

Sétra

Service d'études
sur les transports,
les routes et leurs
aménagement

CETE
Méditerranée

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Risk based methodology applied to bridge scour analysis and implementation on the national road network

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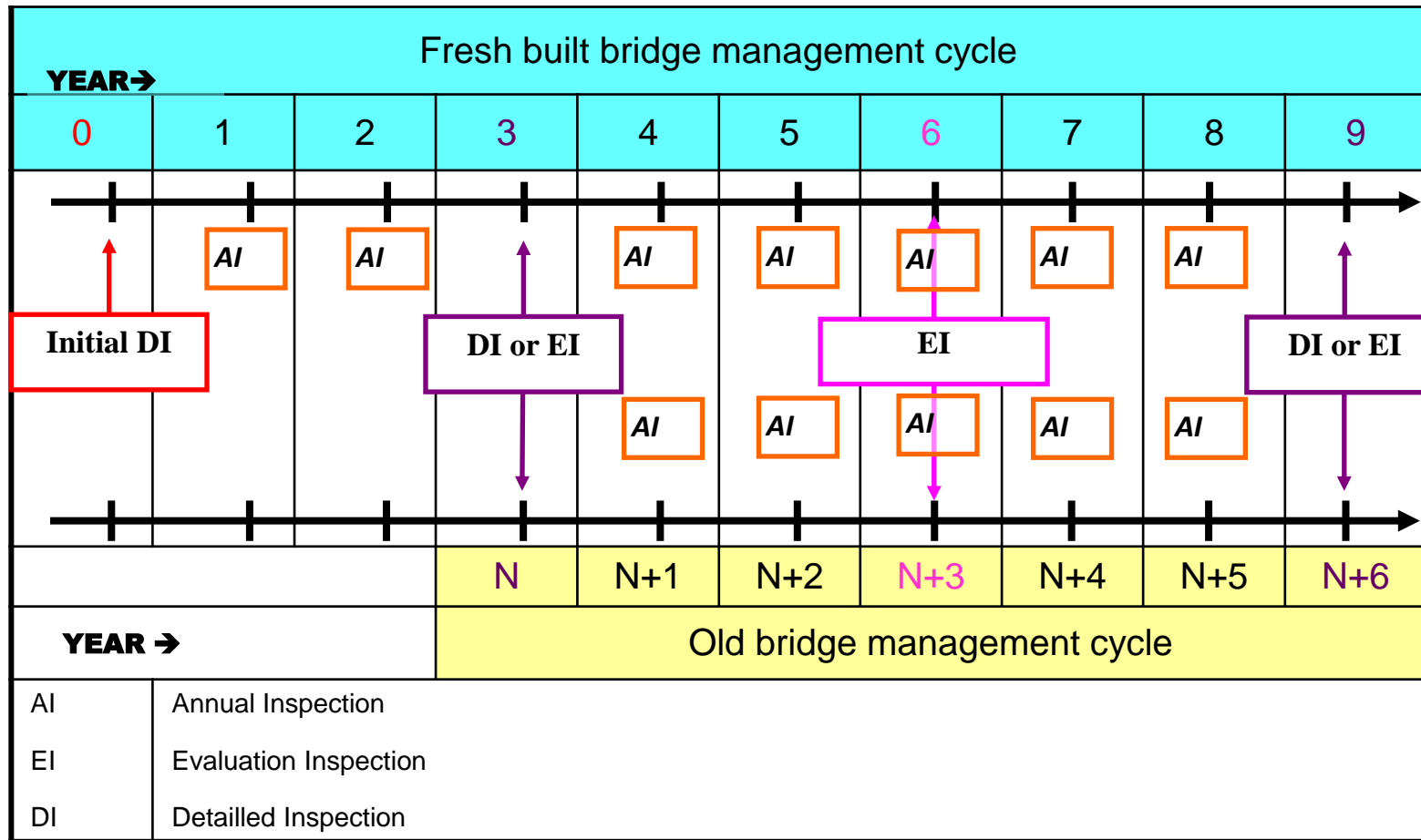
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Curent bridge management in France

- **Annual Inspection:** cursory inspection intend to discover new significant defects.
- **Evaluation Inspection** : occurs every 3 years and consists in a complete visual examination of the structure to classify the condition of bridge into class.
- **Detailed Inspection** : occurs every 6 years and are thorough visual examinations of bridges noting all defects. Ordinary bridges are not submitted to detailed inspection, except if Evaluation Inspection has concluded that it was necessary.



Curent bridge management in France



Parts Detailed Inspection: occurs every 6 years and are thorough visual examinations of a unvisible (like subaquatic peers) of bridges noting all defects.



The principals of the risk analysis

Sensitive structure = structure with a lack of strenght which could brutaly failed



Gobal Warming: More devastating floods in the South of France. The Meditteranean climate involved fast and consequent flood with high power of erosion

Note: lack of knowledge about scour and health state of ours piers'bridge, only important bridge are inspected.

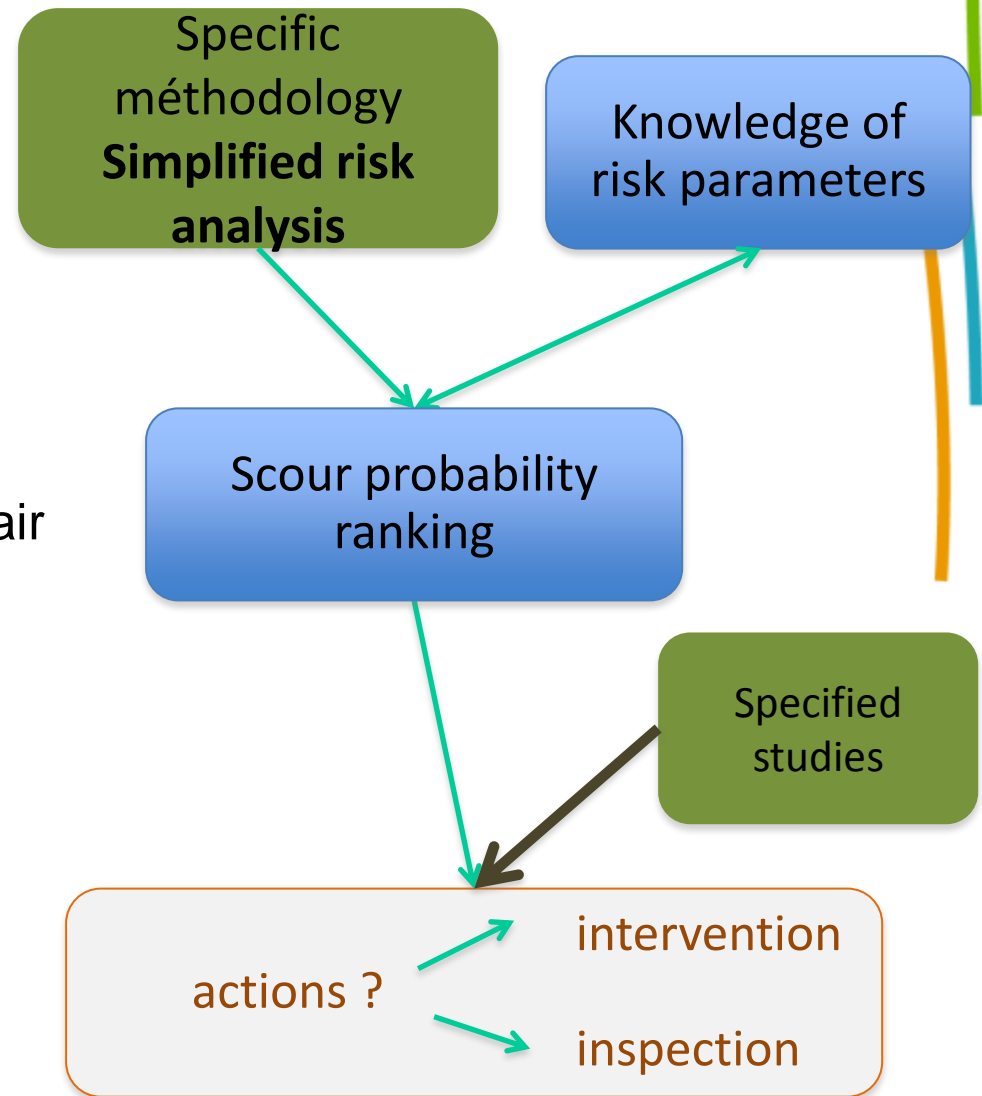


Risk management

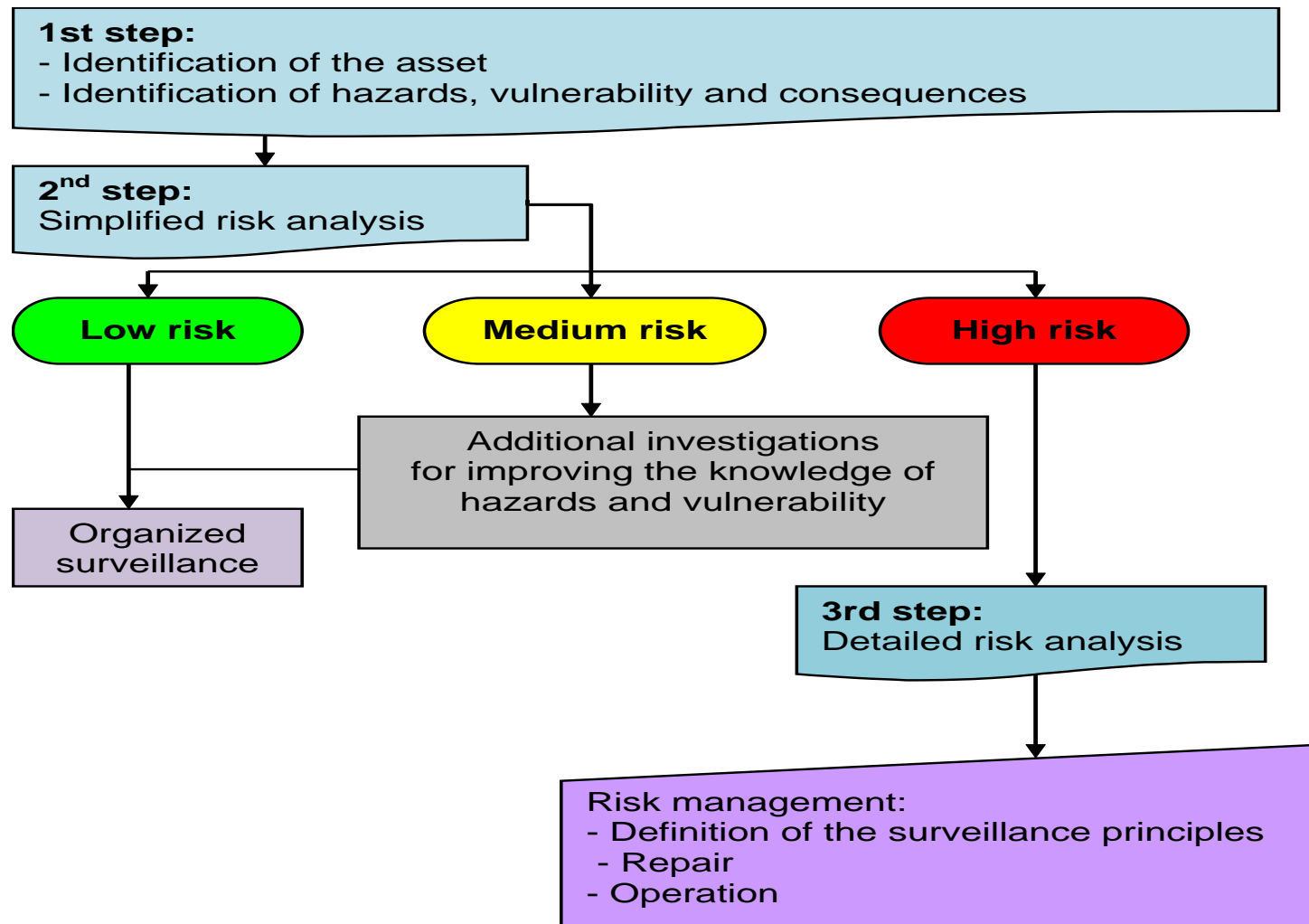
Classify these structures,
prioritization of repairs.

Identify structures for which further
investigations or reinforcement/repair
works have to be primarily
implemented to ensure

users' safety,
improved durability.



General procedure



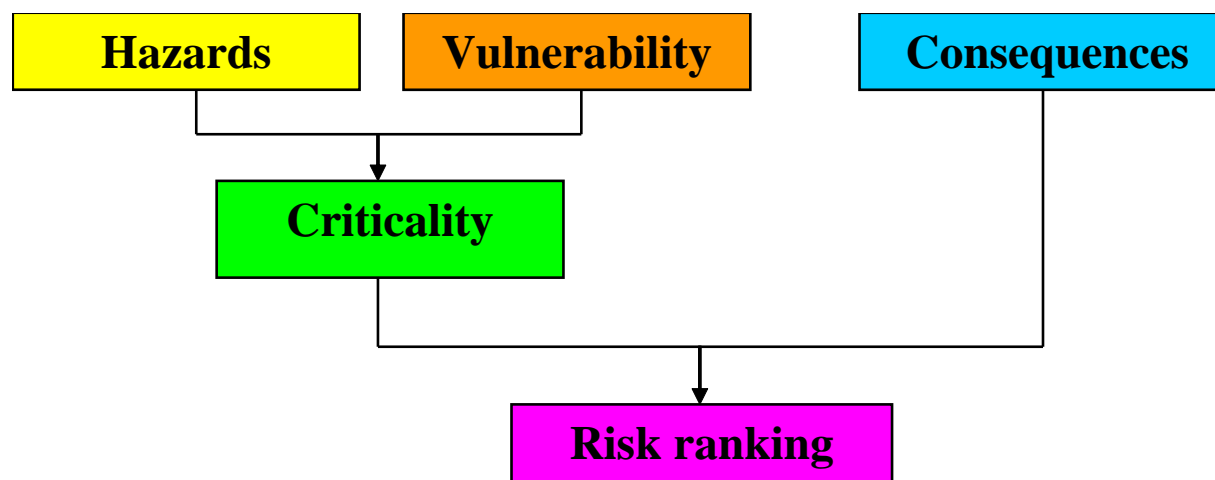
Simplified risk analysis

Performed prior to more sophisticated assessments

Requires the evaluation of three criteria.

- assessing the hazards that affect the structure,
- quantifying the vulnerability with respect to hazard,
- evaluating the consequences.

Crossing these criteria gives the risk category low, medium or high.



Scour simplified risk analysis

Scour around bridge piers requires knowledge from many engineering fields:

geotechnical,
hydraulic & civil engineering
bridge management.

The method is intended to be applied by non-experts and has to be well understood (this is why it is named “simplified” analysis);

This is why many factors, identified as too difficult to score, have not been considered.

Evaluation of bridge by different people : Variability of answers due to the person and not the situation



Scour simplified risk analysis

Informations used for the analysis

LAGORA BMS database information (bridge management software).

Map and GIS analysis

Knowledge of the local management teams

Main difficulties :

adaptation/translation of complex factors in simple factor

Right and justify pound factor



Scour simplified risk analysis

Hazard factors		Options	Pounds
Hydraulic regime	Not standard conditions	Torrents	4
		Estuary or river in Mediterranean climate	3
	Standard conditions	Non navigable river	2
Soil characteristics under foundation	Rock	Navigable river	0
		All piers on rock	0
	Non-cohesive soil	A least one pier on rock	3
		Deep lower part of the riverbed made of a non-cohesive soil with	4
		Evolution of the riverbed	Riverbed known as stable
Hydraulic outlet		Riverbed without particular planar displacement	2
		Riverbed known as unstable	4
		Well designed	0
		Unknown	2
Protections works around piers		Poorly designed	4
		Yes	4
		No	0

Scour simplified risk analysis

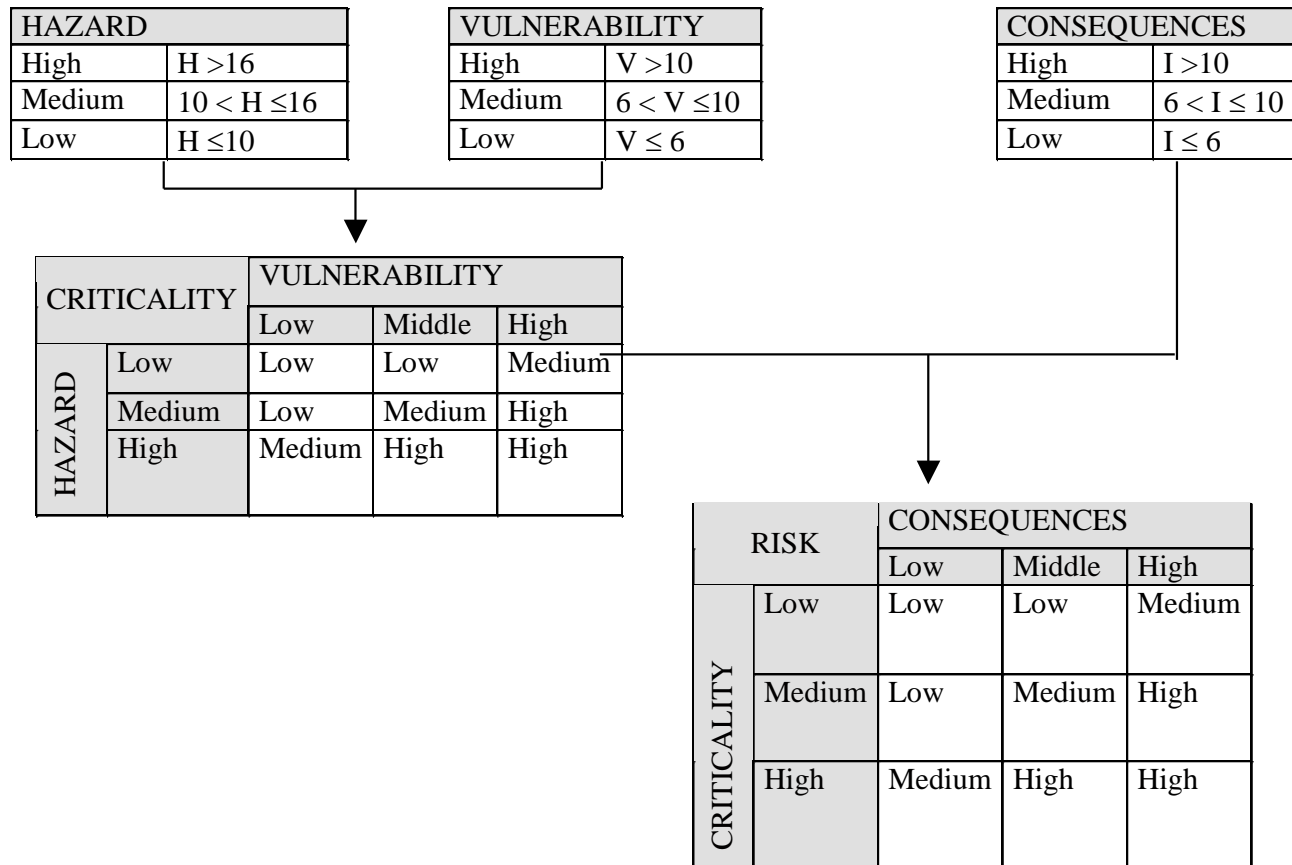
Vulnerability factors	Options	Pounds
Structural type	Concrete culvert or rigid-framed bridge	0
	Other	1
Period of construction	Before 1950	5
	Between 1951 and 1975	3
	After 1976	0
Width of the most disadvantageous piers	Massive piers; width > 3m	2
	Width \leq 3 m	1
	No pier in the riverbed	0
Shape of the most disadvantageous piers	Circle	0
	Other	1
Abutment position relative to the riverbed	The abutment is protruding	2
	The abutment is not protruding	0
Foundation type	Deep foundation built after 1950	0
	Other	6
Piers' state of health	IQA* score : 1;2;2E	0
	IQA* score: 3;3U	2
Foundation inspection	No subaquatic inspections for 6 years or more	1
	Observable foundation when low water or subaquatic inspection of less than 6 years	0

Scour simplified risk analysis

Impact factors	Options	Pounds
Traffic supported by bridge AADT	Less than 15 000 v/d	0
	Between 15 000 v/d and 35 000 v/d	1
	Between 35 000 v/d and 85 000 v/d	4
	More than 85 000 v/d	6
Deck area of the bridge	Less than 100 m ²	0
	Between 100 m ² and 200 m ²	1
	Between 200 m ² and 500 m ²	2
	Between 500 m ² and 1 000 m ²	4
Easy implementation of a deviation with a capacity to absorb deviated traffic	More than 1000 m ²	8
	Easy	0
	Difficult	2
	Impossible	4
Consequence on the river in case of failure or collapse	Low	0
	Medium	1
	High	2

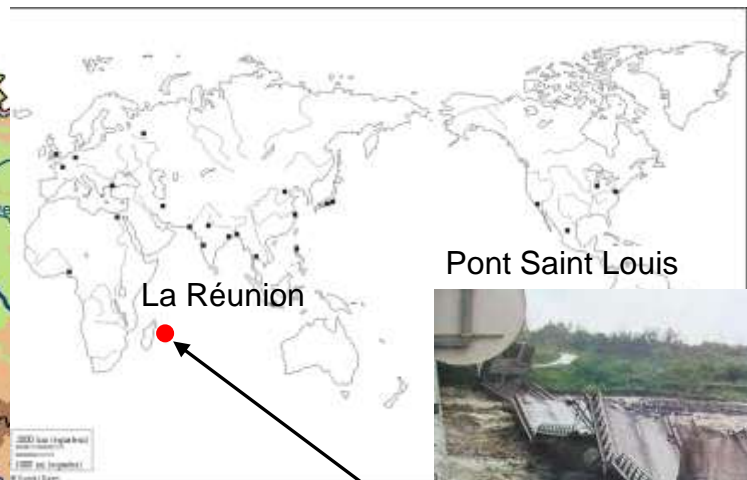


Scour simplified risk analysis



Scour simplified risk analysis : 4 case studies

Pont Wilson



Pont Saint Louis



Pont de Pierre



Pont du Gard



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Scour simplified risk analysis

Evaluation	Pont Wilson (in 1979)	Pont du Gard	Pont de la rivière St Etienne	Pont de pierre
Hazard	Medium (16)	Low (10)	Medium (16)	High (17)
Vulnerability	High (18)	High (16)	High (16)	High (15)
Criticality	High	Medium	High	High
Consequences	High (14)		High (14)	High (16)
Risk	High		High	High

Conclusion

Methodology presented can be improved to be more efficient, less time consuming and more understandable for non-specialists.

Test the methodology on a part of the French road network (West road ongoing) to be sure of its reability

Share the experience of other countries

+ : The risk-based methodology allowed to increase road managers awareness of scour issue. In the future, they may pay more attention to this aspect.

But it's the 1st step:

The implementation of the simplified methodology is planned for 2013. Results are expected for end of 2013.

Risk assessment, Detailed risk analysis, repairs and surveillance



Thank you for your attention

More information

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