CREEP BEHAVIOUR FOR PRESTRESSED GEOPOLYMERIC MICROCONCRETE SLEEPERS

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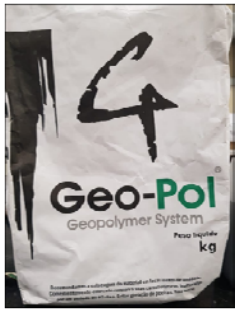
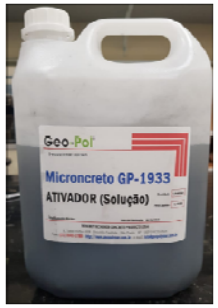
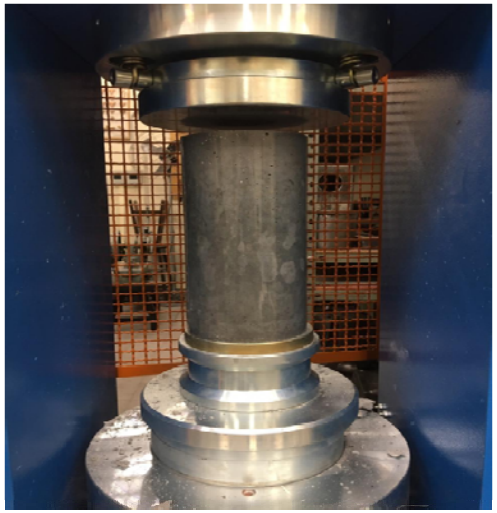
COMPRESSIVE STRENGTH FOR MK750-BASED GEOPOLYMER MICROCONCRETE







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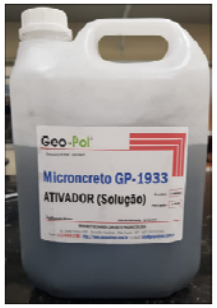
ELASTICITY MODULUS AND POISSON RATIO FOR MK750-BASED GEOPOLYMER MICROCONCRETE



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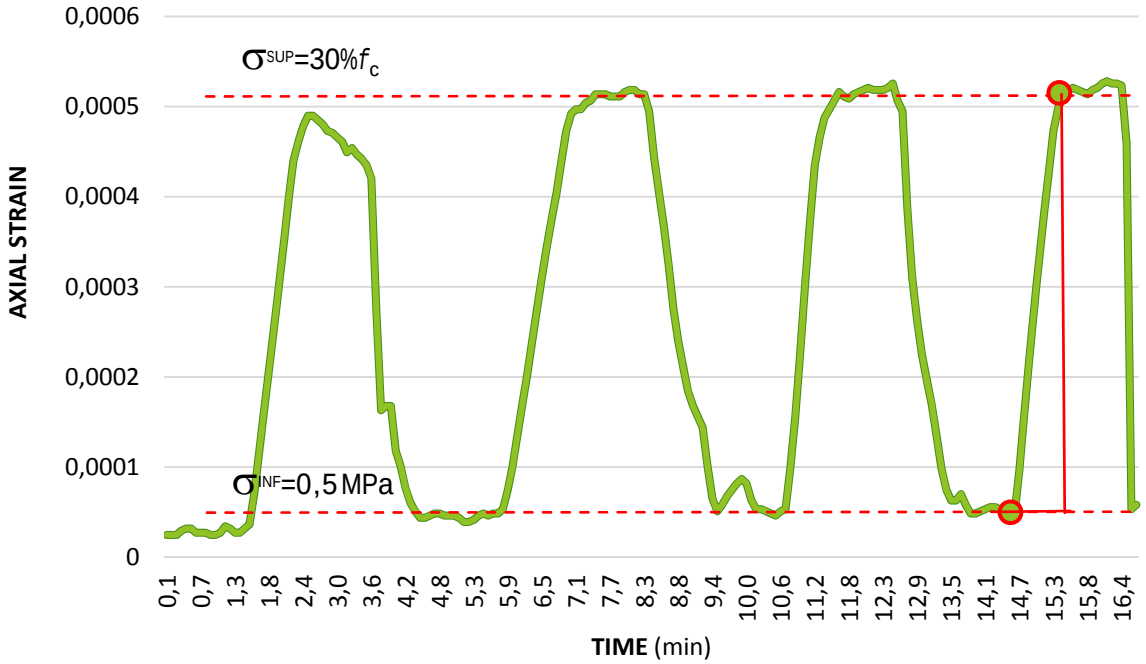
ELASTICITY MODULUS FOR MK750-BASED GEOPOLYMER MICROCONCRETE*



ELASTICITY MODULUS E=41.75 GPa

*According to Brazilian Standard NBR 8522 (ABNT, 2017)

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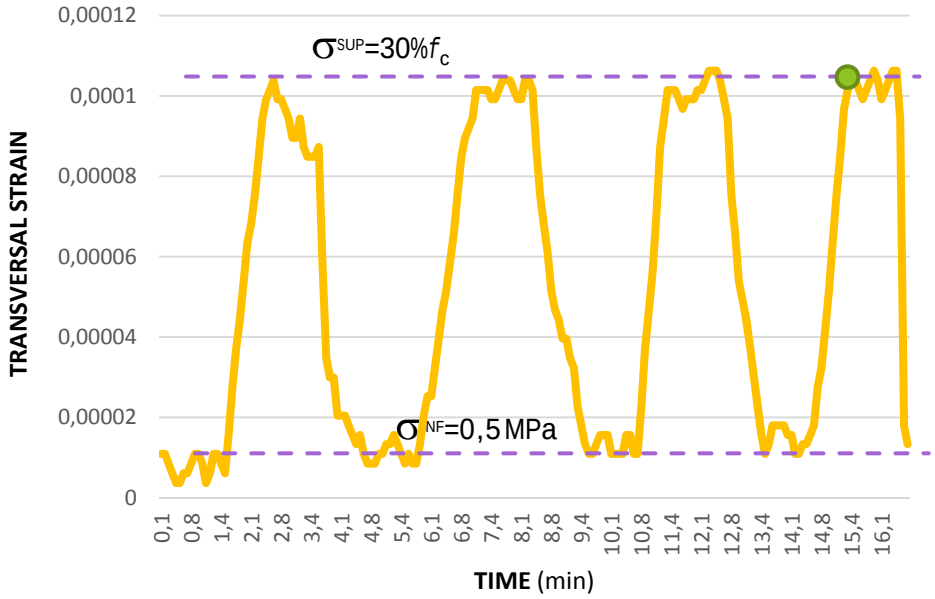
POISSON RATIO FOR MK750-BASED GEOPOLYMER MICROCONCRETE*



POISSON RATIO ν=0.18

*According to Brazilian Standard NBR 8522 (ABNT, 2017)

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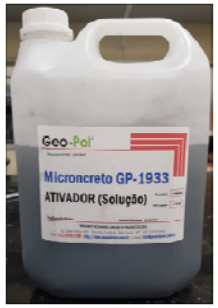
CREEP TEST FOR MK750-BASED GEOPOLYMER MICROCONCRETE



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LONG-TERM COMPRESSIVE CREEP DEFORMATION FOR GEOPOLYMER MICROCONCRETE

- CREEP CURVE TO ESTIMATE THE PRESTRESSING LOSSES ON RAILWAY SLEEPERS FOR EFFICIENT PRESTRESS DESIGN.
- THE CREEP TEST FOR A SPECIMEN LOADED AT 3 DAYS UNDER CONSTANT STRESS OF 0.4 f_C, WHERE f_C IS A 3-DAY COMPRESSIVE STRENGTH, WAS MONITORED FOR UP TO 1000 HOURS AT AMBIENT CONDITIONS.
- VALUES OF CREEP COEFFICIENT OF GEOPOLYMER MICROCONCRETE OBTAINED ARE 50% LOWER THAN CORRESPONDING ORDINARY PORTLAND CEMENT-BASED CONCRETE.

*According to Brazilian Standard NBR 8224 (ABNT, 2012)

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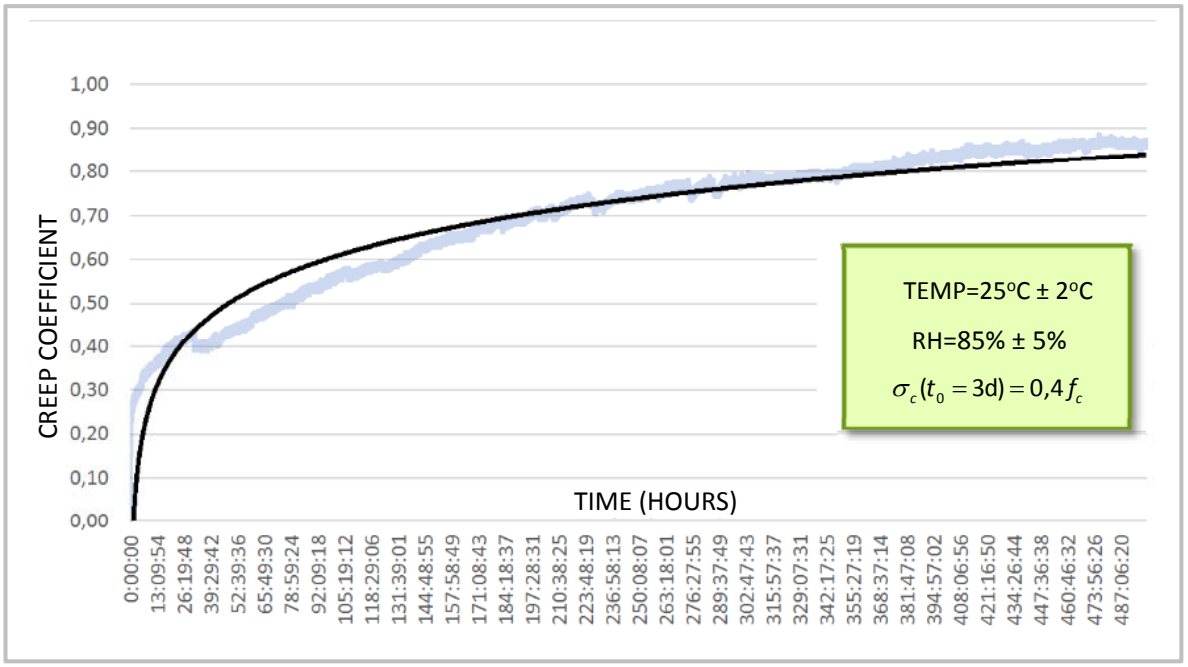
LONG-TERM COMPRESSIVE CREEP DEFORMATION FOR GEOPOLYMER MICROCONCRETE



CREEP COEFF. $\phi \approx 1.00$ @1000 hours

*According to Brazilian Standard NBR 8224 (ABNT, 2012)

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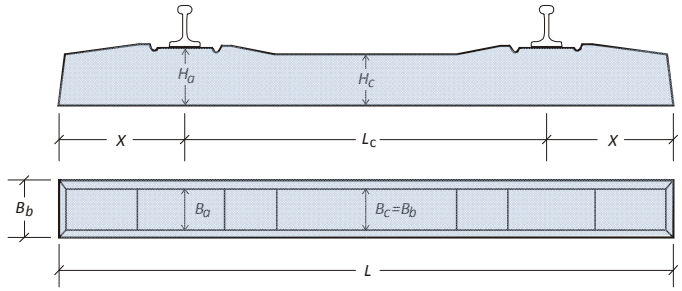
GEOMETRIC AND PHYSICAL CHARACTERISTICS OF THE MODEL AND THE PROTOTYPE MONOBLOCK SLEEPERS

MATERIALS ORDINARY PORTLAND CEMENT CONCRETE (C-50): f_{ck} = 50 MPa, E=40 GPa MK750-BASED GEOPOLYMER MICROCONCRETE (equivalent grade C-50): f_{ck} = 50 MPa, E=40 GPa STEEL STRAND FOR PRESTRESSED CONCRETE (CP190RB): f^{Y} = 1900 MPa, E=200 GPa	**DIMENSIONS** (SCALE FACTOR 1:3,7)	
	PROTOTYPE	**MODEL**
LENGTH *L*	2800 mm	750 mm
HIGHER HEIGHT (RAIL SUPPORT) *H*a	272 mm	72 mm
LOWER HEIGHT (MIDDLE SPAN) *H*c	216 mm	58 mm
BASE WIDTH *B*b	270 mm	70 mm
SPAN *L*c	1675 mm	450 mm
CANTILEVER SPAN *X*	562 mm	150 mm



*According to Brazilian Standard NBR 11709 (ABNT, 2015)

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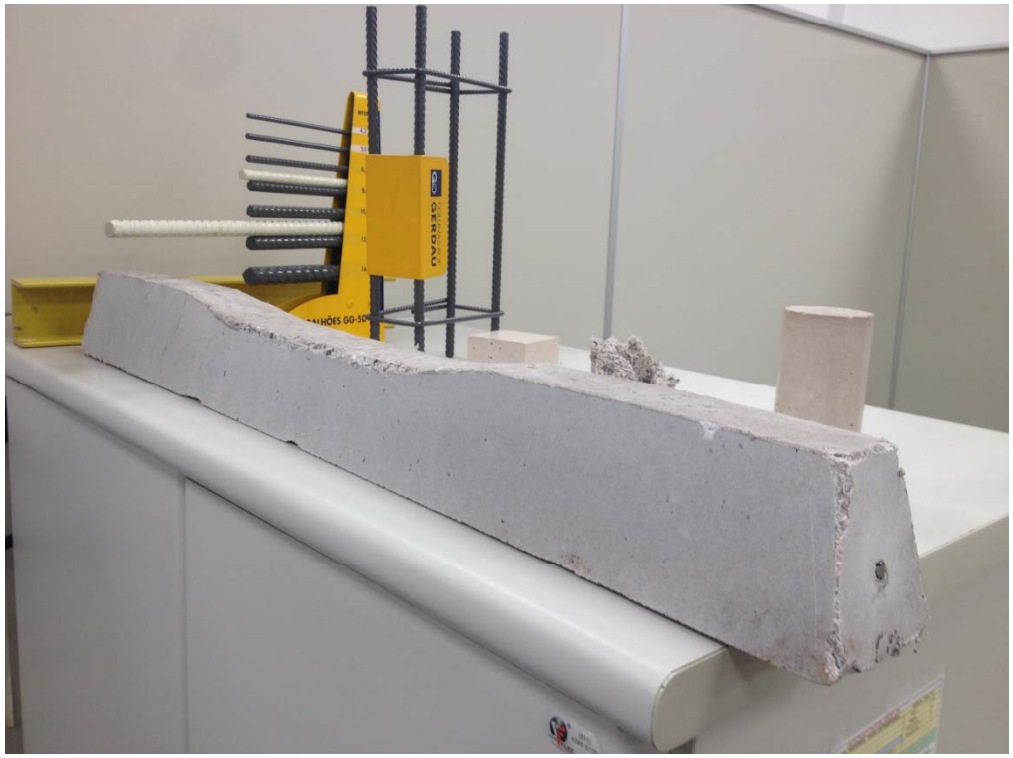
GEOPOLYMER MICROCONCRETE SLEEPERS



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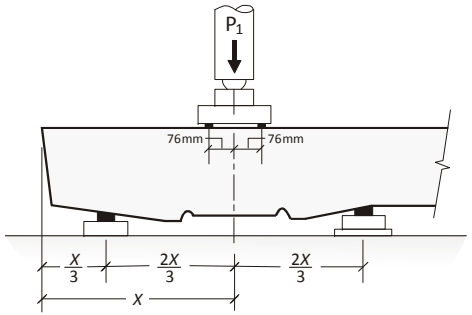
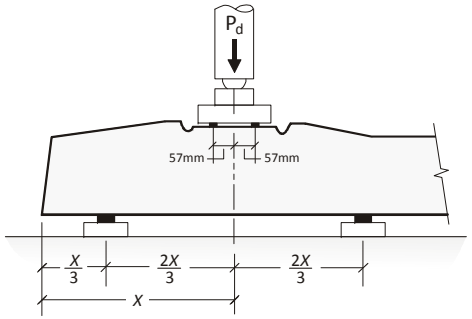
MONOBLOC SLEEPER APPROVAL TESTS FOR STATIC LOAD

NEGATIVE MOMENT AT RAIL SUPPORT



POSITIVE MOMENT AT RAIL SUPPORT



*According to Brazilian Standard NBR 11709 (ABNT, 2015)

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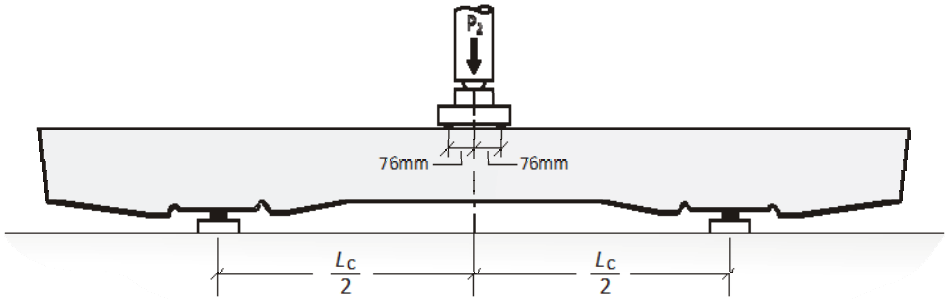
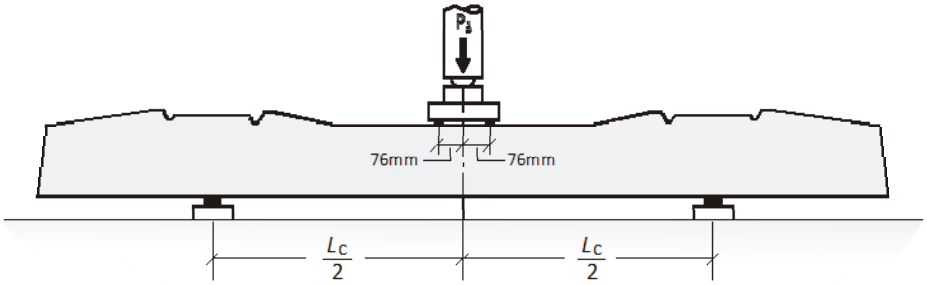
MONOBLOC SLEEPER APPROVAL TESTS FOR STATIC LOAD

NEGATIVE MOMENT AT MID-SPAN



POSITIVE MOMENT AT MID-SPAN



*According to Brazilian Standard NBR 11709 (ABNT, 2015)

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MONOBLOC SLEEPER APPROVAL TESTS FOR STATIC LOAD

NEGATIVE MOMENT AT MID-SPAN FOR ORDINARY PORTLAND CONCRETE

POSITIVE MOMENT AT MID-SPAN FOR GEOPOLYMERIC MICROCONCRETE

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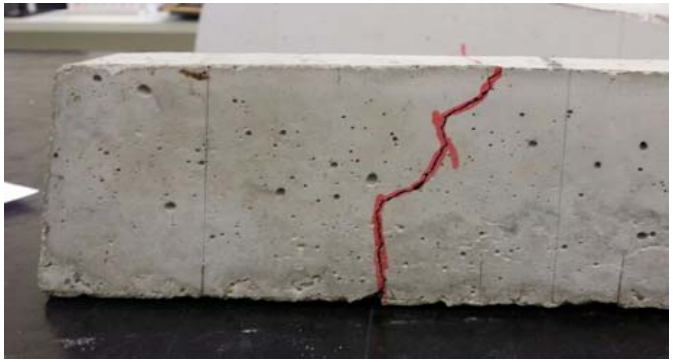
MONOBLOC SLEEPER APPROVAL TESTS FOR DYNAMIC LOAD

SLIPAGE BETWEEN STELL STRAND AND ORDINARY PORTLAND CONCRETE



ULTIMATE POSITIVE MOMENT AT RAIL SUPPORT (FATIGUE TEST) FOR ORDINARY PORTLAND CONCRETE

ULTIMATE POSITIVE MOMENT AT RAIL SUPPORT (FATIGUE TEST) FOR GEOPOLYMER MICROCONCRETE

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MONOBLOC SLEEPER APPROVAL TESTS FOR DYNAMIC LOAD

- MONOBLOC SLEEPER APPROVAL TESTS FOR DINAMIC LOAD TO LOCAL BEHAVIOUR UNTIL THE RUPTURE ACCORDING TO BRAZILIAN STANDARD NBR 11709:2015.
- THE SLIPAGE BETWEEN STEEL STRAND AND ORDINARY PORTLAND CEMENT-BASED CONCRETE TAKEN TO CRACK PROPAGATION UNTIL THE OPPOSITE FACE.
- NO SLIPAGE WAS OBSERVED IN STEEL-GEOPOLYMER MICROCONCRETE INTERFACE PROBABLY DUE TO THE DEVELOPMENT OF ADDITIONAL REACTIONS OCCURRING IN THIS INTERFACE THAT CONTRIBUTE TO A SUPERIOR BEHAVIOUR COMPARATIVELY TO CONVENTIONAL CONCRETE.

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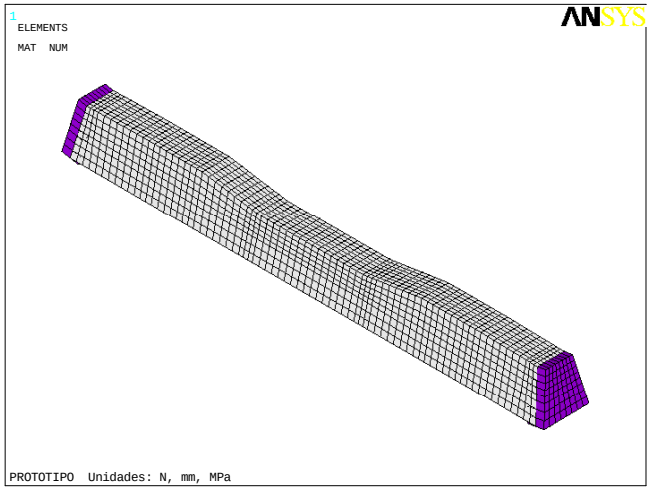
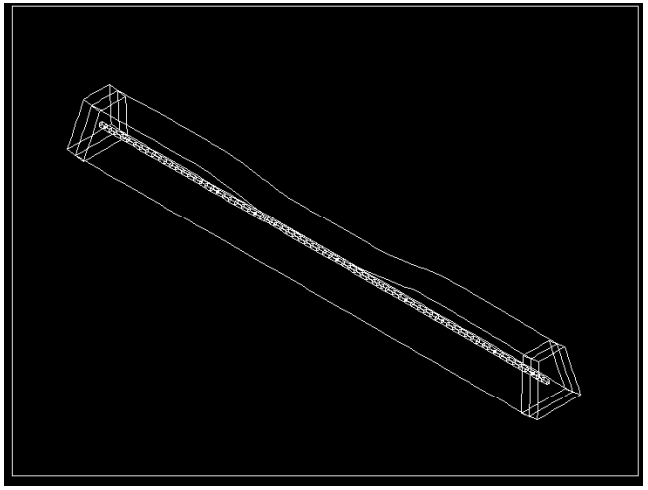
FINITE ELEMENT ANALYSIS TO NUMERIC MODEL RESULTS VALIDATION OF EXPERIMENTAL TESTS



CONCRETE SOLID ELEMENTS AND
ANCHOURAGE SHELL ELEMENTS



PRESTRESS STEEL BAR ELEMENTS
AND CONTACT INTERFACE ELEMENT

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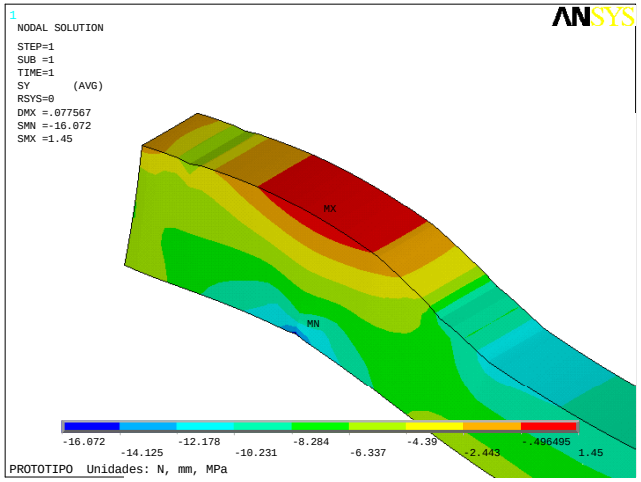
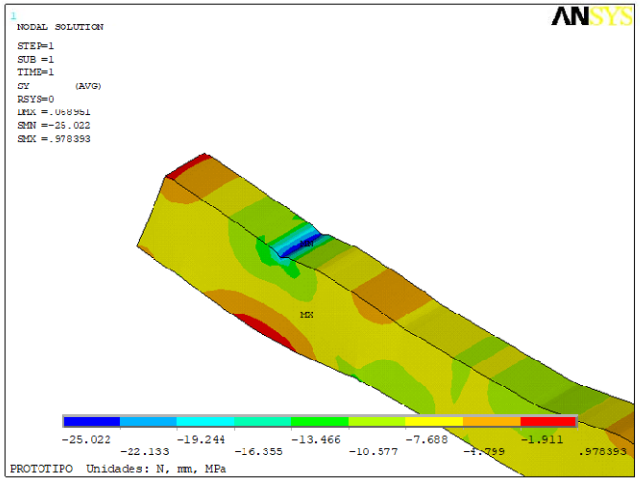
FINITE ELEMENT NUMERIC MODEL RESULTS VALIDATION



LONGITUDINAL STRESSES FOR NEGATIVE MOMENT AT RAIL SUPPORT WITH 0.6% ELONGATION (MPa)



LONGITUDINAL STRESSES FOR POSITIVE MOMENT AT RAIL SUPPORT WITH 0.6% ELONGATION (MPa)

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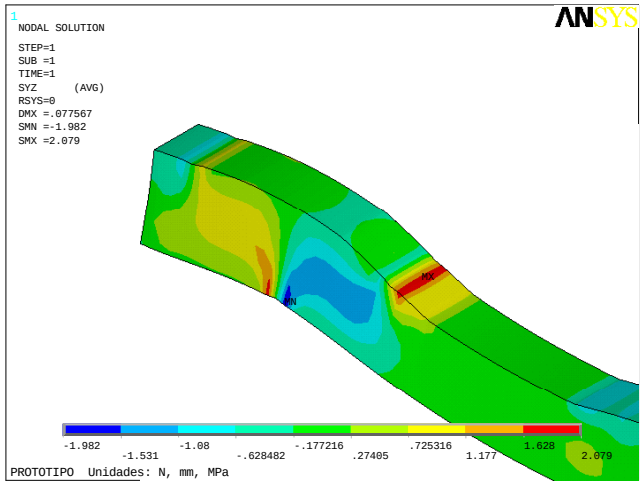
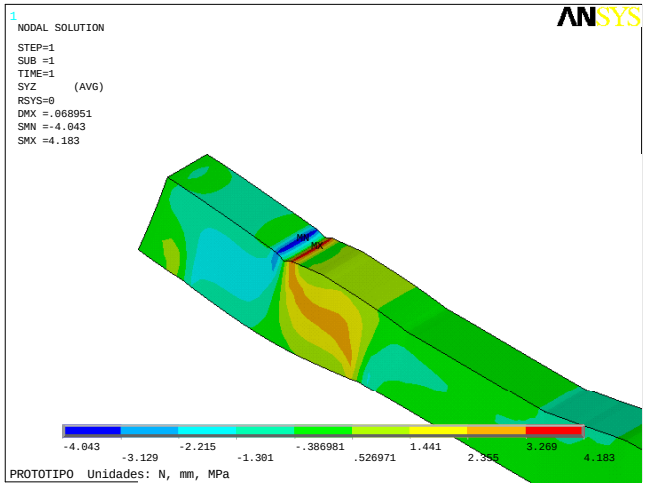
FINITE ELEMENT NUMERIC MODEL RESULTS VALIDATION



SHEAR STRESSES FOR NEGATIVE MOMENT
AT RAIL SUPPORT WITH 0.6% ELONGATION (MPa)



SHEAR STRESSES FOR POSITIVE MOMENT
AT RAIL SUPPORT WITH 0.6% ELONGATION (MPa)

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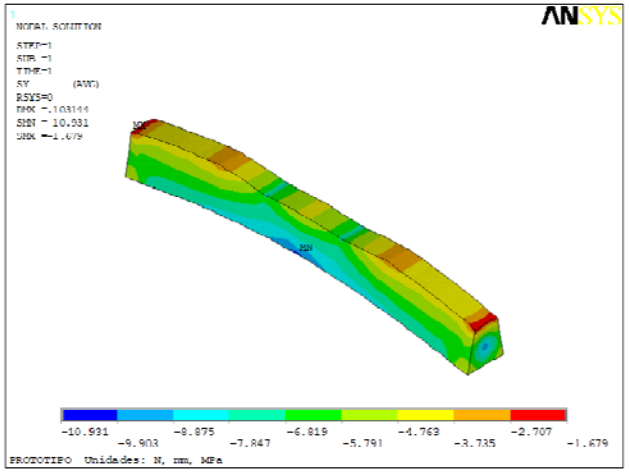
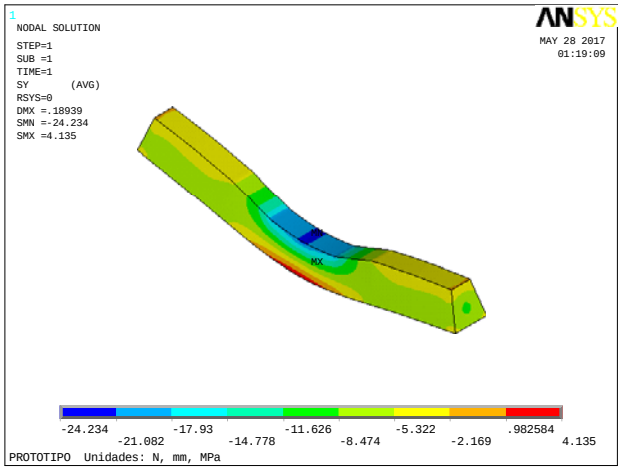
FINITE ELEMENT NUMERIC MODEL RESULTS VALIDATION



LONGITUDINAL STRESSES FOR NEGATIVE MOMENT AT MID-SPAN WITH 0.6% ELONGATION (MPa)



LONGITUDINAL STRESSES FOR POSITIVE MOMENT AT MID-SPAN WITH 0.6% ELONGATION (MPa)

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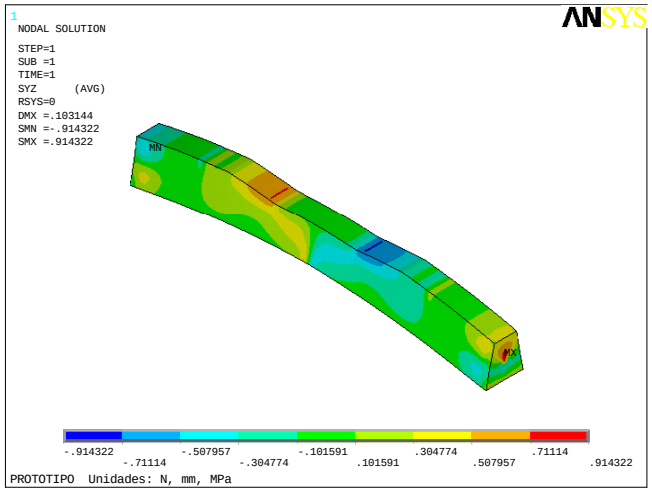
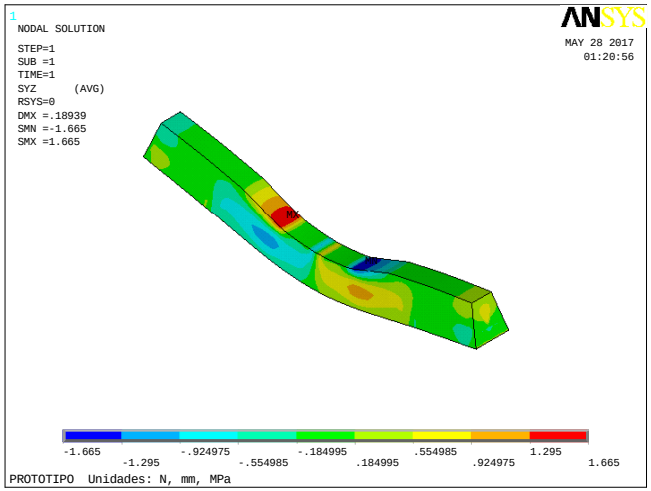
FINITE ELEMENT NUMERIC MODEL RESULTS VALIDATION



SHEAR STRESSES FOR NEGATIVE MOMENT
AT MID-SPAN WITH 0.6% ELONGATION (MPa)



SHEAR STRESSES FOR POSITIVE MOMENT
AT MID-SPAN WITH 0.6% ELONGATION (MPa)

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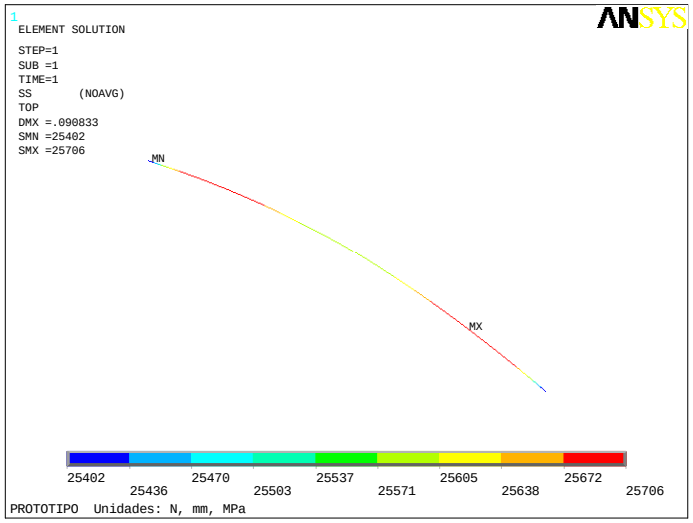
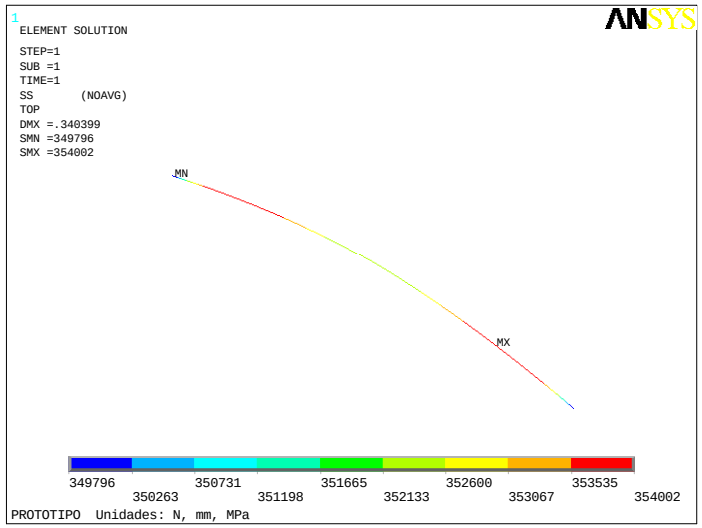
FINITE ELEMENT NUMERIC MODEL RESULTS VALIDATION



LONGITUDINAL AXIAL FORCE FOR NEGATIVE MOMENT AT MID-SPAN IN STEEL BAR WITH 0.6% ELONGATION (N)



LONGITUDINAL AXIAL FORCE FOR POSITIVE MOMENT AT MID-SPAN IN STEEL BAR WITH 0.6% ELONGATION (N)

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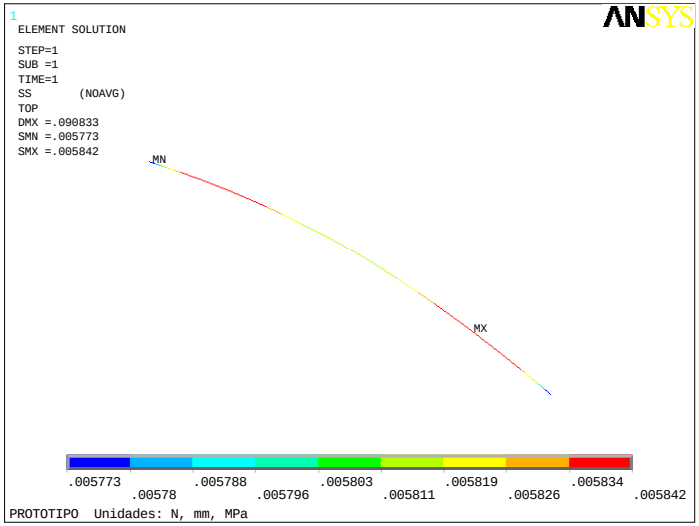
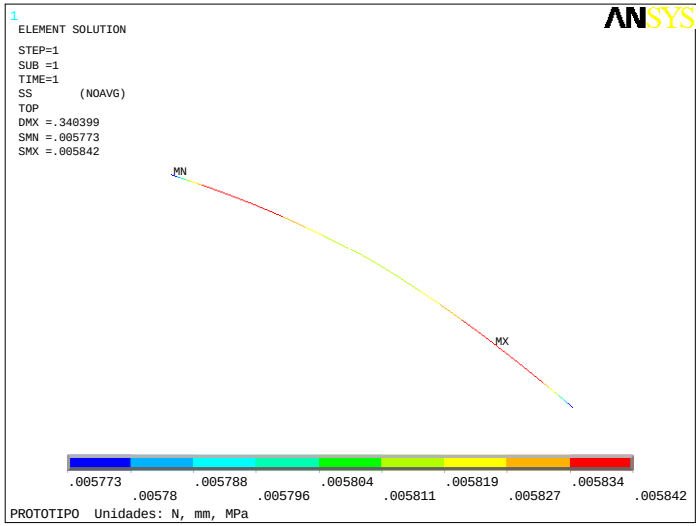
FINITE ELEMENT NUMERIC MODEL
RESULTS VALIDATION



LONGITUDINAL STRAIN FOR NEGATIVE MOMENT
AT MID-SPAN IN STEEL BAR WITH 0.6% ELONGATION



LONGITUDINAL STRAIN FOR POSITIVE MOMENT
AT MID-SPAN IN STEEL BAR WITH 0.6% ELONGATION (N)

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