ARMO ROTMOULDING CONFERENCE
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CREEP - A HIDDEN KILLER, HOW TO PROTECT YOUR DESIGNS

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PROJECT BACKGROUND

- On-going R&D project on stiff materials: creep resistance was a major driver
- Limited open-source data on PE rotogrades
- PE suppliers very reluctant to share creep data
- Temperature-controlled chamber was available from previous project
- Built multiple creep rigs
- Initially concentrated on PE grades as a baseline

CREEP BACKGROUND

- Creep: continuous deformation over time at relatively low stress levels
- Materials with a predominant amorphous phase are very prone to creep
- PE has very poor creep resistance
- Temperature has significant effect
- Creep testing takes a LONG time
- Potential to extrapolate results is limited

CREEP BACKGROUND

Hours	Days	Years
100	4	
1,000	42	
10,000	417	1
100,000	4,167	11
1,000,000	41,667	114

EXPERIMENTAL

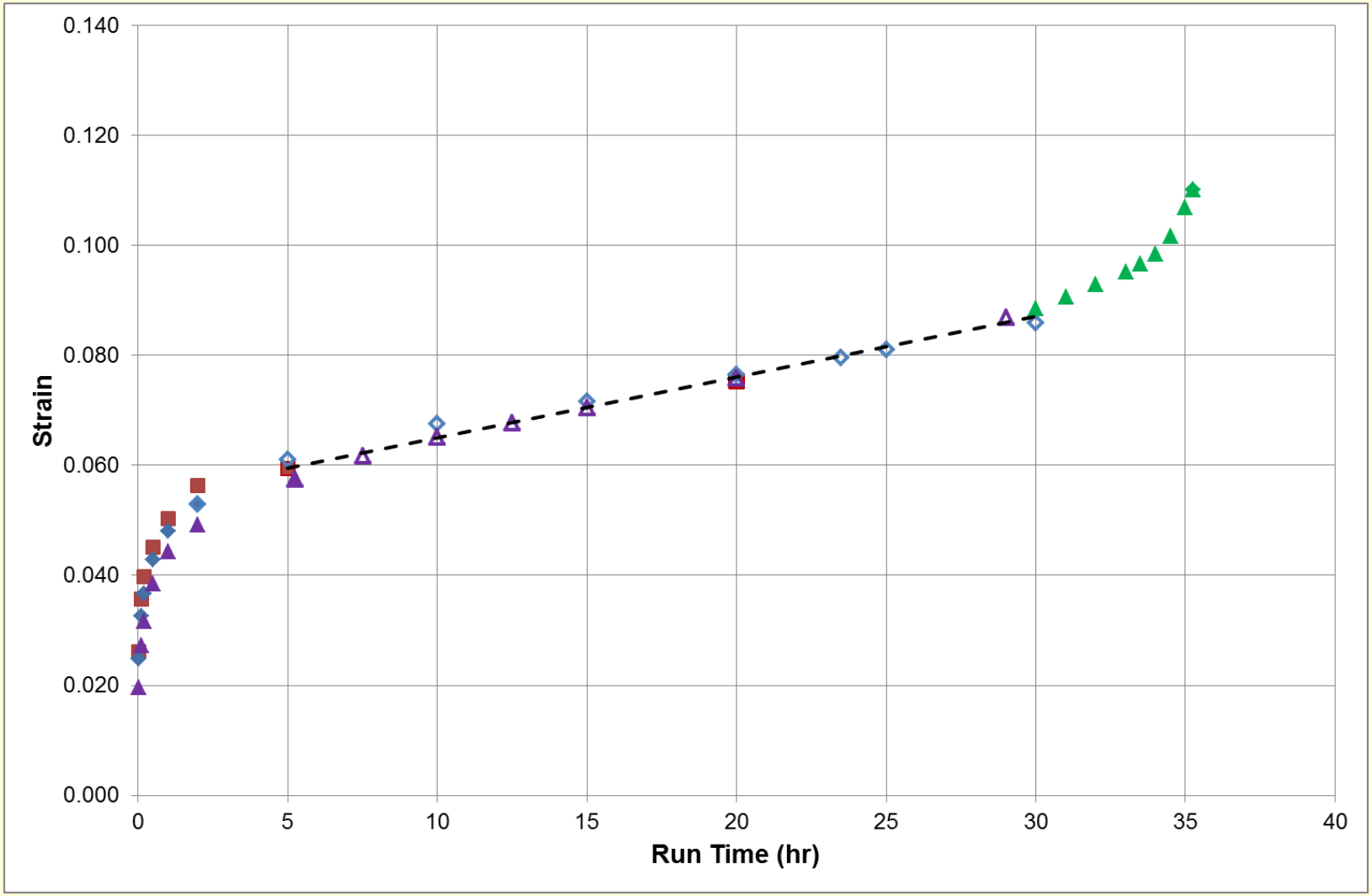
- Method: apply WEIGHT … and … WAIT!
- Used ASTM procedure: conformed to specified measurement times
- Bending test preferred to tensile
- Ambient test temperatures of 23 & 40ºC
- Multiple rigs (4 stresses/ 3 repeats)
- Measurement by simple dial gauges
- Precautions against vibration effects

EXPERIMENTAL

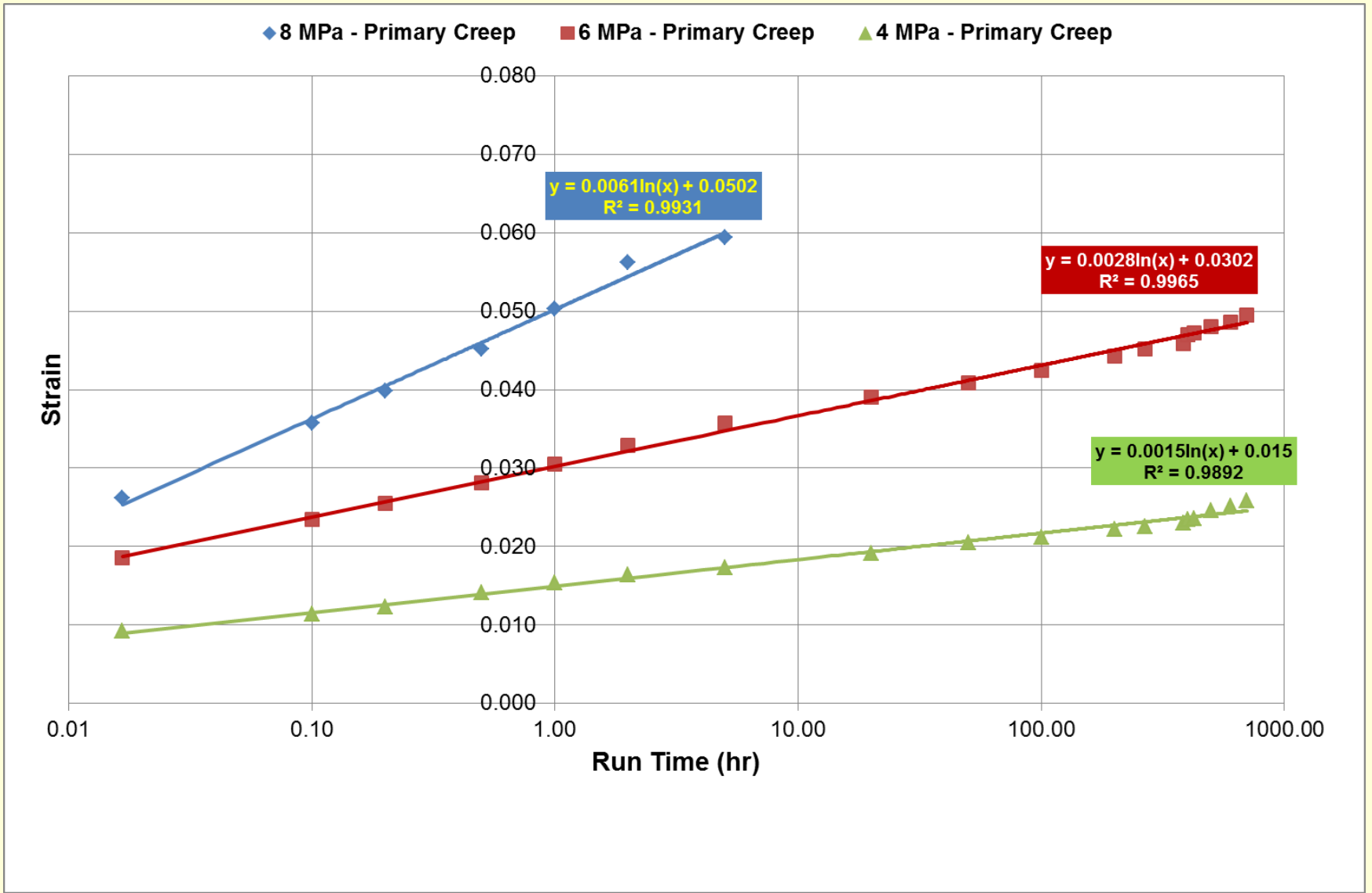
EXPERIMENTAL

- Applied weight is constant throughout test
- Convert applied weight to maximum bending stress at mid-span
- Deflection is measured and varies throughout test
- Convert measured deflection to strain
- Plot strain *vs.* run time
- Repeat test with different applied weight

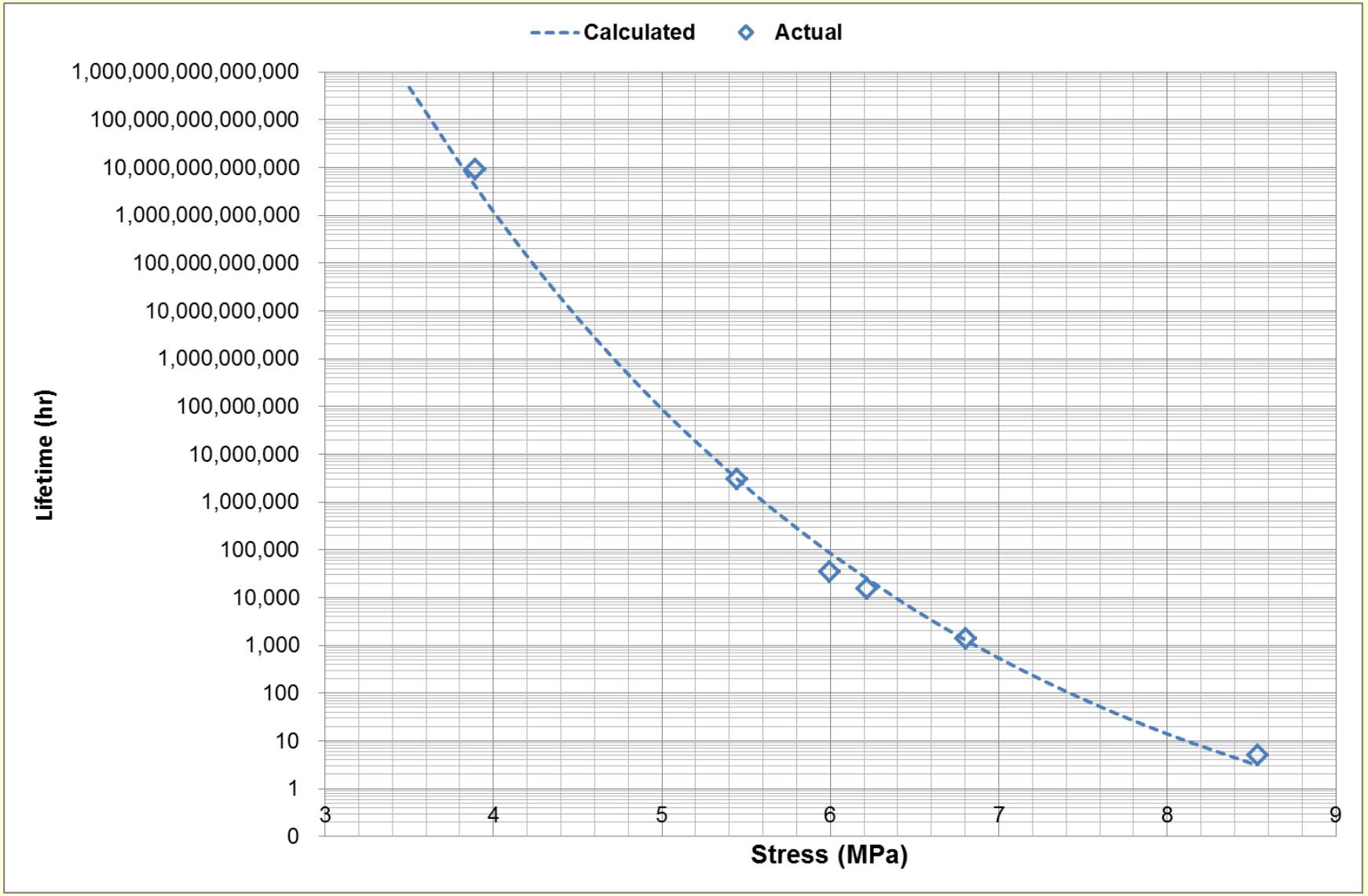
RESULTS – LMDPE – 8 MPa



RESULTS – LMDPE – Various Stresses



LIFETIME PREDICTIONS



CONCLUSIONS

- Creep testing is simple but lengthy
- Data on Primary Creep is reproducible
- Identifying critical strain for onset of Secondary Creep gives a basis for lifetime calculations
- Identify maximum stress to keep below critical strain level (eg 6%) over lifetime of product
- Testing at higher temperature can identify onset of Secondary Creep for lower stress levels
- On-going project: LOOKING FOR PARTNERS!