SAFETY KPI AT SYSTEM LEVEL FOR RAILWAY

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Project objective

→ Our objective is to build a railway safety index :

- Mainly to detect most critical types of safety events in order to define areas of collaborative work with rail companies

- Incidentally to monitor the evolution of the railway safety level for the whole national system

Project team

We have selected two partners for this project :

French national Institute for industrial environment and risks (INERIS)

A consulting firm specialising in rail transport

Data available

- In France, each safety event has to be notified to EPSF according to a event taxonomy

ANNEXE I

NOMENCLATURE DE CLASSIFICATION DES ÉVÉNEMENTS DE SÉCURITÉ FERROVIAIRE

NOMENCLATURE DES EVENEMENTS DE SECURITE				
1 - Accident				Événement indésirable non intentionnel ou un enchaînement particulier de cette nature, ayant des conséquences préjudiciables
	1.1			Collision
		1.1.1		**Collision d'un train avec un véhicule**
			1.1.1.1	Nez à nez
			1.1.1.2	Prise en écharpe
			1.1.1.3	Rattrapage
			1.1.1.4	Heurt d'un train croiseur
		1.1.2		**Collision d'un train avec un obstacle à l'intérieur du gabarit**
			1.1.2.1	Collision contre un élément de l'infrastructure engageant le gabarit
			1.1.2.2	Enfoncement de heurtoir
			1.1.2.3	Collision d'un train contre un animal sur la voie (hors Passage à Niveau)
			1.1.2.4	Collision d'un train contre un obstacle sur la voie (hors Passage à Niveau)
			1.1.2.5	Collision d'un train avec un matériel en stationnement
	1.2			Déraillement
		1.2.1		Déraillement de train engageant une voie principale
		1.2.2		Déraillement de train sans engagement de la voie principale
	1.3			Accident au passage à niveau
		1.3.1		Collision (véhicule; piétons; obstacle; ...)
	1.4			Accident de personnes hors passage à niveau impliquant du matériel roulant en mouvement à l'exception des suicides et des tentatives de suicide
		1.4.1		Accident de personnes hors passage à niveau impliquant du matériel roulant en mouvement à l'exception des suicides et des tentatives de suicide
	1.5			Incendie dans le matériel roulant

Seriousness scale

1	2	3	4	5	6
« Minor » safety related event	Event that could have materiel consequences / light injuries	Event that could have human individual consequences	Event that could have human collective consequences	Accident with significant consequences	Accident with serious consequences

- Each safety event gets a seriousness level:
  - Levels 1 to 4 are used for incidents with potential consequences
  - Levels 5 and 6 are used for accidents with real consequences

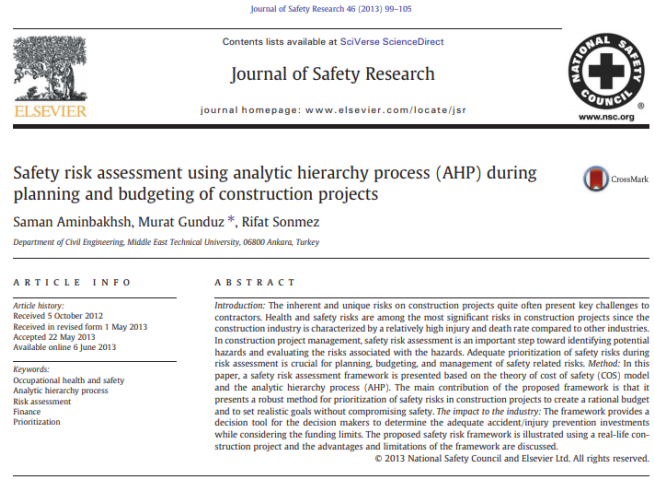
Safety index development

- For a given type of safety event, we have defined 2 safety indexes:
  - Incident Component CI = f (N_1,N_2,N_3,N_4)
  - Accident Component CA = f (N_5,N_6)
  - Where N_i is the number of safety events with seriousness = i

- We choose to use a simple polynomial formula
  - $CI = W_1N_1 + W_2N_2 + W_3N_3 + W_4N_4$
  - $CA = W_5N_5 + W_6N_6$

Safety index development

- Weights W_i had to be computed for CI and CA
  - $CI = W_1N_1 + W_2N_2 + W_3N_3 + W_4N_4$
  - $CA = W_5N_5 + W_6N_6$
- First, the EPSF project team assessed importance degrees that should be given to each seriousness level.
- Then, these importance degrees have been transformed into weights using AHP (Analytic Hierarchical Process), a widely used technic, developed by Thomas Saaty in the 1970s.



Journal of Safety Research 46 (2013) 99–105

Contents lists available at SciVerse ScienceDirect

Journal of Safety Research

journal homepage: www.elsevier.com/locate/jsr

Safety risk assessment using analytic hierarchy process (AHP) during planning and budgeting of construction projects

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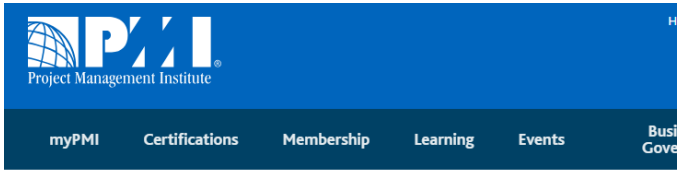
ARTICLE INFO

Article history:
Received 5 October 2012
Received in revised form 1 May 2013
Accepted 22 May 2013
Available online 6 June 2013

Keywords:
Occupational health and safety
Analytic hierarchy process
Risk assessment
Finance
Prioritization

ABSTRACT

Introduction: The inherent and unique risks on construction projects quite often present key challenges to contractors. Health and safety risks are among the most significant risks in construction projects since the construction industry is characterized by a relatively high injury and death rate compared to other industries. In construction project management, safety risk assessment is an important step toward identifying potential hazards and evaluating the risks associated with the hazards. Adequate prioritization of safety risks during risk assessment is crucial for planning, budgeting, and management of safety related risks. *Method:* In this paper, a safety risk assessment framework is presented based on the theory of cost of safety (COS) model and the analytic hierarchy process (AHP). The main contribution of the proposed framework is that it presents a robust method for prioritization of safety risks in construction projects to create a rational budget and to set realistic goals without compromising safety. *The impact to the industry:* The framework provides a decision tool for the decision makers to determine the adequate accident/injury prevention investments while considering the funding limits. The proposed safety risk framework is illustrated using a real-life construction project and the advantages and limitations of the framework are discussed.



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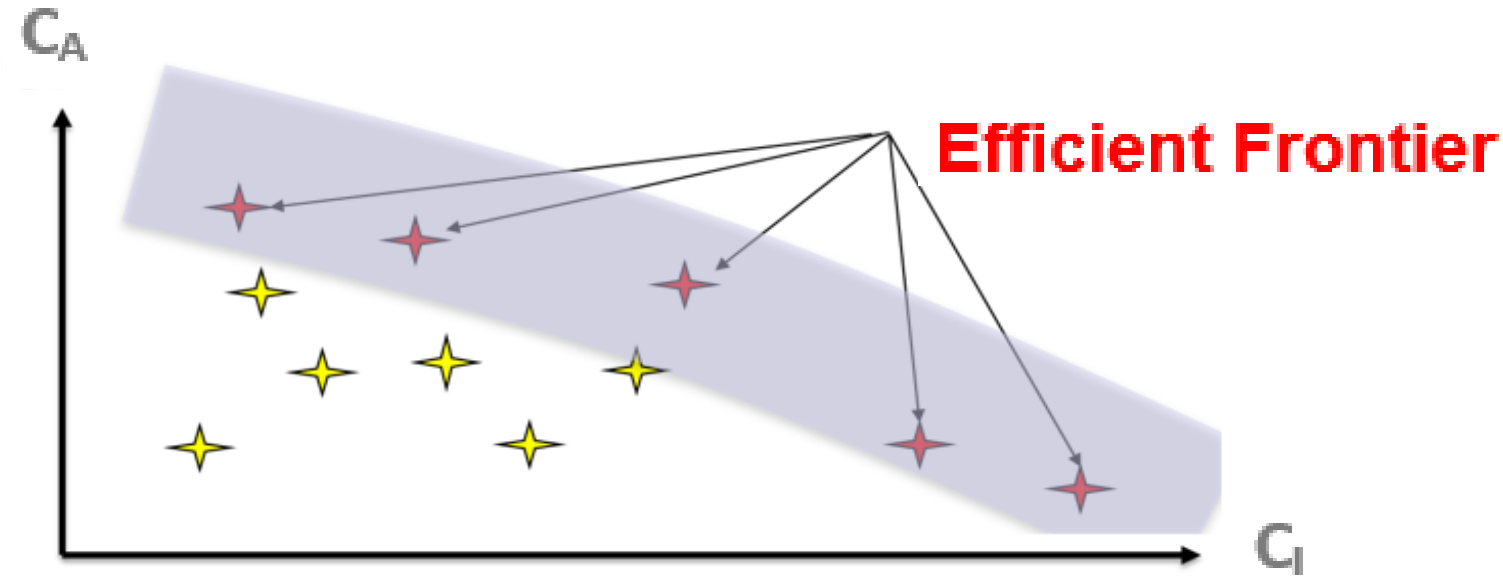
Prioritizing project risks using AHP

CONFERENCE PAPER | Risk Management , Decision Making | 2007

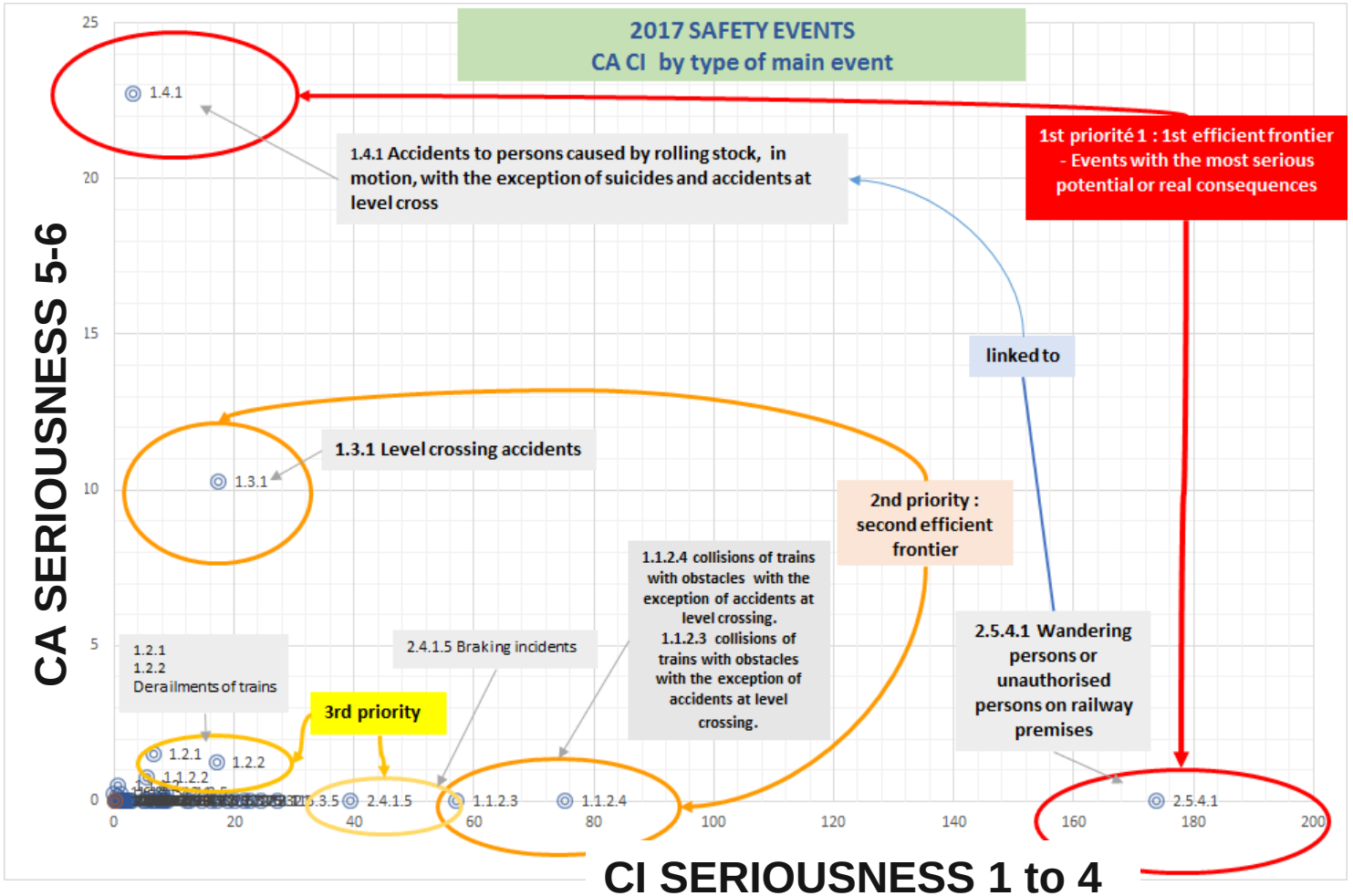
Thibadeau, Barbara

Safety index development

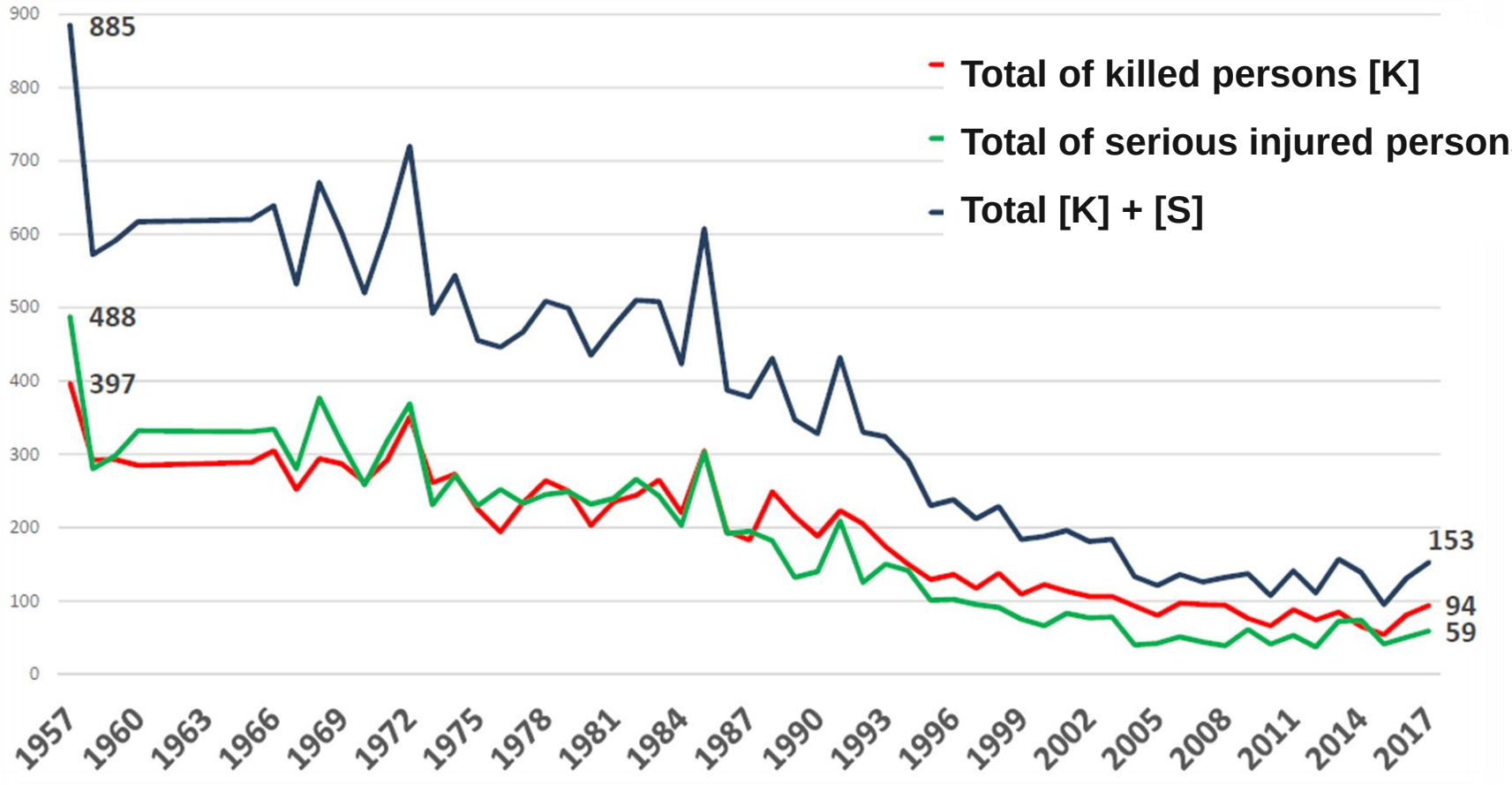
We can represent events in a graphical plan to detect priorities using efficient frontier.



Safety index development



Safety level



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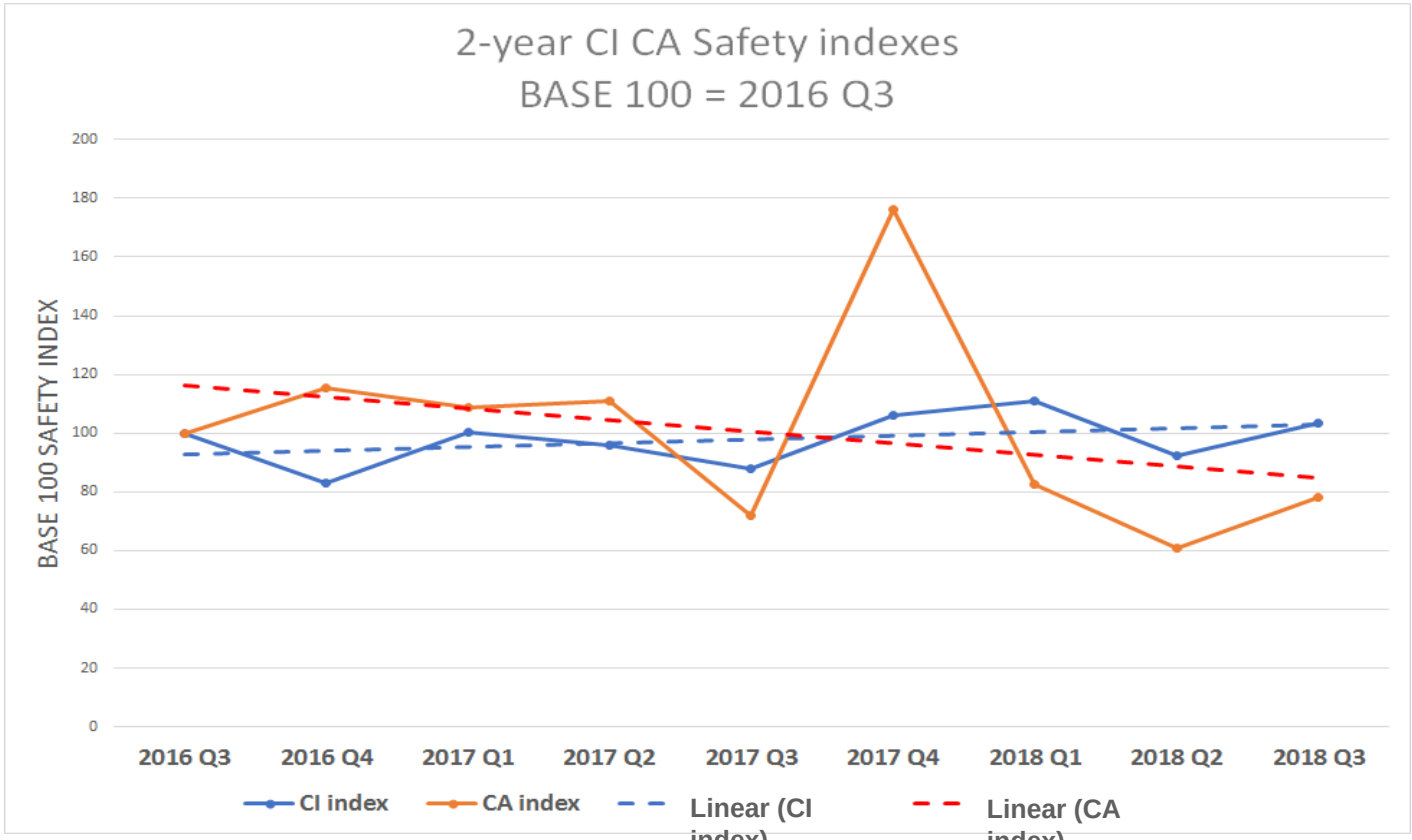

Conclusion

➔ Our objective is to build a railway safety index :

1. to detect most critical types of safety events in order to define areas of collaborative work with rail companies

2. to monitor the evolution of the railway safety level for the whole national system

Conclusion

- Those indexes should help to decision-making on safety
- They must be used as a tool for debate on main safety questions.

- In term of perspectives, many evolutions of those type of indexes can be explored.
  - the possibility of CA/CI projection with causes (instead of type of event)
  - the link with risk modelling such as bow-tie models

Thank you for your attention