

# ProRail

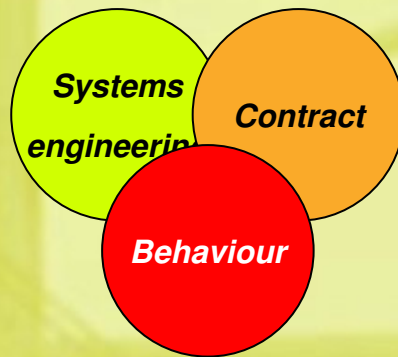
## The paradox of explicit Systems Engineering behaviour in contracts

July-2009

Erik Elich – Infraprojects, Project Manager implementation SE



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- ProRail Infraprojects
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***4 paradoxes on the interaction between  
Systems Engineering, Contract and Behaviour***

## ProRail Infraprojects

- > 600 projects in parallel
- 1 – 1.5 billion € building costs/year
- 600 FTE
- Business lines:
  - *Civil engineering works*
  - *Mega projects & new railways*
  - *Major renewals/maintenance*
  - *Logistics, safety & environment*
  - *Railway Stations*

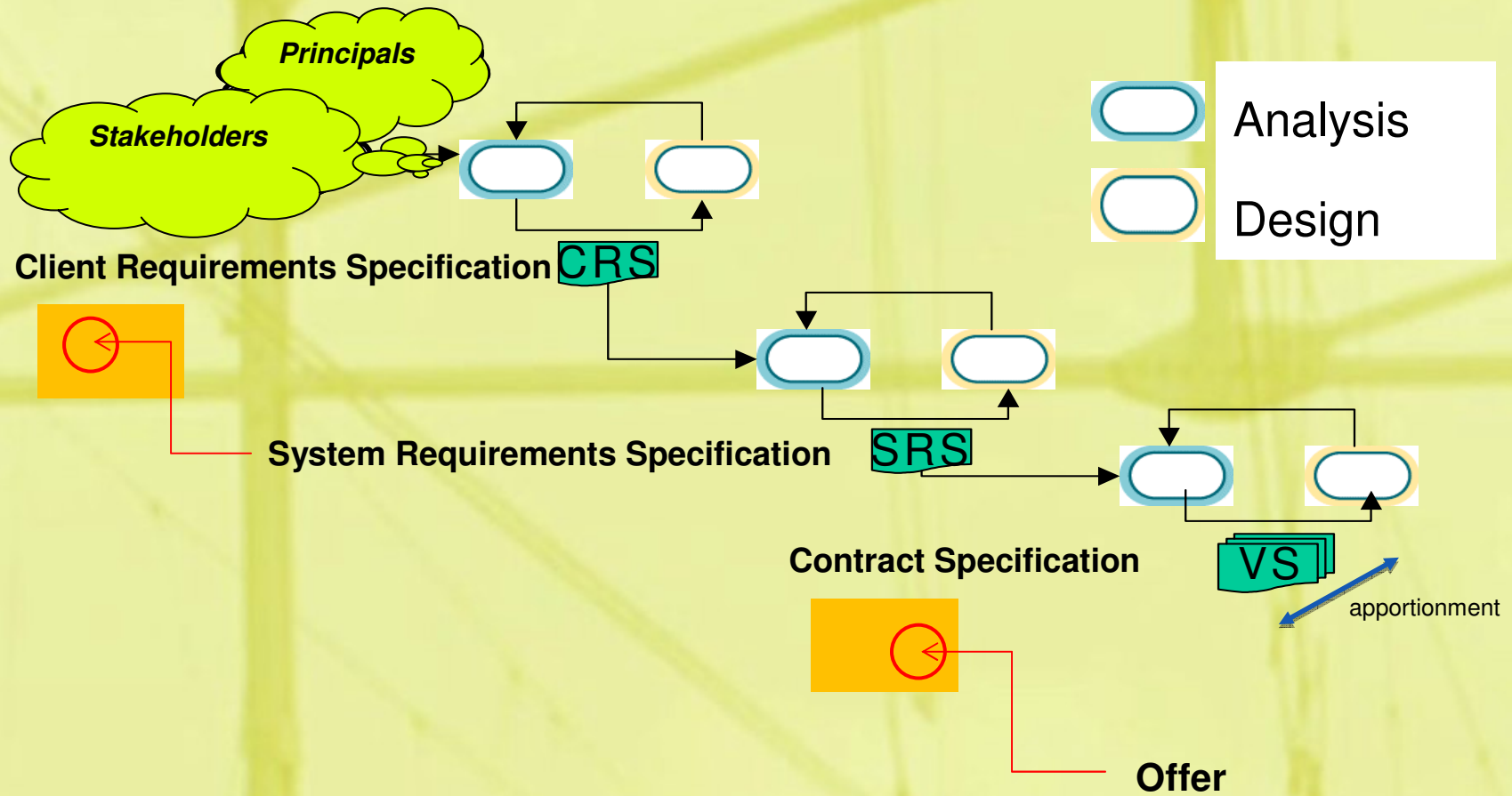
## Systems Engineering

- Started April 2007
- SE training programme: 150 participants
- 20 Pilot projects
- Transition phase started May 2009:
  - *pilots , “oil splash approach”*
  - *roll-out, top-down approach*
- Support team: 5 FTE, 13 members
- SE Community of Practice: 388 unique visitors
- Co-operation programme among principals and suppliers



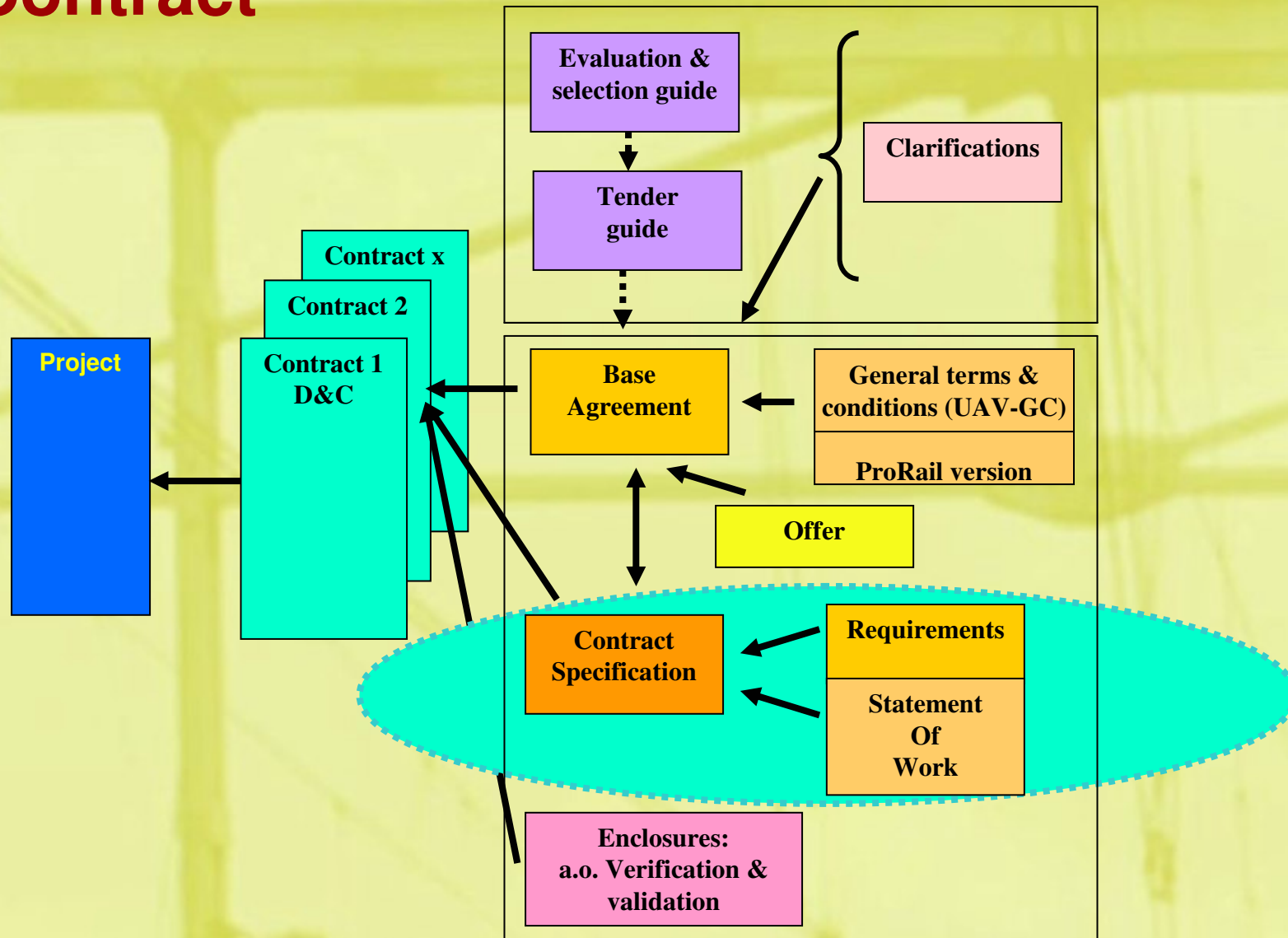
# ProRail

## Analysis & design



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## Contract



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## Decomposition increases complexity



# ProRail

## Tunnel Delft



| Aspect           | Risk area | V&V                        |                             |         | C 1 | C 2 | C 3 | C 4 | C 5 | C 6 |
|------------------|-----------|----------------------------|-----------------------------|---------|-----|-----|-----|-----|-----|-----|
|                  |           | Design                     | Realisation                 | Testing |     |     |     |     |     |     |
| Measurements     | 123, 46   |                            |                             |         |     |     |     |     |     |     |
| Stability        | 28        | 2nd opinion<br>plaxis calc | Measurement<br>Monitor plan |         | x   |     |     | x   | x   | x   |
| Water management | 14, 145   |                            |                             |         |     |     |     |     |     |     |
| .....            |           |                            |                             |         |     |     |     |     |     |     |



# ProRail

## Transparency & responsibility

- SMART specifications
- Hidden specifications, mandatory documents
- Meta specifications, covering risks
- Unknown specifications
- Making compromises
- Implicit expectations

*They probably look for additional work*

*They don't have a clue about the operational concept*

*The supplier is responsible for integration*

*The principal is responsible for integration*

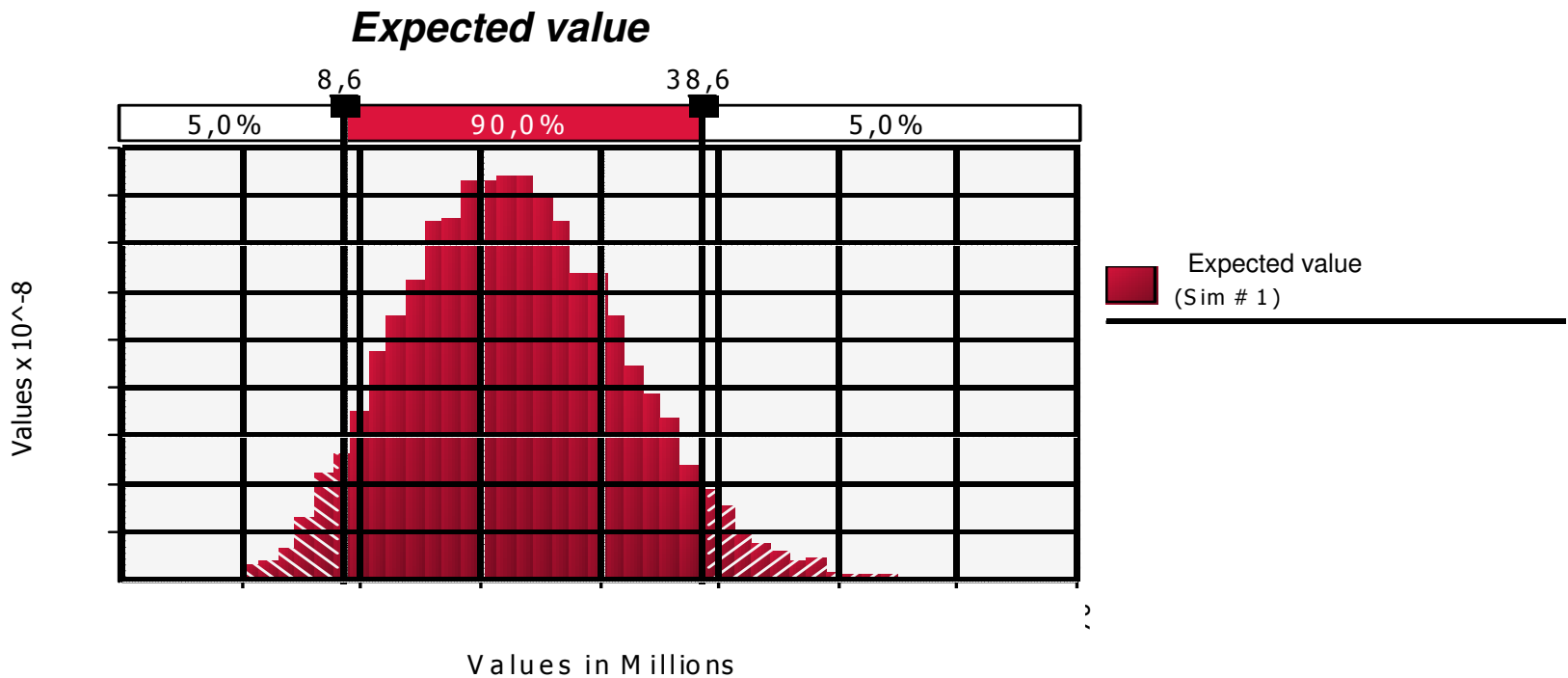
*SH!@!@@#!, rolling stock specifications are not yet known*

*We freeze the design anyhow. Interfaces are not our problem*



# Lightrail RijnGouwelijn

| 'Req | Risk                                  | Cause                                   | Consequence                 | Mitigation                                             | Score |
|------|---------------------------------------|-----------------------------------------|-----------------------------|--------------------------------------------------------|-------|
| SYB5 | Maximum speed restricted to 114 km/hr | Soil conditions are not stable at GD MV | Redesign or adapt timetable | Detailed geo-technical investigation and design review | 115   |



# ProRail

## Standardisation

- Bottom-up component level
- Lack of architectural model
- Suppliers products don't match the 'model'
- Threat for creativity
- Product level: e.g. noisescreens y/n?
- Maintenance urge/legacy

