SAFETY KPI AT SYSTEM LEVEL FOR RAILWAY

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Project objective

Our objective is to build a railway safety index to detect most critical types of safety events in order to define areas of collaborative work with rail companies

Project team

We have selected two partners for this project :

French national institute for industrial environment and risks (INERIS)

A consultancy specialising in rail transport

Data available

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

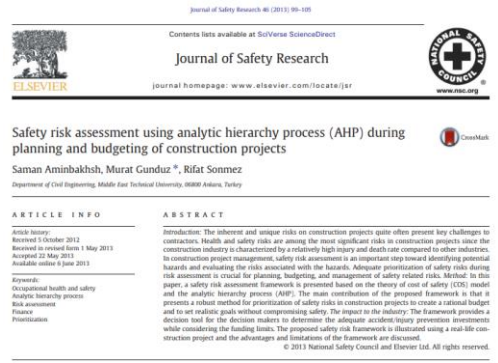
Safety index development

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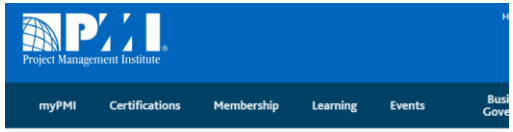
Safety risk assessment using analytic hierarchy process (AHP) during planning and budgeting of construction projects

Saman Aminbakhsh, Murat Gunduz *, Rifat Sonmez

ARTICLE INFO

ABSTRACT




Learning » Library

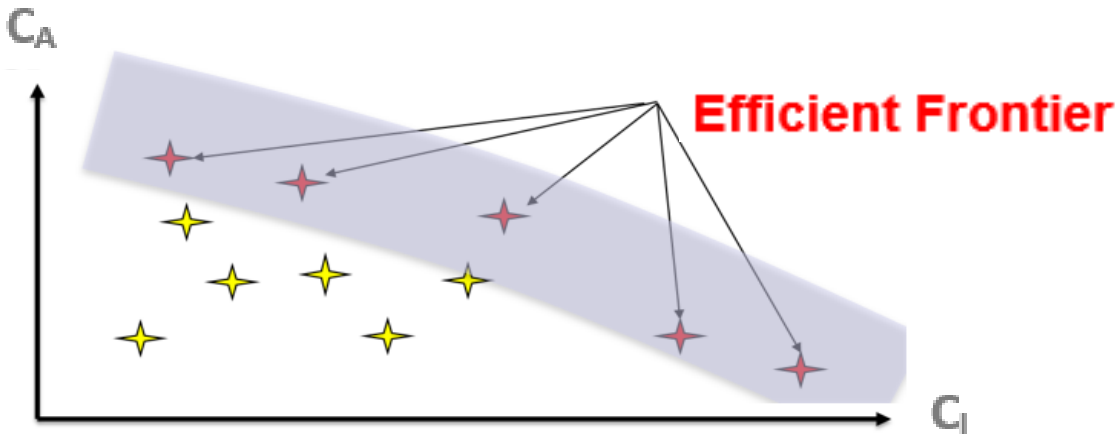
Prioritizing project risks using AHP

CONFERENCE PAPER | Risk Management , Decision Making | 2007

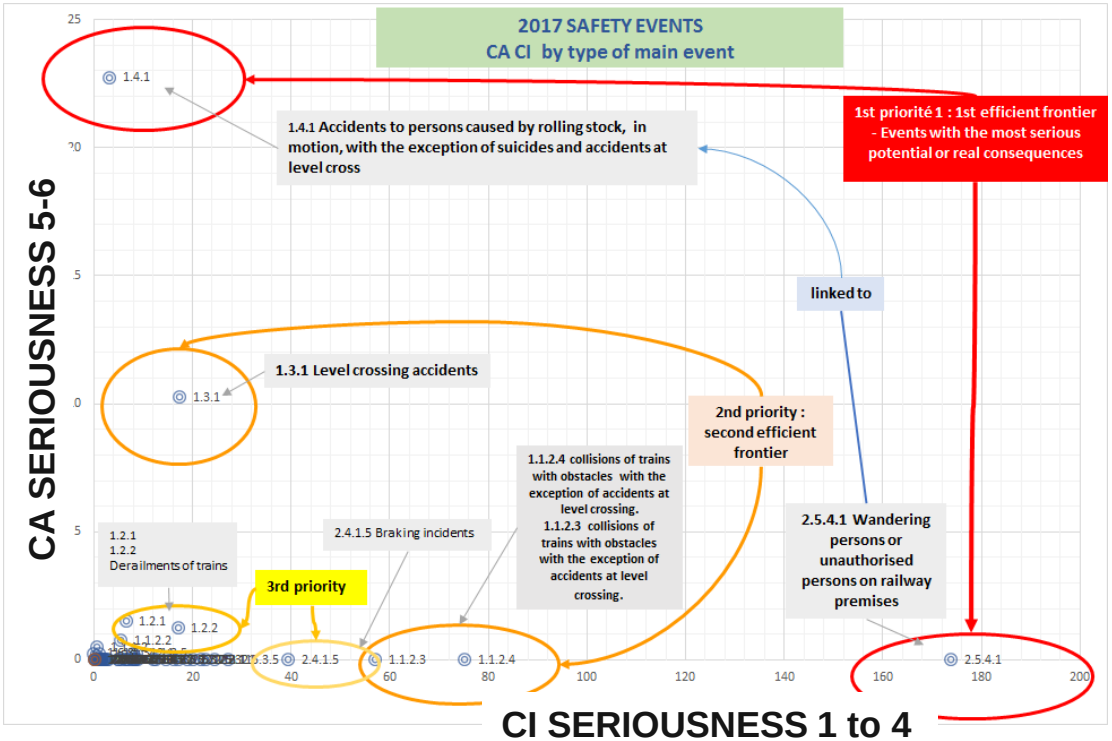
Thibadeau, Barbara

Safety index development

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

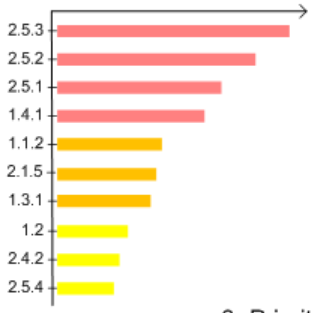


Safety index results

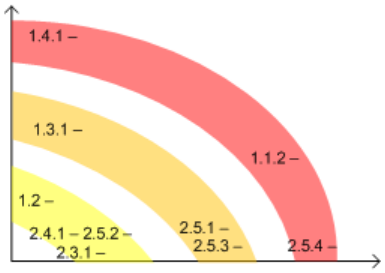


Safety index results

1- Type of events (seriousness 3 to 6) in 2018 by occurences



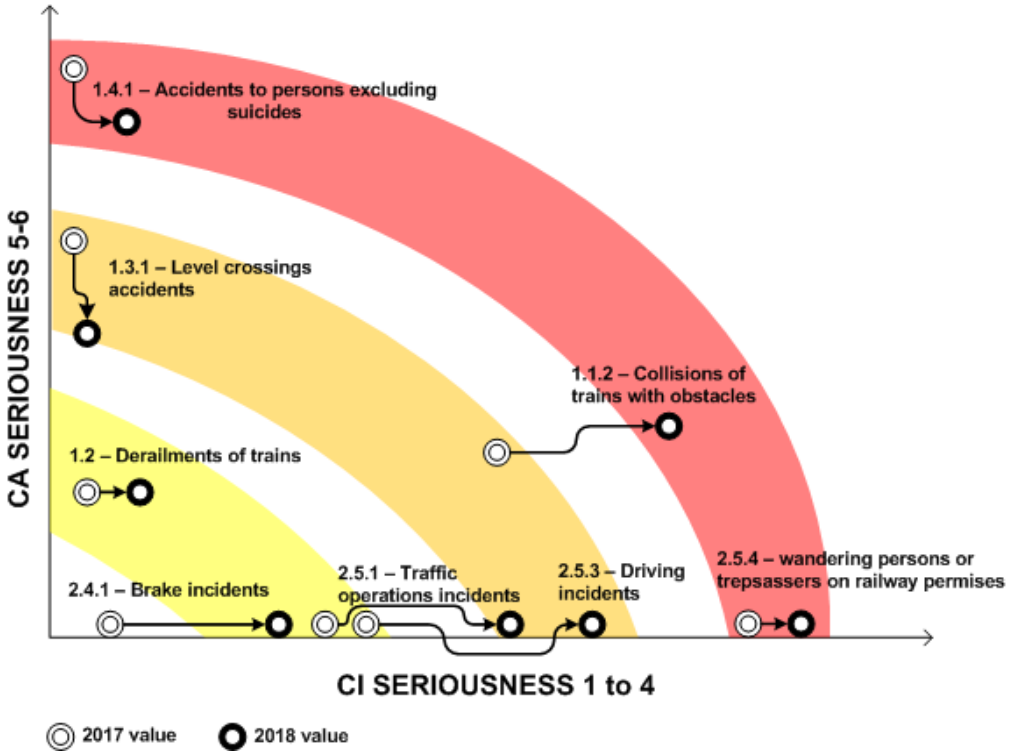
2- Type of events in 2018 using CI /CA projection



3- Priority levels comparison

Type of event	Occurrence priority	CI / CA priority
1.4.1 – Accidents to persons excluding suicides	1	1
2.5.3 – Driving incidents	1	2
2.5.1 – Traffic operations incidents	1	2
1.1.2 – Collisions of train with an obstacle	2	1
1.3.1 – Level crossing accidents	2	2
2.1.5 – Level crossing equipment failures	2	Not identified
2.5.2 – Train composition incidents	1	3
2.5.4 – Others incidents in operations and traffic management sub-system	3	1
1.2 – Derailments of trains	3	3
2.4.2 – Others failures	3	Not identified
2.4.1 – Critic element of rolling stosk failures	Not identified	3
2.3.1 – Signalling incidents	Not identified	3

Safety index results



Conclusion

Our objective is to build a railway safety index to detect most critical types of safety events in order to define areas of collaborative work with rail companies

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)
  - Use of CA/CI by railway companies on their own activities with their events
  - the link with risk modelling such as bow-tie models

Caution

- It is not a KPI to assess the safety level or the safety performance of railway companies :
  - This wouldn’t be relevant : reporting an event does not mean being responsible
  - Not good for Safety Culture

Thank you for your attention