UKOPA Dent Management Strategy - Update February 2013

UKOPA/13/017

Conclusions presented and agreed – October 2012

- The UKOPA recommended size limits for dents plus corrosion are confirmed as dent depth of 6%OD dents with corrosion up to 20%t in depth in pipelines operating up to 72% SMYS
- UKOPA recommends use of the GLND dent fatigue methodology
- Fatigue calculations, to be specified for UKOPA member pipelines, are to be carried out using the GLND methodology and included in the dent management strategy
- A study on extending the dent size limits associated with welds of unknown quality is to be actioned

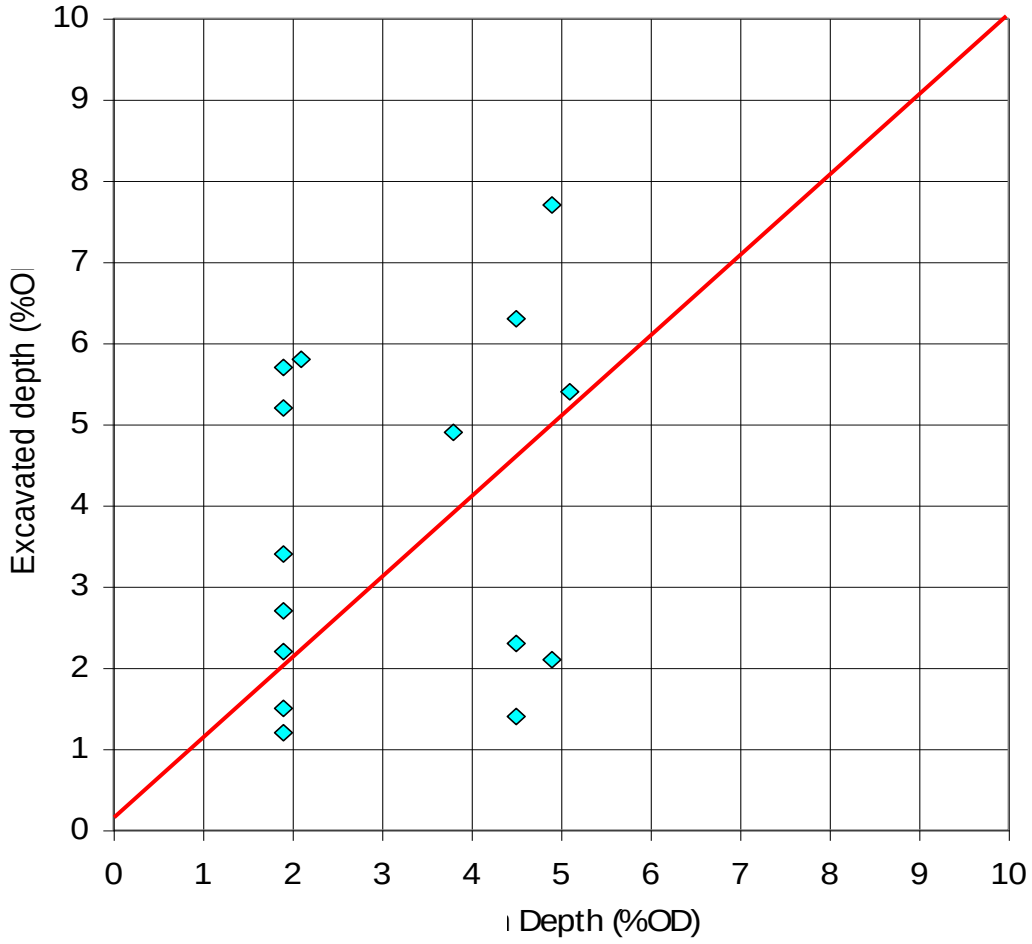
RAWG Discussions

- Dent management work was discussed by RAWG at the December meeting
- It was agreed that Penspen would be requested to provide a proposal for the study on the size limits for dents associated with weld of unknown quality, and incorporate the results be in PDAM
- R McConnell noted that the number of dent damage reports received for input to the UKOPA database had increased significantly
- RAWG agreed that further analysis of dent damage data is required

Dent Damage Data

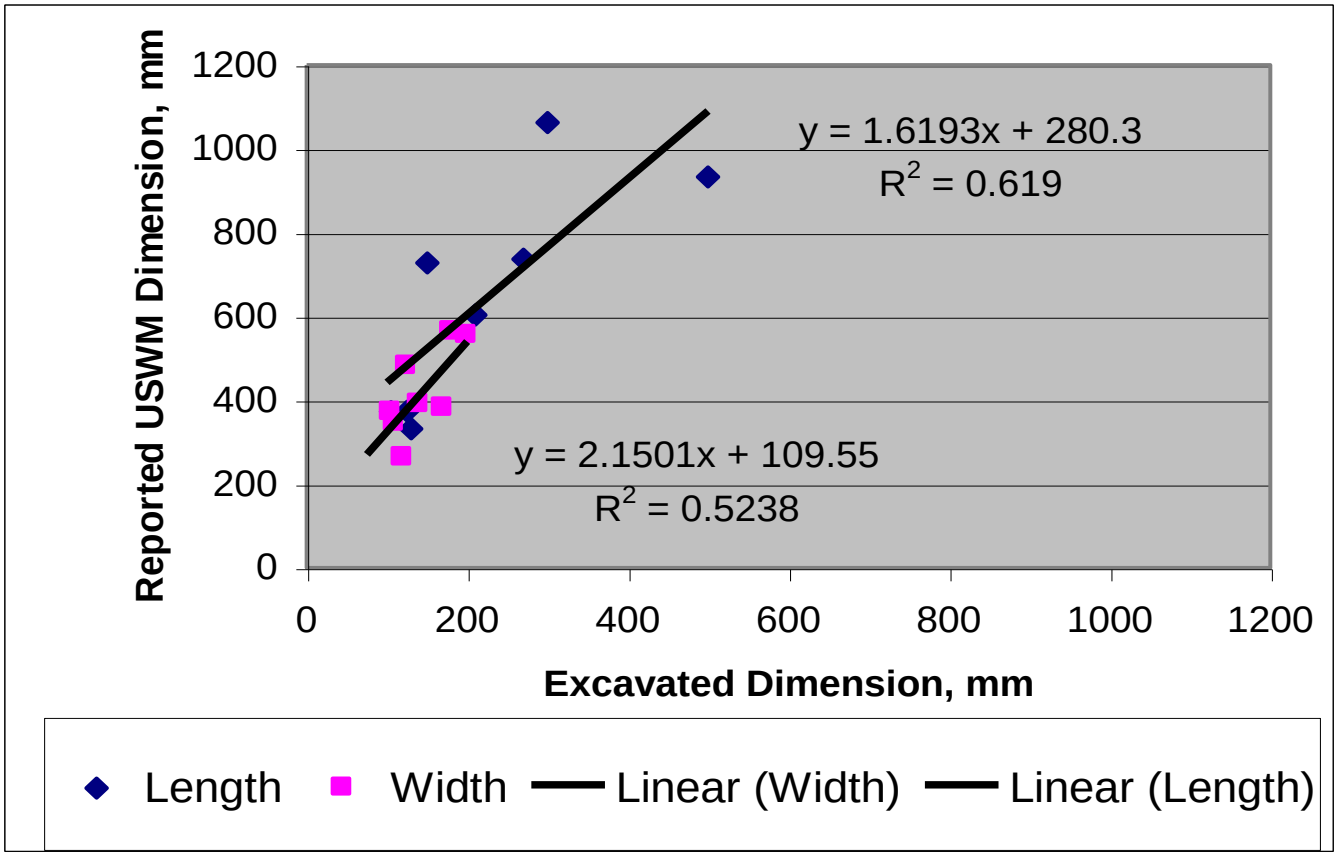
- The GLND FEA studies have indicated the dent depth at zero pressure (H_o) is a factor of 1.43 greater than the dent depth at pressure (H_r) for D/t = 64, and a factor 1.1 greater for D/t = 34
- The SCF used in fatigue calculations is based on either H_o or H_r
- Dent depth measured by ILI may be H_o (if dent is constrained) or H_r (if dent is unconstrained)
- Dent depth measured by ILI has been compared with depth measured in field investigations using data supplied by UKOPA members as part of the dent management work

Data set 1, 1 pipeline, dent depth



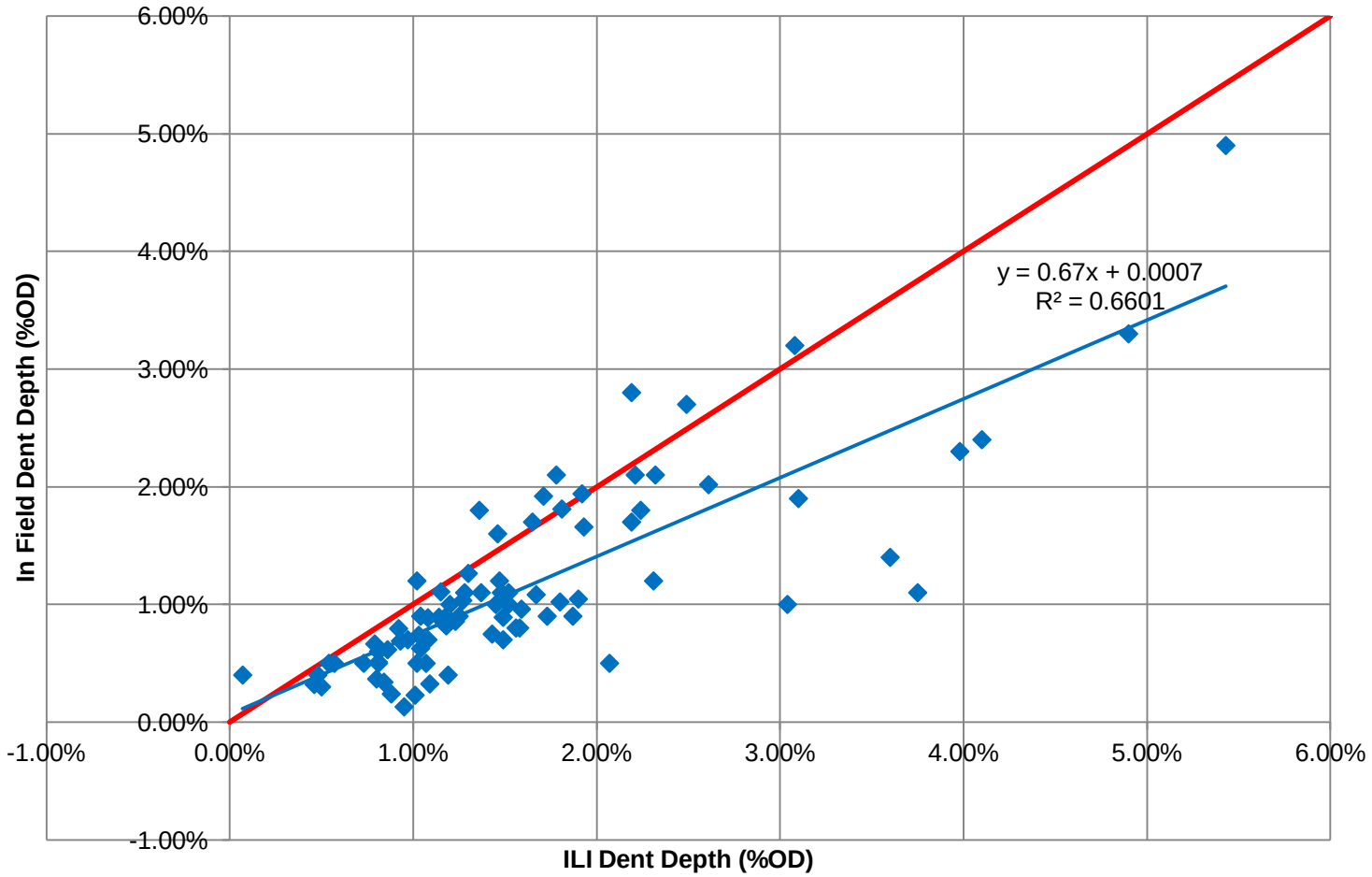
Conclusion - Poor correlation between Calipper results & field measurements

Data set 1, 1 pipeline, dent width and length



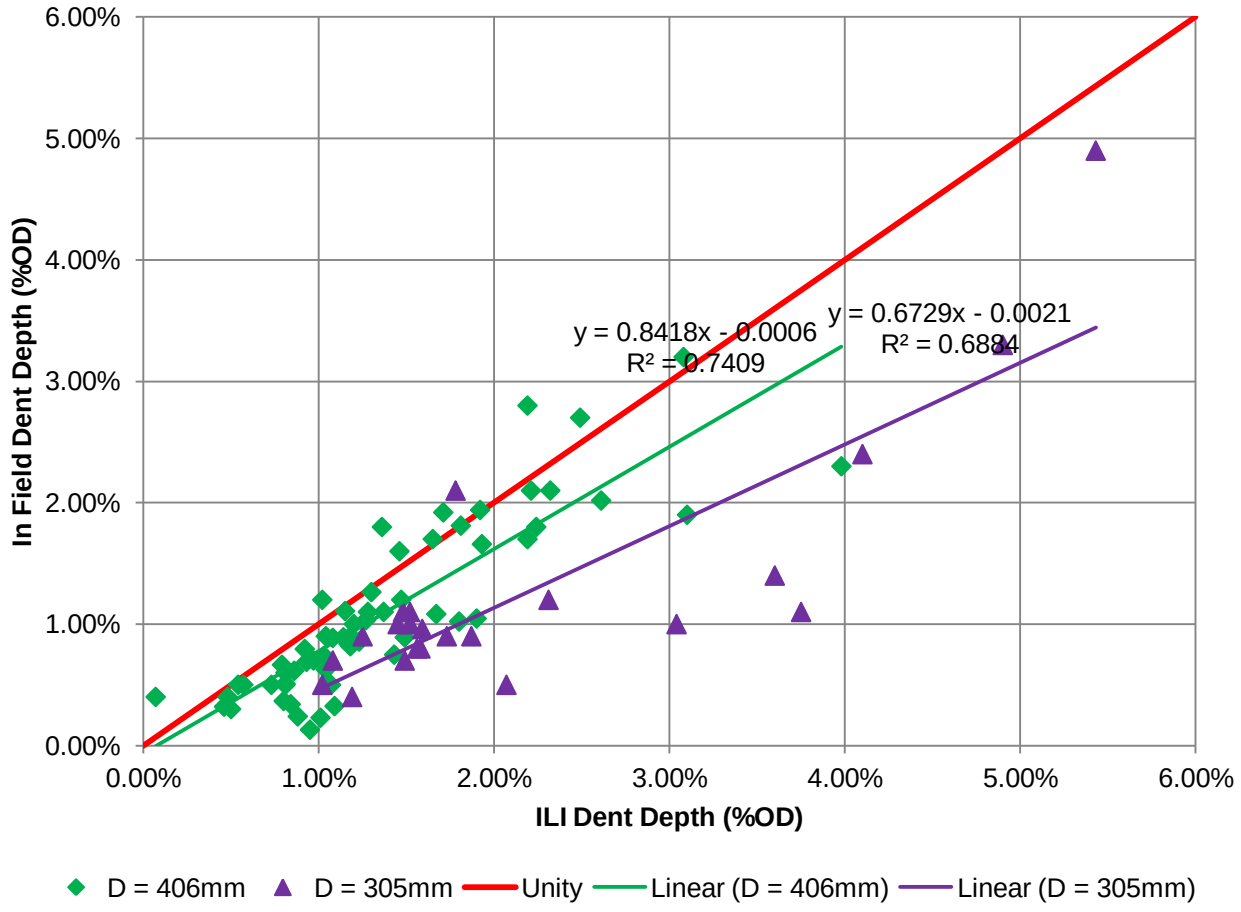
Conclusion - Factor of > 2 between ILI predicted and field measured dent dimensions

Data set 2, 2 pipelines, dent depth



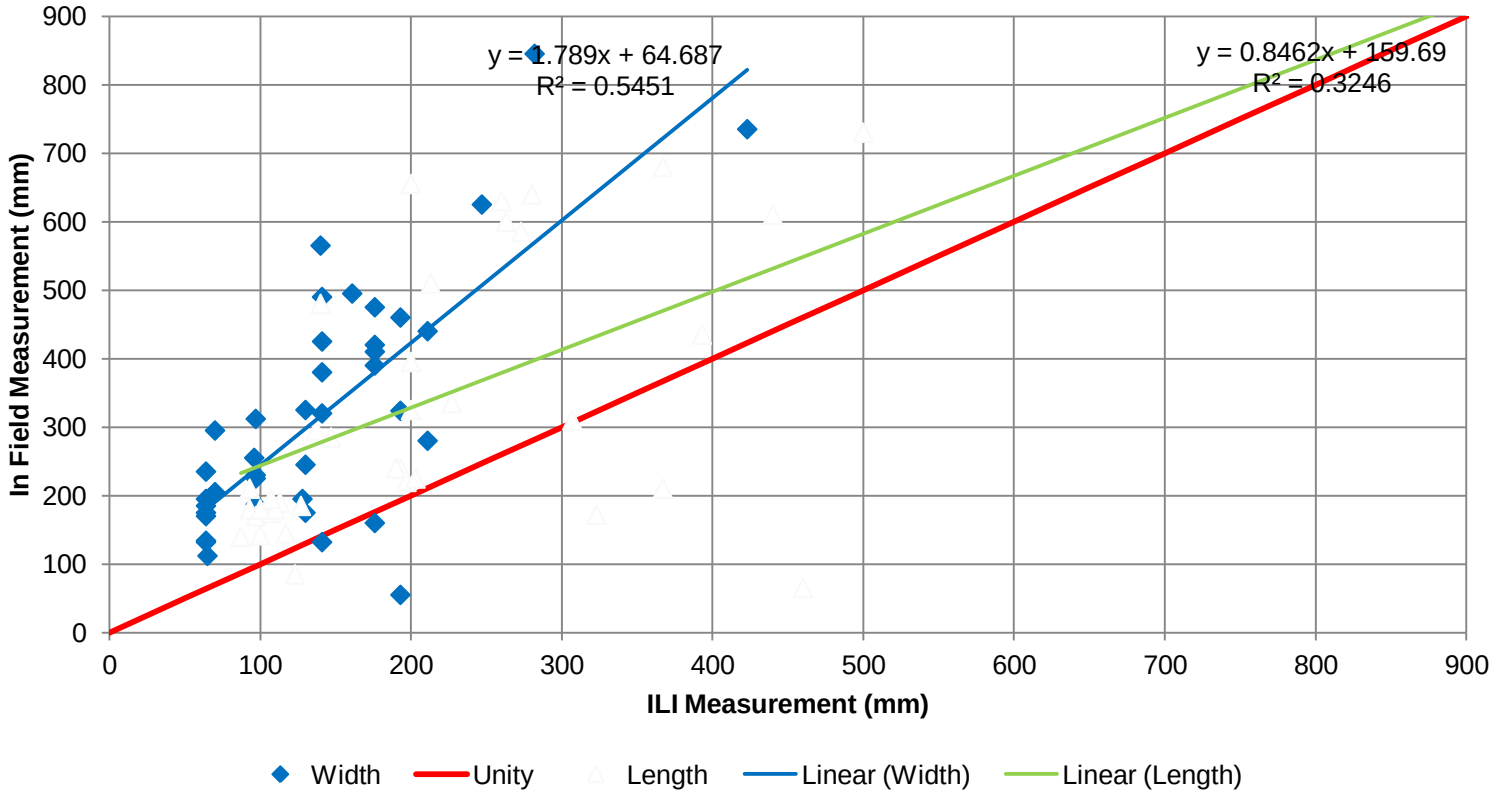
ILI measurement 1.43 x field measurement

Data set 2, 2 pipelines, dent depth



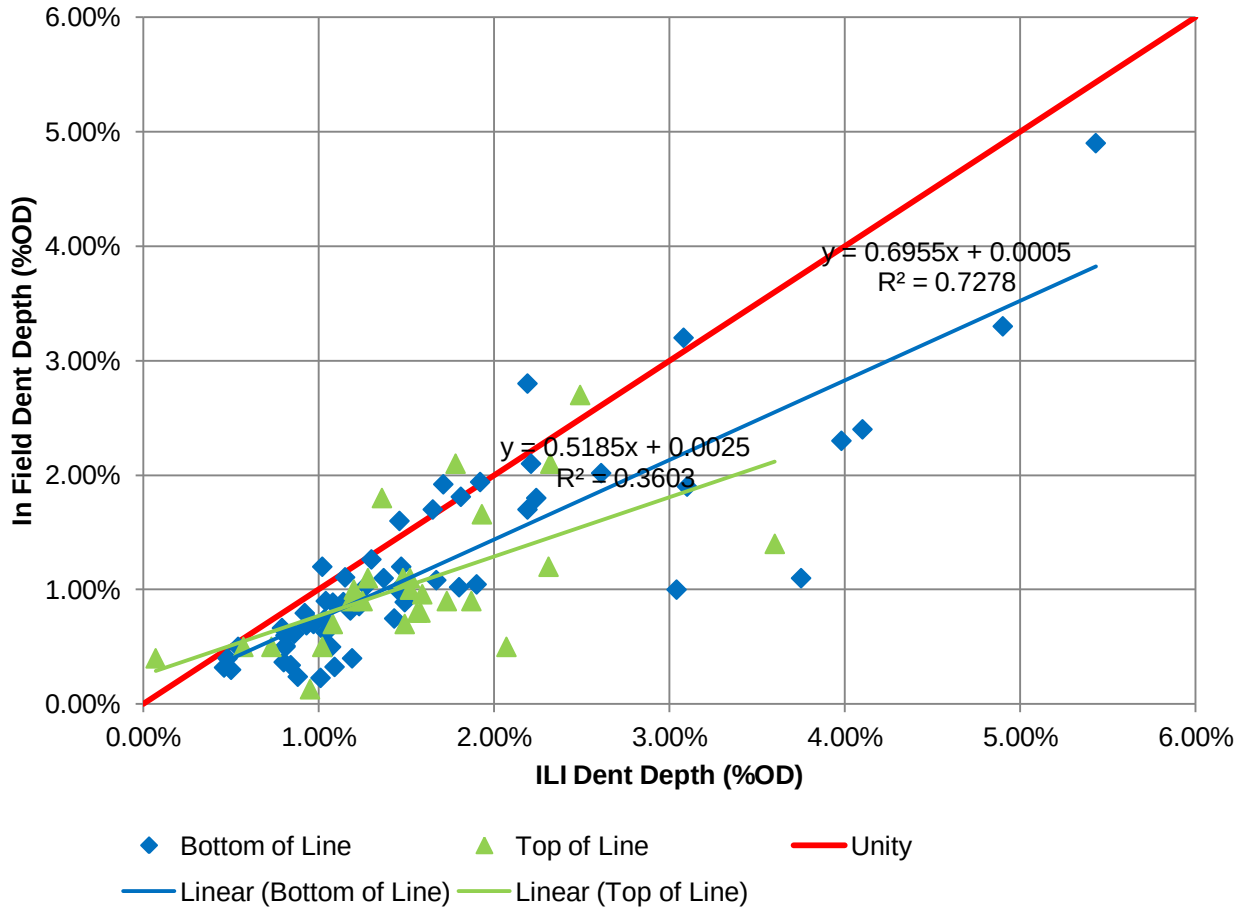
ILI oversizing varies with diameter

Data set 2, 2 pipelines, dent width and length



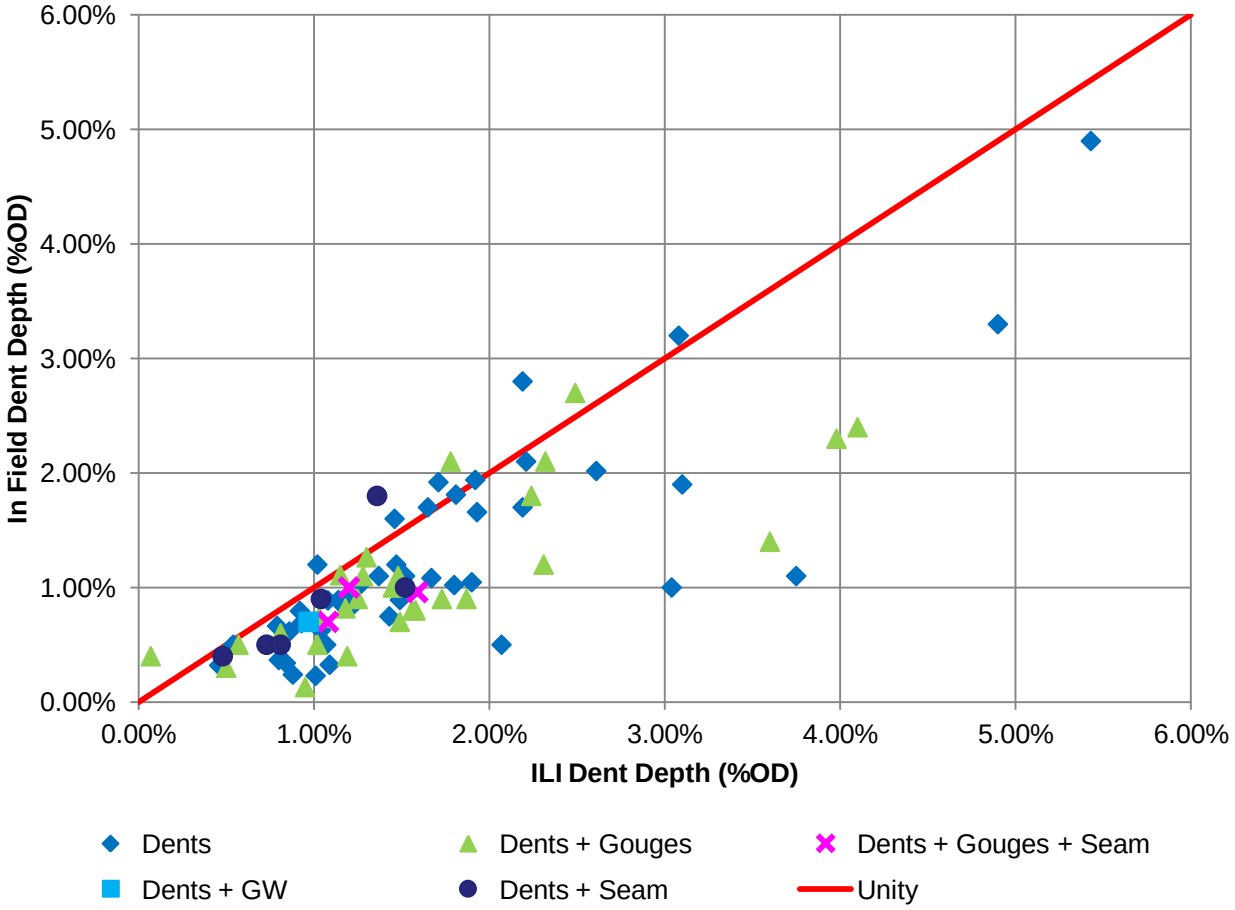
ILI measurement for width is 0.5 x field measurement
ILI measurement for length is 0.75 x field measurement

Data set 2, dent depth and location



No significant discrimination in dent depth sizing

Data set 2, Dent depth + other features



Majority of ToL dents have associated metal loss features

Dent Damage Data - Summary

- 2 sets of detailed dent damage data provided by UKOPA members for 3 pipelines has been analysed
- The results indicate that ILI measurements overestimate depth and underestimate width and length
- ILI measurements are recorded under operational pressure, whereas field measurements are recorded at reduced pressure, so field measurements would be expected to be greater
- The accuracy of dent size inspection data impacts on establishing the maximum acceptable dent parameters
- The majority of dent depths are ≤ 5% OD
- A significant proportion of top of line dents had associated metal loss damage (gouges)

Dent Damage Data – Current Database

Field Measurements Only

Product	Dents
Natural Gas	277
Ethylene	27
Spiked Crude	9
NGL	1
CO	1
	315

Cause of Dent	Number	%
External Interference	109	34.6%
Original Construction Damage	108	34.3%
External Corrosion	10	3.2%
Girth Weld Defect	13	4.1%
Ground Movement	12	3.8%
Pipe Mill Damage	8	2.5%
Pipe Defect	3	1.0%
Other / Unknown	52	16.5%
TOTAL	**315**	**100.0%**

Depth / Diameter Ratio	Number
Greater than 10%	19
Greater than 5%	42
Greater than 1%	134
Greater than 0.5%	187
Greater than 1%	250

Dent Damage Data – Future Data

Typical ILI Inspection Report Results

Feature identification	Length (mm)	Width (mm)	Comments
Dent	67	64	2.3% ID reduction
Dent	57	57	2% ID reduction
Dent with metal loss	104	100	2.4% ID reduction
Dent	324	150	3.7% ID reduction - Multiple dents in Bend
Dent with metal loss	57	164	0.8% ID reduction

Dent Damage Data - Summary

- In order to define a size limit for dents which do not require any further investigation, a better understanding of the accuracy of ILI data is required
- Further data relating ILI and in field measurements is requested
- The UKOPA fault database currently includes field measured damage data only, ILI data for the damage is needed in addition
- It is recommended this additional data is requested by and provided to R McConnell for inclusion in the UKOPA database