Assessing environmental performance of road projects

The recent development of eco-comparators in France

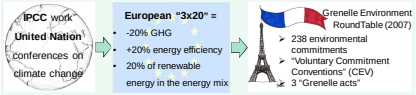
A. DE BORTOLI, Université Paris Est, Laboratoire Ville Mobilité Transport (LVMT), Ecole des Ponts ParisTech, France
anne.de-bortoli@enpc.fr

INTRODUCTION

Transportation is one of the most carbon-emitting sectors in the world, accounting for about 20% of global emissions, and 30% of the French carbon emissions, of which 90% are from road sector. Considering the stakes of climate change, carbon emissions and energetic consumption criteria have become ever more present in transportation projects, and especially in the road sector, thus entailing a prolific development of environmental assessment tools, especially carbon calculators.
The purpose of this article is to enlighten the evolution of sustainable practices in road construction in France in recent years through the development of eco-comparators – i.e. tools to assess environmental variants of a product or a project.
Based on governmental, institutional and academic literatures, and completed with tools manipulation, it traces the political context in which the need for robust environmental assessment tools of road projects appeared, the institutional process that tried to enable the road sector to reach a significant level of agreement about eco-comparators and consistent results in green road construction practices.

Context

Environmental issues have been brought to the political agenda at different scales :



Transport sector	Commitment n°13 :	The "road transportation" Voluntary Commitment Convention (RTCEV)
	1. Creating a transport observatory 2. Developing eco-comparators 3. Promoting them in Europe	Several targets (see table 1)

Voluntary Commitment Conventions (CEV)

A CEV = product of a collaborative work between public and/or private organizations and the French Ministry in charge of Sustainable Development (MEDDE) (see Fig. 1)

It must [1]:
- include **quantified goals** designed in collaboration,
- that **lead to concrete actions** programmed in an **agenda**
- and whose **results** have to be **assessed** thanks to **quantitative indicators every year**
- to enable the MEDDE and the public to follow evolution of industrial practices, and possibly to adjust final goals

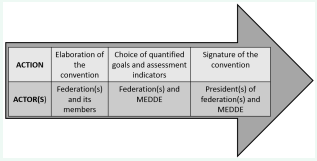


Figure 1 Process to elaborate a Convention (created from [1])

The "road transportation" Voluntary Commitment Convention (RTCEV)

The convention for actors in design, construction and maintenance of roads and urban areas (=RTCEV) was signed on March 2009 by :
- the MEDDE,
- the assembly of French departments
- and the road building sector : the national federation for public work (FNTP), the French professional syndicate of road workers (SPTF), the union of federations for French road industry (USIRF) and the federation of engineering (Syntec-Ingénierie).

The CEV has also been adapted later and signed at local scales in France : in 2012, more than half French "departments" have signed one [6].

Its quantified goals and targeted concrete actions are indicated in table 1.

TARGETS				
n°	Action related to road construction	Situation in 2009	Target for 2012	Target for 2020
1	To re-use or valorise 100% of excavated materials on road work	40 to 80%	+10%	100%
2	To recycle road materials	20%	+60%	100%
3	To reduce GHG emissions	Reference	-6 to -10%	-33%
4	To reduce water consumption	Reference	Assessment tools	-50%
5	To preserve biodiversity & natural milieu	Work on methodologies and recommendations		
6	To increase environmental performance of road companies	Institution of a road industrial common eco-comparator in 2010		
7	To increase road safety	Charter on road safety signed in 2009		
8	To participate in research development, innovation & diffusion	Increase in public-private collaborations to rebuild transportation doctrine		
9	To create a structure for public-private (PP) collaborations	Creation of a partnership platform, or a road and transportation infrastructure institute		

Table 1 Main goals of the RT CEV (created from [2])

The French road eco-comparators

Creation of a public-private institute for transport infrastructure : the IDRRIM

In accordance with the last goal of the CEV (table 1), the IDRRIM, was created in January 2010 to facilitate discussion and common work in order to develop greener practices in transportation infrastructure construction and planning.

It is a non-profit-making association whose the organization is described in figure 2.
Key actors in the field of road transportation have joined the IDRRIM to pool their efforts and in particular to make emerge validated eco-comparators for road construction work.

The operational committee "Notices" ("Avis" in French) is in charge of producing technical notices, guides and synthetic documents on road technical subjects, presented by the specialized groups.

In this committee, a group is specialized in the assessment of eco-comparators.

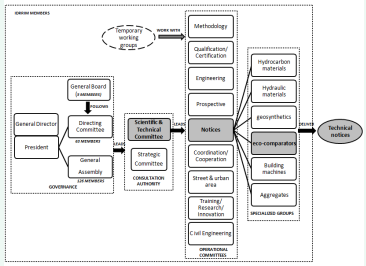


Fig 2 organization of IDRRIM and production chain of technical notices (in grey)

Overview of the eco-comparators

Eco-comparator	Editor	*Technical notice n°* Published on	Application perimeter: Public tender: Conception	Public tender: Response	Public tender: Comparing responses	Construction	Use	Targeted users: Prdj. manager	Contracting authority	University	Engineering consulting	Data base managed by	Type of results and presentation	Availability
ECORCE 2.0	IFSTTAR	*158* April '13	X	X	X							Editor	Tables & graphs by layer, operation, or process	Free but not open-source
VARIWAYS 1.1	EGIS	*159* Sept '13	X	X	X		X	X			X	Software manager	?	For EGIS only
SEVE 2.0	USIRF	*160* Sept '13	X	X	X	X		X	X	X	X	?	Tables & graphs by object	Charged for non USIRF members

Table 2 General information on the eco-comparators (Created from [3], [4] and [5])

Eco-comparator	System perimeter: Upper part of earth work	Subgrade layer	Other layers	Shoulder	Environmental assessment perimeter: Extraction	Production	Transport	Construction maintenance	Use	End-of-Life	Indicators: GHG emissions	Energy consumption	Resource consumption	Aggregate consumption	Aggregate valorisation	Water consumption	Acidification	Chronic toxicity	Ecotoxicity	Eutrophication	Photochemical ozone depletion	Ton.kilometer
ECORCE 2.0	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	
VARIWAYS 1.1	na	na	na	na					X		X €	X										
SEVE 2.0	X	X	X		X	X	X	X			X	X		X	X							X

na = not applicable

Table 3 Perimeters and indicators of the eco-comparators (Created from [3], [4] and [5])

- Tools to compare environmental road construction technical variants
- Based on troncated Life Cycle Assessment (LCA)

ECORCE and **SEVE:**
- **number of similarities** perimeter, targeted users, methodology
- same time range to implement a case study : ≈30 minutes.
- **not the same indicators** (see table 2 and 3)
- **Data to enter very different**:
  - SEVE = used road material masses
  - ECORCE = geometric & nature definition by layer.

VARIWAYS :
- **only consider the use phase** (LCA)
- very different from SEVE and ECORCE (do not consider the use phase)

➢ **They are complementary on a LCA consideration**

Comparison of SEVE and ECORCE

We compared environmental impacts of **major materials** on **energy and climate change indicators.**

Globally, **ECORCE underestimates energetic and global warming indicators compared with SEVE** (see Tables 4 and 5)

Their results have been compared on road projects by **CEREMA** (the French center for expertise and study on risks, environment, mobility and planning) : **most of the time, technical variants' ranking would be in agreement**

Material	Energetic indicator	GHG indicator
	ECORCE compared to SEVE (%)	
Average aggregate	-22,9	-10,2
Wearing course aggregate	0	-12,2
Reinforcing steel	-72,4	-68
Bitumen	-21,4	-23
Modified bitumen*	-0,947	-15
Cement CEM I	-5,80	+5,54
Bitumen emulsion	-89,5	-93,7
Hydraulic binder 10% clinker	-34,9	-33,5
Hydraulic binder 70% clinker	-6,82	2,17

* we compared the modified bitumen of ECORCE with the bitumen with 4% polymers of SEVE

Table 4 Comparison of reference materials vectors for the energetic indicator (in MJ/ton)

Discussion

Achievement assessment of the RTCEV

A popular measure among French departments…
- 87% think the RT CEV is a very positive initiative
- 59% did not encounter difficulties to implement CEV targets despite a tough economic context

… **that has partly reached its intermediary goals** (see table 4)

Goal: n°	Action related to road construction	Target for 2012	Result in 2012	Success (yes/no)	Source
2	To recycle road materials	60%	62%	Yes for aggregates	[6]
3	To reduce GHG emissions	-6 to -10%	-19% from burners	Yes for burners	[6]
4	To reduce water consumption	Tool	ECORCE	Yes	[3]
5	To preserve biodiversity & natural milieu	Methodology	ECORCE	Yes	[3]
6	To increase environmental performance of road companies	A common eco-comparator	SEVE	Yes	[4]
9	To create a structure for PP collaborations	Platform or institute	IDRRIM	Yes	[7]

TABLE 4 Partial intermediary results of the RT CEV (source: see table)

Limits

- hard to determine the quantitative role of eco-comparators
- their implementation and the recent increase in environmental restraints have been concurrent
- efforts have to be maintained as the public-private consensus is not total

CONCLUSION

Lessons learned from the French case

IDRRIM has been created to facilitate discussion on environmental performance, and to unify assessment methodologies between road actors. The example of France confirms that joint work between governments and industry makes emerge better tools.
Nevertheless, despite better communication, two very similar tools have been created. It may introduce conflicts in the choice of variant in a public tender.

In order to fill different actor's needs, it seems essential to produce software including several standards addressed to users with different levels of expertise (expert and basic standards at least).

Besides, there is a need for a LCA-based tool considering the complete life cycle of road or transport road system, which is not possible with current tools.
Indeed, assessing environmental performance of road technical variants on the entire life cycle is important because of the current dominance of the use phase on road life cycle impacts today and the interaction between road and vehicles.

Assessing the impacts of pavement maintenance on road global performance

In developed countries, road networks are almost fully deployed, thus making maintenance one of the important levers to enhance road transportation environmental performance. It currently lacks a global tool to holistically evaluate impacts of road maintenance operations on the entire road transportation system, in order to systemically optimize road maintenance policies.

Aknowledgements

We would like to thank the ParisTech-Vinci Chair in "Eco-design of building complexes and infrastructures" for its support, and especially the Vinci group which sponsors the Chair, in particular our copilots Maxime Trocmé, Christian Caye and Christophe Gobin.

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