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Target Level of Safety for Ground Operation

Derivation and Verification of Safety Targets for Zurich Airport

Background

In the 1950's, H. W. Heinrich published his study on industrial accidents, where he performed his famous Triangle (Figure 1). He classified accidents from different high-risk domains by severity and derived a 1:29:300-rule between major, minor and negligible incidents.

Figure 1: Heinrich Triangle

This master thesis concentrates on the application of the Heinrich approach to the field of ground operation at Zurich Airport.
Ground operation includes all the processes and aspects involved for aircraft handling and movement on the aerodrome, such as loading/unloading, fuelling, pushback, de-icing, taxiing, etc.

Procedure

The analysis of the raw data (occurrence reporting 2001-2010) was structured into three phases (Figure 2). The first phase concentrated on the classification of events according Airport Council Intl.. A first calibration of Heinrich's triangle ended up in a diamond-shape. Therefore, a second, enhanced classification was accomplished, considering a safety assessment approach. The occurrence classification by severity and probability and the definition of risk acceptance regions led to the number of incidents per risk class, which can be rated as a reliable expectancy value, the current level of safety (CLS).

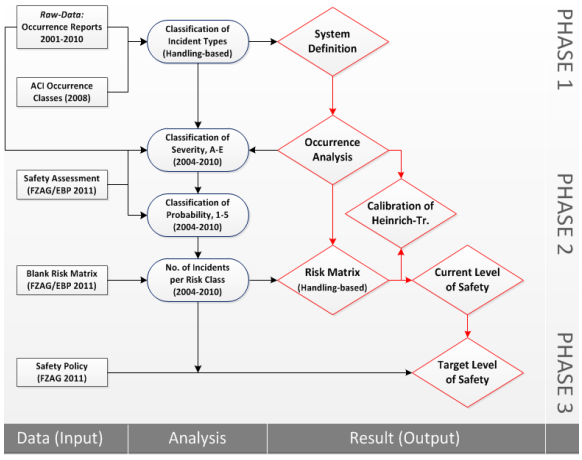

Figure 2: Data Analysis Process Model

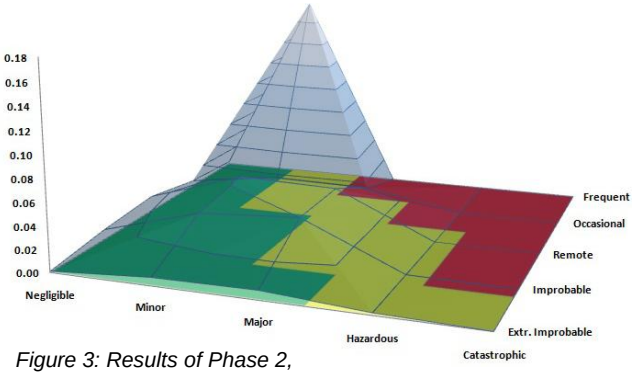

Figure 3: Results of Phase 2,
Incidents per 1'000 Air Traffic Movements by Risk Class

Results

Figure 3 shows that ground handling in ZRH can be assessed as *safe* (no incidents within unacceptable risk region). Many events happen frequently with a minor impact on safety, illustrated by the significant peak of class D5. This class implies all the collisions of vehicles with each other or with infrastructure and service equipment. Since the risk in this class is evaluated as "tolerable", a trade-off between safety improvement and operational enforceability and economic efficiency has to be made.

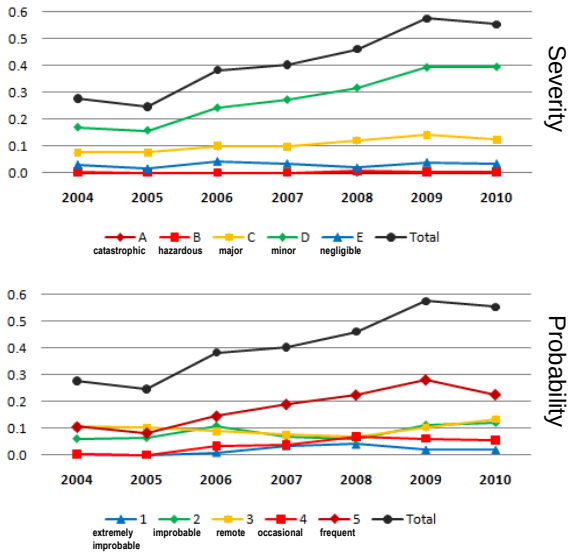

Figure 4: Chronologic Lapse by Severity and Probability

The enhanced data classification concluded in a more accurate representation of Heinrich's triangle. Figure 4 shows more constant severity proportions, while the probability values fluctuate.
The final phase contained semi-qualitative considerations on how a target level of safety can be defined relating to the actual CLS. An international accord and interviews with safety experts supported the assumption that ground handling is safe, but great efforts will be required to preserve the current level of safety.

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