

Creep and Creep-Rupture Behavior

of

TMP Uniaxial Geogrids:

GG80PE, GG130PE, GG160PE, and GG200PE

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Submitted to:

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May 14, 2026

Ms. Xunmei Liang

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Subject: Creep Test Results for TMP GG80PE, GG130PE, GG160PE, and GG200PE Geogrids

Dear Ms. Xunmei Liang

TRI/Environmental, Inc. (TRI) is pleased to present this report for creep testing of soil reinforcement geogrids. The products were tested in the machine direction.

INTRODUCTION AND SUMMARY

Objective. The objective of this effort is to document the creep-rupture performance and the associated creep-rupture reduction factor for select TMP uniaxial geogrids including GG80PE, GG130PE, GG160PE, and GG200PE. Featured herein is conventional isothermal creep-rupture testing in accordance with ASTM D 5262. The results apply to machine direction tensile strengths.

Scope. Rapid loading tensile (RLT) as well as, standard and elevated temperature conventional creep tests were conducted. The purpose of RLT tests was to determine the ultimate tensile strengths (UTS) of the products in order to establish the baselines for the creep tests. Together, the standard and elevated temperature conventional creep test results were used to derive a rupture-based creep reduction factor for the family of products.

The testing program is summarized in Table 1.

Table 1. Creep Testing Matrix (%UTS)

Test	GG80PE	GG130PE	GG160PE	GG200PE
RLT	1	1	1	1
Conventional Creep via ASTM D 5262	50%UTS@40°C 55%UTS @30°C 60%UTS @20°C 65%UTS @20°C	1-50%UTS @40°C 2-55%UTS @30°C 2-50%UTS @20°C 1-60%UTS @20°C 1-65%UTS @20°C	2-50%UTS@40°C 2-55%UTS@30°C 1-60%UTS@30°C 1-65%UTS@30°C 1-55%UTS@20°C 1-60%UTS@20°C 1-65%UTS@20°C	50%UTS @40°C 55%UTS @30°C 60%UTS @20°C 65%UTS @20°C

Summary. The creep rupture results are included in Table 2 and Figure 1.

Table 2. Summary of Creep-Rupture Results for the TMP Geogrid Family

Ref. Temp. of Regression Line	Regression Equation	Retained Strength (%)		Reduction Factor	
		75 Years (log 5.8179 hrs)	114 Years (log 6.0 hrs)	75 Years	114 Years
20°C	%UTS = -6.189 log hrs + 76.94	40.93	39.81	2.44	2.51

MATERIALS AND METHODS

Materials. The products described herein are oriented high density polyethylene geogrids.

Equipment

Testing platforms: TRI model DL PE dead weight creep frames.

Environmental chamber: TRI Model CIPE - conventional isothermal HDPE chamber.

Grips: TRI Model UPE-8", Uniaxial HDPE grips.

Extensometer: Steel Rule.

Temperature controller: Fuji Electric PXR-3 and Delta DTB-1824 temperature controllers.

Heating/cooling- Electrical/HVAC.

Procedures

Conventional: Testing was conducted using multi-rib specimens of all geogrids. Each specimen was allowed to reach equilibrium at the prescribed temperatures prior to test initiation. Specimens were then ramped to the specified percentage %UTS and then held at that load until failure. Strain was measured between two transverse ribs using steel rules.

RESULTS

RLT Results

RLT tests were in accordance with ASTM D 6637 Method B to establish the baseline tensile strength of the specific product being tested and are reported in the Appendix.

Creep-Rupture

Table 2, presented earlier, summarizes the long-term creep-rupture regression line intercept results shown below. The details of the creep-rupture results, at a reference temperature of 20C, are provided in graphic form in Figure 1. The creep rupture behavior as defined by the regression line is determined in accordance with recognized and accepted creep test methods. The "visual/graphical approach" of block shifting as described in WSDOT Standard Practice , T925, Appendix B was used to determine the best fit shift factors of 'x10' for 30°C and 'x100' for 40C for the TMP geogrid product line relative to the baseline temperature of 20C. See Figures 2 and 3 for the before and after time shift plots for the TMP geogrid product line.

TMP UNIAXIAL GEOGRIDS - COMPOSITE CREEP RUPTURE CURVE

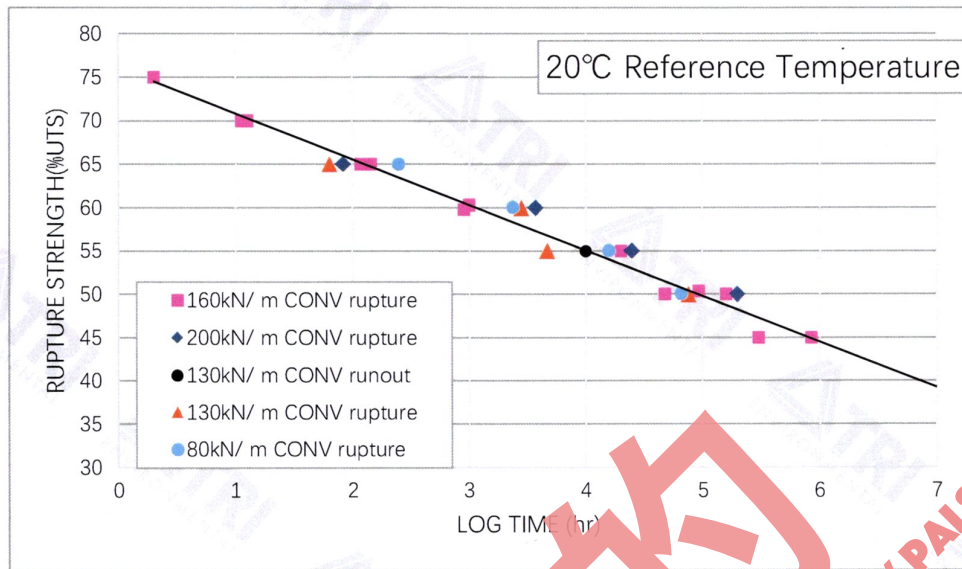


Figure 1. TMP Uniaxial Geogrid Family Creep Rupture Curve.

**TMP UNIAXIAL GEOGRIDS
ACTUAL CREEP RUPTURE DATA & ASSOCIATED REGRESSIONS**

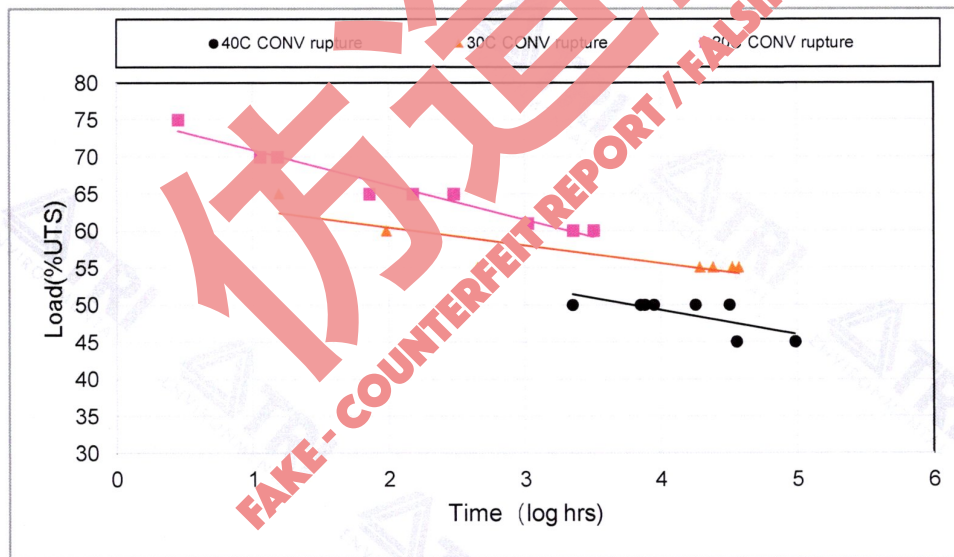
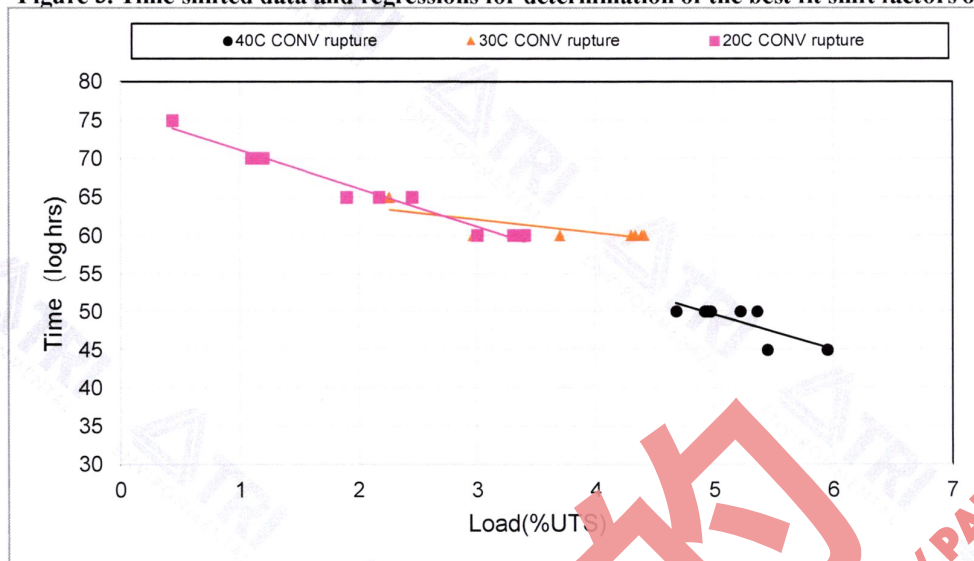


Figure 2. Actual time to rupture data and regressions for determination of the best fit shift factors of 'x10' for 30°C and 'x100' for 40°C for the TMP Uniaxial Geogrid productline.

**TMP UNIAXIAL GEOGRIDS
TIME SHIFTED CREEP RUPTURE DATA & ASSOCIATED REGRESSIONS**



Figure 3. Time shifted data and regressions for determination of the best fit shift factors of



'x10' for 30C and 'x100' for 40C for the TMP Uniaxial Geogrid product line

CONCLUSIONS AND RECOMMENDATIONS

Creep reduction factors have been determined for the family of products tested using creep testing in general accordance with recognized and accepted geosynthetic testing procedures. These reduction factors are reasonably consistent with previously reported rupture-based reduction factors for high density polyethylene geogrids and representative of the TMP geogrid product line.

