Towards a High Reliability, Low Cost Railway

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Overview

- Reliability, and on time running performance, is very important for most rail systems
- The cost of achieving a high reliability, can be similarly very high
- Many rail projects have involved significant expense in attempting to improve reliability performance

Overview of Reliability for a Rail System

- Reliability can mean a number of things, including:
  - Train delays
  - Interruptions to services from weather
  - Engineering failures
  - Poor maintainability
  - Delays to services from maintenance work
- Anything that can delay a train, where the engineering systems can prevent it, are relevant for our reliability talk here

The problem

- Governments want a high reliability system
- This can be achieved, but at a high cost
- Typical solutions involve:
  - Additional redundancy
  - Higher quality (more expensive equipment)
  - Additional systems
  - More expensive configurations
- Can a high reliability be achieved for a lower cost?

Challenges

- The author’s experience is that consistency between design packages for RAM is lacking
- One package may have a lot spent on RAM, others very little
- This inconsistency can result in poor performance, but high cost

So proposed solutions

- Better consistency between design packages
- More focus on the signalling system, which is a key system, and often the leading contributor to delays to rail services
- Focusing on major disruption events

The Signalling System

- The signalling system prevents trains from colliding with one another, amongst other things
- The signalling system is failsafe, so any potential failure results in service stoppage
- This results in the system having a far greater impact to services than might be thought

Estimated number of failures

Discipline	Failures per 100 track kilometres per year	Comments
Signalling	100	1 turnout per 2 kms
Civil (track)	7.3	Includes turnout related track failures
High voltage	3	Assume 1500 V DC
Station blackouts	10	1 station per 5 kms track
Comms backbone	0.5	20 kms comms backbone
Rail corridor & related	10	This category includes many things.
Overhead wiring	8 small failures 0.2 large-scale failures	Large-scale failures involve pulling down of overhead wiring.
Train radio	3.3	Depends on the spacing between antennae masts
Control system	2	One panel/control workstation for the entire 100 kilometres
Bridges	3.4	1 bridge per 5 kilometres, bridge strike incident

Focusing on major incidents

- Major incidents are those that delay large numbers of trains
- They are “memorable” and impact upon business reputation
- Major incidents typically different causes compared to small incidents
- Small incidents are normally far more numerous

Focusing on major incidents - 2

- Major incidents cause a host of delays in one incident
- Major incidents and their causes are a subset of the total number of possible incidents
- Focusing on only these allows for better prioritisation of spending

Other possible solutions

- Operational flexibility
- Sick passengers strategy/first aid rooms
- Examining human factors
- Reviewing maintenance strategy

Final comments

- To summarise, better system design should allow for a better outcomes
- Multiple solutions to the problem of better RAM performance