SURF 2012
Norfolk, Virginia / September 19-22, 2012
7th symposium on pavement surface characteristics

USE AND LIMITATIONS OF CRASH DATA

IN DETERMINING THE PRIORITY FOR TREATING SITES WITH LOW SKID RESISTANCE

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UK skid resistance policy

- Based on annual surveys using a continuous, side-force measurement device (SCRIM)
- Data are post-processed to smooth seasonal variation
- Values are compared with the skid resistance level set by the highway engineer (Investigatory Level)

Site categories and ILs

Site Category	IL for CSC data (SCRIM data speed corrected to 50km/h and seasonally corrected)							
	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
Motorway								
Dual carriageway non-event								
Single carriageway non-event								
Approaches to junctions								
Approaches to pedestrian crossings								
Roundabout								
Gradient 5-10%								
Gradient >10%								
Bend radius <500m – dual c/way								
Bend radius <500m – dual c/way								

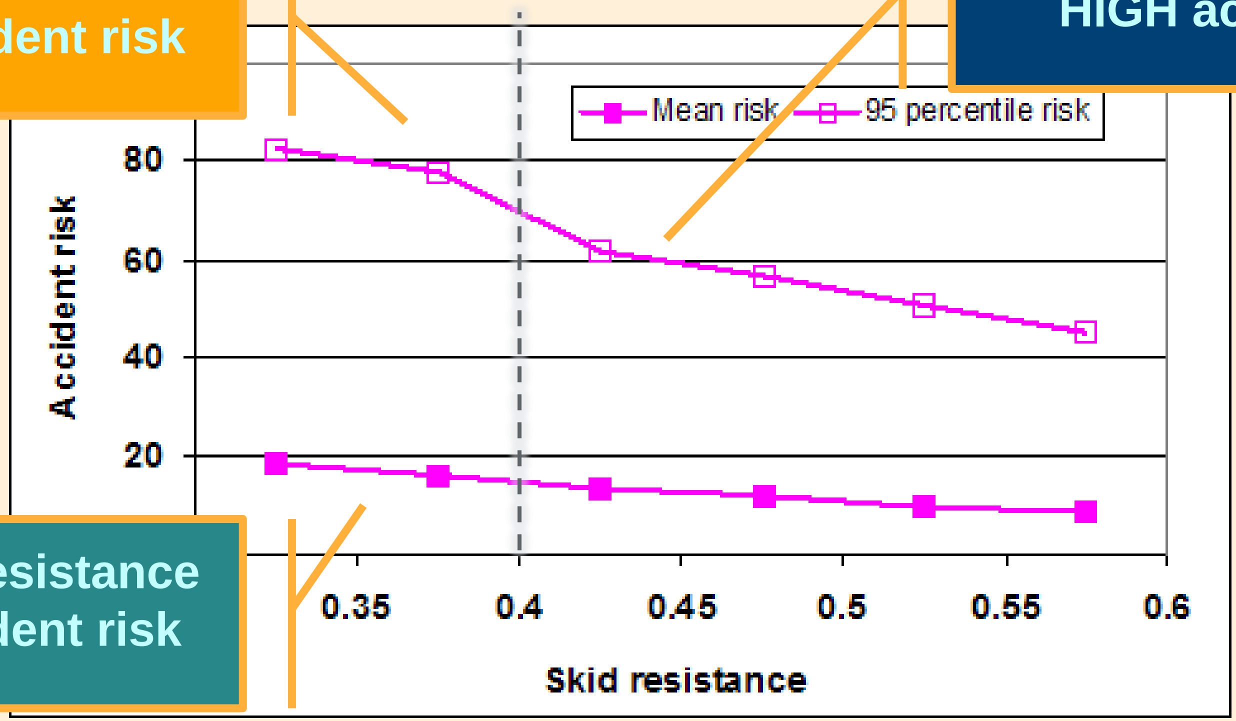
Intervention vs. investigation

- An intervention threshold would require treatment if the skid resistance falls below a specified level
- Advantage: simplicity
- Disadvantages:
  - Requires adequate maintenance budget to be assigned to complete all treatments
  - Does not cater for the wide variation in accident risk that is observed
  - And the relatively weak trend between skid resistance and accident risk

Risk varies within each site category

**Low skid resistance
HIGH accident risk**

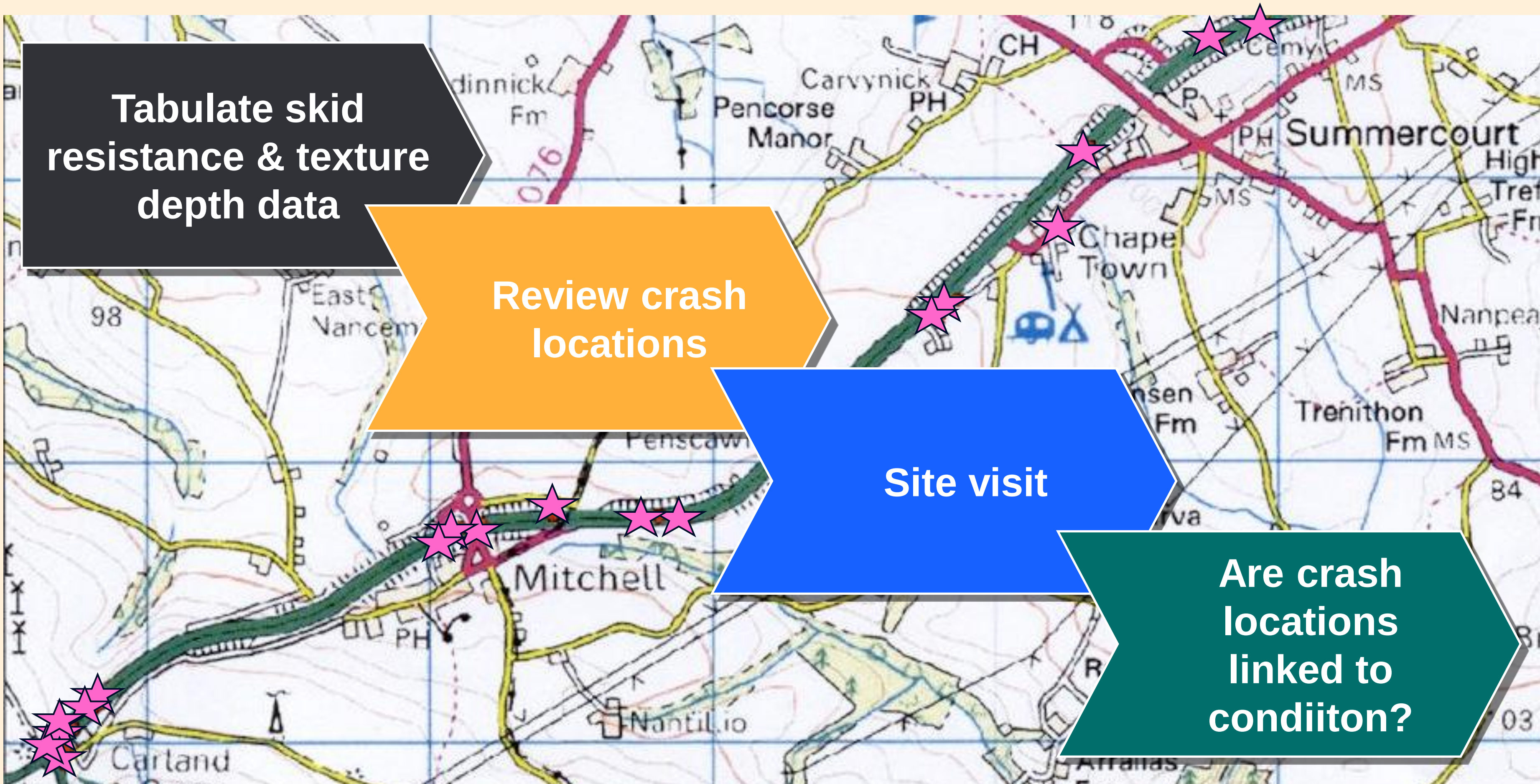
**Skid resistance >IL
HIGH accident risk**



**Low skid resistance
LOW accident risk**

Accident risk for single carriageway trunk roads

Site investigation process



The site investigation dilemma -1

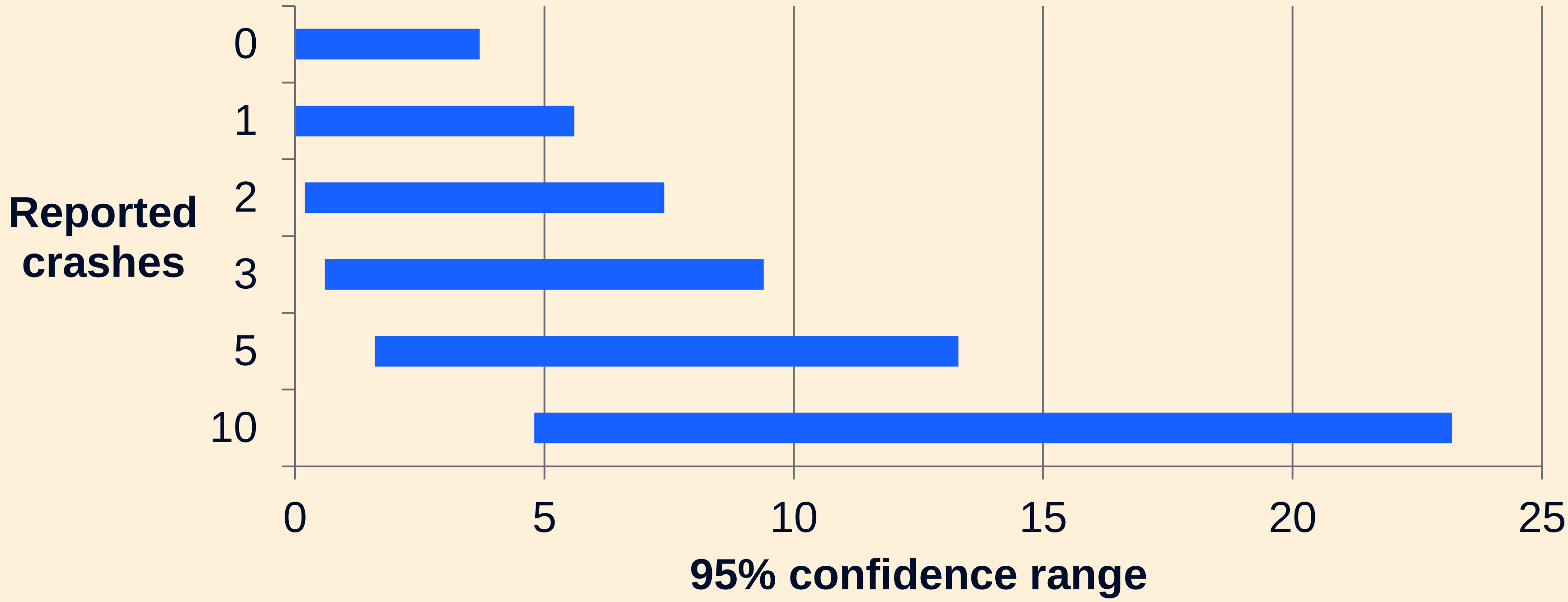
- We want to treat the sites most likely to deliver a safety benefit
- … while monitoring those that are lower risk
- A significant number of sites typically require investigation and possibly treatment
- This takes a lot of staff resource to do properly

The site investigation dilemma -2

- The two main indicators of risk both have limitations
  - Surface condition (skid resistance) explains a relatively low proportion of the overall risk
  - Values fluctuate due to seasonal variation (UK)
  - Crash history is not reliable at 95% confidence levels
- They prioritise sites in a different order
- We need a simple, efficient method of assessing priorities

Crash data are only part of the picture

- Accident numbers (for an individual site) are low
- So, statistical confidence is low



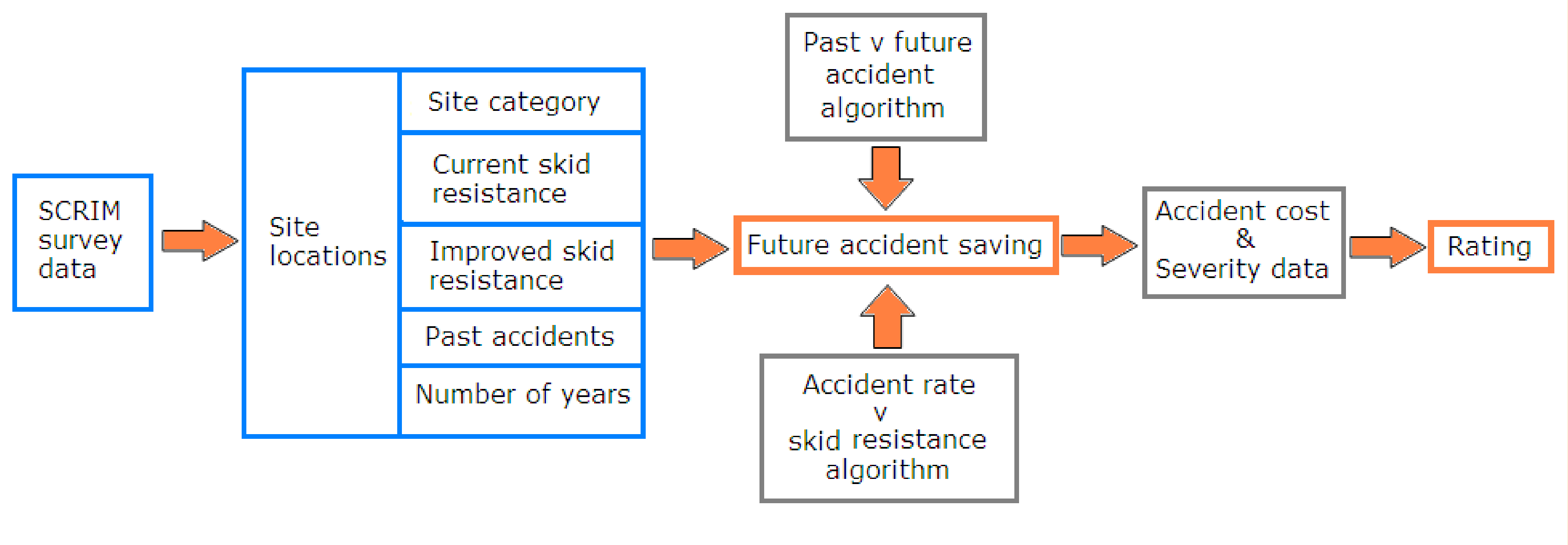
Objectives of the accident model

- To provide a method for rating the loss of skid resistance, history of crashes and the nature of the site during the site investigation
- Which is:
  - Consistent
  - Easy to apply

Methodology

- Method developed to combine the different sources of information:
  - It predicts the number of future accidents
  - Estimates the reduction that would result from improving skid resistance
  - Translates this to accident cost saved
  - Rank sites in order of relative cost saving

Overview of accident model



Prediction of future accident risk

- To what extent is past accident risk a good guide to future risk?
- This will depend on the extent to which accidents occur randomly or systematically

Prediction of future accident risk

- Analysis of crash pattern on English trunk road network over 2 periods
  - "Past" (1999-2002)
  - "Future" (2003-2006)
- Database divided into continuous lengths with consistent site category
  - Motorway - 500m
  - Dual and single carriageway non-event - 200m
  - Event categories - as defined in PMS

Prediction of future accident risk

% analysis lengths	Future Accidents							
Past Accidents	0	1	2	3	4	5	>5	N
0	47.3	28.8	13.7	6.1	2.2	1.0	0.9	2117
1	31.9	30.9	18.0	10.4	3.9	2.5	2.5	1833
2	22.5	28.0	21.1	13.4	6.8	3.6	4.5	1237
3	16.8	23.8	20.1	15.7	9.6	6.5	7.5	827
4	8.8	17.5	22.6	16.6	11.4	7.7	15.5	536
5	7.3	13.5	15.5	14.2	13.5	11.2	24.8	303
>5	2.6	8.9	11.2	11.2	12.4	10.2	43.4	643
N	2088	1913	1286	818	464	307	620	7496

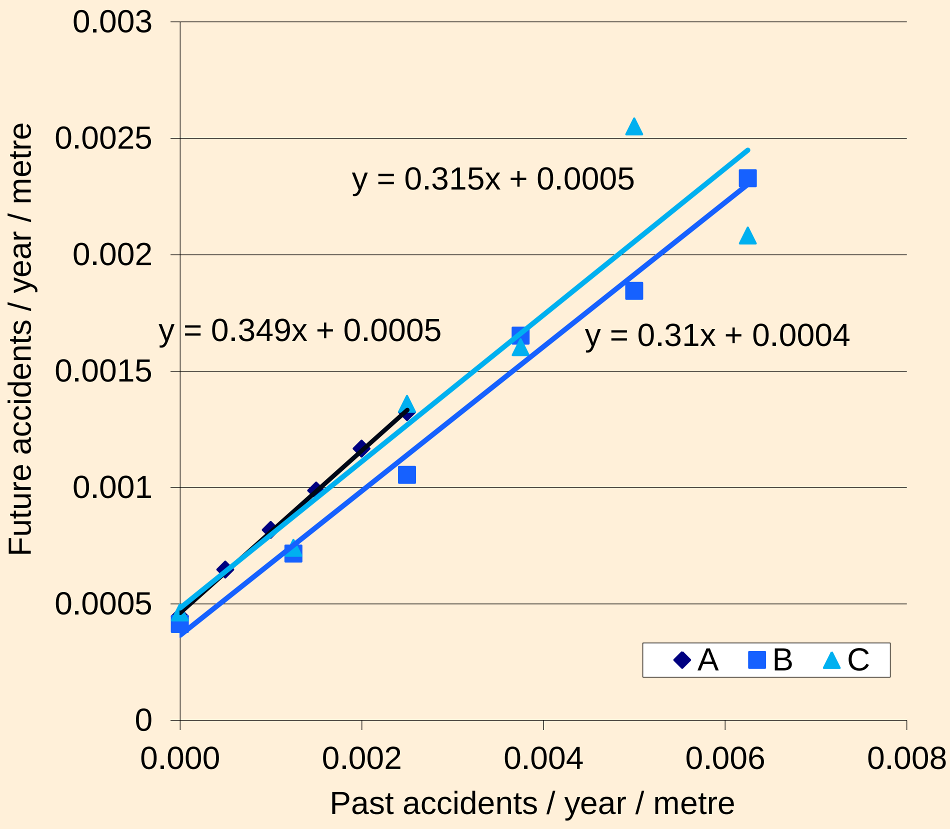
Results for mainline motorway lengths

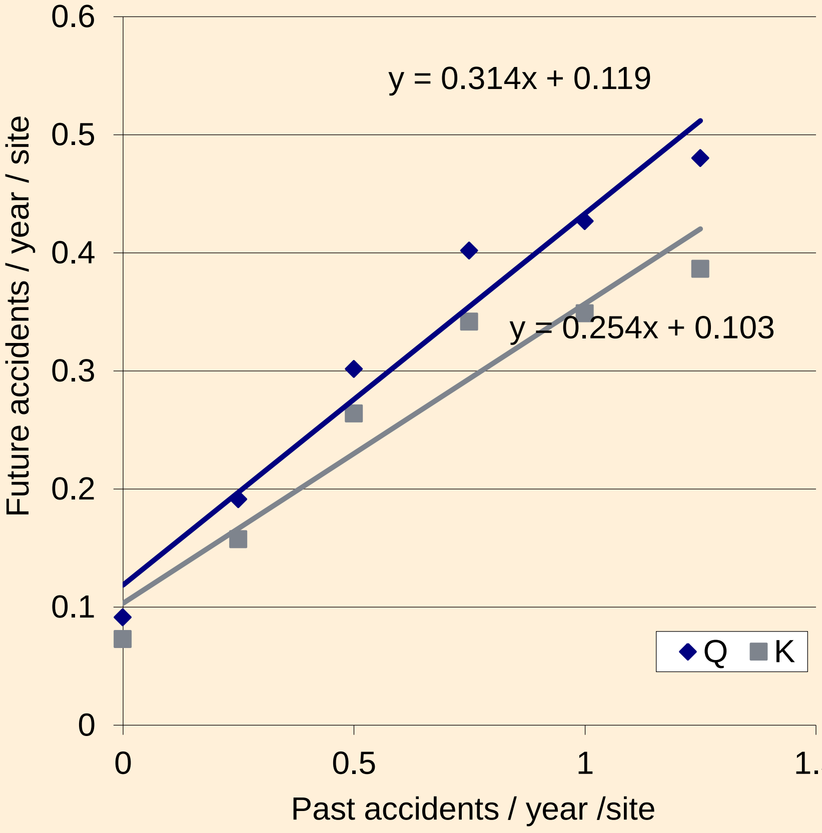
Prediction of future accident risk

% analysis lengths	Future Accidents		
Past Accidents	Less than past accidents	Same as past accidents	More than past accidents
0	-	47.3	52.7
1	31.9	30.9	37.3
2	50.5	21.1	28.3
3	60.7	15.7	23.6
4	65.5	11.4	23.2
5	64.0	11.2	24.8
>5	56.5	43.4	-

Results for mainline motorway lengths

General relationships for future risk

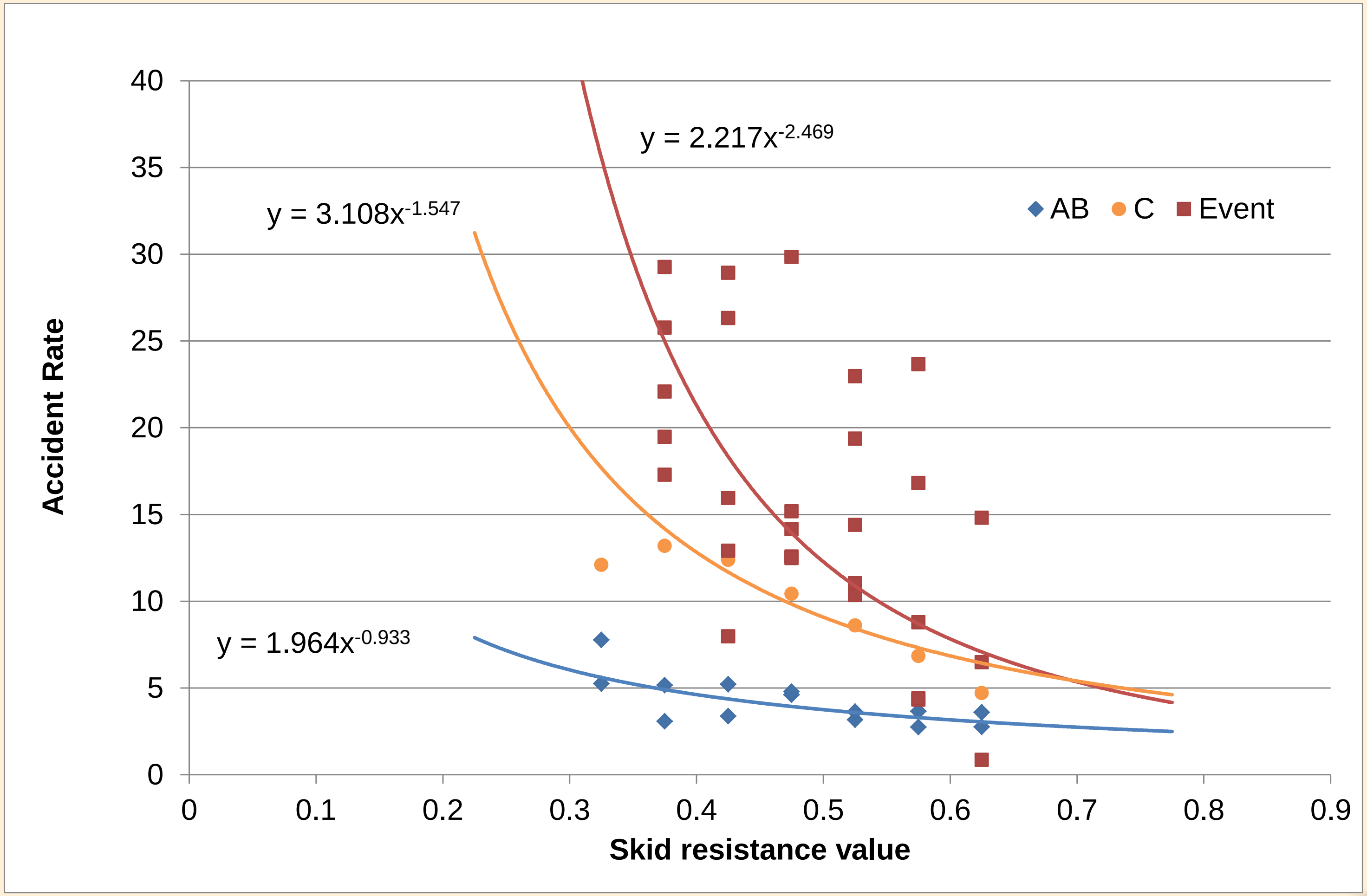




Benefits from improving skid resistance

- Previous work has analysed relationship between skid resistance and accident risk
- Relationship depends on site category
- For some categories, relationships not robust due to lack of data

Data combined into 3 categories



Benefits from improving skid resistance

- Assumed that skid resistance improved from current level to 0.05 above the IL
- Relationships used to estimate saving in accidents
- Converted into economic saving
  - Lack of relationship between skid resistance and accident severities
  - Determined typical distribution of accident severity (fatal/serious/slight for each site category)
- Hence, determined overall accident rating

Refined from sensitivity analysis

Site ID	Site category	Current skid resistance	Ideal skid resistance	Difference	Past Accidents	Rating
43	G	0.3	0.55	0.25	1	93.8
94	R	0.4	0.55	0.15	2	88.7
107	S1	0.3	0.55	0.25	1	86.4
113	S1	0.5	0.55	0.05	3	86.3
34	C	0.4	0.45	0.05	3	82.4
60	K	0.2	0.55	0.35	1	81.2
75	Q	0.3	0.55	0.25	1	79.3
62	K	0.4	0.55	0.15	2	78.5
81	Q	0.5	0.55	0.05	3	71.2
91	R	0.3	0.55	0.25	1	67.2
122	S2	0.4	0.55	0.15	1	66.0
20	B	0.3	0.45	0.15	2	60.4

- 132 hypothetical combinations of site category, skid resistance and accident history

Refined from sensitivity analysis

- Sites with low skid resistance but no previous history receive low rankings
- (In spite of using power relationship for skid vs. accident risk)
- Economic sense?
- But not consistent with duty of care
- Additional weighting introduced based on extent of deficiency

Summary and implementation

- Skid resistance policy can be made more effective if you can target sites likely to deliver safety benefits
- Skid resistance and accident data are both relevant to this, and both have limitations
- A method has been developed that balances the priority of each
- Provides a simple and consistent initial ranking
- Method has been incorporated into a forthcoming update to UK skid resistance standard

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