

UKOPA

Acknowledgements

Slides 5,6 & 7. Diagrams taken from:

Landsliding In Great Britain

Jones, D.K.C. & Lee, M.

HMSO. 1994.

Slide 27. Landslide susceptibility map reproduced from:

Foster, C.

Landslide Susceptibility Mapping - The GB perspective

British Geological Survey.

Presented at Expert Meeting on Harmonised Landslide Susceptibility Mapping for Europe, JRC, Ispra, Italy. 26-27th May 2010.

Slide 28. Two map images reproduced from:

Landslide Assessment GeoReport

Fenny Bentley

Near Ashbourne, Derbyshire.

Report GR_999999/1

British Geological Survey. 23rd June 2011.

http://shop.bgs.ac.uk/GeoReports/info.cfm?STD_REP=S009

UKOPA

Pipeline Failure Rates Due to Inland
Natural Landsliding

IGEM/TD/2:2008

PD 8010-3:2009

Geoff Leach

13 February 2013

Content

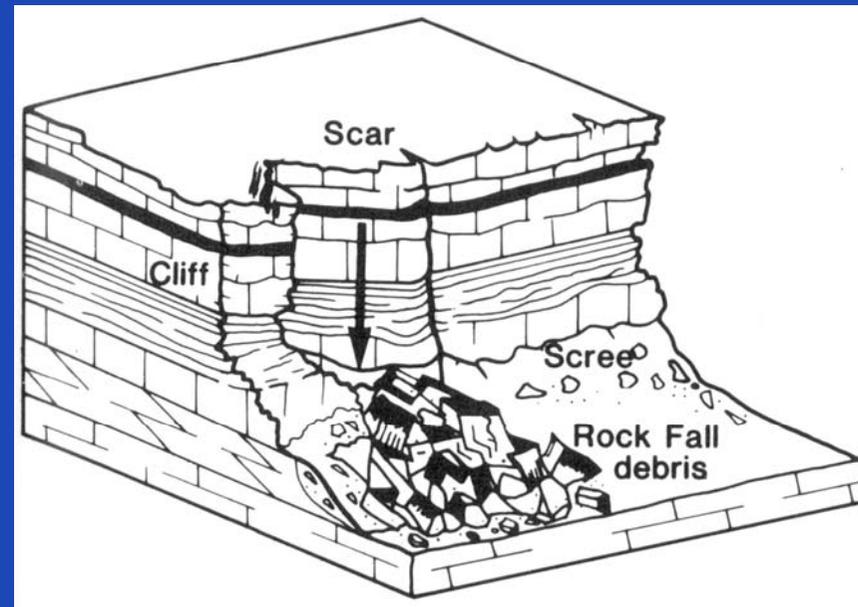
- UKOPA Requirements
- Landslides
- Landslide Hazard
- Pipeline Survival
- NG Study [2005]
- UKOPA Work
- Landslide Potential

UKOPA Requirements

- Inland Natural Landsliding
 - Pipeline Failure Frequency According to Wall Thickness
 - Identify rupture & leak rates
 - Based on 2005 Study for National Grid

Natural Landslides

- Gravity induced mass movements
 - Falls/Topples

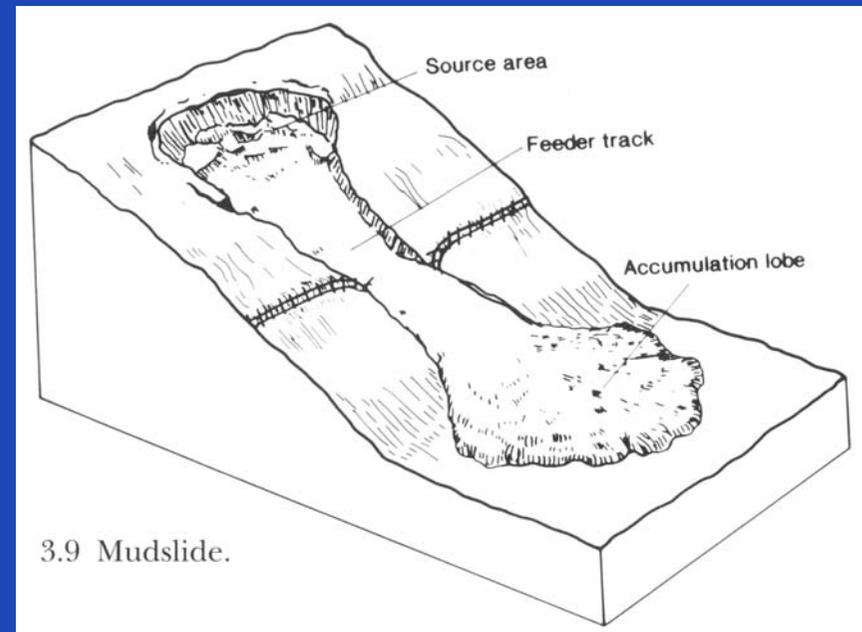
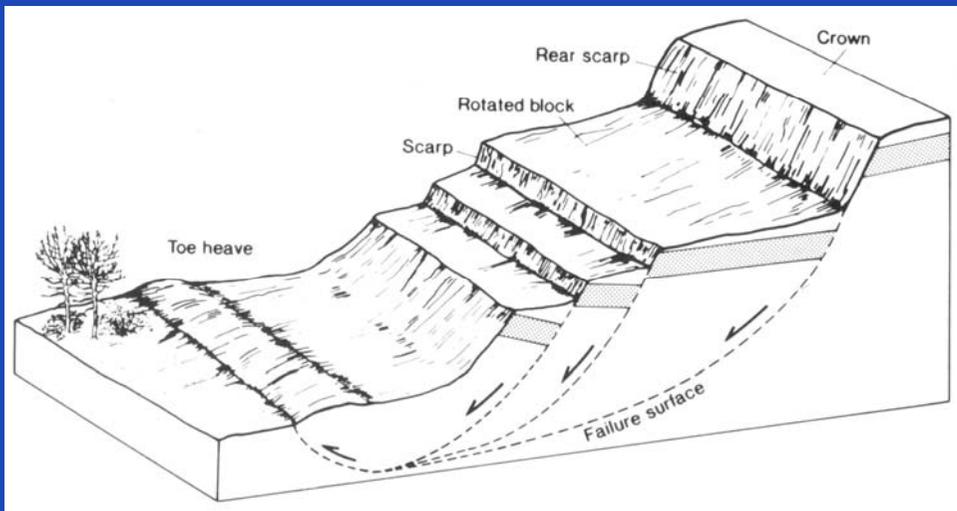


HMSO 1994

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Natural Landslides

- Gravity induced mass movements
 - Falls/Topples
 - Slides

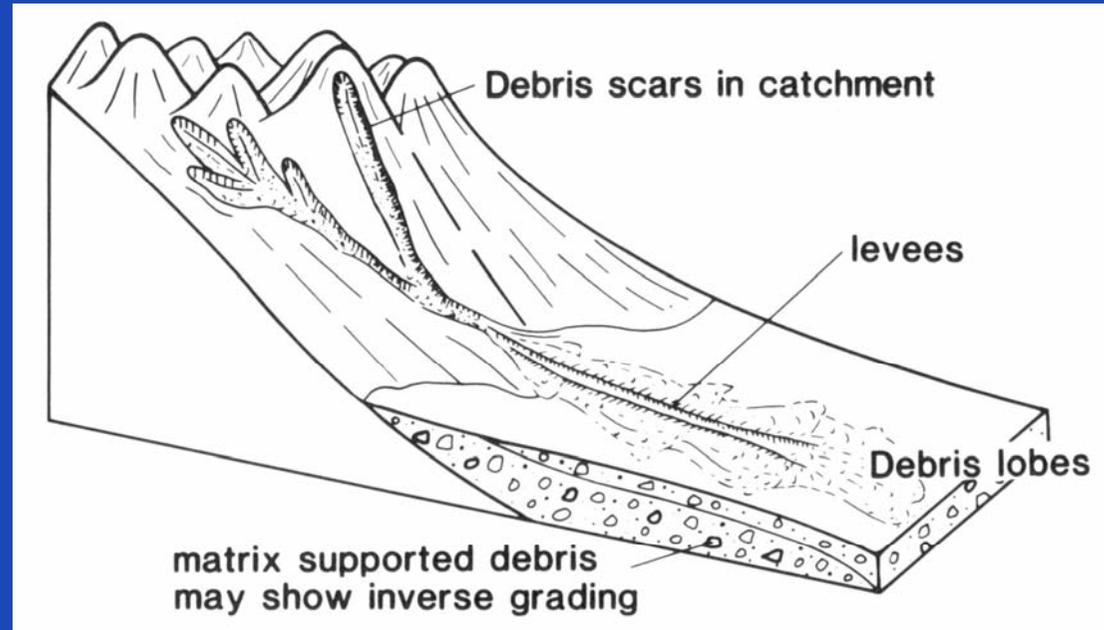


3.9 Mudslide.

HMSO 1994

Natural Landslides

- Gravity induced mass movements
 - Falls/Topples
 - Slides
 - Flows



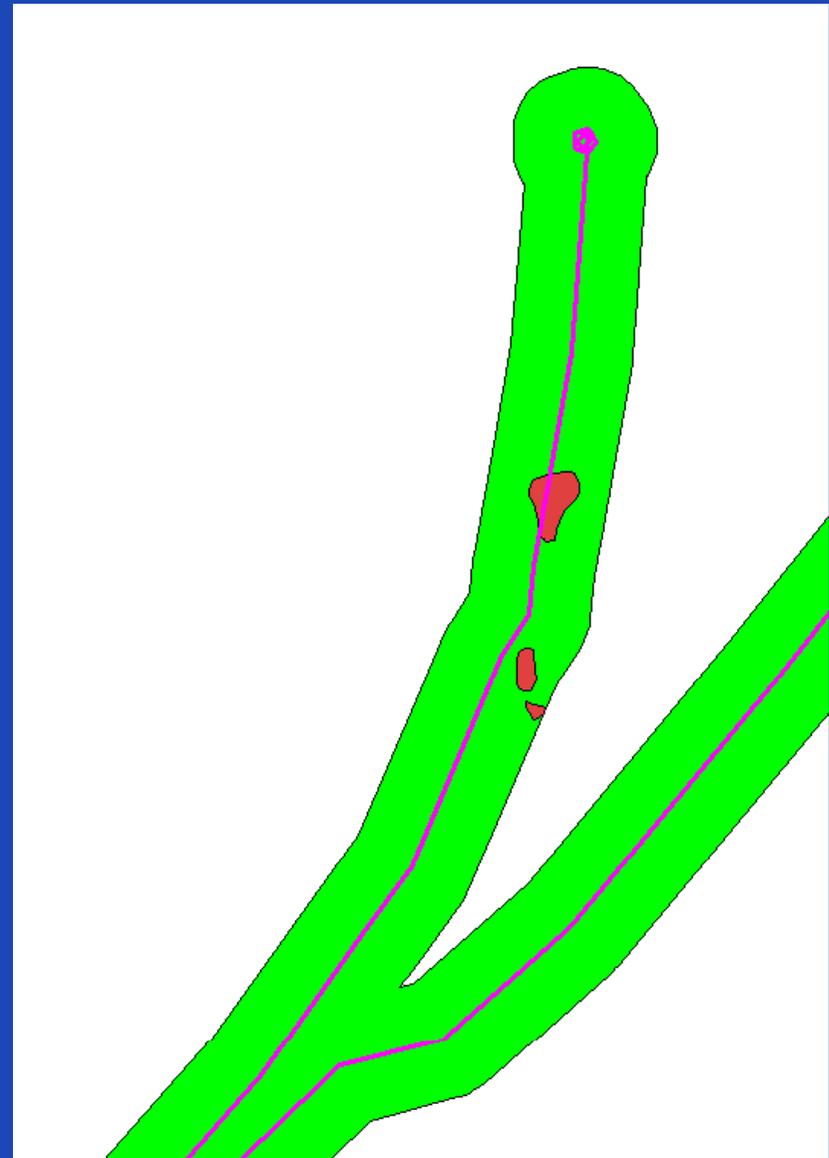
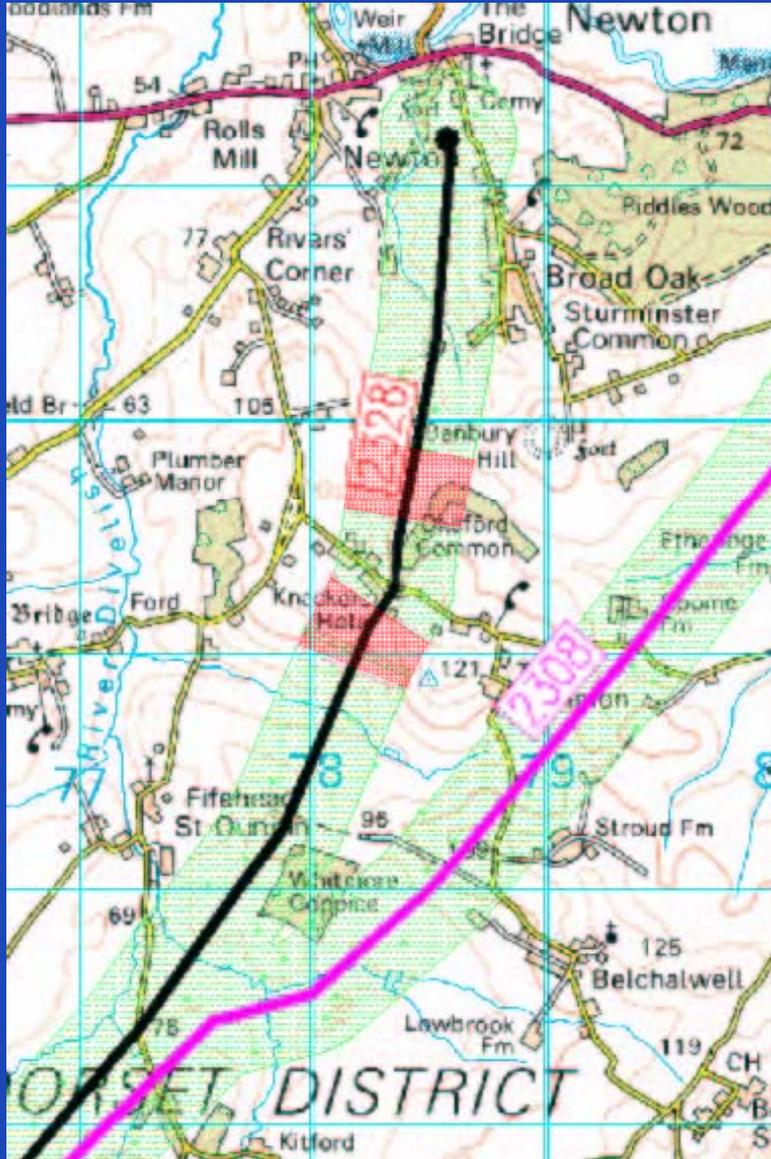
BGS Landslides [2005]



- Falls 1
- Slides 295
- Flows 38

- Attributes
 - Length
 - Width
 - Movement
 - Recurrence

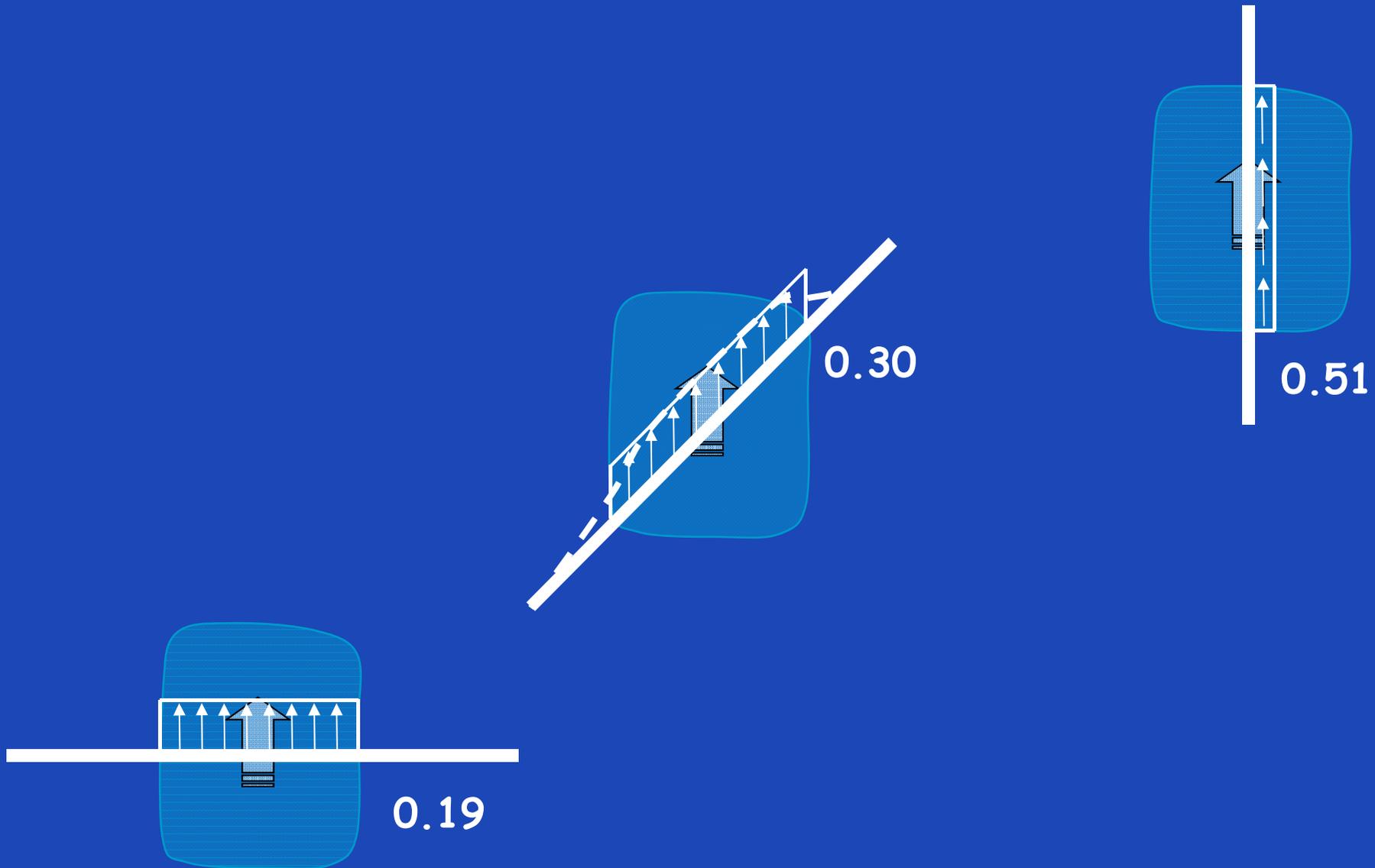
BGS 'Susceptibility' Zones [2003]



BGS Landslides [2005]



Alignment



Pipeline Survival



Pipeline Survival



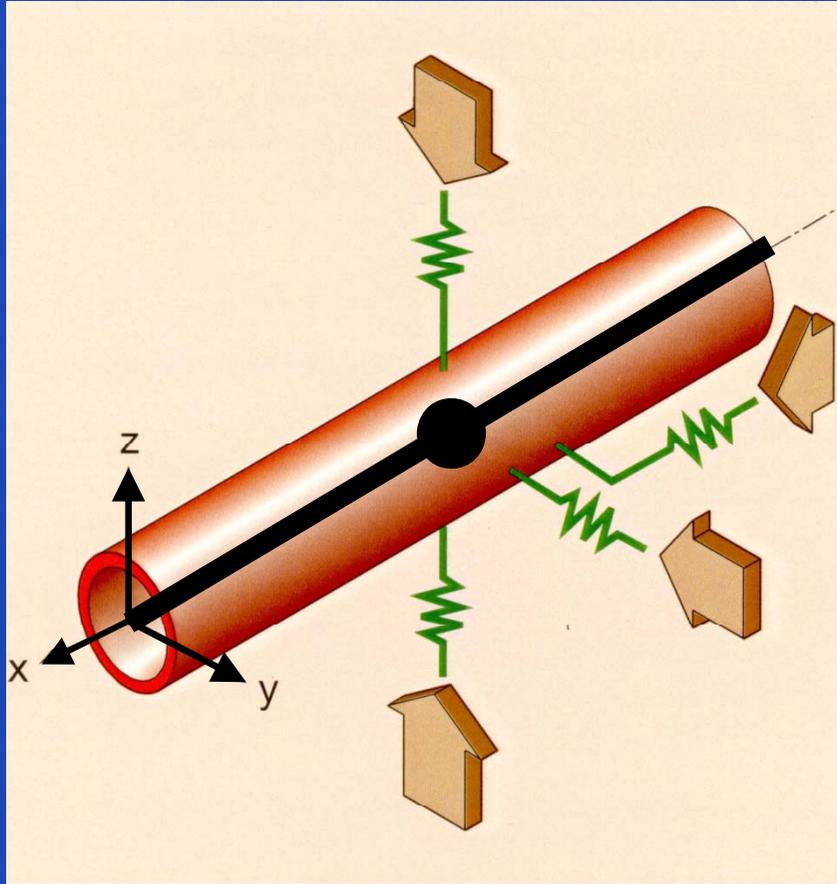
Pipeline Survival



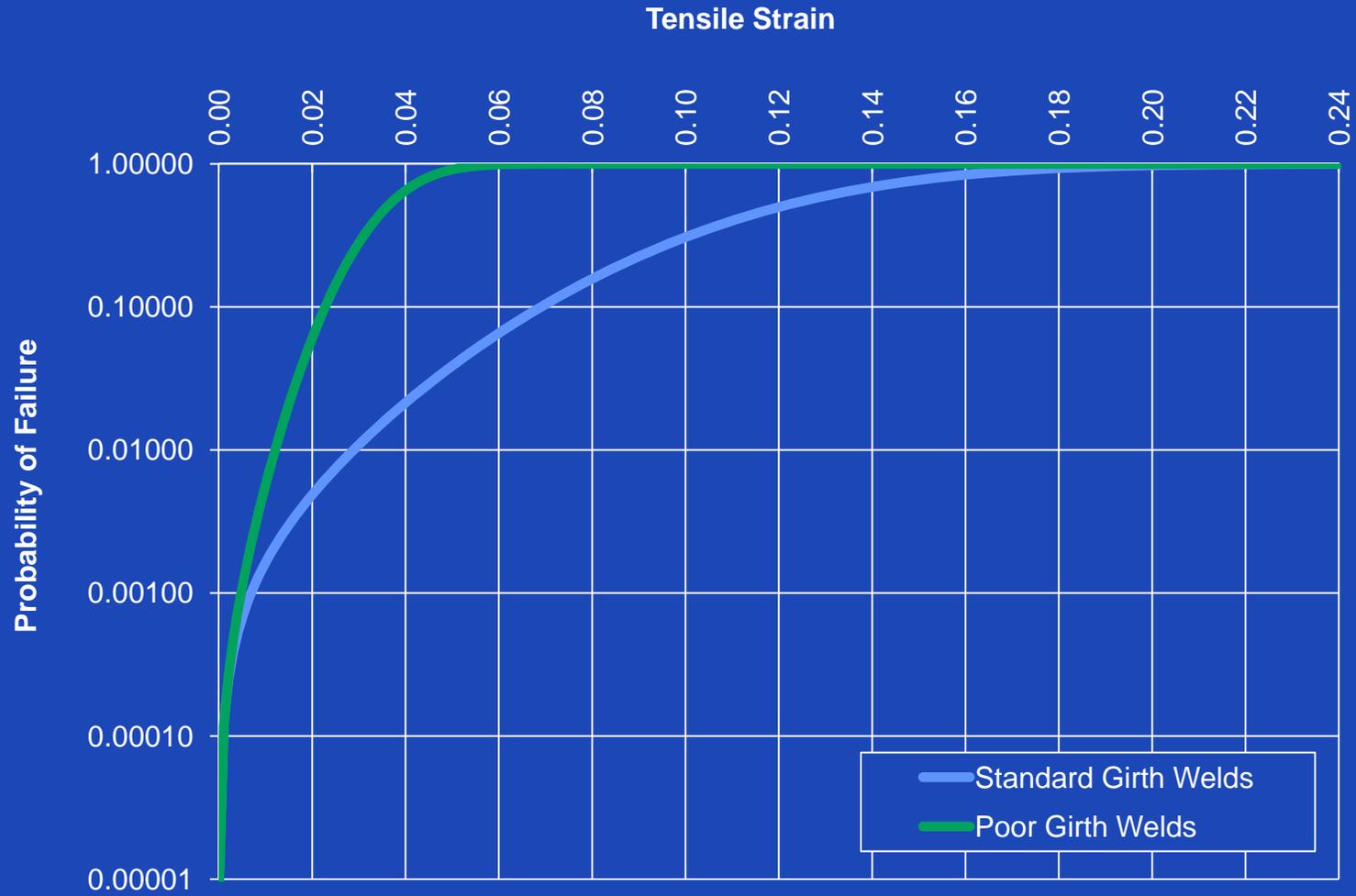
Pipeline Survival



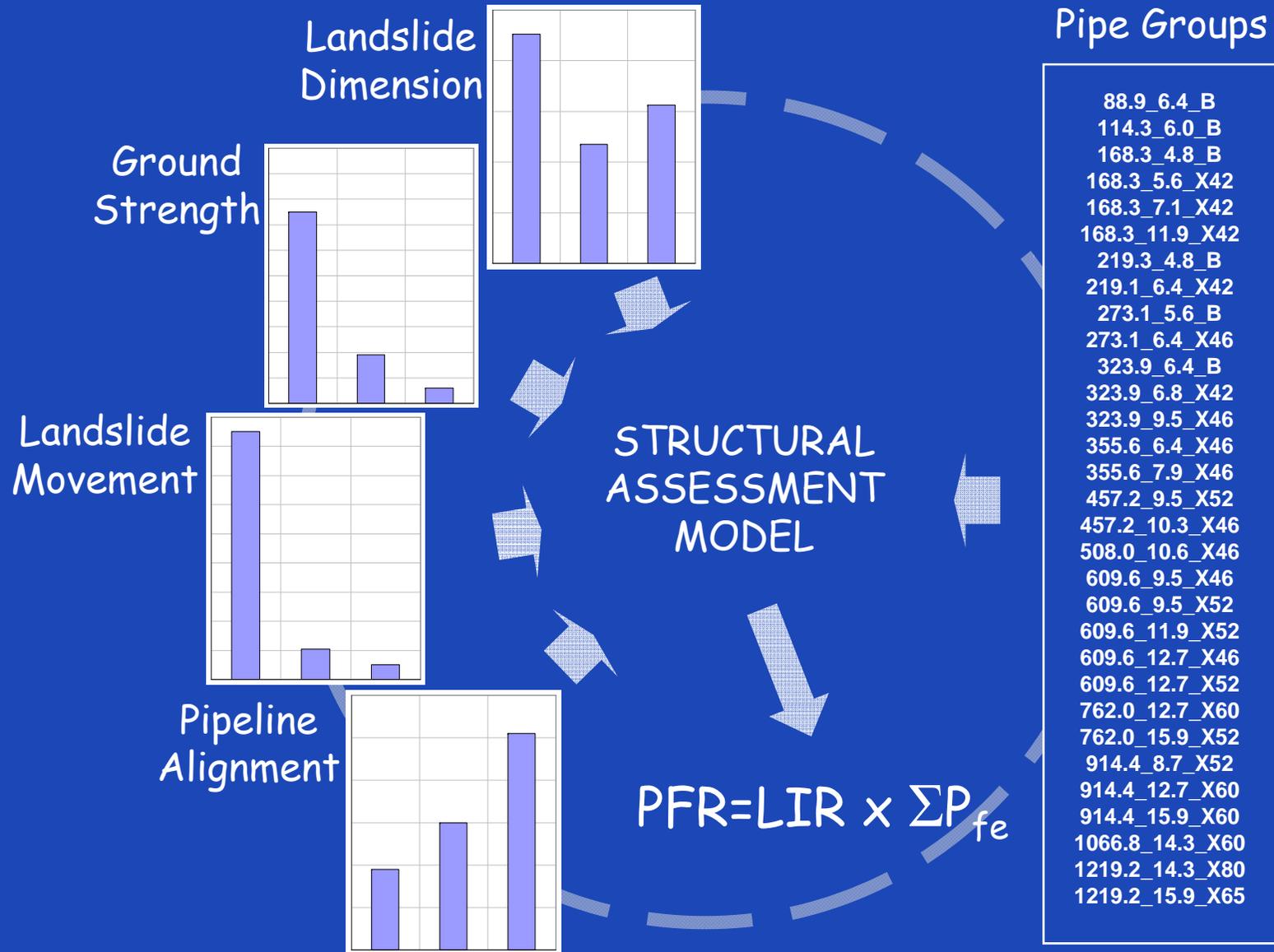
Structural Model



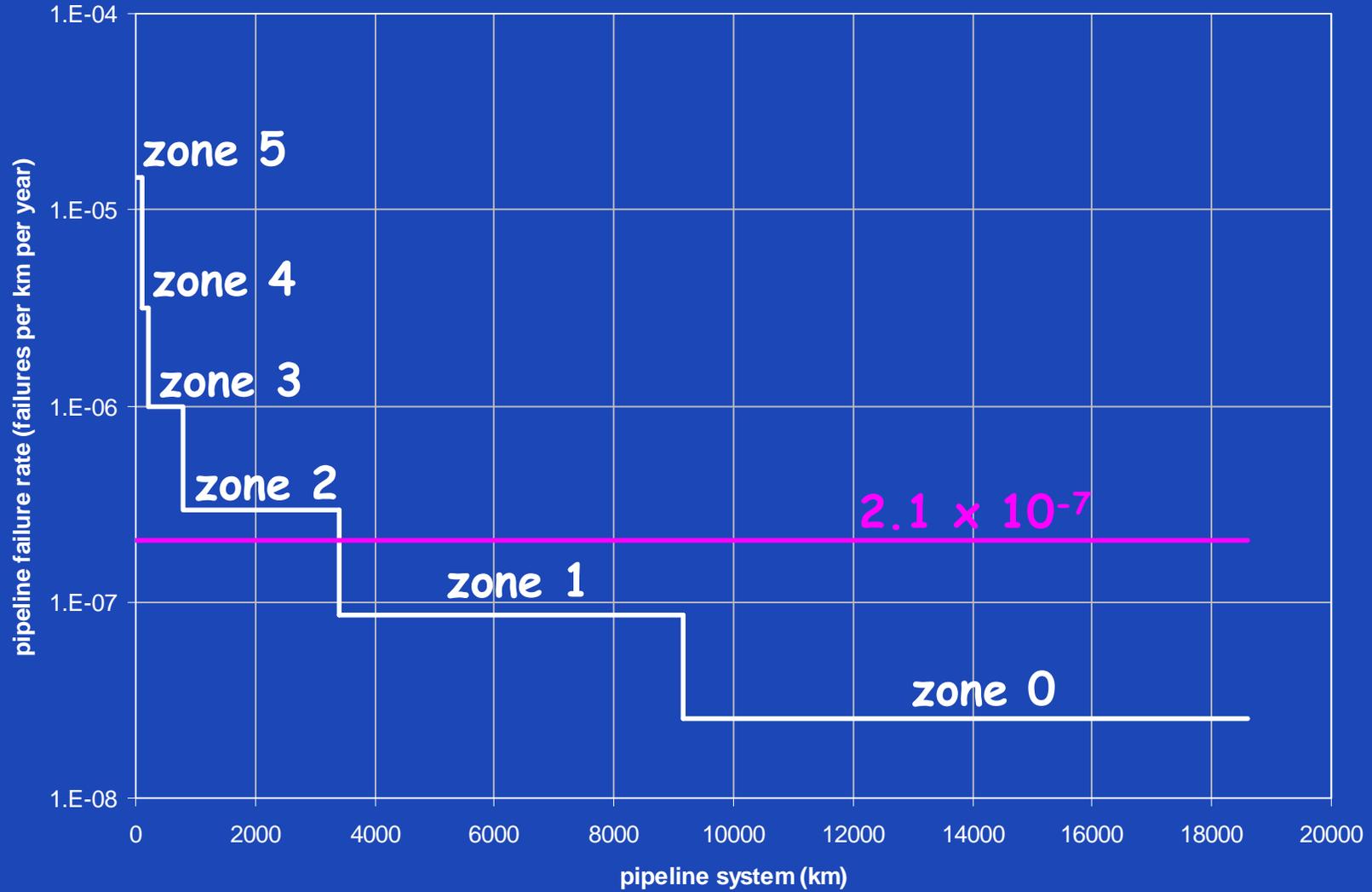
Pipeline Survival



APPROACH [2005]



Pipeline Failure Rates

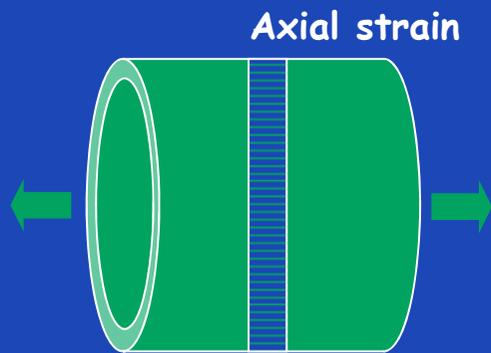


New work

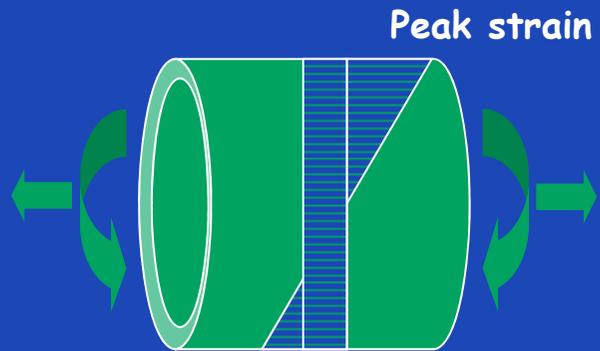
- Numerical Analysis [81 conditions -> SV]
 - Rupture SV vs WT
 - Leak SV vs WT
- Indicative Landslide Incident Rates [LIR]

$$\text{Pipeline Failure Rate} = \text{LIR} \times \text{SV}$$

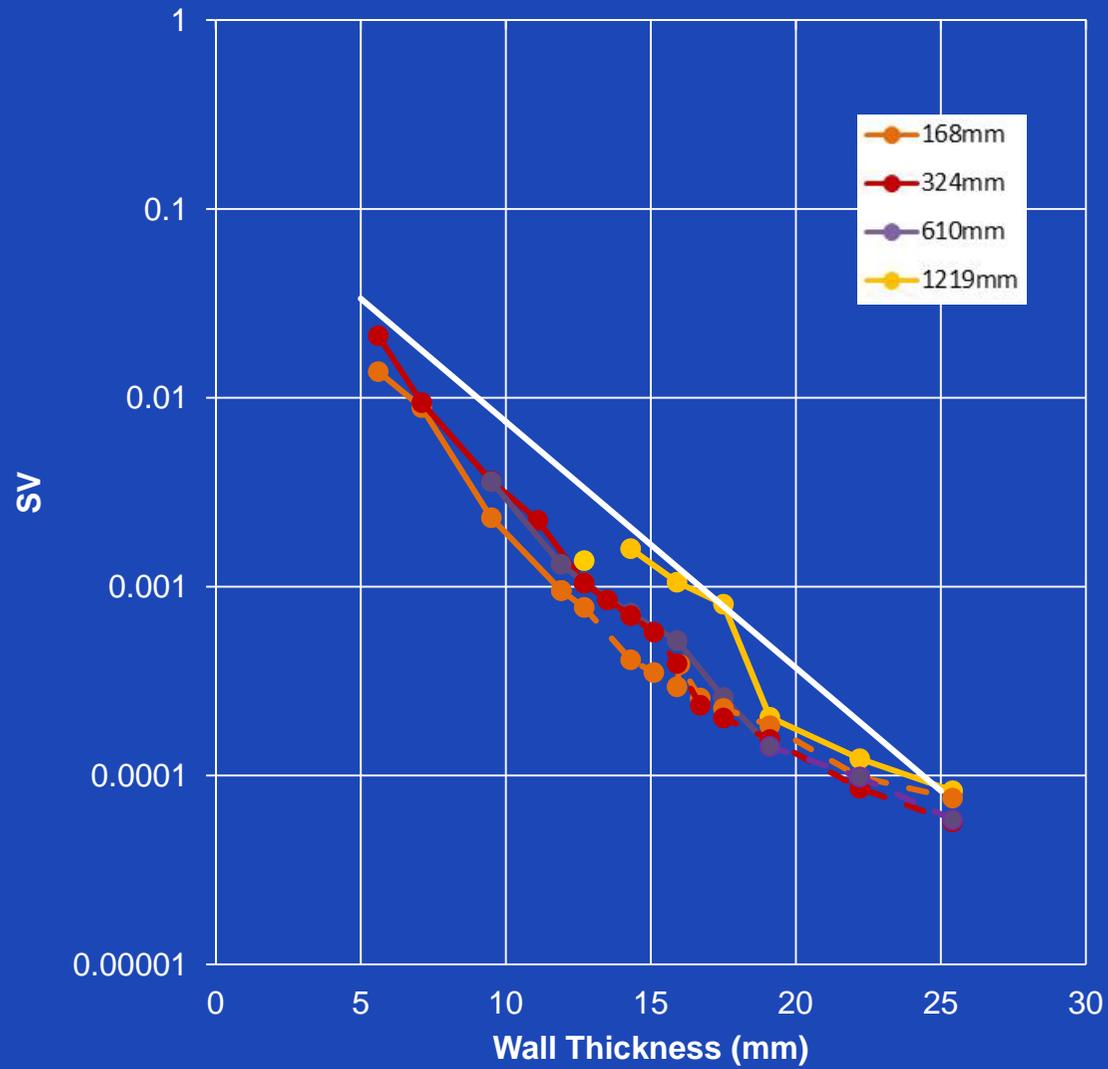
Rupture



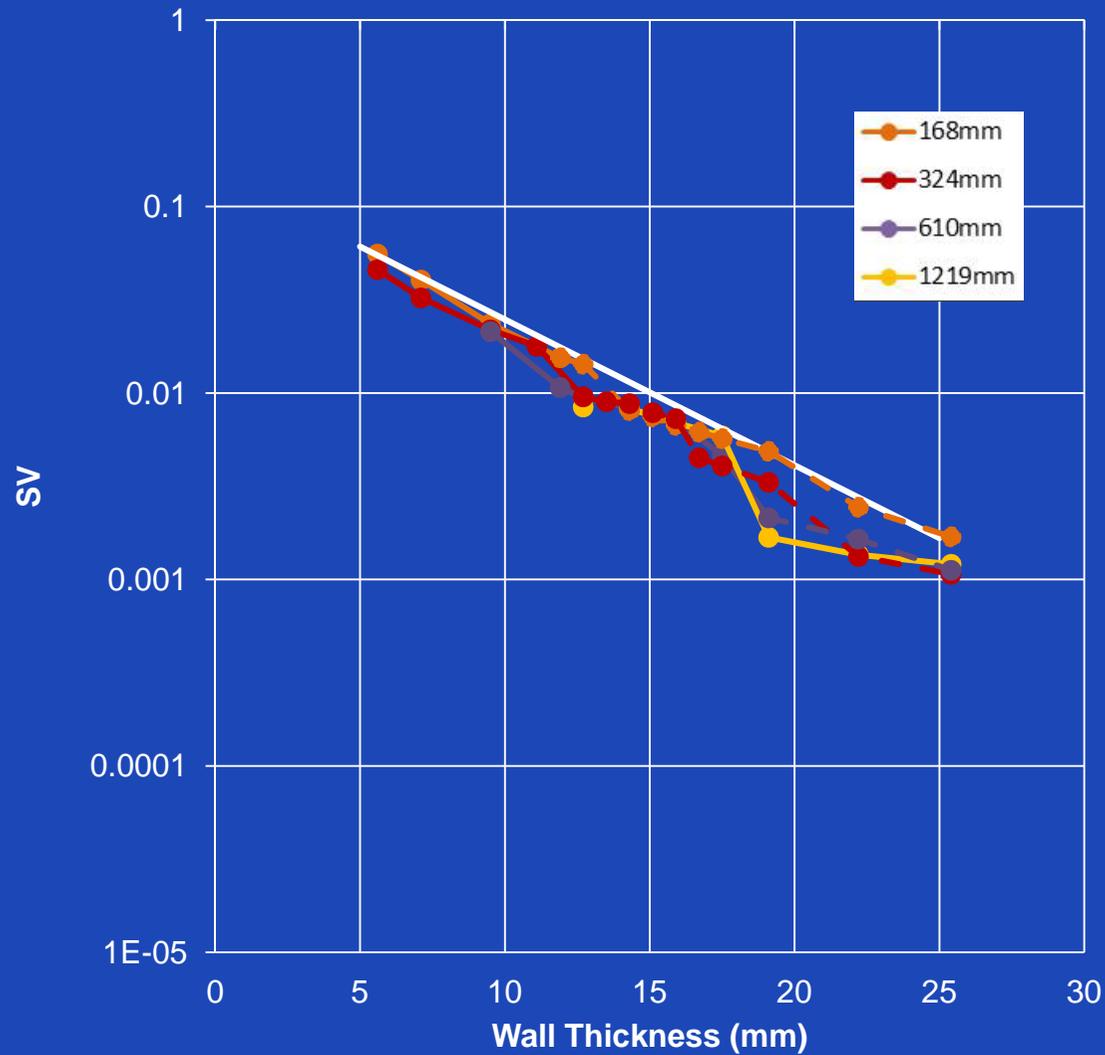
Leak



SV - Rupture - 'high quality' girth welds

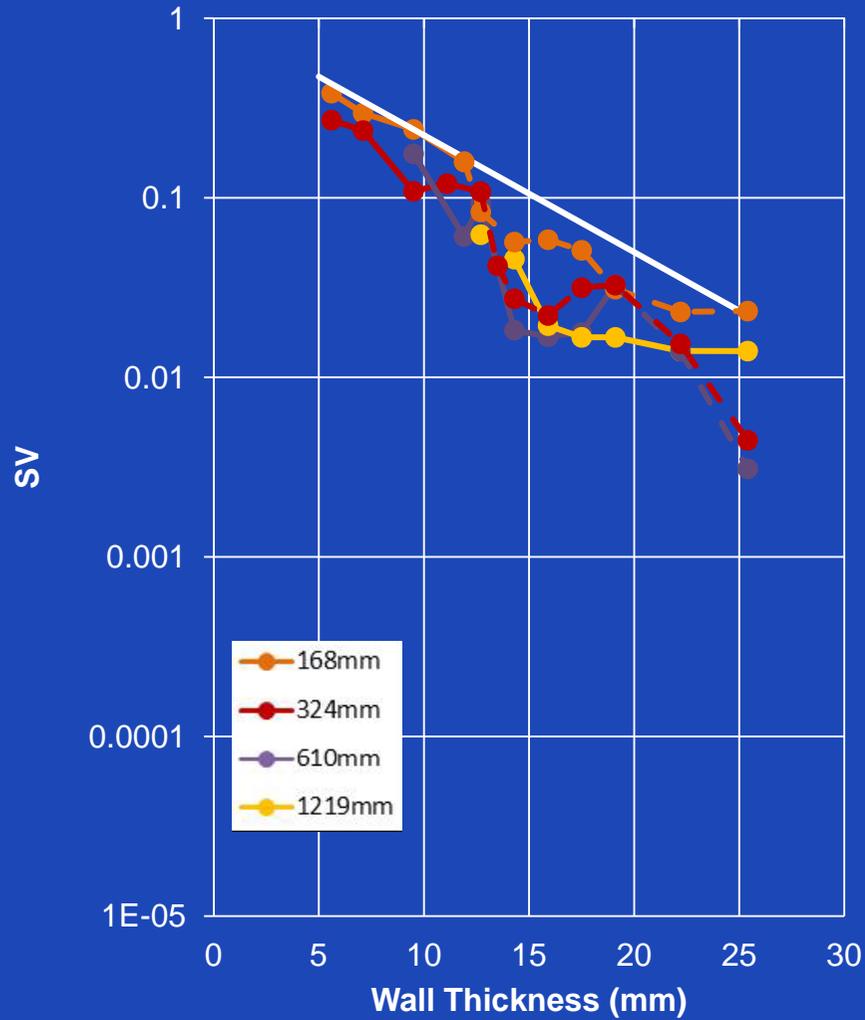


SV - Rupture - 'poor quality' girth welds

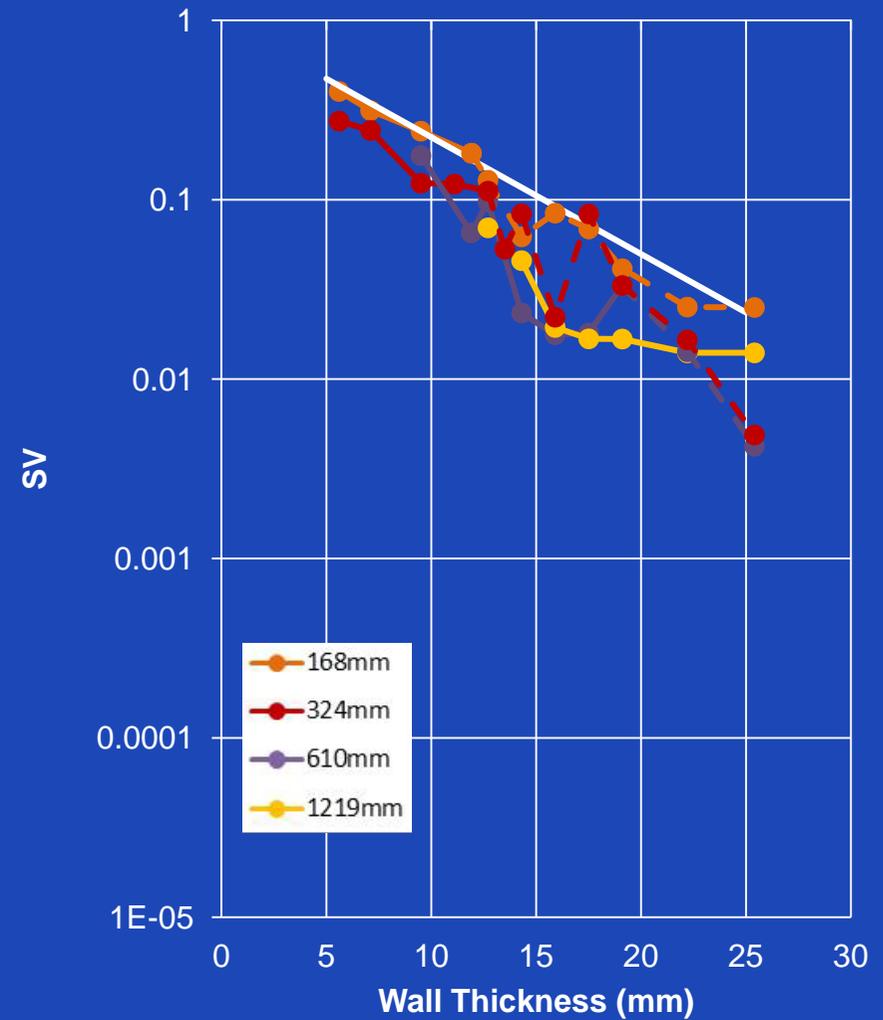


SV - Leak

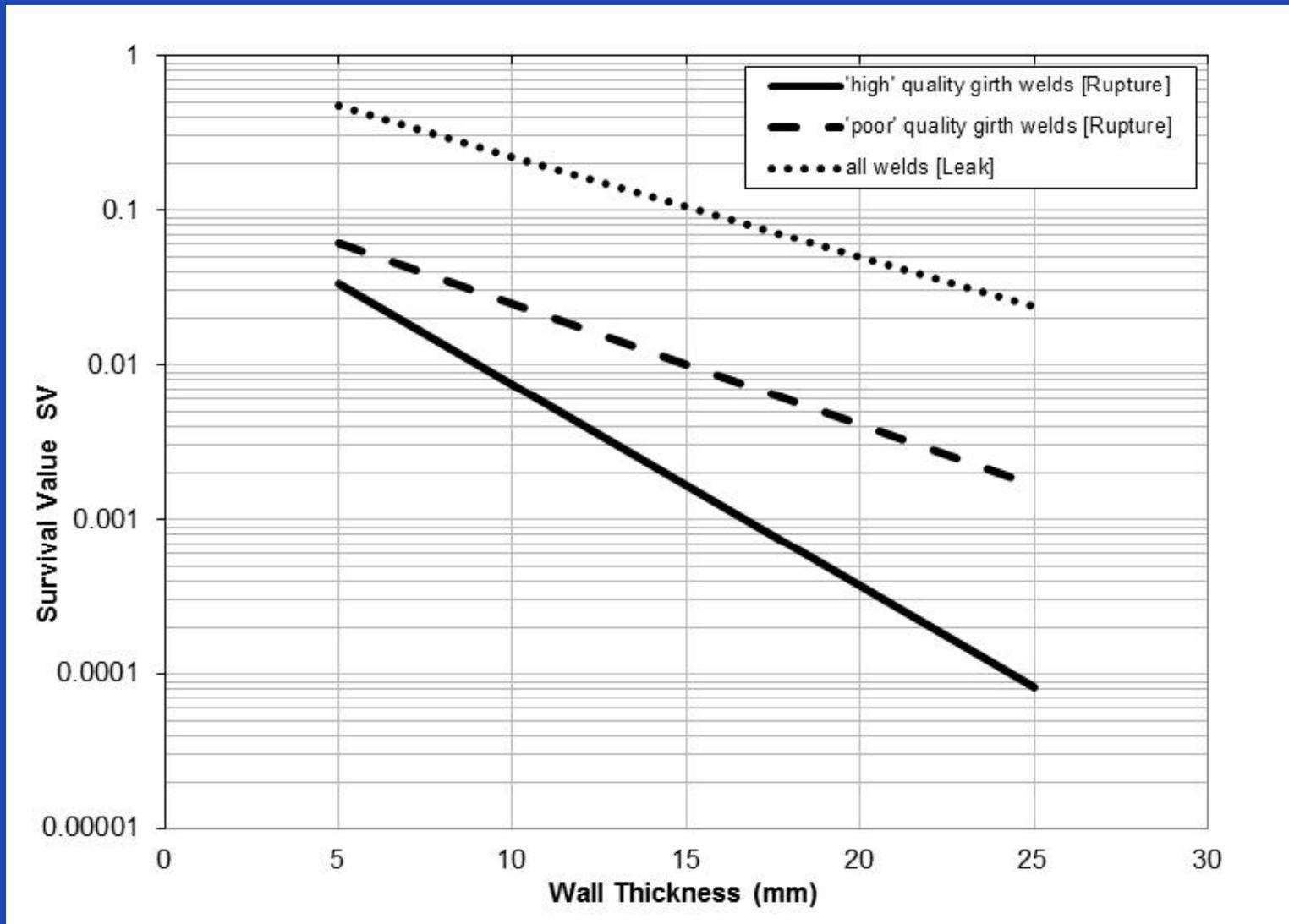
'high' quality welds



'poor' quality welds

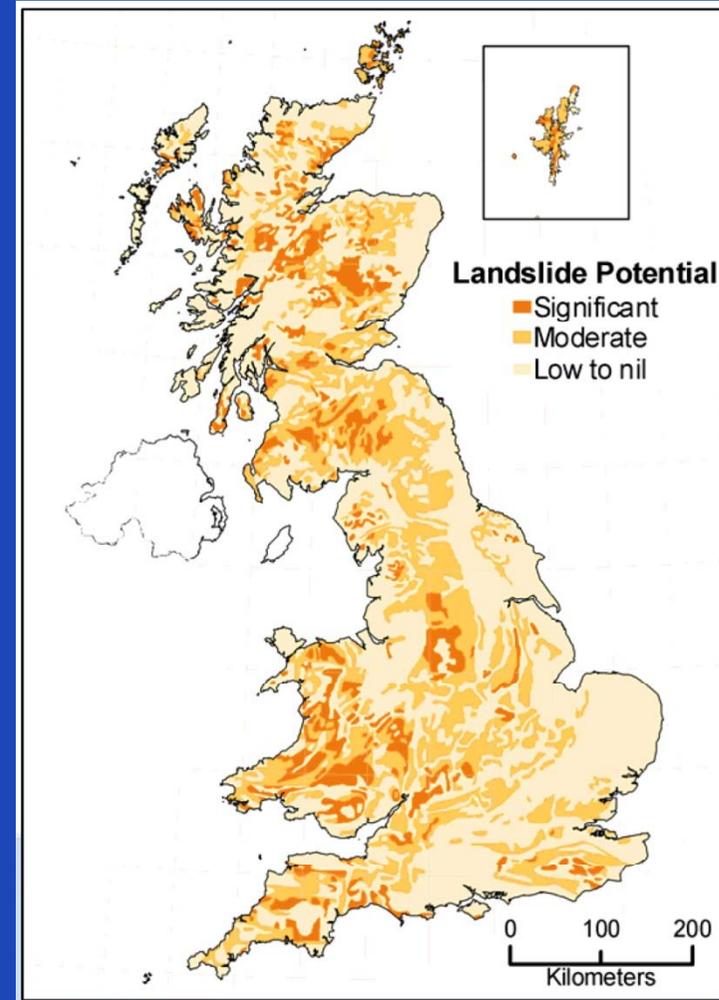


Summary Results



Landslide Incident Rates [LIR]

Landslide Potential	LIR (no per 1000 km yr)
Significant	0.50
Moderate	0.05
Low to nil	0.005
Weighted Average	0.02



Pipeline Failure Rate = LIR x SV

Landslide Susceptibility

Landslide Potential

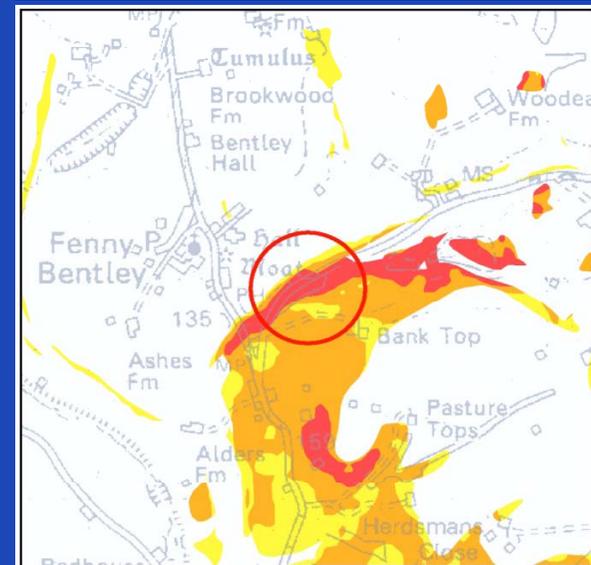
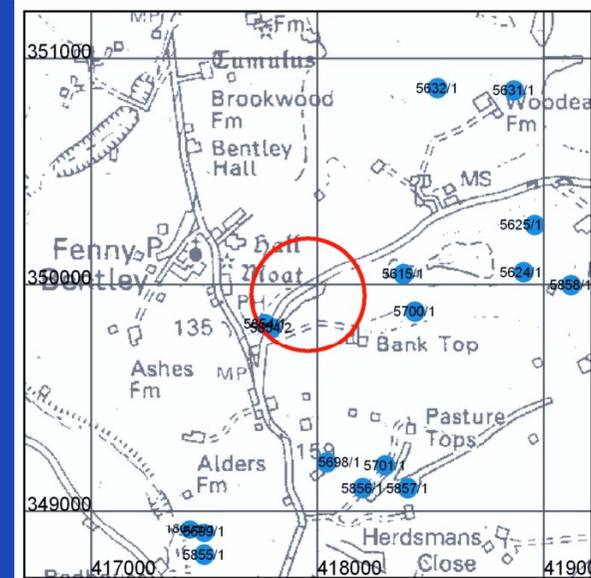
Significant

Moderate

Low to nil

GeoSure 2012

Class	Description
E	Slope instability problems almost certainly present and may be active.
D	Slope instability problems are probably present or have occurred in the past.
C	Slope instability problems may be present or anticipated.
B	Slope instability problems are not likely to occur but consideration to potential problems of adjacent areas impacting on the site should always be considered.
A	Slope instability problems are not thought to occur but consideration to potential problems of adjacent areas impacting on the site should always be considered.



Extract from BGS Landslide GeoReport