on tourism and leisure activities, possible damage on fisheries resources etc.	
Strategic, non-territorial impacts		
D1 Private financial attractiveness	Financial internal rate of return, net present value or equal	CDA
D2 Other strategic policy and planning impacts	Conformity to other strategic and planning concerns	

Table 5.6 EUNET-L waterway framework for corridor development: Modelling approach & Responsibility

FV-L 31 - I **Corridor development**	**Waterway infrastructure** **MODELLING APPROACH & RESPONSIBILITY**	
Impacts	**Model & Source**	**Guideline Responsibility**
Core impacts		
A1 Investment costs	Corridor team	-
A2 System operating and maintenance costs	EUNET (WP3)	PLANCO
A3 Vessel operating and maintenance costs	EUNET (WP3)	PLANCO
A4 Generalised net user benefits	EUNET (WP4)	ITS
A5 Safety	EUNET (WP4)	ITS
A6 Local environment	COMMUTE, EUNET (WP4)	ITS
A7 Revenue	EUNET (WP4)	ITS
Non-core, non-strategic impacts		
B1 Urban quality & landscape	-	ITS
B2 Non traffic related functions	-	PLANCO
Strategic, territorial impacts		
C1 Strategic mobility	UTS, EUNET (WP5), POINTER Index	WP4
C2 Strategic environment	COMMUTE	WP5
C3 Strategic economic development	Point scale (-5,..,0,..+5) Proxy variables (COWI, 1990) Available studies and expert judgement	IFP
Strategic, non-territorial impacts		
D1 Private financial attractiveness	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	Halcrow Fox
D2 Other strategic policy and planning impacts	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	INRETS

See Table 5.2 notes

AIR

Table 5.7 EUNET-L airport development and extension framework for corridor development: Variables & Study Level

FV-L 41 - I Corridor development	Airport development and extension VARIABLES & STUDY LEVEL	
Impacts	**Variables**	**Study Level**
Core impacts		
A1 Investment costs	Materials, labour, land and property acquisition (including compensation), equipment	Project
A2 System operating and maintenance costs	Repair work and current maintenance, traffic control, staff costs and surveillance	
A3 Airline operating and maintenance costs	Fuel, crew costs, terminal costs, maintenance, depreciation and interest, planning, administration, advertising and publicity	
A4 Generalised net user benefits	Time savings and quality effects to business and leisure trips and freight transports (access time to airport, handling time, holding/taxiing time), change in fare and shipment prices	
A5 Safety	Accident statistics, types of safety systems	
A6 Local environment	Noise and air pollution, soil and ground water	
A7 Revenue	Change in income on passengers and freight	
Non-core, non-strategic impacts		
B1 Passenger comfort	Perception of the nodal point facilities while arriving, in transfer and waiting	Project
B2 Urban quality & landscape	Visual environment	
B3 Goods handling	Perception of facilities for goods and express freight	
Strategic, territorial impacts		
C1 Strategic mobility	Accessibility and networks	CDA
C2 Strategic environment	Greenhouse effect, strategic atmospheric pollution, loss and damage of ecological, historical, archaeological and scientific sites, energy consumption, natural resources	
C3 Strategic economic development	Land use, economic development, employment impact	
Strategic, non-territorial impacts		
D1 Private financial attractiveness	Financial internal rate of return, net present value or equal	CDA
D2 Technology development	New technology	
D3 Other strategic policy and planning impacts	Conformity to other strategic policy and planning concerns (CTP deregulation, etc.)	

Table 5.8 EUNET-L airport development and extension framework for corridor development: Modelling approach & Responsibility

FV-L 41-I **Corridor development**	**Airport development and extension** **MODELLING APPROACH & RESPONSIBILITY**	
Impacts	**Model & Source**	**Guideline Responsibility**
Core impacts		
A1 Investment costs	Corridor team	-
A2 System operating and maintenance costs	EUNET (WP3)	PLANCO
A3 Airline operating and maintenance costs	EUNET (WP3)	PLANCO
A4 Generalised net user benefits	EUNET (WP4)	ITS
A5 Safety	EUNET (WP4)	ITS
A6 Local environment	COMMUTE, EUNET (WP4)	ITS
A7 Revenue	EUNET (WP4)	ITS
Non-core, non-strategic impacts		
B1 Passenger comfort	-	ITS
B2 Urban quality & landscape	-	ITS
B3 Goods handling	-	PLANCO
Strategic, territorial impacts		
C1 Strategic mobility	UTS, EUNET (WP5), POINTER Index	WP4
C2 Strategic environment	COMMUTE	WP5
C3 Strategic economic development	Point scale (-5,..,0,..+5) Proxy variables (COWI, 1990) Available studies and expert judgement	IFP
Strategic, non-territorial impacts		
D1 Private financial attractiveness	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	Halcrow Fox
D2 Technology development	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	ITS
D3 Other strategic policy and planning impacts	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	INRETS

See Table 5.2 notes

INTER-MODAL

Table 5.9 EUNET-L inter-modal framework for corridor development: Variables & Study Level

FV-L 51 - I **Corridor development**	**Inter-modal** **VARIABLES & STUDY LEVEL**	
Impacts	**Variables**	**Study Level**
Core impacts		
A1 Investment costs	Materials, labour, land and property acquisition (including compensation), construction infrastructure, plant & machinery, goods handling sorting equipment, special vehicles or boats, telematics (hardware and software), telecommunications etc.	Project
A2 System operating and maintenance costs	Improved nodal centre operating efficiency	
A3 Vehicle operating & maintenance costs	Changes in costs of ownership and operation incl. Depreciation, fuel consumption, etc.	
A4 Generalised net user benefits	Time savings and quality effects to working, home-work and leisure trips and freight transports (access time, waiting time, handling time), change in fare and shipment prices	
A5 Safety	Fatalities, severe and slight injuries, damage only accidents	
A6 Local environment	Noise, air pollution	
A7 Revenue	Income from sales of services, rent of facilities, etc.	
Non-core, non-strategic impacts		
B1 Passenger comfort	Perception of conditions for changing (transit time, distance, comfort, accessibility), facilities while waiting, passability	Project
B2 Urban quality & landscape	Visual environment	
B3 Goods handling	Perception of facilities for goods and express freight	
Strategic, territorial impacts		
C1 Strategic mobility	Accessibility and networks	CDA
C2 Strategic territorial environment	Loss and damage of ecological, historical and archaeological and scientific sites, natural re-sources	
C3 Strategic economic development	Land use, economic development, employment impact (direct employment at node, construction employment at node, generated employment in locality)	
Strategic, non-territorial impacts		
D1 Private financial attractiveness	Financial internal rate of return, net present value or equal	CDA
D2 Technology development	New technology	
D3 Other strategic policy and planning impacts	Conformity to larger sector plans, peripheral-ity/distribution, cross border transit	

Table 5.10 EUNET inter-modal framework for corridor development: Measurement & valuation methods

FV-L 51-I **Corridor development**	**Inter-modal** **MODELLING APPROACH & RESPONSIBILITY**	
Impacts	**Model & Source**	**Guideline Responsibility**
Core impacts		
A1 Investment costs	Corridor team	-
A2 System operating & maintenance costs	EUNET (WP3)	PLANCO
A3 Operating costs	EUNET (WP3)	PLANCO
A4 Generalised net user benefits	EUNET (WP4)	ITS
A5 Safety	EUNET (WP4)	ITS
A6 Local environment	COMMUTE, EUNET (WP4)	ITS
A7 Revenue	EUNET (WP4)	ITS
Non-core, non-strategic impacts		
B1 Passenger comfort	-	ITS
B2 Urban quality & landscape	-	ITS
B3 Goods handling	-	PLANCO
Strategic, territorial impacts		
C1 Strategic mobility	UTS, EUNET (WP5), POINTER Index	WP4
C2 Strategic environment	COMMUTE	WP5
C3 Strategic economic development	Point scale (-5,..,0,..+5) Proxy variables (COWI, 1990) Available studies and expert judgement	IFP
Strategic, non-territorial impacts		
D1 Private financial attractiveness	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	Halcrow Fox
D2 Technology development	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	ITS
D3 Other strategic policy and planning impacts	Point scale (-5,..,0,..+5) Proxy variables (?) Available studies and expert judgement	INRETS

See Table 5.2 notes

5.3 Development tasks

It is foreseen that the guideline information will be gradually improved over the whole project period of CODE-TEN but it is important that information is established as early as possible to facilitate the work on the WP2 corridor cases. This will necessitate early, preliminary results from other later WPs, for which reason some partners from these WPs have also been indicated in the responsibility column of the FVs.

To assist the WP2 cases an intermediate sketch methodology has been worked out which is described in the Appendix Report in section 13.

6. Examination of context feasibility: *Dependency*

6.1 Principles and review results

The planning theme on context feasibility deals with the important question of determining a set of reasonable alternatives (CDAs).The examination of the context feasibility is based on a review of ongoing work from TENASSESS (IFP, 1998a).

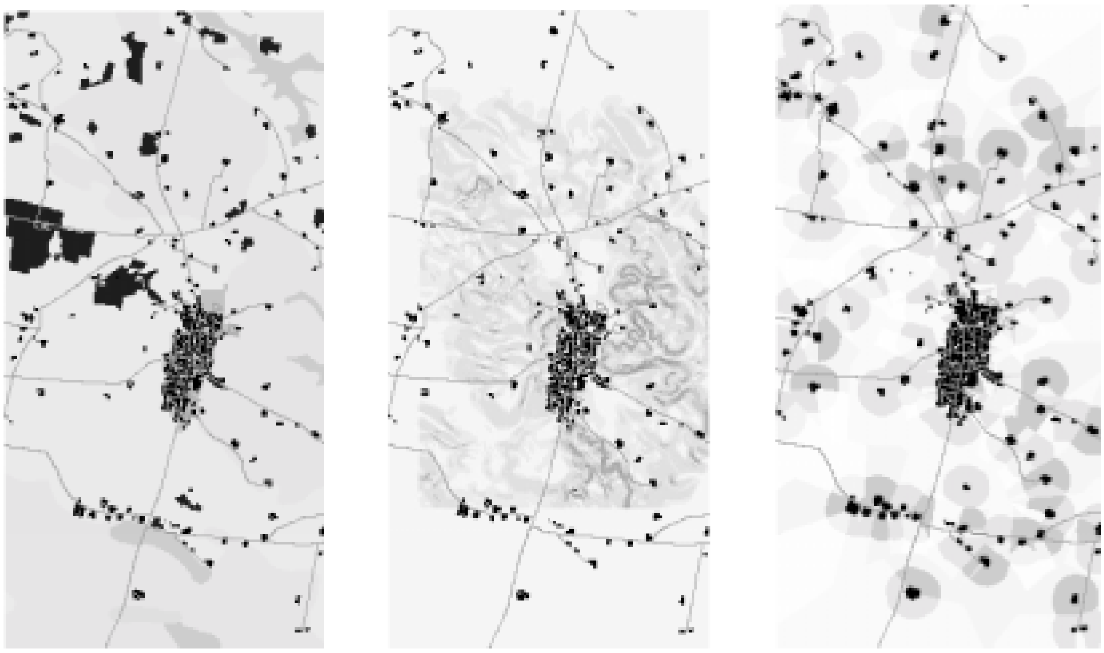
Three main objectives are pursued in the corridor model:

- Minimising construction costs
- Maximising accessibility
- Minimising environmental degradation

The review is based on a technical description of a corridor planning tool from the Danish TENASSESS WP8 ex-ante case (IFP, 1998a) and illustrates methods for determining alternative transportation corridors within a geographical information system (GIS). The corridor planning model is also referred to as COPE (Corridor Planning Model).

A simple example of using raster GIS for corridor planning

One simple example of using raster GIS for corridor planning concerns the optimal location of a by-pass road around a minor rural town (Kjems, 1996). In this case raster GIS was used to find the most suitable corridor for a by-pass road around the small town of Saltum in Denmark. Based on different sources raster layers classify soils, buildings, vegetation, land boundaries, slopes and historic sites. Examples of the raster layer maps representing soils, slopes and buildings are shown in Figure 6.1. Although the scale of the project is fairly small, this way of using raster GIS can be applied to any size of projects.

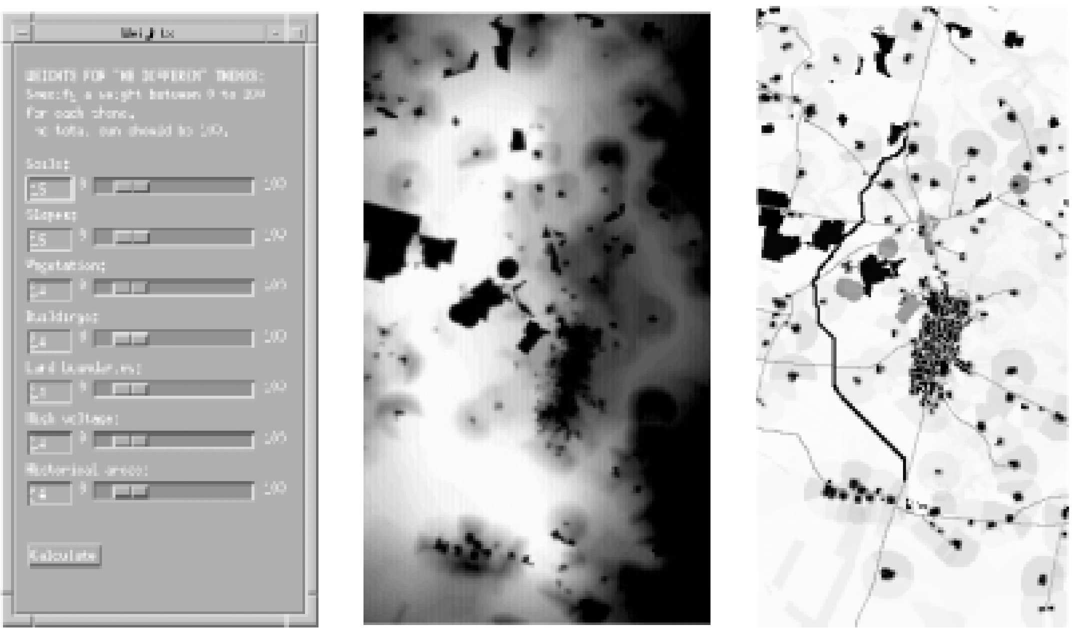


Soils **Slopes** **Buildings**

Figure 6.1 The different layers representing soils, slopes and buildings (Kjems, 1996)

In each layer the cells have values ranging from 0 to 100 e.g. in the soil layer, sand has the value 5 and silt the value 70 representing difficulties for road construction. Each layer (or themes as they are called in this study) has subsequently been weighted against each other on a scale from 1 to 100.

In Figure 6.2 the menu for weighting between the different layers, the calculated corridor space (cost-scape) and the "least cost route " are shown. The corridor is the area represented by light colours, whereas increasingly dark colours represent increasing cost.



Weighting menu **Corridor space (cost-scape)** **Least cost route**

Figure 6.2 The weighting menu, the calculated corridor and the "least cost route" (Kjems, 1996)

This simple approach has, however, some shortcomings when it comes to consistent corridor planning and a new structure for a corridor planning tool is presented in the following section.

6.2 Corridor planning model (COPE) L-version

As shown in the review one way of structuring a simple corridor-planning tool is as a sequential approach with three independent steps as illustrated in Figure 6.3.

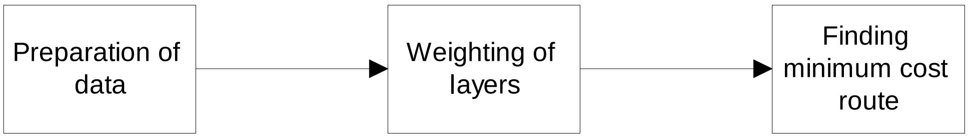


Figure 6.3 The basic structure of a simple corridor planning tool (based on Kjems, 1996)

In this sequential approach the purpose of weighting is to determine and define how different policy objectives will influence the corridor planning.

This sequential approach raises some fundamental questions about weighting within a corridor model. How does one put valuation units on different housing quality and the quality of recreational areas and how does one weight the unit of housing quality against the unit of recreational area quality ?

However, corridor planning is often more complex than that. In the case of a corridor planning process one may also be interested in examining different policies e.g. with focus on economic aspects or with the focus on environmental aspects. The question of finding the minimum cost route is thereby not only dependent on the cost assigned to the layer but also on the impact caused by establishing an alignment within the corridor. Additionally, the measurement and evaluation of the corridor impact are dependent on the chosen strategy or policy. This means that the chosen policy is not only intertwined with the weighting and pricing of the different layers but also with the impact analysis. The corridor planning process can therefore not be viewed as solely sequential as in Figure 6.3 but must also consider recursive or iterative loops as part of the corridor planning process. Such a structure for a corridor-planning tool is shown in Figure 6.4.

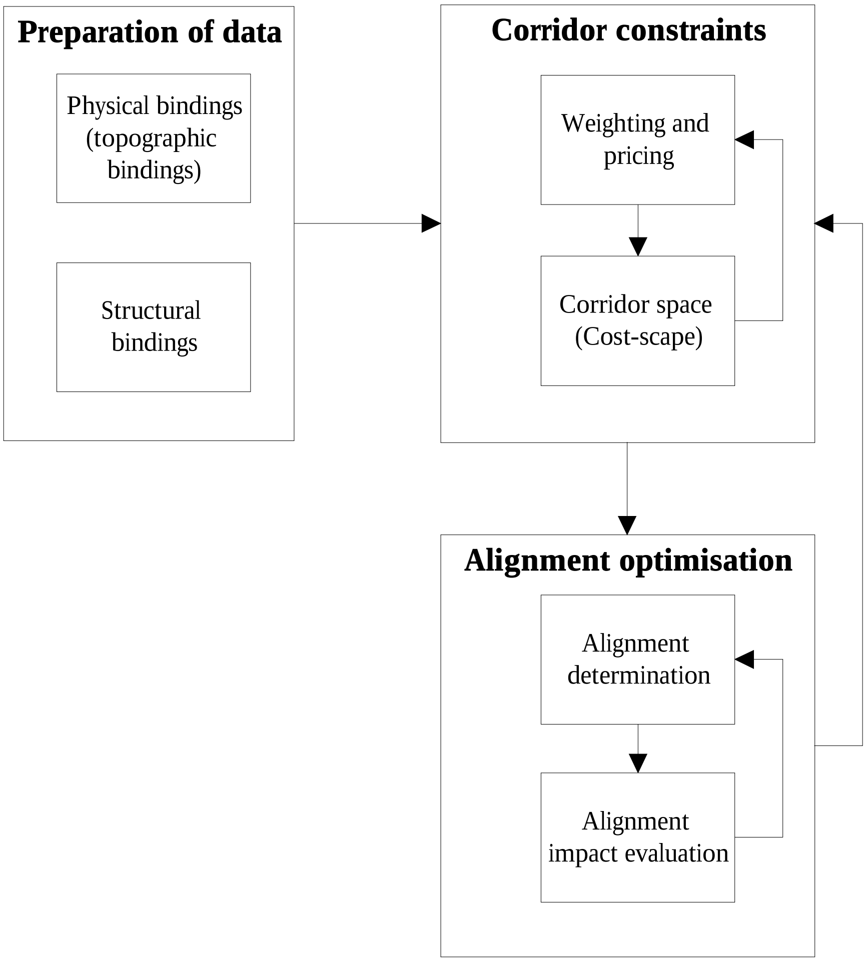


Figure 6.4 The structure of the corridor-planning tool

As can be seen in Figure 6.4 the three main components of the sequential corridor-planning tool are maintained but the structure has been extended with a number of feedback mechanisms.

The *preparation of data* is normally associated with a mapping of the physical bindings but in the case of corridor planning, the mapping of the structural bindings is of equal importance. Another important aspect of utilising GIS is the transformation of data into information, which is often neglected. Nevertheless, this process is often extremely expensive in terms of time and manpower. For a further discussion see (IFP, 1998a).

The *corridor constraint* module consists of the weighting and pricing of the physical bindings and the creation of the corridor space (cost-scape). It is evident that the weighting and pricing that sum up in the corridor space (cost-scape) depend on the policy objectives. Weighting and pricing in a corridor model can be divided into two intertwined types of weigthing: Weigthing between objects within a layer and weigthing between layers. The complexity of the weighting is caused by the multitude of approaches.

Table 6.1 illustrates three different options for combinations concerning weight and valuation.

Table 6.1 Three combinations of weighting and valuation

	Relative measure	**Absolute measure**	**Combined measure**
Within layers:	Weighting	Valuating	Weighting
Between layers:	Weighting	Weighting	Valuating

Note: For a further discussion of the consequences associated with each of the three weighting approaches see (IFP, 1998a).

The *alignment optimisation* module consists of two steps, the alignment determination and the alignment impact evaluation. When the area under investigation has been weigthed and valuated as a corridor space (cost-scape), the next step is to find the cheapest possible alignment, which is relatively simple in a GIS. The simplicity of finding the cheapest alignment is in sharp contrast to the alignment impact evaluation. When an optimum alignment have been determined impacts not included directly in the alignment has to be evaluated. This may lead to a revaluation of the chosen alignment or even of the corridor constraints. The first type of relation has been modelled with an internal feedback mechanism between the alignment impact evaluation and the alignment determination. Whereas the second type of relation has been modelled with an external feedback between the corridor alignment module and the corridor constraint module. For a further discussion see (IFP, 1998a).

Finally, the corridor constraints module and the alignment optimisation have to be placed in a sphere of policy dependency/influence due to the nature of the planning process.

Explorative example from the TENASSESS corridor planning

As part of the description of the Danish TENASSESS WP8 ex-ante case an example of a HST corridor has been investigated. The corridor has its starting point in Rødby (at Femer Belt) and ends in the rail centre of Ringsted (at mid-Zealand).

Figure 6.5 shows the cost-scape (or cost grid) based on valuations of buildings, forests, streams, lakes, restricted areas, roads, railways and land-use.

Figure file: CT-D1-fig6-5.jpg

Figure 6.5 The cost-scape (or cost grid) for the TEN-ASSESS explorative example

Figure 6.6 shows the calculated corridor space and the cheapest alignment through the corridor.

Figure file: CT-D1-fig6-6.jpg

Figure 6.6 The corridor with starting and end points and the cheapest way through the corridor

Figure 6.7 shows a close-up of the corridor space, where it is possible to see how the valuations of the features shape the corridor.

Figure file: CT-D1-fig6-7.jpg

Figure 6.7 Close-up of the corridor. It is possible to see how the corridor is shaped by the valuation of features

6.3 Development tasks

The corridor planning model (COPE) will be developed mainly by IFP. It is possible that it will not be fully implemented until stage II. However, IFP will examine the possibilities of its application in the corridor study (a) St. Petersburg - Helsinki - Stockholm - Copenhagen. Other corridor teams may apply the set of considerations behind the corridor model in their assessments of alternatives. For corridor teams that make use of ARC/INFO in their organisation a compiled version of the corridor model (COPE) will be made available. Some guidelines are given in the Appendix Report section 14.

7. **Examination of action acceptance:** *Suitability*

7.1 Principles and review results

The planning theme about action acceptance deals with the important question whether the transport corridor development as it is currently specified in the planning process can be regarded as possessing the ability of becoming approved by all involved interests. In a conventional, linear planning task this test depending on rules and values, see Table 2.1, will be solely at the end of the process but in the planning process that can be foreseen to apply for European transport corridors, it may be relevant at other stages also, simply to maintain what may be called the "political feasibility" of the planning. Lack of such action acceptance considerations in an ongoing corridor planning process may possibly jeopardise the whole planning if, for example, a given route alignment is later on the issue that prevents an agreement and implementation decision.

In this respect it is important to identify the institutional framework and the influential/critical decision makers (CDMs) for the actual corridor development. The CDMs should include all types of players. To make such a political mapping operational, it may be convenient to identify and operate with a number of relevant coalitions[*]. Each coalition will be seen as representing a certain planning viewpoint (value orientated world view). It is not the purpose of the action acceptance examination (PA4 in the process, see Figure 4.1) to forecast any factual outcome of a public/political debate but to make explicit that this or that particular viewpoint may be raised and that it may be useful to deal with it proactively.

The review of the methodology undertaken in WP1 to formulate the CODE-TEN baseline methodology has not indicated a range of models that can be used to support the examination of action acceptance. However, the TENASSESS policy assessment model (PAM), see model review in the Appendix Report section 2, is considered to be very useful for this purpose[†]. To be described in detail in section 7.2, PAM can assess an infrastructure project in a number of ways which are useful as background the PA4 planning activities.

7.2 TENASSESS policy assessment model L-version

The policy assessment model (PAM) has been developed for the TENASSESS project (Halcrow Fox, 1998). In the CODE-TEN project a modified version of PAM (PAM-L) is envisaged as an integral part of the assessment methodology.

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[*] This was done in the Danish TENASSESS WP7 case dealing with the Øresund Fixed Link about the conflicts and the players in the planning process (IFP & COWI, 1997b). The main players were grouped into the local pro-coalition, the international pro-coalition and the environmental coalition, and the main conflicts were illustrated by making reference to these coalitions and their specific influences on the planning outcome.

[†] The TENASSESS PAM was presented at a seminar held in Bruxelles on the 15th of April with the EU Commission and other bodies represented. A number of case studies were demonstrated from the WP4 work in TENASSESS. The PAM was well received as it was generally acknowledged that it can provide information that is not available on the basis of, for example, a cost-benefit analysis.

PAM adds insight into and can assist the decision making process through assessing the suitability of a project with respect to the underlying value system of decision makers and stakeholders. It does this by presenting the value system as a series of objectives (which ideally are explicitly stated by the stakeholders concerned), and through relating the project to a series of impacts. The impacts are measured in terms of the extent to which they contribute to or work against the realisation of the objectives. As such, it is a form of Goals Achievement Matrix (GAM).

PAM's application to corridors spanning countries outside the EU requires a number of modifications. These are necessary to combat difficulties associated with incomplete data, unclear objectives, objectives that may differ from those of EU nations and regions, and the greater number of stakeholders involved in multi-national projects.

BENEFITS OF THE GOALS-ACHIEVEMENT APPROACH

The GAM presents objectives (goals) so that progress towards or away from them can be measured. It does this through explicitly linking impacts with objectives. In order to do this, objectives should be operationally defined and, if necessary, re-specified, such that degrees of success or failure can be measured from identified impacts.

The output is a set of numeric scores which identify the effect of the project in question on each objective. Scores can be awarded on the basis of quantitative or qualitative information, so there is virtually no constraint on which impacts can be included within the analysis.

The GAM can be presented as a “goals achievement account” in which no scores are weighted. This places the onus on the decision maker to compare the effect of the project on each individual objective and then reach a judgement on the desirability of each potential course of action.

Alternatively, a series of weighted indices of objectives achieved can be produced. This can be done by considering policy areas, or reflecting different decision makers. Whilst it is possible to generate a single index, this is not advisable as it masks much of the information provided by a GAM.

For a collapsed representation of results to be legitimate the weighting systems should be determined by the decision makers (not the analyst) and the system should be transparently presented. A favourable assessment that is insensitive to different weighting systems is indicative of a good project. As with other quantified assessments, the indices should be seen as an aid to human judgement for establishing project priorities, not as a replacement to the decision maker.

The presentation of indices is seen as a strength of the GAM as each weighting system can be used as a proxy for the policy framework or value system of the stakeholders in question. Thus the GAM seeks to assess projects from the viewpoint of stakeholders, thereby identifying conflicts between different social groups. Choices as to the nature of the project can be directed in the light of this information, so that disbenefits for particular stakeholders are made explicit and are minimised within overall project constraints. This can have the advantage of increasing the public or political acceptability of the project, thereby facilitating its implementation and allowing project benefits to be realised.

This advantage of the GAM is not prevalent in CBA. For whilst value systems can also be integrated into a cost-benefit analysis framework, through weighting systems, it is rarely carried out in practice. In consequence the CBA has an imposed value system, that of uniform social benefit, and impacts on particular communities are ignored.

DATA REQUIREMENTS FOR PAM

The data requirements for PAM are intensive. They are described in more detail in the Appendix Report, section 15.

In constructing PAM, policy objectives have been collated and reviewed, and definitions of "success" and "failure" have been attached to each such objective. The application of PAM requires objectives to be weighted with respect to the interested parties considered, and the development of suitable weighting systems require input from the relevant parties concerning their policies and priorities.

Data are needed on certain background measures: emission of pollutants, transport mode shares, accident rates, population and GDP. They are needed in a time series format so that historical trends can be derived.

Detailed data and forecasts specific to the project in question are also required: changes in traffic volumes by mode, pollutant emissions, accident rates, employment, change in generalised cost, time savings, non-user benefits; and the internal rate of return.

APPLICATION OF PAM TO CORRIDORS ON THE EU PERIPHERY

PAM requires a number of modifications in order for it to be applied to projects considered as part of CODE-TEN. The extended model is named PAM-L where L stands for "lite" implying less stringent data requirements. The extension and adaptation of the model fall into two categories:

- systems reflecting increased numbers of stakeholders and different policy objectives; and
- increasing the flexibility of data requirements.

These are discussed in turn.

Policy Objectives

The ability of the PAM to reflect stakeholders' differing policies has already been highlighted as a strength. In the case of multinational corridor studies this is especially advantageous because of the diversity of priorities that are encompassed by affected parties. In particular a scheme may impact on states with disparate levels of wealth, which in turn result in distinct policy objectives.

This was demonstrated in the application of PAM to the Decin-Praha-Breclav rail upgrade in the Czech Republic (Halcrow Fox, 1997). The model found the rail upgrade to favour German and Austrian objectives, but its benefits to be marginal in the Czech Republic itself. This finding is largely due to economic and social differences in the two areas, and can be interpreted as suggesting that Germany and Austria should contribute to the investment, even though the infrastructure improvement would not be in their countries.

The more complex institutional arrangements associated with multi-national projects crossing the EU boundary means that the projects must be approved by more tiers of government and other stakeholder representatives. Appraisal of projects crossing EU boundaries would be enhanced by extending PAM to consider the following policy perspectives:

- the domestic policy of countries within the study area outside the EU;
- associated regional policies, if applicable, within the nation states;
- national policies towards eventual membership of the EU;
- EC policies in relation to central and eastern Europe;
- national policies of EU countries within the study area with respect to international transport links.

Scarcity of Data

It is thought that the application of PAM for corridors outside the EU will have greater problems with satisfying data requirements. Gaps in data can be seen to take the following forms:

- policy objectives that are not well defined, or may conflict;
- the background data are poor: records may only cover one or two years, may be incomplete, have different underlying assumptions making them inconsistent, or may not display trends;
- the project itself is not well defined;
- the impacts of the project are not fully known.

7.3 Development tasks

PAM has been developed as part of the TENASSESS study. During its development it was applied to six case studies, and through this refinements were made. Its application to TEN extensions in the CEEC and CIS requires the incorporation of the countries' policy priorities with respect to relevant stakeholders. Additionally PAM inputs for EU Member States should reflect the changes in their continually evolving policy.

Application of the PAM to CEEC and CIS stakeholders is likely to necessitate adapted methodologies for determining scores, due to data sparsity and higher levels of uncertainty. A process with elements of feedback is required, and this is sketched in Figure 7.1.

In the Appendix Report, section 15, some guidelines are given that can assist the corridor case teams. In particular, data priorities are suggested, and results of sensitivity tests are presented.

The use of PAM-L for specific examinations and interpretations within a corridor study will necessitate the identification of the influential decision-makers of critical importance for the implementation decision, the so-called critical decision-makers (CDMs).

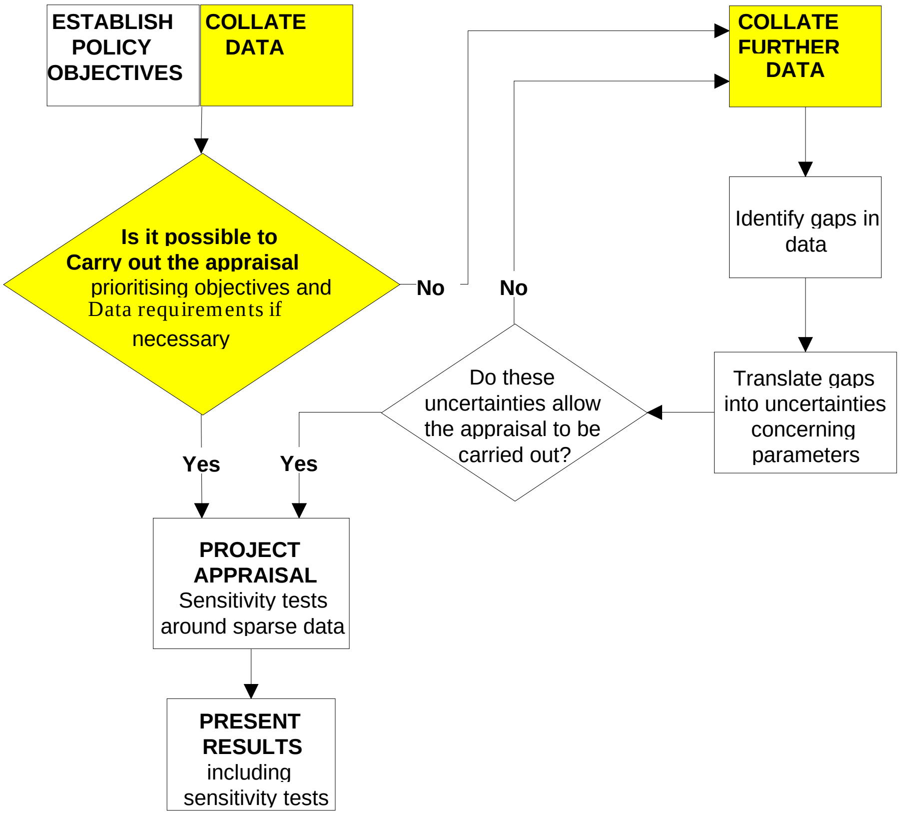

Figure 7.1 Application of PAM to projects with sparse data

As stated previously, the purpose of action acceptance examinations by application of models is not to replace real societal processes where different planning interests make themselves heard when exchanging their viewpoints. As concerns the DECODE methodology, developed in three stages, models as PAM in relating to such real processes may presumably await the stage III of the methodology set-up. On this basis the role of PAM at stage I and II will mainly in the hands of the planners be to mirror or simulate the consequences and possible implications of the different viewpoints.

8. Examination of context acceptance: *Adaptability*

8.1 Principles and review results

The planning theme about context acceptance deals with the important question of whether the transport corridor development as it is currently defined in the planning process has the potential of being part of a development scheme which now and later will be recognised as successful considering all types of uncertainties. The criteria involved in such a test concern robustness and resilience, see Table 2.1, indicating that the good scheme is better than a superior one judged on a “narrow” set of criteria if the good scheme has an in-built flexibility that makes it the better one to match a broad range of developments in the planning environment. The operational way suggested to deal with such questions consists of a mapping and thorough investigation of the set of so-called critical success factors (CSFs) as dealt with in the COST 328 Study (Banister et al., 1997). The occurrence of favourable CSFs, or the lack of the same, can be used to assess what may be called the “societal feasibility” of the planning. As with the political feasibility addressed in the previous section, the societal feasibility should be a recurring concern in the planning process.

Similar to the policy assessment model, the model review undertaken as part of the CODE-TEN WP1, has indicated two models to be used for this purpose, namely the Barrier model developed within TENASSESS and the PENTAGON model from COST 328 (PLANCO et al., 1998) (Banister et al., 1997). In many ways the two models raise similar issues. As concerns the Barrier model a barrier is defined as:

“... something or someone that makes the decision-making process of an infrastructure project, a policy initiative, or - more generally - every measure to implement CTP stop.”

The barrier concept in this model is thus associated primarily with the content and progress of the decision-making process. However, the issues being focal in this respect will very much relate to issues also of relevance for the identification of CSFs. Thus it has been decided to apply the TENASSESS Barrier model to support examinations of context acceptance and supplement it with the findings of the COST 328 Study. This combined model will simply be referred to as the Barrier model, L-version.

8.2 TENASSESS Barrier model L-version

The Barrier model

In the TENASSESS work (WP8 based on WP7 cases) seven major fields of barriers have been identified (PLANCO, 1997):

1. Economic barriers, i. e. barrier due to competition between national economies, regional economies and/or different branches of the economies stemming out of the unequal distribution of benefits and disadvantages (e. g. TGV Barcelona - Montpellier: competition between the seaports of Marseilles and Barcelona, Betuwe-Railway-Line: competition between the seaports of Hamburg, Bremen and Rotterdam).

2. Environmental barriers, including barriers arising out of conflicts between economic and environmental goals.

3. Barriers around financing: Who will pay (system of financing)?, How much? External funding (e. g. INTERREG program)?

4. Barriers due to conflicts about competencies between administration and political bodies on different regional levels.

5. Barriers due to conflicts between the priority given to the international and competing national projects (e. g. Øresund Fixed Link vs. Great Belt Fixed Link, HST Barcelona - Montpellier vs. HST Madrid - Barcelona (Valencia - Barcelona), Twente-Mittelland-Kanal vs. other projects in Germany with a higher cost-benefit-ratio).

6. Purely technical barriers, i. e. barriers arising out of different technical standards or modes of proceeding within administration.

7. Barriers around pricing: pricing for steering the traffic and for internalisation of external effects vs. pricing for financing. The issue of pricing is highly correlated with the issues in the fields of economics, environment, and financing since pricing is an instrument to lower or to avoid the disadvantages of the planned project.

Table 8.1 shows the case background for the different barrier types.

Table 8.1 Barrier types identified in the TENASSESS WP7 case studies (PLANCO, 1997).

Type of barrier	Case study								
	Øre-sund (1)	Brenner (2)	Eastern TGV (3)	TGV PKBAL (4)	TGV E - F (5)	TGV F - I (6)	Island Inter-change (7)	Skara-manga (8)	Betuwe /TMK (9)
1. Economic	X	X		?	X	X	X		X
2. Environmental	X	X		?	X	X	X	X	
3. Financing	X	X	X	?	X	X		X	
4. Competencies		X	X	?	X			X	
5. Priority	X			?	X	X		X	
6. Technical		X	X	?	X			X	X
7. Pricing	X	X		?			X		

In the most recent development of the TENASSESS Barrier model the above seven barrier types have been redefined as five so-called “fields” in the model (PLANCO, 1998). Together with four “stages” and four “policy arenas” the three dimensions form a Barrier model cube, in which the barriers can be located based on their characteristics, see Table 8.2 and Figure 8.1.

Table 8.2 Stages, policy arenas and fields of the Barrier model (PLANCO, May 1998, Minutes)

Dimension	Characteristics of the dimension
1. Stage	• Conceptual phase • Planning phase • Decision phase • Implementation phase
2. Policy arena	• Informal politics (in the Socio-political Framework) • Official politics (in the Socio-political Framework) • Administration (in the Regulatory Framework) • Legislation/Regulation (in the Regulatory Framework)
3. Field	1. Financing 2. Technical requirements 3. Environmental assessment 4. Regional responsibilities 5. Socio-economic assessment

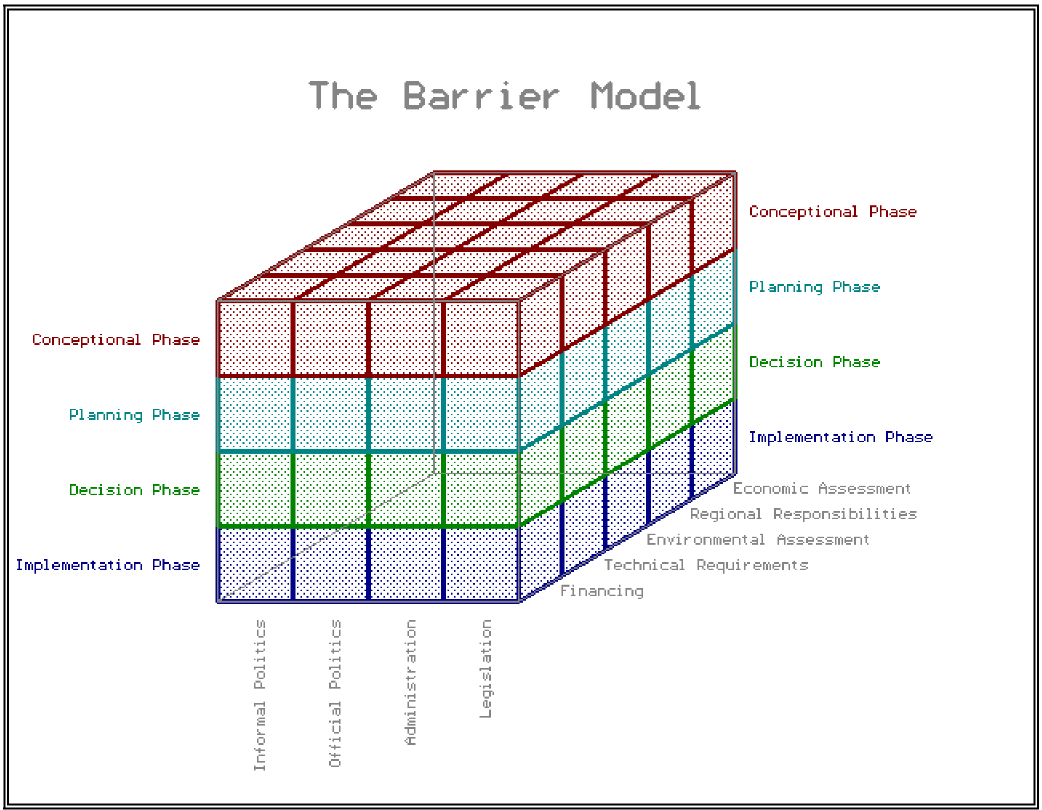

Figure 8.1 The structure of the TENASSESS Barrier model (PLANCO, 1998)

The TENASSESS Barrier model is designed as a tool that structures the planning and decision-making process in a way that helps to identify potential barriers for CTP realisation. The assessment procedure itself has to be done by the project initiator which can use the model as an experimental gaming. The barrier interdependencies in the model are based on analysis of a number of case studies. The model then when used to “diagnose” possible barriers resembles what is sometimes referred to as an expert system.

The Cost 328 Study

The COST 328 Study makes use of the PENTAGON prism model to determine five types of success factors for long term infrastructure development. These factors can be characterised in the following way (Nijkamp et al., 1994):

1. Hard ware refers to the tangible material aspects of transportation infrastructure (e.g. technical equipment, terminals, railways, road networks or harbour).

2. Soft ware refers both to computer software used to control sophisticated hard ware facilities and the services offered to the user of the infrastructure (information and route guidance systems, communication facilities, data services/banks etc.)

3. Org ware comprises all regulatory, administrative, legal, management and co-ordination activities and structures regarding both the demand and the supply side of transport (in terms of legislation, regulation fares, procedures etc.) which form the private and public institutional framework of the transport system.

4. Fin ware refers not only to the socio-economic cost-benefit aspects of new investments, but also to the ways of financing and maintaining new infrastructures, to fare structures, to state contracts for guaranteed finances for public transport deficits, etc. This is very relevant for projects in corridors, which cross the national borders.

5. Eco ware refers to environmental and ecological concerns (including safety and energy questions) in transport systems, as well as to abatement measures for environmental degradation (e.g., user charge principles). It concerns both the infrastructure owner (e.g., landscape deterioration caused by visual pollution) and the infrastructure user (e.g., emission of exhaust fumes of cars)

To support the work of the corridor teams some guidelines have been worked out, see the Appendix Report section 16.

The guidelines give some general advice but it is very probable that for each corridor case the team will have to add specifics.

8.3 Development tasks

The development tasks related to the Barrier model L-version consist of integrating the findings of TENASSESS and the COST 328 Study with due consideration of the aspects covered by other models in DECODE. In this respect it can be noted that with the policy assessment model, see previous section 7, much emphasis is paid to relate the policy assessment to a set of critical decision makers (CDMs) to be determined for the actual corridor case. Similarly, corridor specific sets of critical success factors (CSFs) can form the basis for the adaptability examination with regard to a possible successful development of the corridor.

For the adaptability examinations in stage I and II of the DECODE development the same reservations apply as for the suitability examinations. The checklist in the Appendix Report (questionnaire, barrier comparisons, etc.) aim not at replacing the real societal processes that will take place at stage III. However, concerning the “soft” parts of the DECODE methodology, the planners can try proactively to imagine planning critical issues that may turn out to make a difference for the corridor planning.

9. Traffic modelling requirements

The purpose of this chapter is to provide an introductory discussion on the necessary traffic modelling requirements for corridor studies. This will lead to more specific recommendations in the later phases of CODE-TEN. The first section introduces considerations regarding the planning context to be modelled, while section 9.2 provides an outline of the interaction between land use, transport and the environment. This leads to section 9.3 about models for land use-transport interaction. Finally, section 9.4 gives the recommendations. The Appendix Report, section 8 contains a more thorough discussion of different traffic model types, while section 11 gives operational guidelines to be applied by the corridor case teams.

9.1 The planning context

The main demand on traffic models is that they fit into the planning context in question. Although, this might seem as a banal demand, standard model packages often ignore many effects caused by strategic plan-proposals such as induced traffic. Thus, the choice of traffic model includes many factors to be considered for example:

1. Level of detail
2. Complexity
3. Time horizon
4. Area of influence
5. The planning phase in question
6. Availability of existing traffic models

LEVEL OF DETAIL

Generally, the more time used for collecting data, conducting quality control of data, improving sub-formulae of the model, etc., the better the description of current traffic conditions will be. Thus, the level of detail is typically a trade-off between costs for the study and precision of its outcome. Naturally, the demand on the level of detail increases during the planning process. However, even in the initial phases too low a level of detail may lead to wrong decisions. In this context, it is worth mentioning that quite detailed route choice models and network descriptions can be needed even in the initial planning phases. This is especially the case if the network operates at congestion level or if local bottlenecks occur.

COMPLEXITY

Even a very detailed model in the present situation may fail to describe strategic impacts in the long term. On the other hand, even minor upgrades of strategic corridors may be considered as equal to operational or strategic projects from a traffic model point of view. Thus, it is crucial to outline the most likely impacts of the plan-proposal and then design the model according to these.

As an example, most models overlook induced traffic despite some empirical evidence on the importance of this. Especially, the English debate after the SACTRA study (1994) shows the relevance of including induced traffic in models (refer also to Coombe, 1996, Goodwin, 1996 and Kroes et al. 1996). This may be necessary even in cases with little induced traffic, as a model that ignores this may be criticised or even disregarded by decision-makers afterward.

Section 9.2 discusses the traffic modelling requirements regarding complexity in more detail.

TIME HORIZON

A question closely related to the level of detail and the complexity, is the time-horizon of the study. In the long run, large infrastructure projects may influence the land use pattern and economic growth – which again will influence traffic development. Thus, the models become much more complicated than in the short run. Even operational or tactic plan-proposals may demand strategic models if long-term forecasts are needed. This is needed in order to forecast the development of the whole traffic system which the study is part of.

Figure 9.1 outlines the relationship between the level of detail, the level of complexity and the time horizon (inspired by Nielsen, 1994 and Ramjerdi et al. 1995). The expected level of detail of the model outcome decreases significantly with time, while the complexity of the forecast increases. It is worth noting that some interactions between infrastructure, regional or urban development and the environment are so complex that researchers still debate whether they can be modelled at all. There is due empirical evidence that forecasts often turn to be very different from the actual flows - even if good practice is followed (Skamris & Flyvbjerg, 1996). In addition, the work is often so complex that only few alternatives can be examined thoroughly (although GIS has eased the work process). As a result, the reasonableness of using traffic models in the planning process has been debated (e.g. the discussions by Supernak, 1983, Polak, 1987, Richmond, 1990 and Handy, 1992). However, without traffic models there would be a very weak basis for decision making.

Figure 9.1 represents - to some extent – the traditional view of good practice guidelines for the design of traffic models: Operational models make only sense in the short run, as the large uncertainty in the long run makes it unreasonable to conduct operational studies. On the other hand, as strategic impacts may only first occur after some time it can be claimed that it makes no sense to run these models for short-term situations. Some researchers have explored an idea about developing “comprehensive” models that deal with operational, tactic and strategic impacts in both the short and long term (represented as a union of all types of models in Figure 9.1). Especially, some simulation models that describe evolution of the system over time fall into this category.

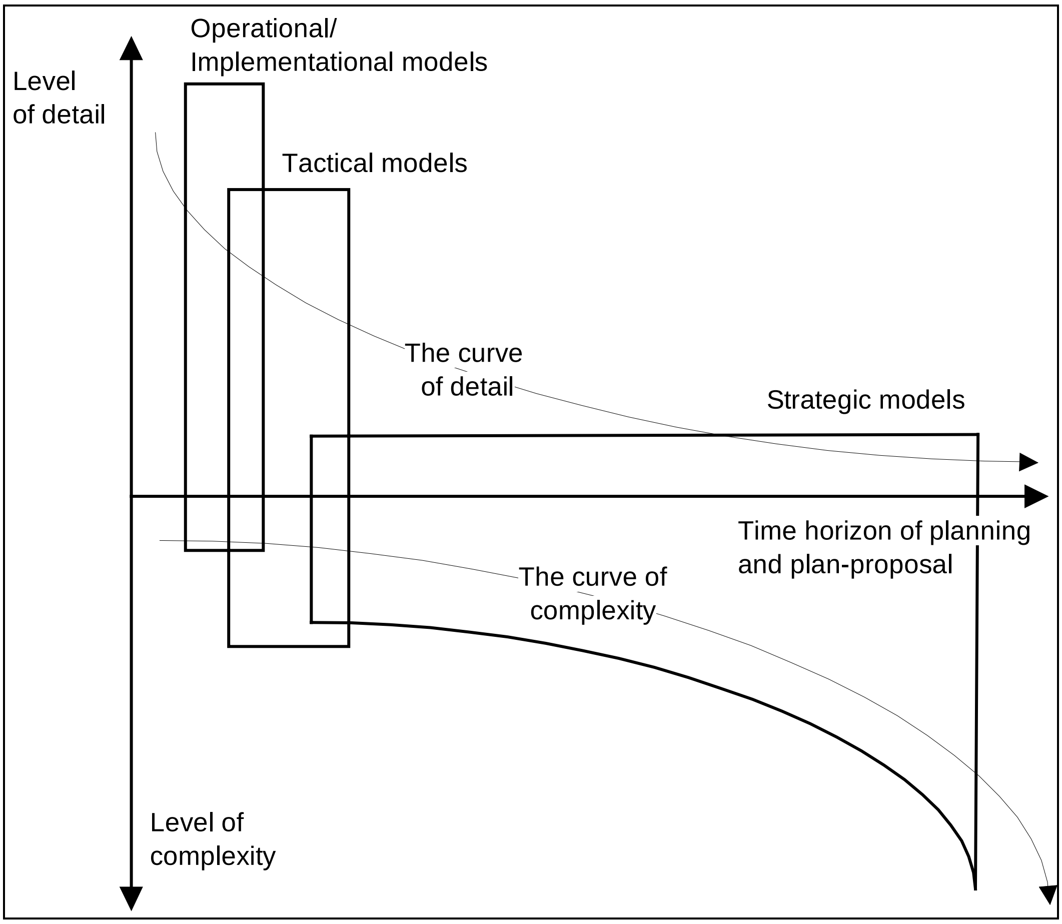

Figure 9.1 The relationship between level of detail, level of complexity and the time horizon

However, IFP's experience shows that it can be quite useful to run strategic models in the short run. This answers questions of the type "what would have happened if the project was finished today and equilibrium of the system had been attained ?". The advantage of this type of analyses is that the uncertainties of the long-term prognosis are excluded. This makes it easier for the planner to pinpoint specific impacts of the plan-proposal. Similarly, one may combine scenarios explored by long-term strategic models with analyses from detailed tactic/operational models. The detailed outcome of such a calculation will be very uncertain, but it might none-the-less pinpoint interesting problems. As an example, it may show that a certain scenario would cause severe capacity problems in intersections in the road network, which then will lead to a need for substantial derived investments.

AREA OF INFLUENCE

Another important issue is the area of influence of the proposed plan-proposal. In this context, it is crucial to distinguish between "true" corridor projects and projects, which are part of a major corridor but influence other corridors and regional/local traffic. An example of the latter is the Øresund Bridge, which is part of the major corridors from Stockholm and Oslo to Germany, but which also facilitates local traffic between the cities of Copenhagen and Malmö, regional traffic between Zealand and Skåne and corridor traffic from southern Sweden to

Jutland. Thus, it is accentuated that only certain types of projects can be treated as corridor projects from a traffic modelling point of view.

9.1.1 *THE PLANNING PHASES*

Finally, the traffic model must be successively refined - or different types of models must be used - as the planning process proceeds. Models that are too rough in the initial planning phase may lead to wrong decisions about which alternatives are the relevant ones. As a result, the more refined model in the medium of the planning may only sub-optimise as the alternatives may not be the most relevant. Finally, very detailed models are often used in the final planning phase partly to justify prior decisions. The funds used on models in this phase often go far beyond the funds used in the initial phase, while the decision making at this stage has far less economic impacts.

Even though traffic models become more and more complex, a number of simplifications are often decided upon at the early stage of the work, e.g. whether to model induced traffic, land use interaction, trip-time, day-to-day dynamics and trip chaining. To assist such technical decisions, one may use minimum-maximum modelling strategies in the initial planning phases to search for critical and non-critical traffic components. As an example induced traffic may be difficult to assess, but the "maximum reasonably induced traffic" can clarify whether it is relevant to consider induced traffic at all.

EXISTING TRAFFIC MODELS

In many cases existing traffic models for the area under examination can be used as basis for the new study. In this case, the modelling work consists of patching up the existing models concerning the impacts that so far have been overlooked. To utilise existing models requires substantial experience with traffic models and accordingly, it is difficult to provide general, valid recommendations and guidelines.

9.2 The interaction between land use, transport and environment

Traditional traffic models – e.g. the widely used 4-step models – consider only the influence from plan-proposals on the traffic. The *transport semi-circle* in Figure 9.2 illustrates this (the figure is a slightly modified version from Wegener, 1995). The last decision in the semi-circle (route choice) is the most immediate and operational, while the first (car ownership) is the most strategic[*]. Most traffic models consider only the supply influence on destination, mode and route choice. In some cases these decisions are taken in another order – or simultaneously. It is recommended that strategic corridor studies shall also address the supply influence on trip decision. If not by use of a unifying framework then at least by use of some practical recommendations, see for example (Daly, 1997). As corridors typically only carry a fraction of all trips undertaken, it is often sensible to discard passenger car ownership models. The exception is, if the corridor passes through large urban areas.

[*] Freight models might not use the term car ownership, but instead whether companies have in-house cars and trucks or use external transportation services.

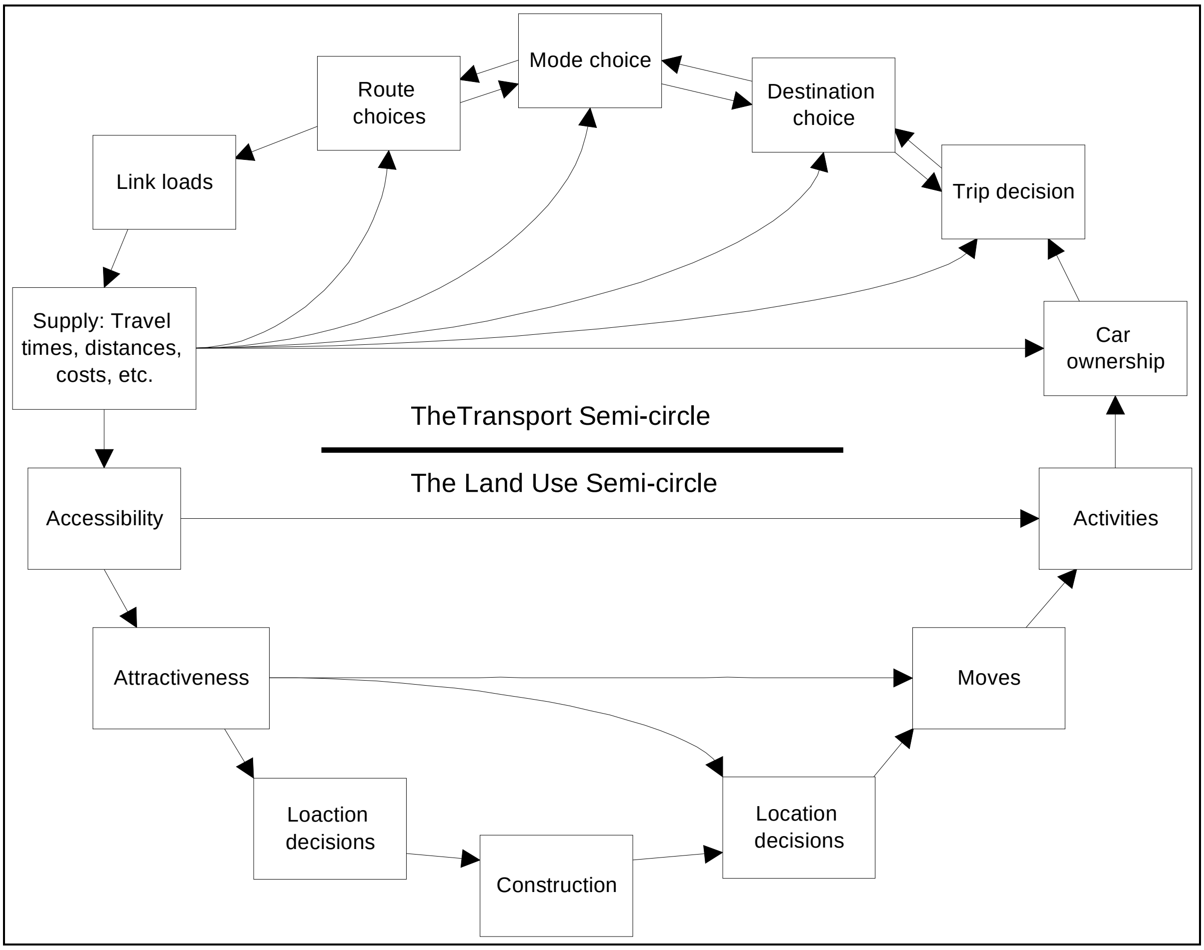

Figure 9.2 The land use transportation feedback cycle (from Wegener, 1995)

The *land use semi-circle* is – on the other hand – usually overlooked in models or it is handled by use of scenario techniques. Thus, the number of full-scale land use models applied in practice as described in e.g. Ramjerdi et al. (1995) and Wegener (1998) is much less than compared with the situation for traffic models. Nonetheless, some attention will be paid to the land use semi-circle.

There is often a considerable long-term interaction between transport and land use in the case of large-scale projects. Transport and land use changes then also affect some other impacts that are addressed by the CODE-TEN assessment criteria. There may also be feedback from these other impacts to land use (and hereby indirectly to transport). This is most notable concerning the contributions to environmental improvements (or deteriorations). Local air pollution dispersion, noise propagation and severance affect the attractiveness of land and hereby the land use and finally the traffic. Although such interdependencies are usually overlooked in models of traffic and land-use, it may be necessary to estimate them by professional judgements. It is noted that few empirical works have been done in this field. Wegener (1998) presents the most recent literature.

9.3 Models for land use-transport interaction

All the changes in the transport semi-circle except car ownership decisions (see Figure 9.2) occur immediately; that is within few months. The land use impacts occur – on the other hand – at a much slower speed. Referring to Wegener et al. (1986) and Wegener (1998), land use impacts can be categorised and ordered by the speed in which they change (from slow to fast):

- *Very slow changes: Networks, land use*. Urban transport *networks* are the most permanent elements of the physical structure of cities. Large infrastructure projects require a decade or more, and once in place are rarely abandoned. The *land use* distribution is equally stable; it changes only incrementally.

- *Slow changes: Workplaces, housing*. Buildings have a life span of up to hundred years and take several years from planning to completion. *Workplaces* (non-residential buildings) exist much longer than the firms or institutions that occupy them, just as *housing* exists longer than the households that live there.

- *Fast changes: Employment, population.* Firms are established or closed down, expanded or relocated; this creates new jobs or makes workers absent and so affects *employment*. Households are created, grow or decline and eventually are dissolved, and in each stage in their life cycle adjust their housing consumption and location to their changing needs, this determines the distribution of *population*.

- *Immediate changes: Goods transport, travel.* The location of human *activities* in space as derived from the employment and population gives rise to a demand for spatial interaction in the form of *goods transport* or *travel*.

Naturally, land use data are essential in order to estimate activities in space as input to traffic models. These data are often assumed to be non-dependent of the transport infrastructure and are thus estimated from pure macroeconomic, regional economic or population/workplace forecasts. One of the reasons for the scarce use of land use transportation interaction models is the quite vast resources needed to model the very complex relationships in combination with the often highly uncertain model outcome. Thus, different scenario techniques are often used instead of models.

In the context of CODE-TEN, it is recommended to utilise existing models for regional economic, land use and transportation interaction - if available. At the most aggregated level, the model developed in the STREAMS project can provide useful input to the more detailed corridor models. In some corridors (such as the Helsinki region and part of the Helsinki–St. Petersburg corridor) more detailed/comprehensive land use models have been developed that can be utilised. In other corridors, one must be content with scenario analyses.

The literature and methodologies on land-use models are too extensive to describe in detail in this document. Thus, one is referred to the recent articles by Wegener (1998), Handy (1997), Martinez (1997) and Eliasson & Mattsson (1997).

9.4 Traffic modelling recommendations

In the following, some recommendations of traffic model requirements for corridor studies are summarised. It must be emphasised that these recommendations may not be optimal in the following two situations:

- The traffic impacts interact strongly with other corridors or include urban, local or regional traffic. In these cases, more comprehensive area-based models must be implemented.

- Existing traffic models exist. In these cases, the work effort will typically focus on model updating and enhancing - if the model does not describe all possible traffic impacts.

Table 9.1 outlines the focus of different sub-models and the core modelling requirements to measure different impacts relating to the CTP objectives (see section 3.1 about EU Transport objectives[*]).

[*] Note that it is only reasonable to use traffic models with respect to the first 6 of these objectives.

Table 9.1 Sub-models and core modelling requirements relating to the different transport objectives

<table>
<tr><th rowspan="2">Model/Objective</th><th rowspan="2">Land-use model</th><th rowspan="2">Car ownership</th><th rowspan="2">Trip decision</th><th rowspan="2">Destination choice</th><th rowspan="2">Mode choice</th><th colspan="2">Route choice</th></tr>
<tr><th>Individual network</th><th>Organisatio-nal network</th></tr>
<tr><td>Phenomena to be modelled</td><td>System wide coherence</td><td>Households' car ownership. Firms ownership of cars and trucks</td><td>The number of trips per unit</td><td>The destination choice within each category</td><td>The mode choice within each category</td><td>Passenger cars. Firms own trucks, ships or plains</td><td>Buses, trains, transport by shipping companies</td></tr>
<tr><td>1. Maximise transport efficiency</td><td colspan="2" rowspan="2">Small modelling need, as this objective is mostly modelled on the short term.</td><td colspan="2" rowspan="3">As precise as necessary to give input to mode and route choice models</td><td rowspan="3">Precise models</td><td colspan="2">Detailed models</td></tr>
<tr><td>2. Improve transport safety</td><td colspan="2">May require more detailed route choice models than regarding transport efficiency</td></tr>
<tr><td>3. Contribute to local environmentally improvements</td><td>May be needed to describe quality of built environment and landscape</td><td>Needed to estimate air pollution and noise emissions</td><td colspan="2">Very detailed models</td></tr>
<tr><td>4. Improve strategic mobility</td><td colspan="2">May be needed to pinpoint regions with infrastructure needs</td><td colspan="2">Comprehensive models to pinpoint missing links, etc.</td><td colspan="3">Medium precise models</td></tr>
<tr><td>5. Contribute to strategic environmentally improvement</td><td>May be needed to describe land use - environmt. interaction</td><td>Needed for estimation of greenhouse gases</td><td colspan="2">As precise as necessary to provide input to mode and route choice models</td><td>Precise models</td><td colspan="2">Detailed models</td></tr>
<tr><td>6. Contribute to strategic economic development</td><td>Needed to describe regional economic impacts</td><td>Medium precise models</td><td colspan="2">Needed to describe spatial planning considerations</td><td colspan="3">Medium precise models</td></tr>
</table>

Table 9.2 outlines the recommendations regarding traffic models for different planning methodology stages. The recommendations lead to a comprehensive modelling framework (see section 9.1). This means that the models incorporate both strategic, tactic and operational elements when necessary. It is noted that the traffic models do not deal with forecasts of the input variables such as population, general development of car-ownership, etc. External models must accordingly provide these.

Land use-transport interactions are recommended to be described by existing models when available; otherwise by use of scenario techniques, etc.. Main regional impacts are modelled by the framework lay-out in STREAMS.

Table 9.2 Traffic model recommendation for different planning phases

Sub-models		Phase 1: Initial phase	Phase 2: Selecting project pools	Phase 3: Detailed modelling
Demand	Car ownership	Not taken into account	Judged	Should be modelled by a discrete choice model, if the local or urban traffic is significant.
	Trip decision	Growth factor and time-series analyses within categories	Simultaneous model	Discrete choice model consistent with microeconomic theory
	Destination choice	Gravity model		
	Mode choice	Distribution curves or simple logit-models		
	Estimation	Regression analyses on a) Existing matrices, b) Directly from traffic counts or c) Indirectly from matrices estimated from counts	From matrices by multiple non-linear regression analyses	Estimated from disaggregated data of RP- or SP-type. Calibrated toward traffic counts and other aggregated data.
	Conversion between GA- and OD-matrices	No	Only in case of separate time-of-day models. The GA-matrix is made symmetric in other cases	By separate models if congestion occurs in the network. The GA-matrix is made symmetric in other cases
Route choices	Route choices, individual networks	By a probit model - or link-based SUE if congestion occur	By SUE, including simulation of distributions of preferences. Separate classes corresponding to the demand model	As phase 2, but intersection models may be necessary in congested urban networks.
	Route choices, organisational networks	All-or-nothing or by standard software if alternative routes exist. Only if the public transport network is improved	By standard software or by discrete choice models in the case of a finite number of alternatives	By probit models, by standard software or by discrete choice models in the case of a finite number of alternatives
	Estimation	Standard parameters are used. These are adjusted if large differences from counts occurs	Estimation towards counts. If available towards stated route choices	Towards counts and stated route choices. Preferences from RP- and SP-analyses.
Supply	Supply model	Simple link-based	Link-based with interaction between classes	Intersection models may be needed
	Feed-back mechanism	Naive iterative	Iterative with consistent sum of supply variables within each class	As in phase 2. MSA if necessary
Number of classes	Different user classes	No, only as categories	Only if strong empirical evidence recommends it	Yes
	Freight model	Yes	Yes	Yes
	Separate trip-length models	Categories in the case of significant local and regional traffic	Only in the case of significant local and regional traffic	Yes, except if the traffic is very uniform
	Separate time-of-day models	No	Only in urban congested networks (strong rush hours)	Yes, if rush hours are notable

On the basis of these preliminary recommendations a set of guidelines have been worked out for the approach to be followed in the corridor cases, see the Appendix Report section 11.

10. Baseline methodology in overview

10.1 Structure and content of DECODE

The baseline methodology will be summarised as a list of paragraphs, with each paragraph ending with a reference to the previous text:

1. The process of corridor planning for major European transport corridors has as a recognition of the complexity of the task adopted a multi-model approach. Specifically, the WP1 team has devised a mo<u>de</u>lling system for <u>co</u>rridor <u>de</u>velopment (DECODE). The DECODE approach has been set out in a context of a non-linear planning process as a more conventional, linear process has been considered unsuitable to deal with the current task of transport corridor development. The complexity stems both from the demands put on the more technical planning models and from the interplay between an array of supra-national, national and regional/local planning interests ("players"). The overall methodological approach to deal with this "complexity planning" task has been set out as a pursuit of four different planning themes concerning both "hard" and "soft" issues, see Table 2.1. (section 2)

2. DECODE makes integrated use of a set of models and results from a number of ongoing research projects within the Strategic Transport part of the EU 4th Framework Programme: EUNET, TENASSESS, etc., see Figure 2.1. In addition on the basis of a major review undertaken as part of WP1, use is also made of policy inventories, data, research findings etc. from a number of other sources, see literature and Appendix Report. New models are also being developed as part of the CODE-TEN work concerning impact measurement, corridor alignment, etc. (section 2)

3. For the sake of linking the corridor planning methodology to the European Common Transport Policy, CTP, and establishing a common basis for operational interpretations of the CTP in the various models made use of, the CTP has been formulated as a set of altogether ten different objectives[*]. As an example the ten CTP objectives have been used to formulate the so-called framework variants to be mentioned below, stemming from the EUNET work, while at the same time the "policy areas" from the TENASSESS model developed for assessment of TEN policies and expressing the objectives of the model, similarly can be derived from the presented list of CTP objectives. (section 3.1)

4. A major difference between a comprehensive assessment of corridor development and of a single infrastructure project is that for the latter, it will most often be relatively clear what it is that is being assessed. In contrast to this the corridor development will comprise a number of initiatives where some may concern infrastructure investments and others may relate to for example new policies. Therefore, the concept of transport initiative has been

[*] It is an interesting finding of the TENASSESS Study that the list produced seems to be a suitable range of objectives, not just for EU transport objectives but also for the various member country national transport policies (NTPs) and for various regional and local transport objectives (RTPs) (LTPs). What differs between CTP, NTPs, RTPs and LTPs are the differences in emphasis ("weights") given to the individual objectives.

defined and a systematic classification of transport initiatives (based on five mode orientations and four domain orientations) has been introduced. (section 3.2)

5. A second concept (and associated with the transport initiative concept above) that has been introduced is the framework variant. The framework variants can be seen as a kind of assessment template connecting the CTP transport objectives and the particular type of transport initiative. All framework variants to be made use of have been developed around the EUNET categories of impact types: Core impacts, non-core & non-strategic impacts, strategic & territorial impacts, and strategic & non-territorrial impacts. (section 3.3)

6. A third concept that has been defined and introduced for common use in the baseline methodology is the corridor development alternative (CDA). The function of the CDAs is to establish "the project" on a corridor scale where it will necessarily consist of a number of individual initiatives/projects. The CDAs are seen as expressions of particular strategies which relate to particular (demand-side) scenarios and underlying (supply-side) mode orientations. Some principles have been defined so the set of CDAs to be examined in a given corridor can be formulated in a consistent way. This aspect is important, among other things, to enable comparisons across corridor case studies (for example to consider methodology modification) but also to make it possible to construct Europe-wide network plans where the corridors function as the links in the network (for example to feed back to the applied scenario formulations). Furthermore, in addition to its technical implications, the CDA has a very obvious function. It can namely be foreseen that the set of CDAs in a particular corridor as the most "visible parts" of the planning will simply be the focal point (interface) between the "hard" and "soft" approaches. This visibility will be greatly enhanced by the use of GIS. This will, for example, be applied in the corridor alignment model. (section 3.4)

7. It has been recognised that a complete understanding of all the process- and methodology aspects will only be obtained with the actual corridor planning being undertaken in full scale. On this basis the DECODE setting up has been seen as consisting of a three-staged development, with the WP1 methodology as stage I, WP6 methodology as stage II and factual, full scale planning of a corridor as stage III. Some of the methodology aspects relate only to real societal processes. As the methodology intends to support such real processes and not to replace them, certain methodology aspects can then only be mirrored/simulated at stage I and II. It will be the responsibilities of the individual case study teams to organise and optimise their study resources in a way so that these aspects are paid attention to in a suitable way while at the same time, the more technical parts of the corridor planning process are also tried out. The WP6 work will depend very much on the set of corridor cases where different parts of the stage I (the baseline methodology) have been tested. (section 4.1)

8. The stage I methodology has been defined as six types of planning activities: PA1 to PA6. Due to the non-linearity of the process stemming from the actual circumstances, these PAs may concerning PA2 to PA5 show up in various orders, see Figure 4.1. These four activities address four different planning themes of adequacy, dependency, suitability and adaptability. The themes aim to cover both "hard" and "soft" planning issues all of which in some respect are important for the corridor planning. To maintain consistency in the DECODE approach two method constructs have been set up: the central forecast scenario and the central set of nested weights. (section 4.2 & 4.3)

9. Each planning theme has been treated on the basis of the WP1 review results, and models to support the WP2 corridor case teams have been worked out considering, among other things, the data demands. As data that are sparse or lacking occur in several of the nine case corridors so-called light L-versions have been set up to replace standard (S-version) models where appropriate. For each of the four themes concerning action and context feasibility and action and context acceptance, the most relevant development tasks have been indicated making use of the working papers produced as part of WP1. As with the range of assessment models, various types of traffic models have been considered and categorised for the actual purpose, with the particular model types being recommended dependent on the corridor type and the available data. (section 5 to 9)

10. The Main Report is based, among other things, on a model and data review presented in a separate Appendix Report. This report also contains a set of working papers for WP2 to WP5, an intermediate sketch methodology and a set of corridor case guidelines. The purpose of the sketch methodology is to support the corridor cases in WP2 and to facilitate the further methodology development.

10.2 General approach and findings

The baseline methodology treated in this report tries to strike a compromise between being “too general” and “too detailed”. A very general approach would leave much freedom to the individual corridor case teams in WP2. This may be considered an advantage by some giving room to very “tailored” approaches. The WP1 team, however, has assumed that the cases will need a number of common concepts and approaches to be able to function as building bricks that can facilitate the development of the corridor planning methodology from stage I to stage II. On the other hand a baseline methodology that is more detailed than the one that has been set out, has also been rejected by the WP1 team. Very detailed methodology guidelines may improve the efficiency (“do the thing right”) in some respects but may also incur the risk of less effectiveness (“not doing the right thing”).

Concerning the effectiveness viewpoint a major reference source exists from the cases worked out in the TENASSESS project and the various associated findings (ICCR et al., 1997b). General advice for the work on the case studies can be to make use of this material and consider its relevance for the current work. To exemplify some recommendations /observations are reiterated:

- The “solution” ought not to be sought from <u>one</u> model but rather the co-ordinated use of a system of models or methodologies, including the sociological method

- The need for improved co-ordination fora[*]. Furthermore, attention is called to the possibilities of network-coordination (“for experts as for decision-makers, the solution for solving problems or conflicts resides in working in networks”)

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[*] In this respect the Commission’s proposal about Europe-wide Transport Networks Partnership can be noted (CEC, 1997a). Among the binding principles formulated are the development of the Public Private Partnership concept as an important tool for project specific investment partnerships (CEC, 1997b). This is related to the importance of organisational structures which allow the creation of single project entities for large investments.

- The State as the remaining ultimate reference point for the co-ordination of interfaces and for a decision
- The need for better integration of the public in the decision process

To support the work on the corridor cases some operational guidelines have been developed which can supplement the structural and methodological ones that have been set up in this Main Report (see section 9 to 16 in the Appendix Report).

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