

Strategic Environmental Assessment of the High-Speed Rail Network in Portugal

M. Coutinho¹, C. Borrego^{1,2}, R. Pinho¹, F. Leão¹ e S. Bento¹

1 – IDAD, Instituto do Ambiente e Desenvolvimento, Campus Universitário, 3810-193 AVEIRO

2 – DAOUA, Departamento do Ambiente e Ordenamento da Universidade de Aveiro, 3810-193 AVEIRO

Abstract

In November 2003, Portugal approved the layout of the future high-speed rail network. The governmental decision was supported by an environmental report that compared the two alternatives that were considered at this stage: a layout that involves the construction of two links with the Spanish network in the eastern boarder, the so-called II plan and another with only one central connection also known as the T plan.

Even if Portugal hasn't yet transposed the European Union (EU) Directive 2001/42 concerning Strategic Environmental Assessment (SEA) of plans and programmes the promoters of the high-speed rail network decided that it was recommendable to produce a study that should follow the guidelines included in Annex I of the Directive concerning the content and structure of the environmental report.

The study began with the identification of the externalities associated with these plans and the estimate of the external costs and benefits of the transport modal shift caused by the operation of the network. At this earlier stage it was also developed an analysis taking into account the objectives specified through the European Environment Agency's (EEA) Transport and Environmental Reporting Mechanism (TERM) set of indicators.

On a later stage, attention was focused in the characteristics of the territory that will be crossed by the railway system and in the analysis of the potential impact that the location of the stations might induce in the urban development of the cities served by the high-speed train. This analysis was supported by GIS mapping techniques.

One of the most interesting features of the methodology used in this study was that mitigation measures and monitoring indicators were organized in a strategic map. This strategic map replicates one of the tools used for strategic business management through the design of a balance scorecard, familiar to top managers.

This paper focus on the most relevant aspects of the environmental report: integration with other plans and programmes, environmental problems, objectives and environmental indicators, impact assessment and monitoring.

1. SEA Process

In many cases, environmental decisions are taken in higher levels of decision-making than the project one. These decisions and their environmental effects depend on the political option if either it is or not necessary to invest in a specific project (policy level), where it is going to be implemented (plan) and what typology will be used (program). At the project level, the decision might be limited to the definition on how the project is going to be implemented.

When the environmental assessment occurs in the project level it is called Environmental Impact Assessment (EIA). In Portugal, the EIA process is regulated by the Decree-Law 69/2000. When the assessment is done in any other previous decision-making levels (policy, plan or program) the study is called Strategic Environmental Assessment (SEA).

SEA is a well-accepted environmental assessment and decision support tool, whose role becomes increasingly more effective the earlier is used (Partidário, 2000). Due to the absence of specific legislation concerning SEA in Portugal, the integration of environmental analysis in decision-making depends on the sensibility of the involved entities.

The distinction between decision-making levels is very important as the degree of detail of the assessment is certainly different. As Lee and Walsh (1992) stated the scale differences of the analyse increase the complexity of the SEA process related to the EIA. Although, the degree of detail and the level of accuracy of the necessary information for decision-making at the political, plan or programme level typically is less than the necessary at the project level (Partidário and Clark, 2000). Consequently it is important to establish a formal linkage between SEA and its related EIAs. An absence of it can lead to inconsistencies between SEA and EIA levels. (Risse *et al*, 2003).

In the last 15 years, many countries developed SEA procedures adapted to local circumstances and to specific conditions of the plans and programmes that are assessed. According to Therivel *et al* (1992) SEA means “a formalized, systematic and comprehensive process of evaluating the environmental impacts of a policy, plan or programme and its alternatives, including the preparation of a written report on the findings of that evaluation, and using the findings in publicly accountable decision-making”.

In the 27th of June 2001, Directive 2001/42/EC on the “assessment of the effects of certain plans and programmes on the environment” was published. This Directive had to be transposed by all EU member states by 21st of July 2004. The Directive has the following objectives:

- Provide for a high level of protection of the environment (Article 1);
- Contribute to the integration of the environmental considerations into the preparation and adoption of plans and programmes (Article 1);
- Contribute to more transparent decision making (15th recital of the preamble).

The Directive lays down a minimum environmental assessment framework which defines the broad principles of the environmental assessment system and leaves the procedural details to each Member States taking into account the principle of subsidiarity. The general requirements of the Directive are not restrict and leave a broad space to creativity, flexibility and adaptability for each Member States context, specially in the definition of when it is necessary to implement SEA in the planning process, the importance of the SEA in the final decision-making and the role of the monitoring mechanisms (Risse *et al*, 2003).

In respect to the Directive requirements it is important to refer the necessary procedures which correspond to the different steps of the SEA process, defined by the European Commission (1999) as follows: screening, scoping, environmental report, decision making and monitoring (Figure 1).

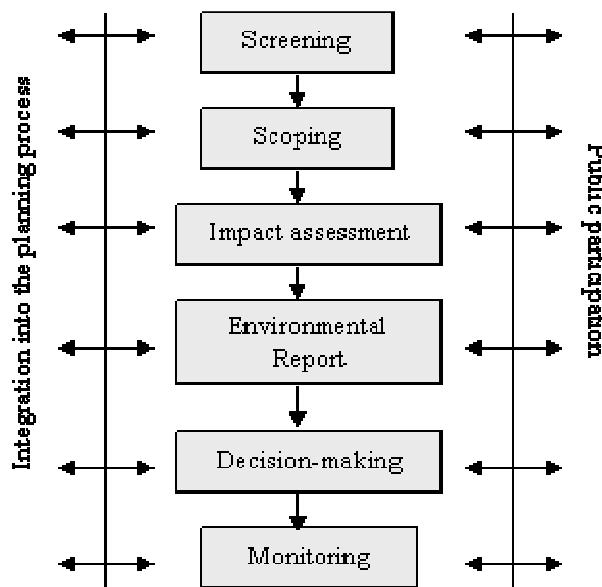


Figure 1 - SEA general process (EC, 1999).

It is of extreme importance, in first place to indicate the existing plans and programmes that the project must integrate and/or must be integrated and in second place to establish mechanisms of communication with the respective involved entities. The integration into the planning process and the public participation must occur during all the SEA process (EC, 1999).

As the Article 8 of the Directive 2001/42/EC clearly states, the environmental report “shall be taken into account during the preparation of the plan or programme and before its adoption or submission to the legislative procedure”.

Applied as a systematic process, SEA leads to a more pro-active decision making in support of sustainable development, ensuring that ethical principles are considered in the approval of policies, plans and programmes. Only systematic objectives-led SEA (with clear objectives) appears to be able to deliver these benefits (Fischer, 2003).

2. Methodology adopted

In Portugal there is a lack of environmental integration into the decision-making process (ICON, 2001), with the following identified problems: lack of clear procedural orientations and criteria in environmental assessment; a limited integration of sustainable development principles; absence of mechanisms of communication between the proponent and the decision-maker; a lack of mechanisms of horizontal and vertical communication and inexistence of mechanisms to involve sectoral authorities in the decision making.

In this context, with the inexistence in the Portuguese legislation of any legal framework that regulates when it is necessary and how to make a SEA, the environmental report done in this work must be understood as a voluntary process and follows an *ad-hoc* structure.

2.1 The decision-making level

Tiering helps to concentrate on relevant alternatives supporting the idea of synoptic planning, but it also enhances communicative aspects (Hildén *et al*, 2004). Table 1 presents the levels of the decision-making process of this specific assessment.

Table 1 – Tiering of the decision process and SEA.

Strategical Decision	High-speed railway network	Instruments	Environmental Assessment
To do or not to do?	Does Portugal need a high speed train?	Policy	SEA
Where?	Which networks will be adopted? TT or T?	Plan	
Which tipology?	Which corridors? Where will be the stations?	Programme	
How is it going to be?	Detailed route for sections of the corridor.	Project	EIA

The present SEA was developed at the plan level, comparing two layout alternatives for the high-speed railway network which differed in the connections options with the Spanish network: a layout that involves the construction of two links with Spain in the eastern boarder, the so-called II plan and another with only one central connection also known as the T plan (see Figure 2). Within this context, the environmental report focuses on the identification of the principal territorial and environmental effects resulted by the adoption either by the II or the T alternatives.

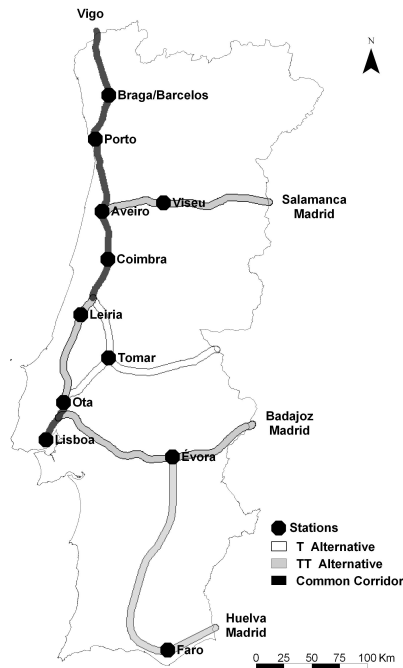


Figure 2 – Railway network alternatives: II or T.

2.2 The Environmental report

The environmental report produced during the present SEA follows the structure proposed by the Directive 2001/42 /EC and assures:

- A clear integration of environmental objectives, through the use of indicators;
- Provides an adequate context for future project proposals.

The integration of sustainability into the plan preparation was made through the:

- Identification of objectives appropriate to sustainable criteria;
- Identification of key performance indicators to allow ongoing assessment and monitoring;
- Scoping to determine constrains and/or opportunities of the project compared with sustainability objectives;
- Follow-up of the plan performance through a matrix (balance scorecard) against each sustainable objective.

The final structure of the environmental report does not follow the same sequence (a) to i)) as the Annex I of the Directive. Besides identifying the alternative more efficient and sustainable, the environmental report also presents the mitigation measures and the design of future monitoring activities.

2.3 Environmental assessment

The identification of the environmental problems associated with the transport sector helps defining the SEA environmental objectives, allowing the evaluation of the opportunities and constraints of each alternative. In Europe, as in other parts of the world, the need of developing a transport system more sustainable has been clearly identified. One way to obtain a better integration of the environmental aspects in the transport policy (EC, 2001) is the revitalization of the rail.

The SEA includes a preliminary assessment of the environmental performance of the high-speed rail network plan based in the analysis of modal split and in the estimative of the externalities (external costs) associated with the Project implementation (Coutinho *et al.*, 2004).

The external costs calculation of the high-speed railway scenarios was based on the methodology used in the study *External costs of transport in Western Union* (INFRAS and IWW, 2000). The following cost categories were considered: accidents, noise, air pollution, climate change, nature and landscape, urban effects and upstream process associated to transport.

This evaluation concluded that the high speed rail network for both alternatives contributes to a reduction of costs in almost all the categories, improving the environmental performance of the transport sector. Only noise and urban effects had an increase of external costs. The most significant reduction is noted in accidents, due to the high expected reduction in road transport and consequently the reduction of accidents. For the year 2010, benefits for the alternative TT were estimated in the order of 92 million Euros per year and the alternative T represents a benefit of approximately 63 million Euros.

The European Environmental Agency (EEA) has published a fundamental work at the indicators levels based in the integration between the transport and environmental sectors within a project called TERM – Transport and Environmental Reporting Mechanism (EEA 2000, 2001, 2002). These reports have a group of indicators that allows to monitor the integration between environmental and transport strategies.

Considering the SEA as a process orientated towards environmental objectives, the report structure and the comparison of alternatives were motivated by the integration between objectives and indicators, based in the TERM methodology. This methodology and subsequent set of indicators supported the selection of the activities with potential environmental and territorial effects: stations site, corridor localization and train operation. It was possible to identify the main opportunities and constraints of the project based on the sustainable objectives associated with the selected indicators, as listed in Table 2.

Table 2 – Main effects: constraints and opportunities.

	Environmental effect	Topic
Constraints	Population exposed to high levels of noise	Noise
	Perturbation of sensible areas	Biodiversity
	Habitat fragmentation	
	Territory fragmentation: barrier effect	Urban and territory dynamics
	Increase of the value of the soil in the vicinities of new stations	
Increase of road traffic near stations and new of parking space		
Opportunities	Reduction of the emissions of greenhouse gases (CO ₂ , CH ₄ e N ₂ O)	Climate change
	Reduction of the emissions of atmospheric pollutants (NO _x , COV's, PM ₁₀ , SO ₂)	Air quality
	Reduction of road accidents	Traffic accidents
	New economical activities	Urban and territory dynamics
	New urban fronts	
	Urban regeneration development	
	Increase of the fiscal benefits to the municipalities	
	Increase in the qualifications of the active population	
	New conditions to attract big structures and equipments	
	Articulation with other transport infrastructures	
Plan the land use transformation		
Creation of new urban centralities		

Figure 3 presents, from global to local scale, the relation between the activities (circulation of High Speed Train (HST), station location and the railway itself) and the affected topics. It is important to consider that often effects are not limited to just one topic. The evaluation was done taking into account two different perspectives:

- Analysis of the selected topics based on the main territorial and environmental effects;
- Reference to the physical infrastructures of the territory capable of constraining and/or promoting the implementation of the railway corridor.

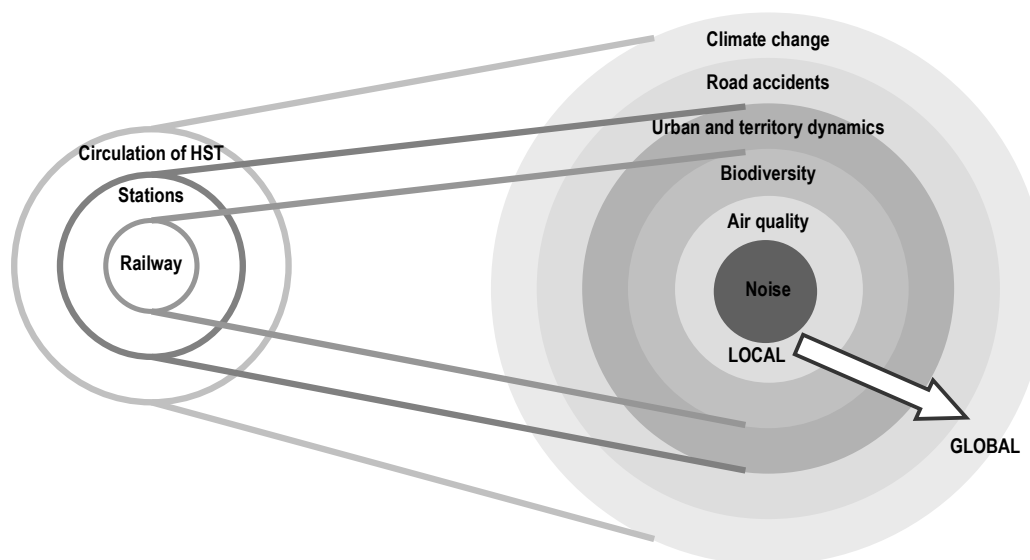


Figure 3 – Scoping - main activities and affected topics.

2.4 Mitigation measures and monitoring

To reach the environmental objectives and sustainability targets mitigation measures were defined, divided into:

- Measures of railway design: to give an answer to constrains and raise opportunities. The HST railway is going to cross a big extension of the Portuguese territory. It is important to analyse the negative effects in the most vulnerable areas in terms of biodiversity and urban centres;
- Measures to manage at the municipality level(integration with the planning process): these measures are associated with the new characteristics of the affected space by the railway, the need of new infrastructures and the effects caused by the circulation of the HST (urban expansion, new roadways).

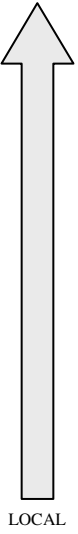
Monitoring represents the last step of the SEA process and comes in effect once the strategic proposal is implemented. This step shall monitor the significant environmental effects in order to identify in an early stage unforeseen adverse effects and to be able to undertake appropriate mitigation action. It may use, if appropriate, previously existing monitoring activities, in order to avoid duplication of monitoring (Article 10th of the Directive 2001/42/EC). This step also aims to give feedback to assist in the realisation of future SEAs and ensures a pro-active assessment – SEA as a supporting tool for sustainable development.

To monitor the environmental effects it was necessary to select quantitative indicators for each objective and respective target, assuring the environmental control of the project. The selected set of indicators was formally organized in a control panel following the methodologies applied in business strategic management: a balance scorecard (Table 3).

The balance scorecard is divided into each level of Project implementation phase: the project implementation by itself, relation with external activities and operations. In each level some objectives were selected for monitoring and to verify the performance of the decisions of each phase. This strategic control map also presents the integration between the different level of

action and the environmental topics analysed and its contribution for sustainability, from local to global scale.

Table 3 – Strategic control map.

Sustainability									
Operations	Increase railway's pkm			Increase railway's tkm				Climate change Road accidents	 GLOBAL LOCAL
	Other plans and programmes	Associated projects	Logistics platforms	Airports and ports	Traditional railway		Iberian Network		
Intermodality and interoperability			Integration and efficient use of existing infrastructure		Interoperability				
Municipalities		Integration of station location	Land planning and new urban fronts	Good local access to stations	Reduce population exposed to noise	Reduce the barrier effect	Increase station regional impact	Urban and territory dynamics	
Project	Stations	Reduce distance station – urban center		Good connections with urban centers				Air quality	
	Corridors	Reduce ecosystems and habitats fragmentation		Coordinate train corridors with high voltage lines		Reduce population exposed to noise		Biodiversity Noise	

3. Conclusions

The objective of this paper is the presentation of the methodology adopted in the SEA environmental report for the high-speed railway network in Portugal. Due to the absence of a legal framework in Portugal and taking into consideration the Directive flexibility, the objective of the authors was to define a methodology that would adapt better to the project in concern. With this exercise it was possible to make a balance of the Directive objectives being important to refer the following aspects:

- Need to define the degree of detail of the SEA, based in the decision-making levels (policy, plan or program);
- Establish a set of environmental indicators to consider in the SEA according with project type (transport, energy sectors...);
- Clarify the relationship between following EIAs (focusing the analysis and avoiding duplications).

The public consultation and the integration into the planning process are 2 fundamentals elements of the SEA procedure. The present SEA was a voluntary process without any nationally legal framework other than the Directive 2001/42/EC. As a consequence public participation was not integrated. Moreover the integration with the planning process is highly recommended in the follow-up activities.

References

Coutinho M., Borrego C., Pinho R., Leão, F. e Jorge, G., 2004, *Os custos externos como instrumento de apoio à decisão de políticas de transportes: o exemplo da rede ferroviária de alta velocidade em Portugal*, 1ª Conferência Nacional de Avaliação de Impactes, Aveiro.

Directive 2001/42/EC of the European Parliament and of the Council of June 27 2001 on the assessment of the effects of certain plans and programmes on the environment, Official Journal of the European Communities 2001; L 197:30-37.

European Commission (EC), 1999, *Manual on strategic environmental assessment of transport infrastructure plans*, Brussels, Belgium: European Commission, DG Energy and Transport.

European Commission (EC), 2001, *White Paper: European transport policy for 2010: time to decide*.

European Environment Agency (EEA), 1999, *Towards a transport and environment reporting mechanism (TERM) for the EU. Part 1: TERM concepts and process, Part 2: some preliminary indicators sheets*, Copenhagen.

European Environmental Agency (EEA), 2001, *TERM 2001: Indicators tracking transport and environment integration in the European Union*, Copenhagen.

European Environmental Agency (EEA), 2002, *TERM 2002: Paving the way for EU enlargement – Indicators of transport and environment integration*, Copenhagen.

Fischer, T., 2003, *Strategic environmental assessment in post-modern times*, Environmental Impact Assessment Review, 23, 155-170.

Hildén, M., Furman, E., Kaljonen, M., 2004, *Views on planning and expectations on SEA: the case of transport planning*, Environmental Impact Assessment Review, 24, 519-536.

ICON, 2001, *SEA and Integration of the Environment into Strategic Decision-Making - Volume 3 - Case Studies*.

INFRAS/IWW, 2000, *External costs of transport – accident, environmental and congestion costs of transport in Western Union*, International Union of Railways (UIC), Paris.

Lee, N. and Walsh, F., 1992, *Strategic Environmental Assessment: An overview*, Proj. Apprais., 7, 126.

Partidário M., 1996, *Strategic environmental assessment: key issues emerging from recent practice*, Environmental Impact Assessment Review, 16, 31-55.

Partidário, M. R., Clark R., 2000, *Perspectives on Strategic Environmental Assessment*, Lewis Publishers, USA.

Partidário, M., 2000, *Elements of an SEA framework – improving the added-value of SEA*, Environmental Impact Assessment Review, 20, 647-663.

Risse N., Crowley M., Vincke P. e Waaub J. P., 2003, *Implementing the European SEA Directive: the Member States margin of discretion*, Environmental Impact Assessment Review, 23, 453-470.

Therivel R., Wilson E., Thompson S., Heaney D., Pritchard D., 1992, *Strategic Environmental Assessment*, Earthscan Publications, London.