9th International Conference on MANAGING PAVEMENT ASSETS (ICMPA9)

ADDRESSING UNCERTAINTIES OF PERFORMANCE MODELLING

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Co-authors

- Michelle Baran - QTMR project leader
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- Ranita Sen & Huimin Liu – coding the model

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- Marc Thebault

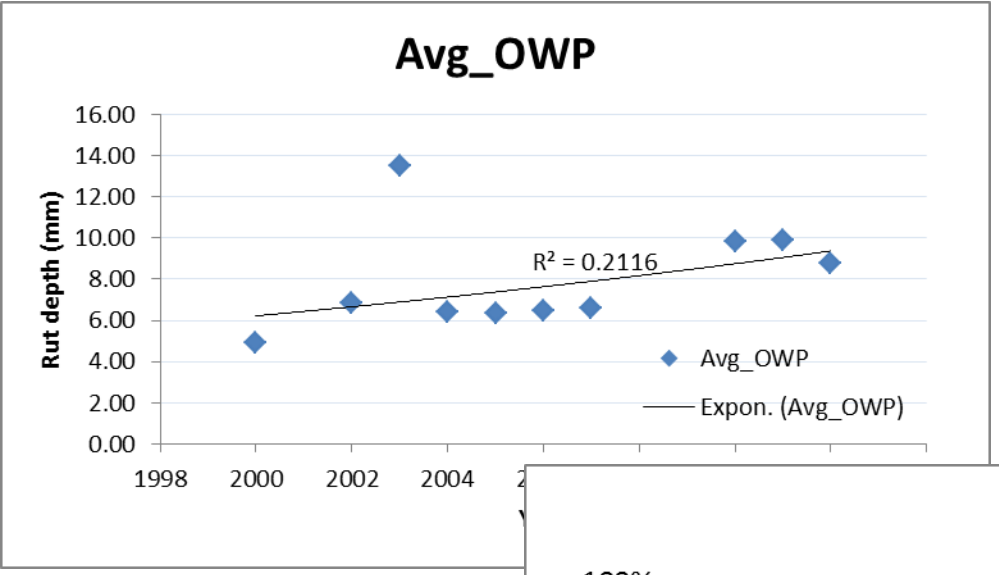
Dealing with uncertainty

- Uncertain information
- Storing uncertain data
- Working with uncertain data

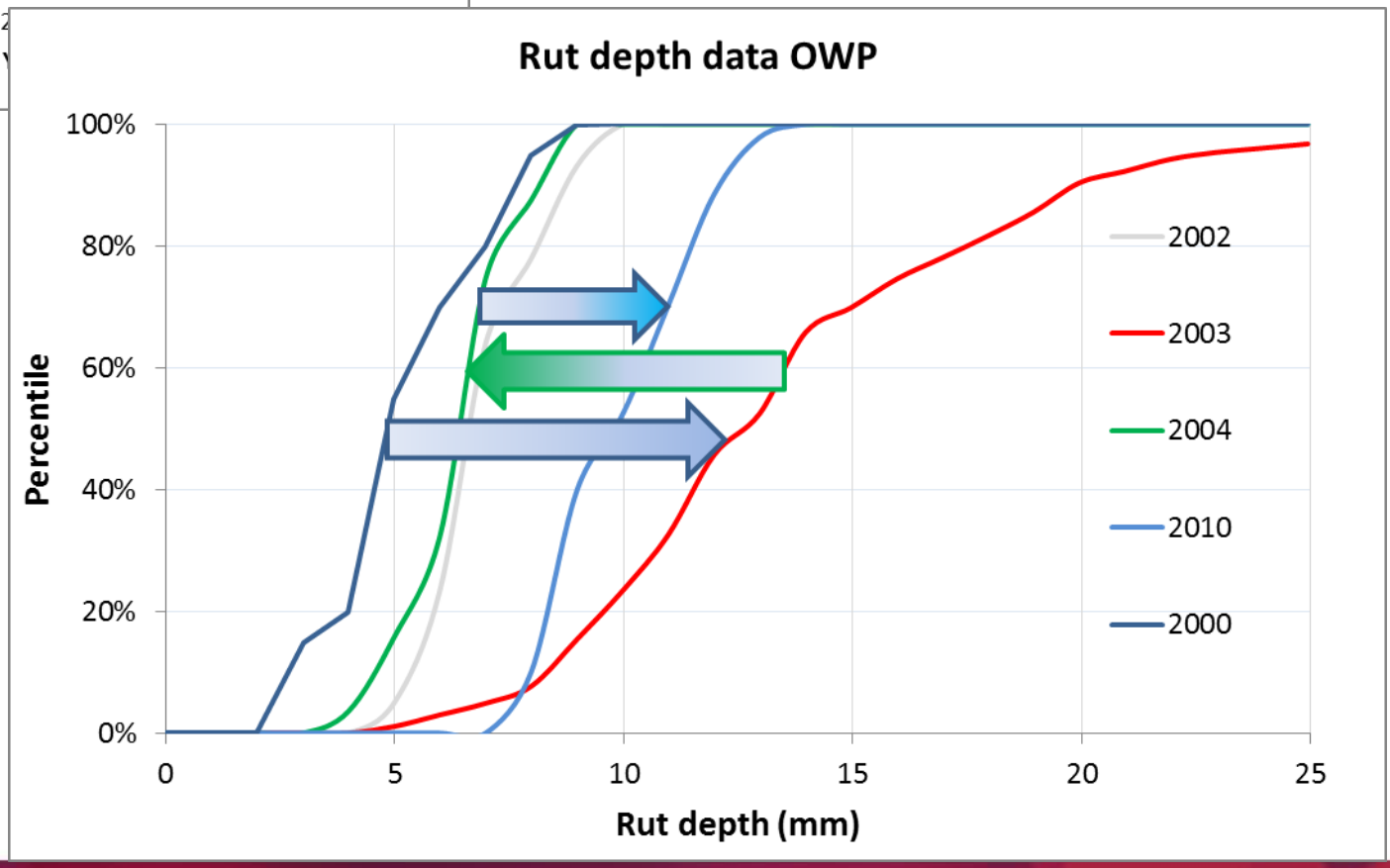
Uncertain information

- External
- Self-afflicted

Average - a convenient untruth



Lost information



Modelling with distributions

- Current models are based on ‘representative’ input – i.e. single values
- ‘Representative input’ – deterministic output
- Array input – array (distribution) output -> probability

No data aggregation

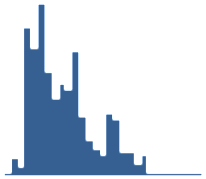
- **Solution:**
- Stochastic Information Packet (SIP)

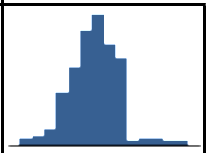
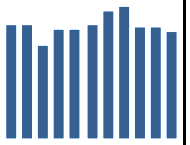
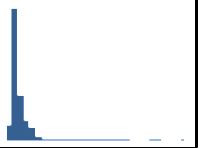

```
<SIP name="TMI_Norm" count="1270"
type="CSV" ver="1.0.0"
>(20.23),(61.22),(26.34),(30.85),(35.41)
,(40.05),(31.75),(27.00),(30.36),(22.25),
(28.85),(27.43),(21.61),(22.13),(33.11),(
8.64),(20.31),(11.69),(20.00),(21.56),(2
3.99),(22.61),(14.34),(21.93),(25.36),(2
1.77),(15.57),(15.55),(36.11),(30.13),(1
4.09),(34.45),(34.10),(30.37),(30.35),(2
4.39),(34.32),(26.56),(8.54),(11.22),(29.
75),(30.77),(28.34),(26.36),(18.92),(34.
49),(31.93),(19.62),(33.82),(27.98),(14.
```


- Operations with SIPs

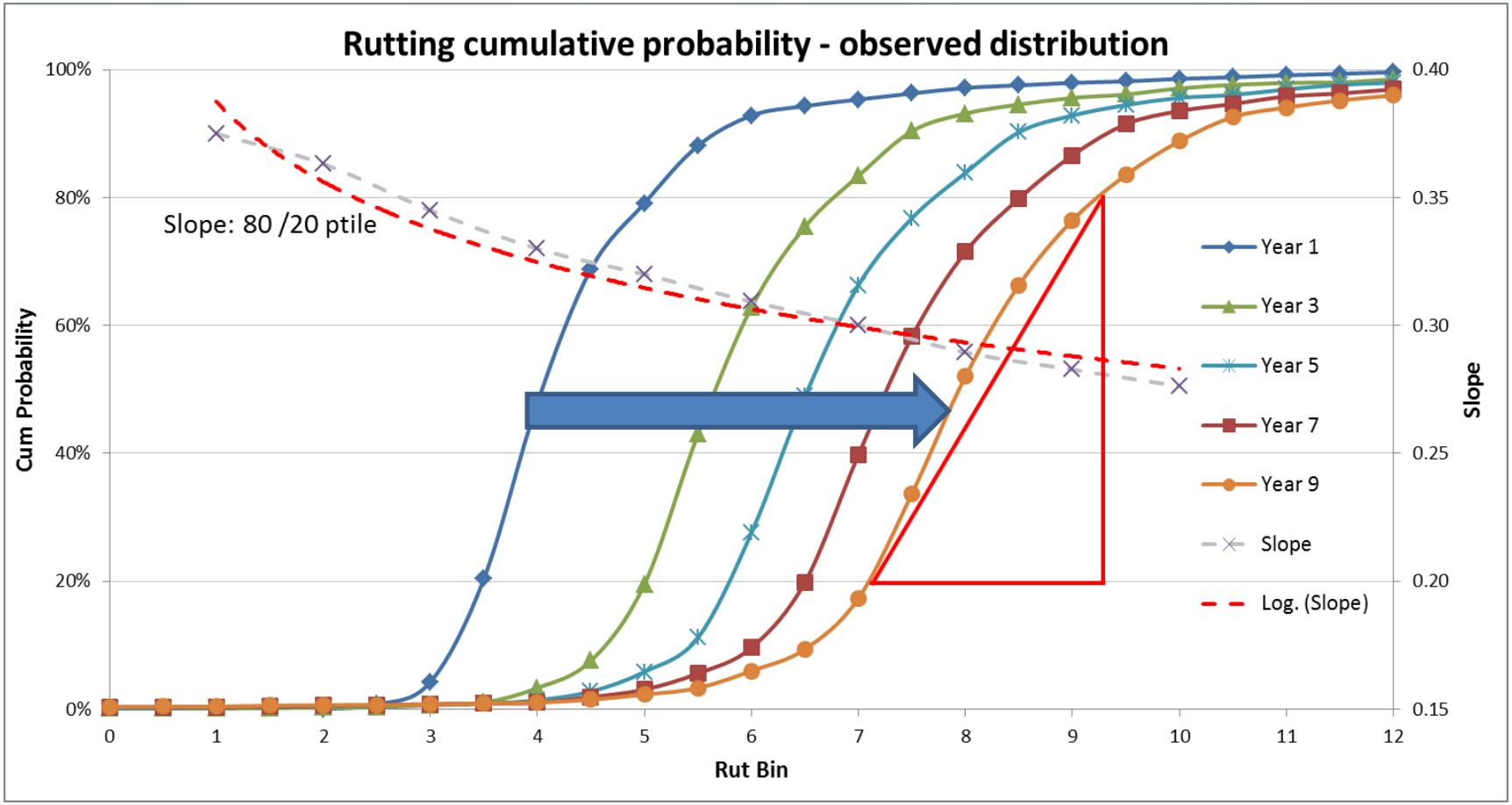
Pilot study

- Austroads rutting and roughness models
- A combination of ‘certain’ (i.e. single number) and ‘uncertain’ i.e. distributed variables

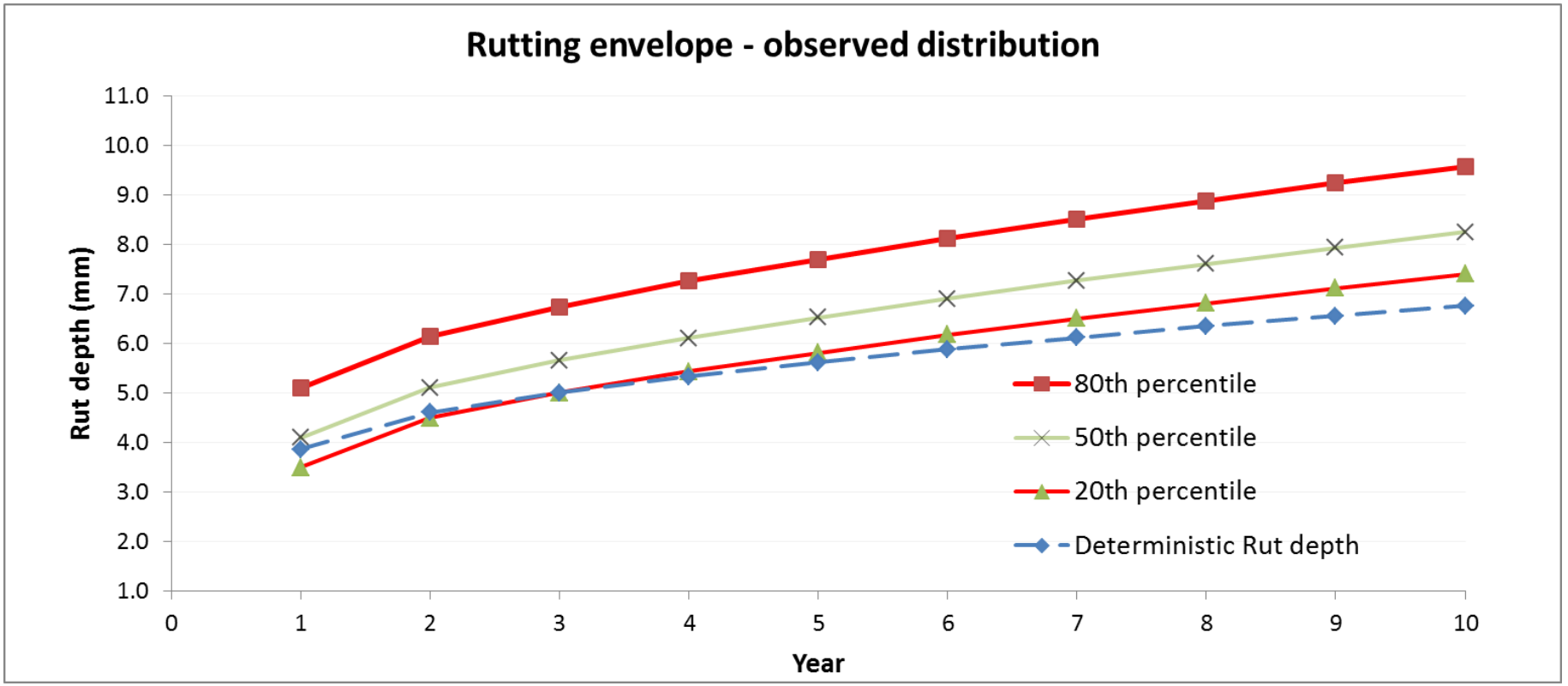
	min	max	average	distribution
cracking (% area)	0.5	8.5	3.2	
rutting (mm)	2.0	16.1	6.0	
roughness (IRI)	1.26	4.91	2.8	

	min	max	average	distribution
SNCo	1.77	5.32	3.3	
Thorthwaite index	20.0	30	25.1	
Maintenance expenditure pa. ($/km)	0	69594	1139.5	
MESA	0.5	0.5	0.5	n/a

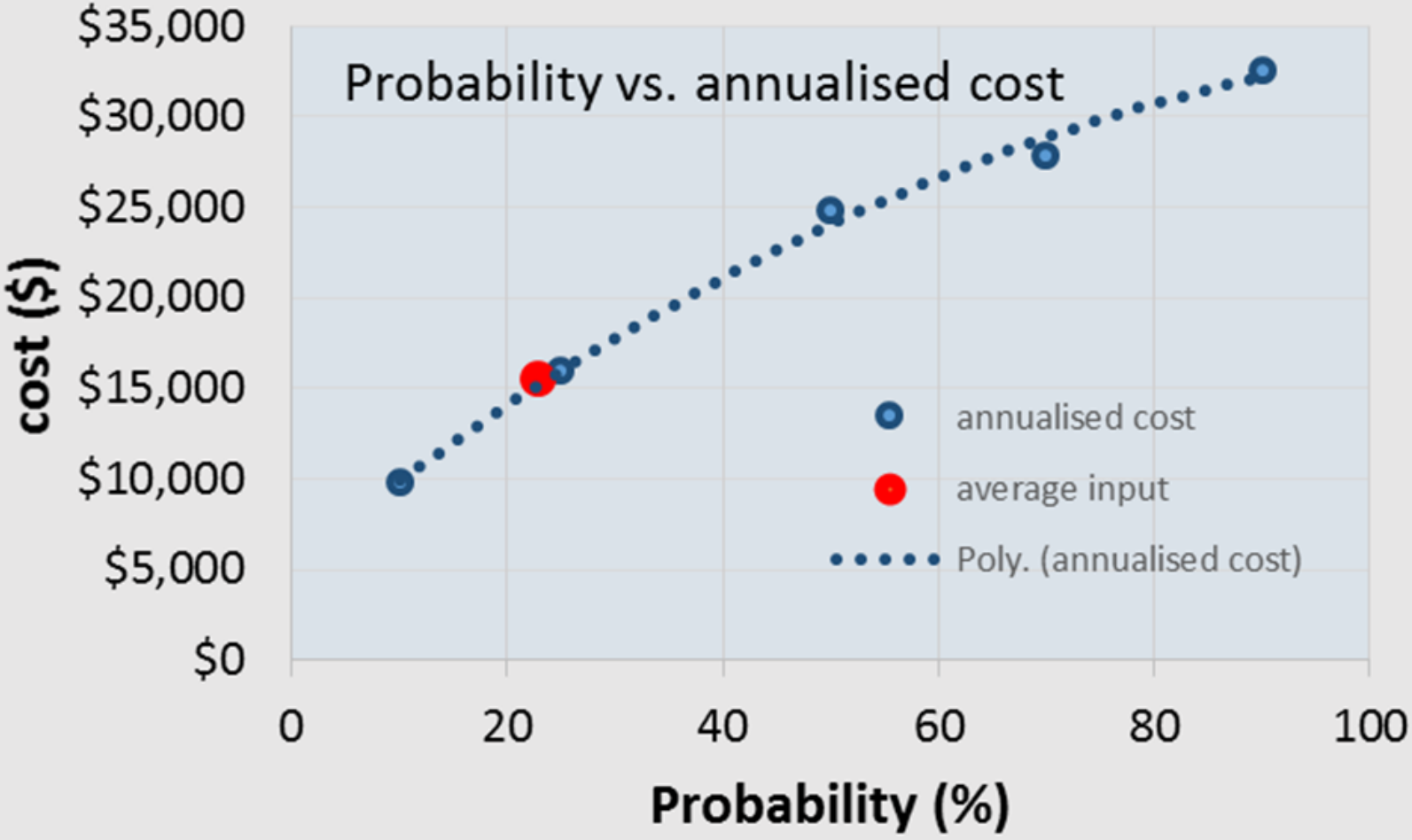
Rutting model



Rutting model



Reliability level of average input



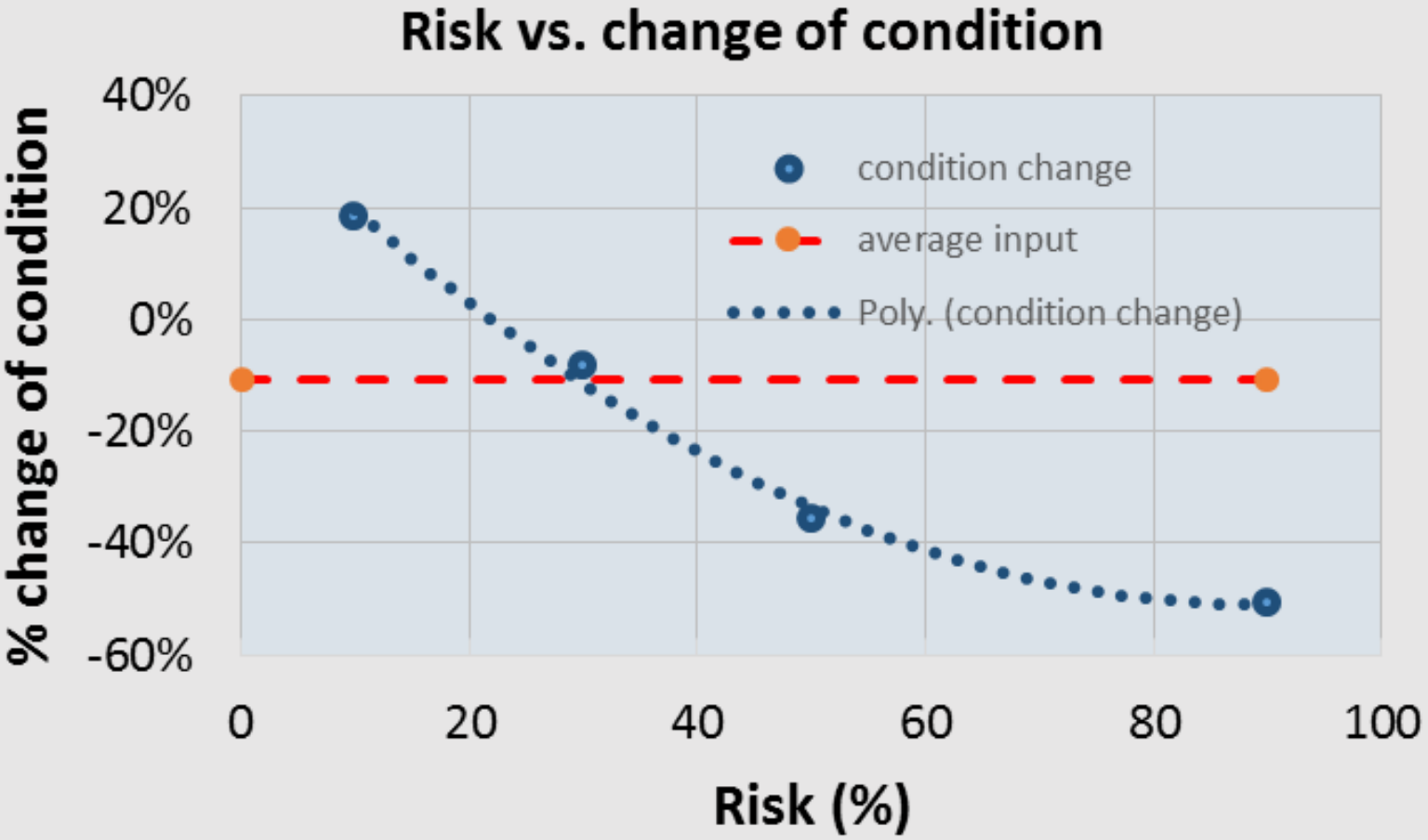
Conclusions

- Storage of distributions solved
- The full data can be used instead of a ‘representative’ (average) value
- Benefits: more realistic treatment quantities and cost estimates
- Risk / probability is known

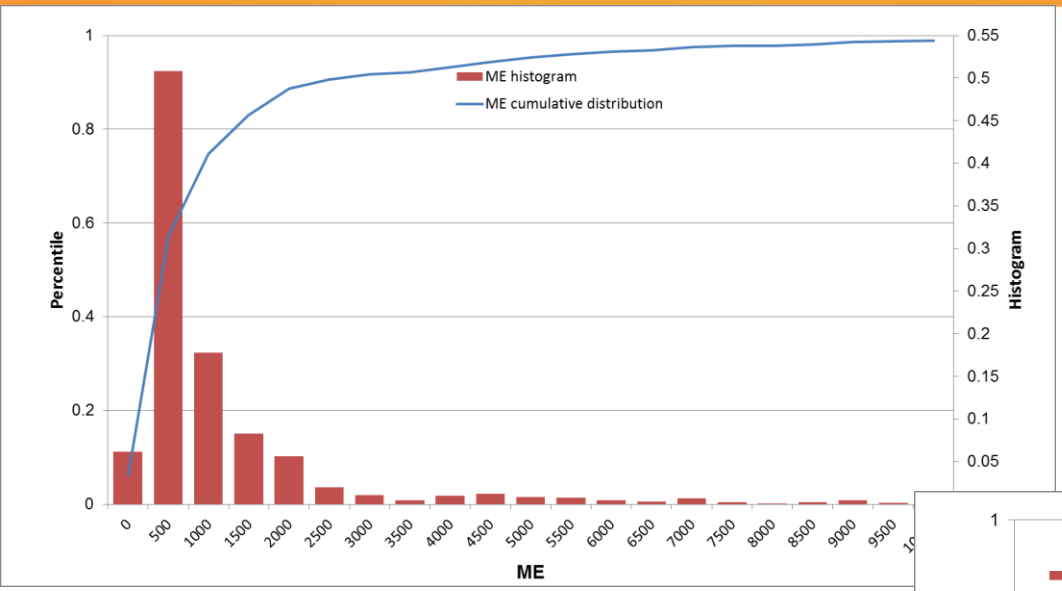
Final message

- Average - a convenient untruth
- ‘Yes we can’
  use the full data to model performance

Risk to contractors



The shape of the data



- Actual shape

- Assumed shape implied by the average