Application of Why-Because Graphs to Railway 'Near Misses'

An industrial case study

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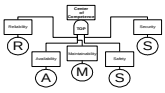
Transportation Systems

IRIA 2002, Glasgow



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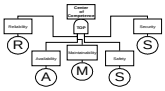
Overview



- What is the Problem?
- Issues in Root Cause Analysis
- Choice of a Causal Analysis Method
- A Simplified Why-Because Graph
- Example of a Why-Because Graph
- Practical Organisation of the Work
- Summary and Ongoing Work

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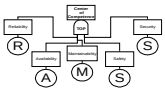
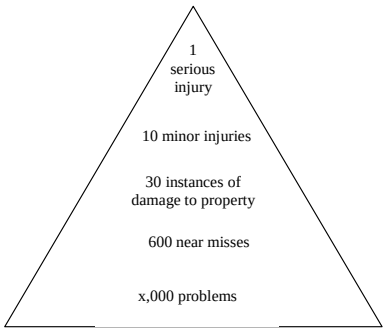
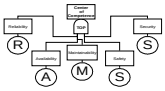
What is the Problem?



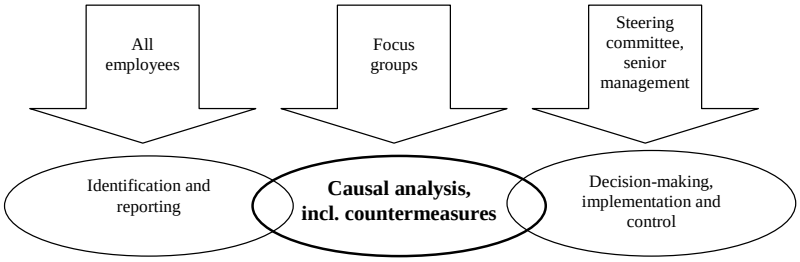


- Incidents occur although systems are assessed and certified.
- Incidents have multiple and common causes.
- Causes also often lie in management or organisation.
- Due to complexity of systems, safety cases cannot address issues fully.
- Root cause analysis of near misses is necessary and a useful complement to safety case process.

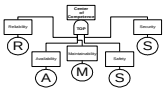
Issues in Root Cause Analysis



- How do we know and ensure that near misses are reported at all?
- How do we know that all the major root causes are identified?
- How do we ensure that countermeasures for all root causes are defined and implemented, and monitored until the problem has been solved?



Choice of a Causal Analysis Method



Major requirements

- The method should be such that it can be easily used (with a minimum amount of training, preferably requiring no proprietary tool) by the average engineer.
- The method should provide a graphical representation (“a picture says more than a thousand words”).
- The method should allow modular approaches (different aspects analysed by different individuals).

(Subjective) choice: Ladkin’s Why-Because Analysis has

- a formal logic foundation
- a good graphical representation
- been applied to several aviation incidents and revealed new causes and relationships between causes.

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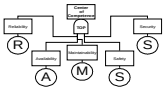
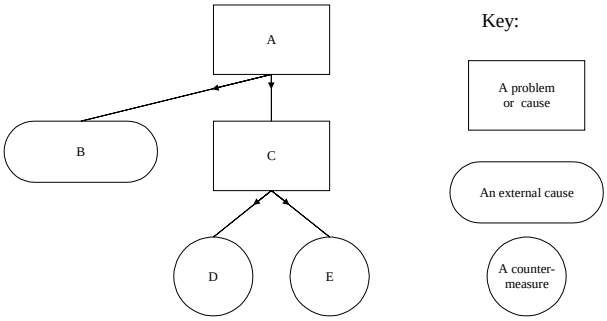
A Simplified Why-Because Graph





- The formal rigour has been relaxed in order to enhance its usability for engineers.
- The symbols have been simplified and adapted to MS Office tools.
- Proposed countermeasures have been directly included in the graphs.
- Hyperlinks to the documentary evidence have been included in the WB graphs.

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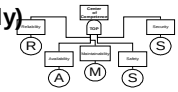
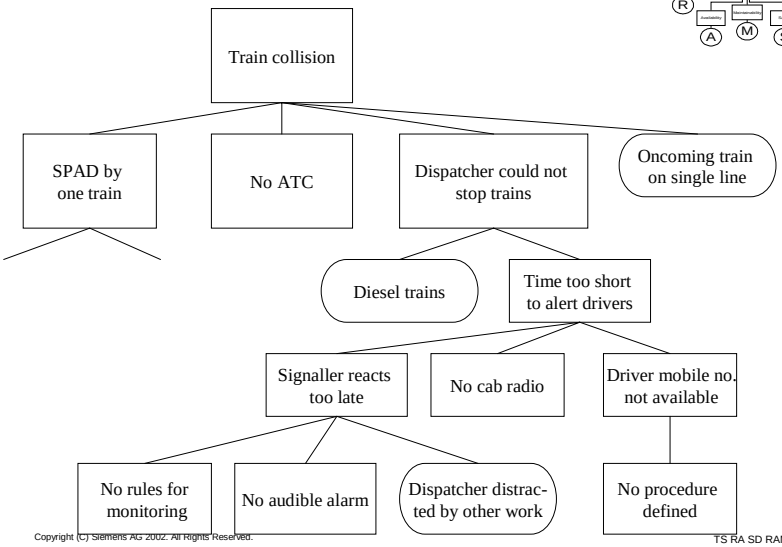
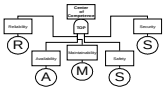
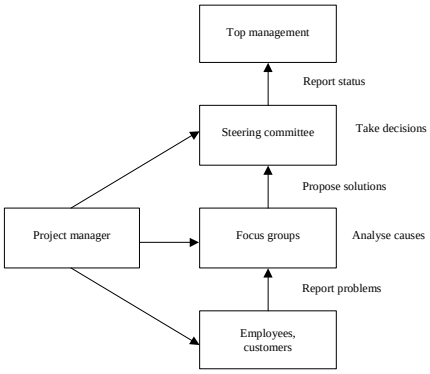
Example of a Why-Because Graph (Part Only)





Practical Organisation of the Work





- Commitment of and encouragement from top management is a crucial success factor.
- “No blame” culture is necessary.
- Definition of near miss should be as broad as possible.
- Problem reporters should be involved in root cause analysis.
- Product-specific focus groups perform the analysis.
- Steering committee assigns priorities and takes decisions.
- Effective implementation of countermeasures must be tightly supervised.

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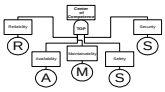
Summary and Ongoing Work



- Ladkin’s original why-because analysis has been both simplified and extended.
- It has shown itself to be a useful causal analysis tool in an industrial environment.
- However, it should be noted that the analysis technique itself is only one link in a larger chain and that only the weakest link matters.

Ongoing work includes:

- statistical analysis (e.g. trend analysis) and classification of the root causes and a comparison with aerospace root causes
- application of WBA to other accidents and near misses in co-operation with rail operators, the rail industry and safety authorities